Effect of Rupee Decline on Indian Economy

Vaibhav Patni, Nikunj Batheja, and Somesh K Mathur

***Abstract*—**The Indian Rupee fell past 65 to the US Dollar to a record low and was expected to breach the crucial 70 mark. This decline would have caused severe repercussions on the Indian economy. These shocks would definitely be changing the entire picture of Indian economic planning. Using monthly time series data, we have applied Auto Regressive Distributive Lag (ARDL) model to estimate the impact of exchange rates on imports, exports and industrial output. We have also used Granger Causality Test to assess the correlation among the series. Results show a positive impact of Indian Rupee decline on exports and the industrial output, and have a negative impact on the imports. Adding to this we must say that the prices have a long run negative impact even on the industrial output and exports.

***Keywords*—** Exports, Imports, Industrial, Output

I. Introduction

A falling currency is always a matter of concern for a country. It signals weakness to the external world, and also makes it more expensive to buy imported goods. Rising cost of imports subsequently aggravates the problem of inflation, which is any day a worse situation for a country. On the flip side softening rupee is also not a healthy sign and increases the implicit cost of India's high foreign debt. India, however, is not the only country suffering from a weakening currency. Other emerging markets like Brazil, Indonesia, Russia, Turkey and South Africa are also witnessing volatility in the currency because of anti-quantitative easing stunt but the US. The Indian Rupee has experienced several crusts and troughs during the past years. While it was the best performing Asian currency in 2006-07 financial year where as it has experienced serious downfalls in the recent past. Few months back Rupee had breached the 65 mark against USD and was even expected to depreciate till 70. There were many futile attempts by the Reserve Bank of India (RBI) and the Planning Commission but some of there policies even worsened the situation.

Speaking holistically, a currency falls whenever inflow of money is greater than the outflow. Foreign institutional Investor (FII) flows were negative for all the trading days in June'13 (for a total of $2 billion) and positive in May'13 ($4.4 billion). Foreign investors moving out of debt gave a signal to the Reserve Bank of India (RBI) to avoid cutting interest rates in the near future. The country's trade deficit was becoming a more serious problem, judging by the government's increasing concern about gold imports. Government agencies tried every way possible to cut-down the gold imports. With gold and oil constituting around 45% of imports, and with oil price remaining steady, evidently gold imports were the one upsetting the scenario.

Even the foreign direct investments and other inflows have not quite made up for the ballooning trade deficit, as manifested by a fall in the country's foreign currency assets by $3.1 billion in the last week of May 2013. Clearly, the perverse face of India's balance of payments justifies a decline in the rupee value. Investor sentiment also plays a critical role in a currency's slide, and this originates from both global and domestic reasons. At the global level, investors have been worried that the Federal Reserve will end its government bond-buying program, which was designed to keep American interest rates low to stimulate the economy, after the Fed chairman, Ben S. Bernanke, suggested that the program may be scaled back in the near future.

If that would have happened, then the foreign funds that had been moving to emerging economies expecting better returns would return to the United States soon enough. This implied that developing countries like India would be short of funds, which in turn puts the currency in a bad situation. This explains to a large extent an apparent paradox in the global currency market, where the USD instead of weakening against the Euro, has strengthened against the currencies of many emerging markets that have been on the receiving side of the fund flows and had grown dependent on the US. Brazil's currency had depreciated by 7 percent in May'13, while the Mexican Peso fell by 4.9 percent and on the flip side the South Korean appreciated by 2 percent and the Russian Ruble by 3.5 percent. Indian government had been emphasizing on these points, and stated that the rupee's fall was part of a global phenomenon and hence there was no reason to worry as things would settle down eventually.

Another major problem was of the investor behavior. It a general seen that when the fear sets in the foreign exchange market, it often reinforces the fundamentals. The anticipation of further decline in the currency caused importers to rush into buying more dollars while exporters holding back their dollars for conversion, thus augmenting the demand-supply gap. This is where the Reserve Bank of India intervened in the past, by forcing exporters to bring in their dollars when the rupee had fallen to its previous low.

The government and the Reserve Bank of India were the other culprits in the origin of a domestic flow. The more the government and central bank pointed out that the gold import situation is serious, the more the investors' belief that

Vaibhav Patni is with Indian Institute of Technology Kanpur, India (phone: +91 7607459005; e-mail: patni@iitk.ac.in).

Nikunj Batheja is with Indian Institute of Technology Kanpur, India (phone: +91 7607452007; e-mail: nikunjb@iitk.ac.in).

Somesh K Mathur, Associate Professor, Economics Department, Indian Institute of Technology Kanpur, India

economic conditions are worsening keeps deepening. In addition, the investors keep expecting these authorities to comment on the dollar, but it's a Catch-22 for the officials: if they say something that is perceived negatively by investors, the rupee will weaken further, but even if they stay quiet, investors may interpret the silence as a tacit acceptance of the current decline, which would cause yet another sell-off of the rupee.

Contrary to the above stated facts, the Rupee depreciation does have its advantages. It makes the Indian goods cheaper overseas and consequently making them more attractive to consumers, which in turn benefits the exporters. But these days, exporters may not actually see significant gains as the global economy is still stagnant and the price advantage on exported goods may not materialize any time soon given their relative inelasticity. In fact, some importers of Indian goods were asking exporters to lower their prices on account of this price advantage. So, with all the eyeballs on the Indian Rupee, investors were waiting for central bank to intervene in the market, which usually commences with some large public-sector banks selling dollars in the market. The second defense approach is through the direct intervention by the R.B.I. to sell dollars in the market. This directly affects not just the fundamentals but also sentiments. But given that India's foreign currency assets have at best been stable at around $ 260 billion, there are limits on such intervention.

There are many factors affecting exchange rate movements and simultaneously exchange rate is responsible for volatility in those markets. This is the reason which led us to choose VAR approach to model the relation between exchange rate, domestic inflation and the industrial output in India. We base our findings on the theoretical framework of the core model suggested by Steven B. Kamin and John H. Rogers (May 1997) in their paper "Output and the real exchange rate in developing countries an application to Mexico". The impact of real effective exchange rate on the industrial output and inflation are also modeled through testing Granger Causality.

II. Theoretical explanations

A. Real Effective Exchange Rate (REER)

Nominal Effective Exchange Rate (NEER) is the weighted average value of Indian rupee relative to a basket of currencies of India's major trade partners. The weights are determined by using bilateral trade flows. Real effective exchange rate (REER) adjusts the nominal effective exchange rate for the effects of relative prices.

REER released by the RBI, is computed as the weighted geometric average of the prices in India relative to the prices of its principal trade partners in international markets. The real effective exchange rate can be formulated as follows:

$$REER = \prod_{i=1}^{N} \left(\frac{P_{India}}{P_i * e_{i,India}} \right)^{w_i}$$

Where,

P_{India}	Price index in India
P_i	Price index in country i
$e_{i,India}$	Nominal exchange rate of country i in terms of INR
N	Number of countries under analysis (here 36)
w_i	Country i's weight in India's REER index

This exchange rate is used to determine an individual country's currency value relative to the other major currencies in the index, as adjusted for the effects of inflation. All currencies within the said index are the major currencies being traded today: U.S. Dollar, Japanese Yen, Euro, etc. This is also the value that an individual consumer will pay for an imported good at the consumer level. This price will include any tariffs and transactions costs associated with importing of the good.

B. How Inflation affects Exchange Rates:

A relatively higher inflation rate in a country A compared to other countries will tend to reduce the value of A's currency because high inflation in A means that A's goods increase in price quicker than other country goods. Therefore A's goods become less competitive. Demand for A's exports will fall. Therefore there will be less demand for A's Currency. Also, consumers in country A will find it more attractive to buy imports. Therefore they will supply currency A to be able to buy other currencies and the imports. This increase in the supply of currency A decreases its value. Therefore in the long run, changes in relative inflation rates should lead to a change in exchange rates.

C. How exchange Rate affects Inflation

If there is depreciation in the exchange rate, this depreciation should cause inflation to increase. Depreciation means the currency buys less foreign exchange, therefore, imports are more expensive and exports are cheaper. Therefore, we get "Imported inflation". The price of imported goods will go up because they are more expensive to buy from abroad. Higher domestic demand: Cheaper exports increases demand for country's exports. Therefore, there is an increase in domestic aggregate demand, and we may get demand pull inflation. Less incentive to cut costs: Manufacturers who export see an improvement in competitiveness without making any effort. Some argue this may reduce their incentive to cut costs, and therefore, we get higher inflation over the long term. Therefore, a depreciation causes both cost-push inflation and demand pull inflation.

D. Relationship between Exchange Rate and industrial Output

Traditional views suggest that there is a positive effect of devaluations on output. The elasticity approach asserts that devaluation will improve trade balance as the Marshall Lerner condition is satisfied. According to absorption approach, devaluation will generate an increase in real output, through its expenditure switching and expenditure reducing effects. The Keynesian approach, in which output is assumed to be demand determined and the economy operates below full employment, states that devaluation will have a positive impact on output and employment. The monetary approach, however states that exchange rate changes influence real magnitudes mainly through the real balance effect in the short-

run but leave all variables unchanged inn long-run (Domac,1997)

In contrast there are some various channels that explain the contrary effect of devaluations such as nominal rigidities in the economy, balance-sheet effects, capital account problems, weakening confidence and associated economic policies (Krugman and Taylor, 1978; Domac, 1997; Kamin and Rogers, 2000; Berument and Pasaogullari, 2003.

E. Relationship between Exchange Rate and Trade

Theoretically for analyzing the impact of currency depreciation on trade we use the J-curve effect and the Marshall-Lerner condition.

The J-curve phenomenon states that following a depreciation of the national currency; a deterioration of the trade balance is then followed by an improvement. At the moment of depreciation, there is a price effect due to higher prices of imported goods. There are some delays in transactions, which have been ordered, several months before, the value of imports increases in the short term. Later, when traders have had some time to change their input strategy, they integrate their loss in competitiveness vis-à-vis goods produced abroad. This provokes a quantity effect: the volume of imports is adjusted downward while local production is probably increased to satisfy demand. In this way, adjustments of quantities traded are slower to adjust than are changes in relative prices. It is expected that the final effect in the longer term is a net improvement in the trade balance. This phenomenon is named the J-curve effect because when a country's net trade balance is plotted on the vertical axis and time is plotted on the horizontal axis, the response of the trade balance to devaluation or depreciation looks like the curve of the letter J.

The Marshall–Lerner condition has been cited as a technical reason explaining why a reduction in value of a nation's currency need not immediately improve its balance of payments. The condition states that, for a currency depreciation to have a positive impact in trade balance, the sum of price elasticity of exports and imports in absolute value must be greater than one. Since a devaluation or depreciation of the exchange rate implies a reduction in the price of exports, the quantity exported will increase. At the same time, the price of imports will rise and their quantity demanded will diminish.

III. Literature Review

[5] Steven B. Kamin and John H. Rogers in their excellent paper "Output and the Real Exchange Rate in Developing Countries: An Application to Mexico" used various VAR models with four main variables (the real exchange rate, output, price index, US interest rate) for 1981-1995 to examine the Mexican quarterly data. Through this they concluded that although the variation of output is mostly depends on the innovation, but at the same time a depreciation shock leads to a sustained reduction in the output and an increase in inflation.

[3] Odusola and Akinlo (2001) used a six variable VAR (official exchange rate, parallel exchange rate, prices, income, money supply and interest rate) for Nigeria and revealed the existence of mixed results regarding the impact of the exchange rate depreciation on output. Their analysis shows that the positive shocks of official exchange rate are followed by a significant increase in prices. These results show that the adoption of flexible exchange rate system does not necessarily lead to output expansion, particularly in short term.

[2] Marilyne Huchet-Bourdon, Jane Korinek in their paper "To What Extent Do Exchange Rates and their Volatility Affect Trade?" stated that trade deficits and surpluses are sometimes attributed to intentionally low or high exchange rate levels. This study examines the impact of exchange rates and their volatility on trade flows in China, the Euro area and the United States in agriculture, manufacturing and mining sectors. It finds that exchange volatility impacts trade flows only slightly. Exchange rate levels, on the other hand, affect trade in agriculture, manufacturing and mining sectors but do not explain in their entirety the trade imbalances in the three countries examined.

[7] Sumanjeet Singh in his paper "Depreciation of the Indian Currency Implications for the Indian Economy" empirically gave reasons for rupee decline and examined that why once the best performing Asian currency has been performing so badly. He empirically showed that with decline in rupee value the exports rose but at the same time imports for Indian economy also rose due to the inefficient manufacturing sector. Apart from all these factors he even discussed about role of FDI and FII in determining the exchange rate.

There are very few studies which examined the impact of change of real exchange rate on both the industrial output and inflation. This is also because of the fact that output is a slow moving series while exchange rate is fast and it is difficult to model a slow moving series with fast one. [6] Klau (1998) investigated this issue for twenty-two Sub-Saharan countries for 1980-1996 and found that the real devaluation increases both output and inflation.

[1] Alessandro Nicita, UNCTAD, Geneva, in his extensive research "Exchange Rates, International Trade and Trade Policies" states: The exchange rate plays an important role in a country's trade performance. Whether determined by exogenous shocks or by policy, the relative valuations of currencies and their volatility often have important repercussions on international trade, the balance of payments and overall economic performance. His paper investigates the importance of exchange rates on international trade by analyzing the impact that exchange rate volatility and misalignment have on trade and then by exploring whether exchange rate misalignments affect governments' decisions regarding trade policies. This paper also shows evidence supporting the argument that trade policy is used to compensate for some of the consequences of an overvalued currency, especially with regard to anti-dumping interventions.

IV. Methodology and Data

Monthly time series data on the variables REER, CPI, Imports, Exports, FOREX with RBI, Oil prices, Gold prices, IIP (Index of Industrial Production) and Oil imports are obtained from Indian governmental data source, RBI database

(dbie.rbi.org.in/DBIE/dbie.rbi?site=statistics).

Then each series I tested for unit root by applying Augmented Dickey-Fuller Test so as to test for stationarity. Then I used the Johansen Cointegration Test to check for long run relationship amongst variables. Results indicated use of VECM (Vector Error Correction Model) but the results obtained were not significant.

To model the impact then I used Autoregressive Distributive Lag (ARDL) general to specific procedure. This methodology was chosen for a number of reasons, both econometric and economic. This procedure has three major advantages in comparison with other previous traditional cointegration methods:

- The ARDL does not need that all the variables under study must be integrated of the same order and it can be applied when the under-lying variables are integrated of order one, order zero or fractionally integrated.
- The ARDL test is relatively more efficient in the case of small and finite sample data sizes.
- By applying the ARDL technique we obtain unbiased estimates of the long-run model
  - The basic model can be expressed as follows:

$$D(\ln(Y_t)) = a_{01} + b_{11}\ln(Y_{(t-1)}) + b_{21}\ln(K_{(t-1)}) + b_{31}\ln(L_{(t-1)}) + \sum_{i=1}^{q} a_{1i} D(\ln(Y_{(t-i)})) + \sum_{i=1}^{q} a_{2i} D(\ln(K_{(t-i)})) + \sum_{i=1}^{q} a_{3i} D(\ln(L_{(t-i)})) + \varepsilon_{1t} \quad \ldots(1)$$

I have taken log of each series which have two advantages

- Avoids heteroskedasticity
- We directly get the elasticities.

In particular, it takes into account the mathematical properties of the series, i.e. the stationarity or non stationarity of the variables. This enabled us to measure of both short-run and long-run effects, which is important here due to delay in trade transaction and associated risks.

Model specifications:

$$\text{Ln } M_t = a(1) + b(1)\text{LnREER}_t + c(1)\text{LnCPI}_t + d(1)\text{LnOilp}_t + e(1)\text{LnFOREX}_t + f(1)\text{LnGoldp}_t + g(1)\text{LnUSIR}_t + u1_t \quad \ldots(2)$$

$$\text{Ln } X_t = a(2) + b(2)\text{LnREER}_t + c(2)\text{LnCPI}_t + d(2)\text{LnOilp}_t + e(2)\text{LnFOREX}_t + f(2)\text{LnGoldp}_t + g(2)\text{LnUSIR}_t + u2_t \quad \ldots(3)$$

$$\text{LnIIP}_t = a(3) + b(3)\text{LnREER}_t + c(3)\text{LnCPI}_t + d(3)\text{LnOilp}_t + e(3)\text{LnFOREX}_t + f(3)\text{LnGoldp}_t + g(3)\text{Ln USIR}_t + h(3)\text{ Ln } M_t + i(3)\text{LnX}_t + u3_t \quad \ldots(4)$$

$$\text{LnCPI}_t = a(4) + b(4)\text{LnREER}_t + c(4)\text{LnIIP}_t + d(4)\text{LnOilp}_t + e(4)\text{LnFOREX}_t + f(4)\text{LnGoldp}_t + g(4)\text{Ln USIR}_t + h(4)\text{ Ln } M_t + i(4)\text{LnX}_t + u4_t \quad \ldots(5)$$

Here,

Mt	Imports at time t
Xt	Exports at time t
REERt	Real Effective Exchange Rate at time t
CPIt	Consumer Price Index at time t
Oilpt	Oil prices at time t
Goldpt	Gold prices in the country at time t
FOREXt	FOREX with RBI at time t
IIPt	Index of Industrial Production(Manufacturing) at time t
USIRt	One year bond monthly interest rate of US
u1,u2,u3,u4	Error terms

Here CPI is used as an aggregate price variable to check for inflation. REER is used instead of nominal exchange rates because it is not only USA that India trades with and a proper measure would be one adjusted for inflation and other basic characteristics. IIP (Manufacturing) is used as a proxy for manufacturing production of India and equation 4 shows how it varies with variables specified above.

This method has several advantages. First, it enables estimation of short and long-run parameters of the model simultaneously. Second, it is a more suitable method than the Johansen cointegration technique since variables included in the cointegration space can be stationary or non-stationary. I have used Wald test to check for combined significance of coefficients.

Note that this methodology does not explicitly consider other possible factors that influence trade flows apart from income and bilateral exchange rates. This methodology does not consider, for example, the possible substitution and other effects of exchange rates. Trade imbalances may be driven by factors other than the exchange rate as suggested by Evenett (2010).

V. Empirical Results (ARDL results)

Dependent Variable: D(LEXPORTS); Refer to (2)

Sample (adjusted): 2007M03 2013M06

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXPORTS(-1)	-0.967989	0.112980	-8.567795	0.0000
LGOLD(-1)	0.297731	0.071095	4.187765	0.0001
LOILPRICES(-1)	0.431593	0.066324	6.507315	0.0000
LREER(-1)	1.013657	0.149012	6.802531	0.0000
LUSIR(-1)	-0.083104	0.022263	-3.732771	0.0004
D(LCPI(-1))	-3.867578	1.032493	-3.745863	0.0004

Dependent Variable: D(LIMPORTS)
Sample (adjusted): 2007M02 2013M06

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGOLD(-1)	0.417658	0.052829	7.905784	0.0000
LIMPORTS(-1)	-0.791200	0.089288	-8.861208	0.0000
LOILPRICES(-1)	0.411836	0.058869	6.995805	0.0000
LREER(-1)	-0.485200	0.063721	7.614458	0.0000

Dependent Variable: D(LIIP)); Refer to (4)
Sample (adjusted): 2007M03 2013M06

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIIP(-1)	-0.725750	0.119571	-6.069626	0.0000
LEXPORTS(-1)	-0.202978	0.072268	-2.808671	0.0064
LGOLD(-1)	0.286876	0.038421	7.466663	0.0000
LOILPRICES(-1)	0.093226	0.038201	2.440401	0.0172
LREER(-1)	0.544531	0.065420	8.323600	0.0000
D(LCPI(-1))	-1.698088	0.622473	-2.727968	0.0081

Dependent Variable: D(LCPI)); Refer to (5)
Sample (adjusted): 2007M03 2013M06

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.066712	0.314539	3.391354	0.0011
@TREND	0.001796	0.000528	3.403143	0.0011
LCPI(-1)	-0.220526	0.065386	-3.372675	0.0012
D(LCPI(-1))	0.232219	0.112798	2.058721	0.0431

Results:

LExports$_t$ = 0.3076 LGold$_t$ + .4458 LOilprices$_t$ + 1.0472 LREER$_t$ - 0.0859 LUSIR$_t$ – 3.9955 D(LCPI$_t$)

LImports$_t$ = 0.5279 LGold$_t$ + 0.5205 LOilprices – 0.6132 LREER$_t$

LIIP$_t$ = -0.2797 LExport$_t$ + 0.3953 LGold$_t$ + 0.1285 LOilprices$_t$ + 0.7503 LREER$_t$ -2.340 D(LCPI$_t$)

LCPI$_t$ = 4.837125781 + 1.053023226 D(LCPI$_t$)

Results of Granger causality can be summarized as follows:

- Inflation (CPI) affect exports (one way relationship)
- Industrial production (IIP) has an effect on inflation (CPI) and vice versa
- Exports affects FOREX (one way relationship)
- Exports affect Gold prices (one way relationship)
- Exports affect REER and vice versa
- FOREX affects Imports (one way relationship)
- USIR affects FOREX (one way relationship)
- Gold Prices affect Industrial Production (IIP) (one way relationship)
- Gold Prices affect Imports (one way relationship)
- Imports affect Industrial Production (IIP) and vice versa
- Industrial Production (IIP) affects REER (one way relationship)
- Oil Prices affect Imports (one way relationship)

VI. Conclusion

In a time period of one-year (June'2012-June'2013) real value of rupee has depreciated by 3.05%. In accordance with the results the export elasticity (% change in exports due to 1% change in REER) is 1.05 and import elasticity is -0.61. This result supports the fact that for India imports are much inelastic, India's demand for fuel, gold, technology at this point of time is non-substitutable. According to findings of this study the exports have increased by 3.19%, Industrial production has increased by 2.30% and imports have been reduced by 1.87%. There is an interesting observation to note that price levels or domestic inflation in the short run does not affect the exports, output and imports, inflation shocks have a delayed effect on them.

The Granger Causality results show that domestic inflation affects the country's exports, this is evident with the fact that if cost of raw material changes so the cost of finished goods which in turn affects the market demand and supply and by the same reason the industrial production is also affected by inflation. We know that if there is an increment in the industrial production that is because we have made changes in the levels of labor and capital which in turn create job opportunities, increase velocity of money and eventually affects inflation. One interesting result is that gold prices affect Industrial production, this is because people see gold as an investment to safeguard their money from inflation and exchange rate shocks and soaring prices of gold indicates that investors are more interested in buying gold they have lost their faith in the economy and are investing more and more in gold rather than the economy which means less money to dedicate towards production of goods and services which in turn depletes industrial production. .

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