



## Effects of Inflation on Agricultural Commodities

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This study examines both the natural world and the volatility of the pricing agents in Pakistan. This study investigates the causes of increased prices of agricultural commodities and food products in Pakistan. The IMF, World Bank, IFS (International Financial Statistics), and SBP (State Bank of Pakistan) provided sufficient data to conduct this research. We studied the dynamics of conditional volatility for agricultural commodities versus food product prices and explained the diffusion between these two. The study indicates that the selected commodities are affected by various factors including the volatility effect, the mean of interest rates, and the exchange rate. In addition, the volatility of wheat prices has a significant effect on the rice price series. In contrast, the cost of chicken has no impact on the average cost of beef or any other commodity. Most commodities, excluding oil and cotton, have been found to have a considerable impact on their present prices due to the influence of pricing. Farmers should be encouraged to utilize hedging mechanisms in the future to lessen price volatility.

**Keywords:** Price volatility, Farming goods, Fertilizers, Interest rate.

## Introduction

Developing economies like Pakistan rely heavily on agriculture. The prices of food and agricultural products are continuously in flux and up for grabs in the marketplace. Price comparisons between agricultural products and foodstuffs in nations like Pakistan are often relatively low. From 2008 to the middle of 2010, the prices of food and agricultural products rose considerably in the domestic and international markets. When we look at the price, we can observe that agricultural and food expenditures have increased significantly in the last 40 years. However, in the second half of 2010, prices decreased quickly due to the financial crisis, culminating in the "2008 price spike."

Contrarily, prices have nearly recovered to pre-spike levels by the end of 2011[1][2], [3]. Some product prices have declined by up to 50% since their peak, yet prices are still higher than in 2002[4]–[6]. Price spikes in agriculture, particularly for food, have historically accompanied economic upheavals, affecting everything from government finances to poverty to inflation to the nation's monetary balance[7][8]. Market participants face major challenges due to these pricing effects, known as volatility, which has peaks and troughs. Various researchers claim[9]–[11] in various ways to uncover commodity price and behavior patterns. [2], [3],[12]–[14], focused on the causes of the global "price surge". The majority of research has focused on changes in the supply and demand aspects of the market. Underinvestment in agriculture can be attributed to a variety of factors, including low commodity inventories. Fast-growing economies in Asia were also mentioned on the demand side. Using food crops for biofuels is also referred to as an emergent sort of change because of the impact it has on farm commodity prices, as well as changes in oil prices, money availability, and the US dollar's value. Climate change, trade policies within economies, expectations for prices vs market responses, and future trading alternatives for food markets are only some other factors.

Agricultural price volatility has been the focus of the majority of studies [3]–[5]. While prices were lower than they are today compared to their predecessor decades, they were higher than they were in the 1960s[15][16]. Price fluctuation in agricultural products was reported by UNFAO, the Organisation for Economic Co-operation and Development (OECD) between 2001 and 2010. From 2006 to 2008, the prices of almost all food and agricultural products in Pakistan were exceptionally variable [17], [18]. Maize, wheat, and rice prices have soared, as have the prices of other agricultural products, including fruits, cattle, vegetables, ghee, and oils. The price of butter and milk has also increased by 100% [18][19].

High energy costs, oil prices, and weather circumstances are to blame for the high price of agricultural products and food commodities in developing countries like Pakistan, [20][21]. Pakistan's increased income and dietary preferences have also contributed to a rise in food prices [22], [23]. For example, [24][25][26] used several econometric models to examine the reasons for food price inflation in Pakistan, ignoring the volatility of food products. [27].

Agricultural and food prices in Pakistan are the focus of this research because of two key factors. Data from food and farm goods will be used to estimate the volatility of the series, which will be used to model the relationship between the series' volatility and a set of other variables[28].

One of the most important aims of our research was to provide a quantitative measure of the price volatility of food and agriculture in Pakistan. A study of how the volatility of one series influences the volatility of another and changes in volatility over time. This volatility impact will also be examined to see if it affects the macroeconomic indicators.

## Methods and Materials

The GARCH Model was used to examine the price volatility of agricultural and food products in Pakistan. To understand the GARCH model, one must first understand what a GARCH model

is used in the preceding two equations for interest rate residuals, urea, and crude oil prices. Those economic variables' squared residuals are what you're looking at in this section. The appropriate lag time for the conditional mean and variance equations is calculated using the Arma (p,q) model. Models are discovered using the "t" test and the ML (Maximum Log-Likelihood estimation).

The residual series must have zero mean and unit variance to be deemed standardized. For the provided GARCH model, the skewness and kurtosis coefficients must be close to zero. It is feasible to determine whether or not the series of residuals under the null hypothesis is normally distributed by using the Jarque-Bera test. JB tests are only significant at a 5% significance level if the critical value is greater than 5.99. Model properties, such as the best fit, can be evaluated using the AIC (Akaike Information Criterion), SIC (Schwartz Information Criterion), Shibata Criterion, Hannan-Quin Criterion, and log-likelihood.

Monthly data from 2000 to 2018 was analyzed for a few selected Pakistani meals and farm goods. The World Bank, the IMF, the IFS, and the SBP (State Bank of Pakistan) all provided data that we used to compile this report. All goods are measured in US dollars, the de facto standard measurement unit. It wasn't only about urea prices; we also looked into how agriculture and food prices are linked to interest rates and currencies. The logarithm of the initial difference in monthly prices for each commodity is what we use in our analysis. In the logarithmic level series, the price movements of all commodities are represented by a simple line graph. For both low and high-volatility return series, all of the selected commodity prices show the ARCH effect. Data from the squared return series shows high levels of volatility and serial correlation.

Extreme values are possible because there are less than three values in a platykurtic series. In this study, JB tests are used to see if the series is normal. The results of the JB-test show that most of the series do not match the typical distribution requirements. Description data reveal a platykurtic and a leptokurtic series skew. As a result, the vast majority of the return series for Pakistani markets are not normally distributed. This is by far the most noticeable attribute in many emerging market countries[30].

We utilized the KPSS test for the first difference with a constant for the unit root to guarantee that the return series is stationary. All series are determined to be non-stationary at 3%, 15%, and 20% levels of importance. All series are non-stationary at the level and stationary at the first difference.

The conditional heteroskedasticity of the study's food and agricultural commodities is examined using the Lagrange Multiplier test. The LM test, which indicates that squared residuals have an ARCH impact, verifies conditional heteroskedasticity to estimate food and farm items further. Q-Statistics were used to determine whether or not the residual and squared residual series are serially correlated. It's now possible to run GARCH models on a subset of commodities to see whether conditional heteroskedasticity holds.

We investigated the effect of explanatory variables on these data sets using price returns of oil, urea, interest rates, and exchange rates. It follows that all of these variables will be applied to the variance equation and subsequently the mean equation if the residuals are both square and agricultural commodities with normal distributions can be studied.

## Results

A GARCH model predicted that all commodities with explanations will be important. The other co-variable in this study suggests that all of the commodities examined to have a significant impact if they have a value near 1. It also illustrates how long the volatility lasted after the shock. We discovered asymmetric impacts in this study by examining the value of the parameter. Using the barley, beef, and tea series, we discovered that our model was biased to the negative. Some other programs, on the other hand, are positively skewed. As evidenced by their considerable excess kurtosis, all other commodities are more likely to have a platykurtic

distribution than leptokurtic ones. According to the LM-ARCH results, the specification is perfect. The JB test for standardized residuals can be used to detect an uneven distribution. According to Tse's diagnostic test, it reveals no or minimum indications of serial correlation and volatility clustering and no heteroskedasticity [31].

The coefficient in the mean equation indicates that the price of lamb, barley, and beef is expected to grow due to rising oil costs. Cotton prices are also affected by the volatility of oil prices. The price of oil, a vital component in the production process, was inversely related to the price of wheat. There is no significant impact on Pakistani production from changes in worldwide prices, even though local prices are affected. A more indirect impact on the cost of food production, distribution, and transportation is feasible though.

Additionally, the high expenses of food and agricultural products, such as the cost of a tube well or a harvesting tractor in Pakistan, are contributing factors. There was a negative correlation between wheat, rice, and chicken prices in Pakistan, which is consistent with this study's results. A large increase in the cost of goods and services is due to the government's instability and competing economic policies. Even if we don't see it globally, like in the case of Pakistan [32], there is still a decline in oil prices.

The researchers found that barley and wheat prices significantly affect the mean equation results. Interest rates have a significant impact on the price of beef and poultry, both favorably and negatively. Apart from oil, we find considerable evidence that the current price affects earlier pricing for other commodities in Pakistan.

### **Concluding**

The GARCH model was used to investigate the volatility of food and agricultural commodities in Pakistan. Prices of cattle, lambs, and barley in Pakistan are influenced greatly and favorably by fluctuations in the price of oil. This study shows that wheat price volatility has a considerable negative impact on the volatility of the oil price. Cotton prices were also boosted by the rise in oil costs. A look at Pakistan's food and agricultural product prices can tell us that they are heavily influenced by the oil market. Barley and wheat prices were found to have a favorable and substantial impact on the exchange rate. The volatility of any other commodity included in this study was not significantly influenced by others. For our analysis, we found that interest rates have a negative impact on the cost of chicken and beef. A rise in interest rates is good for wheat prices but bad for beef prices. According to our data, there was a considerable impact on all commodities except for oil and cotton.

First, we must get farmers to employ hedging instruments to reduce price volatility. Weather conditions, storms, and floods can have a devastating effect on crop production in Pakistan and other nations in the region. Our administration is concerned about rising food and agricultural costs on those with little financial resources. The government collaborates with a wide range of organisations to maintain agricultural sector volatility, which raises GDP. While food prices are lowered, small farmers are encouraged and the market returns to equilibrium when the government subsidizes food and farm inputs. Developing countries like Pakistan require a boost, where agricultural investment is low. Economic activity will rise as the world's population expands and hence increases the need for food. It also helps to keep the cost of food on the market under control.

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