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The Nexus Between Oil Price Volatility and Food Inflation In Pakistan: A Demand-Supply Dilemma

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Abstract: The current study aims to examine the impact of international oil price volatility on aggregate food items prices (Inflation) in both the long-run and short-run demand and supply side factors. In Pakistan, however, inflation is mainly attached to oil prices and is generally referred to as a monetary phenomenon. The Quantity Theory of Money (QTM) has been proposed as the justification of a hypothesis for theoretical reasoning. To obtain empirical results, the ARDL model has been applied to the data set of monthly time series for the period from July-2001 to June-2019. The result of the study suggests that oil prices were found to be positive and statistically significant with immediate and up to 3-month lags on food inflation. However, empirical evidence supports that it is a short-run phenomenon in Pakistan. And on average 1% increase in oil price tends to increase food inflation 0.035% in short run. While inflation driven by the money supply (M2) is a long-run adjustment. On average 1% increase in M2 results in an increase in food inflation of 1.74%. While the 1% increase in interest rate (kibor rate) food inflation by 0.03%. Furthermore, the ITF (Inflation Targeting Framework) has proven to be ineffective in controlling food price hikes, rather than leading to rising food inflation. For policy recommendations, government must have strong administrative control, subsidy reforms, agriculture sector reforms, switching from non-renewable to renewable sources of energy, and monetary policy should be free from political interference.

Keywords: Oil Price Volatility (OPV), Inflation Targeting Framework (ITF), Food Inflation, Pakistan

1. Introduction

Both in terms of life and the economic cycle, food and fuel are necessary factors for human survival. The contemporary world is significantly reliant on energy as a necessary source of economic activity.

Crude oil is a vital source of energy in the fossil fuel family that functions similarly to "the blood that flows through the veins of the Earth" (Andrew Hecht, 2020). From 2015 to 2040, oil's global share in the global energy mix is predicted to maintain at nearly 28 percent, higher than gas and coal (WOO,2018). The modern world's progress is tied to energy and oil markets. Future developments in the energy and oil markets, on the other hand, are linked to a variety of factors, including population expansion, technological advancements, changing demographics, structural transformation, economic growth, and oil price volatility(WOO, 2017).

Crude oil operates as an engine of the economy and a lifeline for all countries' national economic prosperity. The rise in global oil prices is good news for oil-exporting countries and bad news for oil-importing countries. The prime reason for this phenomenon is understandable: additional profits ensure more financial stability for oil-exporting countries, whereas decreased revenue causes financial instability for oil-importing countries, and vice versa (Kurihara,2015).Crude oil has a huge impact on people's lives because of its wide range of applications, serving many sectors of the economy like as transportation, industry, agriculture, and households. As a result, when the price of crude oil is irregular and inconsistent, people's quality of living fluctuates (Jahangir, 2017).This price transmission fluctuations of oil prices may have an impact on the price of other goods (Taghizadeh-Hesary et; al 2019). The persistent rise in the price of oil is regarded as a crucial component of general inflation and food inflation (Hamilton, 2009). In a cause–effect relationship, oil and inflation are commonly linked. Inflation rises whenever oil prices rise, but it begins to decline as prices fall (Baffes, 2010).

When economic growth stability is used as the primary gauge of a country's macroeconomic performance, inflation is virtually always a top goal to avoid economic catastrophe (Acharya, 2010).Because inflation is the enemy of economy and particularly in developing countries like, Pakistan Therefore, since the 1970s, energy and inflation, particularly crude oil price shocks, when combined with US sanctions against IRAN, have become a hot topic on policymakers' and academicians' desks, as well as for the public around the world, in the form of the recent surge in international oil prices (Holland, Det al; 2013). Hence, the question of price stabilization through a collective increase in these two necessary macroeconomic factors remains unanswered, worsening overall inflation and food costs, especially in emerging nations (Nagyová et al., 2016). As a matter of fact, with high food inflation caused by an increase in international oil prices, it is now considered a sensible issue that needs to be carefully resolved by concerned authorities for the general welfare (Tekeber Nigusse, et al., 2019).

If we look at the energy and inflation scenario in Pakistan, we see that it is driven mainly by fluctuations in imported oil price volatility, which has an impact on domestic inflation through food and non-food inflation. Upsurge in food price not only cause budget allocation for food necessities to be delayed, but in an agricultural country like Pakistan, the poorest households are likely to spend 70% of their income on food items, limiting non-food expenditures such as education and health (Murthy P, 2009). Despite its agrarian economy, Pakistan is still unable to protect the welfare of these households, which has been adversely impacted by an expansion in food prices. Keeping in view the importance of food items it is critical to understand the impact of oil price volatility on economic costs of living.

Inflation, however in Pakistan is largely connected with international oil prices and generally known as monetary phenomena. The conventional understanding in the literature postulates price is a temporary response to any economic shocks associated with highly volatile components of inflation, such as food prices and non-food price hikes underlying inflationary trends, especially in oil importer countries. The classical and modern approach of understanding inflation theories also provide some support to policy

insights that help to control inflation, while in general, food inflation is widely ignored. This reason motivates us to investigate the transmission channels that are causing overall and food price increases in an open economy like, Pakistan.

1.1Food Inflation in Pakistan

One of the basic reasons for increased inflation in oil-importing developing countries such as Pakistan is the high price of oil in global markets, which has permanent impact on people's everyday life and wellbeing (ShahbazM, et al., 2008). For its domestic energy needs, the country relies heavily on oil imports, accounting for 85 percent of total demand and only 15 percent is met through indigenous sources, costing the country around $14 billion each year in oil imports bill. During the last 11 months of the fiscal year 2018-19, Pakistan imported oil worth more than 13.14 billion dollars to meet domestic demand. Petroleum crude, natural gas liquefied, and petroleum gas belongs to the petroleum products category. These imports account for approximately 30% of overall imports, with crude oil paying for 50% of the petroleum group's share (Sarwar et al., 2020). This massive burden on the Balance of Payments (BOP) is shifted to the final consumer, either directly or indirectly, as a response of oil price volatility (OPV) in the form of inflation at the petrol pumps and for utility expenditures (Mabro, 1984). The reason for such a significant relationship is a lack of oil reserves and crude energy exploration in the country. Oil is mostly used in the electricity and transportation industries (Pakistan Economic Survey, 2017).

Oil prices and monetary concerns in developing nations like Pakistan are the main causes of inflation as overall and food inflation. Several studies have been conducted at international level to highlight that food inflation in developing oil importing countries supports the existence of oil price pass-through effects in both vertical and horizontal transmission channels (Nazlioglu, S et al; 2013, Davidson, J et al., 2016; Blanchard and Gali, 2007).Much of the studies on the determinants of food inflation in Pakistan have previously been conducted by various researchers, including (Batten et al. 2013, Shahzad and Joiya, 2013, Jalil et al. 2013, Asjed et al. 2013, Kemal et al. 2012 and Arinze E Peter, 2011).

Some of the studies, such as Khan et al. (2007) and Khan and Qasim (1996), focused on internal fiscal or monetary policy factors that caused inflation, while others relied on external factors that caused inflation. Literature also reveals that the rise in food prices in Pakistan is primarily due to higher monetary developments, which are influenced by a large amount of borrowing from both the public and private sectors (Khan and Qasim, 1996).However, in the real world, the only monetary and fiscal components are not the causes of domestic inflation, as some exogenous shocks, particularly oil price volatilityhave been involved. In Pakistan, the change in world oil prices is largely seen as a proxy for the change in domestic inflation.

Recent research on the Oil-Inflation nexus in Pakistan, like (Qayyum, 2018), has discovered that increases in food inflation in Pakistan are controlled by international oil price increases, growing income levels, a rapid spike in domestic demand for commodities, and adjustments in macroeconomic policy. Another study by (Hanif et al, 2017) used monthly inflation data from July 1992 to June 2014, and the findings showed that the impact of global oil price changes on inflation in Pakistan is faster than the impact of cotton and metal prices, and that oil price inflation causes inflation in food prices by up to (2.0 percentage points). According to literature, the price of crude oil throughout the 1990s ranged from US $18 to US $23. It increased from $40 to $60 in 2004-05. However, during the year 2007 to July 2008, it jumped from US $70 to US $174, marking the largest swing in oil prices in

history. Similarly, food prices worldwide increased by 39% over this period (Lescaroux and Mignon, 2008). Pakistan, as an agrarian economy, underwent stagflation1 during the global financial crisis of 2007-08 (Husain et al., 2008).

Oil price volatility in the form of an upward trend will almost probably raise production costs at all stages, making items included in the CPI for both food and non-food inflation (core inflation) more expensive (Economist, 2018). In the 1990s, the CPI average food item price in Pakistan was Rs. 187.05, while the non-food item price was Rs. 173.13. While the CPI average price of food items was Rs/226.59 in 2017 and Rs/215.23 for non-food items (Handbook of Statistics on Pakistan Economy, 2017).

The long-term effects of the global crisis, which kept commodity and world oil prices relatively high even as the crisis's impacts began to fade. In Pakistan, however, inflation remained high, hovering around double digits. Because the government changed its fuel and food subsidy policies for political purposes, ignoring the true picture of oil-inflation, which did not benefit consumers (Jongwanich and Park, 2011). By taking advantage of the circumstances, all stakeholders were able to shift the government's tax burden onto consumers. The focus of the supply-side shock is associated with lowered or limited output growth, and the resulting demand-side pressure is unable to bear the weight of rising oil prices, leading to lower potential output and higher inflation rate(Bernanke, 2001).If change occurs in oil prices on a regular basis, as monthly or quarterly, the domestic inflation rate, particularly for food products, will remain high for a long period, resulting in increased unemployment and poverty (Ismail, A. 2014).

Contrary to demand side, the impact of international oil prices through cost of production is supply side determinants because terms of trade are settled in US dollar to explain inflation via money supply. It is expected that oil price increase contributes to domestic inflation in the short run but in the long run adjustment in money supply will mitigate the impact of increase in oil prices along with any channel by supply-demand gap. According to monetarists point of view inflation is the monetary issue as coated by the Friedman (1963) that. “Inflation is always and everywhere a monetary phenomenon”.

Increase in money supply is the key to inflation(Lim & Papi, 1997). However, in the case of Pakistan the role of monetary authorities has been increased very much in setting in these all effects pursued by oil price. Because monetary authorities through the credible monetary tools can counter inflationary pressure. The view of (Anderton, R et al; 2009) is credible, if the inflation-countering strategy which would create a stable environment of low inflation, anchoring the inflation expectations and influencing the price-setting behavior.

If we trace the reasons behind lacking in energy sources the line of multiple reasons can be incorporated such as improper channelizing of energy, huge impact of private sector, fewer exploration activities in oil and gas sector, poor management, unstable law and order situation, weak monetary policy, and bad governance. According to (Lutz Killian, 2009) economy can be protected from unrestricted inflation caused by oil price volatility only by less relying on oil as a main component for production and through well managed monetary policy. Therefore, it is inevitable to design a national and rational energy production policy in the short and long run which safe the future of world’s sixth largest populous country (Rehman et al; 2017).Changes in oil prices affect the real money balance by motivating people to spend more money, raising interest rates, and slowing economic development (Pierce and Enzler,

1974 and Mork, 1994). Figure 1 shows the rate of growth in oil and food inflation in Pakistan from June 2000 to July 2019.

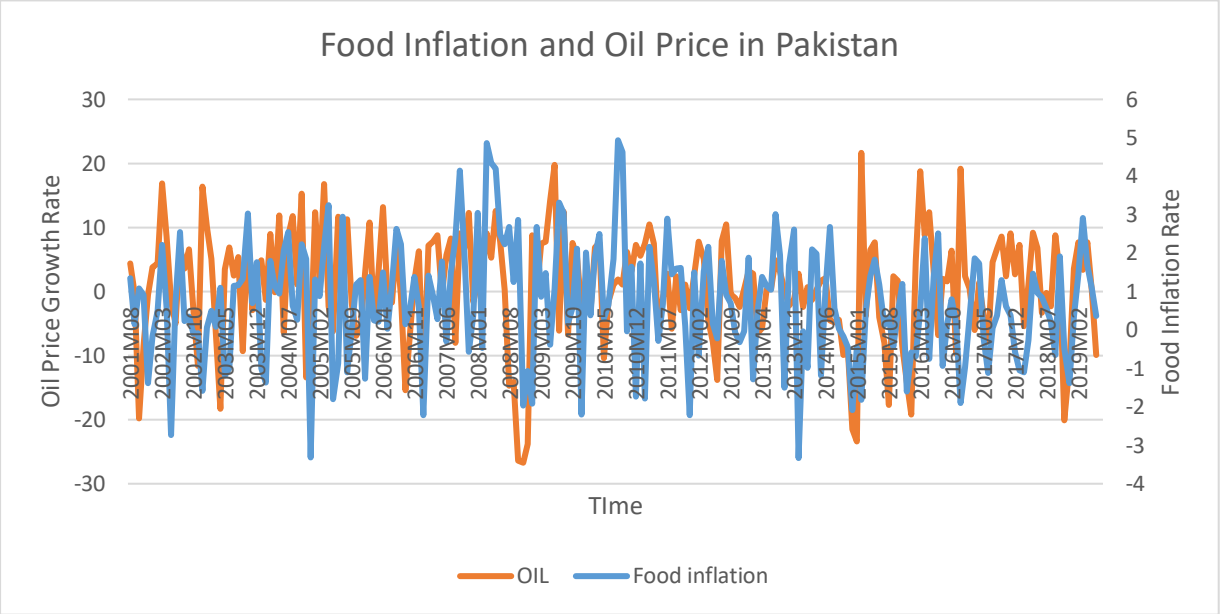


Figure: 1

Sources: Pakistan Bureau of Statistics and Fred Database (2019)

The figure above shows that the link between oil and food inflation is too strong, with the oil price growth rate and inflation reaching new highs.

2. Literature review

To the best of our knowledge, not much has been published in the literature, but a reasonable number of studies have been added to emphasize the issue of inflation with reference to international oil price changes overall and food inflation in other countries, including Pakistan.

In a recent study by Tekeber NIGUSSE (2019), the supply and demand side variables of inflation were analyzed to evaluate the consumer price index (CPI) in Ethiopia's economy. The research is based on the Quantity Theory of Money (QTM) theoretical model, with the Auto-Regressive Distributed Lag Model (ARDL) applied to the data set from 1985 to 2016. The results of the bound test indicate there is a long-term association between explanatory variables and the consumer price index in Ethiopia. The results go on to show that variables such as world oil price, money supply, and real effective exchange rate have a long-run positive impact, while real gross domestic product has a minimal impact on price level. In Ethiopia, the major determinants of inflation are the short run real effective exchange rate, the money supply, the budget deficit, and the international oil price. According to the study's findings, concerned authorities should pay attention to alternative funding sources and establish a well-managed monetary policy mechanism. It is also suggested that policy inference should be based on contractionary monetary as a mechanism of price stabilization in the long and short run.

Qayyum and Sultana (2018) investigated the factors influencing food price inflation in Pakistan for a yearly data set from 1970 to 2017. Food imports, exports, GDP, and taxes each have a significant and positive impact on food prices in Pakistan, except for money supply, which has a negative impact, indicating that money supply causes food price cuts.

Khadija-tul-Kubra (2018) using time series data from 1974 to 2010, assessed the price and income elasticity of demand for imported crude oil, as well as the long- and short-term relationships between crude-oil consumption and Pakistani economic growth. Price elasticity of quantity demand for imported crude oil is positive and significant, according to empirical data.

Hanif et al, (2017) discussed increased global oil prices in 2007-08 produced inflationary pressure, using monthly inflation data from July 1992 to June 2014, and the same prices when they plummeted in 2014 generated considerable disinflation and even deflation in several economies. The exchange rate, broad money growth rate, real economic and wide money growth rate, as well as the behavior of global crude oil commodity prices, are among the variables investigated. The results showed that global oil price fluctuations have a faster influence on inflation in Pakistan than cotton and metal prices. While oil prices have prompted food price inflation of up to (2.0 percentage points). The overall finding shown, the global commodities prices and energy price strongly the domestic inflation in Pakistan. Compared to internal shocks, the administrated factors shown insignificant role but not surprisingly, the incremental change in money growth has significant impact on inflation with 18 months lags.

Moazam and Ali Kemal (2016) used quarterly data from 1980Q2 to 2013Q4 to study the factors of inflation in Pakistan. The Quantity Theory of Money is used to determine model specifications (QTM). When compared to other variables, the descriptive analysis shows a substantial link between money supply and prices, GDP and prices, and a low connection between oil prices and prices. first difference, the results of all stationary tests are reliable. The results of the Johansen Co-integration technique reveal that there is a long-run link between the variables and that there is a single co-integrating vector employing all eight lags in the VAR. Because inflation is a monetary phenomenon, and supply side shocks are reduced in the long run by money supply, the pass-through effect of supply side shocks to inflation is only temporary.

Naurin & Qayyum (2016) investigated the effects of oil price volatility on CPI in Pakistan from the period 1980:M1 to 2014:M12. Oil prices and CPI have a positive association, according to the empirical data. The study also discovered that news has a disproportionate effect on the change in the consumer price index. Positive news tends to intensify CPI volatility more than negative news in Pakistan, which shows that positive news tends to enhance CPI volatility more than negative news. Changes in oil prices, on the other hand, affect Pakistan's real money balance by causing an upward shift in money demand, forcing the monetary authority to raise interest rates, and slowing economic development. Other factors that contribute to inflation include structural concerns, the fiscal deficit, wheat support prices, and oil prices.

In the example of Pakistan, (Azam and Rashid, 2015) investigated the reasons of inflation. They claimed that both monetary and supply restrictions are contributors in Pakistani inflation. Pakistan is an agrarian economy, and the slow expansion of the agriculture sector must be considered because it influences price fluctuations. According to the current literature on oil price volatility and inflation in Pakistan, inflation in Pakistan is largely linked to the volatility of imported oil prices. In addition, it is reasonable to claim that money, along with other significant indicators, explains inflation in the near run.

Kiani (2011) used time series data from 1990 to 2009 to investigate the influence of petroleum prices and inflation on economic growth in Pakistan. The data revealed that the price of crude oil and inflation have a major impact on economic growth. While elasticity is shown for the variables in the case of government expenditure, government revenues are inelastic, indicating that they have a

negligible impact on economic growth. Stock price, on the other hand, plays a little but substantial significance. He went on to say that monetary policy works better than fiscal policy.

Khan and Schimmelpfennig (2006) contributed that money supply plays a role in long-run price variation, according to while wheat support prices play a role in short-run price variation. Inflation explained by (Bilquees, 1988) concludes that structural issues are just as significant as money supply. In the example of Pakistan, (Kemal, 2006) indicates that money supply affects inflation after a 9-month lag. This means that the influence of any shock on inflation over the course of a month or quarter may be subtle, which is one of the key reasons for the widespread perception that inflation is caused by anything other than money.

Hamilton (1983) presented the first model to show how rising oil prices could negatively affect macroeconomic efficiency in a highly important and classic study. Meanwhile, Bernanke (1983) shown that when enterprises realize increased uncertainty about future oil prices, they opt to defer their investments, resulting in decreased total production. They are particularly confronted with a variety of technology linked to fuel efficiency. The more volatile oil prices are, the more attractive the option to delay becomes.

Here, the purpose of the current study is to examine the nexus between imported oil price volatility and domestic food inflation in Pakistan. Hence based on literature it can be recognized that inflation in the Pakistan is a monetary issue. Besides, we believe that the study will append essential outcome to fill existing knowledge gap pertaining to an important problem of Oil-Inflation relationship.

2.1Theoretical framework

For empirical justification, we used the Quantity Theory of Money (QTM), which is based on Milton Friedman's philosophy. Inflation, he claims, is "always and everywhere a monetary phenomenon," resulting from a faster expansion of money than total output. This assertion is also backed up by (Lim & Papi, 1997). They conclude that "monetary expansion is the key to inflation." This monetarist idea, that money is a significant determinant in shaping the behavior of consumer prices and plays a vital role in the transmission of monetary policy in both advanced and emerging countries, has been well recognized and proven(see; Moser, 1995; Fakiyesi, 1996; Kuijs, 1998; Qayyum, 2006; Wolde-Rufael, 2008; Ratnasiri, 2009; Bashir et al, 2011 and Kabundi, 2012). Milton's' theory is well supported and elaborated on the behalf of Fisher Equation. The well-known Fishers equation of exchange, MV= PY, was derived by Irving Fisher (1876-1947). As a result, with the help of Fisher's equation, inflation has been widely accepted as a monetary concern for decades. A simple mathematical equation is used to describe the monetarist method to determining inflation. The monetarist approach of defining inflation is explained with simple mathematical equation (2.1)

$$\mathbf{MV = PY} \qquad \mathbf{2.1}$$

Where, M shows the actual money supply, V shows the velocity of money, P shows the price of output level and Y shows the real output.Thus, rearranging the equation 2.1 to establish the equilibrium pricelevel.

$$\mathbf{P = \frac{MV}{Y}} \qquad \mathbf{2.2}$$

Equation (2.2) shows that, the general price level is function of ratio between broad money supply and real output. To linearized equation 2.2, we transformed equation into natural logarithm. The linear function of the price level can be written as in equation, following equation, (2.3).

$$\mathbf{lnP = lnM + lnV - lnY} \qquad \mathbf{2.3}$$

Further, the limitation of the Quantity theory of money (QTM) cannot be ignored because it only accounts for the influence of real money supply and real output growth on price level. However, based on the empirical and theoretical framework of inflation, it is also caused by supply side factors in Pakistan. During 1994, the State Bank adopted the Inflation Targeting Framework (ITF). According to this framework, raising interest rates reduces inflation rate, and lowering interest rates leads to rise inflation rate. The aggregate monetary targeting framework based on assumption of de jure[1]. The key assumption of this framework, was the stable money demand function which is determined by rate of interest(Kumail et al. 2012).Additionally, the main objective of State Bank is to monitor and control inflation through effective use of monetary policy and ensure economic stabilization without affecting growth and employment. However, the implementation of market-based monetary instruments, the more attention was paid to managing the short-term interest rate.

Based on de facto, the SBP also monitors external factors such as exchange rate, foreign reserves, and current account balances, trade deficits and foreign interest rate which are directly or indirectly associated with economic growth and inflation. The more specified objective of SBP from domestic activities are to pursue and achieve the goal of high GDP growth with stable inflation rate. This objective was earlier confirmed by IMF (2006) and Malik (2007), when Pakistan was categorized as hybrid monetary regime. While the monetary policy in Pakistan can be characterized by "discretion and judgment" rather than as being "model- or rule-based," which brings about the problem of time inconsistency (Gordon 1997; Kydland et al. 2007; Malik 2007). Despite the ITF, Pakistan historically experienced instability in general price level and lower GDP growth rate, but it went historically lower during the period of 2009 and 2019. Regardless of the tight monetary policy at the same time, the inflation rate tends to increase sharply. The role of money supply also plays a significant role which existing theories of inflation support, that it causes inflation over time. These indicators suggest that the sharp increase in the inflation rate in Pakistan challenges the existing monetary policy of the SBP. Therefore, we have added supply side factors and policy variables such as oil price and interest rate, in the benchmark model (2.3). The earlier empirical findings suggestthat these factors significantly contribute to determining the true picture of inflation in economy of Pakistan. So, for this reason we, have extended the equation (2.3) which is represented as(2.4).

$$\mathbf{lnP = lnM + lnV - lnY + lnOP + i} \qquad \mathbf{2.4}$$

3. Research Methodology

3.1 Empirical framework and data source

This study is conventionally designed to investigate the impact of international oil price volatility (OPV) on food inflation in Pakistan. For this purpose, QTM is used as a benchmark model. This model is

[1]Based on laws or actions of the state **de jure** segregation.

carried on by researchers such as, Tekeber Nigusse (2019) in Ethopia and (Mehak Moazam and Ali Kema (2016), Khan and Schimmelpfennig (2006), Qayyum (2006) in context of Pakistan. An autoregressive distributed lag (ARDL) technique to co-integration is used in this work to investigate the long-term relationship between oil prices, interest rates, and food prices.

$$\ln\pi_t^{food} = \beta_0 + \beta_1 \ln GDP_t + \beta_2 \ln M2_t + \beta_3 \ln\pi_t^{Oil} + \beta_4 i_t + \epsilon_t \qquad 3.1$$

Where $\ln\pi_t^{food}$ shows food inflation measured by Consumer food price index. $\ln GDP_t$ Shows growth in real gross domestic product, $\ln M2_t$ board money supply, $\ln\pi_t^{Oil}$shows Brent crude oil price, i_t shows kibor rate, and ϵ_t is assumed to be white noise error term. β_i is the slop coefficient of each regressors. The monthly data for these variables rely from July-2001 to June-2019. The data is taken from the State Bank of Pakistan's monthly statistical bulletins (2018-19), and the Brent crude oil price is taken from Fred-data set 2019, which has also been used extensively in previous studies, e.g. (Abdlaziz et al., 2016; Gazdar, 1992).The yearly series of the real Gross Domestic Product (GDP) is available from of the State Bank of Pakistan. To disaggregate annual series into monthly we use Lisman and Sandee (1964)[2] disaggregation method.

Since, the proper technique to examine the long-run relationship depends on the order of integration of the variables The next section will discuss and presents the econometric study, which began with assessing the order of integration.

3.2 Unit Root Test

Since, the routine of empirical procedures fails if or any of the variable remains non stationary at the first difference. This is done through Augmented Dickey Fuller (ADF) with the help of model stated as 3.1.

$$\Delta Z_t = \Omega_0 + \Omega_1 Z_{t-1} + \sum_{k=1}^{n} d_k \Delta Z_{tk} + \varepsilon_t \qquad 3.2$$

The Z_t in the above equation is a time series variable, Δ is used as first difference operator and ε_t is a white noise error term.

3.3 ARDL Bound Test for Co-integration

The Autoregressive Distributed Lag (ARDL) model after popularization of (Pesaran, 1997;Pesaran & Pesaran, 1997;Pesaran & Shin, 1998;Pesaran et al., 2001) is applied in this study because the unit root test confirms- all series are stationary at level and at first difference. The ARDL technique has the advantage of providing consistent estimates of the long-run coefficients that are asymptotically normal irrespective of whether the underlying regressors are (1) or I (0). Besides that, the ARDL approach is more efficient for small sample data. Pesaran and Shin (1998) show that the OLS estimators of the short-run parameters are consistent and the ARDL based estimators of the long-run coefficients are

[2] Lisman and Sandee (1964) technique ensures the following properties: first the sum of 12 monthly data series equal to an amount of given yearly data. Second, if the yearly totals in three successive years are $Xt-1$, $Xt$and $Xt+1$, the monthly figures of a series during 2nd year are the same but in reverse order from what they would have been had the yearly totals been $Xt+1$,Xt and $Xt-1$. Third, if the yearly totals in three successive years rise by equal steps ($Xt - Xt-1=Xt+1 - Xt$) then monthly figures during next year also rise by equal steps and that if $Xt - Xt-1=Xt - Xt+1$ the monthly figures during next year (2nd year) should lie on sinusoid

super-consistent in small sample sizes. The ARDL version of equation (3.1) is represented as equation(3.3).

$$\Delta \ln \pi_t^{food} = \alpha_i + \sum_{i=1}^{n} \alpha_i \Delta \ln \pi_{t-p}^{food} + \sum_{i=1}^{n} \alpha_i \Delta \ln M2_{t-q} + \sum_{i=1}^{n} \alpha_i \Delta \ln GDP_{t-q} + \sum_{i=1}^{n} \alpha_i \Delta i_{t-q} + \sum_{i=1}^{n} \alpha_i \Delta \ln \pi_{t-q}^{Oil} + \beta_i \ln \pi_{t-p}^{food} + \beta_i \ln M2_{t-q} + \beta_i \ln GDP_{t-q} + \beta_i i_{t-q} + \beta_i \ln \pi_{t-q}^{Oil} + \varepsilon_t \quad 3.3$$

The right-hand side, variables in equation (3.3), shows the short run and long run impact of independent variables with their intermediate and corresponding lags over time. To investigate the presence of long-run relationships in equation (3.3), the bound testing under Pesaran, et al. (2001) procedure is applied. The bound testing procedure is based on the F-test. The F-test is a test of the hypothesis of no co-integration among the variables against the existence or presence of co-integration among the variables. Two critical values are given by Pesaran et al. (2001) for the co-integration test. The lower critical bound assumes all the variables are I (0) meaning that there is no co-integration relationship between the examined variables. The upper bound assumes that all the variables are I (1) meaning that there is co-integration among the variables. When the computed F-statistic is greater than the upper bound critical value, then the H0 (the variables are not co-integrated)is rejected.

3.4 Wald test

The ARDL bound test is based on the Wald-test (F-statistic). The asymptotic distribution of the Wald-test is non-standard under the null hypothesis of no co-integration among the variables.

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ (There is no long-run Co-integration)

H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$ (There is long-run Co-integration)

3.5 Error Correction Model

The Error Correction Model is a useful tool for analyzing the short- run relationship between variables. This is only feasible if a long-run relationship between the dependent and independent variables has been established. ECM can be used to test the above ARDL equations parameters stability. As a result, the above equation contains the short-term equation of the ARDL co-integration model(3.3) is represented as equation (3.3.1).

$$\Delta \ln \pi_t^{food} = \alpha_i + \sum_{i=1}^{n} \alpha_i \Delta \ln \pi_{t-p}^{food} + \sum_{i=1}^{n} \alpha_i \Delta \ln M2_{t-q} + \sum_{i=1}^{n} \alpha_i \Delta \ln GDP_{t-q} + \sum_{i=1}^{n} \alpha_i \Delta i_{t-q} + \sum_{i=1}^{n} \alpha_i \Delta \ln \pi_{t-q}^{Oil} + \partial EC_{t-1} + u_t \quad 3.3.1$$

Where ∂ isthe short run parameters of speed of convergence toward equilibrium and EC with its lagged in above equations (3.4.1) is the residuals generated form longrun ARDL co-integration equations (3.3).The $EC_{t-1}$with its lag must be negative and significant if the short run convergence toward the long run equilibrium exists.

4. Results and discussion

4.1 Descriptive statistics

The ITF seems to be ineffective, as Pakistan has a history of high inflation with low economic growth. Table 1 depicts descriptive statistics of macroeconomic indices as well as food inflation over time.

Table: 1-Descriptive statistic

	π_t^{food}	GDP	i	M2	π_t^{Oil}
Mean	0.72	0.36	8.20	1.16	0.84
Median	0.66	0.35	8.77	1.00	1.93
Maximum	4.94	0.65	20.03	6.11	21.65
Minimum	-3.33	-0.16	0.74	-2.87	-26.73
Std. Dev.	1.50	0.16	3.24	1.75	8.70
Months	215	215	215	215	215

Author estimation

The average growth in food inflation in table 1; found 0.72 percent in each month which is 8.4 percent based onaverage annual rate. There is large deviation from mean value which exhibits that, food inflation rose with high rate than the mean value on month to month ("hereby" MoM) basis since July-2001 to June-2019. Besides that, the average kibor rate found 8.20 percent and deviation from mean value is 3.24 which indicates the direction of tight policy rate to control inflation on (MoM) basis. However, despite average tight monetary policy and low GDP growth rate, the growth in money supply rose on average 1.16 percent on MoM basis. It shows that, despite tight monetary policy the money supply growth faster than inflation rate that may be the reason of food inflation in Pakistan. Moreover, the growth rate of oil price on average 0.84 percent on MoM basis. It seems that the Brent oil price is more volatile than food inflation itself. Therefore, we expect that strong correlation between oil price, interest rate, money supply and food inflation in our prescribed model.

4.2 Correlation

The correlation matrix for the independent variable under investigation is shown in Table 2. The association between LnM2 and lnGDP was found to be strong and positive. The rest of the independent variables, on the other hand, showed a positive but weak correlation.

Table: 2-Correlation coefficient

	lnGDP	i	lnM2	π_t^{Oil}
LnGDP	1	-	-	-
i	0.279	1	-	-
lnM2	0.995	0.247	1	-
π_t^{Oil}	0.544	0.657	0.529	1

Author estimation

4.3 Unit root Results

Table 3 and 4; shows the ADF & P-P unit root test statistics. The results show that, there is the mixture of integrated series. Some variables are found stationary at level (ie: LnM2 and i) and first difference (ie: $\ln\pi_t^{food}$ and LnGDP).Based on empirical results in, therefore we follow the ARDL bound to test long-run association between food inflation, money supply GDP growth, external debt, oil price and interest rate.

Table: 3-ADF unit root

Variables	Level I (0)		First difference I(1)	
	C	**C & T**	**C**	**C & T**
$\mathbf{ln\pi_t^{food}}$	-1.266	-0.188	-12.686*	-12.733*
i	-2.268	-2.526	-11.835*	-11.834*
LnM2	-3.301**	-2.327	-2.185	-4.225*
$\mathbf{Ln\pi_t^{Oil}}$	-2.243	-2.091	-10.978*	-11.002*
LnGDP	-1.79719	-2.77205	-2.671***	-3.02471

Author estimation; *, ** & *** shows 1, 5 and 10% level of significance.

Table: 4-P-P unit root

Variables	Level I (0)		First difference I(1)	
	C	**C & T**	**C**	**C & T**
$\mathbf{ln\pi_t^{food}}$	-1.190	-0.354	-12.690*	-12.733*
i	-2.898*	-3.202***	-23.612*	-23.591*
LnM2	-3.663*	-2.77	-21.577*	-34.748*
$\mathbf{Ln\pi_t^{Oil}}$	-2.100	-1.841	-10.788*	-10.726*
LnGDP	-0.894	-1.470	-2.341	-2.432

Author estimation; *, ** & *** shows 1, 5 and 10% level of significance.

4.4 Diagnostics tests

Table 5; shows some diagnostics test before proceeding to ARDL regression and bound test approach. These tests are pre-requisite to fitful the initial requirements for applying long-run ARDL regression and bound test discussion. The statistical test results reveal that, the food inflation model satisfies these diagnostics tests. We can conclude that, there is no issues of serial correlation. As the H_o is being failed to reject based on F- test statistics at a 1% level of significance. On the other hand, the H_o for homoscedasticity is being failed to reject at a 1% level of significance. Additionally, the Ramsey Reset test confirms, unbiased specification of food inflation model and we found no issues to functional form of estimation. The J-B test statistics shows residuals normality and we found residuals are normally distributed of our food inflation equation. Lastly, the restricted Wald test is failed to accept the null hypothesis of $Ho: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$, thus the results confirm long-run impact of independent variables with their corresponding lags on food inflation at a 1% level of significances. Moreover, the Cusum and Cusum^2 test statistics in figure 4.2 and 4.3 exhibits no structural changes in residuals over time thus concluding that the estimated coefficients for food inflation are consistent.

Table: 5-Diagnostic Tests

Diagnostic Test	F-statistic	Prob
Serial Correlation		
LM Test	0.4291	0.6518
Heteroskedasticity Test		
Breusch-Pagan-Godfrey	0.8446	0.6847
Ramsey-RESET Test	1.8620	0.2061
Jarque-Bera	3.4554	0.1776
Wald test	24307.1	0.0000

Author estimation

4.5 ARDL bound tests.

After testing diagnostics, certain assumptions are relaxed for ARDL estimation. In this section we moved to estimate long run association through ARDL bound test approach. Table 6; shows the output of the ARDL bound test statistics and the empirical results confirms that, there is long run association between food inflation and independent variables. The statistical values of bound testing for food inflation model are analyzed based on F-statistics. Comparing F-statistic values of food price equation (4.654) and the values of lower critical bound I (0) and upper bound I (1). It is determined that the price of crude oil and other independent variables are co-integrated with food inflation in the long-run and the result we found statistically significant at 5% level of significance. Hence, we are failed to accept null hypothesis that the price of crude oil and food inflation do not have a long-term relationship in the period from July-2001 to June-2019.

Table: 6-Bound test

Long-Run Association			
F-statistics	**Lower Bound I (0)**	**Upper Bound I (1)**	**Significance**
4.65466	2.45	3.52	10%
	2.86	4.01	5%
	3.25	4.49	2.50%
	3.74	5.06	1%

Author's estimation

4.6 ARDL Long Run Coefficient

In this section, it is necessary to estimate the long-run slope coefficients of independent regressors. Table 5; shows the long run coefficient of crude price, money supply, output growth, and interest rate. The empirical evidence shows that, there is negative relationship between output growth and food inflation. While the positive association found between M2, i, and oil price in long run. The elasticity of food inflation with respect to real output (GDP) is found negative and statistically significant at 1% level of significance. The long run slop coefficient of real output indicates that, one percent increase in real output decreases food inflation on average 3.6%. Meaning the output growth in negative but highly elastic in response to food inflation. The coefficient of Money supply M2 shows that, on average one percent increase in M2 results an increase in food inflation with 1.74%. The empirical results shows that the long run elasticity of food inflation with respect to nominal interest rate is positive and statistically significant at the 5% level of significance. It suggests that a percent increase in kibor rate, increases food inflation by 0.03%. Furthermore, we found non-significant but positive impact of oil price on food inflation in long run.

Table: 7 ARDL long run Estimates.

Long Run Coefficients				
Dependent Variable: $\mathbf{ln\pi_t^{food}}$				
Selected Model: ARDL (1, 2, 12, 4, 4)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnGDP	-3.578	0.824	-4.341	0.000
i	0.031	0.014	2.259	0.025
LnM2	1.741	0.266	6.544	0.000
$\mathbf{Ln\pi_t^{Oil}}$	0.014	0.066	0.212	0.832
C	26.046	7.066	3.686	0.000

Author estimation: Note, the lag specification of each explanatory variable is defined by minimum AIC value.

4.7 ARDL Short Run Coefficient

Table 8; shows the short-run elasticity between food inflation, money supply, real output growth, oil price and interest rate. The results show that, the lagged error correction model (ECM) for estimated food price equation is negative and statistically highly significant. This suggest that there is strong and significant co-integrating relationship between food price and independent variables. The coefficient of formulating co-integration or ECM is -0.083. It suggests that the food inflation move toward convergence from short run to long run by 8.3% speed in intermediate months. Moreover, the short run impact of Oil price found positive and statistically significant with immediate and up to 3-month lags on food inflation. The result shows that one percentage change in crude price immediately rise food inflation with 0.02 to 0.035% in short run. It means that on average one percent increase in oil price tend to increase food inflation with 0.035% in short run. Thus, we can conclude that the short run impact crude oil remains positive, and it contribute to rise food inflation in Pakistan. The positive relation suggests the consistent impact of oil price changes on food inflation in long run as well as in short run.

Table: 8 Short Run coefficients

Dependent Variable: $\mathbf{\Delta\ (ln\pi_t^{food})}$				
Selected Model: ARDL (1, 2, 4, 4, 12)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Δ LnGDP	-36.994	8.061	-4.589	0.000
Δ LnGDP (-1)	35.821	8.129	4.407	0.000
Δ LnM2	-0.159	0.068	-2.342	0.020
Δ LnM2 (-3)	-0.119	0.067	-1.782	0.077
$\mathbf{\Delta\ Ln\pi_t^{Oil}}$	0.026	0.011	2.339	0.021
$\mathbf{\Delta\ Ln\pi_t^{Oil}}$**(-1)**	0.035	0.018	2.006	0.046
$\mathbf{\Delta\ Ln\pi_t^{Oil}}$**(-3)**	0.020	0.012	1.678	0.095
Δ i	0.002	0.001	1.506	0.134
Δ i (-9))	-0.002	0.001	-2.243	0.026
Δ i (-11)	-0.002	0.001	-2.119	0.036
ECM (-1)	-0.083	0.032	-2.581	0.011

Author estimation: Note, the lag specification of each explanatory variable is defined by minimum AIC value.

Figure 4.1

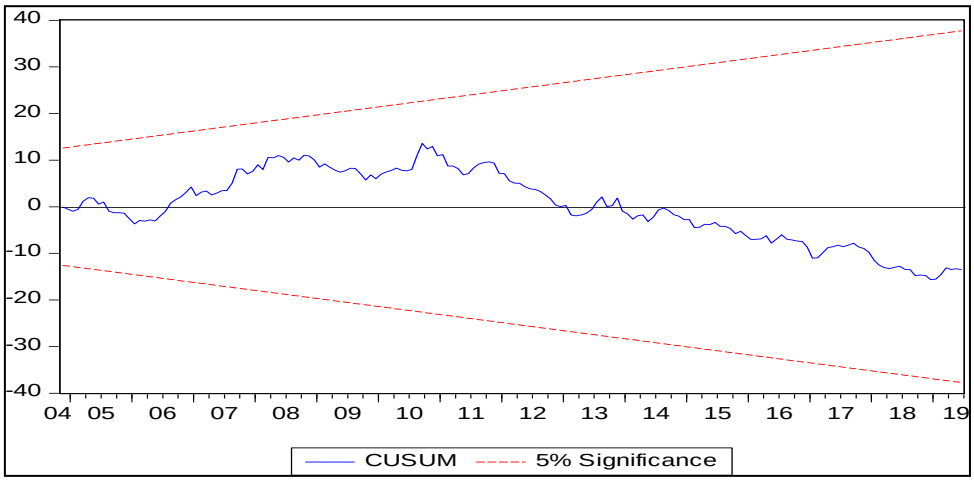
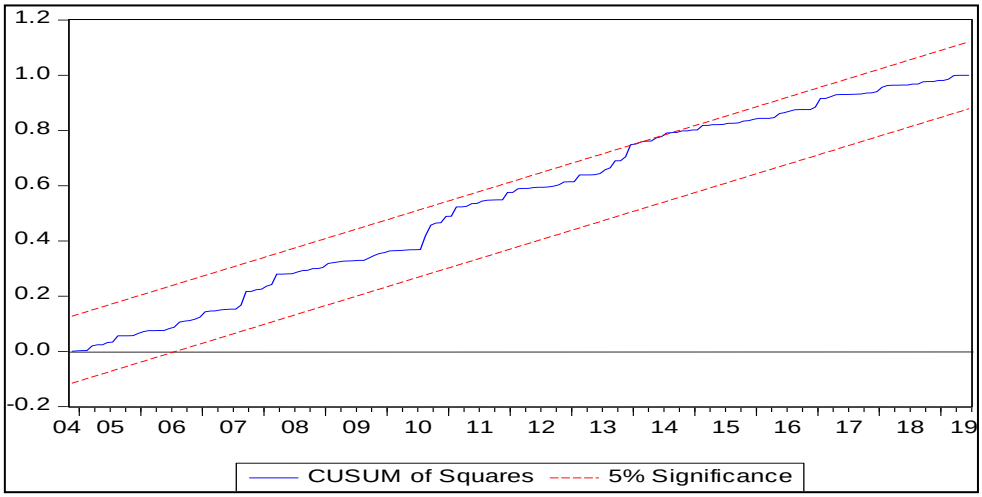


Figure 4.2



Conclusion

The core of the current study highlights that oil and food are the essential ingredients for human survival. Hence monitoring prices of these unavoidable macroeconomic variables is one of the key tasks for monetary authorities. For a sustained economic growth developing countries particularly, heavily rely on crude oil as a basic production input. On the other hand, persistent increase in imported oil prices shapes domestic consumer prices index to boost up as overall inflation via increase in food and non-food items prices. For this purpose, this study attempted to understand the potential causes and consequences of inflation in Pakistan. We postulate ITF (Inflation Targeting Framework) parallel to counter inflation in Pakistan to closely consider the nature of inflation, and the impact of the demand and supply-side factors on food inflation underlying theoretical and empirical approach. To support theoretical views of food inflation, the empirical findings are drawn are based on Quantity theory of Money (QTM).For that, the ADF (Augmented Dickey-fuller test) and (P-P Phillips-Perron Test) test

statistics were used to test the stationarity of dependent and independent variables. The empirical results have shown that there is a mixture of I (0) and I (1) integration among series. Hence the ARDL regression is suggested to deal with a mixture of integrated series. Therefore, the dynamics of inflationary factors are being processed through ARDL bound test and regression models to find long run as well as short-run integration between oil prices volatility and food inflation.

Based on empirical findings, it is revealed that food inflation strongly influenced by real output growth, money supply and kibor rate in long run. Meanwhile, the oil price volatility found positive but insignificant in the long run. The increase in real output is negative and more elastically overcome inflation in long run. While the increase in broad money supply more leverage to inflationary pressure in food items as well in long run. However, the increase in interest rate positively hits the price of food items to hike. It means inflation targeting framework is ineffective when it turns to food inflation. Instead, to control food inflation, it further deteriorated consumer welfare in long run. However, in the short- run, the oil price volatility plays an influential contribution in food inflation. The intermediate and with a lag, a rise in oil price in international markets increases food inflation in the short run. Concluding these results, it cannot be wrong to say that food price has significant variation due to change in oil price in international market, but these phenomena only deal in the short run.

Comparatively, this study has found that food inflation is short-run phenomena that directly affect the cost of living in Pakistan caused by Oil Price Increase. The results of our study of short run phenomena of the oil –food inflation confirms with a recent study by Roman, M et al (2020, Tekeber Nigusse (2019) in Ethopia, (Mehak Moazam and Ali Kema (2016).

The overall conclusion of the study suggests that for Policy to reduce price volatility and its associated adverse macroeconomic effects must therefore encompass both supply-side and demand-side solutions. The primary focus of supply-side (preventative) policy should be the stabilization of oil supply because the largest increases in price volatility have historically arisen from supply-side oil disruptions**.** Viewed as a whole, we would like to stress the relevance that our empirical results have for policy. The findings of this study can inform how policymakers steer the policy outlines of oil –importing-developing country Pakistan to avoid the inflation as overall and food inflation particularly. The study reveals that Price volatility is primarily driven by supply-side factors but mainly has demand-side impacts.

Policy recommendations:

Keeping in view the overall results of the study one thing is solidly acknowledged that the increase in international oil price has a negative effect on the economy and on other hand the government cannot eliminate the adverse impact of oil price shocks, but suitable policy response can border it (Asian Development Bank, 2005). The empirical discoveries in this research have painted a negative and unstable future for the Pakistan's economic growth, because if oil price shock persist continuously both in short-run and long –run as overall inflation. Therefore, for both terms it is compulsory to design valid policy attentiveness for the improvement and strengthen economic structure of the country.
Therefore, the role of macroeconomic policies is more sensitive today than before due to persistently increase in population and simultaneously increase in demand of energy use. Boththe parameters of population and energy consumption is knocking the door to further inflation in the country which may not be controlled in future at the cost of welfare economics. It is inevitable to design and implement such policies which make adjustment in supply -demand gap and protect economy from inflationary situation through concrete inflation targeting framework. From the platform of current study some lucrative policies are recommended to avoid oil-inflation pressure in Pakistan.

- The inflation as an overall and food inflation particularly caused by the imported oil prices to a certain level is the result of weak administrative control of the government. Therefore, it is a dire need to work sincerely by the concerned institutions to avoid structuralism inflation in the country.
- Economy can be protected from unrestricted inflation caused by oil price volatility only by less relying on oil as a main component for production and move from non-renewable to renewable sources ormixture of both.

- Pakistan government needs to seriously consider subsidy reform, subsidy reform entails the implementation of target fuel subsidy.

- Concerned monetary and fiscal bodies should give care of in policy formulation to control inflation by revaluating or appreciating domestic currency not by direct intervention of government but by providing subsidies for those who produce exportable goods and imposing high tax rate for imports.

- Unlike the industrial and services sector, the government should focus on agriculture sector reforms. The anticipated growth of approximately 6-8% output growth in the agriculture sector will enhance the overall productivity and inflation-adjusted economic growth which will help to eradicate poverty level, control inflation particularly food inflation in Pakistan.

- Anti –inflationary policies can be successful if monetary authorities go to work without political purposes.

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