

Government of Pakistan
Ministry of Commerce
National Tariff Commission



Study
on
Impact of Exchange Rate on Pakistan's
Exports

September 30, 2015

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1. Introduction

1.1 A detailed presentation was given to the Minister for Commerce on the enhanced functions of National Tariff Commission (NTC) under new National Tariff Commission Act, 2015 and reforms in the NTC along with an update on its working on June 24, 2015 at the office of the NTC. The Minister for Commerce observed that there is a general perception that appreciation of exchange rate has a negative effect Pakistan's exports (by way of change in relative prices of exports) and informed that Ministry of Finance was of the view that appreciation of Pak. Rupee was necessary so as to decrease the amount of foreign debts, encourage imports and help in reducing inflation.

1.2 The Commerce Minister desired that a study may be conducted by the NTC to analyse the impact of the current phenomena of appreciated exchange rate on exports, and to ascertain whether there is a correlation between the depreciation of Pak. Rupee and increase in exports and vice a versa?

1.3 NTC has accordingly carried out this study to explicitly analyse the impact of only the appreciation or depreciation of exchange rate on exports and particularly the recent phenomena of appreciated exchange rate on exports.

1.4 In economic literature various economic theories use fundamental economic factors to explain why countries trade and how trade patterns emerge and evolve. In David Ricardo's trade theory, for instance, technological differences between countries determine comparative advantage. In the Heckscher-Ohlin model, relative factor endowments (labour, capital and natural resources) shape trade patterns. In other words, a capital abundant country will export the capital-intensive goods, while the labor-abundant country will export the labor-intensive goods. The new trade theory predicts that countries with larger economies – as a result of growth in endowments and incomes – will develop an export edge in those goods consumed in relatively greater quantities in the home market. The

“new new” trade theory identifies trade costs as a key impediment to entry into trade. Others argue that the quality of a country's political and economic institutions can be a key source of comparative advantage.

1.5 There are a number of factors other than exchange rate that affect exports of a country, which inter alia include:

- i) Comparative / competitive advantage in production of product;
- ii) Rich in endowments (labour, capital and natural resources)
- iii) Technological advancement and research;
- iii) Education and skills
- iv) High factor productivity;
- v) Compliance of quality and standards as per the provisions of Agreements on SPS and TBT;
- vi) Economies of scale;
- vii) Political stability;
- viii) Law and order, security situation;
- ix) Intra-industry trade
- x) Infrastructure and transportation costs
- xi) Integration with the world economy through production chains;
- xii) Trade to GDP ratio;
- xiii) Cost of doing business
- xiv) Market Access
- xv) Foreign Direct Investment
- xvi) High economic growth rate (GDP)
- xvii) Interest rate
- xviii) Inflation
- xix) Saving rate
- xx) Rate of Investment
- xxi) Average applied tariff rate

2. Economic Outlook and Pakistan's Export Performance

2.1 As Pakistan is one of the emerging economies in South Asia, it is important to analyse the performance of Pakistan's exports. During the period 1980 to 2004, Pakistan's exports increased substantially and made a major contribution to Pakistan's balance of trade account. Total exports in 1980 were around US\$ 2.79

billion and which increased to US\$ 14.40 billion by 2004-05. The composition of exports in 1980-81 comprised of 44 percent primary commodities, 11 percent semi manufactured goods and 45 percent manufactured goods. Since then Pakistan's exports have increased enormously and reached US\$ 25.35 billion in 2010-11. The composition of exports also changed over time and in 2013-14, the share of primary commodities in total exports consisted of 16 percent, 14 percent semi manufactured goods and 70 percent manufactured goods. Pakistan's exports, however, have not exceeded the US\$25.35 billion achieved in 2010-11 and since then the exports remained in the range of US\$24.70 billion to US\$25.15 billion. Pakistan's trade position during last five financial years is shown in the following table:

Table 1
Pakistan's Trade during Last Five Years

(US\$ billion)

Financial Year	Exports	Imports	Balance of Trade
2010-11	25.35	35.80	-10.45
2011-12	24.71	40.37	-15.66
2012-13	24.80	40.16	-15.36
2013-14	25.16	41.70	-16.54
2014-15	24.35*	41.60*	-17.25

Source: *SBP Annual Report-Statistical Supplement FY 2013-14*

*Estimated figure

2.2 Pakistan's exports base is quite narrow, highly concentrated in a few items namely, cotton and cotton manufactures / textile, leather, rice, chemicals & pharma products and sports goods. These six categories of exports accounted for about 70 percent of total exports during 2013-14 with cotton manufactures alone contributing 53.49 percent. Pakistan has not made much progress in increasing the number of its export products. Pakistan is also yet to enter in hi-tech exports. In short, Pakistan is lagging in product diversification, value addition diversification, sophisticated products, hi-tech industries to face the fierce global competition. Therefore, factor like exchange rate fluctuations have little impact on export performance of Pakistan.

2.3 In terms of directions of Pakistan's exports, most have been highly concentrated among a few major trading partners. The EU-27 remained the top destination for Pakistan's exports, and its share is 24percent in 2013-14. USA was the second-largest market during this period, with a share of 15 percent in 2013-14. Pakistan's exports to China increased sharply from only US\$ 305 million to US\$ 2.42 billion over the period 2000-01 to 2013-14 as a result of the Free Trade Agreement that was signed between the two countries in 2005-06.China's share in total exports has gradually picked up from 4 percent in 2008-09 to 10 percent during current year. Thus there is need to negotiate more such trade agreements in growing markets, which provide more favourable market access to Pakistani products in those partner countries and increase Pakistan's exports.

3. Research Literature on Effects of Exchange Rates

3.1 Several studies have been conducted in the past to examine the impact of exchange rate on exports and the conclusions drawn in some of those studies have been given below for ready reference:

3.1.1 The recent debate on persistent trade imbalances and on the resurgence of non-traditional trade restrictive measures has led to a renewed interest in better understanding of the effect of exchange rates on international trade. In spite of the increasing number of studies on the topic, the actual effect of exchange rates on international trade is still a contentious issue. The theoretical literature on the issue provides little guidance as the presumption that exchange rates directly affect trade depends on a number of specific assumptions which do not hold in all cases.¹

3.1.2 In a theoretical contribution, Baldwin and Krugman (1989) show that only large exchange rate shocks have an influence on trade. Theoretical and empirical studies over the years show that the relationship between the level of a currency and trade is so multi-faceted and complex that it is hard to extract clear lessons. Standard economic theory suggests that under perfect markets, an exchange-rate misalignment has no long-run effect on

¹ Exchange Rates, International Trade and Trade Policies by Alessandro Nicita UNCTAD, Geneva

trade flows, as it does not change relative prices.²The relationship between currencies and trade has been the object of a wide policy debate in recent times.³

3.1.3 The impact of exchange rate levels on trade has been much debated but the large body of existing empirical literature does not suggest an unequivocally clear picture of the trade impacts of changes in exchange rates. The impact of exchange rate volatility on trade also does not benefit from a clear theoretical cause-effect relationship.⁴Simply stated, depreciation of a country's currency makes its exports cheaper and its imports more costly. In the reality of a globalised economy, however, industries are vertically integrated, and exported products contain a large proportion of imported inputs. Imported inputs therefore become more costly for any given exporter and are not necessarily substitutable with domestically-produced products. In addition, exchange rate levels have important implications for debt servicing and foreign investment flows. A depreciation in a country's currency implies that the nominal value of debt denominated in foreign currencies increases relative to the country's resources in local currency whereas its local-currency denominated debt decreases in value for foreign creditors.

3.1.4 The impact of real exchange rate on export growth rate is **insignificant** with positive sign. The benefits of depreciation in currency are not fruitful across the countries, depending upon their domestic structure of economies (Muhammad Tariq Majeed and Eatnaz Ahmad (2007)). Hooper and Kohlhagen (1978,) in their first analysis found **insignificant** and negative alliance in uncertainty of exchange rate and trade level. The sign of relative price ratio (exchange rate) is positive in affecting the output and trade level for Pakistan but it is **insignificant** in case of Pakistan, strongly support to the evidence that nominal exchange rate and real exchange rate are one to one related and all increase in output arises from

² Currencies and trade: looking at the recent literature, Marc Auboin, Michele Ruta 13 November 2011

³ The Relationship Between Exchange Rate and International Trade: A Literature Review by Marc Auboin and Michel Ruta, WTO- Economic Research and Statistics Division, Staff working Paper

⁴Huchet-Bourdon, M. and J. Korinek (2011), "To What Extent Do Exchange Rates and their Volatility Affect Trade?", OECD Trade Policy Papers, No. 119,

nominal to real exchange rate, not from relative price ratio (Sencicek&Upadhyaya, 2010).

4. Methodology

4.1 The methodology used for estimation of impact of exchange rate fluctuations on exports, imports and balance of trade using econometric regression techniques is explained in detail in Annex-II. Furthermore, this section provides information concerning the periods for which the data of exchange rates and exports, imports and balance of trade has been taken and the sources from where the requisite data has been obtained. The Ordinary Least Square (OLS) regression equations prepared to test different hypothesis, to ascertain the impact of exchange rate appreciation / depreciation on import, export and balance of trade, have also been discussed.

4.2 In this study three different time period has been taken to analyse the impact of exchange rate on exports, imports and balance of trade. The time periods are:

- i. **October 2002 – March 2008** Period during which exchange rate remained almost stable;
- ii. **April 2008 – May 2013** Period during which exchange rate depreciated
- iii. **June 2013- July 2015** Period during which exchange rate appreciated

4.3 Data of monthly exchange rates, imports, exports and balance of trade, for the above time periods, has been obtained from the State Bank of Pakistan and Economic Survey of Pakistan (various issues). The tables showing data of exchange rates, imports, exports and balance of trade during the selected time periods are at Annex-I.

4.4 In this study the impact of only one independent variable i.e. changes in exchange rates on (i) exports, (ii) imports and (iii) trade balance, during specific time periods mentioned in para-4.2 above, has been calculated using the econometric regressions equations / models (using OLS model). In this regard the following regression equations have been prepared:

Model 1	Exports	(i)	$\text{Log} (exp_t - exp_{t-1}) = \alpha + \beta \log (exr_t - exr_{t-1}) + \varepsilon$
Model 2	Imports	(ii)	$\text{Log} (imp_t - imp_{t-1}) = \alpha + \delta \log (exr_t - exr_{t-1}) + \varepsilon$
Model 3	Trade Balance	(iii)	$\text{Log} (bal_t - bal_{t-1}) = \alpha + \beta \log (exr_t - exr_{t-1}) + \varepsilon$

4.5 The significance of the hypothesis / model in a regression analysis is measured by t-statistic. The "t" statistic is a measure of the likelihood that the actual value of the parameter (*dependent variable, in for example in this study exports is a parameter*) is not zero. The larger the absolute value of t-statistic, the less likely that the actual value of the parameter could be zero. In the regression analysis if the absolute value of t-statistic (calculated through regression equation/model) is greater than the t-statistic tabulated (*i.e. greater than 1.64 at 10% level of significance*) hypothesis / model tested is significant, which shows significant effect of dependent variable due to change in independent variable. In case t-statistic (calculated) is less than the t-statistic tabulated (*i.e. less than 1.64 at 10% level of significance*) the results of regression shows insignificant effect on dependent variable due to change in independent variable.

4.6 During the period from October 2002 to March 2008, when exchange rate remained almost stable the results of above econometric regression equations show that t-statistic calculated for model 1 is 0.054477, which is less than the 1.64 (t-statistic tabulated). Similarly the t-statistic calculated for model 2 is 1.269514, which is less than the 1.64 (t-statistic tabulated) and t-statistic calculated for model 3 is also 0.827200, which is less than the 1.64 (t-statistic tabulated). Thus there was no significant impact of exchange rate on exports, imports and balance of trade of Pakistan during the period from 2002-08.

4.7 During the period from April 2008 – May 2013, when exchange rate depreciated the results of econometric regression show that t-statistic calculated for model 1 is -1.688490, which is less than the 1.64 (t-statistic tabulated). Similarly the t-statistic calculated for model 2 is -1.667642, which is less than the 1.64 (t-statistic tabulated) and t-statistic calculated for model 3 is also 0.666926, which is less than the 1.64 (t-statistic tabulated). Thus there was no significant impact of exchange rate on exports, imports and balance of trade of Pakistan during the period from 2008 to 2013 there was no significant impact of depreciated exchange rate on exports, imports and balance of trade of Pakistan.

4.8 During the period from June 2013 to July 2015, when exchange rate appreciated the results of econometric regression show that t-statistic calculated for model 1 is -0.009884, which is less than the 1.64 (t-statistic tabulated). Similarly the t-statistic calculated for model 2 is 0.055650, which is less than the 1.64 (t-statistic tabulated) and t-statistic calculated for model 3 is also 0.970031, which is less than the 1.64 (t-statistic tabulated). Thus there was no significant impact of exchange rate on exports, imports and balance of trade of Pakistan

during the period from 2008 to 2013 there was no significant impact of depreciated exchange rate on exports, imports and balance of trade of Pakistan.

5. Conclusions

5.1 Trade data for last five years show that Pakistan's exports are stagnant at around US\$25 billion. The econometric regression analysis of monthly data of exchange rates, exports, imports and trade balance shows that there is no significant impact of variations in exchange rates from October 2002 to July 2015 (thirteen years) on exports, imports and trade balance. There are other factors (other than exchange rate) which largely affect the exports⁵; some of them are mentioned in para-1.5 supra.

5.2 The econometric regression results are consistent with research conducted earlier on impact of exchange rate fluctuations.

⁵ The NTC has simultaneously conducted a study on Reasons of Decline in Exports of Pakistan, which is also being submitted along with this study to the Ministry of commerce

Annex-I

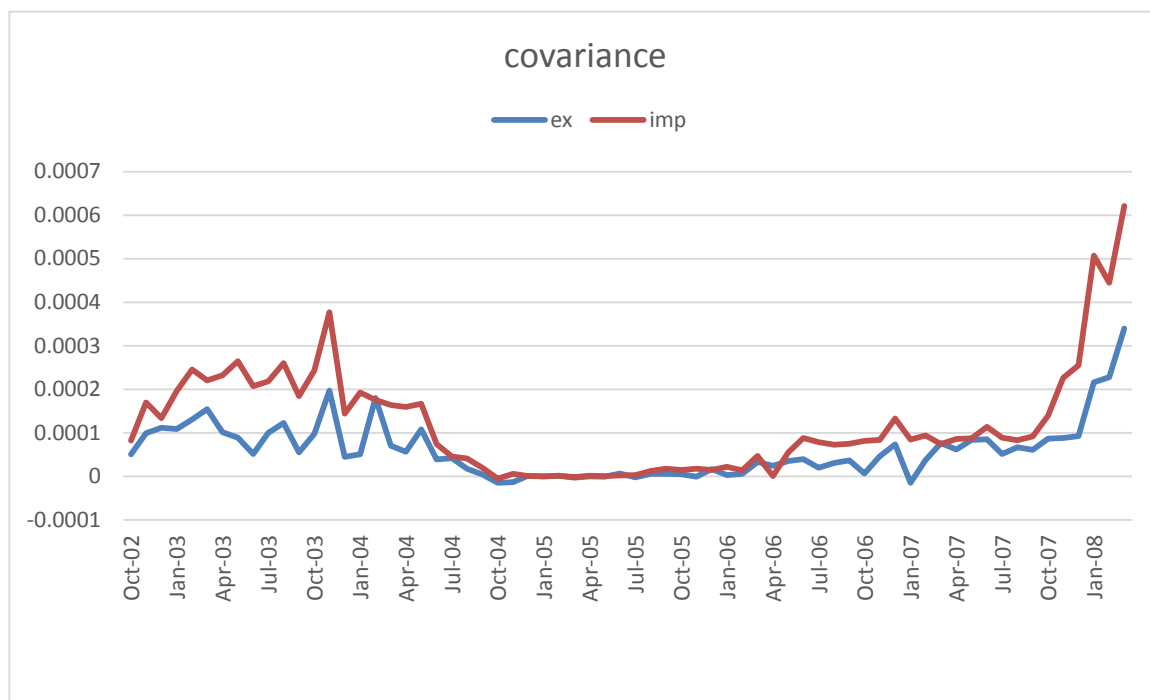
Table below contains monthly figures of exchange rate, exports, imports and balance of trade during the period from Oct. 2002 to March 2008

Time Period	Exchange Rate (Rs./\$)	Exports Million US\$	Imports Million US\$	Trade Balance Million US\$
Oct-02	58.9305	845	899	-54
Nov-02	58.3526	874	920	-46
Dec-02	58.3724	831	1,034	-203
Jan-03	58.1756	893	924	-31
Feb-03	58.1067	852	827	25
Mar-03	57.8265	861	993	-132
Apr-03	57.7850	982	979	3
May-03	57.6292	1,028	959	69
Jun-03	57.8090	1,100	1,029	71
Jul-03	57.7571	989	1,020	-31
Aug-03	57.7485	941	930	11
Sep-03	57.8827	1,084	1,064	20
Oct-03	57.4224	1,031	1,057	-26
Nov-03	57.2277	885	876	9
Dec-03	57.4391	1,139	1,271	-132
Jan-04	57.3993	1,129	1,168	-39
Feb-04	57.3601	893	1,212	-319
Mar-04	57.4495	1,084	1,222	-138
Apr-04	57.4616	1,113	1,230	-117
May-04	57.6753	982	1,166	-184
Jun-04	57.9165	1,126	1,388	-262
Jul-04	58.2777	1,081	1,440	-359
Aug-04	58.7934	1,118	1,311	-193
Sep-04	58.9725	1,194	1,424	-230
Oct-04	60.0311	1,123	1,616	-493
Nov-04	59.9393	1,119	1,745	-626
Dec-04	59.5478	1,311	1,686	-375
Jan-05	59.4452	1,139	1,427	-288
Feb-05	59.3525	1,167	1,591	-424
Mar-05	59.3529	1,445	1,783	-338
Apr-05	59.4031	1,224	1,508	-284

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May-05	59.5081	1,182	1,741	-559
Jun-05	59.6673	1,378	1,724	-346
Jul-05	59.6234	1,171	1,767	-596
Aug-05	59.6547	1,368	2,074	-706
Sep-05	59.7593	1,331	2,058	-727
Oct-05	59.7108	1,332	2,045	-713
Nov-05	59.7647	1,220	2,049	-829
Dec-05	59.8076	1,481	1,951	-470
Jan-06	59.8396	1,269	2,063	-793
Feb-06	59.8855	1,306	1,879	-573
Mar-06	60.0070	1,555	2,297	-742
Apr-06	59.9979	1,463	1,674	-211
May-06	60.0668	1,540	2,352	-812
Jun-06	60.1618	1,535	2,684	-1,149
Jul-06	60.2711	1,357	2,408	-1,051
Aug-06	60.3180	1,419	2,302	-883
Sep-06	60.5037	1,416	2,196	-781
Oct-06	60.5959	1,268	2,197	-929
Nov-06	60.7282	1,426	2,154	-728
Dec-06	60.8878	1,511	2,391	-880
Jan-07	60.8780	1,189	2,099	-910
Feb-07	60.7321	1,388	2,218	-830
Mar-07	60.6927	1,571	2,103	-532
Apr-07	60.7052	1,499	2,175	-676
May-07	60.6718	1,616	2,204	-588
Jun-07	60.6256	1,641	2,426	-785
Jul-07	60.3978	1,528	2,399	-871
Aug-07	60.5145	1,579	2,256	-677
Sep-07	60.6376	1,510	2,252	-742
Oct-07	60.6795	1,627	2,593	-967
Nov-07	61.0003	1,545	2,948	-1,403
Dec-07	61.1798	1,526	2,966	-1,440
Jan-08	62.3667	1,660	3,318	-1,658
Feb-08	62.6185	1,646	2,910	-1,264
Mar-08	62.7500	1,862	3,520	-1,658

Covariance of export and import against exchange rate from Oct. 2002 to March 2008



Through graphical analysis it is shown whether exchange rate has any significant impact on export and import. For this, graph is represented by covariance (it shows the association between two variables) between exchange rate and export once and then by covariance between exchange rate and import during the time period of Oct-2002 to Mar-2008. Graph shows that there is no trend(positive or negative) between the exports and imports against exchange rate.

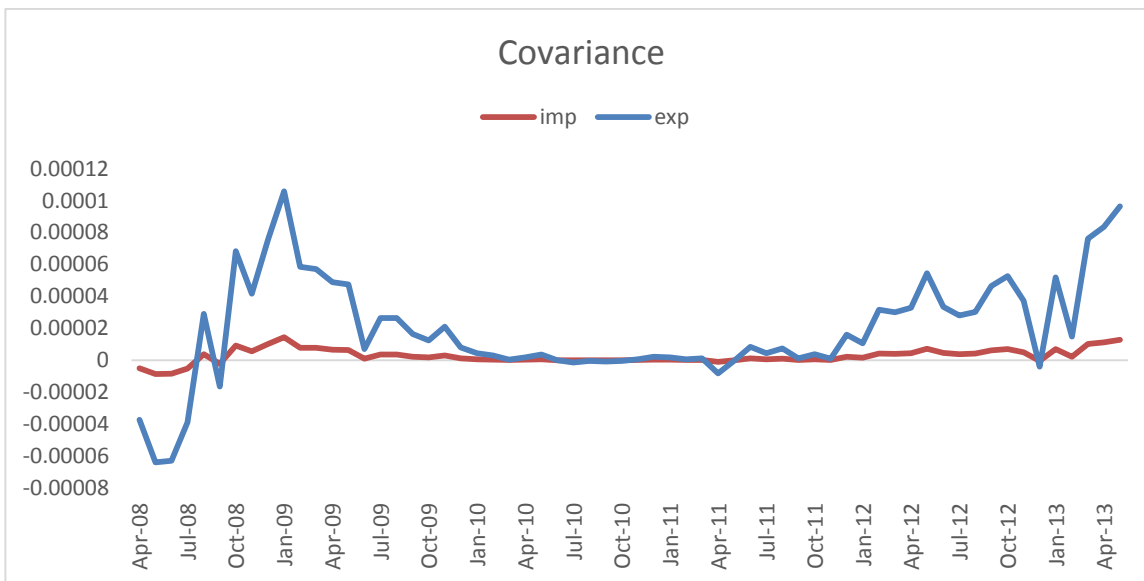
Table below contains monthly figures of exchange rate, exports, imports and balance of trade during the period from April 2008 to May 2013

Time Period	Exchange Rate (Rs./\$)	Exports Million US\$	Imports Million US\$	Trade Balance Million US\$
Apr-08	63.5556	1,938	3,384	-1,446
May-08	67.6009	2,016	3,237	-1,221
Jun-08	67.2563	2,011	3,499	-1,489
Jul-08	70.5896	1,981	3,366	-1,386
Aug-08	74.2926	1,772	3,158	-1,387
Sep-08	77.1668	1,960	3,694	-1,734
Oct-08	80.4331	1,365	3,227	-1,863
Nov-08	79.9239	1,575	2,225	-650
Dec-08	78.9238	1,439	2,594	-1,155
Jan-09	79.0856	1,282	2,138	-856
Feb-09	79.4485	1,499	1,875	-376
Mar-09	80.2355	1,454	2,249	-795
Apr-09	80.3958	1,497	2,359	-862
May-09	80.5268	1,496	1,994	-498
Jun-09	80.9574	1,808	2,786	-979
Jul-09	82.0062	1,559	2,815	-1,256
Aug-09	82.7716	1,471	2,183	-712
Sep-09	82.8462	1,606	2,470	-864
Oct-09	83.2176	1,632	2,747	-1,116
Nov-09	83.4540	1,433	2,184	-751
Dec-09	84.0021	1,619	2,736	-1,118
Jan-10	84.5184	1,636	2,533	-897
Feb-10	84.8991	1,543	2,341	-798
Mar-10	84.3500	1,856	2,474	-619
Apr-10	83.9386	1,819	2,914	-1,095
May-10	84.3318	1,717	2,633	-916
Jun-10	85.2844	1,789	3,102	-1,312
Jul-10	85.5031	1,654	2,920	-1,266
Aug-10	85.6070	1,819	2,925	-1,106
Sep-10	85.7618	1,796	2,392	-596
Oct-10	85.9416	1,841	2,613	-772
Nov-10	85.5440	1,935	2,805	-870
Dec-10	85.7072	2,076	3,191	-1,115
Jan-11	85.7072	2,039	2,791	-752
Feb-11	85.3141	2,260	3,074	-813
Mar-11	85.3380	2,477	3,288	-811
Apr-11	84.6278	2,571	2,904	-333

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May-11	85.2122	2,239	3,350	-1,111
Jun-11	85.7859	2,662	3,543	-881
Jul-11	86.0204	2,138	3,172	-1,034
Aug-11	86.6211	2,120	3,673	-1,553
Sep-11	87.4744	1,895	3,522	-1,626
Oct-11	86.9655	1,969	3,230	-1,260
Nov-11	86.9316	1,900	3,172	-1,272
Dec-11	89.3402	2,056	3,276	-1,220
Jan-12	90.1357	1,974	3,366	-1,392
Feb-12	90.7135	2,154	3,712	-1,558
Mar-12	90.6345	2,142	2,984	-842
Apr-12	91.2605	2,138	3,158	-1,020
May-12	94.1151	2,179	3,452	-1,273
Jun-12	94.3779	2,051	3,653	-1,602
Jul-12	94.4660	2,020	3,446	-1,426
Aug-12	94.5877	2,030	3,232	-1,203
Sep-12	95.3487	2,101	3,098	-997
Oct-12	95.9926	2,117	3,742	-1,625
Nov-12	97.1870	2,027	3,425	-1,398
Dec-12	97.4720	1,859	3,117	-1,258
Jan-13	97.45	2,085	3,402	-1,317
Feb-13	97.925	1,930	3,077	-1,147
Mar-13	98.0783	2,177	3,392	-1,216
Apr-13	98.28571	2,204	3,441	-1,237
May-13	98.31739	2,258	3,468	-1,210

Covariance of export and import against exchange rate from April 2008 to May 2013

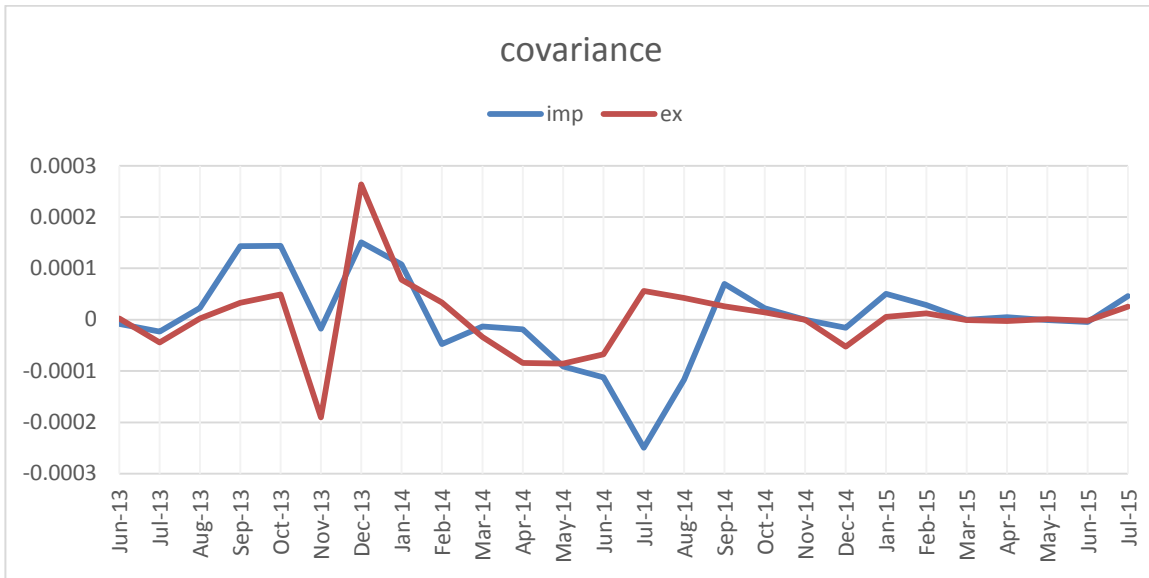


Through graphical analysis it is shown whether exchange rate has any significant impact on export and import. For this, graph is represented by covariance (it shows the association between two variables) between exchange rate and export once and then by covariance between exchange rate and import during the time period of apr-2008 to apr-2013. Graph shows that there is no trend (positive or negative) between the exports and imports against exchange rate.

Table below contains monthly figures of exchange rate, exports, imports and balance of trade during the period from June 2013 to July 2015

Time Period	Exchange Rate (Rs./\$)	Exports Million US\$	Imports Million US\$	Trade Balance Million US\$
Jun-13	98.86905	1,994	3,317	-1,322
Jul-13	100.6825	2,194	3,458	-1,264
Aug-13	103.1368	2,009	3,468	-1,459
Sep-13	105.1429	2,054	3,715	-1,661
Oct-13	106.0941	2,063	3,617	-1,554
Nov-13	107.4650	1,820	3,265	-1,445
Dec-13	106.6238	2,327	3,594	-1,267
Jan-14	105.2368	2,129	3,596	-1,467
Feb-14	105.0111	2,058	3,159	-1,101
Mar-14	99.99545	2,092	3,354	-1,262
Apr-14	97.41429	2,097	3,329	-1,232
May-14	98.5150	2,133	3,531	-1,398
Jun-14	98.4500	2,102	3,582	-1,480
Jul-14	98.6835	1,911	4,023	-2,112
Aug-14	100.0532	1,884	3,876	-1,991
Sep-14	102.7948	2,166	4,084	-1,918
Oct-14	102.7948	2,090	3,532	-1,442
Nov-14	101.9517	1,867	3,080	-1,213
Dec-14	100.8521	2,270	3,420	-1,150
Jan-15	100.8069	1,974	2,929	-955
Feb-15	101.4723	1,864	2,793	-929
Mar-15	101.8742	2,062	3,276	-1,214
Apr-15	101.7483	2,072	3,069	-997
May-15	101.8878	1,883	3,419	-1,536
Jun-15	101.8266	2,094	3,675	-1,581
Jul-15	101.8178	1,129	1,168	-39

Covariance of export and import against exchange rate from June-2013 to July-2015



Through graphical analysis it is shown whether exchange rate has any significant impact on export and import. For this, graph is represented by covariance (it shows the association between two variables) between exchange rate and export once and then by covariance between exchange rate and import during the time period of June-2013 to July-2015. Graph shows that there is no trend (positive or negative) between the exports and imports against exchange rate.

Annex-II.

Model: 1 Estimation of impact of exchange rate fluctuations on exports

$$1.1 \quad exp = \alpha + \beta exr + \mu$$

It is a simple linear single equation model used for estimation of the impact of exchange rate fluctuations on exports. According to econometrics tools the Ordinary Least Square (OLS) method cannot be applied directly on large number of observations (if more than thirty). To use OLS model on large number of observations of independent and dependent variable, first stationarity of data is checked by taking the log of the model for growth (making the model unit less). For this reason the model equation has been modified to:

$$1.2 \quad exp_t - exp_{t-1} = \alpha + \beta exr_t - exr_{t-1} + u_t - u_{t-1}$$

After taking the log of the model the new equation is given below:

$$1.3 \quad \text{Log}(exp_t - exp_{t-1}) = \alpha + \beta \log(exr_t - exr_{t-1}) + \varepsilon$$

Model: 2 Estimation of impact of exchange rate fluctuation on imports

$$2.1 \quad imp = \gamma + \delta exr + \varepsilon$$

It is a simple linear single equation model used to estimate the impact of exchange rate fluctuation on imports as Ordinary Least Square (OLS) model cannot be applied directly on large number of observations. To use OLS model on large number of observations of independent and dependent variable, first stationarity of data is checked by taking the log of the model for growth (making the model unit less). For this reason the model equation has been changed to:

$$2.2 \quad imp_t - imp_{t-1} = \alpha + \beta exr_t - exr_{t-1} + u_t - u_{t-1}$$

After taking the log of the model the new model is as follows:

$$2.3 \quad \text{Log}(imp_t - imp_{t-1}) = \alpha + \beta \log(exr_t - exr_{t-1}) + \varepsilon$$

Model: 3 Estimation of impact of exchange rate fluctuation on balance of payment

3.1
$$BOT = \rho - \sigma exr + \mu$$

Because it is a time series model so first we check stationarity of the model and then take the log the model. For this reason we changed the form of the model.

3.2
$$bot_t - bot_{t-1} = \alpha + \beta exr_t - exr_{t-1} + u_t - u_{t-1}$$

Taking the log of the model the new model is now following:

3.3
$$\text{Log}(bol_t - bol_{t-1}) = \alpha + \beta \log(exr_t - exr_{t-1}) + \varepsilon$$

Annexure-III**Results of Regression equations**

Time Period taken for estimation of the following model is from January 2002 – March 2008

Model No. 1

$$\text{Log}(\text{exp}_t - \text{exp}_{t-1}) = \alpha + \beta \log(\text{exr}_t - \text{exr}_{t-1}) + \varepsilon$$

Hypothesis:

$$H_0 = \beta = 0 \quad \text{and} \quad H_1 = \beta \neq 0$$

Here β shows export elasticity of exchange rate.

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009634	0.017544	0.549148	0.5854
D (LNER)	0.209992	3.854700	0.054477	0.9568
R-squared	0.000062	Mean dependent var	0.010009	
Adjusted R-squared	-0.020770	S.D. dependent var	0.112979	
S.E. of regression	0.114146	Akaike info criterion	-1.463492	
Sum squared resid	0.625411	Schwarz criterion	-1.387011	
Log likelihood	38.58729	F-statistic	0.002968	
Durbin-Watson stat	2.881903	Prob(F-statistic)	0.956781	

Analysis of Results

The above table shows that the estimated value of coefficient is 0.20999 which explains if there is 1 percent increase/decrease in exchange rate then exports will respond by 20%. R^2 of the estimated model is quite low, as only 0.006% variation in exports is explained by the exchange rate. Hypothesis is checked using t-Statistic and Probability value. Tabulated value of t-statistic is 1.64 which is greater than calculated value of t-statistic 0.054, so null hypothesis i.e. $H_0 = \beta = 0$ will be accepted which means that the model is insignificant and exchange rate has no significant impact on exports.

Model No. 2

$$\text{Log}(\text{imp}_t - \text{imp}_{t-1}) = \alpha + \delta \log(\text{exr}_t - \text{exr}_{t-1}) + \varepsilon$$

Hypothesis

$$H_0 = \delta = 0 \quad H_1 = \delta \neq 0$$

Here δ shows import elasticity of exchange rate.

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013432	0.017360	0.773750	0.4429
D(LNER)	0.482069	3.814112	1.269514	0.2104
R-squared	0.032486	Mean dependent var		0.022063
Adjusted R-squared	0.012329	S.D. dependent var		0.113647
S.E. of regression	0.112945	Akaike info criterion		-1.484662
Sum squared resid	0.612310	Schwarz criterion		-1.408181
Log likelihood	39.11656	F-statistic		1.611666
Durbin-Watson stat	2.833834	Prob(F-statistic)		0.210378

Analysis of Results

The estimated model shows that the value of coefficient is 0.48 which explains if there is 1 percent increase/decrease in exchange rate then imports will increase/decrease by 48%. R^2 of the estimated model is quite low, as only 3% variation in imports is explained by the exchange rate. Hypothesis is checked using T-statistic and probability value. Tabulated value of t-statistic is 1.64 which is greater than calculated value of t-statistic 1.26, so $H_0 = \beta = 0$ will be accepted which means that the model is insignificant and exchange rate has no significant impact on imports as well. While using probability method a comparison is made between the value of probability and the level of significance which is normally 5%. In this model probability value 0.21 is greater than the level of significance 0.05 so again $H_0 = \beta = 0$ will be accepted meaning that the model is insignificant and exchange rate has insignificant impact on imports.

Model No.3

$$\text{Log}(\text{bot}_t - \text{bot}_{t-1}) = \alpha + \sigma \log(\text{exr}_t - \text{exr}_{t-1}) + \varepsilon$$

Hypothesis

$$H_0 = \sigma = 0 \quad H_1 = \sigma \neq 0$$

Here σ is trade elasticity of exchange rate

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.098651	0.160031	0.616448	0.5405
D(ER2)	0.003993	0.004827	0.827200	0.4122
R-squared	0.014055	Mean dependent var		0.149992
Adjusted R-squared	-0.006485	S.D. dependent var		1.039653
S.E. of regression	1.043019	Akaike info criterion		2.961293
Sum squared resid	52.21862	Schwarz criterion		3.037774
Log likelihood	-72.03233	F-statistic		0.684260
Durbin-Watson stat	2.405025	Prob(F-statistic)		0.412217

Analysis of Results

The estimation shows that the value of coefficient is 0.0039 which explains if there is 1 percent increase/decrease in exchange rate then trade balance will increase/decrease only by 0.39%. R^2 of the estimated model is quite low, as only 1.40% variation in trade balance is explained by the exchange rate. Hypothesis is checked using T-statistic and probability value. Tabulated value of t-statistic is 1.64 which is greater than calculated value of t-statistic 0.87, so the null hypothesis is accepted i.e. $H_0 = \beta=0$ which means that the model is insignificant and exchange rate has no significant impact on trade balance. While using probability method a comparison is made between the value of probability and the level of significance which is normally 5%. In this model probability value 0.412 is greater than the level of significance 0.05 stating the acceptance of $H_0 = \beta=0$ meaning that model is insignificant and exchange rate has no significant impact on balance of trade.

Time Period April 2008 – May 2013

Model No. 1

$$\text{Log} (\text{exp}_t - \text{exp}_{t-1}) = \alpha + \beta \log (\text{exr}_t - \text{exr}_{t-1}) + \varepsilon$$

Hypothesis:

$$H_0 = \beta = 0 \quad \text{and} \quad H_1 = \beta \neq 0$$

Here β shows export elasticity/ responsiveness of exchange rate.

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013095	0.013974	0.937088	0.3525
D(LNER)	-1.480912	0.877063	-1.688490	0.0966
R-squared	0.046095	Mean dependent var		0.002503
Adjusted R-squared	0.029927	S.D. dependent var		0.099018
S.E. of regression	0.097525	Akaike info criterion		-1.785184
Sum squared resid	0.561154	Schwarz criterion		-1.715975
Log likelihood	56.44810	F-statistic		2.850998
Durbin-Watson stat	3.004520	Prob(F-statistic)		0.096597

Analysis of Results

The value of coefficient as depicted from the above table is - 0.1480 which explains if there is 1 percent increase in exchange rate then exports will decrease by 14.80%. R^2 of the estimated model is quite low, as only 4.60% variation in exports are explained by the exchange rate. Hypothesis is checked using t-Statistic and Probability value. Tabulated value of t-statistic is 1.64 which is smaller than calculated value of t-statistic 1.688 leading to accept $H_1 = \beta \neq 0$ which means that the model is significant and exchange rate had some significant impact on exports during this time period.

Model No. 2

$$\text{Log} (\text{imp}_t - \text{imp}_{t-1}) = \alpha + \delta \log (\text{exr}_t - \text{exr}_{t-1}) + \varepsilon$$

Hypothesis

$$H_0 = \delta = 0 \quad H_1 = \delta \neq 0$$

Here δ shows import elasticity of exchange rate.

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001700	0.001860	0.913917	0.3645
D(LNER)	-0.838185	0.502617	-1.667642	0.1007
R-squared	0.045014	Mean dependent var		0.000327
Adjusted R-squared	0.028828	S.D. dependent var		0.013223
S.E. of regression	0.013031	Akaike info criterion		-5.810787
Sum squared resid	0.010018	Schwarz criterion		-5.741578
Log likelihood	179.2290	F-statistic		2.781031
Durbin-Watson stat	3.002676	Prob(F-statistic)		0.100687

Analysis of Results

The estimated value of coefficient is -0.838185 which explains if there is 1 percent increase in exchange rate then imports will decrease by 83%. R^2 of the estimated model suggests that only 4% variation in imports is explained by the exchange rate. Hypothesis is checked using probability value. While using probability method a comparison of the value of probability with the level of significance is made which is normally checked at 5%. In this model probability value 0.10 is greater than the level of significance 0.05 so it is deduced that the null hypothesis i.e. $H_0 = \beta = 0$ will be accepted meaning that the model is insignificant and exchange rate has insignificant impact on imports.

Model No.3

$$\text{Log}(bot_t - bot_{t-1}) = \alpha + \sigma \log(exr_t - exr_{t-1}) + \varepsilon$$

Hypothesis

$$H_0 = \sigma = 0 \quad H_1 = \sigma \neq 0$$

Here σ is a trade elasticity of exchange rate

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.039095	0.112698	-0.346903	0.7299
D(LNER)	0.305113	30.44584	0.666926	0.5074
R-squared	0.007482	Mean dependent var		-0.005835
Adjusted R-squared	-0.009340	S.D. dependent var		0.785667
S.E. of regression	0.789327	Akaike info criterion		2.396966
Sum squared resid	36.75921	Schwarz criterion		2.466175
Log likelihood	-71.10746	F-statistic		0.444791
Durbin-Watson stat	2.853336	Prob(F-statistic)		0.507419

Analysis of Results

The coefficient of estimated model is 0.305113 which explains if there is 1 percent increase in exchange rate then trade balance will increase by 30%. R^2 of the estimated model is quite low, as only 0.7% variation in trade balance is explained by the exchange rate. Hypothesis is checked using T-statistic and probability value. Tabulated value of t-statistic is 1.64 which is greater than calculated value of t-statistic 0.6669, leading to accept $H_0 = \beta=0$ which means that the model is insignificant and exchange rate has no significant impact on trade balance. While using probability method the value of probability is compared with the level of significance which is normally 5%. In this model probability value 0.507 is greater than the level of significance 0.05 so again $H_0 = \beta=0$ will be accepted that means model is insignificant and exchange rate has an insignificant impact on trade balance.

Time Period June 2013- July 2015

Model No. 1

$$\text{Log}(\text{exp}_t - \text{exp}_{t-1}) = \alpha + \beta \log(\text{exr}_t - \text{exr}_{t-1}) + \varepsilon$$

Hypothesis

$$H_0 = \beta = 0 \quad \text{and} \quad H_1 = \beta \neq 0$$

Here β shows export elasticity of exchange rate

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.022734	0.032574	-0.697915	0.4922
D(LNER)	-0.020534	2.077562	-0.009884	0.9922
R-squared	0.000004	Mean dependent var		-0.022758
Adjusted R-squared	-0.043474	S.D. dependent var		0.158993
S.E. of regression	0.162413	Akaike info criterion		-0.720735
Sum squared resid	0.606691	Schwarz criterion		-0.623225
Log likelihood	11.00918	F-statistic		9.77E-05
Durbin-Watson stat	2.006928	Prob(F-statistic)		0.992199

Analysis of Results

In estimated model the value of coefficient is -0.020534 which explains if there is 1 percent increase in exchange rate then exports will decrease by 2%. R^2 of the estimated model is quite low, as only 0.0004% variation in exports is explained by the exchange rate. Hypothesis is checked using t-Statistic and Probability value. Tabulated value of t-statistic is 1.64 which is greater than calculated value of t-statistic 0.0098 leading to accept $H_0 = \beta = 0$ which means that the model is insignificant and exchange rate has no significant impact on exports.

Model No. 2

$$\text{Log}(\text{imp}_t - \text{imp}_{t-1}) = \alpha + \delta \log(\text{exr}_t - \text{exr}_{t-1}) + \varepsilon$$

Hypothesis

$$H_0 = \delta = 0 \quad H_1 = \delta \neq 0$$

Here δ shows import elasticity of exchange rate.

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.041958	0.050576	-0.829601	0.4153
D(LNER)	0.179511	3.225718	0.055650	0.9561
R-squared	0.000135	Mean dependent var		-0.041747
Adjusted R-squared	-0.043338	S.D. dependent var		0.246877
S.E. of regression	0.252169	Akaike info criterion		0.159187
Sum squared resid	1.462556	Schwarz criterion		0.256697
Log likelihood	0.010166	F-statistic		0.003097
Durbin-Watson stat	1.343170	Prob(F-statistic)		0.956101

Analysis of Results

In the above estimated model value of coefficient is 0.179 which explains if there is 1 percent increase in exchange rate then imports will increase by 17%. R^2 of the estimated model is quite low, as only .0013% variation in imports is explained by the exchange rate. Hypothesis is checked using T-statistic and probability value. Tabulated value of t-statistic is 1.64 which is greater than calculated value of t-statistic 0.055 leading to accept $H_0 = \beta=0$ which means that the model is insignificant and exchange rate has no significant impact on imports. While using probability method a comparison has been made between the value of probability and the level of significance which is normally 5%. In this model probability value 0.9561 is greater than the level of significance 0.05 so again null hypothesis will be accepted i.e. $H_0 = \beta=0$ it means model is insignificant and exchange rate has insignificant impact on imports.

Model No 3.

$$\text{Log}(bot_t - bot_{t-1}) = \alpha + \beta \log(exr_t - exr_{t-1}) + \varepsilon$$

Hypothesis

$$H_0 = \sigma = 0 \text{ and } H_1 = \sigma \neq 0$$

Where σ is trade elasticity of exchange rate

Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.284168	0.312883	-0.908224	0.3732
D(LNER)	0.019307	19.95550	0.097031	0.9235
R-squared	0.000409	Mean dependent var	-0.281892	
Adjusted squared	R- -0.043051	S.D. dependent var	1.527481	
S.E. of regression	1.560014	Akaike info criterion	3.803885	
Sum squared resid	55.97382	Schwarz criterion	3.901395	
Log likelihood	-45.54857	F-statistic	0.009415	
Durbin-Watson stat	1.128286	Prob(F-statistic)	0.923542	

Analysis of Results

In above estimated model value of coefficient is 0.0193 which explains if there is 1 percent increase in exchange rate then trade balance will increase by 1.9%. R^2 of the estimated model is quite low, as only .04% variation in trade balance is explained by the exchange rate. Hypothesis is checked using T-statistic and probability value. Tabulated value of t-statistic is 1.64 which is greater than calculated value of t-statistic is 0.097, so null hypothesis will be accepted i.e. $H_0 = \beta = 0$ which means that the model is insignificant and exchange rate has no significant impact on trade balance. While using probability method a comparison has been made between the value of probability and the level of significance which is normally 5%. In this model probability value 0.9235 is greater than the level of significance 0.05 again endorsing the same result to accept $H_0 = \beta = 0$ this means that model is insignificant and exchange rate has insignificant impact on balance of trade.