THE PRICE VOLATILITY OF RED ONION IN DAVAO CITY

Maria Linda Santander[1], Jesamie Catnadijan[2],
Aira Bangcal[3], and Rosalia Gabronino,DBM[4]

9   Student of the College of Business Administration Education, University of Mindanao, Bolton Street, Davao City, 8000, Philippines
10   Student of the College of Business Administration Education, University of Mindanao, Bolton Street, Davao City, 8000, Philippines
11   Student of the College of Business Administration Education, University of Mindanao, Bolton Street, Davao City, 8000, Philippines
12 Faculty of the College of Business Administration Education, University of Mindanao, Bolton Street, Davao, City, 8000, Philippines

ABSTRACT

Onions are a prominent vegetable in the Philippines. It is generally used as a condiment, particularly in traditional cuisine. Previous research has proven that the price of red onion is highly volatile. This study is conducted to acquire an accurate forecast of the price volatility of red onion in Davao City. The researchers used secondary data from the Philippine Statistics Authority (PSA) to examine and assess the price volatility of red onion, particularly in Davao City. Accordingly, the gathered data were statistically evaluated using the JB test, Chi-squared test, Skew, Kurt, and P-value to measure the price volatility. The result shows the high price volatility of red onion in Davao City, which indicates the existence of volatility in 12 months. In some months, there is a high positive correlation as well as a negative one. This means there can be peaks and low prices of red onion, but in general, it all suggests high price volatility. In addition, based on the results, there is significant price volatility due to the positive and negative shocks, which causes the price to be unstable or asymmetric.

Keywords: Price Volatility, Asymmetric, Correlation, Forecast

INTRODUCTION

Onion is widely consumed as a vegetable and spice in various food preparations and the essential condiment in traditional cuisine. Changes in the prices of onions will significantly affect the consumption pattern of consumers, especially the agribusiness of onion farming. The primary concern for both consumer and producer are understanding the principle of price volatility of onion (Peter, 2016).

The skyrocketing price of onions is due to the soaring demands of consumers, flooding, and poor storage facilities for onions. The households in Nigeria have to dig deeper into their pockets to purchase onions, one of the most regularly consumed vegetables across the country, as prices have

increased substantially, leading to a severe scarcity. Prices have been steadily growing over the last month as the shortage has affected marketplaces around the country. Former agriculture secretary Emmanuel Piñol said that the current increase in red bulb onions prices in the Philippines, which reached up to Php 600 per kilo at the end of the year 2021, was caused by an import reliance (Saron, 2021).

There have been studies that have covered and addressed the price volatility of onion in different countries (Birthal et al., 2019). Nevertheless, less research and studies have been done on the behavior of onion's price volatility and its effect on onion's future prices, most notably in Davao City. The researchers decided to conduct the study because they wanted to add to the current body of knowledge about price volatility in food commodities, particularly onions. To determine the factors behind the volatility of the price of a commodity, Red Onion, for example, is an essential tool for both consumers and entrepreneurs, making it urgent and significant to conduct this study to find out every necessary and relevant information. Determining the level of price volatility of retail and wholesale of the red onion will help the consumers and the Davao City market understand what factors affect the rise and fall in price. The data that answers the price fluctuations can be used. Consumers are now given a choice, and entrepreneurs can use it to make wise economic decisions that eventually help the industry recover from future price fluctuations. This is what urged the researchers to conduct the study to identify how to minimize the price risk of red onion.

In the regions of Maharashtra and Karnataka, onion prices have plummeted due to the lockdown that, causes the demand for onions to dry up from institutional consumers, such as hotels and restaurants. About 70% of onion export from the Nashik district have been delayed, resulting in a price crash. During the lockdown, the Lasalgaon market had only been closed for four days. Onion was brought in by farmers, but there was no demand. Due to farmers wanting to sell products, the flow of onions supply on the market has remained the same throughout the lockdown (Jadhav, 2020).

Similarly, in Navi Mumbai, the increased supply of onion from Nashik, Pune, and Gujarat results from falling demand due to the lockdown that restricts the movement of the consumer. Hundreds of truckloads of onion arrive at the Agricultural Produce Market Committee daily, exceeding the overall demand for onion. Surplus inflow rather than consumer demand has recently caused a significant increase in supply in the Mumbai market. The Nashik onion is projected to dominate the market; therefore, prices will likely decrease further in the following days (The Times of India,2020).

Based on the empirical study made by Mahesh (2021), from 1993-1994 to 2004-2005, the consumption of onions in both urban and rural areas in India increased by approximately 150 grams and 100 grams per month. In recent years, annual domestic onion consumption per person has surged from 4 kg in 2002-2003 to higher than 13 kg in 2012-2013. Furthermore, as per capita income has increased, domestic population, health, and taste awareness of the consumer, the demand for onion are expected to increase. Aside from that, exports have

gradually climbed during liberalization Onions' export competitiveness is generally relatively high.

Price volatility refers to a commodity's price variations. The percentage difference in the price of a commodity from day to day is used to quantify volatility. A volatile market is defined by the degree of volatility rather than the level of pricing. The coefficient of variation can be used to calculate it. However, when used to estimate food costs, this measure of instability has a disadvantage, according to (Birthal et al., 2019).

In addition, as stated by (Yang, 2020), the market price of Chinese onions has been dropping for the last few weeks. The COVID-19 pandemic affected the Chinese onion export causing them to decline. The demand for onions is declining as the consumer's purchasing power is relatively low.

Meanwhile, Ethiopia, the third-biggest producer of Onion in the African continent next to Egypt and South Africa, contributes only 2.7% to the total world production from 2000–2011 (Teklebrhan et al., 2019). According to the most recent evidence, low cultivar quality, improper agronomic techniques, a weak extension system, disease and pests, and climate variability are the critical restrictions to onion output and productivity in Ethiopia. Onion is a vital marketable income crop for smallholder farm households in the Medebay Zana district. However, there is an information gap regarding the determinant of onion supply to the district's markets. A deficit in the global supply of Onions would cause a domino effect in other affected areas, eventually leading to a rise and fall in the local price of onions when distributed to the local markets.

Excessive volatility in food prices impacts farmers, consumers, processors, traders, and even the political system. It may distort the production and investment decisions of farmers and intermediaries on the value chains, leading to inefficient allocation of resources. Poor consumers may be forced to reduce food and non-food productive expenditures, as stated in the study (Joshi et al., 2019).

This study was conducted to obtain a precise forecast of the price volatility of red onion in Davao City. The researchers dealt with the reason why it is a subject of the study. As a result, it aimed to collect data on the following topics such as obtaining a measure of the price volatility of red onion in Davao City, determining the red onion's price's peak and lows, and looking into the changes in market volatility of red onion.

This study aims to forecast the future prices of red onion in Davao City that will benefit different sectors and departments. In the Department of Agriculture, this study will provide information on the future price of red onion that will help them implement plans and strategies in dealing with the price volatility. It will enable them to assist the onion growers in maintaining consistent production. To our Local Government Units (LGU), this will contribute data on the future prices of onions that help the government monitor the prices in the market and protect the consumer. Lastly, our future researchers can use the findings of this study as a reference in their related study, specifically on the price volatility of red onion.

The study is anchored by the study of Engle and Kroner (1995), which is the Baba-Engle-Kraft-Kroner (BEKK) model, and it is a generally applied volatility model, particularly in modeling and forecasting volatilities in the financial application. The BEKK model analyzes the shocks and price volatility and whether the price volatility is shifting from the first price level, the producer, to the second price level or the consumer, using the monthly price data. According to Engle and Kroner (1995), the BEKK model can be useful in testing various economic theories that involve price volatility. The study by Benavides (2009) entitled, Price Volatility Forecasts for Agricultural Commodities: An Application of Volatility Models, option implied and composite approaches for futures prices of Corn and Wheat, was centered on various models that give the most accurate outcome. As stated in the study, BEKK Model combined with Composite Forecast Model can give the lowest mean-square error compared to the same models not combined. Engle and Kroner recognized that BEKK is an appropriate model for measuring volatility between time series.

Price has a diverse viewpoint as a fundamental concept in economics and finance (Fetter, 1912). One of India's most important vegetable products, Onion, is in high demand on the market. Onion price fluctuation and instability is a recurrent trend impacting Indian onion producers and consumers.

According to Ghosh et al. (2020), inefficiencies in the market, poor supply chains, seasonal and annual variations in output, limited and inadequate storage capacity, weak relative prices, and market monopolies are the leading causes of onion price fluctuations. In India, they have identified several determinants for why Onion prices fluctuate. The first of the several factors is Price and Seasonal Arrival because they produce Onion throughout their three seasons. Their production varies in their Rabi, Kharif, and Late Kharif season.

Second, Climatic Influence. In India, the climate also became a significant factor in crop production. Similar to our experience in the Philippines, rainfall and humidity significantly affect their onion production, which indirectly controls the fluctuation in prices.

Excessive rainfall in a season does no good on their crops, as well as too much humidity. Lastly, weak government intervention and control leads to Price Transmission. India has no system of administered pricing policy for onions; hence market forces dominate price determination. (Paul et al., 2015). Large traders frequently engage in stock hoarding to drive up the price of onions in times of crisis for more significant revenue. Retail markup is a strategy that is frequently used by traders heading large retail and wholesale prices are different. Periodic fluctuation of Onion prices is a phenomenon that affects many stakeholders, both farmers and customers included.

Presented in Figure 1 is the conceptual framework of the study. It must have a specific goal, relate the framework to the idea of the study, and provide information and proof about the price volatility of onion.
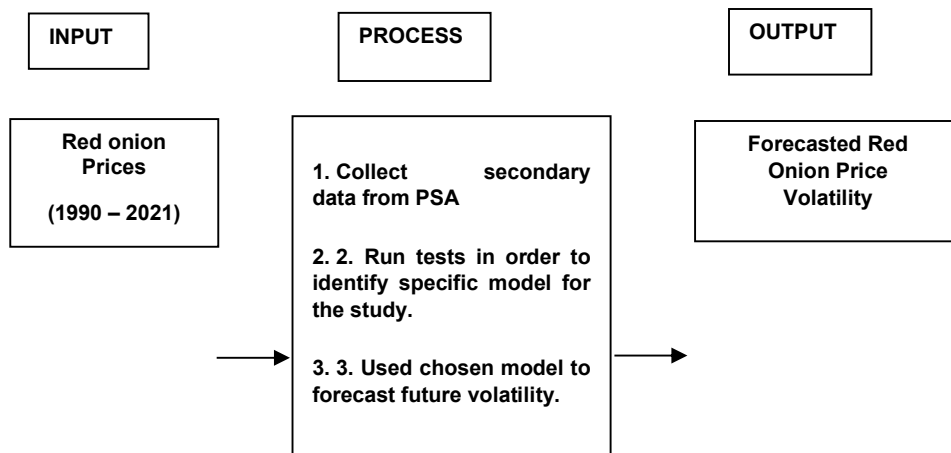
Figure 1. Conceptual Framework of the Study

METHOD

Data Sources

This research study obtained all the necessary data for identifying the price volatility of Red Onion from the Philippine Statistics Authority (PSA). The Philippine Statistics Authority is the country's central statistical agency, providing relevant, accurate, and detailed primary economic data. It is a credible source that certifies its data collection accuracy. This study required data on Red Onion from the previous months and years in Davao City. The necessary data for this study can be accessed on one of PSA's published articles and references, "Price Situationer of Selected Agricultural Commodities,"

together with other crops, poultry, and agricultural products. The database has provided documents with complete lists of retail prices and accurately detailed reports on changes for a specific week. This study focused on and used data based on yearly time series from 1990-2021.

Research Design

Forecasting a future value at a specific point in time can be done using a time series statistical tool Georgiou (2021). According to Allen (2017), Time Series Analysis and Statistical tools are widely used in studies that analyze data in repeated measures over time. This study used a time series statistical tool to generate more accurate values than forecasting. The weighted regression, also known as weighted linear regression, is the model used to analyze time series data. Weighted regression can correct heteroscedasticity by giving more weight to smaller variances, providing more reliable information about the regression function than large variances.

Statistical Treatment of Data

The research instrument that is used in the study is the weighted regression. Data were gathered by the researchers using weighted regression analysis and used secondary data to examine and assess the price volatility forecast of red onions as well as knowing the volatility of the red onion's demand in Davao City.

Research Procedures

These are the following procedures were conducted to gather and analyze the data:

1. Collect Data- The data needed for forecasting the price of red onion was gathered from the Philippine Statistic Authority (PSA) from the year 1990 to 2021 monthly data of prices of red onion in Davao City.

2. Evaluating the Gathered Data- The data gathered was thoroughly checked to ensure the validity of the values of data and to have accurate forecasting.

3. Determining the Appropriate Model in Forecasting Future Price Volatility- The weighted regression model was used to run the gathered data in forecasting the price volatility of red onion.

4. Interpretation of Data- In forecasting the price volatility and future price of red onion, particularly in Davao City, the weighted regression model was able to provide high accuracy in forecasting the price of red onion in Davao City.

RESULT AND DISCUSSION

The graph presents the complete monthly and yearly prices of Red Onion in Davao City. It highlights the peak and low prices from 1990 to 2021. The graph depicts an upward trend regardless of the months where the price declined. An upward trend indicates that Red Onion prices from 1990 have been continuously increasing.
Condiments: Retail Prices of Agricultural Commodities
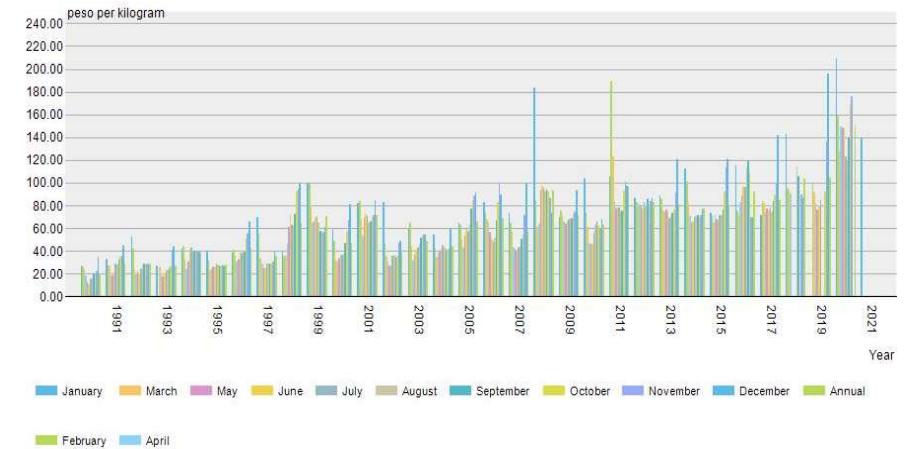
This study uses time series data to identify the patterns in a variable's previous or past movement, with the weighted regression model, which is the best-fitted model in measuring the price volatility of red onion in Davao City. This table explains that there is white noise or the presence of autocorrelations. The volatility exists in a 12 months/1 year period, which affects the next period's price volatility (not good). The chi-squared test result indicates a 0 residual, which means the data are not normally distributed (good). Then, this is followed by a heavy-tailed kurtosis (high peak) and skewness value greater than 0 (skewed to the right).

JB test	3047.12189
Chi-square test	0
Skew	0.649652238
Kurt	13.59670147

This table illustrates how the data fits with the weighted regression model. It indicates that varying prices from the previous month will have a further impact on the prices for the following month. Volatility in a time series indicates the conditional variance of the time series varying over time. The more volatile the price, the greater the price uncertainty (Miftahul, 2021). However, the result of this study shows an upward trend despite the apparent price volatility. It also shows us that the prices are not affected by seasonal factors (which means there is a trend without the presence of seasonality). Based on the findings, price volatility is evident due to positive and negative shocks, making the price unstable or asymmetric.

The high consumption level of red onion in Indonesia, with limited production and challenging geographical conditions, can lead to several issues in the market. This can be significantly pronounced when demand is high at the beginning or end of the year. To address these issues and improve marketing efficiency in the red onion market. It is vital to have effective and efficient coordination between economic actors such as wholesale merchants and retailers. This could involve measures such as improving transportation and logistics systems, implementing effective pricing strategies, and promoting better communication and collaboration between different market players. It is also helpful to consider initiatives that aim to increase production levels or improve production processes' efficiency to meet the market's demands better. Other potential strategies that could help address these challenges include diversifying production, improving storage, and handling practices, developing new markets, implementing quality control measures, and investing in research and development, as stated by (Suwarsinah et al., 2018).

Weighted Regression Analysis

OVERALL FIT

Multuple R	0.929189	AIC	875.3303
R Square	0.863392	AICc	875.361
Adjusted R Square	0.863044	BSC	875.361
Standard Error	3.036883		
Observations	394		

ANOVA   **Alpha 0.05**

	df	SS	MS	F	p-value sig
Regression	1	22849.31	22849.31	2477.519	1.5E-171 yes
Residual	392	3615.283	9.22266		
Total	393	26464.59			

	coeff	Std err	T stat	p-value	lower	Upper vif
Intercept	2.536384	0.604519	4.195706	3.37E-05	1.347879	3.724889
P1	0.958813	0.01919	49.96395	4.3E-172	0.921084	0.996541 1

The Philippines is one of the many countries that heavily depends on the importation of Red Onion, making the country, producers, and consumers vulnerable to price shocks. This research study applied the Weighted Linear Regression Analysis model to data on Red Onion from 1990-2021 to determine the extent of its price volatility.

The results of this study reveal the high price volatility of Red Onion in Davao City without the presence of seasonality, implying that the crisis of Red Onion during December and the high spike of prices at different times of the year are not caused by seasonality.

The result implies that high price volatility remained a vital matter to attend to by policymakers to protect consumers and producers. The results also indicate how any given month's price volatility will affect the following months' prices. The fact that the red onion crisis in the country is not caused by seasonality implicates how the government should invest in the research and development of long-term solutions. Interventions are also needed in dealing with the current crisis we are facing right now in order to improve local production and distribution without relying heavily on imports.

The result of this research study will benefit the field as it suggests the necessity for further study of Red Onion and its price volatility and prepare a course of action for this matter. Further research and development should be the first step in addressing this matter to build a long-term solution.

CONCLUSION AND RECOMMENDATIONS

Conclusion

There is a high price volatility of Red Onion in Davao City. The findings indicate that the data is stationary, making its statistical characteristics constant over time, which attests that it has different data points but, in general, is consistent. This is relative to the high price volatility of the subject. The p-value presents the presence of white noise, indicating volatility in 12 months or one year. This affects the next period's price volatility.

The result of the correlation coefficient of the data is negative, meaning that the two variables move in opposite directions. Though it is stationary, which pertains to its consistency, it does not have a constant data point every month or period. This means there can be peaks and low prices of red onion, but in general, it all suggests high price volatility.

This study used a weighted regression model to measure the price volatility of the subject. The result proves that the model fits this type of study. There is high volatility that can be seen starting from the year 2007 until 2021. Price fluctuations depend on the consumer's purchasing practice and need for services. Prices from previous months influence the prices of the following month based on the increasing inflation rate. Keeping track of the prices would give us insight into how significant the impact may be to preparing for the following months. As a final observation, there is high volatility in the prices of red onion in Davao City.

Recommendations

The following recommendations are based on the factual data drawn from the study. The Department of Agriculture researchers recommend enhancing the investment strategy, particularly in the research and development of Red Onion. Other than that, the department of agriculture should also implement decisive measures on local overproduction to compensate onion farmers with farm gate prices. They should also strengthen and regulate farm gate prices and discourage onion importation from avoiding instability supply and a surge in prices. Importation has been pulling down the value of our locally produced red onions. Hence, the red onion crisis every fourth quarter of the year.

The farmers, with government support, will be able to meet the demand every December. Local growers of red onion will be addressed through an agreement with the department of agriculture on the cost of seeds, pesticides, fertilizers, irrigation, and land rent. By then, adequate supply for year-end holidays demand will be met.

The Local Government Units (LGU) should regularly monitor prices in the market to protect both consumers and producers. Lastly, the future researchers, the result of this study can be used as related literature or reference to their future study.

REFERENCES

Allen, M. (2017). *The SAGE Encyclopedia of Communication Research Methods.* [Online] Available at: https://methods.sagepub.com/reference/the-sage encyclopedia -of-communication-research methods?fbclid= IwAR3FtANnEbbF 7LojwZPkmtMPESjbGsHTH5bNEAC1 otJIr SaxHuGcdAVins4 [Accessed 8 february 2022].

Barakade A. (2010). Agricultural Price Policy and Farm Probability of Onion Satara District City of Maharastra. [Online] Available at: https://www.researchgate.net/profile/AnkushBarakade/publicati on/263779497_economics_of_onion_cultivation_and_it's_mark eting_pattern_in_satara_district_of_maharashtra/links/0deec53 be5be245945000000/economics-of-onion-cultivation and-its-marke. [Accessed 8 February 2022].

Bellemare M., Barrett, C. Just, D. (2011). The Welfare Impacts of Commodity Price Volatility: Evidence from Rural Ethiopia. [Online] Available at: https://www.researchgate.net/publication/46447257_The_Welf are_Impacts_of_Commodity_Price_Volatility_Evidence_from_ Rural_Ethiopia [Accessed 8 February 2022]. [Accessed 8 February 2022].

Birthal, P., Negi, A. Joshi P.K. (2019). Understanding causes of volatility in onion prices in India. Journal of Agribusiness in Developing and Emerging Economies, Issue

https://www.emerald.com/insight/content/doi/10.1108/JADEE-06-2018-0068/full/html, pp. 255-.

Brownlee, J. (2018). How to Model Volatility with ARCH and GARCH for Time Series Forecasting in Python. [Online] Available at: https://machinelearningmastery.com/develop-arch-and-garch-models-for-time   series-forecasting-in-python/ [Accessed 8 February 2022].

Fetter, (1912). *Price, Volatility and the Second-Order Economic Theory.*   [Online] Available   at: https://arxiv.org/ftp/arxiv/papers/2009/2009.14278.pdf [Accessed 8 2022 February].

Georgiou, A., 2021. *An introduction to time series forecasting.* [Online]
Available at: https://www.infoworld.com/article/3622246/an-introduction-to-time-seriesforecasting.html?fbclid=IwAR3O3WNYhsWftKJiORrzlcN__pfJxWzxzrfsI7_6OeC8cx59GeaJ-3Ahsc   [Accessed 8 February 2022].

Ghosh, S. et al. (2022). Onion Price Fluctuation in Indian Market: Analysis and Mitigation Strategies. Vigyan Varta, Issue https://www.vigyanvarta.com/adminpanel/upload_doc/VV_0422_24.pdf , pp. 95-98. [Accessed 9 February 2022].

Given, L. (2017). Time Series Analysis- SAGE Research. [Online]
Available at: https://methods.sagepub.com/reference/the-sage-

encyclopedia   of-communication-research-methods/i14726.xml [Accessed 9 Feb. 2022]

Joshi P., Negi, A. and Birthal, P. (2019). Understanding causes of volatility onionprices in India. [Online] Available at: https://scholar.google.com.ph/scholar?q=price+volatility+Joshi+2019&hl=en&as_sdt=0&as_vis=1&oi=scholart#d=gs_qabs&t=1663225530968&u=%23p%3DQokWhdvLHjMJ [Accessed 8 Feb. 2022]

Mahesh, P. (2021). Onion Marketing and Its Impact on Indian Customer An Empirical Study. Journal of Marketing Vistas, 11(https://www.ipeindia.org/wp-content/uploads/2021/10/JoMV-Jan-Jun-2021.pdf), pp. 9-19.

Peter, K. V. (2016). Handbook of herbs and spices. Issue https://www.academia.edu/18671222/Handbook_of_Herbs_and_Spices_Vol_2.

Rakshit, D., Kumar, R. and Panwar S. (2021). Asymmetric Price Volatility of Onion in India. Indian Journal of Agricultural Economics,   Issue   http://isaeindia.org/wp-content/uploads/2021/07/03-Ranjit-Kumar-Paul.pdf?fbclid=IwAR3Gn rRwJW8w9kCbXtKw3SkCoFoLIzsZ6jFIKfnTD17L5W24vyVBS zwsWM .

Sally, M. (2015). Demand for Indian onions picks up internationally.   Issue https://economictimes.indiatimes.com/news/economy/agriculture/demand-for   indian-onions-picks-up-

internationally/articleshow/46901551.cms?from=mdr.

Stanton, J. (2001). A Brief History of Linear Regression for Statistics Instructors. Journal of Statistics Education, Issue doi: https://doi.org/10.1080/10691898.2001.11910537..