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An Empirical Analysis of the Prices of Selected Food Items Across Three Political administrations in Pakistan

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Abstract: This study compares the prices of selected food items across three political administrations in Pakistan. We have taken monthly data from July 2008 to October 2021 of the prices of selected food items from the Pakistan Bureau of Statistics, the Ministry of Finance (Pakistan)'s Pakistan Economic Survey, and Index Mundi. Thirteen food items were selected: Wheat, Basmati Rice, Basmati Super Rice, Basmati Broken Rice, Sindh/Punjab Rice, Tinned Vegetable Ghee, Loose Vegetable Ghee, Whole Masoor Pulse, Washed Masoor Pulse, Washed Mong Pulse, Washed Mash Pulse, Gram Pulse and Refined Sugar. We theorize that an increase in prices will be independent of changes in political administration, as prices are determined purely based on economic factors in the market. We provide graphical and regression analysis, with our study pointing to a consecutive rise in the absolute price of selected food items across all three administrations. Increasing real prices of selected food items are specific to each administration.

Keywords: Political administration; selected food items; nominal prices; real prices; food inflation; ARDL model.

JEL Classification: L66, N70, Q11.

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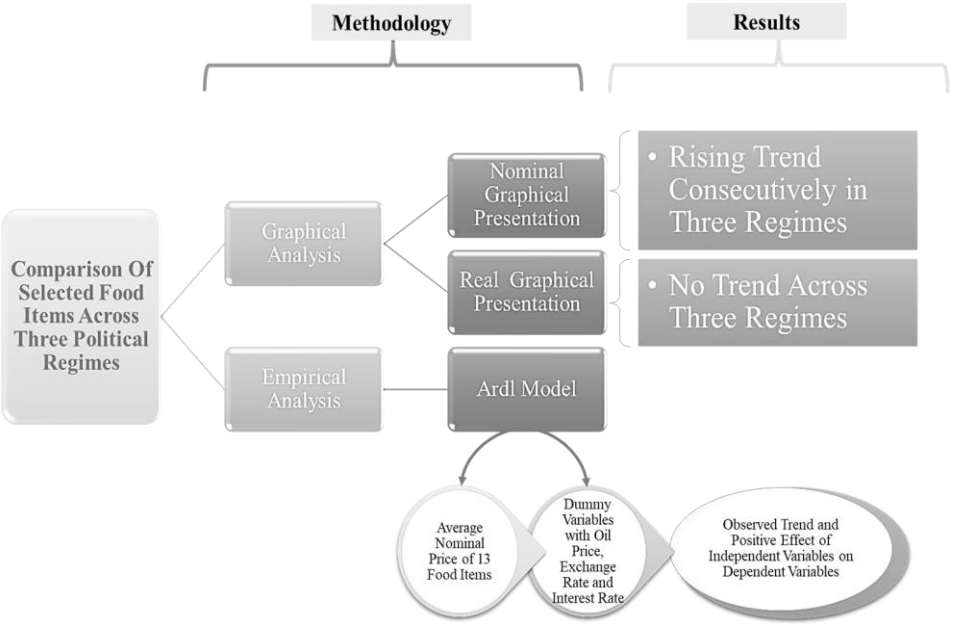
Graphical Abstract



1. Introduction

The past decade has seen an increase of the price of essential food items across the globe. Increasing prices of food, also often referred to as food inflation, is a heavily studied area of economic research and fluctuations in food prices and food inflation levels are also a matter of serious concern for policymakers – if a government has no control over food prices, the impact on poor or lower-income families will be severe. A shortage of food supply, coupled with ever growing food demand, negatively impacts consumer welfare (World Bank, 2008).

Pakistan has gone through periods of severe economic strain a number of times, with 2005-2006 being the first significant period of the 21st century: the shortage of grain (for foodstuff) due to natural disasters such as the 2005 Kashmir earthquake; political instability impacting fiscal monetary policies; supply shocks; rising petroleum prices; and an export-import situation that exacerbated food inflation (Ahsan et al., 2011; Abdullah & Kalim, 2011). Food inflation levels rose again in the period

starting in 2008, with an inflation rate of 8.8 percent recorded in December 2008. However, the inflation rate jumped to 20.5 and 21.1 percent in January and February 2009, respectively. At the end of July 2009, the inflation rate was recorded at 25.1 percent, the highest recorded over the course of the Pakistan People's Party (PPP) government's 2008-2013 tenure. Food inflation had been comparatively low in the post-2013 tenure of the Pakistan Muslim League-Nawaz (PML-N) government but the overall condition of the economy had not visibly improved, owing to discrepancies between expenditure and revenue intake that resulted in a shortfall, and the fiscal deficit making up 5.8 percent of the GDP in 2017-2018. The post-2018 governance of the Pakistan Tehreek-e-Insaaf (PTI) administration saw food inflation levels of 23.8 percent in rural areas, and 19.5 percent in urban areas, in 2020, with the cost of food items increasing rapidly during the early part of the global COVID-19 pandemic – exacerbating the already serious situation pertaining to household's ability to purchase food (Khan, 2021).

In this study, we will use two approaches - graphical and empirical - to ascertain the nominal and real prices of thirteen selected food items across three administrations in Pakistan: the Pakistani People's Party (PPP), the Pakistan Muslim League Nawaz (PML-N), and Pakistan Tehreek-e-Insaaf (PTI) administrations. We aim to do so by examining data from January 2008-October 2021. In do so, and in studying the nominal and real prices as discussed, we aim to calculate the average changes in prices.

For our graphical analysis, we plot time trends of nominal and real prices of selected food items whereas for our regression analysis we use time period indicators to represent different administrations in order to check the effects of the nominal diesel price and nominal interest rate on average prices of selected food items. The food items that we focus on are: Wheat, Basmati Rice, Basmati Super Rice, Basmati Broken Rice, Sindh/Punjab Rice, Tinned Vegetable Ghee, Loose Vegetable Ghee, Whole Masoor Pulse, Washed Masoor Pulse, Washed Mong Pulse, Washed Mash Pulse, Gram Pulse and Refined Sugar. In practice, we present two figures to ascertain the nominal and real price trends. For our empirical analysis, we used an ARDL model, supplemented with assessment mechanisms such as the Augmented Dickey-Fuller test (ADF test) to check for stationarity, the Cumulative Sum Control Chart (CUSUM) test to ascertain model stability, the Variance Inflation Factor (VIF) to test for multicollinearity, and White's test to test for heteroskedasticity. By analyzing the trends of selected food items via graphs across three political administrations, we estimate the

effects of the nominal diesel price and nominal interest rate on nominal average prices of selected food items.

Our graphical analysis confirms that the nominal average price of selected food items moves upward across all three political administrations in this case study (PPP, PMLN, PTI), although the changes in average real prices are not significant across these governments. Also, our empirical results appear to support the graphical results. Our estimates, containing dummy indicator variables, confirm that the prices of selected food items experienced an upward trend. A positive relationship between the nominal diesel price and the nominal average price of selected food items could also be inferred: if the price of diesel rises, market prices also rise. Interest rates and market prices of selected food items have a positive relationship meaning that the prices of selected food items and interest rates increase together. There is no evident long-run relationship between independent and dependent variables.

The rest of the paper is as follows: Section 2 is a review of the literature as it pertains to our study; Section 3 describes and discusses the graphical results; Section 4 examines and discusses the data and methodology; Section 5 looks at regression results and discussions; finally, Section 6 presents our conclusions.

2. Relevant Literature

The literature on the market prices of food items, their fluctuations, and their interlinkages with the real economy is extensive (Deaton, 1999; Beck, 2001; Cashin et al. 2002; Enders & Holt, 2012; Karali & Power, 2013). Saadi, (2011) reviews the literature on the dynamics of food items in international markets. The upward and downward movements of food items are one of the most analyzed aspects of the literature on commodity prices (Pindyck & Rotemberg, 1990).

Chand (2010) examines the factors that were suggested to lead to increased food inflation during the PPP administration in 2009. These factors include international trade, international prices, speculative activities, food management and supply shocks. Some of these factors had impacts in the short-term, whilst others were more long-term, in regards to influencing or informing food inflation levels. According to Ivanic et al. (2011), the upsurge in commodity prices during 2007-2008 and 2010-2011 had an overall negative effect on the population – the poor in particular – especially keeping in mind that people in developing countries like

Pakistan spend a significant proportion of their income on food items. A number of studies have investigated the determinants behind these price fluctuations: Frankel (2008), for instance, indicates that the real interest rate may be an important determinant of the prices of oil and other mineral and agricultural commodities. Svensson (2008) highlights the importance of considering aggregate supply-and-demand shifts to explain commodity price dynamics. Gilbert (2010) asserts that the recent commonality of rises and falls in the price of energy, metals, and food items is unlikely to be coincidental, and that it may well be the result of a common set of macroeconomic and financial factors driving prices across a wide range of commodities. Byrne et al. (2013) document a significant degree of price co-movement across 24 commodities and argue that such co-movements may be due to common factors related to macroeconomic fundamentals, such as the real interest rate and stock market uncertainty. Awan & Imran (2015) concluded that high-interest rate and cost-push variables, including fuel costs, money supply, and per capita GDP, are directly related to food inflation while foreign aid is adversely related to food inflation in Pakistan. Habib et al. (2021) examined the factors that impacted the price volatility of selected food items in Pakistan and found that price volatility was significantly affected by changes in interest and exchange rates. They also found that the volatility of wheat prices impacted the prices of rice.

Setiawan & Hadianto (2014) examine the fluctuation of food prices for food items such as corn, rice, curly red chili, onion, beef, eggs, and chicken in Banten province (Indonesia) and that the increases in the prices of these goods had the greatest impact on overall food inflation in the long run. Ilman et al. (2020) investigated the relationship between the prices of meat, chili, rice, and chicken and the volatile inflation rate in the Indonesian province of Nusa Tenggara Barat, though he did not find a significant relationship.

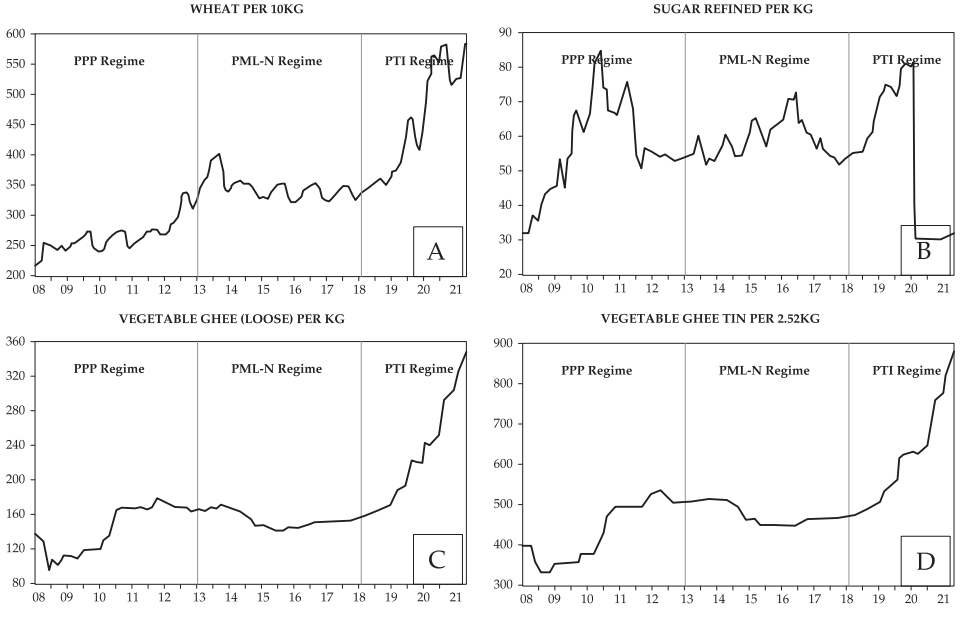
Batool et al. (2021) finds that the COVID-19 pandemic has had a detrimental impact on global economies, and that the economic ramifications of preventive measures, such as lockdowns, were and continue to be extremely high. Asghar et al. (2020) contends that the impacts of COVID-19 have led to one of the worst economic slumps since the Great Depression of the 1930s.

We contribute to the existing literature by comparing the prices of selected food items graphically as well as via empirical testing, to see the factors that impact these prices across multiple political administrations. We find that the prices of selected food items rise in each of these

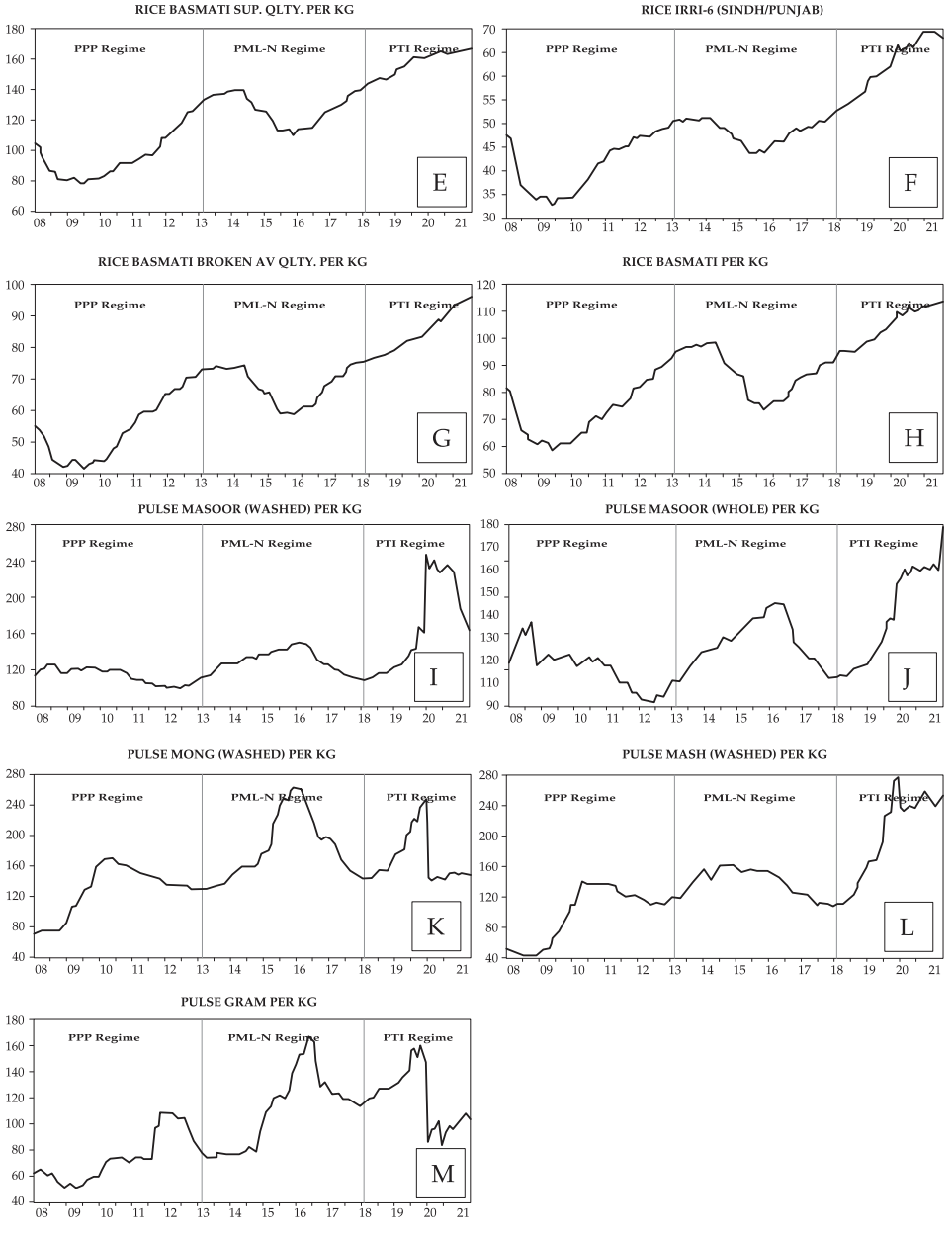
administrations as well as across administrations. We also empirically find that diesel prices, interest rates and exchange rates have a significant impact on the average prices of selected food items in the short and long run across administrations. We will divide our graphical analysis into an analysis of absolute food prices across administrations as well as an analysis of real food prices across administrations[1] where the real price is adjusted for inflation. In our empirical analysis using dummy indicator variables representing different political administrations, we alternate the base period: so we perform three different estimations with either the PTI period being the base period, the PML-N period being the base period and then the PPP period being the base period.

3. Graphical results and discussions

Figure 1



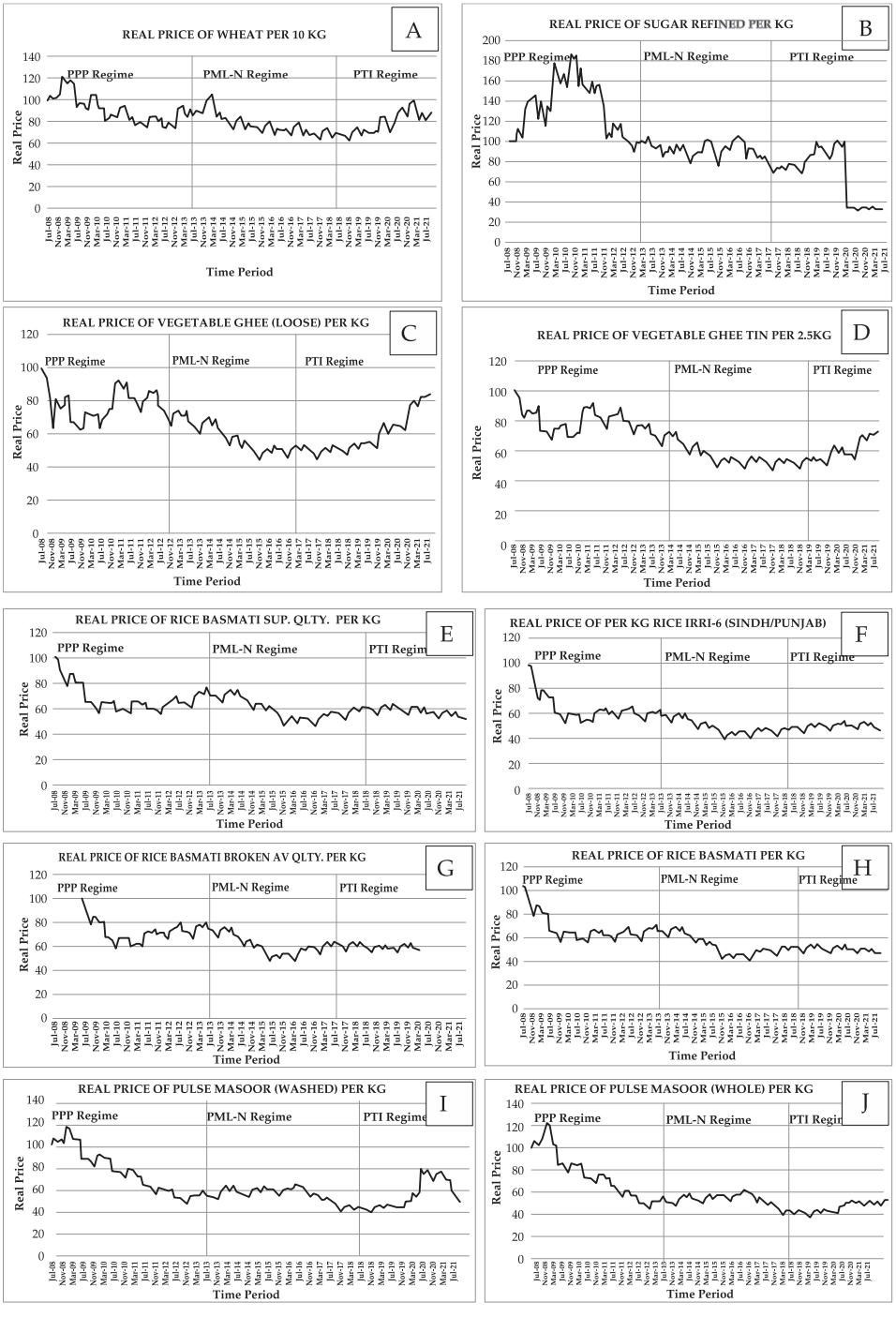
[1] Nominal price divided by price index (general CPI) multiplied by 100.

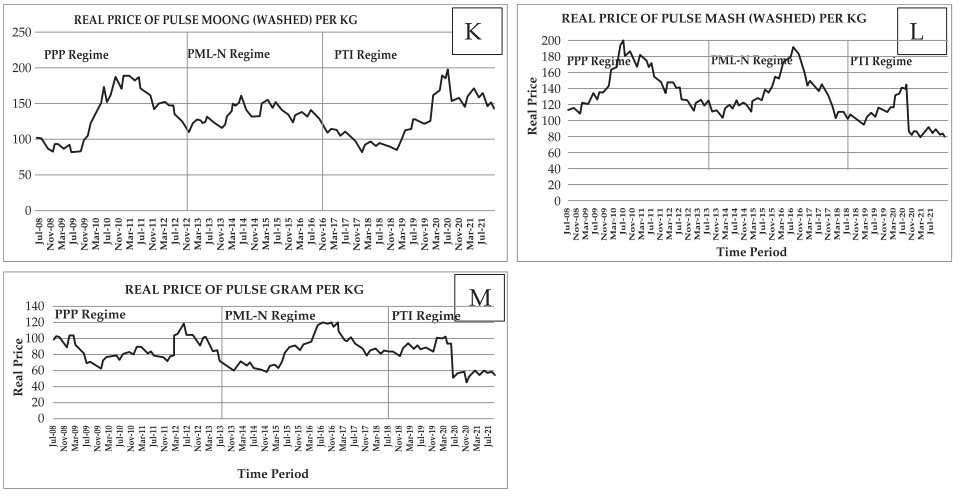


Source: Authors' calculations.

Figure 1 (A-M): Nominal price of selected food items. Thirteen food items have been chosen for comparison across three political administrations as Wheat, Basmati Rice, Basmati Super Rice, Basmati Broken Rice, Sindh/Punjab Rice, Tinned Vegetable Ghee, Loose Vegetable Ghee, Whole Masoor Pulse, Washed Masoor Pulse, Washed Mong Pulse, Washed Mash Pulse, Gram Pulse and Refined Sugar.

Figure 2

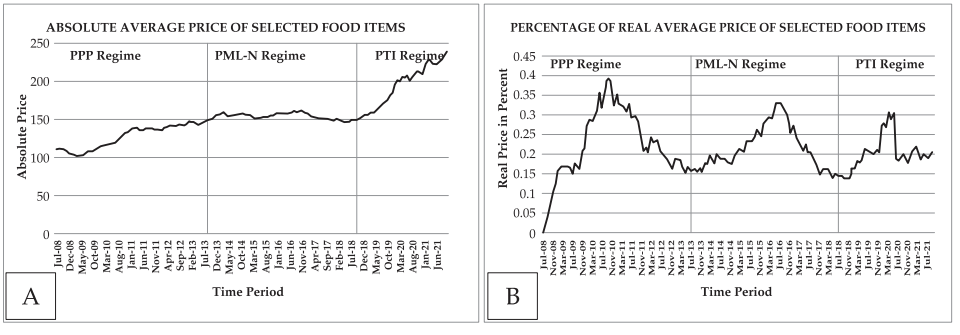

A
REAL PRICE OF WHEAT PER 10 KG
PPP Regime
PML-N Regime
PTI Regime
Real Price
Time Period
B
REAL PRICE OF SUGAR REFINED PER KG
PPP Regime
PML-N Regime
PTI Regime
Real Price
Time Period
C
REAL PRICE OF VEGETABLE GHEE (LOOSE) PER KG
PPP Regime
PML-N Regime
PTI Regime
Real Price
Time Period
D
REAL PRICE OF VEGETABLE GHEE TIN PER 2.5KG
PPP Regime
PML-N Regime
PTI Regime
Real Price
Time Period
E
REAL PRICE OF RICE BASMATI SUP. QLTY. PER KG
PPP Regime
PML-N Regime
Real Price
Time Period
F
REAL PRICE OF PER KG RICE IRRI-6 (SINDH/PUNJAB)
PPP Regime
PML-N Regime
PTI Regime
Real Price
Time Period
G
REAL PRICE OF RICE BASMATI BROKEN AV QLTY. PER KG
PPP Regime
PML-N Regime
PTI Regime
Real Price
Time Period
H
REAL PRICE OF RICE BASMATI PER KG
PPP Regime
PML-N Regime
PTI Regime
Real Price
Time Period
I
REAL PRICE OF PULSE MASOOR (WASHED) PER KG
PPP Regime
PML-N Regime
Real Price
Time Period
J
REAL PRICE OF PULSE MASOOR (WHOLE) PER KG
PPP Regime
PML-N Regime
Real Price
Time Period



Source: Authors' calculations

Figure 2 (A-M): The real price of selected food items. Thirteen food items have been chosen for comparison across three political administration: Wheat, Basmati Rice, Basmati Super Rice, Basmati Broken Rice, Sindh/Punjab Rice, Tinned Vegetable Ghee, Loose Vegetable Ghee, Whole Masoor Pulse, Washed Masoor Pulse, Washed Mong Pulse, Washed Mash Pulse, Gram Pulse and Refined Sugar.

Figure 3



Source: Authors' calculations

Figure 3: (A) Average Nominal price of selected food items. (B) The average real price of selected food items. Thirteen food items have been chosen for comparison across three political administrations: Wheat, Basmati Rice, Basmati Super Rice, Basmati Broken Rice, Sindh/Punjab Rice, Tinned Vegetable Ghee, Loose Vegetable Ghee, Whole Masoor Pulse,

Washed Masoor Pulse, Washed Mong Pulse, Washed Mash Pulse, Gram Pulse and Refined Sugar.

We compare both the absolute and real prices of selected food items graphically across the three different administrations. The real price of selected food items is adjusted for inflation, with the base month set to July 2008.

The graphs on the left show price trends during the PPP administration, the graphs in the middle show the prices in the PML-N administration, and the graphs on the right show prices during the PTI administration. The prices rise in July 2009, with the price of wheat PKR 273 per 10kg (Figure 1A). This upward trend tends to continue throughout the PML-N administration. The real price of wheat during the PPP administration seems very high from November 2008 to March 2009 (Figure 2A). In the beginning, the PPP administration's wheat price is indicated to be high owing to the global financial crisis, government policies, and the shortage of wheat due to smuggling to Afghanistan. The increase in wheat prices was steeper from May 2013 to March 2014, during which time the price per 10kg of wheat continuously rose, reaching a high of PKR 403 per kg in March 2014. During the PML-N administration, furthermore, the real price of wheat began to fall, starting in March 2014, reflecting the fall in international oil prices. This trend was reversed during the PTI government. The reason for this ranges from the post-Covid-19 pandemic time period to the significant rise in international oil prices. As a result, we see a sharp rise in wheat prices with a high of PKR 584 per 10kg of wheat in March 2021.

Sugar prices follow an upward trend starting in November 2009 where the price of refined sugar was PKR 84 per kg which then decreased to PKR 73 per kg in December 2010 (Figure 1B). At the same time, the real price of sugar (Figure 2B) started out as relatively low in July 2009 but ahd increased significantly by November 2010. During the PML-N administration, prices fluctuated but significantly increased in the PTI administration with the most significant increase in the real price of sugar occurring in May 2020. We can conclude that the real price of sugar was highest during the PPP administration and lowest in the PTI administration.

Figures 1C and 2C show the nominal and real prices of Loose Vegetable Ghee (VGL) across the three administrations. The VGP price in November 2008 was PKR 135 per kg and reached its peak in the PPP administration of PKR 170 per kg in September 2023. During the PML-N administration, VGP prices tended to fall with a price of PKR 139 per kg in

January 2016. But there were huge surges in VGL prices during the PTI administration with a high price of PKR 350 per kg in October 2023.

Figure 1D show the nominal and real prices of Tinned Vegetable Ghee (TVG). In the PPP era, the Tinned Vegetable Ghee (TVG) was PKR 395 per 2.5kg which then fell to PKR 327 per 2.5 kg in March 2009, although this increased again to PKR 534 per 2.5 kg by October 2012. In December 2018, the price of TVH was PKR 482 per 2.5 kg in December 2018. The real price of Tinned Vegetable Ghee in the PPP administration was PKR 100.53 per 2.5kg (Figure 2D). Then the real price fell to PKR 80 in March 2009, and the minimum real price during the PPP administration was PKR 70 in March 2009. During the PML-N administration, the real price of Tinned Vegetable Ghee per 2.5 kg went down but rose again in the PTI administration. The real price of TVG and VGL was highest during the PPP administration, fell in the PML-N administration, and then rose again in the PTI administration.

Figure 1F shows the price of Rice IRRI-6 Sindh/Punjab Rice (RPS) across the three administrations. In the PPP administration, RPS price rose in September 2008 and then fell to PKR 33 rupees per kg in May 2009 and reached a high of PKR 54 per kg in December 2018. During the PPP administration, the price of BR (Basmati Rice) started at around PKR 80 per kg and then increased to PKR 137 per kg by December 2013 (Figure 1H). During the PML-N administration, the price of BR was PKR 94 per kg in January 2014 and increases to a high of PKR 93 per kg by December 2018. This price increased again after that in the PTI administration with a price of PKR 111 per kg in October 2021 (Figure 2H). The real price of RPS was higher during the PPP administration as compared to the PML-N administration and then rises to a high level during the PTI's time.

The price of Broken Basmati Rice (BBR) across the three administrations is shown in Figure 1G. In the PPP administration, the price of BBR was PKR 54 per kg August 2008, rising to PKR 76 in December 2018. The price of BBR remained relatively constant after that and was PKR 93 per kg in October 2021. Figure 1E shows is the price per kg of Super Quality Basmati Rice (SBR) across the three administrations. The price of SBR was KR 104 in July 2008 and then decreased to PKR 78 per kg in December 2009. Then the price rose to PKR 110 per kg by May 2016. By December 2018, the price of SBR hit PKR 137 and reached a maximum of PKR 167 per kg in October 2021. (See Figures 1G and 2G for the real prices of BBR and SBR over time.) The real price rose during the PPP administration, fell during the PML-N administration and then rose again during the PTI administration.

Figure 1I shows the price of Washed Masoor Pulse (WMP) over the three administrations. During the PPP administration, the price of WMP started at PKR 114 per kg and fell to PKR 100 per kg by November 2009. In the PML-N administration, the price of WMP started at PKR 121 rupees per kg in January 2014. Figure 1J shows the price of Whole Pulse Masoor (WPM) for three administrations. In the PPP administrations, the price of WPM started high and then fell dramatically. The minimum price of WPM during this administration is PKR 92 per kg in December 2013. After that, the price rose again and hit a maximum of Rs 140 per kg in July 2016. During the PTI administration, the price of WPM rose after which it fell, while real prices stayed constant and then came down gradually (Figure 2J).

The price of Washed Pulse Moong (WPMA) increased over the course of the three administrations, with a high of PKR 158 per kg in July 2014 under the PML-N administration. Under the PTI government, the price of WPMA fell to PKR 142 per kg by February 2019 (Figure 2K). By February 2020, the price of WPMA rose again to PKR 221. Looking at the real prices (Figure 2L), the real price of mash washed rose in both the PPP and PML-N administrations and fell during the in PTI's administration.

Figure 2M shows the price of Washed pulse gram Maash (PGRAM). During the PPP's rule, prices started at PKR 49 per kg in October 2009 and rose to Rs 108 per kg by May 2012. The lowest price was PKR 72 per kg in November 2013, and the peak price per kg was PKR 168 in November 2016, which fell again to PKIR 102 per kg in October 2021. The real price of pulse grams rose during the PPP administration and fell during the PML-N and PTI administrations.

We can conclude from the above discussion, that the real prices of selected food items tended to be highest during the PPP administration and lowest during the PML-N administrations. Figure 3A shows the absolute average price of selected food items across the three administrations, and it shows that it remained relatively low during the PPP administration. Figure 3B shows the real average price of selected food items, peaking during the PPP administration. This surge was due to many reasons such as the international financial crisis, natural disasters, and political instability in the region. The absolute average price increased the most during the PTI administration which could be due to reasons such as political instability, the COVID-19 pandemic, and increases in the price of oil.

4. Data and Methodology

Here, we discuss the econometric model to be estimated. Our dependent variable is the nominal average price of the selected food commodity (AVR), for which certain food items were selected. Our independent variables are the nominal diesel price (D), nominal interest rate ® and exchange rate (ER) which are used to estimate short and long run impacts. We estimate separate impacts for different administrations by using dummy variables for each administration. Before estimating our ARDL model, we perform tests for stationarity.

4.1 Unit Root Test

Before we estimate an ARDL model, we test to see if the variables are stationary in levels or in first differences. Using the Augmented Dickey-Fuller (ADF) test for stationarity using the formula:

$$\Delta H_t = H_t - H_t - 1$$

A time-series data is stationary assuming that its mean and variance are consistent over a period, while the value of the covariance across time periods is dependent on the gap between the periods. If either of these conditions is not fulfilled, then the variable is non-stationary.

4.2 Theoretical ARDL Model

An autoregressive distributed lag (ARDL) model is an ordinary least squares (OLS) based model, which is valid for both non-stationary time series as well as for times series with mixed order of integration. The ARDL model contains the lags value of the dependent variable and the current and lagged value of the regressor variables. In assessing the ARDL model, the best length (p) was chosen by utilizing the Akaike Information Criterion while ensuring that the error is white noise. After the estimation of the appropriate number of lags, the ARDL model is then specified and estimated.

To apply the ARDL methodology, we first perform the unit root test for three-time series variables in the study to determine whether they are stationary. For this review, the Augmented Dickey-Fuller (ADF) unit root test was applied for this purpose.

4.3 Empirical Model

Three regression structures were produced in the ADF test for stationarity.

$$\Delta H_t = \beta_1 H_{t-1} + \sum p_{j-I} \alpha_j \Delta H_{t-j} + \mu_t \ldots \quad (4.3.1)$$

$$\Delta H_t = \beta_0 + \beta_1 H_{t-1} + \sum p_{j-I} \alpha_j \Delta H_{t-j} + \mu_t \ldots \quad (4.3.2)$$

$$\Delta H_t = \beta_0 + \beta_1 H_{t-1} + \alpha t + \sum p_{j-I} \alpha_j \Delta H_{t-j} + \mu_t \ldots \quad (4.3.3)$$

where μ_t are white noise errors. The extra lagged terms are included in the model to ensure that errors are uncorrelated. The ADF test depends on the following hypothesis:

Hypothesis 1: Variable is non-stationary.

Hypothesis 2: Variable is stationary.

The representation of the ARDL model in general model form is:

$$Y_t = \beta_0 + \beta_1 y_{t-1} + \alpha_1 t_x + \alpha_2 x_{t-1} + \mu_t \ldots \quad 4.3.4$$

where it is assumed that $\mu_t \sim$ iid (0, $\upsilon 2$) and $|\beta_1| < 1$. Equation 4.3.4 coefficients are interpreted as a long-run equilibrium, since in the long-run equilibrium:

$$y = y_{t-1} \text{ and } x_t = x_{t-1}$$

So we can write equation 4.3.4 as:

$$y_t = \beta_0 + \beta_1 y_t + \alpha_1 t_x + \alpha_2 x_t \leftrightarrow (1-\alpha) y_t = \beta_0 + (\alpha_1 + \alpha_2) x \quad (4.3.5)$$

Hence, the long-run response to y change in x variables given by:

$$k = \alpha_1 + \alpha_1/(1-\alpha) \ldots . \quad (4.3.6)$$

Now we can build the connection between the ARDL and ECM, subtracting y_{t-1} from both sides of the equation (4.3.4)

$$Y_t - y_{t-1} = \beta_0 + (\beta_0 - 1) y_{t-1} + \alpha_1 (x_t - x_t - 1) + (\alpha_1 + \alpha_1) x_{t-1} + \mu_t \ldots \quad (4.3.7)$$

Substituting $(\alpha_1 + \alpha_1) = k(1 - \alpha)$ from (4.3.6) and putting $\Delta y = \Delta y_{t-1}$ and $\Delta x = x_t - x_{t-1}$ into (4.3.7), we get:

$$\Delta y_t = \beta_0 + (\beta_0 - 1)(y_{t-1} - kx_{t-1}) + \alpha_1 \Delta x_{t-1} + \mu_t \ldots \quad (4.3.8)$$

Generalized, the ARDL model with two independent variables is:

$$Y_t = \beta_0 + \sum p_j = 1\beta_j y_{t-1} + \sum q_{j-1} \sum m_{i-1} + \mu_t \quad (4.3.9)$$

4.4 Dummy Variables

We use a dummy or dichotomous indicator variable to measure the difference in price levels across administrations. Below, we estimate our model using different base categories to estimate differences across political administrations. So, to compare the PPP and PML administrations, we use the PTI administration as the reference group. Then to compare the PPP and PTI administrations, we use the PML administration as the reference group. Finally, to compare the PML-N and PTI administrations, we use the PPP as the reference group.

4.5 Estimation Techniques

We estimate both a short-run ARDL model and a long-run ARDL model with the average price of selected food items as the dependent variable and the price per gallon of diesel, the interest rate and the exchange rate as the independent variables:

4.6.1 ARDL Short Run Model

$$AVR_t = \beta_0 + \sum p_{j-1} AVR_{t-1} + \sum q_{r-1} \gamma_r R + \sum m_{i-1} r_i D + \sum n_{n-1} r_n ER + \mu_t \ldots \quad (4.6.1.1)$$

4.6.2 ARDL Long Run Model

$$AVR_t = \beta_0 + \sum p_{j-1} AVR_{t-1} + \sum q_{r-1} \gamma_r R + \sum m_{i-1} r_i D + \sum n_{n-1} r_n ER \mu_t + ECM_{t-1} \ldots \quad (4.6.2.1)$$

We use the ARDL bound test proposed by Pesaran (Pesaran 1997; Pesaran et al., 2001) to test for the existence of a long run relationship. Again, we perform three different groups of estimations in which a different administration is kept as the base category:

Group 1

$$PPP = 1 if PPPregime; PPP = 0, otherwise\ldots \quad (4.6.2.2)$$

$$PMLN = 1, if PMLNregime; PMLN = 0, otherwise\ldots \quad (4.6.2.3)$$

Group 2

$$PPP = 1 if PPPregime; PPP = 0, otherwise\ \ldots \quad (4.6.2.4)$$

$$PTI = 1 if PTIregime; PTI = 0, otherwise\ \ldots \quad (4.6.2.5)$$

Group 3

$$PMLN = 1 if PMLNregime; PMLN = 0, otherwise\ \ldots \quad (4.6.2.6)$$

$$PTI = 1 if PTIregime; PTI = 0, otherwise\ \ldots \quad (4.6.2.7)$$

The following three sets of relationships are estimated:

$$AVR = f(D, R, ER, PPP, PMLN)$$

$$AVR = f(D, R, ER, PMLN, PTI)$$

$$\text{AVR}=f(D, R, ER, PPP, PTI)$$

where the average price of selected food items (AVR) is a function of the diesel price (D), the interest rate I, the exchange rate (ER), and the political administration (PPP, PML-N, and PTI).

Models for the short run with dummy variables are estimated following Saeed et al. (2012):

$$\text{AVR}_t = \beta_0 + \sum {}^{p}{}_{j-1}\, \text{AVR}_{t-I} + \sum {}^{q}{}_{r-1}\, \gamma_r\, R_+ \sum {}^{m}{}_{i-1}\, \gamma_i\, D + \sum {}^{n}{}_{n-1}\, \gamma_n\, ER + PPP + PMLN + \mu_t \ldots \quad (4.6.2.8)$$

$$\text{AVR}_t = \beta_0 + \sum {}^{p}{}_{j-1}\, \text{AVR}_{t-I} + \sum {}^{q}{}_{r-1}\, \gamma_r\, R + \sum {}^{m}{}_{i-1}\, \gamma_i\, D + \sum {}^{n}{}_{n-1}\, \gamma_n\, ER + PPP + PTI + \mu_t. \quad (4.6.2.9)$$

$$\text{AVR}_t = \beta_0 + \sum {}^{p}{}_{J-1}\, \text{AVR}_{t-I} + \sum {}^{q}{}_{r-1}\, \gamma_r\, R + \sum {}^{m}{}_{i-1}\, \gamma_i\, D + \sum {}^{n}{}_{n-1}\, \gamma_n\, ER + PMLN + PTI + \mu_t. \quad (4.6.2.10)$$

5. Regression Results and Discussions

Table 1: Augmented dicky fuller test for unit root

Variables	1(1)	Probability
AVR	Stationary	0.000
R	Stationary	0.000
ER	Stationary	0.000
D	Stationary	0.000

Source: Authors' calculations

In Table 1, the first column lists the variables, which are the average price of selected food commodities, diesel price, exchange rate, and interest rate, the second column shows whether the first difference of the variable is stationary or non-stationary and the third column shows the associated probabilities. All the variables are stationary at first difference.

Table 2: Short-run result of the ARDL model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
AVR (-1)	1.270	0.123	10.274	0.000
AVR (-2)	-0.153	0.190	-0.807	0.420
AVR (-3)	-0.332	0.205	-1.617	0.108
AVR (-4)	0.233*	0.128	1.813	0.071
D	0.010	0.009	1.127	0.261
D (-1)	0.006	0.014	0.484	0.628
D (-2)	0.018*	0.009	1.874	0.050
R	0.335	0.199	1.677	0.095
R (-1)	-0.320	0.232	-1.377	0.170
R (-2)	0.030	0.173	0.178	0.858
R (-3)	0.605	0.126	4.785	0.000
R (-4)	0.412*	0.160	2.567	0.011
ER	-0.00	0.001	-1.169	0.244
ER(-1)	0.000	0.001	0.809	0.419
ER(-2)	-0.000	0.001	-0.570	0.569
ER(-3)	-0.001	0.001	-1.167	0.244
ER(-4)	0.003*	0.000	3.070	0.002
Adjusted R-squared	0.995	---		---
Prob(F-statistic)	0.000	Durbin-Watson stat		1.759

Source: Authors' calculations.

Table 2 shows the result of the short run of the ARDL model. The R-squared is close to 1, which means that model fit is good. The Durbin-Watson statistic is 1.7 which indicates no autocorrelation. The optimal lag selection is

based on the AIC criteria. The diesel price variable is significant at lag 2 and the interest rate and exchange rate variable are significant at lags 4.

According to the Fisher hypothesis[2], inflation is the sum of the real interest rate and nominal interest rate. Accordingly inflation affects nominal interest rate, not real interest rate (Tunalı & Erönal, 2016) because the fact is that real interest rate is stable in the long- run (Mercan, 2013). In other words, we can say that a change in monetary policy could affect the nominal interest rate, not the real interest rate (Tunalı & Erönal, 2016). The same case to the relationship between the average price of selected food commodities and interest rate.

The interest rate is positively associated with the average price of selected food items. So interest rates and inflation move together. What is interesting is that it is the previous month's interest rate which has a significant relationship with the current month's inflation rate. The same relationship of interest rate with inflation was found for Turkey (Turna & Özcan, 2021) where a one percent change in interest rate was associated with a 0.21 percent change in inflation. Further, the diesel price and exchange rate have a positive relationship with the average price of the selected food items, if one percent change in diesel price and exchange rate it would push up by 0.018 and 0.003 percent the average price of the selected food items.

Table 3: Comparison of average prices of food items between PPP and PML-N based on PTI

Variable	Coefficient	Prob.
PPP	-0.21265	0.000
PMLN	-0.11862	0.000

Source: Authors' calculations.

Table 4: Comparison of average prices of food items between PPP and PTI based on PML-N

Variable	Coefficient	Prob.
PPP	-0.09422	0.004
PTI	0.132963	0.019

Source: Authors' calculations.

[2] $r = i - \pi e \ldots a$
$i = r + \pi e \ldots b$

Table 5: Comparison of average prices of food items between PML-N and PTI based on PPP

Variable	Coefficient	Prob.
PMLN	0.112425	0.042
PTI	0.240114	0.019

Source: Authors' calculations.

In Table 3 we test the difference in inflation between the PPP and PML-N (using the PTI administration as the reference group). The coefficient of the PPP administration is -0.212, which means that average food price increases were lower in the PPP time period than in the PTI time period. Similarly, the coefficient for the PML-N administration is -0.118 which means that average food price increases were lower in the PML-N time period than in the PTI time period. But comparing the PPP and PML-N coefficients show that the PPP coefficient is larger in absolute terms which means that the fall in prices was greater in the PPP administration.

In Table 4 we test the difference in inflation between the PPP and PTI (using the PML-N administration as the reference group). The coefficient of the PPP administration is -0.094, which means that average food price increases were lower in the PPP time period than in the PML-N time period. Similarly, the coefficient for the PTI administration is -0.132 which means that average food price increases were higher in the PTI time period than in the PML-N time period. But comparing the PPP and PTI coefficients show that the PPP coefficient is negative while the PTI coefficient is positive, meaning that prices fell in the PPP administration and rose in the PTI administration on average.

In Table 5 we test the difference in inflation between the PML-N and PTI (using the PPP administration as the reference group). The coefficient of the PML-N administration is 0.112, which means that average food price increases were higher in the PML-N time period than in the PPP time period. Similarly, the coefficient for the PTI administration is -0.240 which means that average food price increases were higher in the PTI time period than in the PPP time period. But comparing the PML-N and PTI coefficients show that the PTI coefficient is larger which means that the rise in prices was greater in the PTI administration.

Table 6: Long Run Coefficients of the ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D	-0.034	0.110	-0.310	0.756
R	-7.792	2.400	-3.246	0.061
ER	-0.045	0.210	-0.214	0.697

Source: Authors' calculations.

Table 6 shows us long-run results. First, if we look at the R-squared and adjusted R-squared, the values are low and on the other side all the variables are insignificant in the long run. We run the bound test for a long-run relationship with the average selected price of food commodities, to find whether there exists a long-run and the results are shown in Table 7:

Table 7: ARDL Bounds Test

Null Hypothesis: No long-run relationships exist		
F-statistic	4.227	
	Critical Value Bounds	
Significance	I0 Bound	I1 Bound
5%	3.79	4.85

Source: Authors' calculations.

In Table 7 we choose a 5% critical value; the F value is 4.227 percent; the lower bound is 3.79 while the upper bound is 4.85. We can decide if the F-value is lower than the lower bound value, we can say that the variables have no long relationship with the average price of selected food commodities. Our result shows that since the F-value is lying between the two bounds, the result is inconclusive.

6. Conclusion

The objective of the study is to compare the price of selected food items across three administrations: PPP, PMLN, and PTI through graphs as well as through a regression analysis. In our regression, we estimate the relationship between the average price of selected food items and the nominal interest rate, the exchange rate and the nominal diesel price.

The figures of the nominal price levels show that the prices of almost all the selected commodities rose the most in the PTI administration. But looking at the real prices, the greatest increase occurred in the PPP administration.

Our estimations show that the highest increase in price levels occurs during the PTI administration and the smallest increase occurred during the PPP administration when one controls for the interest rates, the exchange rates and the price of diesel.

7. Policy Recommendations

- The Government of Pakistan should monitor the oil price which can aid in reducing the cost of food items.

- The Government of Pakistan should be more proactive in developing a stable monetary policy that controls the price of essential food items.

- The Government of Pakistan should take steps to control exchange rates.

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Appendix

Figure 1: Cusum test for model stability

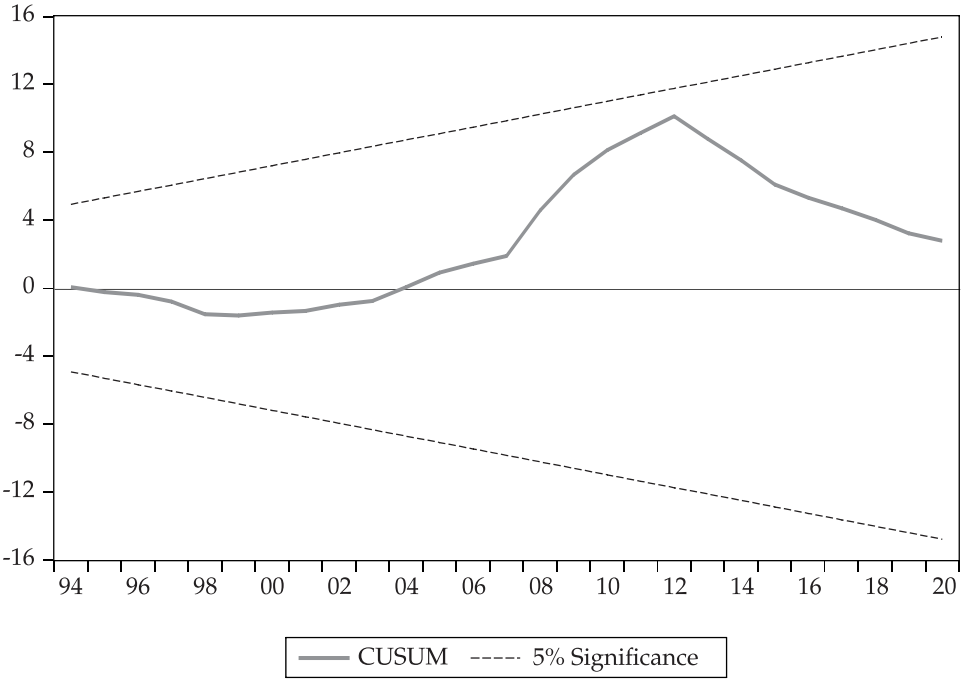

Table 1: Variance inflation factors

Variable	Centered
C	NA
D	2.204
R	2.646