

Supply and Demand Analysis of a Spicy Smashed Fried Chicken Business Using Linear Functions in Mathematics Learning

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ABSTRACT

This study aims to analyze the relationship between demand and supply in a Spicy Smashed Fried Chicken business around UIN Suska Riau and its application in mathematics learning. The research used a descriptive quantitative approach with a case-study design. Primary data were collected in December 2024 on Jl. Buluh Cina, Pekanbaru, through purposive sampling involving one business owner and six observations of daily transactions at different price levels. Data were analyzed using simple linear regression under the assumption of *ceteris paribus*. The results indicate that an increase of Rp1,000 in price decreases demand by approximately 5 portions per day and increases supply by approximately 5 portions per day. The market equilibrium occurs at a price of Rp12,500 with an equilibrium quantity of around 37–38 portions per day. These findings provide insights for culinary MSMEs in determining pricing strategies based on market conditions, especially among students who are sensitive to price changes. In addition, the resulting linear models can be applied in Realistic Mathematics Education (RME) to help students understand mathematical modeling through real-world contexts.

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SUBJECT

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1. Introduction

Education is one of the essential sectors that influences social and economic development in various regions [1]–[3]. The increasing number of higher education institutions has not only created academic environments but also stimulated the growth of supporting economic activities around campuses [4]–[8]. University environments generally encourage the emergence of businesses that cater to the daily needs of students, lecturers, and educational staff. Among these supporting sectors, food and beverage businesses have experienced rapid development because they are closely related to the lifestyle and consumption habits of the academic community. This phenomenon demonstrates the strong relationship between educational environments and the growth of the culinary industry.

The culinary industry is one of the sectors that plays an important role in the economy because it is directly related to fulfilling the daily food needs of society [9], [10]. The development of lifestyles and increasing purchasing power have encouraged the emergence of various culinary innovations that consumers increasingly favor [11], [12]. One consumer

group that exhibits distinctive consumption patterns is university students. Their busy academic activities lead them to choose food that is practical, affordable, and easily accessible [13]. This condition has caused areas surrounding higher education institutions to develop into centers of culinary business activities [14], [15], including the environment of State Islamic University of Sultan Syarif Kasim Riau (UIN Suska Riau).

Among the various types of food sold around the campus, Spicy Smashed Fried Chicken is one of the most popular menus among students [16], [17]. This dish, consisting of battered fried chicken served with chili sauce, has become part of the daily food choices for many students [18], [19]. The high demand for Spicy Smashed Fried Chicken is influenced by several factors, such as its relatively affordable price [20] the preferred spicy taste [21], and its fast serving process, which suits students with high mobility [22]. In addition, the ease of ordering through online motorcycle taxi services also contributes to the high purchasing rate of this food [23]–[25].

The high level of transaction activity in Spicy Smashed Fried Chicken businesses around the campus indicates a market dynamic that is interesting to study from a microeconomic perspective [26]. In economic theory, the interaction between buyers and sellers is explained through the concepts of demand and supply [27], [28]. Demand describes the quantity of goods that consumers wish to purchase at a certain price level, while supply refers to the quantity of goods that producers are willing and able to provide [29]. By analyzing these two concepts, business actors can understand market conditions, making it easier to set prices, regulate production levels, and formulate more effective business strategies [30], [31].

To describe the relationship between price and quantity of goods more measurably, a mathematical approach can be used in the form of a linear function [32]. A linear function expresses the relationship between two variables in the form of a straight-line equation, making it suitable for representing the relationship between price and the quantity demanded or supplied of a good. In mathematics education, linear functions are often used as a bridge to help students understand the abstract concept of functions through simpler representations in everyday life.

The integration of mathematical concepts with real-life contexts is in line with the principles of Realistic Mathematics Education (RME), which emphasizes the importance of contextual experiences in building mathematical understanding [3], [33], [34]. Thus, the use of linear functions not only serves as an analytical tool in determining price equilibrium in demand and supply cases [35], but also functions as an effective means to develop students' mathematical literacy [36], as well as critical thinking and mathematical modeling skills [37].

Several previous studies have examined demand and supply in various products. Ariasih et al. investigated the demand for Singapore Fried Chicken products in Kendari [38]. Another study by Muslimin et al. discussed the demand curve for marine commodities [39], while Sukanto and Masfufah analyzed the relationship between demand and supply in apple cider products [40]. Although previous research has examined market dynamics in culinary products such as chicken-based dishes and marine products, most of it remains descriptive. It has not yet developed the results into a context applicable to mathematics education.

Therefore, this study, entitled "Supply and Demand Analysis of a Spicy Smashed Fried Chicken Business around UIN Suska Riau Using Linear Functions as a Context for Mathematics Learning", was conducted. This study aims to construct mathematical models of demand and supply functions, determine the market equilibrium point using a linear

function approach, and utilize this approach as a context for mathematics learning. The results of this study are expected to provide practical contributions for MSME actors in determining optimal pricing, as well as theoretical and pedagogical contributions for mathematics educators as a reference for context-based learning.

2. Methodology

This study employed a case-study design with a descriptive-quantitative approach. The case study design was selected because it enables a more in-depth understanding of real-world conditions in the field, particularly those related to campus economic activities. The research was conducted on Jl. Buluh Cina, Pekanbaru, is a culinary business center that serves many students of UIN Suska Riau, who have relatively similar purchasing power.

The unit of analysis in this study was daily Spicy Smashed Fried Chicken sales transactions. The data used were primary data collected through direct observation of sales during December 2024. The sampling technique employed was purposive sampling, in which the researcher selected one Spicy Smashed Fried Chicken business considered representative, given its complete sales records and varying prices. From this process, six observation data points were obtained, each representing a different price level.

For clarity, each variable in this study is defined as follows:

1. Price (P): the price of one portion of Spicy Smashed Fried Chicken set by the seller, expressed in thousands of rupiah.
2. Demand Quantity (Q_d): the number of Spicy Smashed Fried Chicken portions purchased by consumers at a given price, expressed in portions per day.
3. Supply Quantity (Q_s): the number of Spicy Smashed Fried Chicken portions provided by the seller at a given price, expressed in portions per day.

The collected data were then analyzed using simple linear regression. The equation modeled the demand function $Q_d = a - bP$, while the supply function was modeled by $Q_s = c + dP$. This model was used because, in the short run, price changes are generally followed by proportional and linear changes in the quantity demanded and supplied.

In addition, this analysis employed the *ceteris paribus* assumption, meaning that other factors such as food taste, consumer income, and market conditions were considered constant. Furthermore, market equilibrium was determined by equating demand and supply, $Q_d = Q_s$, to obtain the equilibrium price and quantity. This study did not employ correlation analysis between sales and revenue because, mathematically, these two variables are directly related (revenue = price $\times$ quantity sold). Therefore, correlation analysis was not necessary as it would always indicate a very strong relationship.

3. Results and Discussion

3.1. Demand Function Analysis

A demand function analysis was conducted to determine the relationship between the price of Spicy Smashed Fried Chicken and consumer demand in the UIN Suska Riau area. Data was obtained by observing sales activity at several price levels. The results of the data collection are presented in Table 1.

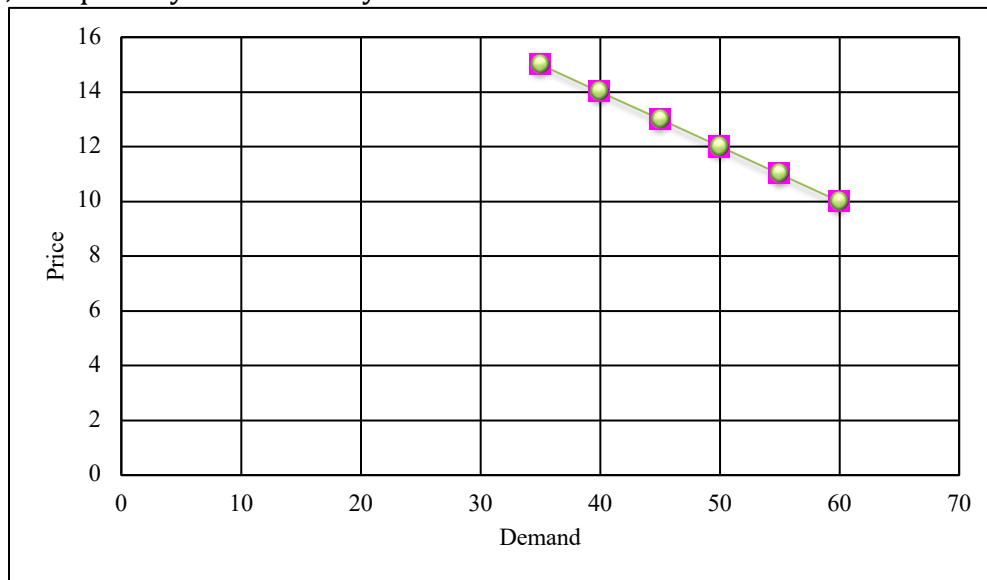
Table 1. Price and Demand

Price (P) (Thousand Rupiah)	Demand (Q_d) (Portions/day)
10	60
11	55
12	50
13	45
14	40
15	35

Based on Table 1, it can be observed that when the price of Spicy Smashed Fried Chicken increases gradually from IDR 10,000 to IDR 15,000, consumer demand decreases from 60 portions to 35 portions per day.

Through simple linear regression analysis using computational software, the estimated intercept (a) is 110 and the regression coefficient (b) is -5 . Thus, the demand function model is expressed as $Q_d = 110 - 5P$. The coefficient of determination (R^2) obtained is 1, indicating that price changes can fully explain all variation in demand in the data. This indicates that the relationship between price and demand in this study is linear and very strong.

The relationship between price and demand can be illustrated by a demand curve, as shown in Figure 1. The curve has a negative slope, indicating that as the price of a product increases, the quantity demanded by consumers decreases.

**Figure 1.** Demand Curve

3.2. Supply Function Analysis

A supply function analysis was conducted to determine the relationship between the price of Spicy Smashed Fried Chicken and the quantity supplied by producers in the UIN Suska Riau area. Data were obtained by observing the number of Spicy Smashed Fried Chicken portions produced and sold at several price levels. The data are presented in Table 2.

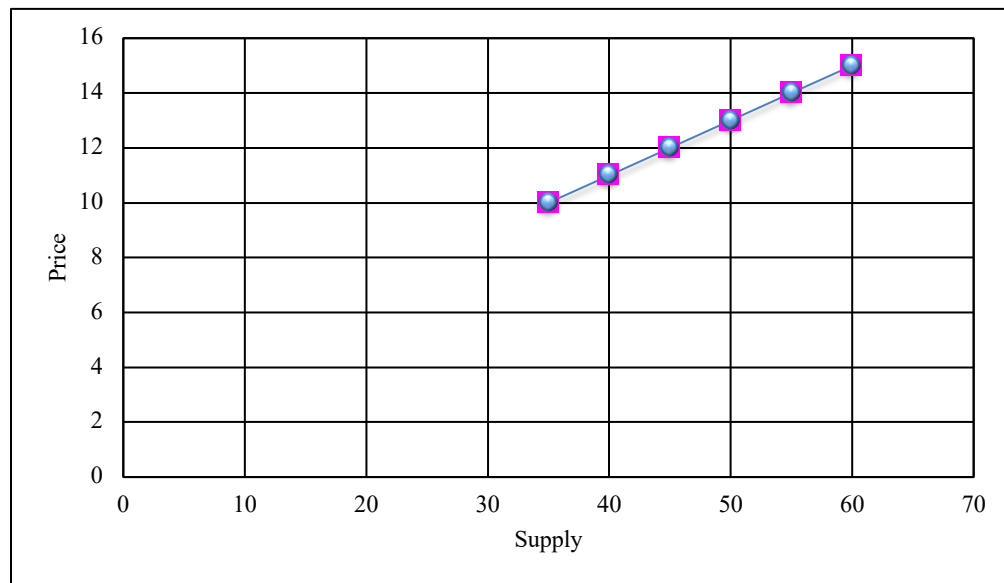
Table 2. Price and Supply Data

Price (P) (Thousand Rupiah)	Supply (Q_s) (Portions/day)
10	35
11	40
12	45
13	50
14	55
15	60

In contrast to the demand curve, the data in Table 2 reflect the law of supply, where a price increase encourages producers to increase output, from 35 to 60 portions per day.

The linear regression analysis yields an intercept (c) of -15 and a slope coefficient (d) of 5 . Thus, the supply function is expressed as $Q_s = -15 + 5P$. Like the demand function, the regression model for the supply function also produces an ($R^2 = 1$) in the observed data. This indicates that price changes can perfectly explain all variations in supply, so the relationship between price and supply is also linear and very strong.

The relationship between price and supply can be illustrated by a supply curve in Figure 2. The supply curve has a positive slope, indicating that a price increase will increase the quantity of goods produced.

**Figure 2. Supply Curve**

3.3. Market Equilibrium Analysis

Market equilibrium analysis determines the price and quantity at which demand and supply are in equilibrium. Market equilibrium occurs when the quantity of goods demanded by consumers equals the quantity supplied by producers at a given price. Based on the

functions derived earlier, namely $Q_d = 110 - 5P$ and $Q_s = -15 + 5P$. Market equilibrium is obtained by equating these two functions:

$$\begin{aligned} Q_d &= Q_s \\ 110 - 5P &= -15 + 5P \\ -10P &= -125 \\ P &= 12,5 \end{aligned}$$

To find the equilibrium quantity, the price value is then substituted into one of the functions, for example, the demand function.

$$\begin{aligned} Q &= 110 - 5(12,5) \\ Q &= 110 - 62,5 \\ Q &= 37,5 \end{aligned}$$

This yields the market equilibrium point, namely $E = (12,5, 37,5)$.

The relationship between the demand and supply curves that determines the market equilibrium is shown in Figure 3. The market equilibrium curve in the figure shows the point of intersection of the demand and supply curves. The demand curve has a negative slope, indicating that as the price increases, the quantity demanded decreases. Conversely, the supply curve has a positive slope, indicating that as the price rises, the quantity supplied increases. The point of intersection between these two curves indicates market equilibrium, that is, the state where the quantity demanded equals the quantity supplied.

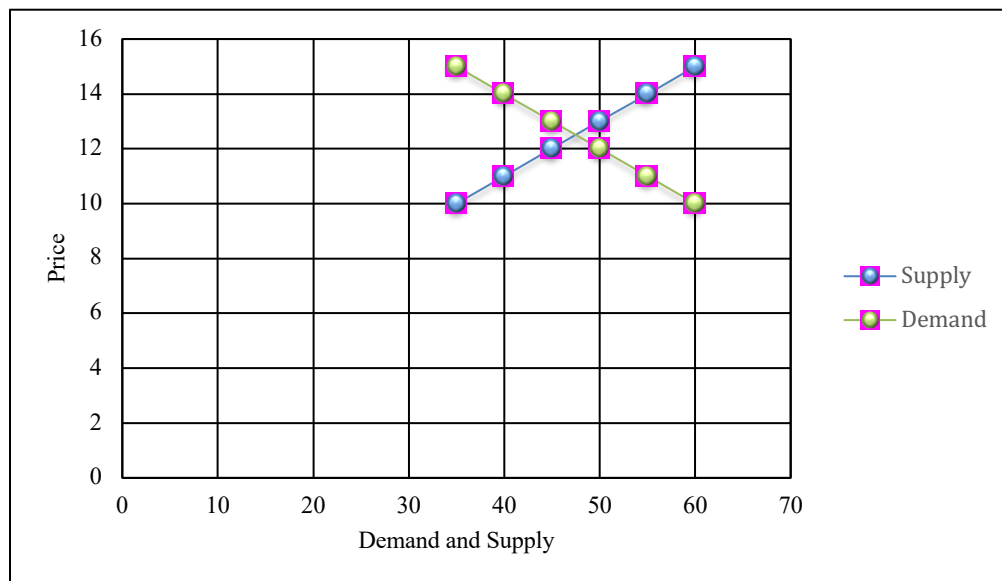


Figure 3. Market Equilibrium Curve

3.4. Discussion and Implications

Based on the results of the analysis, the demand function model formed, namely ($Q_d = 110 - 5P$), provides a clear description of consumer behavior in the campus environment. The negative regression coefficient value, namely 5, indicates that demand is highly sensitive to price changes (elastic). This means that, as consumers, students have limited pocket money, so even a slight price increase may cause them to switch to other food options. This condition is also influenced by the large number of food stalls around UIN Suska Riau, meaning that consumers are not heavily dependent on a single seller. This condition is

consistent with economic principles, where if prices are not aligned with market conditions, the quantity purchased will decrease significantly. This finding is consistent with Zelina's research and with Nasution and Hadita's, which show that student consumers are highly sensitive to price changes [41],[42].

On the other hand, the supply function ($Q_s = -15 + 5P$) provides important information for producers. The negative intercept value (-15) indicates a minimum price threshold for the business to remain viable. In simple terms, if the price is too low (even theoretically below production cost), sellers will choose not to produce because they will incur losses. This is related to production costs, such as fluctuating prices for raw materials like chicken and chili. Therefore, the market equilibrium point is ($E = 12,5; 37,5$), which indicates the ideal condition for both sellers and buyers. For IDR 12,500, consumer needs can be met, and producers still obtain profits without experiencing surplus or shortage [28], [43].

In addition, the perfect coefficient of determination ($R^2 = 1$) in this study occurs because the data used are still limited and assume that other factors are held constant (*ceteris paribus*). In real conditions, such relationships rarely occur because many other factors influence the market. However, in mathematics learning, such simplification is actually beneficial because it helps students understand concepts more easily.

This context is highly suitable for use in the Realistic Mathematics Education (RME) approach to learning the concept of a System of Two-Variable Linear Equations (SPLDV). Through examples close to everyday life, students can more easily understand the relationship between two variables in a meaningful way. The learning implications can be implemented through the following five main stages in RME [44]:

1. Understanding the contextual problem. Learning begins by presenting problems that are close to students' lives, namely data on the prices and sales quantities of Spicy Smashed Fried Chicken around the UIN Suska Riau campus. Students are invited to observe why the number of buyers decreases when prices increase, and why sellers increase production when prices rise.
2. Explaining the contextual problem. If students have difficulty understanding the data, the teacher provides guidance or assistance as needed. The teacher also explains the problem constraints, such as assuming other factors are constant (*ceteris paribus*), without directly providing mathematical solutions, so that students remain actively thinking.
3. Solving the contextual problem. Students are allowed to find solutions independently. Based on the given data, students try to construct graphs on the Cartesian plane, then draw demand and supply curves to find their intersection point.
4. Comparing and discussing answers. The teacher facilitates students' presentation of their work. Students then compare and discuss their results to determine the market equilibrium point, which is considered the most appropriate given the available data.
5. Concluding. In the final stage, the teacher helps students connect the discussion results with formal mathematical concepts. The intersection point of the graphs is designated as the solution, namely, the point $E = (12,5; 37,5)$.

In addition to being used in learning approaches, this context can also be used as an evaluation instrument to measure students' mathematical modeling abilities through six cognitive process indicators [45]. The following is an example problem and its solution steps based on these indicators:

“A Spicy Smashed Fried Chicken stall around UIN Suska Riau is analyzing its daily sales. Based on observations, when the price is set at IDR 10,000, demand reaches 60 portions, but the seller can only supply 35 portions. When the price is increased to IDR 15,000, demand decreases to 35 portions, while the seller is willing to supply up to 60 portions. Assuming the relationship between price and portions is linear, and other factors are constant, it helps the stall owner determine the ideal selling price so that the business does not incur losses and students can still buy!

The solution to this problem requires students to go through six systematic mathematical modeling stages, namely:

1. Constructing. Students build an initial understanding from the given situation. They recognize the imbalance between demand and supply and understand that price affects both aspects in different directions.
2. Simplifying. Students filter important information from the problem by defining price as variable P and quantity as variable Q . The data is then converted into ordered pairs, namely demand (10, 60) and (15, 35), and supply (10, 35) and (15, 60).
3. Mathematizing. At this stage, students transform the data into mathematical form. Using the concept of a linear equation, the demand function $Q_d = 110 - 5P$ and the supply function $Q_s = -15 + 5P$ are obtained.
4. Interpreting. Students interpret the mathematical solution back into a real-world context. By equating $Q_d = Q_s$, the equation $110 - 5P = -15 + 5P$ is obtained, resulting in the solution (12,5 ; 37,5). Then $P = 12,5$ is interpreted as “ideal selling price of IDR 12,500 per portion,” and $Q=37,5$ is interpreted as “number of portions sold.”
5. Validating. Students re-evaluate the obtained results by considering relevant contextual factors. They assess whether the price of IDR 12,500 is appropriate for students’ purchasing power and whether the resulting quantity is realistic.
6. Exposing. Students present the final result as conclusions or recommendations. For example: “The recommended price is IDR 12,500 with an estimated sales of 37–38 portions per day to achieve equilibrium between sellers and buyers.”

The use of real-life contexts in mathematics learning makes learning activities not only focused on calculation, but also helps students understand the meaning of concepts in everyday life. In the Realistic Mathematics Education (RME) approach, this method facilitates students in constructing concepts from familiar situations, allowing them to move more easily from concrete understanding to more abstract forms. In addition, such learning also increases student engagement, reduces the perception that mathematics is difficult, and helps develop critical thinking and mathematical modeling skills. This is consistent with research showing that the use of local contexts can improve understanding from the concrete to the abstract stage and increase student participation in learning [46].

4. Conclusion

Based on the results and discussion, the demand function $Q_d = 110 - 5P$ and the supply function $Q_s = -15 + 5P$ were obtained. The findings show that every increase of IDR 1,000 in price decreases the quantity demanded by 5 portions per day and increases the quantity supplied by 5 portions per day. The market equilibrium occurs for IDR 12,500 with an equilibrium quantity of approximately 37–38 portions per day. Under these conditions, the quantity demanded equals the quantity supplied, so there is neither a surplus nor a shortage.

In practical terms, these findings can serve as a reference for culinary MSME actors in determining selling prices that align with market conditions, particularly for student consumers who are sensitive to price changes. From a theoretical and pedagogical perspective, this study contributes to mathematics education, especially in relating mathematical concepts to real-life situations. The resulting model can serve as a learning context grounded in the Realistic Mathematics Education (RME) approach and as an evaluation instrument to assess students' mathematical modeling ability, thereby helping students connect real situations to abstract concepts. Through this approach, students not only learn computational procedures but also understand the meaning of mathematical concepts in everyday life.

However, this study has several limitations. The data used consists of only six observations and applies the *ceteris paribus* assumption (other factors are considered constant), resulting in a seemingly perfect relationship ($R^2 = 1$). This condition does not fully represent real market conditions, which are typically influenced by many other factors and tend to fluctuate. Therefore, future research is recommended to use a larger dataset with a longer time period to improve model generalization. In addition, further studies, such as Design Research or Classroom Action Research (CAR), are suggested to directly test the effectiveness of using this Spicy Smashed Fried Chicken context in improving students' learning outcomes and mathematical modeling abilities in the classroom.

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