Journal of Business & Economics
Vol. 12, No. 1, 2020, pp. 27-42

Fiscal Deficit-Inflation Nexus in Pakistan, 1977-2018: Dynamic ARDL Approach

NADIA TAHIR and PERVEZ TAHIR

The prevailing view in the macroeconomic literature is that persistent fiscal deficits are inflationary. Pakistan's economy has experienced an increasing inflation rate and a slowdown in GDP growth. The current study empirically investigates this contradiction for the period 1977- 2018 by using Dynamic ARDL (Bounds, 2017) co-integration technique. The results of the study demonstrate a long-term positive relationship between fiscal deficit and inflation, with severe implications for growth in the long run. However, fiscal deficit does not pose inflationary threat in the short run. Interest rate and inflationary expectations are important short run determinants of inflation in Pakistan.

Keywords: Inflation; inflationary expectations; exchange rate; fiscal deficit; Pakistan; ARDL co-integration

1. INTRODUCTION

Despite the persistently high fiscal deficits, the GDP growth rate of Pakistan has been falling in recent years. The growth rate testifies the fact that expansionary fiscal policy does not work well; it does not contribute to the economic growth. Easy availability of credit leads to inflation as it increases the aggregate demand, however, inflation rate in Pakistan has been satisfactory over the years (King et al. 2012).

There is a debate in macroeconomic literature put forward by Kydland and Prescott (1982) that inflation is due to fiscal deficit because the central bank has to act as government's bank. It happens to be a rule that printing new currency note to fill in the fiscal deficit without any due considerations results in inflation fiscal deficit in Pakistan has persistently remained high, averaging 5.2 percent of the GDP during 1977-2018 and the GDP growth rate has been approximately 5 percent per annum during the same time period. Pakistan's inflation rate, over the period of analysis, averaged around 8.4 percent with a standard deviation of 3.8 percent. High volatility of inflation rate is the causative factor in uncertainty which has been hampering growth. The whole story of macroeconomic stability floats around the curtailing of fiscal deficit, inflation and GDP growth rate.

Now the question arises: how is fiscal deficit affecting the inflation rate in Pakistan? According to Easterly et al. (2004), there is no relationship between long term inflation rate and fiscal deficit at a low inflation rate, whereas, Sargent and Wallace

Nadia Tahir <nadiatahir332@yahoo.com> is Managing Director, Quality Assurance Agency, Higher Education Commission of Pakistan, Islamabad. Pervez Tahir <perveztahir@yahoo.com> is Visiting Senior Fellow at PIDE, Islamabad.

(1985) show that fiscal deficit increases aggregate demand and real returns by keeping the nominal interest rate at zero.

The current study in hand attempts to answer the question of fiscal deficit and inflation nexus by linking two important theoretical strands. First, Kydland and Prescott (1977; 1982) see macro economy as a dynamic, forward looking and interrelated decision-making system, which integrates all types of policies. In their theoretical model, time inconsistency and deviation from the proclaimed policy creates sustained high inflation rate. The analysis shows that policy makers' inability to carry out the announced policies creates inflationary expectations. Households and businesses realise that the announced government policies will not coincide with the future. According to them, discretionary policies, not the variations in aggregate demand are responsible for inflation in an economy.

In addition, the theoretical foundations of the fiscal theory of the price level (FTPL) developed by Leeper (1991), Sims (1994) and Woodford (1994) lead to the conclusion that fiscal deficit affects inflation rate. These economists tried to resolve the well-known monetarist-structuralist controversy by assuming that monetary and fiscal policy interaction determines the price level. Olivera (1967) shows that, keeping other things constant, inflation is an increasing function of fiscal deficit. Monetary and fiscal policy generates inflationary spiral by accommodating higher price and wage expectations.

1.1. Literature Review

In the literature review first, the researcher tried to look at the theoretical formulations of inflation and their need to control it. Next it looks into the justification of the empirical studies for the relationship between monetary and fiscal policies against inflation in various countries, and, then it concludes with Pakistan-specific studies. According to IMF (2009) the success of monetary policy depends on the predictability of expected inflation rate. Recent models relate inflation to economic activity. Macroeconomic volatility determines optimal inflation rate as it shifts the aggregate demand curve outward and generates output and employment cost. Highly volatile countries should maintain low but positive inflation rate. At a high inflation rate, output gap is vertical which means a low cost of reducing inflation. According to Fagan and Messina (2009) and Benigno and Ricci (2010) the coordination of fiscal and monetary policy is necessary to minimise volatility. In another view monetary policy may be useful in times of inflation but not in the times of deflation or crises. Rudebusch (2001) and Ball (2010) declare that with falling aggregate demand and near zero interest rate, there I s no way to boost demand by reducing interest rate. As Bernanke (2010) puts it, one has to rely on fiscal policy and larger deficits in crises so that the Fed can raise interest rate in future. Blanchard et al. (2010) holds that monetary policy can be applied only if there is a small output gap. Political constraints limit usefulness of fiscal policy. Financial regulations were outside the macroeconomic policy framework, amplifying the financial crisis. Consensus and pragmatism are required to shape policies.

According to Mountford and Uhlig (2009), fiscal policy can undermine the effectiveness of monetary policy as it is easy for a central bank to extrapolate fiscal policy based on past behaviour, but in unusual times monetary policy is not capable of

dealing with uncertainty. William (2009) suggests that higher inflation rate is the key to come out of crises. Fed's policy of keeping the interest rate at a zero bound proved costly. Deteriorating fiscal situation and larger output gap may cure crises. Ball (2010) suggests that monetary policy may be effective in controlling inflation but at the cost of output gap. Castelnuovo and Surico (2010) observe that a good monetary policy must capture the views and sentiments of the private sector for controlling inflation. When the long-term bonds market fails to explain the sentiments of the private sector the monetary policy fails. Decressin and Laxton (2009) think that a credible monetary policy can control inflation, avoid liquidity trap and problems of zero-interest rate.

Leeper (2010) sees monetary policy as "scientific "in its approach and fiscal policy is "voodoo". Monetary policy choices are based on systematic analysis whereas fiscal policy deals with unsystematic political economy. (Fiscal and monetary policies are considered as separate and segregated. Inflation rate is an outcome of monetary expansion. During financial crisis of 2008, central banks throughout the world reduced the policy interest rate along with the large fiscal stimulus. Scholars like Cochrane (2014) analysed that central banks purchased sovereign debt, paying interest rate on short-term government bonds closer to the reserve rate. There is hardly any distinction left between monetary and fiscal policy. Leeper and Leith (2016) introduced a joint fiscal and monetary policy ad hoc rule. According to them, short term policy rate can be linked to the government bonds rate. They amend the conventional interest rate rules to peg the policy rate to the debt to GDP and tax to GDP ratios. Loyo (1999) provides empirical evidence for Brazil where the fiscal consequences of monetary policy led to explosive inflation.

After the financial crisis, while the world faced aggressive monetary policy with low inflation and near zero interest rate (New Keynesian Framework), Pakistan confronted the issue of dealing with increasing fiscal deficit in a period of relatively low inflation and low growth. Using dynamic panel model technique, Nguyen (2015) finds that fiscal deficit is a statistically significant determinant of inflation in developing countries like Pakistan. Naqvi et al. (1994) concludes that the State Bank of Pakistan (SBP) should shift from fiscal austerity to high growth. Nasim (1995) suggests that growth dampens prices. Two studies on Pakistan's inflation rate have identified two different sources. Agha and Khan (2006) show fiscal deficit and its financing as the source of inflation whereas, Hyder and Shah (2004) finds some evidence of exchange rate pass-through.

A discussion finds that inflation is influenced by real factors. More recent studies (Ahmad & Mashkoor, 2016; Ali & Khalid, 2019; Mughal & Khan, 2011; Qayyum & Sultana, 2018) conclude that fiscal deficit is inflationary in Pakistan. These studies use various variables like government borrowing, private borrowing and changes in money stock as variables to show that fiscal deficit is a contributor to the inflation rate. However, these studies do not provide the theoretical underpinnings of their empirical model while exploring the determinants of inflation rate in Pakistan.

This study is an effort to use New Keynesian framework (Del Negro, 2015) by incorporating inflationary expectations and nominal exchange rate explicitly in the model. Movements in exchange rate are the key determinant of increasing debt servicing burden, a major determinant of fiscal deficit in Pakistan. It may be noted that Ali and

Khalid (2019) go further to conclude that fiscal deficit should be financed through external sources, declaring it non-inflationary. This calls for a model that includes Wicksellian theory (1907) along with the New Keynesian structuralist model. This model measures the long run and short run dynamics of inflation–deficit by incorporating the expectations.

2. METHODS

The existing study model assumes Wicksellian theory (Wicksell, 1907) as a theory of inflation determination in which monetary and fiscal policies always interact with natural interest rate at zero and shocks in the New Keynesian framework to bring inflation rate close to the optimal inflation rate in the economy. In this model, as maintained by Leeper (1991), Sims (1994) and Woodford (1994), fiscal deficit causes money supply to increase and is a cause of generating inflationary spiral. Following Kydland and Prescott (1977; 1982) time inconsistency and lack of credible government policies create inflationary expectations. They see discretionary policies as the real cause of inflation. Bianchi (2012) and BianchiandIlut (2017) estimate a model with fiscal policy habits and inflation inertia. We use their model to allow for switches in monetary and fiscal policy rules.

Building on these theoretical premises, we start with the transaction demand for money in which inflation rate is the function of nominal rate of growth in money supply, interest rate and income. It is assumed that movements in interest rate provide a good indicator of expectations. But in an economy where interest rates are controlled and credit markets are not functioning well, this assumption can easily be relaxed. Most of the time, fiscal deficit can be used as a good indicator of expectations, as the central bank has to finance government's excessive spending. Another variable which may affect the demand for money and ultimately prices is the nominal exchange rate. If there is increase in money supply, it will give a feedback to the exchange rate through interest rate channel (Krugman & Obstfeld, 1997).

We specify the model as follows:

$$\Pi_t = f(M2g, GDPR, \Pi^e, I, DFCT, MXR)$$

$$Ln\pi t = \beta_0 + \beta_1 LnM2g + \beta_2 LnGDPr + \beta_3 Ln\pi exp + \beta_4 Lnit + \beta_5 LnDfct + \beta_6 Ln\,MXR + \varepsilon_t$$

Where Π_t is the yearly inflation rate measured by CPI, GDPR is the real GDP and Π^e denotes inflationary expectations. As expectations are not observable directly, we use difference in inflation rate as a measure of inflationary expectations. DFCT is the fiscal deficit which is an indicator of the expansionary fiscal policy helping the formation of expectations. MXR is the market exchange rate and M2g is the broad money supply growth rate.

The equation helps us to couple the inflation rate with fiscal behaviour. Increased fiscal deficit and inflationary expectations demand a passive monetary policy. We checked the framework for two types of hypotheses: "inflation is a monetary phenomenon" as a general theory of price determination as explained by the monetarists or it is the fiscal policy which can be held responsible for not having price inertia. We also test how inflation rate affects growth rate and fiscal policy.

The primary variable is the inflation rate measure on the basis of consumer price index. This is widely used as a proxy for inflation rate of national price level. The other variables include fiscal deficit, interest rate, nominal exchange rate and money supply. The data for all these variables were obtained from the *International Financial Statistics* (IFS, 2018) data by

through online access. Data on GDP growth rate and per capita GDP were obtained from the Pakistan Bureau of Statistics (PBS, 2018). All data were in natural logs. The sample period was 1976- 2018 were selected on the basis of availability of a consistent dataset. In Pakistan, the time-series properties of data on most variables are not satisfactory. In most cases, data series are not stationary. This makes the case for using dynamic co integration technique. This approach has no pretesting requirements and very effective in small samples.

2.1. Econometric Technique

In cases where unit roots are present in the data series, short-run dynamic properties of the model can only be captured in an error correction model, after we have demonstrated the existence of co-integration. For estimating the long run behaviour, we use co-integration technique and Vector Error Correction technique. This method requires the variables in the system to be integrated of order one I (1). These models generate dubious results for a small sample size.

2.1.1. *Dynamic ARDL Bound Test*

In small samples, Error Correction Models imposes the condition of mutual co-integration at level. For overcoming this problem, Pesaran et al. (1996; 2001) developed Autoregressive Distributed Lag Model (ARDL) for finding co-integration between more than two variables, irrespective of their level of integration and mutual co-integration. It starts with the assumption that no co-integration exists between the variables. The model has three levels. The first estimates the model. On these cond level, we estimate a combination of I (0), I (1) or a fraction of integration. It is suitable for more than two variables and a finite sample size. Pesaran et al. (1996) offers two sets of asymptotic critical values. One set assumes that all variables are I (0) and the other assumes they are all I (1). If the computed F-statistic falls above the upper bound critical value, then the null hypothesis of no co-integration is rejected. If it falls below the lower bound, then the null hypothesis cannot be rejected (Narayan, 2005). ARDL boundsco-integration test compares F-statistics against the critical value for specific sample sizes. According to Jordan and Philips (2018), ARDL bounds test for co-integration generates more conservative results. Jordan and Philips (2018) generate dynamic simulation of critical value band.

Consider the following ARDL (p,q) model

$$Y_t = \alpha_0 + \sum_{j=0}^{q} \beta_j L^j X_t + \sum_{i=1}^{p} \gamma_i L^i Y_t + \varepsilon_t \quad \ldots\ldots 1$$

Where L represents the lag operator. This can be re-parameterized as follows:

$$\left(1 - \sum_{i=1}^{p} \gamma_i L^i\right) Y_t = + \sum_{j}^{q} \beta_j L^j X_t + \varepsilon_t \quad \ldots\ldots .2$$

$$\sum_{j=0}^{q} \beta_j L^j X_t = \beta_0 X_t - \sum_{j=0}^{q} \beta_j \Delta X_{t-j+1} \quad \ldots\ldots 3$$

$$\left(1 - \sum_{i=1}^{p} \gamma_i L^i\right) Y_t = Y_t - \left(\sum_{i=1}^{p} \Gamma_i \Delta Y_{t-j+1}\right) \quad \ldots\ldots .4$$

Thus the ARDL(p,q) model of equation

$$Y_t = \alpha_0^* + \beta_0^* X_t - \beta_j^* \Delta X_{t-j+1} - \Gamma_i \Delta Y_{t-j+1} + \varepsilon_t^* \quad \ldots\ldots 5$$

With a view of avoiding the problem of inconclusive results in small samples, we are also employing dynamic simulation of auto regressive distributed lag (dynardl) model.

According to Jordan and Philips (2018), dynamic simulation of ARDL estimates parameters from a multivariate regression of normal distribution. These distributions are assumed to have means equal to the estimated parameters and variance is equal to the estimated variance-covariance matrix. This would allow us to overcome the problem of normality of residuals and autocorrelation.

3. RESULTS

3.1. Descriptive Analysis

Table 1 show below descriptive statistics of all the variables used in this study. We find that average inflation rate is 8.5 percent and growth performance on average is 5 percent. The inflation rate showed greater volatility (3.9) compared to GDP growth rate (2.0), which is an indicator of uncertainty.

Table 1

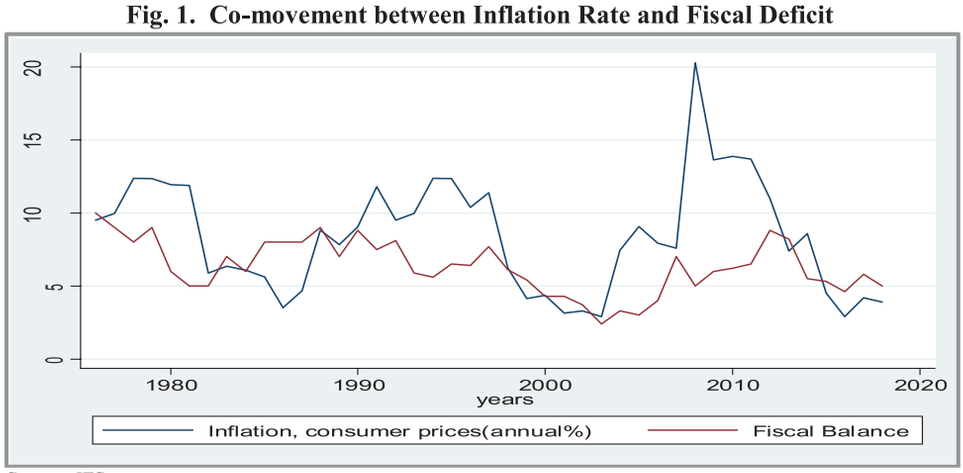
Descriptive Analysis (1976-77 to 2017-18)

Variable	N	Mean	S Dev.	Min	Max	Skewness	Kurtosis
Inflation rate	43	8.5	3.9	2.9	20.3	0.5	3.2
GDP growth rate	43	5	2	0.4	10.2	0	3.2
GDP per capita	43	687	308	358.7	1547.9	1.5	4.4
Broad money supply growth rate	43	15.3	5.7	4.3	32.2	0.5	4.1
Broad money supply as percent of GDP	43	42.7	3.2	37.5	49.2	0.3	1.9
Nominal exchange rate	43	47.6	33.9	9.9	121.8	0.6	2
Discount rate	43	10.8	3	6.3	20	1.2	4.3
Call money rate	43	8.7	2.7	1.9	15	-0.1	3.1
Fiscal deficit	43	6.3	1.8	2.4	10	-0.61	2.3
Inflationary expectations	42	-0.13	3.1	-6.6	12.7	1.3	8.6

Source: Authors' estimation.

Table 1exhibited that the inflation rate, nominal exchange rate, discount rate and money supply are highly volatile, as these variables have very high standard deviation compared to GDP and fiscal deficit. In a managed floating exchange rate regime, the role of monetary policy is limited as it is subservient to the imports transmitting countries' exchange rates. CPI and growth rate of broad money supply are highly volatile series.

Fig. 1. Co-movement between Inflation Rate and Fiscal Deficit



Source: IFS.

Figure 1, depicts the macroeconomic relationship between inflation rate and fiscal deficit. Inflation rate is measured in terms of consumer price index. It will be seen that fiscal deficit and inflation are both moving together. When inflation rate was lowest at 2.9 percent in 2003, fiscal deficit was also the lowest i.e. 2.4 percent. When inflation was the highest at 12 percent in 2010, fiscal deficit was around 9 percent of the GDP. Inflation is considered as the indirect tax and directly impacts servicing of public debt.

3.2. Unit Root Test

Before applying the co-integration test, it is imperative to find out the order of integration in the variables. The co-integration test assumes that two non-stationary series

Table 2

Unit Root Test (Augmented Dickey Fuller Test)

Variables	Level with zero lag	Level with one lag	First difference with zero lag	First difference with one lag	Test
Discount rate	-1.981	-2.411	-5.270	-3.302	I(1)
	(0.2948)	(0.1387)	(0.0000)	(0.0148)	
Nominal exchange rate	-0.345	-0.560	-4.656	-4.077	I(1)
	(0.9188)	(0.8797)	(0.0001)	(0.0011)	
Broad money supply growth rate	-5.399	-4.600	-8.618	-6.961	Level stationary
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	
GDP growth rate	-4.834	-3.569	-9.681	-7.044	Level stationary
	(0.0000)	(0.0064)	(0.0000)	(0.0000)	
Fiscal deficit	-2.666	-2.240	-7.797	-4.505	I(1)
	(0.0800)	(0.1919)	(0.0000)	(0.0002)	
Broad money supply as percentage of GDP	-2.993	-3.499	-5.849	-5.209	I(1)
	(0.0356)	(0.0080)	(0.0000)	(0.0000)	
GDP per capita growth rate	0.728	0.802	-6.642	-4.513	I(1)
	(0.9904)	(0.9917)	(0.0000)	(0.0002)	

Source: *Authors' estimation.*

Suppressed constant and trend term, Interpolated Dickey-Fuller: 1 percent Critical Value -3.648, 5 percent Critical Value -2.958, 10 percent Critical -2.612.

can generate a series which is stationary. If this happens, it confirms that long term relationship between the variables exists. This means that variables must be I(0) and I(1). For finding out the order of integration between the variables, we used Augmented Dickey Fuller (ADF) Test on all variables. Results of ADF test are shown below in Inflation rate, nominal exchange rate, fiscal deficit, discount rate, growth rate of broad money supply and GDP per capita income are all integrated of order one. Growth rate of GDP and broad money supply growth rate are level stationary; therefore, we dropped these variables.

3.3. Error Correction Models

Since the data is non-stationary, we apply Error Correction Model (ECM) developed by Engle and Granger (1987) and measure how much disequilibrium it can correct in the short run and long run. Our data is integrated of order one. Our results show that residuals obtained from two step ECM regressions are stationary and integrated of order zero *I(0).* This confirms long run co-integration between variables.

In Table 3 below, the researcher estimated ECM by using general to specific approach. Table 3 presented the results of-6 econometric models. For testing the long-term determinants of inflation, general to specific approach is a good starting point. ECM term in all models except model 2 is negative and significant depicting that disequilibrium in the short run can be corrected in each period. In model 2, ECM term is negative and insignificant. It shows that there is no short run and long run disequilibrium which can be corrected every year. Money supply cannot be used as a good instrument to correct inflation in the economy.

Table 3

Results of Error Correction Model

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	D.inflation	D.linf	D.linf	D.linf	D.linf	D.linf
L._egresid	-0.309**	-0.161	-0.243**	-0.247**	-0.267**	-0.295**
	(0.151)	(0.108)	(0.111)	(0.119)	(0.111)	(0.125)
LD.dr	0.231					
	(0.283)					
LD.lm2gdp		1.881**				
		(0.857)				
LD.lexchange			-0.885			
			(0.970)			
LD.lfdeficit				0.153		
				(0.241)		
LD.lgdppc					0.627	
					(0.718)	
LD.linfexp						-0.0719
						(0.111)
Constant	-0.125	-0.0301	0.0308	-0.0171	-0.0422	-0.0255
	(0.478)	(0.0522)	(0.0773)	(0.0544)	(0.0585)	(0.0549)
Observations	41	41	41	41	41	40
R-squared	0.100	0.185	0.142	0.114	0.147	0.131
D.W	2.192733	1.894876	1.974486	1.894163	1.772298	2.043994

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Model 1 illustrates that the coefficient value of residuals in ECM is -0.309 which is significant and residuals are integrated of order zero *I(0).* This is the constant elasticity of the error correcting term. It shows 30 percent of partial disequilibrium between short run and long run coefficient can be corrected by changes in interest rate every year. In model 2, coefficient to f ECM is -0.161 which is insignificant. This means that there is no short-run adjustment to make and Equation 2 is in equilibrium condition and no long run and short run adjustments need to be made between broad money supply and inflation rate. In econometric model no 3-6 in Table 3 above, ECM coefficient is negative and significant. These models show the need for short-term adjustment as there is long run equilibrium. The estimated ECM term between nominal exchange rate and inflation rate can correct 24 per cent of disequilibrium every year. The coefficient of market exchange rate is negative and insignificant. In an inflationary environment, according to Krugman and Obstfield (1997) Flexible Price Model, increase in money supply will give a feedback to the exchange rate through interest rate channel. The coefficient value of nominal exchange rate has, therefore, to be positive. In ECM and in our double Log Model, the value of the coefficient is negative. This means that an increase in nominal exchange rate in a highly inflationary environment is not depreciating the currency in Pakistan. Model 4 discusses the importance of fiscal deficit for correcting disequilibrium in Pakistan. The ECM term is negative and it can correct 25 per cent of disequilibrium in the short run. It also shows that fiscal deficit is contributing to short run inflation in Pakistan.

3.4. Vector Error Correction Model

After applying the error correction model which confirms long term relationship between interest rate, money supply, nominal exchange rate and fiscal deficit, it is logical to see the interaction of all these variables in determining inflation in Pakistan. We have shown in Table 2 that variables are integrated of order one I (1). It confirms that VECM can be applied to the current model. In Table 5, lag length was selected with the help of VAR lag selection criteria. Akaike Information Criterion and Schwarz Information Criterion suggested two optimal lags. Trace statistic was 140.24 atr=0 which exceeds its critical value of 76.07at1percent of the critical level. Rejection of the null hypothesis of no co-integrating equation on the basis of trace statistic occurred. The researcher accepts r=2.This means that there are two or fewer integrating equations for these five variables at 1 percent level of significance. We conclude that there are 2 co-integrating vectors.

Model l in Table 4 represents the L.ce1 and L.ce2 - two co-integrating equations - to ascertain the long-term causality between inflation rate, discount rate, fiscal deficit, exchange rate and GDP per capita. All the variables are in natural log transformation. The co-integrating coefficient error term is negative and significant. It confirms long term causality between the variables. To ascertain short term causation, only the lag coefficient values of inflation and discount rate have to be significant. This means only interest rate has short-term causality with inflation rate in Pakistan.

Model 2 has one error term coefficient negative but insignificant to meet both the conditions of long-term causality between discount rate and all other variables. The only significant variable is fiscal deficit which confirms short run causation between interest rate and fiscal deficit. This means that increased fiscal deficit exerts pressure on interest rate to come down. It again verifies Kydland and Prescott (1982) hypothesis of time inconsistency and Leeper et al. (1996) hypothesis of integration between monetary and fiscal policy. Model 5 shows both error term coefficients negative but only one term significant, again showing no long run causation between the variables.

Table 4

Results of Vector Error Correction Model

Variables	(1) D_linf	(2) D_ldr	(3) D_lfdeficit	(4) D_lexchange	(5) D_lgdppc
L._ce1	-0.150**	0.0142	0.0657	-0.0271**	-0.0331*
	(0.0702)	(0.0343)	(0.0463)	(0.0124)	(0.0172)
L._ce2	-0.912***	-0.176	-0.198	0.166***	-0.100
	(0.297)	(0.145)	(0.195)	(0.0522)	(0.0726)
LD.linf	-0.374**	-0.0136	-0.174	0.0569*	0.0143
	(0.172)	(0.0840)	(0.113)	(0.0303)	(0.0421)
LD.ldr	1.710***	0.269	0.661**	-0.0550	-0.0175
	(0.489)	(0.239)	(0.322)	(0.0861)	(0.120)
LD.lfdeficit	0.0134	0.285**	-0.163	0.0346	0.00220
	(0.230)	(0.112)	(0.152)	(0.0405)	(0.0564)
LD.lexchange	-0.861	0.181	1.149*	0.187	0.150
	(1.013)	(0.495)	(0.668)	(0.178)	(0.248)
LD.lgdppc	0.237	0.235	-0.676	-0.0748	0.0270
	(0.665)	(0.325)	(0.438)	(0.117)	(0.163)
Observations	41	41	41	41	41

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

For the validity and reliability of the results, author performed Lagrange Multiplier (LM) test for estimating the autocorrelation and Jarque-Ber (JB) test for assessing the normality of the residuals. LM test fails to reject the null hypothesis of autocorrelation. JB test assumes that residuals of the variables are normally distributed .All other variables are significant and we again reject the null hypothesis of normally distributed residuals. These two tests give evidence that there is still the problem of normality and autocorrelation in our model.

3.5. Long Run Determinants of Inflation Using ARDL and Dynamic ARDL Approach

After ensuring that all regressors are first-order non stationary or less (Table2), as there is a small sample size and more than two variables, we applied ARDL bounds co-integration to ascertain the long run relationship between inflation rate, interest rate and fiscal deficit.

This technique detects long term relationship through the calculated F-statistic exceeding the critical values by using Pesaran, Shin, and Smith (2001) Co-integration test. These critical values are reported in the Table 6. Pesran, becomes asymptotic for small samples, so we used Narayan (2005).

Table 5

Results of ARDL Bounds Cointegration and Dynamic Simulation ARDL

ARDL	(1,0,2)	(4,0,0)	(1,2,1,0)	(1, 1, 1)	(1,1,1)	(1,1,1)
Variables	Dlinf (1)	Dlinf (2)	Dlinf (3)	Dlinf (4)	Dlinf (5)	Dlinf (6)
L.linf (ECT)	**-0.373*** **	**-0.490*** **	**-0.398*** **	**-0.293** **	**-0.253** **	**-0.293** **
	(0.126)	**(0.159)**	**(0.124)**	**(0.125)**	**(0.125)**	**(0.115)**
lm2r	-0.0322					
	(0.326)					
Ldr	0.135		0.453			
	(0.629)		(0.569)			
D.ldr	0.959***		1.018***	1.087***		1.251***
	(0.317)		(0.311)	(0.371)		(0.317)
LD.ldr	0.653*		0.682*	0.0619		-0.149
	(0.360)		(0.353)	(0.249)		(0.305)
Lfdeficit		0.275	0.428			
		(0.391)	(0.442)			
Lgdppc		-0.134				
		(0.333)				
LD.linf		0.232				
		(0.182)				
L2D.linf		0.175				
		(0.177)				
L3D.linf		0.398**				
		(0.171)				
Lexchange			0.0509		-0.847	-1.100
			(0.168)		(0.986)	(0.935)
D.lexchange			-1.779*		-0.0432	0.326*
			(0.967)		(0.0756)	(0.190)
D_lm2gdp				-0.940		
				(0.888)		
L1_lm2gdp				-0.188		
				(0.840)		
D_lfdeficit					0.163	0.394*
					(0.273)	(0.229)
L1_lfdeficit					0.0762	0.363
					(0.228)	(0.219)
D_lgdppc						-1.424*
						(0.714)
L1_lgdppc						-0.697*
						(0.401)
Constant	0.647	1.166	0.101	1.142	0.563	3.726
	(0.635)	(1.146)	(0.631)	(3.097)	(0.560)	(2.264)
Observations	39	39	39	42	42	42
R-squared	0.416	0.278	0.480	0.361	0.148	0.504

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 6

Critical F Test Values Based on Narayan (2005) and Pesaran, Shin, and Smith (2001)

	Narayan (2005)		Pesaran, Shin and Smith (2001)	
	I(0) Sample Size (30)	I(0)Sample Size (80)	I(0)	I(1)
10% critical value	2.496	- 3.346	3.33	4.347
5% critical value	2.962	– 3.910	4.083	5.207
1%critical value	4.068	– 5.250	5.92	7.197

Source: Authors' estimation.

Table 5 reports a number of important findings emerge from these two experiments on co- integration. According to the ARDL bound test for co-integration, if the computed F-statistic is greater than the upper bound critical value, and then were ject the null hypothesis of no co-integration. When F-statistic is below the lower bound critical value, then we are unable to reject the null hypothesis of no co-integration. When the computed F-statistic falls between the lower and upper bound, then the results are inconclusive. In the models 1-3, F-statistic is 2.60, 2.31 and 1.85 respectively.

In all cases, the critical value of F test is below the lower bound even at the10 percent level. The researchers, therefore, conclude that there is no co-integration. Since a small sample (42 observations), Pesaran, Shin, and Smith (2001) provide asymptotic critical values and critical values for case 1, which is no intercept and no trend. Narayan (2005) is significant for Model 1 at 10 percent. We conclude that there is co-integration between inflation rate, interest rate and money supply. Thus, it is accepted that inflation is a monetary phenomenon in Pakistan. Application of the ARDL bound test with GDP and fiscal deficit but the inclusion of these variables resulted as inconclusive results. Then the author estimated the ARDL Bound test for testing the hypothesis that inflation is due to fiscal policy and GDP growth objectives. It resulted in no co-integration between the variables. The presence of fiscal deficit, GDP growth rate and market exchange rate make adjustment slow. Growth in broad money supply is insignificant. Hence, we conclude that interest rate and inflation have a long-term relationship and co-integration exists between the two. However, as the test result is close to the I(0) lower bound of the test, it can also be treated as inconclusive, which calls for further testing. We use dynamic simulations for hypothesis testing. The results in Table 6 show significant and stable long-term relationship by using dynamic ARDL simulation. Our results are also stable and efficient. Interest rate, exchange rate and fiscal deficit are short run determinants of inflation rate in Pakistan. Our results are stable and converge.

4. DISCUSSION

While the jury is still out to determine the best course of action for an effective central bank policy, in the current study the researcher presents a relatively general to specific framework for analysing the interaction between monetary and fiscal policies. The framework covers many practical issues in controlling inflation, which appear as a real constraint on macroeconomic stability. In case of a developing economy like Pakistan where markets are not functioning fully and information available to the central

bank on the nature of shocks and variability are incomplete, inflation lies low in priorities. The central bank has to finance government borrowing. Less sophisticated models for monitoring the effectiveness of monetary policy make the quest for an optimal monetary policy difficult. In this scenario, monetary policy should be designed on the basis of realistic assumptions about policy options. The objective of price stability without sacrificing growth can be achieved by using an effective nominal anchor, which enables people to form expectations about future. Our study finds this to be the missing link.

Our application of ARDL Co-integration method to find the long run determinants of inflation in Pakistan shows that GDP growth and fiscal deficit do not significantly affect inflation. The negative sign trade-off between inflation rate and real GDP. The results of ECM show that broad money supply, market exchange rate and interest rate are co-integrated with inflation rate. It is concluded that inflation is monetary in nature in the long run and control upward movements in inflation. Real GDP and market exchange rate are divergent cases of equilibrium. Decline in real GDP and depreciation in market exchange rate with high inflation makes a case for the central bank to control inflation.

Controlling inflation rate appears as a real constraint for macroeconomic stability and it is the responsibility of central bank to ensure that inflation should not exceed a certain limit, as there is long term co-integration between interest rate and inflation rate.

Central bank plays an effective role in controlling inflation in the long run. It has to pursue diversified objectives while prioritising inflation rate via interest rate. Insignificance of the growth of broad money supply due to measurement issues in our case corroborates with Roger (1995) who noted the difficulties in measuring inflation as a monetary phenomenon since money growth is not necessarily an exogenous variable. Expansion of money supply leads to the trend of amalgamated growth and inflation in the economy. It has to keep an eye on output-inflation gap, exchange rate movements, and stability in the financial market. Fiscal deficit and real GDP are shocks of transitory nature, significant in the short run but not suited to the long run dynamics of inflation in Pakistan. Our results are in line with the earlier studies by Hammond (1986) and Moore (1979) that a strong relationship between fiscal deficit and inflation exists only during high inflation episodes. Real GDP and market exchange rate are divergent cases of equilibrium. Decline in real GDP and depreciation in market exchange rate with high inflation makes a case for the central bank to control inflation.

Policy matters but right choice of policy matters more when it comes to inflation. This paper shows that monetary policy is the right choice to control inflation in Pakistan. It is the responsibility of the central bank to ensure that inflation does not exceed a certain limit as there is long term co-integration between interest rate and inflation rate. The analysis presented in this paper leads to the conclusion that inflation in Pakistan is monetary in nature and interest rate is more effective as anchor than exchange rate management due to the small trade to GDP ratio.

The current research highlighted the importance of rigorous monetary policy which is overlooked in Pakistan due to lack of political will to allow an autonomous central bank and commitment with short run objectives. The result is an expansionary monetary policy that generates growth in the short run and inflation in the long-run. The State Bank never had inflation as serious policy objective. It used exchange rate

adjustments and monetary aggregates for controlling inflation half-heartedly. This type of policy stance widened the output gap and generated inflation.

In the current research work, it is concluded that inflation is monetary in nature in Pakistan and interest rate is the more effective anchor available to State Bank than managing exchange rate due to the smaller trade to GDP ratio. Fiscal deficit and real GDP are shocks of transitory nature, significant in the short run but not suited to the long run dynamics of inflation in Pakistan.

Finally, an important result is that there is "no right or wrong policy" when it comes to controlling inflation because price determination as explained by Leeper and Leith (2016) is "more complex than the benchmarking theories". Fiscal and monetary policy coordination work well in recession and for inflationary environment. Monetary policy is still a preferred choice.

REFERENCES

Agha, A. I., & Khan, M. S. (2006). An empirical analysis of fiscal imbalances and inflation in Pakistan. *SBP Research Bulletin*, *2*(2), 343-362.

Ahmed, O., & Mashkoor, A. (2016). The Economic Development Planning: *Most Innovative Solution of the Most Orthodox Problems.* Germany: Scholars Press Inc.

Ali, K., & Khalid, M. (2019). Sources to Finance Fiscal Deficit and Their Impact on Inflation: A Case Study of Pakistan. *The Pakistan Development Review*, *58*(1), 27-43.

Ball, L. (2010). The performance of alternative monetary regimes. *In Handbook of Monetary Economics, 3*(2), 1303-1343.

Benigno, P., & Ricci, L. A. (2010). The inflation-output trade-off with downward wage rigidities. *American Economic Review, 101*(4), 1436-66.

Bernanke, B. S. (2010). Semiannual Monetary Policy Report to the Congress: testimony before the Committee on Banking, Housing, and Urban Affairs, US Senate, July21, 2010 (No.97). Board of Governors of the Federal Reserve System (US).

Bianchi, F. (2012).Evolving monetary/fiscal policy mix in the United States. *American Economic Review*, *102*(3), 167-172.

Bianchi, F., & Ilut, C. (2017). Monetary/fiscal policy mix and agents' beliefs. *Review of Economic Dynamics*, *26*,113-139.

Blanchard, O., Dell'Ariccia, G., & Mauro, P. (2010). Rethinking macroeconomic policy. *Journal of Money, Credit and Banking, 42(1)*, 199-215.

Buiter, W. H. (2009). The unfortunate uselessness of most 'state of the art' academic monetary economics. *VoxEU, Research-based Policy Analysis and Commentary from Leading Economists*, 1-5.

Bilquees, F. (1988). Inflation in Pakistan: Empirical evidence on the monetarist and Structuralist hypotheses. *The Pakistan Development Review, 27*(2), 109-129.

Castelnuovo, E., & Surico, P. (2010). Monetary policy, inflation expectations and the price puzzle. *The Economic Journal*, *120*(549), 1262-1283.

Cochrane, J. H.(2014).Monetary policy with interest on reserves. *Journal of Economic Dynamics and Control, 49*, 74-108.

De Carvalho Filho, I. E. (2011). 28 months later: how inflation targeters outperformed their peers in the great recession. *The BE Journal of Macroeconomics*, 11(1), 1-49.

Decressin, M. J., & Laxton, M. D. (2009). *Gauging risks for deflation*. International Monetary Fund.

DelNegro, M., Giannoni, M. P., & Schorfheide, F. (2015). Inflation in the great recession and new Keynesian models. *American Economic Journal: Macroeconomics*, *7*(1), 168-196.

Easterly, W, Ross L., & David R. (2004). "Aid, Policies, and Growth: Comment." *American Economic Review, 94*(3), 774-780.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: Journal of the Econometric Society, 13*(2), 251-276.

Fagan, G., & Messina, J. (2009). Downward wage rigidity and optimal steady-state inflation, Working Paper No. 1048, European Central Bank.

Pakistan Bureau of Statistics, Pakistan (2018), Government of Pakistan, Islamabad. www.statpak.gov.pk/depts/index.htm.

Hammond, J. D. (1986). Monetarist and antimonetarist causality. *Research in the History of Thought and Methodology, 4*, 109-126.

Hyder, Z., & Shah, S. (2005). *Exchange rate pass-through to domestic prices in Pakistan* (No. 0510020). University Library of Munich, Germany.

International Monetary Fund. (2018). *International Financial Statistics* (Edition: September 2018). ESDS International, University of Manchester.

IMF. (2009). *The implications of the global financial crisis for low-income countries.*

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, *12*(2-3), 231-254.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, *52*(2), 169-210.

Jordan, S., & Philips, A. Q. (2018). Cointegration testing and dynamic simulations of autoregressive distributed lag models. *The Stata Journal*, *18*(4), 902-923.

King, K., Jin, M., & Lew, D. (2012). Roles of Hsl1p and Hsl7p in Swe1p degradation: beyond sept in tethering. *Eukaryotic Cell*, *11*(12), 1496-1502.

Kydland, F. E., & Prescott, E. C. (1977). Rules rather than discretion: The inconsistency of optimal plans. *Journal of Political Economy, 85*(3), 473-491.

Kydland, F. E., & Prescott, E. C. (1982). Time to build and aggregate fluctuations. *Econometrica: Journal of the Econometric Society, 12*(2), 1345-1370.

Krugman, P. R. & Obstfeld, M. (1997), *International Economics: Theory and Policy*. Boston, Mass.: Addison-Wesley.

Leeper, E. M. (1991). Equilibria under 'active' and 'passive' monetary and fiscal policies. *Journal of Monetary Economics*, *27*(1), 129-147.

Leeper, E. M. (2010). *Monetary science, fiscal alchemy* (No. w16510). National Bureau of Economic Research.

Leeper, E. M. (2011). Anchors aweigh: how fiscal policy can undermine "good' monetary policy. *Series on Central Banking Analysis and Economic Policies no.16*.

Leeper, E. M. (2009). Anchors Away: How Fiscal Policy Can Undermine 'Good' Monetary Policy. *Available at SSRN 1502870*.

Leeper, E. M., & Leith, C. (2016). Understanding inflation as a joint monetary–fiscal phenomenon. In *Handbook of Macroeconomics, 3*(2), 2305-2415.

Loyo, E. (1999). Tight money paradox on the loose: A fiscalist hyperinflation. *Manuscript, Harvard University*.

Moore, B. J. (1979). The endogenous money stock. *Journal of Post Keynesian Economics*, *2*(1), 49-70.

Mountford, A., & Uhlig, H. (2009). What are the effects of fiscal policy shocks? *Journal of Applied Econometrics*, *24*(6), 960-992.

Mughal, K., & Khan, M. A. (2011). Fiscal deficit and its impact on inflation, Causality and Co- integration: The Experience of Pakistan (1960-2010). *Far East Journal of Psychology and Business*, *5*(2), 51-62.

Narayan, P. K. (2005). The saving and investment nexus for China: evidence from cointegration tests. *Applied Economics*, *37*(17), 1979-1990.

Nasim, A. (1995). Determinants of inflation in Pakistan. *Karachi: State Bank of Pakistan*, *35*(4).

Naqvi, S. N. H., Khan, A. H., Ahmed, A. M., & Siddiqui, R. (1994). *Inflation in Pakistan: Causes and remedies*. Islamabad: Pakistan Institute of Development Economics.

Nguyen, B. (2015). Effects of fiscal deficit and money M2 supply on inflation: Evidence from selected economies of Asia. *Journal of Economics, Finance, and Administrative Science*, *2(1)*, 49-53.

Olivera, J. H. (1967). Money, prices and fiscal lags: a note on the dynamics of inflation. *PSL Quarterly Review*, *20*(82), 258-267.

Pesaran, M. H., Shin, Y., & Smith, R. J. (1996). *Testing for the 'Existence of a Long-run Relationship'* (No. 9622). Faculty of Economics, University of Cambridge.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289-326.

Qayyum, A., & Sultana, B. (2018). Factors of food inflation: Evidence from time series of Pakistan. *Journal of Banking and Finance Management*, *1*(2), 23-30.

Roger, S. (1995). *Measures of underlying inflation in New Zealand, 1981-95*. Reserve Bank of New Zealand.

Rudebusch, G. D. (2001). Is the Fed too timid? Monetary policy in an uncertain world. *Review of Economics and Statistics*, *83*(2), 203-217.

Sargent, T., & Wallace, N. (1985). Interest on reserves. *Journal of Monetary Economics*, *15*(3), 279-290.

Sims, K. (1992). Interactive evolution of dynamical systems. In *Toward a practice of autonomous systems: Proceedings of the First European Conference on Artificial Life.*

Williams, J. C. (2009). Heeding Daedalus: Optimal inflation and the zero lower bound. *Brookings Papers on Economic Activity, 12*(2), 1-37.

Woodford, M. (1994). Monetary policy and price level determinacy in a cash-in-advance economy. *Economic Theory*, *4*(3), 345-38