Available Online
Journal of Economic Impact
ISSN: 2664-9764 (Online), 2664-9756 (Print)
https://www.scienceimpactpub.com/jei

SHORT AND LONG RUN EFFECTS OF MONETARY POLICY ON FOOD INFLATION: A STUDY OF PAKISTAN

Choudary Ihtasham Ali [a], Sami Ullah [b], Umar Ijaz Ahmed [b,*], Abd Ur Rehman [b], Hafiz Zahid Mehmood [b], Mudassar Yasin [c], Mohsin Raza [b]

[a] *Faculty of Social Sciences & Humanities, MNS University of Agriculture, Multan, Pakistan*
[b] *Department of Agribusiness and Applied Economics, MNS University of Agriculture, Multan, Pakistan*
[c] *Department of Agricultural Extension, MNS University of Agriculture, Multan, Pakistan*

ARTICLE INFO

Article history
Received: March 17, 2023
Revised: May 12, 2023
Accepted: June 08, 2023

Keywords
Monetary policy
Food inflation
ARDL
Pakistan

ABSTRACT

Food plays a major role in the consumption basket of developing countries such as Pakistan, with a significant portion of the insufficient income of poor individuals spending on food. Therefore, higher food inflation severely affects the purchasing power of poor people. This study is designed to estimate the short and long-run impacts of monetary policy on food inflation in Pakistan. For this purpose, time series data from September 2005 to October 2020 was used through the Autoregressive Distributed Lag (ARDL) model. The findings indicate that food inflation can become stable by restrictive monetary policy in both the short and long run. The results show that the short-run shocks can be adjusted at the speed of 13.9% per month. To tackle food inflation, a balanced monetary policy is suggested. On the other hand, a fiscal policy providing subsidized food items to people can also be implemented to tackle food inflation in Pakistan.

* *Email: umar.ijaz@mnsuam.edu.pk*
https://doi.org/10.52223/j.econimpact.2023.5203

INTRODUCTION

Food inflation has become one of the most significant issues for developing countries with huge population and low level of income (Ali et al., 2022). Higher food inflation with price volatility decreases the purchasing power of poor people, resulting in lower per capita real income (Egwuma et al., 2017). South Asia had the highest food inflation rates from July 2019 to February 2020 compared to other Asian regions, with 11.2 percent in July 2019 and 10 percent in February 2020 (FAOSTAT, 2020). Whereas Pakistan experienced the maximum rate of food among countries in South Asia, the double-digit food inflation hit Pakistan from July 2020 to December 2020 and decreased to 6.7% in January 2021. The peak food inflation rate was about 17.8% in July 2020 (TradingEconomics, 2021). Literature has agreed that food inflation is decisive for constructive monetary policy in developing countries like Pakistan (Soskic, 2015). A famous economist and statistician said, "Inflation is always and everywhere a monetary phenomenon" (Friedman, 1956). Therefore, central banks should tackle inflation carefully (Ali et al., 2022; Iddrisu and Alagidede, 2020). De Gregorio (2012) stated that food prices have a destructive subsequent impact on the consumer price index (CPI) and general inflation. If this damaging subsequent impact is not considered, we could underestimate the effect of food prices. An insight has been made prior by Bernanke and Gertler (1999) that there is some information behind food prices that talks about feasible upward or downward shifts of inflation, so they should have a significant consideration for monetary policy structure (Hammoudeh et al., 2015).

Conversely, the existing literature also reveals that the food share in the consumption basket and income levels determine how much food inflation affects general inflation (Ali et al., 2022; Catão and Chang, 2015; Iddrisu and Alagidede, 2020). In developing countries, food has a major share in the consumption basket and needs a significant amount of money to spend on it from inadequate income (Anand et al., 2015; Iddrisu and Alagidede, 2020). The food expenditures in developing countries are huge (based upon Engel's Law), which seriously damage the welfare of people (Hanif, 2012). Thus, food inflation is imperative not only for present inflation but also for inflation in the future for developing countries (Ali et al., 2022).

As the share of expenditure on food is very significant in developing countries, if food prices have been overlooked during inflation impact estimation, it can result in a deceptive estimate of living costs and expenses by ordinary households (Alper et al., 2016). Accordingly, developing countries with inflation-targeting central bank should provide significant consideration to food inflation in policy making (Catão and Chang, 2015; Pourroy et al., 2016), and maximum welfare in such countries can only be achieved through monetary policy by aiming for food inflation. Therefore, in countries like Pakistan, where 38.3 percent of the population is multidimensionally poor, and 12.9 percent of the population (25.454 million people) is at risk of poverty based on MPI, monetary policy becomes extremely important (UNDP, 2021). In Pakistan, food (means food and non-alcoholic beverages) had about 36 percent share in the consumption basket during 2018-19 (PBS, 2019). However, developed nations have about 15 percent of the food share in the consumption basket (Alper et al., 2016). So, the occurrence of such high poverty in Pakistan and the dominant food share in the consumption basket

takes a huge amount of expenditure of poor households. In Pakistan, several studies, including Ali et al. (2022), Qayyum and Sultana (2018), Rehman and Khan (2015), Choudhri et al. (2015), Awan and Imran (2015), Anam et al. (2014), Hanif (2012), Ahsan et al., (2011), Khan and Gill, (2007), Khan and Qasim (1996) provide a significant contribution in the literature about food inflation dynamics and determinants of food inflation. However, the effect of monetary policy on food inflation needs to be more adequately highlighted. To the best of our knowledge, this study is one of the leading studies that is carried out to measure the short-run and long-run impact of monetary policy on food inflation in Pakistan by employing monthly data. We have used the Autoregressive Distributed Lag (ARDL) model proposed by Pesaran and others (Pesaran et al., 1996; Pesaran et al., 2001; Pesaran and Shin, 1997) which captures both the short-run and long-run impacts of regressors on the dependent variable.

Monetary Policy and Food Inflation Dynamics in Pakistan

The Act-1956 of the State Bank of Pakistan (SBP) provides the monetary policy framework in Pakistan. This Act commends the SBP to set or formulate Pakistan's credit and monetary policy framework. This Act also encourages SBP to obtain financial stability (price stability) and maximum employment of valuable resources in the country. The SBP should accomplish credit and monetary policy conferring the targets of government about inflation and real growth in corresponding to Section 9-A (a) of the Act (Hanif, 2014). Zaidi (2006) stated in his study that the monetary policy of Pakistan had been thought to be flexible before the mid-2000s. But, in the last few years, officials have been making efforts to make the monetary policy reliable through committee-based evaluation and bring transparency by publishing policy recommendations (Hanif, 2014).

The State Bank of Pakistan has adopted inflation targeting monetary policy during the last decade. Thus, it has implications for food inflation in Pakistan. Food inflation impacts the country's economy because it influences the individuals' purchasing power (Qayyum and Sultana, 2018). Stable inflation in an economy can diminish its productivity since it ensues inefficient distribution of resources (Shahid, 2014). As a low-income country, Pakistan faces food price inflation and its dynamics from the previous decades. This high food inflation in Pakistan has raised the living cost and decreased the level of consumption, which results in malnutrition among the people in Pakistan. Due to this, malnutrition or undernourishment of the people results in a productivity reduction of almost 10% (Alderman, 2005).

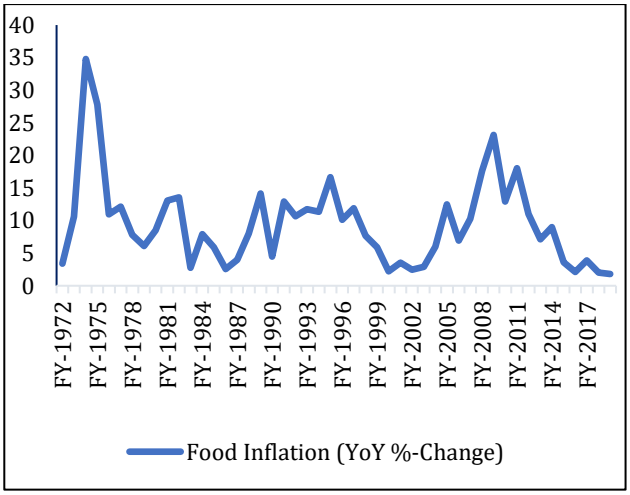

Figure 1. Food inflation trend in Pakistan; Source: GOP, 2023.

Figure 1 demonstrates Pakistan's food inflation trend from FY-1972 to FY-2019 (the value is given in percentage change yearly). If we see the above graph, the food inflation was very low during FY-2000-2004, but then it increased to double digits in 2005-06. Food inflation reached its highest point (26.6%) during FY-2008-09. After that, it fell to 2% in FY 2013 and rose to 9% in FY 2014.

Catão and Chang (2015) found that a world food price shock results in welfare-augmenting outcomes by focusing on CPI rather than PPI. They used the Dynamic Stochastic General Equilibrium (DSGE) approach in their study under a condition of perfect sharing of international risk and the country's export prices' elasticity. They suggest that targeting the expected CPI rather than just CPI results in more outstanding welfare advantages. Similarly, Anand et al. (2015) stated that welfare advantages are higher when the central bank targets headline inflation rather than core inflation in financial friction. Anand et al. (2015) and Catão and Chang (2015) worked in an open economy framework.

By using the DSGE framework, Ginn and Pourroy (2019) exhibit that fiscal and monetary policy that subsidizes or have targets to subsidize the prices of food may be synchronized with each other for increasing the welfare in low-income countries, where the share of expenditures on food is high, and the people experience problems for credit. So, their study emphasized that food prices and consumption become efficient by providing subsidies for those with credit constraints; that's why we should not overlook the monetary policy that subsidizes the prices.

Bhattacharya and Jain (2019) stated in their study that monetary policy can diminish food price inflation in an economy by restricting aggregate demand (restrictive monetary policy). They also noted that non-food inflation is affected more than food inflation through the implication of the restrictive monetary policy. Still, in food-dominant (in consumption basket) countries, the effect of restrictive monetary policy on food inflation is more significant than impacts on non-food inflation.

Few studies have highlighted the factors affecting food price inflation. Akram (2009) postulates that as the price of crude oil increases, it boosts the demand for substitutes such as biofuel due to its low cost. Since the sources for biofuels are agricultural commodities, as the biofuel demand increases, the demand for agricultural commodities increases, resulting in increased prices. Similarly, Akram (2009) and Donald (2008) also observed that the growth of biofuel production from agricultural commodities (i.e., grains & oil seeds) increases food prices.

Soskic (2015) stated that by increasing the income in a country, the aggregate demand boosts, which increases food prices. Pourroy et al. (2016) noted that food prices are not forced by weather conditions only; some other factors impact food prices, such as growth in aggregate demand resulting from an increase in income, restrictions on trade imposed by main food exporters, cost increment to the farmers deriving from unstable oil prices and investors' actions in the market for goods.

We have some studies about food inflation and its determinants in the Pakistan milieu, but most did not describe the monetary policy and food inflation relationship. Qayyum and Sultana (2018) suggested in their study that special consideration must be given to food exports and imports and monetary policy to overcome food price inflation in the country. They also highlighted several factors such as taxes, GDP, and food imports and exports significantly affecting food inflation.

Rehman and Khan (2015) recommended that the government should pay attention to the farming segment and cut down the taxes on food products. They concluded that by imposing indirect taxes on agricultural commodities, food inflation rises, while

subsidizing the agricultural commodities, food inflation falls. Shahid (2014) studied the impact of unemployment and inflation on economic growth in Pakistan from 1980 to 2010. The author measured the short and long-run relationship among variables using the ARDL model and found co-integration among them. Abdullah and Kalim (2012) studied the impact of supply and demand side factors on food inflation by applying co-integration techniques from 1972 to 2008 data. They found that support prices, food exports, and expectations for inflation positively impact food price inflation in the short run.

In this study, the short and long-run impacts of monetary policy on food inflation are examined using the monthly data of variables of interest. It is worth mentioning here that most of the studies in the literature were conducted to measure the determinants of food inflation in Pakistan by employing the annual and quarterly observation of the data. By deviating from existing literature, we find some gaps to measure, especially the short and long-run impacts of monetary policy on food inflation, by employing the monthly observations of the data in Pakistan.

METHODOLOGY

The variables defined for the final model have been constructed by obtaining data from different sources. To estimate the final model, we used monthly time series data from September 2005 to October 2020, which provided enough weight for data analysis. The variables deemed for analysis include food CPI (FI), proxy for food inflation, SBP's reverse repo rate (MPR); proxy for monetary policy, FAO's world food price index (WFPI); real effective exchange rate (REER), quantum index of manufacturing (QIM); poxy for GDP and transport CPI (TRANS). The selection of variables is conversant by the literature (Akram, 2009; Ali et al., 2022; Bhattacharya and Jain, 2019; Bhattacharya and Sen Gupta, 2018; Hammoudeh et al., 2015).

The data about food and transport prices in the CPI basket was collected from many volumes of the state bank's monthly publication of inflation monitor. At the same time, the data about the real monetary policy rate (MPR), an effective exchange rate (REER), and the quantum index of manufacturing (QIM) were collected from state bank's statistical bulletins. As the Food and Agricultural Organization (FAO) published the data about the World Food Price Index (WFPI), the data about WFPI was gathered from the FAO's official website. The autoregressive distributed lag (ARDL) model measures the short and long-run effects of monetary policy and other macroeconomic factors on food inflation. The general form of the model is given in equation (1) as follows:

$$FI_t = \alpha_0 + \alpha_1 MPR + \alpha_2 QIM + \alpha_3 TRANS + \alpha_4 REER + \in_t \quad (1)$$

Where FI represents the Food CPI, MPR means monetary policy rate, QIM is used as a proxy for GDP, TRANS represents the Transports CPI, REER represents the real effective exchange rate, t represents the time, α_0 represents the slope parameter $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ represents the coefficients of variables, and $\in_t$ represents the error term.

Equation (1) can be written in ARDL form as follows:

$$\Delta FI = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta FI_{t-i} + \sum_{i=1}^{n} \alpha_2 \Delta MPR_{t-i} + \sum_{i=1}^{n} \alpha_3 \Delta QIM_{t-i} + \sum_{i=1}^{n} \alpha_4 \Delta TRANS_{t-i} + \sum_{i=1}^{n} \alpha_5 \Delta REER_{t-i} + \emptyset ECM_{t-1} + \epsilon_t \quad (2)$$

Where Δ represents the first difference and ∅ represents the coefficient of ECM, autoregressive distributed lag (ARDL) model estimates show the short-run and long-run relationship between food inflation and other independent variables. The first step in ARDL estimation is selecting the appropriate lag length of variables. Following the lag length selection, we employed the ARDL model and then estimated Bound's Test to determine the long-run form of the ARDL model. After that, we evaluated the error correction model (ECM) and did the test about the model stability, i.e., CUSUM or CUSUMSQ.

RESULTS AND DISCUSSION

Descriptive Statistics

After the graphical trend analysis, the most important thing ahead to model estimation is descriptive analysis of the data that defines the basic attributes of data, i.e., minimum, maximum, median, mode, mean, skewness, and kurtosis (Kemp et al., 2018). Table 1 describes the descriptive statistics of the variables.

The first row of Table 1 describes the average of Food inflation, monetary policy rate, quantum index of manufacturing, real effective exchange rate, transport prices, and world food price index is 9.75%, 8.49%, 121.87, 105.19, 7.06%, and 101.04, respectively. The second row of the table representing the median values of FI, MPR, QIM, REER, TRANS, and WFPI is 9.03%, 9%, 175.17, 127.44, 39.95%, and 99.87, respectively. The third and fourth rows describe the minimum and maximum values, and the last row briefs about the number of observations. The most important thing in Table 1 is the Jarque-Bera statistics of the data. The Jarque-Bera test is used to check the normality of the variable and compare the skewness and kurtosis parameters of data (Thadewald and Büning, 2007). The results of Table 1 indicate that all the Jarque-Bera statics are significant except WFPI, which is insignificant.

Stationarity Test

After a demonstration of descriptive statistics of the data, the very first step in the time series analysis is the unit root test, also known as the stationarity test (Menegaki, 2019). A time series having unit roots or structural breaks is said to be a non-stationary time series. The existence of unit roots is the main reason for non-stationary, and the non-existence of such unit roots denotes that the series is stationary. The unit root occurrence contravenes constant variance and means assumptions of OLS (Schotman and van Dijk, 1991). Taking the difference of the non-stationary series would turn to be stationary. The differencing is the process of regressing the series on time; after that, the residual series from this is to be stationary (Nkoro and Uko, 2016).

Table 1. Descriptive statistics.

Variables	FI	MPR	QIM	REER	TRANS	WFPI
Mean	9.756	8.496	121.875	105.195	7.068	101.043
Median	9.03	9.0	118.42	101.61	5.80	99.87
Maximum	33.93	15.0	175.17	127.44	39.95	129.35
Minimum	-0.60	4.250	85.590	89.744	-14.950	77.192
Jarque-Bera	44.993***	6.817**	16.229***	22.170***	4.983*	2.372
Observations	182	182	182	182	182	182

Note: *, ** and *** means significant at 10%, 5% and 1% level of significance respectively; Source: Author's calculation.

Table 2. Results of the stationarity test.

Variables	ADF Test		PP Test	
	Level	First Difference	Level	First Difference
FI	-1.506	-5.682***	-2.381	-14.532***
MPR	-2.105	-6.806***	-2.006	-12.164***
QIM	-1.374	-5.571***	-4.509***	-23.246***
REER	-1.806	-11.625***	-0.939	-11.572***
TRANS	-2.088	-6.385***	-2.959	-9.911***
WFPI	-3.368*	-6.417***	-2.817	-9.086***

Note: *, ** and *** means significant at 10%, 5% and 1% level of significance respectively; Source: Author's calculation.

The results of the stationarity test given in Table 2 indicate that all the variables are non-stationary at the level except QIM, which is stationary at a level under the PP test. Nevertheless, all the variables are stationary at first difference.

Lag Length Selection

Defining the appropriate lag length for every variable in the ARDL model is necessary because it aims to hold Gaussian error terms (normally distributed error terms that do not have heteroskedasticity problems, autocorrelation, etc.). To choose the appropriate long-run model equation, it is compulsory to determine the optimal lag length (k) (DeSerres and Guay, 1995; Rao, 2007) using appropriate selection criteria for model order.

Here, we estimated the VAR model and determined the lag length criteria using EViews software. We selected the lag of 2 as suggested by Akaike Information Criteria (AIC). Table 3 represents the results of the lag length criteria.

Estimates of the ARDL Model

After selecting the lag length, we employed the ARDL model with a lag length of 2 through the AIC model selection method. The final ARDL model is (1, 0, 1, 2, 1) after evaluating the 162 total models to determine the relationship between food inflation and regressors. This model is also called the short-run ARDL model. The results of ARDL are presented in following Table 4.

Table 4 shows that the lagged variable of food inflation shows a positive relation with current food inflation, which points out the positive association between inflation expectations and current food inflation. Agreeing with the results, if food inflation increases by one percentage point in the previous month, then food inflation increases by 0.86 percentage points in the present month. Capistran and Ramos-Francia (2010), Gábriel (2010), Hilegebrial (2015), Dua and Goel (2021), and Abdullah and Kalim (2012) observed the same trend in Pakistan.

The coefficient of monetary policy rate (MPR) also exhibits a positive relationship with food inflation (FI), which supports the hypotheses of classical and neoclassical economists that inflation is a monetary phenomenon (Salih and Kabasakal, 2021). Okotori (2019,) Dua and Goel (2021), Joshi (2021), and Makun (2021) observed the positive relationship between monetary policy and food inflation. The insignificant result of our model can be supported by Choudhri et al. (2015) argument that the monetary policy effectiveness decreases by the friction in credit and exchange markets in Pakistan. The results show that one percentage point increase in MPR will increase the 0.0018 percentage point FI, having insignificant t-statistics (0.015).

QIM that proxies GDP shows a positive relationship with food inflation (FI), and its lagged value shows a negative relationship. These results are in correspondence with the findings of Abdullah and Kalim (2012), Awan and Imran (2015), Egwuma et al. (2017), Makun (2021), and Qayyum and Sultana (2018). The anticipated production in the previous month results in a decrease in inflation in the current month; this argument is supported by the findings of Rehman and Khan (2015). The results show that one unit increase in QIM results in a 0.024 percentage point increase in FI, whereas the one unit increase in lagged QIM can diminish the FI by 0.023 percentage points.

If the transport price in the CPI basket increases, it causes a rise in food prices (Hanif, 2012). Our model shows that if transportation prices increase by one percentage point, the FI increases by 0.302 percentage points, which is highly significant with a t-statistic of 6.16***. However, the first lagged variable of transport shows that a one percentage point increase in transport prices in a previous month would cause a reduction in FI of the current month by 0.384 percentage points and is supported by a t-statistic value of -5.08 is significant at 1%.

Table 4 shows the highly significant positive relationship between food inflation and real effective exchange rate. Bleaney and Fielding (2002), Kara and Nelson (2003), De Grauwe and Schnabl (2008), and Carranza et al. (2009) found a similar relationship between exchange rate and inflation (food). For Pakistan, Salman et al. (2014) and Awan and Imran (2015) stated that there is a reciprocatory relation between exchange rate and inflation, which is a contradiction to the findings of Okotori (2019), Iddrisu and Alagidede (2020), Dua and Goel (2021) and Makun (2021). However, the results indicate that if REER is increased by one unit, FI significantly increases by 0.32 percentage points.

The last section of the table describes the general statistics of the model. Here, the R-square means coefficient of determination that describes the proportion of variance of one variable (dependent) explained by other variables (independent variables) in a regression/model (Kasuya, 2018). In our estimation, the value of 0.9185 represents that the independent variables explained 91.85% of the dependent variable, and highly significant F-statistics support that. In the end, the Durbin-Watson statistics are used to test the existence of serial correlation, especially when lagged variables (independent) are included in the model/regression (Nerlove and Wallis, 1966). Our model's resultant value of D-W statistics (2.13) represents no serial correlation among variables.

Bounds Test for Long-Run Form

The Bounds test is an extension of the ARDL model, determining the long-run relationship among variables (Jailani and Masih, 2015).

The bounds test treats each variable as endogenous and the remaining as exogenous variables during estimation. The Bounds test results are given in Table 5 and describe that a long-run relationship between food inflation and other independent variables exists. The value of F-statistics (4.061) is above the

upper critical bound I(1) at a 5% significance level. This implies that the independent variables have a long-run relationship with the dependent variable (food inflation). The results of the long-run form of ARDL are presented in Table 6.

Table 3. Lag length criteria.

No. of Lags	Lag Length Criteria				
	LR	FPE	AIC	SC	HQ
0	NA	1.08 E^{+08}	32.691	32.782	32.728
1	1739.358	4609.528	22.625	23.169*	22.846
2	79.953	3764.740*	22.422*	23.420	22.827*
3	28.966	4184.837	22.526	23.978	23.115
4	34.246	4474.067	22.589	24.496	23.363
5	22.490	5150.287	22.725	25.085	23.682
6	33.594	5470.847	22.777	25.591	23.919
7	38.261*	5588.020	22.787	26.055	24.113
8	34.453	5834.292	22.816	26.538	24.326

Source: Author's calculation.

Table 4. ARDL estimates (Short run estimates).

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
FI (-1)	0.8607	0.037	23.200	0.000
MPR	0.0018	0.115	0.015	0.988
QIM	0.0245	0.017	1.423	0.157
QIM (-1)	-0.0237	0.017	-1.396	0.164
TRANS	0.3017	0.049	6.166	0.000
TRANS (-1)	-0.3844	0.076	-5.081	0.000
TRANS (-2)	0.1062	0.049	2.155	0.033
REER	0.3238	0.089	3.617	0.000
REER (-1)	-0.3981	0.091	-4.350	0.000
C	8.9778	3.837	2.340	0.020
R-Squared	0.918568			
Adjusted R-Squared	0.914257			
F-statistics	213.0715***			
Durbin-Watson statistics	2.136517			

Note: *** means significant at a 1% level of significance; Source: Author's calculation.

Table 5. Bounds test estimates.

Test Statistic	Value	K
F-Statistics	4.061	2
Critical Values		
Significance Level	I(0)	I(1)
10%	2.45	3.52
05%	2.86	4.01
2.5%	3.25	4.49
01%	3.74	5.06

Source: Author's calculation.

Table 6. Long-run form of the ARDL model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FI (-1)*	-0.1393	0.037	-3.756	0.000
MPR**	0.0018	0.115	0.016	0.987
QIM (-1)	0.0008	0.011	0.075	0.940
TRANS (-1)	0.0236	0.020	1.136	0.257
REER (-1)	-0.0743	0.028	-2.689	0.007
D(QIM)	0.0245	0.017	1.423	0.156
D(TRANS)	0.3017	0.048	6.167	0.000
D(TRANS (-1))	-0.1062	0.049	-2.155	0.032
D(REER)	0.3238	0.089	3.617	0.000
C	8.9778	3.837	2.340	0.020

Note: *p-value is incompatible with t-bounds distribution; **Variable interpreted as $Z = Z(-1) + D(Z)$; Source: Author's calculation.

Agreeing with the results in Table 6, if food inflation increases by one percentage point in the previous month, the food inflation decreases by 0.13 percentage points in the present month. This finding is supported by highly significant t-statistics at a 1% significance level. Okotori (2019,) Dua and Goel (2021), Joshi (2021), and Makun (2021) observed the positive effect of monetary policy on food inflation or general inflation. In Pakistan, Khan and Gill (2007), Ahsan et al. (2011), and Awan and Imran (2015) found the same relationship between monetary policy and food inflation.

The coefficient of QIM lagged value depicts the positive relationship with FI, however, with insignificant t-statistics. The result further shows that if transportation prices of the previous month increase by one percentage point, the FI increases by 0.0236 percentage points. This finding is supported by Fitrawaty et al. (2020) and Iddrisu and Alagidede (2020).

In Pakistan, studies by Salman et al. (2014) and Awan and Imran (2015) found a reciprocating relationship between inflation and the exchange rate, which contradicts the findings of Okotori (2019), Iddrisu and Alagidede (2020), Dua and Goel (2021) and Makun (2021). In the long-run form, the lagged value of REER shows a negative relationship with the FI. If the REER of the previous month increases by one unit, then the FI of the current month decreases by 0.074 percentage points, having highly significant t-statistics.

ECM Estimates

The ECM indicates the speed of adjustment in long-run equilibrium in pursuit of a shock in the short run (Pesaran and Shin, 1997). The term $CointEq_{t-1}$ in Table 7 expresses how much of the disequilibrium is adjusted, that is, the degree to which the disequilibrium of the previous period is changed in the current period. The positive coefficient of the ECM term indicates a divergence, and the negative value of the coefficient suggests a convergence (Rishad et al., 2018). The stable long-run relationship exists and is strengthened by the highly significant error correction term (Banerjee et al., 1998). The negative sign of the ECM term indicates the uni-directional effect of variables.

Here, in our scenario, the value of the ECM term is negative, showing that the speed of adjustments is 13.9%. This describes that the short-run shocks are adjusted in the long run at 13.9% per month (as we employ monthly data). The highly significant t-statistics of the ECM term support the long-run relationship.

Stability Diagnostic

To test the stability of short and long-run coefficients of the ARDL model, we employed the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) at a 5% significance level over time. CUSUM and CUSUMSQ diagnostics were proposed by Brown *et al.* (1975). Stability diagnostics is necessary for time series analysis because structural changes exist due to structural breaks in the data (Stromberg, 1993). Figures 2 and 3 represent the CUSUM and CUSUMSQ tests of the ARDL model as a measure for stability diagnosis. Both CUSUM and CUSUMSQ are stable at a 5% level of significance. This is indicated by diagnostic lines of CUSUM and CUSUMSQ, which move inside the 5% significance.

Table 7. Estimates of ECM.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(QIM)	0.025	0.016	1.539	0.125
D(TRANS)	0.302	0.046	6.511	0.000
D(TRANS (-1))	-0.106	0.046	-2.284	0.023
D(REER)	0.324	0.088	3.689	0.000
CointEq(-1)*	-0.139	0.031	-4.559	0.000
C	8.978	1.958	4.584	0.000
R-squared	0.307622			
Adjusted R-squared	0.287726			
F-statistic	15.46154***			
Durbin-Watson stat	2.136517			

Note: *p-value is incompatible with t-bounds distribution; Source: Author's calculations.

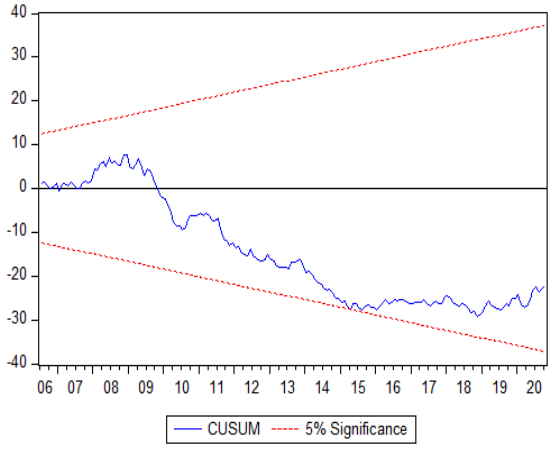

Figure 2. CUSUM Graph; Source: Author's calculation.

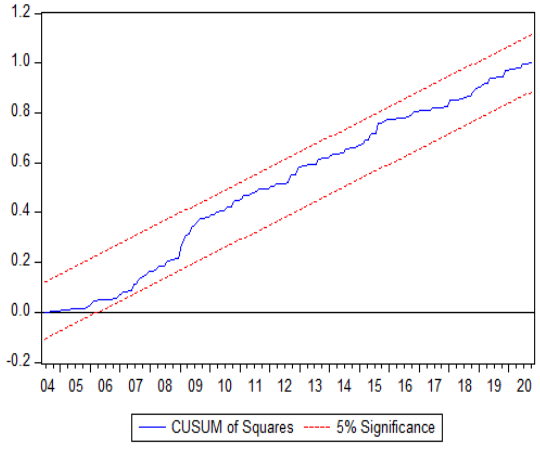

Figure 3. CUSUM of Squares Graph; Source: Author's calculation.

CONCLUSION AND RECOMMENDATIONS

Food prices are critical in general inflation in developing economies, where food items dominate the consumption basket. The food price volatility creates some challenges for inflation, targeting central banks for measuring current inflation and forecasting future inflation. Ensuring stable food prices is crucial for establishing an effective inflation-targeting policy framework that prioritizes the well-being of individuals and upholds the credibility of policy institutions. From a policy point of view, a persistent monetary policy restriction may ultimately provide price stability, as Bhattacharya and Jain (2019) suggested. The monetary policy stabilizes the prices through a significant negative effect (by aggregate demand channel) that dominates the positive impact on food prices (by cost of production channel). The persistent monetary policy restriction may negatively affect the growth rate, a serious concern for Pakistan. Balanced monetary and fiscal policies may boost the welfare of people and be consistent in Pakistan's context (Ginn and Pourroy, 2019). Therefore, budgetary policy subsidizing food prices does not require a persistent monetary policy restriction. This supports smooth consumption among poor people by stable food prices in Pakistan. However, this type of fiscal intervention may lead to implications for financing and fiscal budget subtleties. The QIM proxy for GDP positively affects food inflation by provoking a rise in food demand. Therefore, policies should be adopted in favour of agriculture to accelerate agricultural production in the country. These policies can be in different ways, such as establishing credit, mechanized farming, high-efficiency irrigation systems, pesticides, hybrid crop varieties, and provision of other inputs that boost agricultural productivity and tackle food inflation.

REFERENCES

Abdullah, M., Kalim, R., 2012. Empirical analysis of Food Price Inflation in Pakistan. World Appl. Sci. J. 16, 933–939.

Ahsan, H., Iftikhar, Z., Kemal, M.A., 2011. The determinants of food prices: A case study of Pakistan (No. 76), PIDE Working Papers. Islamabad, Pakistan. https://file.pide.org.pk/pdfpideresearch/wp-0076-the-determinants-of-food-prices-a-case-study-of-Pakistan.pdf.

Akram, Q.F., 2009. Commodity prices, interest rates and the dollar. Energy Econ. 31, 838–851.

Alderman, H., 2005. Linkages between poverty reduction strategies and child nutrition : an asian perspective. Econ. Polit. Wkly. 40, 4837–4842.

Ali, C.I., Ullah, S., Ahmed, U.I., Baig, I.A., Iqbal, M.A., Masood, A., 2022. Can Food Inflation Be Stabilized By Monetary Policy? A Quantile Regression Approach. J. Econ. Impact 4, 205–212. https://doi.org/10.52223/jei4032207.

Alper, E.C., Hobdari, N., Uppal, A., 2016. Food inflation in sub-saharan africa: causes and policy implications (No. WP/16/247), IMF Working Paper. https://doi.org/10.5089/9781475563115.001.

Anam, S., Rakha, A., Fareed, Z., 2014. Determinants of food price inflation in Pakistan. Eur. Acad. Res. I, 5213–5234.

Anand, R., Prasad, E.S., Zhang, B., 2015. What measure of inflation should a developing country central bank target? J. Monet. Econ. 74, 102–116.
https://doi.org/10.1016/j.jmoneco.2015.06.006.

Awan, A.G., Imran, M., 2015. Factors affecting food price inflation in Pakistan. ABC J. Adv. Res. 4, 74–88.
https://doi.org/10.18034/abcjar.v4i1.46.

Banerjee, A., Dolado, J.J., Mestre, R., 1998. Error-correction mechanism tests for cointegration in a single-equation framework. J. Time Ser. Anal. 19, 267–283.
https://doi.org/10.1111/1467-9892.00091.

Bernanke, B., Gertler, M., 1999. Economic policy symposium, in: monetary policy and asset price volatility. Jackson Hole, pp. 71–128. https://doi.org/10.1093/acprof:osobl/9780199844333.003.0007.

Bhattacharya, R., Jain, R., 2019. Can monetary policy stabilise food inflation? Evidence from advanced and emerging economies. Econ. Model. 89, 122–141.
https://doi.org/10.1016/j.econmod.2019.10.005.

Bhattacharya, R., Sen Gupta, A., 2018. Drivers and impact of food inflation in India. Macroecon. Financ. Emerg. Mark. Econ. 11, 146–168. https://doi.org/10.1080/17520843.2017.1351461.

Bleaney, M., Fielding, D., 2002. Exchange rate regimes, inflation and output volatility in developing countries. J. Dev. Econ. 68, 233–245.
https://doi.org/10.1016/S0304-3878(02)00002-0.

Brown, R.L., Durbin, J., Evans, J.M., 1975. Techniques for testing the consitancu of the regression relationships over time. J. R. Stat. Soc. 37, 149–192.

Capistran, C., Ramos-Francia, M., 2010. Does inflation targeting affect the dispersion of inflation expectations? J. Money, Credit Bank. 42, 113–134. https://doi.org/10.1111/j.1538-4616.2009.00280.x.

Carranza, L., Galdon-Sanchez, J.E., Gomez-Biscarri, J., 2009. Exchange rate and inflation dynamics in dollarized economies. J. Dev. Econ. 89, 98–108.
https://doi.org/10.1016/j.jdeveco.2008.06.007.

Catão, L.A.V., Chang, R., 2015. World food prices and monetary policy. J. Monet. Econ. 75, 69–88.
https://doi.org/10.1016/j.jmoneco.2014.12.010.

Choudhri, E.U., Jan, A., Malik, H., 2015. Monetary policy in Pakistan: effectiveness in inflation control and stabilization (No. S-37204-Pak-1), IGC Working Paper.
https://www.theigc.org/sites/default/files/2015/05/Choudhri-et-al-2015-Working-Paper.pdf.

De Grauwe, P., Schnabl, G., 2008. Exchange rate stability, inflation, and growth in (South) Eastern and Central Europe. Rev. Dev. Econ. 12, 530–549. https://doi.org/10.1111/j.1467-9361.2008.00470.x.

De Gregorio, J., 2012. Commodity prices, monetary policy, and inflation. IMF Econ. Rev. 60, 600–633.

DeSerres, A., Guay, A., 1995. Selection of the Truncation Lag in Structural Vars (or Vecms) with Long-Run Restrictions. Available online at SSRN: https://ssrn.com/abstract=6988.

Donald, M., 2008. A note on rising food prices, Policy research working paper 4682, the World Bank, Development Prospects Group.

Dua, P., Goel, D., 2021. Determinants of inflation in India. J. Dev. Areas 55. https://doi.org/http://doi.org/10.1353/jda.2021.0040.

Egwuma, H., Ojeleye, O.A., Adeola, S.S., 2017. What determines food price inflation ? evidence from Nigeria. J. Agric. Hum. Ecol. 1, 46–61.

FAOSTAT, 2020. Consumer price indices and inflation rates (Issue September). Retrieved online from the website: http://www.knbs.or.ke/index.php?option=com_phocadownload&view=category&id=8&Itemid=509.

Fitrawaty, M.A., Rahman, H., Joharis, M., 2020. Analysis of the Effect of Consumer Price Fluctuations on Inflation in the City of Medan, in: 1st Unimed International Conference on Economics Education and Social Science (UNICEES 2018).

Science and Technology Publications, Medan, pp. 65–70. https://doi.org/10.5220/0009492900650070.

Friedman, M., 1956. The quantity theory of money-a restatement, in: studies in the quantity theory of money. Chicago : University of Chicago Press, pp. 1–21.

Gábriel, P., 2010. Dynamics, household inflation expectations and inflation (No. 2010/12), MNB Working Papers. Budapest. https://www.econstor.eu/handle/10419/83594.

Ginn, W., Pourroy, M., 2019. Optimal monetary policy in the presence of food price subsidies. Econ. Model. 81, 551–575. https://doi.org/10.1016/j.econmod.2018.06.012.

GOP, 2023. Economic survey of Pakistan, Ministry of Finance, Government of Pakistan, Islamabad, Pakistan.

Hammoudeh, S., Nguyen, D.K., Sousa, R.M., 2015. US monetary policy and sectoral commodity price. J. Int. Money Financ. https://doi.org/10.1016/j.jimonfin.2015.06.003.

Hanif, M.N., 2012. A note on food inflation in Pakistan. Pak. Econ. Soc. Rev. 50, 183–206.

Hanif, M.N., 2014. Monetary Policy Experience of Pakistan (No. MPRA Paper No. 60855). https://mpra.ub.uni-muenchen.de/60855/.

Hilegebrial, Z., 2015. Determinants of food price inflation in Ethiopia. Food Sci. Qual. Manag. 41, 30-43.

Iddrisu, A.A., Alagidede, I.P., 2020. Monetary policy and food inflation in South Africa: A quantile regression analysis. Food Policy 91. https://doi.org/10.1016/j.foodpol.2019.101816.

Jailani, M.Z., Masih, M., 2015. Determining the relationship between financial development and economic growth: An application of ARDL technique to Singapore (No. 65847), MPRA Paper. Kuala Lumpur. http://mpra.ub.uni-muenchen.de/65847/.

Joshi, U.L., 2021. Effect of money supply on inflation in Nepal: empirical evidence from ARDL Bounds Test. Int. Res. J. MMC 2, 84–98. https://doi.org/10.3126/irjmmc.v2i1.35134.

Kara, A., Nelson, E., 2003. The exchange rate and inflation in the UK. Scott. J. Polit. Econ. 50. https://doi.org/10.1016/0022-1996(74)90058-0.

Kasuya, E., 2018. On the use of r and r squared in correlation and regression. Ecol. Res. 1–2. https://doi.org/10.1111/1440-1703.1011.

Kemp, S.E., Ng, M., Hollowood, T., Hort, J., 2018. Introduction to descriptive analysis, in: Kemp, S.E., Hort, J., Hollowood, T. (Eds.), Descriptive Analysis in Sensory Evaluation. John Wiley & Sons Ltd, West Sussex, UK.

Khan, A.H., Qasim, M.A., 1996. Inflation in Pakistan revisited. Pak. Dev. Rev. 35, 747-759.

Khan, R.E.A., Gill, A.R., 2007. Impact of supply of money on food and general price indices: a case of Pakistan. IUB J. Soc. Sci. Humanit. 5, 125–143.

Makun, K., 2021. Food inflation dynamics in a pacific island economy-a study of Fiji: Causes and Policy Implications. J. Dev. Areas 55, 119-132.

Menegaki, A.N., 2019. The ARDL method in the energy growth nexus field; best implementation strategies. Economies 7, 1–16. https://doi.org/10.3390/economies7040105.

Nerlove, M., Wallis, K.F., 1966. Use of the durbin-watson statistic in inappropriate situations. Econometrica 34, 235–238. https://doi.org/10.2307/1909870.

Nkoro, E., Uko, A.K., 2016. Autoregressive Distributed Lag (ARDL) cointegration technique: application and interpretation. J. Stat. Econom. Methods 5, 63–91.

Okotori, T.W., 2019. The dynamics of monetary policy and inflation in Nigeria. IOSR J. Econ. Financ. 10, 37–49. https://doi.org/10.9790/5933-1002013749.

PBS, 2019. Pakistan social & living standards measurement survey: PSLM/HIES 2018-19. Islamabad, Pakistan. http://www.pbs.gov.pk/sites/default/files//pslm/publications/pslm_hies_2018_19_provincial/key_findings_report_of_plsm_hies_2018_19.pdf.

Pesaran, M.H., Shin, Y., 1997. An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, in: Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium. Cambridge University Press, Cambridge. https://doi.org/10.1017/ccol0521633230.011.

Pesaran, M.H., Shin, Y., Smith, R.J., 1996. Testing for the "Existence of a Long-run Relationship," Cambridge Working Papers in Economics. Cambridge.

Pesaran, M.H., Shin, Y., Smith, R.J., 2001. Bounds testing approaches to the analysis of level relationships. J. Appl. Econom. 16, 289–326. https://doi.org/10.1002/jae.616.

Pourroy, M., Carton, B., Coulibaly, D., 2016. Food prices and inflation targeting in emerging economies. Int. Econ. Elsevier 146, 108–140. https://doi.org/10.1016/j.inteco.2015.12.001.

Qayyum, A., Sultana, B., 2018. Factors of Food Inflation: Evidence from Time Series of Pakistan. J. Bank. Financ. Manag. 1, 23–30.

Rao, B.B., 2007. Estimating short and long-run relationships: A guide for the applied economist. Appl. Econ. 39, 1613–1625. https://doi.org/10.1080/00036840600690256.

Rehman, F.U., Khan, D., 2015. The determinants of food price inflation in Pakistan: an econometric analysis. Adv. Econ. Bus. 3, 571–576. https://doi.org/10.13189/aeb.2015.031205.

Rishad, A., Sharma, A., Gupta, S., 2018. Demand for money in india: an ARDL approach, in: Mishra, A.K., Patnaik, D., Arunachalam, V. (Eds.), Current Issues in the Economy and Finance of India: ICEF 2018. Springer, Switzerland.

Salih, E.A., Kabasakal, A., 2021. The role of monetary policy in controlling on inflation rate in Iraq for the period (2004-2020). Int. J. Econ. Stud. 7, 89-102. https://dergipark.org.tr/tr/download/article-file/792932.

Salman, H., Aftab, F., Lodhi, R.N., 2014. Macroeconomic Variables and Rising Food Prices: Empirical Evidence from Pakistan. IBT J. Bus. Stud. 10., 66-81. https://doi.org/10.46745/ilma.jbs.2014.10.01.05.

Schotman, P., van Dijk, H.K., 1991. A Bayesian analysis of the unit root in real exchange rates. J. Econom. 49, 195–238. https://doi.org/10.1016/0304-4076(91)90014-5.

Shahid, M., 2014. Effect of Inflation and Unemployment on Economic Growth in Pakistan. J. Econ. Sustain. Dev. 5, 103–107. https://doi.org/10.21275/ART20174660.

Soskic, D., 2015. Inflation Impact of Food Prices: Case of Serbia. Econ. Agric. 62, 41–51. https://doi.org/10.5937/ekopolj1501041s.

Stromberg, A.J., 1993. Computing the Exact Least Median of Squares Estimate and Stability Diagnostics in Multiple Linear Regression. SIAM J. Sci. Comput. 14, 1289–1299.

Thadewald, T., Büning, H., 2007. Jarque-Bera test and its competitors for testing normality - A power comparison. J. Appl. Stat. 34, 87–105. https://doi.org/10.1080/02664760600994539.

TradingEconomics.com, 2021. Food inflation. Retrieved online from the website: https://tradingeconomics.com/country-list/food-inflation.

UNDP, 2021. Global multidimensional poverty index-2021: unmasking disparities by ethnicity, caste and gender. https://hdr.undp.org/system/files/documents//2021mpireportenpdf.pdf.

Zaidi, I.M., 2006. Exchange Rate Flexibility and the Monetary Policy Framework in Pakistan. SBP- Res. Bull. 2. https://doi.org/10.19030/jabr.v14i2.5715.