RELATIONSHIP AMONG EXCHANGE RATE, FDI AND FOREIGN EXCHANGE RESERVES (AN EMPIRICAL INVESTIGATION IN CASE OF PAKISTAN)

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Abstract  
This research study is aimed to empirically investigate the relationship among the broad macro variables such as Foreign exchange reserves, foreign direct investment and nominal exchange rate in Pakistan by testing annual data set of sample size 30 over the period of 1980 to 2010. In order to investigate the stationarity of data at level or at 1st difference, unit root test has been used. On the basis of ADF unit root test, results shows that exchange rate, FDI and foreign exchange reserves are stationary at 1st difference. For the investigation of long run relationship, Johnson co-integration is applied, the results of co-integration test shows the long run relationship among the variables. Vector error correction method is used to investigate short run association of the variables. Results suggest that nominal exchange rate have a significant positive impact on foreign exchange reserves while FDI have insignificant impact on FER.

Keywords: Exchange rate, FDI, Foreign exchange reserves (FER).
1. Introduction

This is a complex issue to have an understanding of interaction of macro variables of external sector, and it is a challenge to policy makers irrespective of the stage of development. This work is a modest attempt and our results suggest a significant association among Foreign currency reserves, FDI and exchange rate either in the short run as well as an the long run. So if the government wants to build required pace of economic growth they must have an expert eye on the interrelationship among these macro variables.

This research study presents a statistical analysis that examines the nature of interaction among key macro variables of external account like FDI, exchange rate and foreign currency reserves. Different studies have been done in different tenures regarding the relationship among these variables. On the basis of those previous studies this is our humble attempt to investigate the dynamic relationship among the key macro variables in context of Pakistan. Annual data from 1980 to 2010 is collected for the application of empirical testing.

This study will be structured as follows: Section 2 will be of literature review comprised of theoretical relationship among the variables in context of previous research studies. Next section will be comprised of theoretical framework, model and suitable testing procedure. To check the dynamic association among the variables, traditionally Johansson co-integration is used. Results and discussion will be presented in the last section.

2. Literature Review:

If we talk about the relationship of foreign currency reserves and exchange, Different researchers like (Kasman and Ayhan in 2007) examines the long-term relationship between them. They argue that direction of causation both in the short run and long-run is from the foreign currency reserves to exchange rate. While in case of the association between the nominal exchange rate and foreign exchange reserves, their empirical results suggests that foreign currency reserves and nominal exchange rate have bi-causality relationship.

Although some of the studies done by (Gupta and Agarwal, 2004) critically argued that foreign exchange reserves holdings which is a major strategy of self-insurance is expensive, the preventive holdings of reserves of foreign currencies in rising economies are motivated by many feature. Economies that have foreign currency reserves can take itself out of effects of weak internal and external shocks, make the necessary arrangements to correct the exchange rate difficulties of international payments, and the implementation of external debt service, and uplift the worldwide integrity of the state and deal with speculative attacks. The cost of holding high level of foreign reserves is low as compared to the loss faced in case of currency crises in emerging economies. Requirement of foreign currency reserves depends mainly on the exchange rate regime, the volume of economy, trade and financial openness and financial deepening, capital controls, and the level of foreign debt and political wavering.

An investigation done by (Mohanty and Turner in 2006) states that Over the past several years emerging market economies has accumulated their foreign exchange reserves on an unprecedented scale, and over the past few years these economies faced considerable excess ability low inflation and having an upward pressure on their currencies.

In this perspective, reserve buildup did not generate the dilemma that was faced by the policymakers in the periods of high inflation when they were supposed to choice one of the objectives among exchange rate and inflation. The exchange rate appreciation has a widespread effect of current account surpluses and the story also reflects net inflow of private capital. The impact of exchange rate fluctuation is usually seen in China, Korea, Latin America, central and Eastern Europe, except Russia, where rising oil prices caused the current account surplus.

Qin (2000). (Be’assy-Quere’ et al. 2001) and Goldberg and Kolstad (1995) argues that a firm had to choose whether it should produce in its own country and exporting to the foreign market or to produce in a foreign country to sell in the domestic market. However, multinational companies often set up plants in foreign countries, re-exporting home country or to sell product at the local level. In either case, exchange rate uncertainty faced by multinational companies has lot of sources and they would try to reduce the fluctuation of their total profits by exploiting the correlation between exchange rate movements.

According to (Dooley and Garber 2005) the massive accumulation of foreign reserves began in the mid 1990's and has accelerated in recent years. It has been driven by emerging market economies; the phenomenon is very general, including Africa and oil exporters in fact with the exception of developed economies and countries in Latin America. It has been most spectacular in Southeast Asia and in particular in China. In fact, in late 2006, seven countries in East Asia - ASEAN plus China and Korea - held a total of more than $ 1500 million, of which $ 1000 million only belong to China. The phenomenon has been widely discussed.
Gottschalk and Hall in (2008) empirically examine the roles of exchange rate risk diversification and uncertainty in the location of US and Japanese FDI in Indonesia, and Thailand. They constructed a mean-variance empirical model same like Qin(2000) and Be´nassy-Quere et al. (2001), where firms minimize their overall risk by diversifying their investment across different locations in a single market. They found that that USA and Japanese firms appear to be averse to the yen/dollar risk. Moreover it is discussed earlier that Japan is the major source country of foreign investment in the Asean-4 that is why Japanese firms are more sensitive to local exchange rate volatility than US investors. It has been argued that Japanese firms reduce their investments when there is an increase in exchange rate volatility of local currencies. And Appreciation yen/dollar exchange rate also has negative impact on Japanese FDI. The impact of exchange rate movements on Foreign direct investment has been discussed in the previous studies for a long time but there is still a controversy on the issue that in which direction these effects take. Many previous Researchers have argued that the movements of the exchange rate should have no impact on FDI at all.

An empirical investigation done by Froot and Stein (1991) regarding the impact of the level of the exchange rate, suggest that the level of the exchange rate can influence FDI if there are imperfect capital markets. Imperfection in the capital markets means that firm bears a lower cost of domestic financing as compared to the cost which it would have to pay for external financing. As a result, the depreciation of the currency of the recipient country increases the relative wealth of foreigners, and therefore may increase the attractiveness of the host country for FDI as foreign firms are able to acquire assets in the host country relatively cheap.

Countries that have accumulated foreign exchange reserves do not agree with many of the previous argument according to (Feldstein, 1998, Wyplosz 2006). They want to secure themselves against foreign exchange market turbulence and they use the strategy of accumulating foreign reserves. Asian countries had faced the 1997-8 crisis, which is devastating in many ways and is generally not expected to be happened which is supported by many authors.

3. Theoretical framework:

![Diagram](Exchange rate -> Foreign exchange reserves)

FER = $\alpha_0 + \alpha_1 (E) + \alpha_2 (FDI) + \varepsilon$

Exchange rate have a positive influence on foreign exchange reserves because when exchange rate appreciates it means currency is depreciating which in turn increase the exports and hence foreign currency reserves increases. When currency depreciates it increases the relative wealth of the foreigner i.e. domestic product become cheaper for the foreigners that is why exports will rise. Foreign direct investment also has positive impact on foreign currency reserves.

Hypothesis: There is positive impact of exchange rate and FDI on FER.

3.1 Process of Empirical Testing:

This process includes three steps. In the first step, ADF unit root tests are used to establish the integrating order of the sample data. In the second step, the (Johansen, 1988 and Engle and Granger, 1987) co-integration test is applied to check out the long -run association among the variables. To explore the significance of long run relationship, VAR estimation will be applied where as for short term movements VEC estimation is used.

3.2 Unit roots:

Augmented dickey fuller test is applied (Dickey and Fuller, 1979) to explore the problem of unit root existence in data series of all the variables considered in the study.
3.3 Co-integration:
For the purpose of investigation of equilibrium relationship among the variables in the long run, we use the concept of co-integration. This technique uses two likelihood ratio (LR) test statistics—namely, the trace and the maximal eigen value (A-max) statistics—to investigate whether there are some vectors in non-stationary time series data or not. The numbers of lags are also chosen on the basis of the AIC criterion, and the Ljung-Box test. (Augustin 2000). The null hypothesis of co-integration is accepted on the basis of above mentioned criteria then such output will suggest some long-run association among the selected variables.

4. Results and Discussion:
Following are the results of above empirical testing in a sequential manner. In the 1st phase results of unit root test will be presented and interpreted and then output of Co-integration and granger causality test will be presented along with discussion and theoretical justifications.

4.1 Test of Unit Roots Hypothesis
In order to investigate the trend of the data all the three variables are plotted and viewed graphically. Figure demonstrates time series graph of all the three selected variables.

Insert Graph 1
Insert Graph 2
Insert Graph 3

The above graphs show that the time series data of all the three variables i.e FDI, FER and exchange rate is having trend at level. Therefore, in this study, we apply a model intercept (c) and trend (t) and other with intercept (c) and without trend (0). As we have taken annual data sets, we will use the lag (n = 1). Therefore, we chose (c, t, n) = (c, 0, 1) for without trend and (c, t, n)= (c, t, 1) for with trend in the ADF test.

Insert Table 1

The result of the test indicates that Foreign exchange reserves and foreign direct investment have a unit root problem at levels with lag 1. On the other hand Nominal exchange rate is having a problem of non stationarity at lag 1 at level. FDI and foreign exchange reserves become stationary in their first differences with Lag 0. While Nominal exchange rate become stationary at first difference with lag 1. Schedule -1 shows the results. The null hypothesis of unit root problem is rejected at the first difference for foreign reserves at 1 % and 5 % level. While in case of Nominal exchange rate and FDI the hypothesis of non stationarity is rejected at 5% level of significance.

4.2 Co integration:

Insert Table 2
Insert Table 3

Trace test indicates 2 co-integration equation(s) at the 5% level and Trace test indicates 1 co-integration equation(s) at the 1% level. Max-eigen value test indicates 2 co-integrating equation(s) at both 5% and 1% levels. This means that there are two Co-integration equation r = 2 among the three variables at a significance level of 5 %. So in Pakistan there exist a long-run association among the exchange rate, foreign capital flows and foreign currency reserves. (Kasman , Ayhan 2007) also proves that there is long run relationship exists between exchange rate and FER. (Togan and Ersel, 2004 ) argues that demand of FER depends upon financial openness(FDI).

4.3 Vector Error Correction Estimates:
In order to investigate short run association among the variables VEC shows the following results.

Insert Table 4

FER = 10697.38 + 390.0475(E) + 34.49(FDI)

In the above table t-value of exchange rate greater than 2 which shows that exchange rate has a significant positive influence on FER. While the t-stats of FDI is less than 2 which shows that FDI don’t have a significant impact on FER in the short run. Slope co-efficient of exchange rate shows that when exchange rate increases by one unit it will cause 390.0475 times increase in foreign exchange reserves. So there is a clear significant positive influence of exchange rate on foreign exchange reserves. Slope of FDI shows that if FDI increases by one unit then the pace of
increase in foreign reserves would be 34.49 times. Hence the impact of exchange rate movement on foreign reserves is significantly greater than the influence of FDI, although both the variables are positively associated with Reserves. (Kasman, Ayhan 2007) also proves that there is positive relationship exists between exchange rate and FER. (Togan and Ersel, 2004) argues that demand of FER depends upon financial openness (FDI).

5. Conclusion and Recommendations

The objective of this study was to explore that whether there is a long-run relationship exists among Foreign exchange reserves, foreign direct investment with exchange rate (nominal) in context of Pakistan using conventional, ADF and Johnson co-integration test (Johansen, 1988 and Engle and Granger, 1987). Annual data from 1980 to 2010 is used for empirical testing. The empirical output of co-integration test suggests that there is association among foreign exchange reserves, FDI and exchange rate.

Our result shows that FDI, nominal exchange rate and foreign exchange reserves have significant association both in the short run and long run as well, which is very important for market participants. So any new information and expectations regarding the accumulation of foreign currency reserves affects the nominal exchange rates. Foreign reserves should not be increased through inflationary borrowings, they should be increased through earnings, in this way it strengthens the domestic currency. Future research studies can include some other macro variables like inflation and interest rate. A comparison among two countries may also be a good option.
References:

Annexure

Graph 1

Graph 2

Graph 3
### Table 1

<table>
<thead>
<tr>
<th>Variables</th>
<th>Types of test (c, t, n)</th>
<th>ADF test Statistics</th>
<th>D-W Statistics</th>
<th>Probability</th>
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</thead>
<tbody>
<tr>
<td>FER</td>
<td>C 0 1</td>
<td>-0.367</td>
<td>2.036</td>
<td>.716</td>
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<tr>
<td>ΔFER</td>
<td>C 0 0</td>
<td>-5.464*</td>
<td>1.955</td>
<td>.000</td>
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<tr>
<td>FDI</td>
<td>C 0 1</td>
<td>-2.506</td>
<td>2.398</td>
<td>.0188</td>
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<tr>
<td>ΔFDI</td>
<td>C 0 0</td>
<td>-3.824**</td>
<td>2.045</td>
<td>.0003</td>
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<tr>
<td>NE</td>
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<td>-2.166</td>
<td>1.867</td>
<td>.040</td>
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<tr>
<td>ΔNE</td>
<td>C 0 1</td>
<td>-3.40**</td>
<td>1.819</td>
<td>.002</td>
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</table>

Note:
* shows the rejection of null hypothesis at 1%
** shows the rejection of null hypothesis at 5%
c, t, and n denotes intercept, trend, and lags.
Δ denotes the first differential.

### Table 2

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigen-value</th>
<th>Trace Statistic</th>
<th>5 Percent Critical Value</th>
<th>1 Percent Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>None **</td>
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<td>45.93670</td>
<td>29.68</td>
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<tr>
<td>At most 1 *</td>
<td>0.482460</td>
<td>20.00003</td>
<td>15.41</td>
<td>20.04</td>
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<tr>
<td>At most 2</td>
<td>0.030512</td>
<td>0.898641</td>
<td>3.76</td>
<td>6.65</td>
</tr>
</tbody>
</table>

*(**) shows the rejection of null hypothesis at the 5% (1%) level.

### Table 3

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigen-value</th>
<th>Max-Eigen Statistic</th>
<th>5 Percent Critical Value</th>
<th>1 Percent Critical Value</th>
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</thead>
<tbody>
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<td>25.93668</td>
<td>20.97</td>
<td>25.52</td>
</tr>
<tr>
<td>At most 1 **</td>
<td>0.482460</td>
<td>19.10138</td>
<td>14.07</td>
<td>18.63</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.030512</td>
<td>0.898641</td>
<td>3.76</td>
<td>6.65</td>
</tr>
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</table>

### Table 4

<table>
<thead>
<tr>
<th>Co-integrating Eq:</th>
<th>CointEq1</th>
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<tbody>
<tr>
<td>FER(-1)</td>
<td>1.000</td>
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<tr>
<td>E(-1)</td>
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<tr>
<td>(52.7360)</td>
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<td>[-7.39623]</td>
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</tr>
<tr>
<td>FDI(-1)</td>
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<td>(6.226)</td>
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<td>[0.5539]</td>
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</tr>
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<td>C</td>
<td>10697.38</td>
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