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Does Globalization Matter for Inflation in Pakistan? Empirical Evidence from Global Slack Hypothesis

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Abstract

This paper aims to evaluate the global slack hypothesis as well as to examine the impact of economic openness on the inflation trend and short-run Phillips curve. For this purpose, the study utilized the Auto Regressive Distributive Lag (ARDL) model to investigate how different measures of openness and global factors (global output and inflation) affect inflation over the period 1970 to 2018. In addition, we also investigate the effect of political regimes (1 for autocracy and 0 for democracy) on inflation and its various proxies in Pakistan. Unlike the existing work that has been done in Pakistan, this study has analyzed the global implications directly for inflation as well as the global slack hypothesis. Results indicate that trade openness is inflationary while financial sector development and the broad measure of openness which is the KOF index have had the opposite effect which might suggest the importance of other dimensions of globalization than trade only. One important finding is that the world output shock and world inflation directly transmit to Pakistan price inflation and in this sense, global factors along with economic openness have some association with inflation. The inclusion of political dummy variable has weaker explanatory power with negative sign maintaining that prudent macroeconomic policy during military regimes keep the inflation level lower. The empirical findings also suggest that although, the global slack hypothesis is validated its impact is not increasing over time. However, comparatively the global slack has dominated the domestic slack and in this sense, its importance has increased over time. Consequently, the process of globalization has important implications for inflation and its dynamics in Pakistan.

Keywords: *Inflation, Philips curve, global slack hypothesis, ARDL*

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1. Introduction

Globalization and economic openness is the process of economic and social

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integration that brings some benefits along with some challenges as well, (Abbas, Muhammad & Ali, 2016; Hamdani, 2015). The positive economic impacts are trade and technological flows, economic growth and development, structural transformations, capital, and financial flows, capacity utilization, and many more. Pakistan's economy also facing major challenges in the fields of policy designs, structural transformations, the infrastructure necessary for global opportunities, trade, and industrial policy and competition concerns, (Hamdani, 2015). According to the KOF index of globalization, Pakistan had gain momentum in the process of globalization since the late '80s. As a result of this phenomenon, there must be many economic and social implications of globalization and economic openness for Pakistan and of course, inflation is one of these. This study is motivated to find the impact of globalization and openness on inflation in Pakistan. The seminal work of Romer (1993) hypothesized negative relation between trade openness and inflation, which then lead to a vast volume of literature. Rogoff (2003a & 2003b) provides a supportive argument in the favor of globalization and the disinflation hypothesis. According to Rogoff (2003a & 2003b) it is globalization along with the interaction of privatization and deregulation which may be held responsible for past decades' lower average inflation. According to this argument, globalization accounts for low inflation in two ways: directly and indirectly. The direct response works through greater market competition, while the indirect response operates through the declining political pressure over central banks to create inflation. The increased competition provokes efficiency and productivity and this helps to make surprise inflation less potent.[4] This line of research produced a large number of studies most of which conclude negative relation between openness and inflation. However, few of these conclude positive relation, (Evans, 2007 & 2012; Samimi, Ghaderi, Hosseinzadeh & Nademi, 2012; Zakaria, 2010).

Economic outcomes including inflation are greatly associated with the political regimes of Pakistan. All macroeconomic indicators perform well and are considered stable during autocratic regimes, while on the other side macroeconomic instability, in general, is associated with the democratic regimes (Chani, Irfan, Iqbal & Khan, 2008; Haider, Din & Ghani, 2011). External sector indicators also perform well during autocratic regimes such as low trade deficit, high capital inflows and portfolio investments. In contrast, all the aforementioned indicators remain very volatile and deteriorated during different episodes of democratic regimes.

Literature suggests that inflation is not only determined by global and monetary factors but also by political factors such as political instability denoted by political regimes (Aisen & Veiga, 2006; Haider et al., 2011; Khani Hoolari, Abounoori &

4 The discussion assumes supply side consideration which contains impacts for medium term inflation. Demand side considerations are relevant only for temporary short term inflation and trade.

Mohammadi, 2014; Vansteenkiste, 2009). Haider et al., (2011) conclude that high instability in democratic regimes is the result of week governance and high corruption which in turn causes high inflation in Pakistan. However, Vansteenkiste (2009) finds that democracy is inversely related to prolong inflation but the magnitude of the influence of democracy on inflation is very small. Similarly, Khani Hoolari et al., (2014) and Aisen & Veiga, (2006) maintain that it is the political instability that drives domestic inflation in the country. The recent work by Baumann, Rossi and Volkmann (2020) analyzed the forces that explain inflation in 124 countries covering the period from 1997 to 2015. The study finds that among the relevant drivers of inflation includes globalization, output gap, and exchange rate, while money growth, political variables as well as a central bank-related variables are less important in explaining domestic inflation.

Another, line of analysis is the test of the global slack hypothesis. Through this way it could be shown whether global slack has dominated and replaced domestic slack or not? The existing literature argues that the internal country-centric approach for explaining the inflation process may not be adequate, but instead a more global-centric approach must be required for better analysis (Borio & Filardo, 2007). To answer this issue, many efforts are done in this field to determine the global implication for the inflation process. However, one apparent limitation of the work done on this particular subject is that most of them are based on cross-country analysis. Little efforts are made to examine the question at the country-specific level. Furthermore, previous research on the subject matter either considers the impacts of economic openness of the economy on the inflationary trend or either on the slope of short term Phillips curve, but never considered it simultaneously. The problem with the analysis that considers just only the impact of globalization (trade, financial, or both at a time) on inflation fails to identify the channels through which globalization might impact inflation. Those studies which analyze the global impacts on the Philips curve only are unable to highlight the ultimate source of globalization on inflation (Badinger, 2009). Also much of the studies particularly Pakistan literature did not use the appropriate time series method which is the primary motivation and contribution of this study.

This study attempts to overcome these limitations and provide answers to these questions. As the literature is least evident about these questions and has mixed conclusions. The basic motivation of the endeavor to determine the impacts if any? Of economic openness/globalization (trade and financial openness) over inflation in Pakistan economy and also to test for the implications of Phillips curve and test the global slack hypothesis. Thus, this paper tackled the problem by finding the impact of globalization on inflation and also test global slack to see whether the impact is growing over time? Hence, the basic motivation of this work is many fold. First, some

of the studies used inappropriate econometrics methods which are not suitable for time series data. Next, not any single of them reconfirmed the role of global factors in the determination of inflation dynamics with the help of the global slack hypothesis. The test of the hypothesis will help to compare the importance of internal factors relative to global. Also, this work contributes to Pakistan's literature in terms of utilizing relatively longer time series. Last but not the least, unlike the literature, it incorporated the global output level and global inflation directly to determine if the global factors are significant in the inflation process of Pakistan?

The empirical work on these questions is scant, particularly in Pakistan. To our knowledge, the literature in Pakistan related to the subject issue is limited to (Afzal, Malik, Butt & Fatima, 2013; Hanif & Batool, 2006; Mukhtar, 2010; Munir & Kiani, 2011; Zakaria, 2010). The given studies examine the implications of trade openness for inflation using historical data of Pakistan's economy. The findings of these studies provide mixed conclusions. However, there is no study in the knowledge of this study that tests the global slack[5] hypothesis in Pakistan.

The study is aimed to determine the impacts of economic globalization on domestic inflation both in the long term and in the short term horizon. The study includes trade and financial openness, global inflation, and global capacity utilization in the context of globalization. Concerning domestic economic slack (output gap), the study also estimated the slope of the short-run Phillips curve. The estimated slope coefficient of domestic and global slack is used to determine, whether, global slack has any impact on domestic inflation about the domestic demand pressure? Moreover, the relative importance of global slack in comparison to domestic slack over time is also explored in the study. Lastly, the study determines the relative importance of import prices both with domestic slack and across the time in the Phillips curve.

The study is organized as follows. Section 2 pinpoints the theoretical background and develops an empirical framework. Section 3 proposes the econometric methodology to be used to come up with desirable results and discuss the data information and construction of variables. Section 4 is based on empirical findings and results from the discussion while conclusions and policy recommendations are given in the last section.

2. Theoretical Framework

The country-centric approach of inflation focuses only on traditional country-specific determinants. The foreign influences are captured through the exchange

5 Technically, economic slack refers to the business cycle or in other words it is the deviation of actual output from the trend.

rate. While with the surge of openness and liberalization of economies in terms of both goods and financial markets; some global factors may appear to be relevant for the inflation process.[6] Therefore, these global variables such as trade and financial openness, global output, and global inflation along with the political dummy variable and traditional variables are included in the model which is specified as follows:

$$\pi_t = f\left(MS, PCI, ER, TO, FO, W.INF, W.GDP, POL\_DUMMY\right) \quad (1)$$

Where π_t is domestic inflation, MS is the broad supply of money that is used to capture monetary policy stance, PCI is the per capita gross domestic product, ER is nominal effective exchange rate, TO is trade openness, FO refers to financial liberalization/openness, W.INF is the global inflation, W.GDP is the global output and *POL_DUMMY* is a political dummy variable taking the value of 1 for the autocratic regime and otherwise.

The money supply is expected to be directly associated with inflation as the monetarist maintain that long-term inflation is solely determined by monetary factors (Akbari & Rankaduwa, 2005). However, in the short-run money supply may have no significant impact. Per capita GDP is expected negatively with inflation as, the availability of goods and services per person increases, it is most likely to have less pressure on the prices (Romer, 1993). Trade openness, which is the main theme and concern of this study may relate to inflation both positively as well as negatively because the impact of openness to trade on inflation is inconclusive and the literature cited so far provides mixed conclusions (Ahmed, Ghauri, Vveinhardt, & Streimikiene 2018; Evans, 2007; Forbes, 2019; Hanif, & Batool, 2006; Zakaria, 2010).

The capital account liberalization or financial openness increases interest elasticity of money demand which leads to greater currency substitution and thus reduces the inducement of the monetary authority to inflate (Gruben & McLeod, 2002; Gupta, 2008). The nominal exchange rate has an inverse relationship with that of inflation, as the depreciation of the domestic currency against foreign currencies will cause an increase in the domestic price level of imported goods which in turn will surge upward pressure on domestic prices. World inflation is expected to positively cause inflation. The reason is that higher global inflation will exert pressure on domestic inflation to rise directly. The global output may negatively impact domestic inflation because worldwide demand pressure may ease due to global output growth, and thus makes worldwide inflationary pressure smooth. As discussed above the inclusion of both global output and inflation as control variables are meant to capture the direct impact of these two. In addition, a dummy variable that controls the form of government i-e dictatorship/democracy has been incorporated. It is defined as; 0 for democracy and

6 *Some factors e.g import prices must have direct implications for inflation.*

1 for autocracy. The impact of this control variable is found significantly negative for Pakistan's economy by (Hayat, Fatima & Bano, 2016).

Another dimension of the subject matter is the global slack hypothesis. Two types of questions are frequently analyzed: the first one is the consequences of globalization on the short term Phillips curve and the second is the relevance of the global slack hypothesis (Borio & Filardo, 2007; Chen, Imbs & Scott, 2009; Forbes, Gagnon & Collins, 2020). Some researchers suggest that the declining trend in inflation maybe because of domestic determinants of inflation is accompanied by the global forces, like global economic slack (Borio & Filardo, 2007; Chen, Girardin & Mehrotra, 2017; Ihrig, Kamin, Lindner & Marquez, 2010; Nefussi, 2020; Zhang & Zhou, 2016). For instance, Forbes, Gagnon & Collins (2020) has to found support for nonlinearity in the estimation and specification of the Phillips curve. They estimated the nonlinear model and concluded the importance of international factors in explaining inflation. Also, Forbes (2019), studied the inflation and slack relation. It suggests that global factors must be incorporated to model inflation as the traditional domestic slack-inflation relation has weakened. Consequently, the importance of global forces is dominating the traditional domestic factors (Borio & Filardo, 2007; Nefussi, 2020). However, the literature provides mixed conclusions. Some argued that the Phillips curve is steeper in an open economy (Romer, 1993) while some suggest that trade openness will flatten the Phillips curve i.e increase in the sacrifice ratio (Borio & Filardo, 2007). The reduced form equation for the augmented Philips curve is specified and the global slack (global output gap) variable is included. The theoretical justification for the inclusion of the global slack variable is provided by (Razin & Yuen, 2002; Martínez-García & Wynne, 2010; Woodford, 2007; Zaniboni, 2008).

Three hypotheses are tested in the present context: first, to find if global slack has any significance along with the domestic slack and if present whether it is increasing over time? Second: whether, the domestic slack losing its dominance and significance relatively to the global slack? Third: to test that whether the importance of import prices increasing over time. Together, these hypotheses are referred to as the global slack hypothesis. The empirical findings of these hypotheses have important bearings on the results of equation (1) above.

The general reduced form of the augmented Phillips curve for inflation under the global slack hypothesis by following (Ball, 2006; Borio & Filardo, 2007; Lakova, 2007; Milani, 2010) is given as follows:

$$\boldsymbol{\pi}_t - \boldsymbol{\pi}_t^T = \boldsymbol{C} + \boldsymbol{\beta H}_{t-1} + \boldsymbol{\alpha F}_{t-1} + \boldsymbol{\eta X}_{t-1} + \boldsymbol{\varepsilon}_t \qquad (2)$$

Whereas, 'π_t' is the inflation in period t, $\boldsymbol{\pi}_t^T$ is the trend inflation which is used

as a proxy for inflation persistence, C is the constant, *F* is foreign output gap and *H* is the domestic gap, *x* represents the vector of some control variables and ε_t is the white noise error term.

Another variant of equation (2) may also be specified as:

$$\Delta\pi_t = C + \sum_{i}^{k} \alpha_{t-i}\pi_{t-i} + \beta H_{t-1} + \omega F_{t-1} + \eta X_{t-1} + \varepsilon_t \qquad (3)$$

In equation (3) the term $\sum_{i}^{k} \alpha_{t-i}\pi_{t-i}$ is used to represent persistence in inflation. The other terms are the same as defined in equation (2). This is the backward-looking behavior model in which the lag response of inflation persistence is specified based on adaptive expectation modeling of inflation. These models are specified in such a way to test for the hypothesis: which is the slope of the Phillips curve and to test for the prevalence of the global slack hypothesis. It means that the empirical results will determine, whether, global factors are more important relative to domestic conventional ones for explaining inflation in Pakistan's economy. This may be of particular interest for policy formulation strategy.

3. Econometric Methodology and Data

3.1 Auto-regressive distributed lag (ARDL) model

The structure of inflation is a very much complex and dynamic process and its current value depends on its determinants current and lag values as well as on expectations, (Frisch, 1983). For this reason, the study will employ ARDL bound estimation approach to estimate the parameters of equation (1).

The simple model of inflation on its domestic and global determinants generally highlighted in equation (1) is specified below.

$$\pi_{t=} + \beta_1 TO_t + \beta_2 FO_t + \beta_3 W.GDP_t + \beta_4 W.INF_t + \beta_5 MS_t + \beta_6 PCI_t + \beta_7 ER_t + \beta_8 POL\_DUMMY + \varepsilon_t \qquad (4)$$

Where,

π = domestic inflation

TO= trade openness

FO= financial openness

W.GDP= world output

W.INF= world inflation

MS= money supply

PCI= per capita GDP in Pakistan

ER= nominal effective exchange rate.

POL _ DUMMY = 1, if Autocracy and 0 otherwise.

ε_t = error or disturbance term

For estimation and testing the long-run relation the study employ technique of bound approach to Co-integration (Modified ARDL) developed by (Pesaran, Shin & Smith, 2001). For testing the long run Co-integration relation the literature also provides some other techniques which are Engle and Granger (1987) two-step technique and Johansen (1991) system based reduced rank regression approach. But the bound test (ARDL) approach has certain advantages over the Engle and Granger (1987) and Johansen (1991) methods. The first most important advantage is, it does not depend upon whether the order of integration of variables are I(0) or I(1) or any mixture. The unrestricted error correction version of the ARDL model is given as follows:

$$\Delta(\boldsymbol{\pi}_t) = \boldsymbol{\alpha}_0 + \sum_{i=1}^{k}\sum_{j=0}^{p}\boldsymbol{\beta}_{ij}\Delta\boldsymbol{W}_{it-j} + \sum_{i=1}^{k}\boldsymbol{\varphi}_i\boldsymbol{W}_{\mathbf{it}-1} + \boldsymbol{\varepsilon}_t \;\; \boldsymbol{j} > 0 \;\; \boldsymbol{if}\; \boldsymbol{i} = 1 \tag{5}$$

Whereas, α_0 is a constant term, β_{ij} are the short-run coefficients in which the subscript *i* denotes the variable and *j* for the lags included. Further, φ_i are long-run coefficients and for the test of Co-integration, these coefficients are tested for the joint significance through the Wald test F version. The optimal lag length is selected by SBC (Schwarz Criteria).

The null hypothesis of no Co-integration against its alternative hypothesis of Co-integration is given below.

$$H_0: \boldsymbol{\varphi}_1 = \boldsymbol{\varphi}_2 = \boldsymbol{\varphi}_3 = \boldsymbol{\varphi}_4 = \boldsymbol{\varphi}_5 = \boldsymbol{\varphi}_6 = \boldsymbol{\varphi}_7 = \boldsymbol{\varphi}_8 = 0 \tag{6}$$

Against the alternative

$$H_1: \boldsymbol{\varphi}_1 \neq \boldsymbol{\varphi}_2 \neq \boldsymbol{\varphi}_3 \neq \boldsymbol{\varphi}_4 \neq \boldsymbol{\varphi}_5 \neq \boldsymbol{\varphi}_6 \neq \boldsymbol{\varphi}_7 \neq \boldsymbol{\varphi}_8 \neq 0 \tag{7}$$

The restriction in equation (6) is tested by comparing[7] the Wald test with the

7 *If the calculated F-statistics found to be higher than upper bound then reject H0 and it must be concluded the long term equilibrium relation exists and when it is found smaller than the lower bound then the null hypothesis of no Co-integration is accepted. On the other hand, when the calculated F-statistic lies between the two bounds the test is inconclusive.*

critical values taken from the Pesaran, Shin and Smith (2001) table. In the next stage, the long-run coefficients of equation (5) are estimated. Again the optimal lag length is selected through information criteria of SBC. The long-run equation is given below.

$$\pi_t = \theta_0 + \sum_{i=1}^{k}\sum_{j=0}^{p}\alpha_{ij}W_{it-j} + \varepsilon_t \;\; j > 0 \;\; if \; i = 1 \tag{8}$$

Where, θ_0 is a constant term, α_{ij} are long term estimated coefficients; W is the variables vector and ε_t is the random factors or error term with the assumptions given. The final step is the short-term coefficients estimation which includes the error correction term (ECT).

$$\Delta\pi_t = \omega_0 + \sum_{i=1}^{k}\sum_{j=0}^{p}\lambda_{ij}\Delta w_{it-j} + \gamma ECT_{t-1} + \upsilon_t j > 0 \;\; if \; i = 1 \tag{9}$$

Here, ω_0 is constant, λ_{ij} are short term coefficients, γ shows periods time required for adjustments to the long term equilibrium in case of any short term deviation, ECT_{t-1} is the lag of error term in the long term equation (8) and finally ν_t is the usual error term assumed as white noise. All the variables are converted to natural logs level to generate smoothness in the data. Thus all the long-term and short-term coefficients should be interpreted as elasticities.

3.2 Ordinary Least Square (OLS) Phillips Curve Estimation

The short-term inflation dynamics represented by the Phillips curve are estimated by the Ordinary Least Square (OLS) method. Equation (10) below gives the reduced form augmented Phillips curve.

$$\Delta\pi_t = C + \sum_{i}^{k}\alpha_{t-i}\pi_{t-i} + \beta H_{t-1} + \omega F_{t-1} + \eta X_t + \varepsilon_t \tag{10}$$

In the above equation, $\Delta\pi_t$ is the first difference of inflation index, C is the constant term, $\sum_{i}^{k}\alpha_{t-i}\pi_{t-i}$ are the lags of inflation that captures persistence of inflation expectations, H_{t-1} is the lag of domestic economic output gap, F_{t-1} is the global output gap, X_t is the vector for the control variables and ε_t is the error term assumed to follow the white noise properties. $\varepsilon_t \sim N\left(0, I\sigma\right)$

The coefficients are estimated to check for the relative importance of global and domestic slack variables over time. Therefore, first, only domestic slack is included and then subsequently, the global slack is added to find the explanatory power of the newly included global slack and check the behavior of the domestic slope coefficient after that. This entire analysis is conducted to test for the global slack hypothesis.

The justification for using the OLS estimation technique is based on Haussmann's endogeneity test (see appendix C). The analysis of the global slack hypothesis is con-

ducted over two time periods by dividing the entire sample between 1970-1990 and 1991-2018. The choice of choosing the 1990s as the point of time for breaking the sample is because the structural adjustment program was initiated at this time along with economic openness in the form of trade and financial openness.

4.3 Data Sources and Construction

The sample data are used in the study consists of annual observations for the period 1970-2018. Various indicators of inflation like CPI, WPI, and GDP deflator are used as indexes to represents inflation. The data on these variables are taken from the World Development Indicators (WDI) and the federal bureau of statistics. The money supply (MS), per capita output of Pakistan (PCI), real GDP of Pakistan, Global output (W.GDP), financial development indicator defined as the financial system deposits to GDP as a percentage (FO) and trade share (TO) as a percent of GDP of Pakistan are taken from world development indicators. Next, bilateral trade statistics, the nominal effective exchange rate(ER), and world inflation (W.INF) are extracted from international financial statistics. Finally, the newly developed index of economic globalization which is the KOF index is taken from (Axel, Gaston & Martens, 2008; Dreher, 2006). The use of this broad measure is not investigated before in the context of Pakistan, which is one of the empirical contributions towards Pakistan literature. Further, the non-availability of some variables which are the KOF index, financial development indicator, trade shares of some trading partners, and exchange rate before the 1970 period put data limitations on this study.

The core variables of the study which are trade and financial openness being used as a proxy for globalization which has so many different proxies[8] and indicators[9] commonly used in the empirical studies (Squalli & Wilson, 2006). The financial development variables are used to proxy for financial openness/liberalization[10] because no reliable time-series data is available for the financial openness index. Although, KOF index of globalization is based on three components such as economic, social, and political globalization, this study used only the economic component because the theme of the study is economic globalization/openness. This is the weighted average

8 The different proxies include imports intensity, exports trade intensity, total trade intensity, relative world trade and trade restrictions.

9 See, Squalli and Wilson, (2006) for the relative pros and cons of these various indicators.

10 Groenewold, Peng, Li, and Fan, (2008) argued that financial development is de facto measure of financial markets openness and financial liberalization which is de jure (policy based) measure causing financial development.

of the major trading partner output gap.[11] For constructing the global output gap[12] the raw GDP data of the major trading partners are taken from WDI.

4. Empirical Results and Discussions

The descriptive statistics (see Table: A-1 of Appendix A) highlights the main feature and behavior of the data like its means, standard deviations, and normality, etc. The Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root test being performed to analyze the stationarity (non-stationarity) of the selected set of variables (see Table A-2). Table A-2 shows the unit root test results of the variable set included in all the ARDL models. The results show that most variables are stationary I(0) at their level form while some are stationary at the first difference I(1).

4.1 Impact of Openness On Various Indicators Of Inflation

4.1.1 The impact of financial and trade openness on CPI inflation

The results derived from the first step of the unrestricted error correction model (UECM) are sensitive to the lag length selection, therefore the lag length is chosen based on SBC information criteria. The information criteria suggest two lags, so the F-Statistic is calculated from equation (5). The estimated F values are the Wald test of join significance of lag level variables for testing the presence of Co-integration are provided in table 1 below.

Table 1 shows that at maximum lag length 2, the estimated F value suggests the existence of Co-integration at a 10% significance level while, at lag 1 and 0, the system shows the existence of Co-integration at 1% significance level. This suggests the rejecting of null-hypothesis of no Co-integration among consumer price index and

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11 The global output gap is estimated by three methods of weighting schemes. 1) The trade share of the major trading partners out of the entire trade of the country for a particular year. 2) The trade weights constructed as the trade share of the major trading partners out of the total of those trading partners in order to make the sum of weights equal to one. 3) The output gap which is constructed as using imports weights average output gap. The import weights are constructed as the share (percent) of imports from total imports in a particular year. As pointed by Calza (2009) these measures does not take into account the impact of developments in the third country markets on its trading partners. Further, unlike Calza (2009) which used average weights for a fixed period, this study uses the time varying weights. Borio and Filardo (2007) provides some alternative measures of output gap along with their relative pros and cones.

12 The estimation technique for global output gap which is Hordrick-Prescott (HP) filter is given as:

$$\text{Min}\ \mu_t \sum_{t=1}^{T}[(y_t-\mu_t)^2+\lambda\{(\mu_{t+1}-\mu_t)-(\mu_{t+1}-\mu_t)\}^2$$

Where, the value of λ is determined by the user, while some defined value considered to be robust is said to be the fourth power of the change given by HP i.e. (1600) for quarterly data. The annual data consists of four quarters, so the value of λ is defined as:

$$\lambda=\frac{1600}{4^4}$$

Table 1: The Bound Test Values Of UECM For CPI Index

Order of lag	F- Values.
0	F (8, 41) = 5.98*
1	F (8, 38) = 4.70*
2	F(8, 31) = 3.30***

The relevant critical values (no trend and unrestricted intercept) are taken from (Pesaran, Shin & Smith, 2001). At 10% significance level the bound values are 1.95 & 3.06, at 5% significance level the corresponding bound values are 2.22 & 3.39 and at 1% significance level are 2.79 & 4.10 respectively. *** indicates significance at 10%, ** at 5% and * at 1%.

its underlying determinants.[13]

To obtained long-term coefficients, equation (8) is estimated and long-run coefficients obtained after normalization and their t-values and standard errors are given below in table 2. The coefficient of financial openness is negative and significant in our case. This finding is consistent with (Gruben & McLeod 2001; Gruben & McLeod, 2002). The authors argued that openness/liberalization of capital account increases money demand's interest rate elasticity and thus reduces the seigniorage bias of inflation. Moreover, Gupta (2007) advance other descriptions and explanations for the observed inverse relationship between capital account openness and inflationary trend. Accordingly, financial openness helps to promote discipline in monetary policy and boost the agent's confidence over the authority to be more discipline in the future. The observed negative relation in Pakistan may be partly due to the positive impact of financial development on private sector investment and growth, which may help to ease pressure on prices. Hung (2003) found a positive relationship between financial development and inflation where initial inflation is high and negative relation where initial inflation is lower. The impact of financial openness on domestic prices in Pakistan is not investigated. However, the impact of trade openness on domestic prices is investigated by two studies (Hanif & Batool, 2006; Munir, & Kiani, 2011). The two studies find contrasting evidence. First study finds negative and significant relationship of trade openness with inflation in Pakistan which supports Romer's (1993) hypothesis that inflation is lower in small open economies. The second study finds a positive relationship between trade openness with inflation in Pakistan.

The finding that trade openness (TO) have a positive impact on CPI inflation is consistent with (Evans, 2007; Evans, 2012; Hanif, & Batool, 2006; Samimi et al., 2012; Zakaria, 2010) who maintain that there is a direct relation between openness to

13 The determinants are: trade openness, financial openness, global inflation, global output, per capita GDP, money supply, real exchange rate and political dummy.

trade and inflation. Domestic authority enjoys a monopoly power internationally as external consumers have some amount of inelasticity for the home country products. The monetary authority in this sense exploits the benefits of inflation in the form of consumption tax, real wage, and term of trade appreciation (Evans 2007; Evans, 2012). It is also possible that the authority may lose control over domestic inflation and policy becomes less potent when the economy opens up to international trade. In Pakistan's case, the most probable and solid explanation for such a finding may be imported inflation. As the major share of Pakistani imports is energy and petroleum products. Additionally, the demand for these nature of imports is highly inelastic and its prices in terms of unit value increased significantly from 1970 to 2018.

The other two global factors world output (W.GDP) and world inflation rate (W.INF) also have some repercussions for domestic inflation. The world inflation has expected sign which shows positive impact on domestic inflation and which support the conventional purchasing power parity theory (Zakaria, 2010). Thus it appears that the world inflationary shocks have direct consequences for inflation in Pakistan. The world output has turned insignificant in the analysis by the incorporation of political dummy so this variable is dropped from the analysis.

The traditional domestic determinants such as GDP per capita (PCI), money supply (MS), and nominal effective exchange rate (ER) are all significant statistically and are according to prior expectations. The PCI has a deflationary effect which is compatible theoretically with (Gruben & McLeod, 2002; Gupta, 2007; Romer, 1993; Samimi, et al., 2012) which also derives the negative results for per capita GDP. It means that the level of growth and development of the economy is still an important factor for controlling inflation. Moreover, the money stock (MS) has an expected positive and direct impact on inflation which is also statistically significant. Money stock is a proxy for monetary policy stance, result validates the monetarist's theory of inflation in the Pakistan case. This result also signifies the importance of monetary developments of the authority. Finally, the exchange rate (ER) has also its expected impact, suggesting that depreciation will leads to inflation in Pakistan. It captures the influence of foreign factors, particularly those of the trading partners.

The impact of the control dummy for autocracy/ democracy has significant and negative. This result is found to be consistent with (Hayat, Fatima & Bano, 2016). As the military regimes in Pakistan performed well in terms of inflation and economic growth.

The ARDL version of the Error correction model estimates of equation (9) is given in table 3. Financial openness has the same negative impact just like in the long run, but its magnitude is smaller comparatively, it shows the same response of

Table 2: Long Run Estimated Coefficients For CPI Inflation In The Selected ARDL Model

Variable	Coefficient	Standard Error	t- Ratio
Constant	4.13**	2.11	1.96
FO	-1.92*	1.02	-1.87
TO	0.48*	0.27	1.77
Winf	0.45*	0.18	2.48
PCI	-0.89*	0.35	-2.36
M2	0.43*	0.20	2.10
ER	-0.93*	0.36	-2.56
D	-0.27**	0.13	-2.07
	R^2 0.99	Adj R^2 0.99	D-W 2.02
Auto Correlation	Chi-Sq (1) = 0.0074 [0.931]		F(1, 34) = 0.0051 [0.943]
Hetero-Scedasticity	Chi-Sq (1) = 1.63 [0.202]		F(1, 45) = 1.61 [0.210]
Normality:	Chi-Sq (2) = 1.05 [0.591]		

NOTE: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

domestic inflation to financial openness.[14]

On the contrary, trade openness is insignificant in the short term horizon, suggesting that trade openness has no short-term impact on inflation. Moreover, global inflation (CPI) is significant and also has the same signs as in the long run, but its magnitudes are relatively smaller than their long-run counterparts. Furthermore, the domestic per capita output (PCI) and exchange rate provide similar results to those in a long time. At the same time, the money supply becomes insignificant in the short run which is in line with monetarist's assumptions that money produces inflation only in the long period. The ECM estimate has a negative sign and highly significant. It is interpreted as the adjustment to the long-term equilibrium that will approximately occur in few years almost. The negative and significant value of ECM (-1) corroborates the finding of long-run level relation.

4.1.2 Evidence From The KOF Index.

In this section, the concerned analysis is conducted by replacing the trade and financial openness variables with the KOF index of economic openness/globalization. To check for the co-integration, the UECM model is re-estimated across various lags and the F-value is computed for testing jointly the significance of lag level coefficients

14 It may suggest the relatively quick adjustments and flexible nature of financial market.

Table 3: Short-Run Estimates For CPI Inflation In The Selected ARDL Model

Variable	Coefficient	Standard Error	t- Ratio
Δ(FO)	0.090	0.066	1.36
Δ(FO)1	-0.19*	0.050	-3.80
Δ(TO)	-0.04	0.053	-0.77
Δ(W.INF)	0.04*	0.010	3.94
Δ(PCI)	-0.14**	0.072	-1.99
Δ(M2)	0.07	0.055	1.26
Δ(ER)	-0.05*	0.045	-1.02
Ecm(-1)	-0.16*	0.061	-2.63
D	-0.04*	0.008	-5.48
R^2 0.90		Adj R^2 0.86	D-W 2.02

NOTE: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

in the general UECM model. Table 4 below reports the computed F value across the various lags from 0 up to 3 lags.

Table 4: The Bound Test Results, UECM For Using KOF Index

Lags	F-statistics
1	F (7, 35) = 19.38*
2	F (7, 31) = 13.49*
3	F (7, 27) = 11.80*

The relevant critical bound values are collected from the table Pesaran et al., (2001). At 10% level, the bounds are 2.03 & 3.13, at 5% significance, the corresponding bound values are 2.32 & 3.50 and at 1% significance level are 2.96 & 4.26 respectively. *** indicates significance at 10%, ** at 5% and * at 1% level.

Comparing the computed F values with the critical bound values suggest that co-integration relation exists at every lag at one percent level.

Table 5 shows the coefficients of the long-term relation. The effect of the KOF index is significantly negative on CPI inflation. This finding is compatible with the result of (Samimi et al., 2012) which found the broader measure of globalization (KOF) index to be a good indicator of globalization. The reason is that they have found the traditional trade openness indicator to be inflationary contrary to the (Romer, 1993) hypothesis, but the KOF index is found to have a deflationary impact, thus validate the (Romer, 1993) hypothesis. In addition, (Binici, Cheung, & Lai 2012) corroborates

the negative relation among the KOF index of economic globalization and inflation. According to them, productivity growth and competitiveness in the markets are the basic channels through which, openness to trade affects inflation, but once these channels are controlled then the remaining part of trade does not explain inflation. On the other hand, the KOF index is a comprehensive measure that explains inflation negatively even after accounting for the productivity and market competitiveness channels. This suggests that the KOF index contains some channels other than the productivity and market competition explaining inflation.

Table 5: Long Term Coefficients Of Estimated ARDL For CPI Index

Variable	Coefficient	Standard Error	t- Ratio
Constant	12.99	10.473	1.154
KOF	-0.96*	0.378	-2.539
W.INF	0.21*	0.063	3.438
W.GDP	-2.11**	1.785	-1.182
PCI	-0.45*	0.246	-1.829
M2	0.72**	0.451	1.596
ER	0.46	0.723	0.636
D	-0.16*	0.060	-2.70
R2 0.99		Adj R^2 0.99	D-W 2.05
Serial-Correlation		Chi-Sq (1) = 0.385 [0.729]	F(1, 34) = 0.176 [0.737]
Hetero-Scedasticity		Chi-Sq (1) = 0.872 [0.613]	F(1, 44) = 0.896 [0.458]
Normality		Chi-Sq (2) = 0.776 [0.638]	

NOTE: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

The possible explanations might be put, that in Pakistan even if trade openness is inflationary, but KOF index contains some channels other than trade flows like, portfolio investment and FDI which helps in bringing down inflationary pressure. Another supportive reason for this explanation is the inverse effect of financial market development and openness on inflation. So these results suggest the importance of financial openness rather than trade openness for controlling inflation.

The world inflation, GDP per capita, and money supply produce the same results as in the previous model. In addition, the exchange rate is statistically insignificant, contrary to the previous model. Further, the world output level is also found to be statistically insignificant. The reason may be the KOF index is so comprehensive that it outpaces these two determinants. So, it seems the KOF index has replaced the importance of these two determinants and turns them insignificant statistically. Another

reason might be that the correlation among world output, exchange rate, and the KOF index is very high. The corresponding short-run estimates are given in table 6.

Table 6: Short Term Coefficients Of Estimated ARDL For CPI Index

Variable	Coefficient	Standard Error	t- Ratio
Constant	3.64	3.923	0.927
Δ(KOF)	-0.18**	0.104	-1.730
Δ(W.GDP)	-0.44**	0.226	-1.968
Δ(W.INF)	0.05*	0.008	5.314
Δ(PCI)	0.34	0.209	1.639
Δ(M2)	-0.06	0.055	-1.216
Δ(ER)	-0.09	0.048	-1.968
D	-0.03*	0.007	-4.731
Ecm(-1)	-0.21*	0.047	-4.422
	R^2 0.88	Adj R^2 0.75	D-W 2.12

NOTE: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

The above table gives the short-term estimates which found the importance of persistence of formation inflation expectation, as two lags are significantly impacting current inflation.[15] The conclusions about all the explanatory variables are similar to the long-run results. Further, the money supply was again found insignificant in the short run. This result corroborates that money matters for inflation in the long term only. The magnitude of the lag ECM term that shows adjustment back to the long term equilibrium relationship is highly significant which suggests that the system converges back to equilibrium in almost four periods.

4.1.3 The Comparative Analysis Across GDP Deflator And WPI Indices

(A) The comparative analysis for GDP deflator inflation

This section discusses the results of the impact of hypothesized global and domestic variables on the GDP deflator as another inflation indicator. The empirical analysis is conducted on the prominent indicator of domestic inflation that is CPI, which is widely accepted across empirical studies and policy issues. The analysis and empirical results are discussed in the previous section but, the objective behind this section is to relate and compare the main results qualitatively over the other indicators of domestic inflation like GDP deflator and wholesale price index (WPI).

15 The coefficients of the inflation lags are 0.69 (0.125) and 0.25 (0.129) respectively. The values in the parenthesis are their respective standard errors.

The empirical results of both long-term and short-term relationships between indicators of economic openness (trade and financial openness) and inflation proxies like GDP deflator and WPI are tabulated in appendix B. First, table B-1 to B-6 in appendix B reports the GDP deflator results. The long-term co-integration relation exists between the GDP deflator and the set of explanatory variables. These estimates show some differences from the CPI inflation result: first, trade openness and world inflation are insignificant statistically. The reason may be that the GDP deflator reflects the prices of domestic production only and does not contain imports. In the same way, world inflation shocks are irrelevant for the GDP deflator. Thus, the rest of the conclusion holds the same as that for CPI inflation qualitatively. The same inference can be drawn in the short run as well. Further, the dummy variable has the same expected negative sign and is significant.

Further, replacing the trade and financial openness with the KOF index of globalization does not change the conclusion. As table B-5 and B-6 in appendix B shows that in long term as well as in the short term KOF index and world inflation are both insignificant respectively. So, this result corroborates the above finding that GDP deflator has no statistical relation with trade openness, world inflation, and even with the comprehensive measure of economic globalization (KOF) both in the long term horizon as well as in the short term. However, the dummy variable is shown to exert a negative and significant influence.

(B) The Comparative Analysis For Wholesale Price Index (WPI) Inflation:

For WPI inflation the conclusion remains entirely the same as for CPI inflation qualitatively. The empirical results are placed in appendix B, from table B-7 to table B-11. The long-run co-integration relation also exists between WPI inflation and the set of explanatory variables.

The impact of trade and financial market openness on WPI inflation is completely identical to the CPI inflation results. Further, the KOF index of economic globalization also hurts WPI both in the long as well as in the short term. This may partly reflect the reason that Pakistan importing raw inputs and machinery, the demand for which is certainly inelastic. This line of reasoning is further justified by the significance of world inflation and output. So, it seems that comparatively, WPI and CPI reflect the same behavior concerning economic openness, global determinants, and government dummy, both in the long term and short term as well.

4.2 The Philips curve and global slack hypothesis

This section consists of the test for the global slack hypothesis in the Philips curve. One of the main objectives is to find whether the global factors have changed

the structure of domestic inflation rendering the traditional country-specific model irrelevant, or it has never changed the traditional structure substantially (Borio & Filardo, 2007). The reduced form augmented Phillips curve specified above is estimated which includes global slack (output gap) along with the traditional domestic slack variable. It is computed by the simple Ordinary Least Square (OLS) method. This analysis is helpful to examine the short-term inflation dynamics and to test for the global slack hypothesis. The analyses are done in three-time frames to highlight the relative importance of the global and domestic output gap over time. First, the slopes are estimated for the entire sample from 1970 to 2018, and then these are re-estimated from 1970 to 1990, and finally from 1991 to 2018 respectively to find the relative importance over time.

To begin with, the reduced form Phillips curve is estimated on the domestic output gap only. The results are given in the first column of Table 7 below. Next, the global output gap is included and the equation is re-estimated given in the second column of table 7. This is for comparison motive among global and domestic output gaps in the Phillips curve. After that, the comparative analysis is conducted over time. These comparative estimates for the periods of 1970-1990 and 1991-2018 are given in column 3 and 4 respectively in table 7.

Column 1 and 2 shows that the inclusion of global slack proxy adds explanatory power to traditional reduced-form Phillips curve which makes domestic slack variable (output gap) insignificant at 5% and thus supplants the domestic slack measure. The coefficient of the global gap is larger than the domestic gap. These findings are substantial even in the presence of import inflation which captures the external influences, so it shows much resemblance to (Borio & Filardo, 2007) findings. Thus, it validates the global slack hypothesis.

One explanation might seem that the pricing behavior of domestic producers is changed due to enhanced competition as a function of globalization, thus fades the importance of domestic economy demand pressure (output gap) on inflation. It suggests that either the relation between marginal cost which is a function of domestic output level and thus inflation is declined or the marginal cost becomes a function of global output.

The results in columns 3 and 4 reveal that in the first sample period the importance of the domestic output gap is greater as compared to global and in the second sample period the importance of both falls. Comparatively the global output gap is still a significant factor for inflation dynamics and the domestic output gap completely loosed its role both in terms of the size of coefficient and statistical significance. This evidence is also in line with (Borio & Filardo, 2007). This shows that the global slack

is important for the short-run inflation dynamics and further, its relevance is comparatively greater than domestic slack, but individually its relevance is decreasing slightly.

Table 7: Slopes Coefficients Of Global And Domestic Output Gaps In The Philips Relation (Dependent Variable: ∏t)

Variables	(1) Full sample without global gap (1970-2018)	(2) Full sample with16 global gap (1970-2018)	(3) 1st sample with both gaps (1970-1990)	(4) 2nd sample with both gaps (1991-2018)
Constant	1.85** [1.757]	2.09** [1.983]	1.96 [1.188]	0.83 [0.482]
π¬¬t-1	0.55* [5.416]	0.53* [5.894]	0.41* [2.826]	0.63* [3.606]
π¬¬t-2	0.002 [0.016]	0.04 [0.459]	0.15 [0.834]	0.04 [0.240]
Ht-1	3.77** [2.399]	2.21*** [1.832]	4.32*** [1.804]	0.36 [0.212]
Ft-1	-	2.34* [2.733]	3.94*** [1.928]	1.61** [2.243]
πimpt	0.16** [2.348]	0.14** [2.361]	0.13*** [1.827]	0.19* [2.854]
R2	0.59	0.68	0.75	0.71
Adj R2	0.54	0.63	0.65	0.61
F. Value	12.77 (0.00)	14.79 (0.00)	7.90 (0.00)	7.39 (0.00)
Durbin-Watson	2.63	2.34	2.31	2.01

Note: Ht-1 and Ft-1 are domestic and global output gaps respectively and πimp is the import prices. The t- statistics are contained within the parenthesis. The t-ratios are based on HAC estimated standard errors. *, ** and *** over the coefficients indicate significance level at 1%, 5%, and 10% respectively.

Also, the coefficient of import price inflation further provides support for the role of global factors in the inflation dynamics as its size becomes larger in the next sample period, and this result is compatible with, (IMF, 2006). Moreover, the positive and significant impact of import prices is compatible with the results of (Pain, Koske & Sollie, 2008). Thus, it satisfies the hypothesis that import prices are an important factor for short-run inflation dynamics (Phillips curve) and even its significance is increasing over time.

5. Conclusion

The study is mainly concerned with finding the global determinants of inflation in Pakistan. The recent trend observed since 1980 and particularly after 1990 is the worldwide integration of economies in terms of economic, social, political, and cultural integration. These developments have many macro-economic implications for economies where inflation is one of them. Though, economic literature contains a

16 By using other measures for global output gap like bilateral trade of exports and imports instead of imports as weights does not change the general conclusion of the empirical results.

plethora of work on its causes, cures, and its consequences. But the question raised in this work is the impact of economic openness on the inflation trend and global slack hypothesis.

To achieve these objectives, the study estimated various versions of ARDL model by incorporating different proxies of openness and inflation. At first the dynamic impact of trade openness in the framework of ARDL on CPI inflation was investigated, where finding suggest that trade openness in Pakistan is inflationary. More specifically, trade openness leads to high average inflation. Our results are consistent with (Mukhtar, Jehan & Bilquees, 2019; Munir & Kiani, 2011) while in contrast with (Afzal et al., 2013; Mukhtar, 2010). Moreover, financial sector openness and development has favorable implications in term of inflation. It significantly reduces domestic inflation in Pakistan. In addition, the direct influences of world output and inflationary shock have important bearings for Pakistan, as these shocks directly transmit to Pakistan price inflation. All these findings and results suggest that in the long term these global factors and openness of the domestic economy have implications for inflation.

We then replace the trade and financial openness variables with the KOF index of economic openness/globalization and employed the same econometric method to examine its impact on domestic inflation. Our results show that openness leads to deflationary trends. This provides us the conclusion that although trade is inflationary still other components of openness may be contributing toward low and stable inflation performance. This suggests the importance of dimensions of globalization other than trade. These conclusions also hold in the short term as the empirical results suggest. In this regard, Ul Haq, Zhu, Shafiq & Khan (2016) investigated the impact of different proxies of openness on inflation in South Asia and South East Asia by employing OLS, GMM and random effect model and conclude that it is the methodology and not the proxy of openness that matter for inflation. The study finds that different proxies of openness has negative impact on inflation. Moreover, the analysis of comparative analysis across various indicators shows that consumer price inflation and wholesale price inflation share almost the same conclusion but a slight difference observed regarding the impact of the KOF index, global inflation, and trade openness on GDP deflator. The results suggest that these factors have no consequences for GDP deflator because this indicator is based on the prices of nationally produced goods. Therefore, the overall conclusion remains the same and the global factors and openness of the domestic economy have important bearings on inflation in long term and short term as well.

Further, it corroborates the importance of global forces, as the global slack hypothesis is validated in Pakistan suggested by empirical findings. In addition, the

hypothesis that global slack is the contributing factor, but its impact is not increasing with time is established based on empirical results. However, study exist maintaining that global resource capacity as a driver of domestic inflation cannot be validated for Pakistan, India and China (Abbas, 2018). However, comparatively the global slack dominating the domestic slack, and in this sense, its importance is growing with time. Finally, another indicator of foreign influences which is import prices is also an important factor for short-term inflationary dynamics. That is, it significantly influences the Phillips curve and also its impact is growing over time.

Finally, we also bring into the context the effect of political regime type on domestic inflation in Pakistan. The political regime type i.e. democracy and autocracy are controlled by the use of a dummy, where results show that military (autocratic) regimes are associated with low inflation in Pakistan's economy. Our results are in line with studies conducted in Pakistan. Haider et al., (2011) conclude that high instability in democratic regimes is the result of week governance and high corruption which in turn causes high inflation in Pakistan. Some policy implications could be drawn on the basis of study findings. To pursue the objective of low and stable inflation along with steady-state growth in the economy the monetary authority must pay much attention and efforts should be done to open and develop the financial sector of the economy. Based on empirics, the domestic output gap and demand pressure in the domestic economy becomes irrelevant for inflation dynamics. This recent development carries two different important implications for policymakers: First, the positive output gap becomes less inflationary over time, and second, it would be difficult for the authority to stabilize the inflationary pressure because the cost associated with the reduction of inflation rises. Imports substitution-led industrialization policy will help to improve long-run inflation behavior.

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Appendix A

Table A-1: Descriptive Statistics

	CPI	GDPdep	WPI	TO	PCI	ER	MS	FO	KOF	WGDP	WINF
Mean	3.79	3.65	3.75	3.49	6.07	5.35	12.90	3.33	3.32	16.98	2.18
Median	3.78	3.55	3.73	3.52	6.11	5.39	12.80	3.31	3.26	17.01	2.39
Maximum	5.56	5.73	5.72	3.66	6.51	6.79	15.74	3.55	3.76	17.56	3.40
Minimum	1.90	1.67	1.69	2.99	5.63	4.13	9.94	3.01	3.03	16.31	0.78
Std. Dev.	1.01	1.12	1.09	0.13	0.27	0.68	1.74	0.13	0.23	0.37	0.68
Skewness	-0.15	0.01	-0.12	-1.76	-0.12	0.02	-0.05	-0.03	0.37	-0.11	-0.19
Kurtosis	2.04	2.00	2.04	6.90	1.85	2.21	1.82	2.54	1.72	1.83	1.75
Jarque-Bera	1.75	1.72	1.71	48.33	2.38	1.08	2.45	0.37	3.82	2.45	2.98
Probability	0.41	0.42	0.42	0.00	0.30	0.58	0.29	0.82	0.14	0.29	0.22
Sum	159.5	153.7	157.5	146.7	255.0	224.9	541.8	139.8	139.6	713.5	91.6
Sum Sq. Dev.	42.03	52.34	49.50	0.74	3.04	19.21	125.47	0.72	2.27	5.62	19.44
Obs	49	49	49	49	49	49	49	49	49	49	49

Table A-2: Testing Unit Root For Stationary Variables Set In ARDL.

Variables	Augmented Dickey-Fuller			Phillips Perron				
	Level	P-value	1st Dif:	P-value	Level	P-Value	1st Dif:	P-value
πCPI[17]	-4.18	0.01	-	-	-2.31	0.42	-3.31	0.08
πdeflator	-3.38	0.06	-	-	-2.15	0.50	-3.42	0.06
πWPI	-2.93	0.16	-4.01	0.01	-2.05	0.55	-3.67	0.03
TO	-3.58	0.01	-	-	-3.58	0.01	-	-
FO	-3.06	0.03	-	-	-2.16	0.22	-4.46	0.00
WGDP	-3.67	0.03	-	-	-4.37	0.00	-	-
WINF	-1.46	0.54	-7.31	0.00	-1.29	0.62	-7.95	0.00
KOF	-2.54	0.30	-6.93	0.00	-2.54	0.30	-28.41	0.00
PCI	-1.91	0.63	-5.16	0.00	-1.91	0.63	-5.16	0.00
MS	-3.01	0.14	-5.13	0.00	-2.23	0.45	-5.13	0.00
ER	-5.34	0.00	-	-	-3.02	0.13	-4.62	0.00

Table A-3: Testing Unit Root For Stationarity Of Variables Set In Phillips Curve.

Variables	Augmented Dickey-Fuller			Phillips Perron				
	Level	P-value	1st Dif:	P-value	Level	P-Value	1st Dif:	P-value
Inf	-3.28	0.08	-	-	-3.33	0.07	-	-
H^t	-7.55	0.00	-	-	-7.64	0.00	-	-
F^t	-6.03	0.00	-	-	-6.23	0.00	-	-
Impinf	-4.29	0.01	-	-	-4.29	0.01	-	-

17 The ADF and P-P tests gives opposite conclusion to each other. ADF suggest that the underlying variable is I(0), while Phillips-Perron considers it integrated as I(1). Also, the result from KPSS test runs in the favor towards I(1). The result is produced here: LM statistics = 0.8190, under H0: lcpi is stationary. The critical asymptotic values: at 1% = 0.2160, at 5% = 0.1460 and at 10% = 0.1190

Appendix B

The long-term and short-term results of GDP deflator and wholesale price (WPI) index are tabulated in this section of the appendix.

(i) GDP Deflator, Trade Openness, And Financial Openness Results

Table B-1: Bound Test Values Of The Estimated UECM For GDP Deflator, TO, And FO.

Lags	Computed F-statistics
1	F(9, 29) = 9.22*
2	F(9, 21) = 5.43**

The relevant critical values (no trend and unrestricted intercept) are taken from (Pesaran et al., 2001). At 10% significance level the bound values are 1.95 & 3.06, at 5% significance level the corresponding bound values are 2.22 & 3.39 and at 1% significance level are 2.79 & 4.10 respectively. *** indicates significance at 10%, ** at 5% and * at 1% level.

Table B-2: Long Run ARDL Estimates Of GDP Deflator Index Dependent Variable ($\prod_{gdp\ Deflator}$)

Variable	Coefficient	Standard Error	t- Ratio
Constant	15.35*	6.836	2.247
FO	-0.49**	0.255	-1.921
TO	-0.46	0.278	-1.65
W.INF	0.02	0.08	0.25
W.GDP	-1.94*	0.652	-2.975
PCI	-0.45	0.826	-0.544
MS	0.86*	0.141	6.099
ER	-0.77*	0.313	-2.460
D	-0.10	0.048	-2.136
	R2 0.99	Adj R2 0.99	D-W 2.21
Auto-Correlation	Chi-Sq (1) = 0.010 [0.789]	F (1, 32) = 0.125 [0.418]	
Hetero-Scedasticity	Chi-Sq (1) = 1.743 [0.255]	F (1, 45) = 1.103 [0.325]	
Normality	Chi-Sq (2) = 0.251 [0.760]		

NOTE: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

Table B-3: Short-Run ARDL Estimates Of GDP Deflator Index Dependent Variable Δ ($\prod_{\text{gdp Deflator}}$)

Variable	Coefficient	Standard Error	t- Ratio
Constant	9.54**	3.421	2.788
Δ(FIN)	-0.29*	0.120	-2.416
Δ(TOP)	0.009	0.070	0.128
Δ(W.INF)	0.015	0.110	0.136
Δ(W.GDP)	-0.61*	0.293	-2.081
Δ(PCI)	0.58	0.946	0.613
Δ(MS)	0.24	0.472	0.508
Δ(ER)	-0.42*	0.142	-2.957
D	-0.29*	0.091	-3.186
ECM(-1)	-0.31*	0.114	-2.719
	R2 0.89	Adj R2 0.77	D.W 2.03

NOTE: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

(ii) GDPdeflator and KOF index results

Table B-4: Bound Test Values Of The Estimated UECM For GDP Deflator Index And KOF Index Of Globalization.

Lags	Computed F-statistic
1	F (8, 28) = 9.01*
2	F (8, 23) = 5.87*

The critical bounds are collected from (Pesaran et al., 2001). At 10% level, the bound values are 2.03 & 3.13, at 5% significance level, the corresponding bound values are 2.32 & 3.50 and at 1% significance level are 2.96 & 4.26 respectively. *** indicates significance at 10%, ** at 5% and * at 1%.

Table B-5: Long Run ARDL Estimates Of GDP Deflator Index That Includes KOF Index Of Globalization. Dependent Variable: ($\prod_{gdp\text{-}deflator}$)

Variable	Coefficient	Standard Error	t- Ratio
Constant	45.62*	22.156	2.059
KOF	-0.41	0.537	-0.763
W.INF	0.45	0.299	1.499
W.GDP	-1.89	1.692	-1.117
PCI	0.85	0.786	1.081
MS	0.89*	0.424	2.099
ER	-2.49*	0.798	-3.120
D	-0.54*	0.197	-2.741
	R2 0.99	Adj R2 0.99	D-W 2.05
Serial-Correlation	Chi-Sq (1) = 0.08 [0.452	F (1, 32) = 0.002 [0.649]	
Hetero-Scedasticity	Chi-Sq (1) = 0.764 [0.517]	F (1, 43) = 0.321 [0.410]	
Normality	Chi-Sq (2) = 0.913 [0.142]		

NOTE: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

Table B-6: Short-Term ARDL Estimates Of GDP Deflator Index That Includes KOF Index Of Globalization. Dependent Variable: Δ (∏gdp Deflator)

Variable	Coefficient	Standard Error	t- Ratio
Constant	15.45*	4.815	3.208
Δ(KOF)	0.45	0.514	0.875
Δ(W.INF)	0.51	0.761	0.670
Δ(W.GDP)	-2.45*	0.897	-2.731
Δ(PCI)	0.76*	0.254	2.992
Δ(MS)	0.38*	0.142	2.676
Δ(ER)	-0.25	0.181	-1.381
D	0.28	0.58	0.482
ECM(-1)	-0.41*	0.128	-3.203
	R2 0.88	Adj R2 0.78	D-W 1.90

NOTE: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

(iii) Wholesale price index (WPI), TO, and FO

Table B-7: Bound Test Values Of The Estimated UECM For WPI Index, TO And FO

Lags	F-value
1	F (9, 28) = 7.49*
2	F (9, 20) = 11.49*

The relevant critical values (no trend and unrestricted intercept) are collected from (Pesaran et al., 2001). At 10% significance level the bound values are 1.95 & 3.06, at 5% significance level the corresponding bound values are 2.22 & 3.39 and at 1% significance level are 2.79 & 4.10 respectively. *** indicates significance at 10%, ** at 5% and * at 1%.

Table B-8: Long-Term ARDL Estimates Of WPI Index Of Inflation That Includes TO And FO. Dependent Variable: ($\prod_{wpi}$)

Variable	Coefficient	Standard Error	t- Ratio
Constant	42.42*	11.510	3.685
FIN	-0.24*	0.113	-2.123
TO	1.14**	0.472	2.415
W.INF	0.17*	0.029	5.862
W.GDP	-0.91**	0.462	-1.969
PCI	-0.86*	0.245	-3.510
MS	1.05*	0.189	5.555
ER	-0.45	0.421	-1.068
D	-0.68**	0.342	-1.988
	R2 0.99	Adj R2 0.99	D-W 2.16
Serial-Correlation	Chi-Sq (1) = 1.046 [0.385]		F(1, 31) = 0.776 [0.471]
Hetero-Scedasticity	Chi-Sq (1) = 1.646 [0.442]		F(1, 44) = 1.946 [0.348]
Normality	Chi-Sq (2) = 2.751 [0.106]		

Note: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

Table B-9: Short-Term ARDL Estimates Of WPI Index Of Inflation That Includes TO And FO. Dependent Variable: Δ (∏wpi)

Variable	Coefficient	Standard Error	t- Ratio
Constant	38.66*	9.241	4.183
Δ(FIN)	-0.04*	0.011	-3.636
Δ(TO)	0.64*	0.096	6.666
Δ(W.GDP)	0.21	0.046	4.565
Δ(W.INF)	0.005	0.024	0.208
Δ(PCI)	-0.83***	0.510	1.627
Δ(MS)	0.94	1.054	0.891
Δ(ER)	-0.65*	0.170	-2.586
D	-0.19***	0.101	1.881
Ecm(-1)	-0.47*	0.069	-6.811
	R2 0.88	Adj R2 0.78	D-W 2.15

Note: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

(iv) WPI Inflation On KOF Index Of Globalization

Table B-10: Bound Test Values Of The Estimated UECM For WPI Index And KOF Index Of Globalization

Lags	F-statistics
1	F (8, 30) = 7.84*
2	F (8, 27) = 5.34*
3	F (8, 24) = 3.12**

The relevant critical bounds are gathered from (Pesaran et al., 2001). At 10%, the critical bound values are 2.03 & 3.13, at 5% level, the corresponding bound values are 2.32 & 3.50 and at 1% significance level are 2.96 & 4.26 respectively. *** indicates significance of statistic at 10%, ** at 5% and * at 1%.

Table B-11: Long Run ARDL Estimates Of WPI Index Of Inflation That Includes KOF Index Of Globalization. Dependent Variable: ($\prod_{wpi}$)

Variable	Coefficient	Standard Error	t- Ratio
Constant	12.80	10.412	1.229
KOF	-0.58*	0.229	-2.532
W.INF	0.46*	0.164	2.804
W.GDP	0.15	0.680	0.220
PCI	-0.76*	0.174	-4.367
MS	0.91*	0.422	2.156
ER	-0.78	0.894	-0.872
D	-0.69***	0.491	-1.405
	R2 0.99	Adj R2 0.99	D-W 2.14
Serial-Correlation	Chi-Sq (1) = 1.321 [0.292]	F(1, 31) = 1.163 [0.327]	
Hetero-Scedasticity	Chi-Sq (1) = 2.113 [0.213]	F(1, 43) = 2.254[0.184]	
Normality	Chi-Sq (2) = 1.523 [0.467]		

Note: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

Table B-12: Short-Run ARDL Estimates Of WPI Index Of Inflation That Includes KOF Index Of Globalization. Dependent Variable: Δ ($\prod_{wpi}$)

Variable	Coefficient	Standard Error	t- Ratio
Constant	2.14	2.787	0.767
D	-0.14	0.162	-0.864
Δ(KOF)	-0.74**	0.386	-1.917
Δ (W.GDP)	0.24**	0.126	1.904
Δ (W.INF)	0.01	0.051	0.196
Δ (PCI)	-0.56**	0.341	-1.642
Δ (MS)	0.38	0.561	0.677
Δ (ER)	-0.84*	0.382	-2.198
Ecm(-1)	-0.24*	0.103	-2.330
	R2 0.78	Adj R2 0.69	D-W 2.20

Note: *, **and *** shows significance of the estimates at 1%, 5% and 10% level respectively.

Appendix C

Diagnostic Test Of The Phillips Curve.

Table C-1: Hausman's Endogeneity Test Dependent Variable Δ (∏cpi)

Variable	Coefficient	Standard errors	t-ratio
Constant	9.473*	0.895	10.583
Ht	2.190	9.593	0.228
Resid	-3.175	9.884	-0.321
R2	0.0056		
F-Statistic	0.1113		
Durbin-Watson	0.8696		

*, ** and *** shows significance at 1%, 5% and 10% respectively.

The above table suggests the result that there is no endogeneity problem in the Philips curve equation. This justifies the application of the OLS method to compute the Phillips curve relation.

Table C-2: Breusch-Godfrey Serial Correlation LM Test

F-statistic	2.212752	Probability	0.125867
Obs*R-squared	4.859787	Probability	0.088046

The results above in table C-2 show that there is no serial correlation in the equation estimated by OLS in table 5-7. The F-value is statistically insignificant and also the Chi-square statistic is weakly significant at 8% only.

Table C-3: Sample Correlation Metrics

Variables	π_t	H_t	F_t	π^{imp}_t
π_t	1.000000	-0.055210	0.021283	0.471184
H_t	-0.055210	1.000000	0.240998	0.083929
F_t	0.021283	0.240998	1.000000	0.318850
πimpt	0.471184	0.083929	0.318850	1.000000

The estimated equation does not contain any symptoms of the multicollinearity problem. The above table shows that the correlation among the variables is very weak.

Table C-4: Jarque-Bera Normality Test.

Jarque-Bera statistic	**0.0947**
Probability	0.9537

The normality test shows that the residuals from the equation are normal.

Thus, the entire set of diagnostic tests (assumptions of classical OLS) suggests that all the assumptions of OLS are satisfied and hence, OLS is a suitable technique to estimate equation 10.