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Revisiting the Dynamic MacroeconomicEffects of Real Exchange Rate and Economic growth: Application of Structural Vector Autoregressive (SVAR) Analysis

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Abstract

This research study endeavor to inspect the influence of real effective exchange rate on level of real GDP consumer price index (CPI) by using restricted VAR (VECM) econometrics approach for Pakistan economy over the period 1980-2020. We examined the bivariate relationship between real effective exchange rate and level of real GDP. It was concluded a negative correlation between these two variables. Thelong-term interrelationship among real effective exchange rate, CPI price level, and level of real GDP has also been examined by employing Johansen co-integration. By utilizing various VECM models we have found the long-term causality (A) from CPI price and level of output to the real effective exchange rate, and (B) from the real effective exchange rate, CPI price level `and level of real output to M2 money supply and (C) from the real effective exchange rate, M2 and real output level to CPI price level. The money supply (M2) growth has a very strong positive impact on both levels of real GDP and CPI level.

Keywords: Exchange rate, Consumer price index, Bivariate, GDP, VAR, VECM Model, Co-integration,Causality, M2 money, Money supply.

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1. Introduction

The traditional view regarding impacts of devaluation/depreciation on output level is expansionary and similar to many other less-developed nations, Pakistani economy had practiced a series of large devaluations/depreciation in different periods since 1955 to up till now in hope to reap these economic benefits. The influences of devaluation/depreciation on the level of GDP and general prices may not be identical across all less developed countries; empirical upshots from these studies could not be generalized for all LDCs. Pakistan has been facing financial crises during the past three decades. The exchange rate has been regarded by the govt. policymakers as an important macroeconomic tool for ensuring a low inflation rate in the economy and for stabilization of the financial system, for promoting exports, controlling imports, and increasing the level of economic growth. The relationship between the real exchange rate, inflation, and real output are very controversial and important topics for developing countries. In this study,we aim to check the influence of large depreciation on economic performance. The financial effect of the economic performance of a country is measured by various variables like real exchange rate, real output, and rate of inflation. The exchange rate has been considered an important macroeconomic tool for ensuring a reduction in inflationary pressure on domestic prices and enhancing economic growth.

A vast body of empirical studies examined the impacts of real exchange rates on the level of real output level and price level. However, the result of these empirical studies varied because they adopted different analyses techniques and also for different data samples. So, the relationship between the exchange rate and output level is an important and also very controversial topic for different economies. Edwards (1989) by using pooled time series data he examined exchange rate crises and their causes and consequences, he investigated the eighteen series of devaluations that took place between 1961 and 1982 for 24 developing countries in Latin America. He inferred that devaluation tended to decrease output in developing countries while holding other factors constant. Domac (1997) investigated the relationship between exchange rate and output level for the economy of Turkey. They have used nonlinear three-stage least squares to test the hypothesis “Are devaluation contractionary” for the period of 1960 to 1990 and concluded that unanticipated devaluation has an expansionary effect on the level of output while anticipated devaluation does not have a significant impact on the level of output.

Many empirical studies consist of either the impact of real Exchange rate on output or the impact of real Exchange rate on inflation separately. Secondly,this research work is going to use a real effective exchange rate. Growth in the real effective exchange rate means that there is a loss of competitiveness. Thirdly, the influence of real effective exchange rate on both output and inflation related to Pakistan using restricted VAR approach while taking world interest rate as an exogenous variable will be estimated.

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2. Empirical Literature survey

Berument and Pasaogullari (2003) analyzed the effect of the real exchange rate on inflation and output for the Turkish economy. They used time series quarterly data from the period of 1987:1 to 2001:3. The VAR model has been employed for the analysis. They resulted that because of real exchange rate depreciation, there will be inflationary pressure. They documented that fluctuation in the real exchange rate caused the changes in output. A long-run relationship was also found among the exchange rate, output level, and inflation.

Kandil (2004) incorporated unexpected demand and supply shocks and examined the impact of exchange rate variations on economic activities. By using the rational expectation theoretical model, the researcher decomposes real exchange rate movement into anticipated and unanticipated elements (components). This study analyzed the annual time-series observations of price and real output for twenty-two less developed countries. The researcher concluded that both unanticipated and anticipated exchange rate depreciation reduces output growth level and raised price inflation.

Upadhyaya et al. (2004) also investigated the effect of currency depreciation by using panel data ranging from 1969 to 1998in Greece and Cyprus economies and found that in the short run, the depreciation exchange rate is expansionary but for the long run and medium period, it is neutral for Greece and Cyprus economies.Hyder and Shah (2005) examined the impact of exchange rate fluctuation on domestic consumers and wholesale prices in Pakistan. They analyzed the monthly data for the period of January-1988 to September-2003.They used the VAR model, Variance decomposition, and impulse response function to estimate the exchange rate pass-through. They concluded that the exchange rate pass-through effect was relatively more on wholesale price than on consumer price index. So the exchange rate pass-through had a low impact on domestic prices. Miteza (2006) by using a smooth transition regression model (STR) for the transition economy like Bulgaria examined the Possibility of non-linear effects of real exchange rates variation on output growth. He used the quarterly data covering the period from 1994-1 to 2004-IV for Bulgaria. The author inferred that real currency appreciations had helped output growth in Bulgaria. And real appreciation in the currency could turn in contractionary when there is excessive real money growth.

Vinh and Fujita (2007) analyzed real exchange rate impact on output and inflation using the VAR technique for Vietnam's economy. They used the time series monthly data of Vietnam from January 1992 to April 2005. They observed the Causality between the price level and the output level to the real exchange rate. The results of this study showed the dual causality relationship between real exchange rate and output. The shock of devolution in Vietnam currency may affect inflation level and output growth via its impact in improving trade balance and raising money supply.

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Javed and Frooq(2009) studied the relationship between economic growth and exchange rate volatilityfor the Pakistan economy by using quarterly data over the period from 1982-I to 2007-IV. They apply Error Correction along with Auto-Regressive Distributed Lag (ARDL) econometrics technique to analyze the Pak economy using quarterly data. They inferred that exchange rate volatility, manufacturing, and reserve money have a positive long-run relationship with economic growth. So according to this research work, in the long run,the domestic economic performance of the Pakistani economy is very sensitive to exchange rate volatility.

Achsaniet al. (2010) analyzed the influence of real exchange rates on inflation in Asia and then compare this result with North America and the EU. By using the fixed-effect model and the Granger-causality test for explorative statistical analysis they concluded that a strong relationship occurs between exchange rates and inflation in Asian countries while no significant relationship exists between above mentioned two variables in the case of the EU and North American countries. They also resulted that the Asian financial crisis hadonly a local impact in Asia while this financial crisis had no significant global impact on other countries.Khamis et al. (2013) examined the Tanzania economy using annual data frequency from 2000 to 2010. They used the mathematical expression of the multivariate VAR model in their study and concluded that greater the exchange rate flexibility the greater the chances to improve the d help the economy to improve its trade balance in Tanzania.

3. Data sources

An adequate source of data for the study and construction of variables are very essential not only for appropriate empirical analysis of the study but also for reliability/authenticity of the research. The secondary data for this empirical work has been obtained from International Financial Statistics (IFS) which are organized and published by International Monetary Fund's (IMF). Annual data frequency is ranging from 1980-2020 for various used in the study[1]

4. Empirical Results and discussion

a) Stationarity Analysis

A time series is considered stationary if it is time invariant. A time series must be stationary in order to use in VARs model. The implications of Unit Root Tests are either the VARs models would be computed on the level or on 1st or on second differenced form. To test stationarity,

1**Real Effective Exchange Rate:** Real effective exchange rate is defined as nominal effective exchange rate which divided by price deflator.
Consumer Price Index: Consumer Price Index shows the changes in the cost to the average basket of goods and services attained by a consumer.
Real Gross Domestic Product: The gross domestic product (GDP) is a measure of an economy' overall output.
Money Supply (M2): Money plus quasi money is the sum of currency which is outside the banks, demand deposits excluded the time deposits.
US Interest Rate: US interest rate (lending rate) is used as a proxy for international interest rate.

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ADF (Augmented Dicky-Fuller) and PP (Phillips-Perron) tests have been conducted for this research study.

Table 1: ADF and PP Test Results

Variables	ADF test for unit root		PP test for unit root		Remarks
	with-trend	without-trend	with-trend	without-trend	
Lrexchange	-1.553	-1.919	-1.873	-0.671	Non-stationary
	-6.386**	-5.020**	-5.031**	-10.17**	Stationary at first difference
LCPI	-2.884	0.236	0.776	-0.671	Non-stationary
	-3.685*	-3.711**	-3.632**	-3.671*	Stationary at first Difference
LRGDP	-2.415	-1.479	-2.520	-2.227	Non-stationary
	-4.282**	-3.708**	-3.628**	-4.282**	Stationary at first Difference
Lusinterest	-2.544	-2.520	-0.926	-2.031	Non-stationary
	-5.104**	-5.194 **	-4.960**	-4.975**	Stationary at first Difference
LM2	-2.706	-2.786	-1.412	-3.617	Non-stationary
	-7.476**	-7.609**	-7.609**	-7.477**	Stationary at first Difference

Source: Author's Estimations.

Note: Values with * are the stationary values.

The examination of the ADF and PP test results in the above table show that all included variables are stationary at their first difference at the 5 percent level of significance. And stationarity of the variables at first difference is required for modeling these time series in this research work.

b) Johansen's Co-integration Test for Long-Run Relationship

After the fulfilling the preconditions (i.e., at level all included variables must be non- stationary but at first difference all variables should be stationary) of Johansen co-integration (1991) is to be applied. The existence of long-term relationship among the included variables is checked by Johansen co-integration test, trace statistics, and max eigen values.

Table 2: JohansenCo-integration Test Results

H_0	H_1	Eigen value	Trace statistics	5%critical values	Probability	Decision
$r \leq 0$	$r > 0$	0.619	48.36	29.79	0.0001	rejection of the Ho
$r \leq 1$	$r > 1$	0.47	19.36	15.49	0.0124	rejection of the Ho

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r≤ 2	r>2	0.002	0.09	3.84	0.7682	Not reject the Ho
r = 0	r= 1	0.619	28.99	21.13	0.0032	rejection of the Ho
r = 1	r=2	0.47	19.27	14.26	0.0074	rejection of the Ho
r= 2	r=3	0.002	0.09	3.84	0.7682	Not reject the Ho

Source: Author's Estimations.

Note: Trace and max test indicates twocointegrating eq.(s) at 5%.

c) Bivariate Data Analysis

Table 3: Ganger Causality Test for Bivariate Analysis

Null Hypothesis	Prob.	Conclusion
LCPI does not GC Lrexchange	0.3552	no GC
Lrexchange does not GC LCPI	0.1907	no GC
LRGDP does not GC Lrexchange	0.8620	no GC
Lrexchange does not GC LRGDP	0.9365	no GC
LRGDP does not GC LCPI	0.0067	GC exists
LCPI does not GC LRGDP	0.5507	no GC

Source: Author's Estimations

The result of pair wise Granger causality test indicate that neither log form of the lagged real effective exchange rate (at level) Granger cause to real output and nor lagged real output Granger cause to real effective exchange rate. However, this result from Granger causality does not contradict with my findings based on cross correlationanalyses that shows cross correlation between real effective exchange ratesandlevel of real GDP is not significant at log form of the variables (at level).

d) Multivariate Analysis

i. **VAR models (Unrestricted/Restricted)**

In this sub-section, the core model suggested by Kamin&Rogger (2000) and one alternative model on which that my econometric analyses are based, are going to describe.

Multivariate Analysis for theCore Model

Models which are estimating causal links among included variables are highly sensitive to number of lags that are going to involved means how many past values of included variables should enter the into estimated equation. Lag length (number of lags) are being selected using Unrestricted VAR Model.

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Table 4: Co-integration Test Results

H_0	H_1	Eigen value	Trace statistics	5%critical values	Probability	Decision
r ≤0	r> 0	0.63	42.33	29.79	0.0011	rejection of the Ho
r≤ 1	r>1	0.31	11.67	15.49	0.1731	Not reject the Ho
r≤ 2	r>2	0.01	0.34	3.84	0.5615	Not reject the Ho
r = 0	r= 1	0.63	30.67	21.13	0.0017	rejection of the Ho
r = 1	r=2	0.31	11.33	14.26	0.1385	Not reject the Ho
r= 2	r=3	0.01	0.34	3.84	0.5615	Not reject the Ho

Source: Author's Estimations.

Note: Trace and max test indicates one cointegrating eq.(s) at 5%.

$$\text{Lrexchange} = -1.21\text{LCPI} + 2.59\text{LRGDP}$$

The included variables are in log form and 1cointegrating vector is estimated. Then estimated coefficients are interpreted as long-run elasticities.

Vector Error Correction Model (VECM)

Having established that variables in this model are I (1) and co-integration. The VEC Model in econometrics technique allows these endogenous variables' long-term behavior to converge towards the long-term equilibrium as well as allowing a range of short-term dynamic. Error Correction Terms, which are the estimated coefficients of cointegrating equations with different order of variables, included in the model, and other concerned statistics from VECM are mentioned in following table.

Table 5: VECM Estimations

	Lrexchang	LCPI	LRGDP
Error correction term	-0.32	-0.19	0.001
Std. Error	0.112	0.083	0.132
R*	0.308	0.466	0.072
Prob.	0.0082	0.0263	0.9560
Decision	Significant (long-run to long-run equilibrium convergence)	Significant (long-run to long-run equilibrium convergence)	Not Significant

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Source: Author's Estimations.

The Error Correction Terms indicates the extant which are deviating from long-run equilibrium in the short-run. Error correction coefficient for real effective exchange rate is -0.32 at 5% level of significance which indicates that when deviation from long run equilibrium exists, the error correction coefficient plays a role in adjusting it and reduces extent of deviation and convergence mechanism prevents it for deviating from long term equilibrium when the short run fluctuation of real effective exchange rate deviates from long term equilibrium, so it will pull non-equilibrium state in real effective exchange rate back to equilibrium state with speed of adjustment 0.32 within one year. Similarly, error correction coefficient for CPI is -0.19 at 5% level of significance which indicates that if the short run fluctuation of CPI price level deviates from long term equilibrium, convergence to non-equilibrium state in CPI level back to equilibrium state with speed of adjustment 0.19 within one year.

Granger Causality under VECM-Short Run Causality

Granger causality under VECM environment in multivariate analyses is going to performed. Short run causality from one and more than one independent variables towards dependent variable is estimated by Ho: = coefficient of each independent variable is zero under Wald test.

Table 6:Ganger Causality Test Analysis for Core Model

Null hypothesis	Chi-sq	Prob.	Conclusion
Exchange equation			
LRGDP does not GC to Lrexchange	6.19	0.045	GC exists
LCPI does not GC to Lrexchange	5.02	0.0813	No GC
LCPI equation			
Lrexchange does not GC to LCPI	0.14	0.934	no GC
LRGDP does not GC to LCPI	0.76	0.684	no GC
LRGDP equation			
Lrexchange does not GC to LRGDP	0.39	0.824	no GC
LCPI does not GC to LRGDP	3.29	0.193	no GC

Source: Author's Estimations.

The Wald test statistic (result) showed that there is short run causality from level of real output level to real effective exchange rate after taking the Lusinterest as exogenous variable.

a) Forecast Error Variance Decomposition

Following table presented the forecast error variance decomposition of variables used in core model (VAR).The table presented the %age of forecast error variances of each interested

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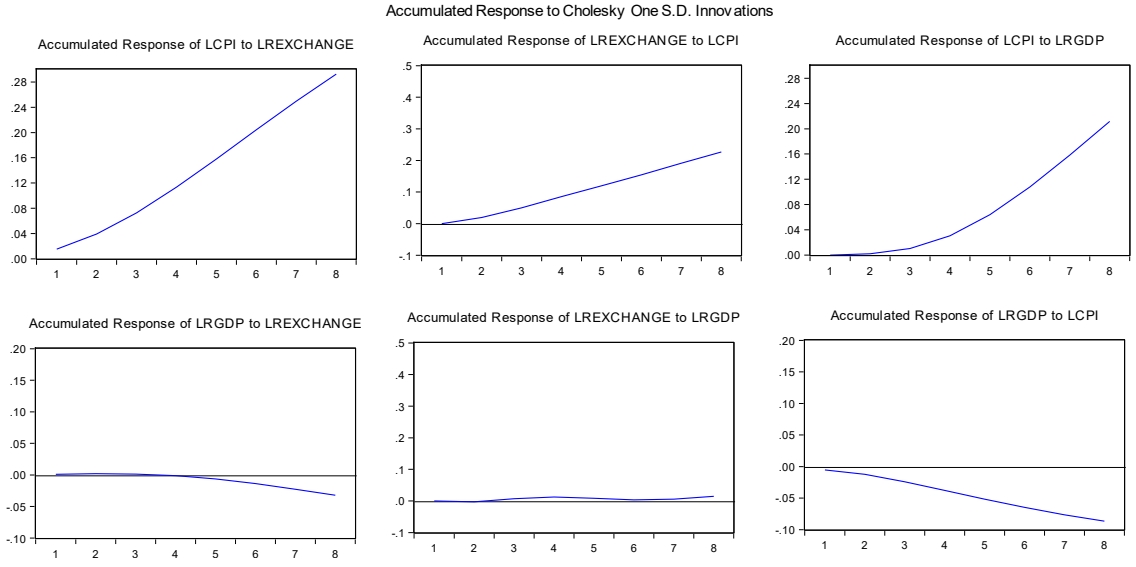
variables which are attributed to its own shocks and the shocks of the other variables in the model[2]

Impulse Response Function for Core Model

A unit shocks to the j-th variables, at time t, is directly affects that variable (j-th) and will also transmitted to other all included endogenous variables in the model via the dynamic structure of the VAR model. An impulse response function explains the effect of one-time shock to innovation/impulse of a variable on present and future values of all other included endogenous variables.

Figure 1:



Source: Author's Estimations.

The following conclusions from impulse response function emerge as, First, a permanent positive percentage shock to the real effective exchange rate (currency appreciation) leads to reduction in real GDP level about 3.2 % from its base level. There is negative relationship between real effective exchange rate and level of real GDP. Secondly, a permanent positive shock to the real effective exchange rate (currency appreciation) leads to increase in the domestic CPI price level about 29.3 % from its base level. So, there is positive relationship between real effective exchange rate and CPI price level. Thirdly, a positive unit shock to domestic CPI level decreases the level of real GDP about 8.7% from its base level in Pak economy. Fourthly, a positive unit shocks' effect of real GDP level on CPI price level is positive and stronger as 21.2%. So, depreciation (negative exchange rate's shock) has a strong positive effect on level of real GDP and negative effect on CPI price level.

2 See appendix (A) for table.

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Multivariate Analysis for Alternative Model

Table 7: Co-integration Test Result for the Alternative Model

H_0	H_1	Eigen value	Trace statistics	5%critical values	Probability	Decision
r ≤0	r> 0	0.68	76.42	47.86	0.0000	rejection of the Ho
r≤ 1	r>1	0.56	41.49	29.79	0.0015	rejection of the Ho
r≤ 2	r>2	0.36	15.74	15.49	0.0465	rejection of the Ho
r≤ 3	r>3	0.06	1.88	3.84	0.1698	Not reject the Ho
r = 0	r= 1	0.68	34.94	27.58	0.0047	rejection of the Ho
r = 1	r=2	0.56	25.78	21.13	0.0103	rejection of the Ho
r= 2	r=3	0.36	13.78	14.26	0.0587	Not reject the Ho
r=3	r=4	0.06	1.88	3.84	0.1698	Not reject the Ho

Source: Author's Estimations.
Note: Trace and max test indicates two cointegrating eq.(s) at 5%.

Vector Error Correction Model (VECM) for alternative model

Having established co-integration, VEC Model with two co-integrating relation in equations is estimated.

Table 8: Result Summary of VECM Estimation for Alternative Model

	Lrexchang	LM2	LCPI	LRGDP
Error-correction term	-0.273	-1.223	-0.201	0.023
Std. Error	0.130	0.263	0.095	0.144
R*	0.273	0.548	0.395	0.008
Prob.	0.0496	0.0002	0.0475	0.8748
Decision	Significant (long-run to long-run equilibrium convergence)	Significant (long-run to long-run equilibrium convergence)	Significant (long-run to long-run equilibrium convergence)	Not Significant

Source: Author's Estimations.

Similar to core model VECM result, error correction coefficient for real effective exchange rate is -0.273, error correction coefficient for CPI is -0.201and error correction coefficient for LM2 is -1.223 which are significant at 5% level of significance, which indicates that if the short run fluctuation in real effective exchange rate, CPI level and LM2 deviates from long term equilibrium, convergence to non-equilibrium state in real effective exchange rate, CPI level and

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LM2 can be back to equilibrium state with speed of adjustment 0.273, 0.201 and 1.223respectively within one year.

Granger causality under VECM environment/short run causality

Table 14: Granger causality under VECM environment/short run causality

Null hypothesis	Chi-sq	df	Prob.	Conclusion
Exchange equation				
Lrgdp does not GC to Lrexchange	3.14		0.0077	GC exists
LCPI does not GC to Lrexchange	4.29		0.117	no GC
LM2 does not GC to Lrexchange	1.47		0.4806	no GC
LCPI equation				
Lrexchange does not GC to LCPI	0.22		0.8949	no GC
Lrgdp does not GC to LCPI	1.05		0.5918	no GC
LM2 does not GC to LCPI	0		0.9989	no GC
Lrgdp equation				
Lrexchange does not GC to lrgdp	0.47		0.7895	no GC
LCPI does not GC to lrgdp	2.11		0.3478	no GC
LM2 does not GC to Lrgdp	1.56		0.4575	no GC

The Wald test statistic (result) showed that there only short run causality from real output level to real effective exchange rate.

Forecast Error Variance Decomposition

Following table presented the forecast error variance decomposition of these interested variables which are used in core model (VAR). The table presented the %age of forecast error variances of each interested variables which are attributed to its own shocks and the shocks of the other variables in the model[3].

3See appendix (A) for table.

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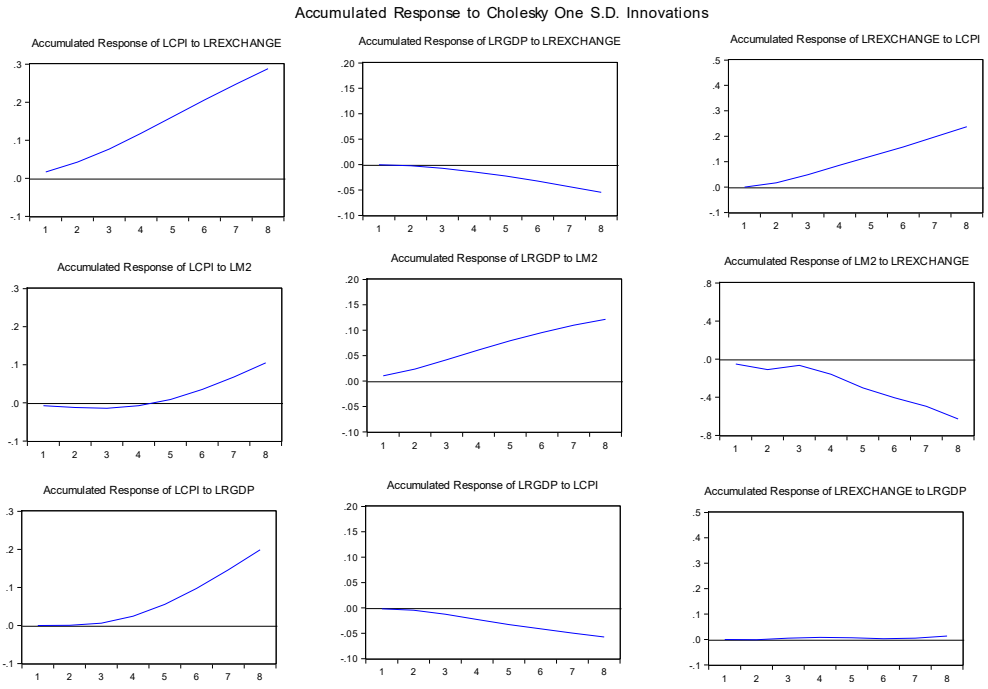
Figure 2: Impulse Response Function for alternative model



Source: Author's Estimations.

The following conclusions from impulse response function emerge as;First, a permanent positive unit shock to real effective exchange rate (currency's appreciation) leads to reduction in real GDP level about 5.5% from its base level. And there is negative relationship between real effective exchange rate and level of real GDP. Secondly, a permanent positive shock to the real effective exchange rate (currency's appreciation) leads to increase in the domestic CPI price level about 29.0 % from its base level. There exists positive relationship between real effective exchange rate and CPI price level. Thirdly, a positive unit shock to domestic CPI level decreases the level of real GDP about 5.7% from its base level in Pak economy. Fourthly, a positive unit shocks' effect of real GDP level on CPI price level is positive and stronger as 20.0%. Fifthly, the effect of one S.D innovation/shocks to money supply (M2) on level of real GDP is positive and cumulative effects of M2 on level of real GDP by approximately 12.1% of its baseline level over longer period of 8th years. Sixthly, the effect of one S.D innovation/shock to money supply (M2) is significantly positive on CPI price level by approximately 10.0% of its baseline level over longer period of 8th years. However, this positive effect occurs after 4th years, it remained negative during the 1st year to 4th years. Seventhly, the effect of the real effective exchange rate appreciation on money supply (M2) has a very strong negative effect. A positive S.D innovationshock to real effective exchange rate (appreciation) cause M2 to decrease approximately 63.0% from its base level. So, the alternative model supports the core model finding, depreciation (negative real effective exchange rate's unit shocks) has a strong positive effect on level of real GDP and negative effect on CPI price level.

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5. Conclusion and policy recommendations

This came out with the conclusion that research study endeavor to inspect the influence of real effective exchange rate on level of real GDP consumer price index (CPI) by using restricted VAR (VECM) econometrics approach for Pakistan economy over the period 1980-2020. We examined the bivariate relationship between real effective exchange rate and level of real GDP. It was concluded a negative correlation between these two variables. Thelong-term interrelationship among real effective exchange rate, CPI price level, and level of real GDP has also been examined by employing Johansen co-integration. By utilizing various VECM models we have found the long-term causality (A) from CPI price and level of output to the real effective exchange rate, and (B) from the real effective exchange rate, CPI price level `and level of real output to M2 money supply and (C) from the real effective exchange rate, M2 and real output level to CPI price level. The money supply (M2) growth has a very strong positive impact on both levels of real GDP and CPI level(Asif, Shah, Zaman, & Rashid, 2011). The real depreciation has a positive effect on level real GDP but negative effect on the CPI price level means deflationary effect on CPI price level was also found from the error forecast variance decompositions and impulse responses function. Money supply (M2) growth has very strong positive impact on both level of real GDP and CPI level (expansionary monetary policy's effects). After augmenting the core model by including M2 as an endogenous variable, expansionary effect on real GDP, but deflationary effect on CPI price level remained as already exists in core model.The inferring from this research work suggest that Pakistani policy makers ought to be very cautious while adopting revaluation along with adopting flexible exchange rate system.

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Appendix-A

Table A-1: Variance Decompositions of Core bmodel

Variance decomposition of Exchange rate					Variance decomposition of Inflation				Variance decomposition of LRGDP			
Period	SE	Lrexchange	LCPI	Lrgdp	SE	Lrexchange	LCPI	Lrgdp	SE	Lrexchange	LCPI	Lrgdp
1	0.04	100	0	0	0.03	34.79	65.21	0	0.02	0.29	8.15	91.57
2	0.07	92.22	7.58	0.19	0.04	43.21	56.56	0.23	0.03	0.21	7.42	92.37
3	0.09	83.36	15.37	1.27	0.06	52.35	45.73	1.92	0.04	0.15	12.1	87.75
4	0.11	77.72	21.12	1.15	0.08	57.46	34.91	7.63	0.05	0.36	15.97	83.66
5	0.13	76	23	0.98	0.09	57.73	25.72	16.56	0.06	1.09	18.12	80.79
6	0.14	75.4	23.71	0.89	0.12	55.53	18.94	25.53	0.06	2.32	19.3	78.37
7	0.16	74.96	24.29	0.75	0.14	52.72	14.42	32.86	0.07	3.83	20.24	75.93
8	0.18	74.7	24.44	0.85	0.152	50	11.53	38.47	0.07	5.34	20.91	73.74

Source: Author's Estimations.

Table A-B: Forecast Error Variance Decomposition for Alternative Model

Variance decomposition of Real Effective Exchange rate						**Variance decomposition of M2**				
Period	SE	Lrexchange	LM2	LCPI	Lrgdp	SE	Lrexchange	LM2	LCPI	Lrgdp

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1	0.04	100	0	0	0	0.39	1.58	98.42	0	0
2	0.07	93.73	0.58	5.66	0.03	0.42	3.43	87.27	2.79	6.49
3	0.09	83.79	0.75	15.02	0.43	0.45	3.93	75.69	2.42	17.95
4	0.11	77.63	0.53	21.46	0.37	0.47	7.52	70.49	3.22	18.78
5	0.13	76.58	0.54	22.59	0.29	0.5	14.67	61.77	4.98	18.57
6	0.15	76.21	0.55	22.96	0.28	0.52	17.85	59.24	5.33	17.58
7	0.17	75.63	0.45	23.68	0.24	0.53	19.95	57.19	5.97	16.88
8	0.19	75.06	0.37	24.17	0.4	0.55	23.76	52.25	6.81	17.17
Variance decomposition of CPI						**Variance decomposition of LRGDP**				
Period	SE	Lrexchange	LM2	LCPI	Lrgdp	SE	Lrexchange	LM2	LCPI	Lrgdp
1	0.03	36.43	6.99	56.58	0	0.02	0.02	26.7	0.74	72.53
2	0.05	44.34	3.68	51.98	0.01	0.03	0.4	24.2	0.99	74.41
3	0.06	52.28	1.99	44.98	0.75	0.05	1.32	29.05	3.55	66.08
4	0.08	56.2	1.79	36.74	5.25	0.06	2.53	30.78	5.67	61.02
5	0.1	54.41	3.69	29.26	12.65	0.07	3.45	30.93	6.49	59.14
6	0.12	49.91	7.03	22.97	20.08	0.07	4.69	30.63	6.8	57.88
7	0.14	45.23	10.36	18.23	26.18	0.08	6.24	30.45	7.18	56.14
8	0.16	41.186	13.13	14.88	30.8	0.08	7.67	30.06	7.51	54.76

Source: Author's Estimations.