

The Price of Distance: A Computational Analysis of Market Prices in Tanjay City

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Abstract

The study examined how far away from the city center sari-sari stores are located in relation to the prices charged for a selection of commonly purchased goods (rice, sugar, cooking oil, eggs, instant noodles, and Coca-Cola, 1 liter) within the city of Tanjay on the island of Negros Oriental. To collect this information, a computational-descriptive research strategy was employed which utilized the direct price queries method to collect data from 10 sari-sari stores. In addition to gathering price data, the distance from each store to the city center was also recorded in kilometers. The summarization of distances and prices has been accomplished through descriptive statistics, means, and standard deviations. The association between distances from the city center and product prices is determined using Pearson's correlation coefficient (r). The results of this study demonstrated that certain commodity prices, eggs and cooking oil had minimal variance with respect to distance from the city center, and there were moderate variances in the prices for rice and Coca-Cola. The correlations calculated from this study revealed differing levels of correlation, with cooking oil showing the strongest positive correlation which indicates that prices increase to a small degree as the store's distance increases from the city center. The study results demonstrate how the application of computational mathematics can assist analysts in the assessment of markets and also provide valuable information concerning pricing trends for consumers and small shop owners. In addition to providing information that could help consumers, small enterprises, and municipal planners in understanding pricing behavior in semi-urban areas, the study shows the value of computational mathematics in market analysis. The study demonstrates the usefulness of computational mathematics in market analysis in addition to providing information that could help consumers, small businesses, and municipal planners in understanding pricing behavior in semi-urban locations.

Keywords: market prices, computational analysis, store location, price variability, Tanjay City, correlation

Introduction

The price of common goods represents a key measure of how easy it is for people to afford what they need to maintain their quality of life. This is very important in communities that depend on small local retailers such as sari-sari stores. Market pricing is primarily determined by factors such as the availability and demand for products; the amount paid for transporting them; how easy it is to get to the store; how far away the store is located from a major marketplace. There is a direct correlation between distance from major cities and the amount paid for common products sold by small retailers located near one another, not just in distance. Across the globe, social science research in economic geography has demonstrated that there is a direct correlation between transportation costs and geographical distance and retail pricing, that commodities are being transported a greater distance from their points of manufacture or distribution do incur higher transportation costs. Krugman (1991) has pointed out that, "the greater the distance from the core economic area, the greater the cost of providing goods and services to the consumers in those remote areas." The World Bank (2020) stated, "Small retailers located in developing countries often set their prices based on the transportation costs of getting to those small retailers, which often includes significant barriers to accessing wholesale suppliers, especially where the retail outlet is located quite far from the major retail distribution center." Based on these comments, location plays a major role in determining the pricing differences in micro-retail settings from all over the world.

For many Filipinos, sari-sari stores serve as an important part of their daily lives, especially for their easily accessible products. According to the Department of Trade and Industry (DTI-2023), due to the limited cashflows and dependency on local markets or wholesale suppliers to get their goods, sari-sari stores are extremely vulnerable to

changes in current supply costs. Furthermore, according to the Philippine Statistics Authority (PSA-2023), the average retail price of goods found in barangays varies greatly from the national average depending on factors like geographic location, accessibility, and distribution method. This highlights the importance of looking into local pricing variation rather than relying exclusively on national averages.

Nearby sari-sari stores in Tanjay City in Negros Oriental, provide easy access to foods like rice, sugar, cooking oil, and instant meals. Stores owned by Barangays that are away from the central area of Tanjay, have to pay high transportation costs when purchasing their stock due to limited access to the public market or wholesaler's prices. Based on reports from DTI Negros Oriental (2023) pricing monitoring, it has been observed that the distance from the distribution center as well as delivery routes will likely have an impact on the price of small stores in the province. Although no formal studies on Tanjay City have been published at this time, the information above provides further evidence that geographical characteristics are likely to play a role in determining the price of goods sold in sari-sari stores located throughout the district.

Through the global and national economy and the various global and local factors influencing financial markets, the focus of this research is to provide a quantitative comparison of the price of selected similar items at sari-sari stores relative to their distance from the center of Tanjay City in Negros Oriental. To do this, the study employs basic analytical techniques including averages, correlation analysis, and visual representations to identify trends of pricing differences and provide insight into the forces that influence the operation of local markets for consumers and small retailers.

Literature Review

Economic and retail research has long focused on market pricing variance, especially when it comes to geographical considerations like accessibility and distance. Distance from economic centers raises transportation and distribution expenses, which are frequently reflected in higher retail prices (Krugman, 1991). Fujita, Krugman, and Venables (1999) provided additional support for this theory by explaining that stores nearer commercial hubs can offer more competitive prices because they have lower logistical costs than those farther away.

Research conducted in developing nations shows that small retailers are more affected by geographical distance. According to the World Bank (2020), micro-retailers that are farther away from suppliers have less consistent access to goods and pay more for delivery, which increases the price volatility of basic commodities. These international studies demonstrate that distance, especially in small-scale retail systems, is a significant factor affecting price formation.

Pricing trends in small retail outlets differ dramatically from those in giant supermarkets. At times, micro-retailers place orders in very small quantities or have very little capital at hand, unlike major retailers, who benefit from the advantages of well-structured supply chains and bulk purchasing capabilities. Gómez and Ricketts (2013) suggest that small retailers often transfer increased operational costs to consumers, which leads to observed price differences in different locations.

Pricing in micro-Retail is also affected by consumer behavior. For instance, consumers are usually willing to pay higher costs in local retail stores due to convenience and reduced travel distances, as emphasized by Berry, Levinsohn, and Pakes (2018). Such factors reinforce links between retail price and distance to ensure that neighborhood retail outlets can sustain higher price levels in areas with limited access to other marketplaces.

Many household units in the Philippines rely on sari-sari stores for basic needs. The Department of Trade and Industry (2023) states that small businesses have limited funds and sources of products from either public markets or wholesalers; hence, these are vulnerable to the change in the supply of products and an increase in transportation costs. Due to these aspects, the prices of goods may vary in relation to accessibility zones.

As suggested by the Philippine Statistics Authority (PSA, 2023), while national data regarding inflation reveal quite a comprehensive view of price movements, local consumers find varied retail prices due to variations in delivery schedule, market accessibility, and competition. Thus, price developments in smaller retail environments could not

have been comprehensively captured by economic indicators. The role of accessibility and distance in influencing prices within the local market is further exemplified by various studies conducted by researchers affiliated with the University of the Philippines. Balisacan (2001) argued that in rural and semi-urban settings in particular, price differentials within local markets are greatly linked to the cost of transport and a lack of accessibility to market areas. Consumers who reside far from market areas often must pay higher prices for basic necessities

Similar findings were reported by Clarete & Roumasset (2010) when they examined the costs involved in local markets in the Philippines and were able to conclude that cost barriers associated with distance and lack of access to markets decrease the competitiveness of prices offered by small businesses. This renders it possible for costs to be vastly different even within nearby communities. Supporting this are the findings reported by Reyes, Sobreviñas, & de Dios (2016) when they asserted that prices at the community level are highly vulnerable to costs associated with the supply chain.

Though the current literature deals in detail with the effects of distance, accessibility, and transport costs on retail prices, most literature considers large markets or data sets at the national level. There is no substantial current literature available on such problems being analyzed from a computing perspective, specifically dealing with small community-based retail outlets and short time-period variance in prices. This paper bridges this gap by applying a data-driven computing approach to explore the relationship between market prices of mainstream commodities and distances, contributing towards the broad field of retail pricing and spatial economics.

Methodology

This study utilized computational mathematics, which allows the researchers to process numerical information in an unbiased and organized manner, identify trends, and convert raw data on price and distance into a more meaningful indication of how the market behaves. Researchers must consider and analyze a variety of interconnected variables when evaluating the price of a product in the market. Variables include location of the store; the ease of accessing the store; the cost of transport to reach the store; the availability of suppliers; demand within the local market; and local market conditions. Results from the study will use a quantitative descriptive research design when collecting, organizing, and analyzing numerical data to assess the relationship between the distance to a store and the prices of certain types of products (Rice, 2019; Stock & Watson, 2019).

This study examines the effect of distance from the city center on the prices of essential goods sold in sari-sari stores. To reflect the differences between sari-sari stores and the actual center of the city, transportation costs, frequency of deliveries to sari-sari stores, availability of suppliers and the like must be considered. The dependent variables for this study are rice (ordinary milled, or price per kg), sugar ($\frac{1}{4}$ kg), cooking oil, eggs (large size), instant noodles (price per package), and Coca-Cola (1 Liter). Each of these items will be the indicator of price movements for essential goods in the local market because they are commonly purchased for home use and can always be found in sari-sari stores.

To minimize the influence of external factors on the distance, researchers modified several variables within the study. Researchers considered only ten sari-sari stores which regularly sold the selected products across all the study locations located within Tanjay City, Negros Oriental. The researchers also ensured that they were able to properly compare prices by placing limitations on the standards associated with the products, including the size of the egg (large only) and type of rice (regularly milled).

To reduce the impact of price fluctuations resulting from inflation, seasonal demand, or supply disruption, researchers collected data over one time period. The price was defined as the actual price being charged by the store owner or attendant at the time of data collection, and the distance was calculated as the distance (in km) between each store and the center of the city using standard mapping techniques. After collecting the data, we compiled a table of prices for the selected items based on how far they were from the center of the city. Using the mean and the standard deviation, the researchers can calculate the average price level and show the difference in prices that occur between stores. Next, to confirm whether prices and distance from the center of the city were correlated, the investigators calculated a Pearson's correlation coefficient.

The formula for Pearson's correlation coefficient is expressed as: $r = (\text{sum of } ((x - \bar{x}) \times (y - \bar{y}))) \div \text{square root of } ((\text{sum of } (x - \bar{x})^2) \times (\text{sum of } (y - \bar{y})^2))$.

Where:

- r = the Pearson correlation coefficient
- x = the distance of the store from the city center in kilometers
- Y = the price of the selected good in pesos
- $\bar{x}$ and $\bar{y}$ = mean distance and mean price, respectively, and sum of indicates the summation of all values included in the calculation.

The pricing trends and store locations can be quantitatively estimated using this calculation.

The stores were not obligated to take part in the research, and the collection of data did not have a disrupting effect. In addition, anonymity is guaranteed for those establishments that participated in the research study. The approach that is used in the research study is largely objective and is of a quantitative nature because it presents the effect of the distance of the shop and market movements of prices of necessities against the prices of necessities due to the use of computational mathematics.

Conceptual Framework

This research will try to uncover how the price of common goods is related to geographic distances between sari-sari stores through simple computations. The influence of geographic factors, including distances between business locations, towards price variations will also be explained through this computational process. The phenomenon related to price variations towards various distances will be studied through simple quantitative examination in this research study. The research study's conceptual framework will comprise three main steps.

In this study, the variables that represent the input are the distance in kilometers of each store from the city center and the prices of some few commonly consumed goods like rice (in kilograms, normally regular milled), sugar (in $\frac{1}{4}$ kg), cooking oil, eggs (in large pieces), instant noodles, and Coca-Cola (1 liter). To have similar pricing from each establishment, the prices of the goods were obtained directly in each store by asking the owner or attendant about the prevailing market prices at each place.

The process begins with arranging the data gathered into a table with increasing distances from the city center. To determine average pricing levels and store-to-store differences, descriptive statistics like mean and standard deviation are calculated. Pearson's correlation coefficient is used to determine the direction and intensity of the relationship between shop distance and product prices. The following formula is used $r = (\text{sum of } ((x - \bar{x}) \times (y - \bar{y}))) \div \text{square root of } ((\text{sum of } (x - \bar{x})^2) \times (\text{sum of } (y - \bar{y})^2))$. This process allows the researchers to quantitatively analyze trends and patterns in pricing relative to store location.

The output results of the study provide mean prices, standard deviation values, and the values of correlation in order to find a specific relation between market product prices and their distance from city centers. The findings support the application of computational analysis in research on market behavior and offer a unique perspective on how prices vary among the stores.

Results

The table below shows the average prices and standard deviations of some common products, such as rice (per kilogram, usually sold as regular milled rice), sugar ($\frac{1}{4}$ kilogram), cooking oil, eggs (per piece, large size), instant noodles, and Coca-Cola (1 liter). These prices were gathered from 10 sari-sari stores in Tanjay City, Negros Oriental. We got the prices directly from the store owners or employees and we measured how far each business was from the city center in kilometers. The average prices of the selected commodities give an overview of pricing levels across the surveyed stores. Rice cost an average of ₱57.10 per kilogram, sugar ₱19.70 every $\frac{1}{4}$ kilogram, cooking oil ₱34.60, eggs ₱10.50 per piece, instant noodles ₱11.80, and Coca-Cola (1liter) ₱41.80. Rice had a standard deviation of ₱3.70,

sugar ₱3.13, cooking oil ₱1.17, eggs ₱0.85, instant noodles ₱1.69, and Coca-Cola ₱3.68. These findings show that, while some products, such as eggs and cooking oil, have relatively consistent pricing across retailers, others, such as rice and Coca-Cola, vary considerably.

Table 1. MEAN PRICES AND STANDARD DEVIATIONS OF SELECTED GOODS (n=10)

ITEM	MEAN PRICE(₱)	STANDARD DEVIATION(₱)
Rice (per kg)	57.10	3.70
Sugar (¼ kg)	19.70	3.13
Cooking oil	34.60	1.17
Eggs (per piece, large)	10.50	0.85
Instant Noodles	11.80	1.69
Coca-Cola (1L)	41.80	3.68

Pearson's correlation coefficient (r) was used to investigate the relationship between store distance from the city center and selected product prices. A correlation study yielded the following values: rice ($r = -0.01$), sugar ($r = 0.10$), cooking oil ($r = 0.44$), eggs ($r = 0.35$), instant noodles ($r = 0.29$), and Coca-Cola ($r = 0.12$). These findings show varied degrees of connection between distance and price. There is almost no relationship between the price of rice and distance. There is a very weak positive relationship between sugar and Coca-Cola, and a slight favorable connection between cooking oil and distance. This means that prices go up a little as stores are placed farther away from the city center. Eggs and instant noodles had weak to moderate positive connections, which means that prices went up a little as the distance between them increased.

Table 2. CORRELATION BETWEEN DISTANCE FROM CITY CENTER AND PRICES OF SELECTED GOODS

ITEM	PEARSON CORRELATION (r)	INTERPRETATION
Rice (per kg)	-0.01	No relationship
Sugar (¼ kg)	0.10	Very weak positive
Cooking oil	0.44	Moderate positive
Eggs (per piece, large)	0.35	Weak to moderate positive
Instant Noodles	0.29	Weak positive
Coca-Cola (1L)	0.12	Very weak positive

Discussion

The results of the study indicate that the price of typical items in sari-sari stores and the distance from the city center are correlated differently depending on the product. Cooking oil showed a bit positive relationship with distance, but most of the products possessed modest to very poor relationships. For instance, rice had almost no correlation with distance ($r = -0.01$), suggesting that its prices were essentially the same at all store locations. Cooking oil, on the other hand, showed a slightly positive trend ($r = 0.44$), suggesting that stores farther from the city center tended to sell this item at slightly higher prices. While sugar ($r = 0.10$) and Coca-Cola ($r = 0.12$) showed extremely weak positive associations, eggs ($r = 0.35$) and instant noodles ($r = 0.29$) also showed positive but weaker tendencies.

These results are in line with what is happening with small business prices in the Philippines as a whole. Sari-sari sellers frequently have to deal with increasing expenses that cause prices to change. Studies of retail trends in thousands of sari-sari businesses show that the prices of many products continue to rise up, even though national inflation has decreased. This underscores the susceptibility of micro-retail outlets to changes in upstream costs and supply chain limitations.

For instance, Packworks' examination of more than a million transactions from more than 300,000 sari-sari stores revealed that prices for several product categories rose despite a general reduction in inflation, partly because store owners had narrow profit margins and little purchasing power. These pressures may lead to different prices at different locations, especially in more remote areas where delivery frequency and logistics are more difficult. Some sellers may be forced to increase prices in order to cover operating costs and supplier markups (Montiel & Tan, 2025). These trends are also reflected in the price of rice in sari-sari stores. Rice prices have fluctuated significantly in recent years due to both market conditions and regulatory actions, according to national monitoring statistics.

The Department of Agriculture set maximum suggested retail prices for imported rice to stabilize consumer pricing. However, actual retail rates, particularly those in sari-sari stores, were above average market levels due to higher handling and distribution costs (Packworks Study, 2025). This is well supported by the near zero correlation in this study, proving that, on their own, distance classes did not have a very significant impact on the prices of rice within the area researched. This could be because price regulations and rice distribution networks are stable at this staple across locales. The moderate positive correlation coefficients for cooking oil, eggs, and instant noodles imply that these products are relatively sensitive to spatial cost differentials.

In sari-sari stores, such products can be received less regularly or sourced from mid-level wholesalers and may cost more for transportation and handling in stores that are further away from the main distribution areas. This would make pricing in remote areas disproportionate, as represented in the positive correlations which were highlighted. These trends highlight the role of accessibility and logistical costs as major determinants of retail prices in local micro-retail environments, and these have been emphasized within retail geography and micro-retail pricing research in emerging markets-on the influence of transport cost on unorganized retailers.

The competitive environment and market dynamics usually evidenced by sari-sari stores can be another factor that can be considered. The profit margins are low, there is minimal cash, and they do not require a lot of storage. More specifically, for the more impoverished regions, which are dominated by sari-sari stores in terms of actual purchase, small changes to the wholesale prices or transportation costs can easily give way to observable price variations on the retail level (Montiel, 2025).

It is also evident from the data that there are other factors, independent of distance, which influence price strategies in micro-retail arrangements, such as supply chain links, local demand, or network effects due to clustering or competition.

In summary, in the context of the Sari-Sari stores in Tanjay City, the distance from the center of the city can have some bearing in terms of prices of some products, but it is in no way the lone factor in terms of the change in prices in the markets.

Rather, what drives similarities and discrepancies of price differences between localities seems to be informed by a complex interplay of logistics cost, frequency of supply, and micro-economic elements.

These results above verify the relative importance of scrutinizing various contextual factors in understanding price variations in community markets, along with affirming the importance of contributing to knowledge about variations in retail prices within sari-sari store sectors.

Conclusion

The research effectively explored the correlation between the distance of sari-sari stores away from the downtown area of the cities and the pricing of selected daily commodities like rice, sugar, cooking oil, eggs, instant noodles, and Coca-Cola. In using a computational mathematics approach, the research managed to structurally organize and analyze the collected data into trends and patterns within market pricing through processing said data computationally.

The findings discovered that some products, like eggs and cooking oil, remained reasonably steady across all locations, whereas rice and Coca-Cola showed moderate variance. In addition, correlation research identifies various levels of relationship between distance to the center and prices. The price of cooking oil showed us a moderate and positive relationship with distance, which means that as distance from the city center improved, prices slightly improved in upcountry retail outlets.

The other items' correlations were small to very weak, suggesting that distance does not have any effect on the prices. These findings were supported by correlation analysis results, where there were different levels of correlation values between prices and distances. The strongest positive correlation was found to be in cooking oil, showing a slight increase in price as the distance from the city center increases. Other items showed lesser or irrelevant coordination, emphasizing the point that various economic variables can also impact market pricing and the simple matter of distance being insufficient in showing different kinds of prices.

Overall, the analysis shows that using computational techniques in processing market data is beneficial and helpful in recognizing price tendencies, variability, and how location affects price. Customers, small business organizations, and planning organizations can analyze and understand better about the price trends in Tanjay City through these observations.

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