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Trade Flexibility Under Exchange Rate Volatility: An Impulse Response Function Approach for Russia

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Abstract

The study analyzes the relationship between exchange rate, import, and export in the Russian economy using a Vector Autoregressive (VAR) and Impulse Response Function model with historical data spanning from 1995 to 2022. The Augmented Dickey Fuller (ADF) unit root test reveals that the variables are non-stationary with intercept term at level data but stationary after first differencing. The VAR model results show that the exchange rate is significantly persistent, and import and export are influenced by their own lagged values as well as the lagged values of other variables. There is positive relationship between export and import and not only that we observed on the basis of this VAR model there is significant relationship between export and Exchange rate in the economy of Russia. Overall, the study provides insights into the dynamics of the Russian economy's exchange rate, import, and export and can help policymakers make informed decisions regarding trade policies.

Keywords: Stationarity Test, Vector Autoregressive Model, Impulse Response Function, Engle Granger Regression Analysis.

JEL Classifications: F1, F4, F130

1. Introduction:

January 1995 - October 2022, Russia has experienced various fluctuations in exchange rates which have had a significant impact on its import and export activities. Here are five different ways to paraphrase the impact of exchange rates on Russia's import and export over this period:Over the past 27 years, fluctuations in exchange rates have significantly influenced Russia's import and export activities. Changes in exchange rates have impacted the competitiveness of Russian goods in foreign markets, affecting the demand for exports and import costs. From 1995 to 2022, fluctuations in exchange rates have had a profound impact on Russia's import and export activities. The devaluation of the ruble has been beneficial to Russian exporters as it makes their goods cheaper in foreign markets, while importers have faced higher costs. Over the years, the fluctuations in the exchange rate have affected Russia's import and export activities. A stronger ruble makes imports cheaper and exports more expensive, while a weaker ruble makes imports more expensive and exports cheaper. Russia's import and export activities have been

impacted by fluctuations in the exchange rate over the past 27 years. A strong ruble can make imports more attractive to Russian consumers, while a weak ruble can make exports more attractive to foreign buyers.The impact of exchange rates on Russia's import and export activities has varied over time. Exchange rate fluctuations can have both positive and negative effects on trade, depending on the relative strength of the ruble and other currencies, and the demand for Russian goods in foreign markets.

2. Review of Literature:

Z. Muhammad (2014) examines how exchange rate instability affected Pakistan's imports, exports, trade balance, foreign exchange reserves, and GDP during 1952–2010. The study finds significant relationships among these variables, showing that depreciation can boost exports, while excessive exchange rate volatility may hinder economic growth. Statistical tests confirm the model's reliability for predicting trade balance and GDP outcomes.

Duasa (2008) investigated the effects of exchange rate shocks on Malaysia's import and export prices using a Vector Error Correction Model (VECM) with monthly data from 1999 to 2006. The findings revealed significant but incomplete exchange rate pass-through to import prices. Variance decomposition and impulse response analyses highlighted dynamic interactions among exchange rates, money supply, and trade prices.

S.C. Barma (2025) investigates the dynamic relationships among exchange rates, exports, and imports in Kazakhstan using monthly data from November 1993 to October 2022. Johansen cointegration confirms a stable long-run relationship among the variables. Granger causality reveals exchange rate effects on imports and strong export-import interdependence. The stable VAR model highlights significant lagged effects, emphasizing the role of trade flows in exchange rate dynamics.

Data Source:

The study uses monthly secondary data covering the period from January 1995 - October 2022. The data were collected from the International Monetary Fund's (IMF) International Financial Statistics (IFS) database and various editions of the Direction of Trade Statistics Yearbook. These sources provide consistent and reliable information required for the empirical analysis.

Test of Stationarity: Augmented Dickey-Fuller (ADF) Unit Root Test

Stationarity of exchange rate (e_t), import and export (p_t) series has been studied through the Augmented Dickey Fuller (ADF) tests. The basic ADF equation estimated with appropriate changes under different assumptions are

$$\Delta e_t = \alpha_1 + \gamma_1 e_{t-1} + \sum_{i=1}^{n} \delta_{1i}\Delta e_{t-1} + \varepsilon_{1i} \quad \text{..................................(1)}$$

$$\Delta X_t = \alpha_2 + \gamma_2 X_{t-1} + \sum_{i=1}^{n} \delta_{2i}\Delta X_{t-1} + \varepsilon_{2i} \quad \text{..................................(2)}$$

$$\Delta M_t = \alpha_3 + \gamma_3 e_{t-1} + \sum_{i=1}^{n} \delta_{3i}\Delta M_{t-1} + \varepsilon_{3i} \quad \text{..................................(3)}$$

$$\varepsilon_{1t} \sim \text{iidN}(0, \sigma_{\varepsilon_1}^2), \quad \varepsilon_{2t} \sim \text{iidN}(0, \sigma_{\varepsilon_2}^2) \text{ and } \quad \varepsilon_{3t} \sim \text{iidN}(0, \sigma_{\varepsilon_3}^2),$$

where $\Delta e_t = (e_t - e_{t-1})$, $\Delta X_t = (X_t - X_{t-1})$ and $\Delta M_t = (M_t - M_{t-1})$

α = constant term, ε_t = Random error term

The optimal lag (k) may be determined through Akaike Information Criterion, Schwartz Information Criterion, Hannan-Quinn Information criterion etc.

Table:1

Augmented Dickey Fuller Unit Root Test

Variables	Prob. Values		t – Stat.	
	At Level	At First Difference	At Level	At First Difference
Exchange Rate	0.616	0.000	-1.331	-12.578
Import	0.556	0.000	-1.454	-4.310
Export	0.526	0.002	-1.513	-3.962

Finding from the ADF Tests (Table 1)

It is observed from the ADF Unit Root Test results as presented through the Table 1 that

i. the hypothesis of 'unit roots' in Exchange rate, Import and Export cannot be rejected even at 10% level in the presence of 'intercept' term and 'time 'variable in the maintained regression equation.
ii. the hypothesis of 'unit root' in Exchange rate, Import and Export is accepted in the presence of 'intercept' term alone without 'linear trend' and even in the absence of any 'intercept' term and 'linear trend' in the maintained regression equations.

All these observations indicate that

i. Exchange rate, Import and Export series contain 'unit roots' and, therefore, these series are 'non-stationary' by nature.
ii. Exchange rate, Import and Export series contain 'non-stationary' stochastic trends.

Again, after first differencing in the Table 1 shows that

i. the hypothesis of 'unit roots' for 1st difference values of exchange rate series is rejected even at 1% level in the presence of an 'intercept term' in the maintained regression equation.
ii. the hypothesis of 'unit roots' for 1st difference values of exchange rate series is rejected even at 1% level both in the presence and absence of an 'intercept term' in the maintained regression equation.
iii. the hypothesis of 'unit root' in 1st difference values of import and export series are rejected even at 1% level when the estimated maintained regression equation contains an 'intercept term' term in it.
iv. the hypothesis of unit root for 1st difference values of import and export series are also rejected even at 1% level when the maintained regression equation is estimated with and without an 'intercept' term given that no 'time' variable appears in it.

All these observations indicate that

a) 1st difference values of exchange rate, import and export are stationary. So, all are I(0) variables.
b) exchange rate, import and export are 'Differenced Stationary' and these are not 'Trend Stationary' series.

c) exchange rate, import and export are I(1) variables. Therefore, e_t and p_t represent First Order Integrable Series,

In the ADF Unit root test we examined that for the Exchange Rate, the p-values are 0.616 at the level and 0.000 at the first difference. Similarly, in case of Import and Export, the p-values are 0.556 and 0.526 at the level respectively, and all are significant at the first difference (0.000 and 0.002) in the economy of Russia. The t-stat. values for all variables suggested that the significant values at the first difference, indicating stationarity after differencing.

Engle Granger Regression Analysis

$$Y_t = \alpha_t + \beta_t X_t + \gamma_t Z_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Estimated equation of the above equation (10)

$$\Delta \text{Export}_t = 0.001 + 0.737\Delta \text{Import}_t - 0.003\Delta \text{Ex} - \text{Rate}_t \ldots\ldots\ldots (11)$$

t-stat.	0.33	**12.401**	**- 3.975**
S.E	0.002	0.059	0.001

$$R^2 = 0.365 \quad F.\text{Stat} = 94.808 \quad \text{Prob}(F - \text{Stat}).= 0.000 \quad \text{DW Stat.} = 2.115$$

The findings from the regression analysis in equation (11): Coefficients of import has a positive, which means that an increase in imports is associated with a corresponding increase in exports. This suggested that a complementary relationship between imports and exports in the Russian economy. Exchange Rate has a negative coefficient (-0.003), implies that a depreciation of the exchange rate is associated with an increase in exports which means that a weaker currency makes exports cheaper for foreign buyers, potentially boosting export competitiveness. The constant term (C) is statistically insignificant, indicating that it does not have a significant impact on export levels. The value of R^2 indicates that around 36.5% of the variation in export levels can be explained by the variation in import and exchange rate. The Adjusted R^2 adjusts for the number of independent variables in the model. The F-stat. value (94.808) is significant at a high level, indicating that the overall regression model is statistically significant. The low p-value [(F-stat.) = 0.000] suggests that the model is a good fit for the data. The Durbin-Watson statistic (2.115) measures the presence of autocorrelation in the residuals. A value around 2 suggests there is no autocorrelation on that historical datasets in Russia.

The Vector Autoregressive (VAR) Model:

The Vector Autoregressive (VAR) Model for exchange rate, export and import in the economy of Russia are as follows.

$$E_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i} E_{t-i} + \sum_{i=1}^{n} \gamma_{1i} X_{t-i} + \sum_{i=1}^{n} \delta_{1i} M_{t-i} + \mu_{1t} \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$X_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i} E_{t-i} + \sum_{i=1}^{n} \gamma_{2i} X_{t-i} + \sum_{i=1}^{n} \delta_{2i} M_{t-i} + \mu_{2t} \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$M_t = \alpha_3 + \sum_{i=1}^{n} \beta_{3i} E_{t-i} + \sum_{i=1}^{n} \gamma_{3i} X_{t-i} + \sum_{i=1}^{n} \delta_{3i} M_{t-i} + \mu_{3t} \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where $E_t = \Delta\text{Exchange Rate}$, $X_t = \Delta\text{Export}$ and $M_t = \Delta\text{Import}$ represent the first differenced stationary time series dataset for Exchange Rate, Export and Import respectively over the period 1995 - 2022. Since Exchange Rate $\sim I(1)$, Export $\sim I(1)$and Import $\sim I(1)$, the stationary of E_t „ X_t and M_t is ensured through the first difference filtering of exchange rate, Export and Import respectively.

$\mu_{1t} \sim GWN(0, \sigma^2_{\mu_1})$, $\mu_{2t} \sim GWN(0, \sigma^2_{\mu_2})$ and $\mu_{3t} \sim GWN(0, \sigma^2_{\mu_3})$

are the stochastic error terms which are known as impulse or innovations or shocks in the VAR Model. 'Contemporaneous Var-Covariance matrix (Ω) of the cross-equation error terms involved such that Ω = Var-Covar (u_{1t}, u_{2t}, u_{3t}) where Ω is a Positive Definite Matrix. A matrix is Positive definite if all its eigen values are positive and all diagonal entries are positive.

A is positive definite if, for every non-zero vector x

$$x^{\tau}Ax > 0$$

$$(x_1 \quad x_2 \ldots\ldots\ldots\ldots \quad x_n) \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1n} \\ A_{21} & A_{22} & \cdots & A_{2n} \\ \vdots & \vdots & & \vdots \\ A_{31} & A_{32} & \cdots & A_{nn} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} > 0$$

Selection of Lag Length in the VAR Estimation :

The optimum lag length (m) has been determined on the basis of some Information Criteria, like Akaike Information Criterion (AIC), Schwartz Information Criterion (SIC), Hannan-Quin Information Criterion (HQIC), Sequential Modified LR Test Statistic (SMLST), Forecast Prediction Error(FPE) Statistic etc. The Table presents the relevant lag length statistics as given by these criteria.

Table:2
VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: Export ImportExchange Rate
Exogenous variables: C
Sample: 1995:01 2022:10
Included observations: 325

Lag	Log L	LR	FPE	AIC	SC	HQ
0	520.6136	NA	8.30E-06	-3.185315	-3.150387*	-3.171375
1	545.2928	48.75078	7.54E-06	-3.281802	-3.142091	**-3.226043***
2	553.3703	15.80714	7.58E-06	-3.276125	-3.031632	-3.178547
3	572.3966	36.88180	7.13E-06	-3.337826	-2.988549	-3.198429
4	581.6711	17.80688	7.12E-06*	-3.339514*	-2.885455	-3.158299
5	587.1484	10.41534	7.27E-06	-3.317836	-2.758994	-3.094802
6	597.8559	20.16311*	7.20E-06	-3.328344	-2.664719	-3.063490
7	602.0860	7.887416	7.42E-06	-3.298991	-2.530583	-2.992318
8	608.9496	12.67128	7.52E-06	-3.285844	-2.412653	-2.937352

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

In the above table-2 VAR Lag order selection criterion, we observed that a higher log-likelihood (LogL) indicates a better fit of the model to the data. The sequential modified LR test statistic (LR) tests the hypothesis that all lag coefficients are jointly equal to zero. A significant LR value suggests the rejection of the null hypothesis, indicating the presence of lagged effects. Final Prediction Error (FPE) measures the accuracy of the model's predictions. A lower FPE value indicates better predictive performance. Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ) are used to assess the trade-off between goodness of fit and model complexity. Lower values of these criteria indicate a better model fit. The lag order selected by each criterion is denoted by an asterisk (*) in the table.

Estimated equations of the VAR(1,1) model for the Equations (4), (5) and (6)

$$E_t = 0.126Ex - rate_{t-1} - 5.615M_{t-1} - 5.446X_{t-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

S.E	0.056	4.436	3.391
t-stat.	2.255	-1.266	-1.606

$R^2 = 0.055$ Adj $R^2 = 0.047$ $F - Stat = 6.404$
Log Likelihood = -737.883 AIC = 4.469 SIC= 4.515

$$X_t = -0.003Ex - rate_{t-1} - 0.302M_{t-1} + 0.075X_{t-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

S.E	0.001	0.09	0.07
t-stat.	**-2.777**	**-3.448**	1.116

$R^2 = 0.056$ Adj $R^2 = 0.047$ $F - Stat = 6.498$
Log Likelihood = 564.820 AIC = -3.378 SIC= -3.332

$$M_t = -0.001Ex - rate_{t-1} - 0.263M_{t-1} + 0.162X_{t-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

S.E	0.001	0.066	0.050
t-stat.	-1.055	-3.993	**3.224**

$R^2 = 0.055$ Adj $R^2 = 0.047$ $F - Stat = 6.417$
Log Likelihood = 659. 868 AIC = -3.951 SIC= -3.905

Findings from the estimated equation (8) with VAR(1,1) Model

We observed that coefficient of exchange rate indicates that when the exchange rate increases by one unit, exports decrease by approximately 0.003 units in the next period. The t-stat value is statistically significant even at 1% level. Similarly, coefficient of import is also significant with the t-value which implies that a one-unit increase in imports reduces exports by approximately 0.302 units in the following period. Again, values of R^2 indicate that Exchange rate, imports, and lagged exports together explain only 5.6% of the variation in Russian exports and Adj. R^2 implies after adjusting for the number of variables, about 4.7% of export variation is explained by the model. So, we say that the small difference between R^2 and adjusted R^2 indicates that the included regressors contribute meaningfully to the model. The values of F-stat shows that exchange rate and imports still play a meaningful role in the economy of Russia.

Again, findings from the estimated equation (9) of VAR model the coefficient of export is significant with t-stat. values so there is significant relationship between import and export in the economy of Russia. We

observed that a one-unit increase in exports leads to approximately a 0.162-unit increase in imports in the following period. R^2 values indicate that about 5.5% of the variation in Russian imports is explained by exchange rate, lagged imports, and lagged exports. Adj-R^2 implies that after adjusting for the number of variables, the model explains approximately 4.7% of import variation in Russia. The value of F-stat indicate that the model is statistically significant as a whole.

Impulse Response Function:

Methodology: We consider for three variables, with VAR model:

- E_t= Exchange Rate
- X_t= Export
- Z_t= Import

The VAR(1) system is:

$$\begin{bmatrix} Y_t \\ X_t \\ Z_t \end{bmatrix} = A \begin{bmatrix} Y_{t-1} \\ X_{t-1} \\ Z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{Y,t} \\ \varepsilon_{X,t} \\ \varepsilon_{Z,t} \end{bmatrix}$$

where A is a 3×3 coefficient matrix.

The moving-average representation is:

$$\begin{bmatrix} Y_t \\ X_t \\ Z_t \end{bmatrix} = \sum_{h=0}^{\infty} \Phi_h \begin{bmatrix} \varepsilon_{Y,t-h} \\ \varepsilon_{X,t-h} \\ \varepsilon_{Z,t-h} \end{bmatrix}$$

where

$$\Phi_h = \begin{bmatrix} \phi_{YY}(h) & \phi_{YX}(h) & \phi_{YZ}(h) \\ \phi_{XY}(h) & \phi_{XX}(h) & \phi_{XZ}(h) \\ \phi_{ZY}(h) & \phi_{ZX}(h) & \phi_{ZZ}(h) \end{bmatrix}$$

The IRF matrix at horizon h is therefore:

$$\mathrm{IRF}(h) = \Phi_h = \begin{bmatrix} \phi_{YY}(h) & \phi_{YX}(h) & \phi_{YZ}(h) \\ \phi_{XY}(h) & \phi_{XX}(h) & \phi_{XZ}(h) \\ \phi_{ZY}(h) & \phi_{ZX}(h) & \phi_{ZZ}(h) \end{bmatrix}$$

Each element is interpreted as:

$$\phi_{ij}(h) = \frac{\partial y_{i,t+h}}{\partial \varepsilon_{j,t}}$$

For example:

- $\phi_{YZ}(h)$: response of Exchange Rate(E) to an Export (X).
- $\phi_{XY}(h)$: response of Export (X) to a Exchange Rate (E).
- $\phi_{ZX}(h)$: response of Export (X) to an Import (M).

The general IRF formula for three variables (and for any n-variable VAR) is:

$$IRF_{ij}(h) = \frac{\partial y_{i,t+h}}{\partial \varepsilon_{j,t}}$$

Impulse Response to Cholesky one S.D. (d.f. adjusted) innovations

Table : 3

Response of Exchange Rate

Period	Ex- Rate	Export	Import
1	2.2471458...	0	0
	0.0872061...	0	0
2	0.3793907...	-0.333995...	-0.154546...
	0.1234985...	0.1206501...	0.1222483...
3	0.0960764...	-0.041788...	0.0665030...
	0.0472988...	0.0314048...	0.0339187...
4	0.0204217...	-0.002699...	-0.006599...
	0.0154114...	0.0084604...	0.0074245...
5	0.0036946...	-0.003525...	6.5575760...
	0.0042683...	0.0023783...	0.0022020...
6	0.0009655...	-0.000202...	0.0004943...
	0.0011389...	0.0006106...	0.0004980...
7	0.0001837...	-6.787272...	-8.963573...
	0.0002939...	0.0001557...	0.0001214...
8	3.7398016...	-3.095958...	1.4033046...
	7.1947659...	3.8711521...	3.0770857...
9	9.3465458...	-9.829769...	2.1863368...
	1.7671460...	9.1276438...	7.3426808...
10	1.6782237...	-1.046122...	-7.265050...
	4.2188144...	2.1535850...	1.6791120...

Table: 4

Response of Export

Period	Ex-Rate	Export	Import
1	-0.012314...	0.0426754...	0
	0.0023903...	0.0016561...	0
2	-0.006215...	-0.002278...	-0.008320...
	0.0024488...	0.0024103...	0.0024349...
3	-0.000847...	0.0001977...	0.0020392...
	0.0007336...	0.0007713...	0.0008624...
4	-0.000157...	0.0003385...	-0.000259...
	0.0001745...	0.0002035...	0.0002646...
5	-6.001508...	-3.863509...	-2.693582...
	5.4711996...	5.3446144...	7.3705934...
6	-6.448715...	9.5797544...	1.6060275...
	1.2936720...	1.3649402...	1.7669164...
7	-1.980922...	1.8608508...	-3.780540...
	3.2958700...	3.5135521...	4.3036154...
8	-5.233664...	-3.143050...	2.4635329...
	8.5365972...	8.6561146...	1.1088544...
9	-5.733914...	1.3604382...	7.0290564...
	1.9047388...	1.9057923...	2.6566084...
10	-2.270775...	3.4093771...	-3.476269...
	4.7065298...	4.3842387...	5.9528296...

Findings from the Table-3 the response to its own shocks (Exchange rate -Exchange rate)

This is the most striking result. In Period -1, the exchange rate shows an enormous response of 2.247 to its own shock-meaning the ruble reacts strongly and immediately to any disturbance in itself. The standard error (0.087) is relatively small, confirming this is highly significant. By Period 2 the response collapses to 0.379, then 0.096 in Period 3, and essentially converges to zero by Period 5–6. This pattern of rapid decay indicates the Russian exchange rate is mean reverting-shocks are absorbed quickly and the system returns to equilibrium within about 4–5 periods. This is consistent with a managed float regime where the central bank (Bank of Russia) intervenes to stabilize the ruble after large swings.

Findings from the Table: 4 the response to an Exchange Rate shock (Exchange Rate on Exports)

The export response is persistently negative throughout all 10 periods:

- Period 1: −0.0123 (std. error 0.00239 — highly significant)
- Period 2: −0.0062 (still significant)
- Period 3: −0.00085, continuing to decay toward zero

A positive shock to the exchange rate (ruble depreciation) causes exports to fall, not rise — which seems paradoxical. In standard theory, a weaker currency makes exports cheaper and more competitive. However, this result is entirely consistent with Russia's commodity-dominated export structure. Russian exports are overwhelmingly oil, gas, and raw materials - priced in US dollars on global markets. A ruble depreciation doesn't make barrels of oil "cheaper" internationally; global commodity prices determine export volumes, not the ruble exchange rate. Furthermore, ruble depreciation often reflects broader

economic stress (sanctions, oil price collapse), which suppresses production capacity and logistics, actually reducing export volumes in the short run. The effect is statistically significant in Periods 1–4 and dies out by Period 5–6.

Table: 5

Response of Import

Period	Ex-Rate	Export	Import
1	-0.005259...	0.0180962...	0.0275258...
	0.0018193...	0.0016659...	0.0010682...
2	-0.002579...	0.0021667...	-0.007238...
	0.0018453...	0.0018220...	0.0018342...
3	-0.000661...	-0.000647...	0.0006881...
	0.0004080...	0.0006354...	0.0007232...
4	-4.742460...	0.0002389...	9.1847040...
	9.4044710...	0.0001349...	0.0002086...
5	-3.095783...	-5.522195...	-6.045573...
	2.9401199...	3.4564839...	5.2359456...
6	-4.828292...	-1.736064...	1.1469085...
	7.1491290...	1.0758989...	1.2581118...
7	-6.209388...	2.1879370...	-8.418099...
	1.7801844...	2.5658402...	3.2722998...
8	-3.188080...	-2.140317...	-3.137922...
	4.4771163...	5.3277589...	8.4435919...
9	-3.379018...	3.2340100...	1.1022715...
	1.0096048...	1.3046480...	1.8738015...
10	-8.589944...	1.4432481...	-1.948996...
	2.5009209...	3.3562053...	4.0240577...

Cholesky One S.D. (d.f. adjusted) Innovations
Cholesky ordering: Exchange Rate
Export Import
Standard errors: Analytic standard deviations in parentheses

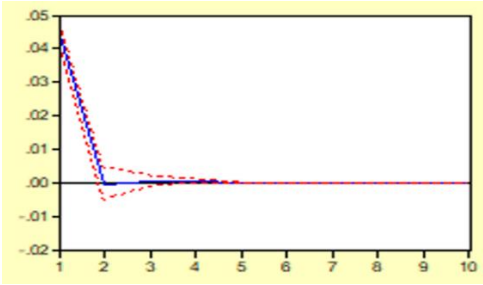
We observed from the Table -5 that the response to an import shock on exchange rate. The exchange rate starts at zero in Period 1, then shows a negative response of −0.155 in Period 2 (standard error 0.122, marginally significant). In Period 3 it flips to a small positive value of +0.067 before dying out. This oscillation (negative than positive) reflects the J-curve dynamic: when imports surge, the ruble initially weakens (import demand raises the price of foreign currency), but adjustment in trade flows and capital markets quickly reverses this in the following period. By Period 4 the effect is statistically indistinguishable from zero.

Graph of the Impulse Response Function about Exchange rate, Export and Import:

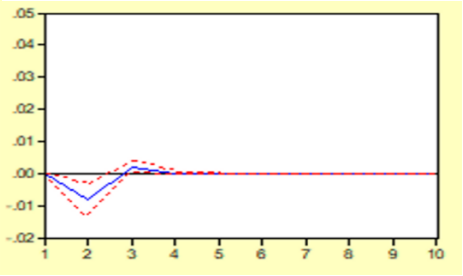
Figure: 1
Response to Cholesky one S.D.

Figure: 2
Response to Cholesky one S.D.

Innovations ±2 S.E
Response to Export to Export



Innovations ±2 S.E
Response to Export to Import



Observations of From the Impulse Response Functions in Figure 1 and Table 4:

It is observed from the Figure 1 and Table 4 that, following a positive impulse transmitted through the export channel, export

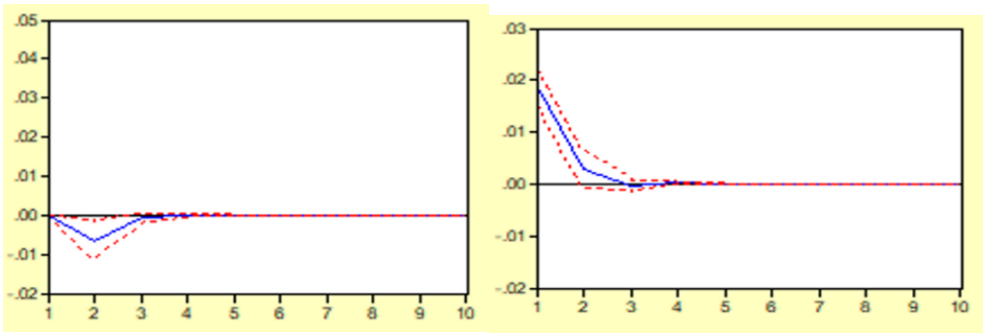
i. responds immediately by rising above the long run base at t = 0.
ii. The export response to its own shock is large and immediately positive.
iii. the export always responds positively to its own shock in Period 1.
iv. Export confirming high statistical significance

It is observed from the Figure 2

i. The response drops dramatically and turns slightly negative by Period 2.
ii. exports fall back below baseline.
iii. The response from the period 3-5 means the response makes small positive and negative oscillations of diminishing magnitude.
iv. Export returned to equilibrium.
v. damped oscillation of export in the economy of Russia is consistent with a stationary VAR model which implies that the shocks have no permanent effect.
vi. After period 6 export shock has been fully convergence to zero and absorbed which means that the system is mean reverting.

Figure: 3
Response to Cholesky one S.D.
Innovations ±2 S.E
Response to Export to Exchange Rate

Figure: 4
Response to Cholesky one S.D.
Innovations ±2 S.E
Response to Import to Export

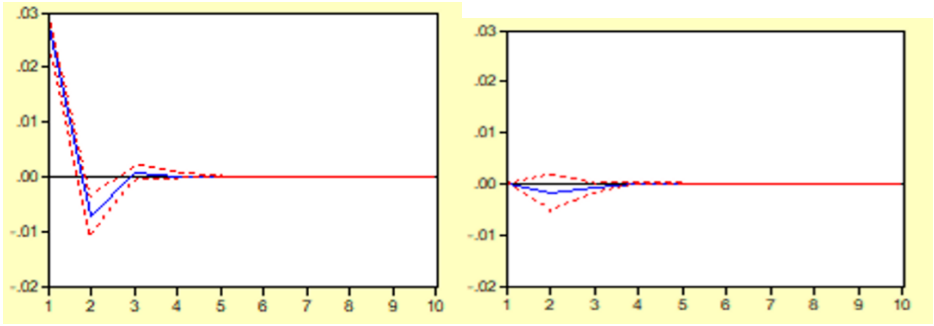


It is observed from the figure 3 and figure 4

i. The response is negative after first period
ii. trough the period 3–4, it gradually recovers toward zero. This delayed negative peak is the central economic story of this IRF which means the lowest point of the business or economic cycles before the recovery begins and weakened export demand reduced global orders.
iii. After the period 3-4 means that the negative export response to a ruble depreciation shock is statistically significant at approximately the 95% level.
iv. For the period 5 the recovery begins and which reflects the market normalization
v. For the period 7 -8 confidence indicates the straddle zero symmetrically and response is no longer statistically significant implies exchange rate has fully absorbed.
vi. there is no permanent negative effect on Russian exports and the VAR system is stationary.
vii. from the beginning (Period 1) to the end (Period 4–5), the response stayed clearly positive the whole time.
viii. response decreases steadily and continuously over time without any ups and downs. It never increases again, never changes direction, and never becomes negative implies that "Russia's imports/exports decreased steadily over time without any temporary recoveries or sharp fluctuations.

Figure: 5
Response to Cholesky one S.D. Innovations ±2 S.E
Response to Import to Import

Figure: 6
Response to Cholesky one S.D. Innovations ±2 S.E
Response to Import to Exchange Rate



Findings from the figures 5 and 6 of Impulse response Function

i. In the Figure -5 the response for import in period 1 is positive and sharp sign reversal in period 2 and after the oscillation is convergent and system returns cleanly to zero.

ii. In the figure 6 for the period 1 response is essentially zero and rapid oscillation for the period 2 and full convergent at the period 5 and quickly damped oscillation towards zero.

Figure: 7
Response to Cholesky one S.D.
Innovations ±2 S.E
Response to Exchange Rate to Export

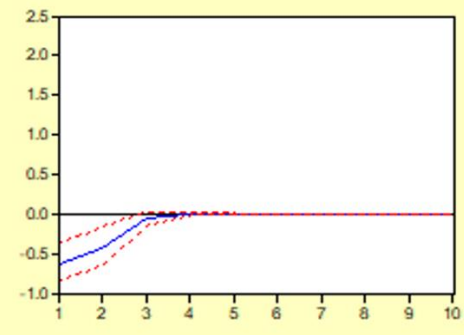


Figure: 8
Response to Cholesky one S.D.
Innovations ±2 S.E
Response to Exchange Rate to Import

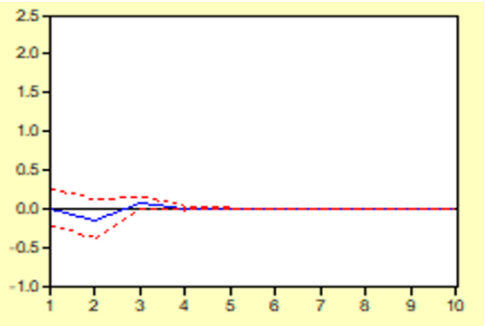
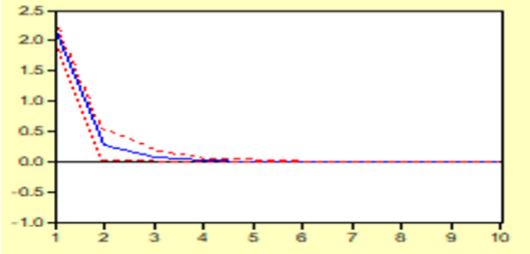


Figure: 9
Response to Cholesky one S.D.
Innovations ±2 S.E
Response to Exchange Rate to Exchange Rate



In the above Figures 7, 8 and 9 we observed that

i. the large negative response in period 2 and after the period 3 response towards zero and convergence.
ii. In figure 8 immediate response for the period 1 is exactly zero and small negative dip in period 2.
iii. There is positive excursion in impulse response function for the period 3 and response is convergence for periods 5 and 6 which indicates that the imports fell sharply and quickly reached very low or near-zero levels.
iv. Similarly in figure 9 we see that the largest single response which is highly significance in the entire IRF with no oscillation
v. Response is full convergence by the period 5 and 6 and shocks is completely absorbed.

3. Summary, conclusion and future policy implications:

Based on the results of the regression analysis, we can derive some implications for future planning and suggestions in the Russian economy.

Increase import from Russia: The coefficient of import is positive and statistically significant, indicating that import has a positive effect on the export performance of Russia. Therefore, policymakers could consider measures to encourage more imports in order to boost exports.

Monitor exchange rate fluctuations: The coefficient of exchange rate is negative and statistically significant, suggesting that a strong exchange rate could have a negative impact on export performance. Therefore, policymakers should monitor exchange rate fluctuations and take steps to stabilize the exchange rate if necessary.

Promote export-oriented industries: Since exports are an important source of foreign exchange earnings for Russia, policymakers could consider promoting export-oriented industries and providing incentives to increase export volumes. This could include developing new export markets, improving the competitiveness of Russian exports, and investing in export-oriented industries.

Enhance research and development: To improve the quality and competitiveness of Russian exports, policymakers could invest in research and development (R&D) to develop new products and technologies. This could help Russian firms to create innovative and high-quality products that can compete in global markets.

Develop international trade agreements: To facilitate exports, policymakers could consider developing international trade agreements with key trading partners. This could help to reduce trade barriers and promote the free flow of goods and services, which could boost export volumes and foreign exchange earnings for Russia.

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