

A Nexus between Devaluation and Inflation in Pakistan

Ramsha Saleem* Rashida Saleem** Abdul Ghafoor Awan***

Abstract

This study empirically analyzes the relationship between the devaluation of currency and inflation in Pakistan by using time series data from 2001 to 2018. Although the government in Pakistan adopted policies to stabilize prices and boost exports yet exchange rate depreciation is observed over the years coupled with an increase in inflation. The exchange rate is predominantly a key element of international trade because a country fails to meet the demand of its population through endowed natural resources in a close economy that they have. So, they depend on other markets for the fulfillment of their demand. Eventually, exchange rate and inflation are the main determinants of macroeconomic evaluation in a country. This research work examines the relationship between the devaluation of currency and inflation in Pakistan over the period from 2001 to 2018, with the application of the cointegration test, VECM model, and correlation analysis. In an econometric model Inflation (INF) is taken as a dependent variable and exchange rate (used as a proxy for currency devaluation EXC), gross domestic product (GDP), and money supply (MS) are independent variables in the study. The role of the central bank in this domain has always been crucial. Central Bank takes action to stabilize the currency in the country which sometimes is observed in inflationary pressure. The study employed a stationary test and the variables are found stationary at the second difference. The cointegration test describes that there is a long-run relationship between inflation and devaluation of the currency. The correlation coefficient reveals a negative correlation between inflation and currency devaluation. This study recommends that government should float feasible policies parallel to the exchange rate (currency depreciation/devaluation of PKR) to tackle the persistent rise in the inflation rate.

Keywords: Exchange rate depreciation; currency devaluation; inflation; Pakistan; VECM.

JEL Classification: B55, E00

*Assistant Professor of Economics, Lahore College for Women University, Lahore, Punjab, Pakistan, Email: ramsha.saleem@lcwu.edu.pk

** M.Phil in Economics Institute of Southern Punjab, Multan, Punjab, Pakistan email: rashada.saleem@gmail.com

*** Dean Faculty of Social Sciences & Management, Institute of Southern Punjab, Multan, Punjab, Pakistan. Email: ghafoor70@yahoo.com

1. Introduction

The exchange rate is considered a vital instrument of macroeconomic policy in an economy. Fluctuation in the exchange rate affects the prices of tradable and non-tradable goods in a country (Bobai et al., 2013). Generally, in Pakistan, currency devaluation is the procedure to decline the currency value at the official level and it's a part of central bank monetary policy. Formally it's a procedure adopted by authorities to set the value of a currency at a lower level in relation to currency which is often called the exchange rate. Currency devaluation is a regular depreciation in the value of a currency as compared to other currencies; it may be compared with a single unit of any other currency unit or in a form of the group (currency). Those countries which follow the exchange rate system are either fixed or -fixed, in both cases, they require a monetary policy for their assistance in case of either devaluation or revival of the devalued currency. Thus, the exchange rate influences the movement of inflation in an economy, keeping in view the behavior of nominal and real exchange rates the policymakers have concentrated on the determination of exchange rate, and also used it as a determinant of inflation.

It is the most critical decision to choose the right exchange rate regime, as it affects the economic performance of a country (Obadan, 2007). The economic performance may include economic growth, per capita income, the balance of payments, etc. So, the exchange rate is one of the central macroeconomic policy debates (Sebastian, 2006). By definition, the exchange rate is a ratio between one unit of currency and the amount of another currency for which it is exchanged in a given period (Termunonimim & Reginald, 2013). Resultantly it plays a central role in the trade level of a country. It is classified into nominal and real exchange rates. The former involves the relative price of two currencies of two countries whereas the latter measures the relative price of tradable goods to non-tradable goods. Henceforth, the exchange rate affects the prices of imports and exports. Both the concepts are interrelated so, the domestic prices of traded goods and prices of imports and exports are predominantly affected by the exchange rate (Obadan, 2007).

From 2001 to 2002 steps are taken in Pakistan to reduce the impact of high prices which can also be seen by economic development indicators respectively, also recognized by World Bank statistics. Due to such evaluation steps Pakistani rupee PKR gradually becomes stronger in 2006-2007 (PKR59/60 per \$). This evaluation was transitory and PKR again declined after 2007 which continued till 2020. In such a situation central bank (State Bank of Pakistan) interferes in government action by injecting some amount of dollar into the market for stabilizing the Pakistani rupee. But the immediate effects of this action do not need to be viewed positively and the central bank is successful at its first attempt. This action and reaction process takes more time so eventually, its results are not permanent, but for a short period, it accelerates the inflation in the economy. Devaluation of currency in Pakistan affects the economy in the form of high prices (CPI), enveloping the whole economy in its vicious circle which is still prevailing.

Notwithstanding, the exchange rate has become a central issue in Pakistan's economic policies, to put inflation under effective control. A continuous decline value in Pakistan's domestic currency (PKR) is in line with inflationary growth which in turn is reducing the living standard of residents in the economy. Monetary authorities, policymakers, and practitioners have ever remained concerned with the unfavorable impact of inflation arising from devaluation in the currency as both variables are core determinants of economic performance (Nwosa & Oseni, 2012). Truthfully, inflation is an ongoing rise in price levels in an economy. Put differently, the general price index persistently increases making the value of money decline. Inflation is a vital issue to tackle on the macroeconomic front, especially from an economic and business perspective. Quite considerably, inflation is amongst few other macroeconomic problems of developing or a developed countries. Many demand-side and supply-side factors are detrimental to inflation in Pakistan. One most important reason behind the general price level might be the expansionary monetary policy which reveals the role of the Bank in the credit policy perspective. Keeping the control on price level needs an active monetary policy that plausibly involves policy variables like money supply, interest rate, etc. (Ali et al., 2015).

Globally, the countries have close connections and interactions with one another. Generally, these countries have free markets for trade and the real exchange rate plays a decisive role in this regard. Pakistan does have significant openness to free trade, and so does the imperative role of the exchange rate cannot be ignored. Nonetheless, inflation in the country is closely linked with external price shocks. Bearing in mind, all the above exchange rate is an economic measure that is sensitively analyzed by the monetary authorities. Sometimes unexpected monetary shocks cause massive fluctuations in the exchange rate and instability in domestic currency (Benita & Lauterbach, 2007). The least variations in the exchange rate are crucial in promoting price stability and facilitating investment in the economy at a steady pace. In Pakistan, a formulation in monetary policy is made not only to achieve domestic price stability but also to attain the external value of the currency.

There are numerous causes behind the currency devaluation process in an economy. Pakistan is listed among developing countries in the world ranking and its industrial sector mainly depends upon other countries' raw materials which means Pakistan imports raw materials for finalizing its goods, especially manufactured goods, and other essentials. For such requirements Pakistan has limited resources, thus Pakistan takes a step to devalue its currency for boosting export and earning a balance of payment. Political instability, features of governance, and especially the prices of crude oil remained the major causes of devaluation in Pakistan. Despite all, any gap which exists between demand and supply of traded items may also become a cause of devaluation. This study examines the relationship between currency devaluation and inflation in Pakistan over the period 2001 to 2018.

1.1 A Brief Background

After the failure of the Bretton Wood System in 1971, the floating exchange rate was adopted by many industrial economies. In the aftermath, volatility in the real and nominal exchange rates was observed (Sundquist, 2002). Many economists lamented that monetary authorities were solely responsible for such fluctuations. Similar observations were also made in Pakistan when all private sectors were nationalized while in the 1980s the reversal in the decision was made and the policy of deregulation was adopted. Meanwhile, Pakistan adopted managed float exchange rate system in 1982 which caused depreciation (20%) in the PAK rupee. More so, in 1988 an agreement was signed with IMF which has multiple clauses including devaluation, tariff reduction, and financial sector reforms (Stockman, 1983). In the 1990s Pakistan got a little improvement on the macroeconomic front but in the late 1990s exports reduced alarmingly and the current account deficit turned negative. Furthermore, in the 2000s trade liberalization policy was pursued to impoverish the structural reform program commenced in the 1990s. Quite noticeably, the per capita income in Pakistan raised from \$897 in 2005-06 to \$1368 in 2012-13 due to a stable exchange rate and increase in real GDP growth rate. However, the printing of notes in 2013 raised the price level and the exchange rate was again observed unstable (devalued).

2. Literature review

The exchange rate is considered a key determinant to assess the economic performance of a country (Nwosa & Oseni, 2012). It is pertinent to discuss it as a key determinant while targeting successful inflation-controlling macroeconomic objectives. It is also used as a key determinant to assess the international competitiveness of an economy. Arguably, it is also an indicative measure of international competitiveness (Danmola, 2013).

In my opinion, volatility in the exchange rate makes foreign trade and investment decisions difficult (Adekunle, 2010). Factually, the nature of exchange rate policy in an economy is detrimental in reducing risks related to exchange rate which in turn affects inflation in an economy (Achsani et al., 2010). Stability in the exchange rate causes stability in price levels (Bobai et al., 2013). The stability in the exchange rate attracts foreign direct investment (FDI) in an economy. Generally speaking, stability of prices is needed in an economy which can be gained through exchange rate stability. In a developing country like Pakistan, trade is import-dependent. The country imports to fulfill its fuel needs and other related items as the manufacturing sector remains a neglected sector in Pakistan. The stability in the exchange rate is required for stability in imported items prices as volatility in the exchange rate is causing an unfavorable balance of payments. It is lamented in a study that domestic firms compete with their foreign counterparts in the international markets and their ability to compete is predicted by relative prices of goods which in turn is determined by the exchange rate (Ogbonna, 2009).

Conversely, a negative relationship between the inflation rate and economic growth rate in Pakistan is empirically reported for the period from 1972 to 2010 by applying the OLS technique. Eventually, it is stressed that exchange rate policy plays a key role in reducing risk and fluctuations in the real exchange rate as the exchange rate affects prevailing prices and whole economic activity in the economy (Noer et al., 2010) There are particular challenges to the view that devaluation is inflationary in effects and it is also shown that there is no association in rupee value and prices in short term, and these effects of rupee depreciation had pass-through effects on prices (CPI) in the economy (Chaudary & Khan, 2002).

It is an overt fact that currency depreciation remains responsible for increasing the prices of imported raw materials, and prices of finished goods via the (CPI). Eventually, the cost of domestically produced items increases relatively, which may cause a shrink in the country's export basket and inflationary pressure is observed in Pakistan (Imimole & Enoma, 2011). Generally speaking, money supply, currency value rate, rate of interest, and government deficit budget are the key elements that might be accountable for inflation growth (Umeora, 2010). Additionally, the exchange rate and GDP didn't show any causal link (Mujahid & Zeb, 2014). It is justified in the study that the exchange rate does not directly affect GDP but an indirect effect is observed through imports, exports, and FDI. A further argument is made that the exchange value of the currency may cause a decline in GDP because when the domestic currency depreciates/devalues in comparison to other currency, disequilibrium in markets occur due to inflationary pressure. Various theories present the interaction among foreign exchange, current account, relative prices and relative income which are as under;

2.1 Traditional Flow Model

This model proclaims that the demand and supply forces of foreign exchange are the determining factors of the exchange rate. The very famous doctrine is also documented in this theory that supply creates its demand. Any imbalance in the current account can be offset through the net flow of capital but in opposite direction. Henceforth, any surplus in the current account can be financed through the outflow of capital while the deficit in this account can be maintained through the inflow of capital. Thus, the current account presumably depends upon changes in relative prices and real income. A rise in domestic relative prices in comparison to foreign prices depreciates the exchange rate as higher domestic prices make exports costly (Adeoye & Saibu, 2014). On the other hand, the import level rises, as an inflation-ridden economy assumes to be a profitable place to export which necessarily raises demand for foreign exchange. Keeping in view all the above mentioned, it can be easily portrayed that three main factors are detrimental to exchange rate which includes relative prices, income and relative interest rate. The economy that tends to strengthen its exchange rate must raise the interest rate. Equally, an increase in real income also tends to increase the demand for importing commodities leading the exchange rate to depreciate. Similarly, an upsurge in domestic prices relative to foreign prices brings forth a negative impact on the exchange rate which causes disequilibrium in it.

2.2 *The Monetary Model*

The model illustrates the changes in demand and supply of money between two trading countries which resultantly cause changes in the exchange rate. The model identifies that the main determinants of exchange rate are core macroeconomic variables like money supply, real income and interest rate. The model stresses upon money supply increase which causes inflationary pressure in the economy but the phenomenon works through exchange rate depreciation and devaluation of the currency. The macroeconomic indicators crucially and dynamically work together so inflationary pressure does impact the domestic interest rate making the demand for money lower and resultantly inflationary pressure depreciates the exchange rate so devaluation in domestic currency is observed (Adeoye & Saibu, 2014).

2.3 *Portfolio Balance Model*

It is generally believed that residents of a country distribute their wealth in three forms of assets i.e monetary base, domestic bonds, and foreign bonds. The exchange rate is in equilibrium if these assets are held in desired proportions. An increase in wealth makes the demand for foreign bonds rise or the exchange rate depreciates (Adeoye & Saibu, 2014). Furthermore, an increase in private sector holding of govt bonds raises interest rates by driving down bond prices which in turn appreciates the exchange rate. The phenomenon of appreciation or depreciation of the exchange rate also depends upon the income and substitution effect. Despite all, a major criticism of this model is that it ignores the major determinants of trade and the role of purchasing power parity.

2.4 *The purchasing power parity model*

The model portrayed in purchasing power parity (PPP) is predominantly important in both monetary and portfolio balance models. It is proposed by Gustar Cassel in 1920. Arguably, a consumer can buy the same amount of commodities with the same amount of currencies in any country (Asher, 2012). The equilibrium exchange rate between two inconvertible paper currencies is determined by making the purchasing powers equal. Mainly exchange rate determination depends upon relative prices. The theory explains the difference in the inflation rate of two countries which proposes that the exchange rate of two countries' currencies movement offset the difference in inflation in two economies so the real purchasing power of two currencies is maintained. In the light of the above-mentioned views, the present study adopts purchasing power parity theory to describe the relationship between exchange rate depreciation and inflation in Pakistan.

3. Research method

Secondary data is used in this research. However, data is collected from different sources such as the State Bank of Pakistan (SBP), IMF, World Bank Development indicators, and OECD national account data files. This study is conducted for the period from 2001 to 2018. From the analytical perspective, the study employed an augmented dicker fuller (ADF) test to check the stationary of data and the study also applied different econometric techniques such as co-integration test, vector Error Correction model (VECM) and the analysis for partial correlation coefficients.

In this study co-integration test investigates the equilibrium relationship between variables in the long run, whereas the Vector Error Correction Model (VECM) examines the short-run dynamics and long-run relationship between the exchange rate and inflation. Moreover, the Partial Correlation Coefficient analysis test investigates the degree of correlation between exchange rate and inflation in Pakistan. The inflation rate (INF) is employed as the dependent variable in this study, while exchange rate (EXC), money supply (MS) and gross domestic product (GDP) are included as independent variables.

3.1 Model Specification

The model highlighting the relationship among employed variables in the study is specified in equation 1:

$$\text{INF} = f(\text{EXC}, \text{GDP}, \text{MS}) \quad \text{equation (1)}$$

The linear functional form of the model is expressed in equation 2:

$$\text{INF} = b_0 + b_1(\text{EXC}) + b_2(\text{GDP}) + b_3(\text{MS}) + \mu_t \quad \text{equation (2)}$$

Where INF = Inflation Rate, EXC = Exchange rate (used as a proxy for devaluation of currency), GDP = gross Domestic Product, MS = Supply of Money, μ_t = Error term.

b_0, b_1, b_2, b_3 depict coefficients of the variables in the aforementioned regression equation

To avoid some misleading and spurious estimation the logarithm of all variables is taken, Then the equation become as:

$$\log \text{INF} = b_0 + b_1(\log \text{EXC}) + b_2(\log \text{GDP}) + b_3(\log \text{MS}) + \mu_t \quad \text{equation (3)}$$

or

$$\text{LINF} = b_0 + b_1(\text{LEXC}) + b_2(\text{LGDP}) + b_3(\text{LMS}) + \mu_t \quad \text{equation (4)}$$

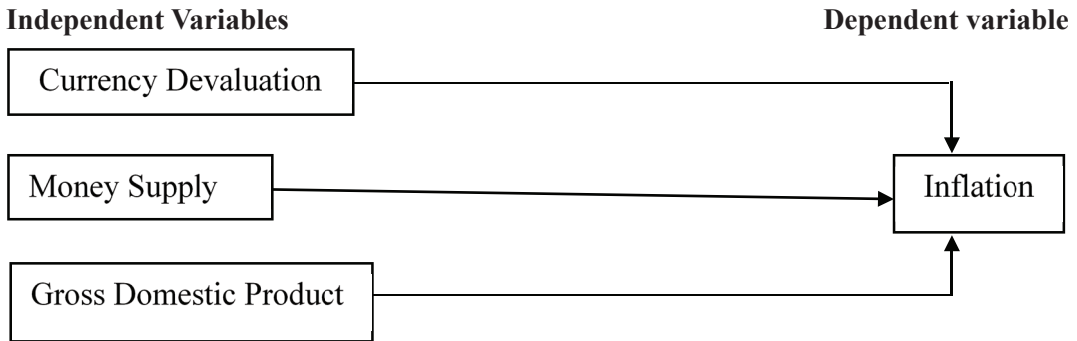


Figure 1: Independent Variables and Dependent variable

3.2 Data Description and sources

The study is examining the relationship between devaluation of currency or exchange rate depreciation and inflation in Pakistan. The inflation rate (INF) represents the per annum percentage change in the price level of commodities in Pakistan. The exchange rate (EXC) is depicting the rate at which one unit of currency of a country is exchanged for another country’s currency. Formally it involves two countries that are involved in bilateral trade and are using an exchange rate. Money supply (MS) is the total volume of money in circulation in a specific time span. Gross domestic product (GDP) is used as a proxy for economic growth.

4. Estimation procedure

4.1 Unit Root Test

The first step in the formal level of this empirical investigation is to check the stationary i.e. tests of a unit root. Mostly, the time series data for macroeconomic variables is found non-stationary, so the application of the OLS (Ordinary Least Square) method leads to spurious results. So testing whether the variable is stationary, ADF unit root test (Augmented dicky fuller 1979; 1981) is applied which also equips the research work to find the order of integration in time series data. So, to handle such an issue augmented Dickey-Fuller test is applied (stated below as equations 5, 6 and 7).

$$\Delta Y_t = B_1 + Z_{yt-1} + ai + e_t \quad \text{with intercept equation (5)}$$

$$\Delta Y_t = B_1 + B_{2t} + Z_{yt-1} + ai + e_t \quad \text{with intercept and trend equation (6)}$$

$$\Delta Y_t = Z_{yt-1} + ai + e_t \quad \text{none equation (7)}$$

It’s compulsory to test the stationarity of all variables in the model.

4.2 *Cointegration Test*

This test is used to estimate the long-run relationship among the same order data series through Johanson Cointegration Test. If data is stationary at first difference or second difference, but the condition of stationarity for both differences is that variables should be integrated in the same order then Johanson cointegration is applied to check association among variables. This method determines the number of cointegrated vectors using the Johanson cointegration method with two different tests, Terrace test statistics and Maximum Eigen-value test statistic. When conditions of Johanson test are verified by earlier mentioned criteria then Johanson cointegration is being applied to see the relationship between different variables.

4.3 *Vector Error Correction Model (VECM)*

Vector Error Correction Model (VECM) is the estimation procedure employed to find the short-run dynamic as well as the long-run relationship among variables. The application of VECM is compulsory to rectify the provisional short-term divergence of series in a long-run equilibrium relationship. VECM approach can be specified as in the following equation 8:

$$\Delta Y_t = a_0 + a_1 \Delta X_t + a_2 U_{t-1} + \varepsilon_t \quad \text{equation (8)}$$

Where;

$Y_t = Y_t - Y_{t-1}$, a_1 and a_2 are the dynamic adjustment coefficients of the data series, U_{t-1} is the residual lag representing the deviation in the short-run from the equilibrium position, and it is estimated to correct long-run equilibrium error, where ε_t is the error term.

The following model expresses the vector error correction model in equation 9.

$$\Delta \text{LINF}_t = \beta_0 + \beta_1 \Delta \text{EXC}_{t-1} + \beta_2 \Delta \text{MS}_{t-1} + \beta_3 \Delta \text{GDP}_{t-1} + \text{ECM}_{t-1} + \mu_t \quad \text{equation (9)}$$

The above model will estimate the dynamic behavior of the variables.

If no cointegration equation is found by the Johanson test then application of VECM is no more required and the Granger causality test is directly applied to proceed further and to establish a causal relationship between variables.

4.4 *Partial Correlation Coefficient*

Such estimation step measures the direction and strength among variables of the model under study. A low value or figure of correlation coefficient reflects a delicate correlation while a high value of the coefficient of correlation reveals a secure correlation among

variables. The coefficient sign indicates the direction of change; a positive sign means the movement of change in two variables in the same direction. Pearson correlation coefficient analysis is being used to calculate the correlation coefficient through equation 10.

$$r_{XY.Z} = \frac{r_{XY} - r_{XZ}r_{YZ}}{\sqrt{(1-r_{XZ}^2)(1-r_{YZ}^2)}} \quad \text{equation (10)}$$

r = Coefficient of correlation

X and Y are variables under examination.

5. Empirical Results and Discussion

5.1 Unit root test

Table 1:

Series at 1st difference (intercept/trend)

SERIES	ADF	5%	10%	PROB	ORDER	REMARKS
LGDP	-4.1153	-3.7332	-3.3103	0.0261	1	STATIONARY
LINF	-4.7111	-3.7332	-3.3103	0.0093	1	STATIONARY
LEXC	-2.9255	-3.7597	-3.3249	0.1825	1	NOT STATIONARY
LMS	-3.4728	-3.7332	-3.3103	0.0770	1	NOT STATIONARY

Table 2:

Series at 2nd difference (intercept)

SERIES	ADF	5%	10%	PROB	ORDER	REMARKS
LGDP	-9.4991	-3.0810	-2.6813	0.0000	2	STATIONARY
LINF	-4.4075	-3.1199	-2.7011	0.0055	2	STATIONARY
LEXC	-4.1937	-3.0988	-2.6904	0.0071	2	STATIONARY
LMS	-4.8226	-3.0988	-2.6904	0.0024	2	STATIONARY

Table 3:
Series at 2nd difference (intercept & trend)

SERIES	ADF	5%	10%	PROB	ORDER	REMARKS
LGDP	-9.333	-3.7597	-3.3249	0.0000	2	STATIONARY
LINK	-4.5915	-3.8289	-3.3629	0.0157	2	STATIONARY
LEXC	-3.8289	-3.7911	-3.3422	0.0472	2	STATIONARY
LMS	-4.7538	-3.7911	-3.3422	0.0108	2	STATIONARY

The above tables 1, 2 & 3 depict the estimation of unit root test. The results reveal that all the variables become integrated of the same order at the second difference, with the application of the Augmented Dickey-Fuller (ADF) unit root test at 5% and 10% critical values. Table 3 shows the comparison of ADF statistics and the critical values implying that ADF statistics of the individual variables of the study are greater than critical values chosen at the second difference. Additionally, the order of integration of the variables meaningfully suggests that the study may attempt the estimation of long-run relationships among variables for achieving better empirical results

5.2 Selection of lag length criteria

Akaike information criterion (AIC) selected one as optimal lag length.

Table 4:
Var lag length selection criteria

Lag	LogI	LR	FPE	AIC	SC	HQ
0	0.519361	NA	1.77e-05	0.409487	0.605537	0.428975
1	58.90026	82.42009*	1.30e-07*	-4.576501*	-3.596250*	-4.479062*

5.3 Co-Integration Test

Table 5:
Unrestricted cointegration test (trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob. **
None*	0.922673	68.26945	47.85613	0.0002
At most 1	0.651793	27.31398	29.79707	0.0942
At most 2	0.466022	10.43467	15.49471	0.2488
At most 3	0.024462	0.396258	3.841466	0.5290

Trace test indicates 1 cointegration eqn(s) at 0.05 level.

Table 6:
Unrestricted cointegration test (maximum-eigenvalues)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Static	Critical Value	Prob. **
None *	0.922673	40.95546	27.58434	0.0006
At most 1	0.651793	16.87931	21.13162	0.1778
At most 2	0.466022	10.03842	14.26460	0.2094
At most 3	0.024462	0.396258	3.841466	0.5290

Max-Eigenvalue test indicates 1 cointegration equation (s) at 0.05 level.

Tables 5 and 6 represent the estimated results of trace statistic and maximum eigenvalue test respectively. Results of the trace test reveal that P-value is less than 0.05 which is significant hence, the null hypothesis of no co-integration is rejected. Results of trace test (table 5) and eigenvalue test (table 6) attested that one cointegrating equation exists at a 5% level which testifies the existence of a long-run relationship among variables. Furthermore, the existence of one cointegrating equation is proved through the Johanson cointegration test. In this way, VECM is a better approach to employ for investigating the long-run and short-run relationship among variables.

5.4 *Vector Error Correction Model (VECM)*

The estimation of VECM is done in two steps. Firstly, the Johanson procedure was used for estimating the cointegrating relation whereas, in the second step, the error correction term (ECT) was calculated by estimated cointegration relation. Moreover, ECT estimated from the first step is represented by cointegrating equation 1. Table 7 portrays the results of error correction t and cointegrating equations, presented as under:

Table 7:

Vector error correction estimates

a) Cointegrating Eq:	CointEq1			
LINF(-1)	1.000000			
LEXC(-1)	7.577747			
	(0.86512)			
	[8.75921]			
LGDP(-1)	-0.800273			
	(0.55354)			
	[-1.44572]			
LMS(-1)	-22.56289			
	(3.74179)			
	[-6.02997]			
C	55.35653			
b) Error Correction:	D(LINF)	D(LEXC)	D(LGDP)	D(LMS)
CointEq1	-0.174634	-0.011771	0.187330	-0.000416
	(0.06120)	(0.00772)	(0.04360)	(0.00807)

Table to be continued...

	[-2.85353]	[-1.52498]	[4.29628]	[-0.05153]
D(LINF(-1))	-0.285085 (0.24007) [-1.18750]	-0.004272 (0.03028) [-0.14108]	0.300407 (0.17104) [1.75631]	-0.016248 (0.03165) [-0.51336]
D(LEXC(-1))	0.107278 (2.44726) [0.04384]	0.060007 (0.30865) [0.19442]	-2.535944 (1.74361) [-1.45442]	-0.235623 (0.32264) [-0.73029]
D(LGDP(-1))	0.321021 (0.29580) [1.08526]	-0.029722 (0.03731) [-0.79668]	-0.418401 (0.21075) [-1.98528]	0.061829 (0.03900) [1.58542]
D(LMS(-1))	-1.175879 (2.37859) [-0.49436]	-0.607242 (0.29999) [-2.02420]	2.647970 (1.69469) [1.56251]	-0.104144 (0.31359) [-0.33210]
C	0.033629 (0.15663) [0.21470]	0.058020 (0.01975) [2.93706]	0.084669 (0.11159) [0.75872]	0.022790 (0.02065) [1.10364]
R-squared	0.523762	0.480151	0.666268	0.379392
Adj. R-squared	0.285643	0.220226	0.499401	0.069088
F-statistic	2.199582	1.847269	3.992824	1.222646

Standard error () and t statistic [].

Equation 11 depicts cointegration equation below (standard error displayed in parenthesis).

$$\text{LINF} + 7.577747\text{LEXC} - 0.800273\text{LGDP} - 22.56289\text{LMS} + 55.35653 = 0$$

or

$$\text{LINF} = -7.577747\text{LEXC} + 0.800273\text{LGDP} + 22.56289\text{LMS} - 55.35653 \quad \text{equation (11)}$$

(0.86512) (0.56354) (3.74179)

The coefficients of cointegrating equations reveal the long-run relationship among variables whereas the coefficients of the VECM term portray how the deviations from a long-run relationship do impact changes in the variables in the next period. Considerably, the coefficients for all variables are long-run elasticities because all variables are taken in long-form having one cointegrating vector. Long-run results portray that all variables in the cointegration equation significantly influence the inflation rate in Pakistan from 2000 to 2018. More so, results also indicate that the exchange rate (a proxy for devaluation) negatively affects the inflation rate at a 5% significance level. It is evident that a 7.57% increase in inflation takes place due to 1% devaluation, while GDP and MS have a significant positive impact on the inflation rate as a 1% change in GDP causes a 0.80% increase in the inflation rate and 1% increase in money supply causes 22.56% increase in inflation.

The results of the error correction term (ECT) are also presented in table 7, the value of it should lie between (0, 1). Its negative sign reveals the convergence by evaluating the speed of adjustment towards equilibrium. It is also indicated in the results that (ECT) for all the variables possesses negative signs within the range of (0, -1) except for GDP. The main feature of ECT is its relevance with convergence towards equilibrium and correction of disequilibrium occurring due to any shock in the economy. It not only corrects disequilibrium but does guides variables for coming back towards equilibrium. It can also be observed from the results that disequilibrium was corrected per annum by 17.46% in the inflation rate.

5.5 Partial Correlation coefficient

Table 8:

Results of Correlation

	LINF	LEXC	LGDP	LMS
LINF	1	-0.043623	-0.372877	0.226458
LEXC	-0.043623	1	0.024566	0.462022
LGDP	-0.372877	0.024566	1	0.368560
LMS	0.226458	0.462022	0.368560	1

Table 9 portrays, the results describing the “partial correlation coefficient test” in matrix form. The obtained results indicate no powerful correlation between inflation (LINF) and explanatory variables when the exchange rate is used as a proxy for currency devaluation (LEXC), Gross Domestic Product (LGDP) and money supply (LMS) are the rest of the explanatory variables. The correlation static (value) of the independent variables comprises -0.044 for (LEXC) and -0.373 for (LGDP) respectively, which implies adverse (negative) and delicate (weak) correlation existence among dependent variable and explanatory variables as designated by negative coefficient values of the variables. Similarly, results show a correlation between dependent variable inflation (LINF) and independent variable money supply (LMS) having a value of 0.226 with a positive sign. The correlation matrix shows the strength of the relationship of variables.

5.6 Conclusion and recommendations

The prime and foremost purpose of this research is to analyze the relationship between devaluation and inflation in Pakistan over the period 2001-2018. As the data is found stationary at the second difference so the cointegration test based on stationarity findings is applied and VECM is employed for checking the long-run association between devaluation and inflation rate in Pakistan. VECM results revealed that devaluation has a significant effect on inflation in Pakistan. Error correction term C (1) describes that it took 17.46% per year to rectify the transitory deviation for long run association. Partial correlation coefficient analysis shows a negative correlation among independent variables (LEXC and LGDP) and dependent variable inflation rate whereas money supply indicates positive correlation with the dependent variable. The study recommends that Government must float activities parallel to the exchange rate (currency depreciation/devaluation of PKR) to tackle the persistent rise in the inflation rate. Government should also adopt flexible policies regarding interest rates to strengthen the economy and boost local industry and export of domestic goods. It is strongly recommended that government should provide a platform for investors to produce exportable than recurrently devalue the currency, and improvement in the balance of payment (BoP) should also be encouraged. The Central bank should keep an eye on the growth rate of the supply of money as this channel also affects inflation.

Conflicts of Interest

The authors declare no conflict of interest.

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