WEP
Warwick
Evans
Publishing

Transactions on Economics, Business and Management Research
ISSN: 2960-1789, eISSN: 2960-2254 | Volume 14
AFTEM 2024

Study of Maximizing Profits in Perfect Competition

Wenyuan Jiang *

Jiangsu Tianyi High School, Wuxi, China

* Corresponding Author Email: yijing@ldy.edu.rs

Abstract. The concept of a perfectly competitive market is one of the foundational theories in microeconomics. This model provides a clear framework for understanding supply, demand, and price determination. In this market structure, many small firms sell almost the same products and compete with each other. As a result, there is no big firms that have significant market power to change the market price. This idea was first come up by economists such as Adam Smith. This paper explores how a firm can maximize profits and minimize costs using Calculus, particularly derivatives and integrals. It will provide a clear derivation process and explain each step in detail. Moreover, this research discusses real-world economic problems related to pricing and cost structures, using bakery as an example. By addressing these multifaceted issues, the study strives to give a better suggestion to small businesses in the Perfect Competition about management strategies to ensure a comparatively stable economic environment for business growth. Then the failure rate can be reduced.

Keywords: Perfect competition, Microeconomic, Profit maximization, Derivative, Calculus.

1. Introduction

Maximizing profits proves to be significant in running a business in Perfect Competition. According to the definition in AP Microeconomics/Macroeconomics with Online Tests, Perfect Competition is a large market. There, all firms (sellers) compete with each other to gain more buyers, selling homogeneous products [1]. Also, without a barrier for firms to enter or exit the market, the competition is fierce. Therefore, many businesses fail due to their inability to achieve cost efficiencies and competitive pricing [2]. The way to run a business in the long term is a crucial topic: long-term successful businesses create stable job opportunities, leading to economic growth and societal well-being. As a result, research has explored the factors influencing a business's running time—for example, Brigham, E. F. and Houston, J. F. discovered that effective financial management, including budgeting strategies, and adequate financial resources are important to long-term sustainability [3]. Besides, to survive in the long period, firms must operate at maximum efficiency to minimize costs. This requires a suitable strategy to optimize production numbers to reduce average costs and guarantee enough profits. This paper explores an equilibrium point of price, quantity, and cost, which can help the small firms in this market maximize their benefits. By addressing this question, the study aims to ensure a stable economic environment for businesses, leading to the reduction of failure rate.

Research framework: The remaining parts of this paper are arranged as follows: the second part is the Literature Review, the third part is the Methodology, the fourth part is the Result, and the last part is the Conclusion of this paper.

2. Literature Review

Perfect competition as a phenomenon is familiar to economic scientists who have discussed the reasons for profit maximization. The principal theories and research papers furnish details regarding how costs can be saved, exact pricing can be attained, and an understanding of market operations.

The seminal ideas, like those of Alfred Marshall and Adam Smith, gave an impulse to developing competitive markets. "Principles of Economics" by Marshall developed supply and demand and price theory [4]; "The Wealth of Nations" by Smith explained the invisible hand effect and profit

maximization as guiding principles of the markets [5]. According to Mankiw, firms that are also in perfect competition are price takers and need to lower costs, as well as cut down on production with the intensity of profits in mind [2]. To achieve the profit goal, the marginal revenue (MR) and marginal cost (MC) must be met.

Pindyck and Rubinfeld put a particular emphasis on the fixation and nature of cost [6]. They dwell upon the operation of the law of diminishing returns which asserts that after a certain stage of production is passed, the marginal cost of production will significantly increase. Regarding managing financial affairs, Brigham and Houston highlight the effectiveness of strategic financial management, smart budgeting, and keeping costs under control for a sustainable long-term profitability position [3].

Makowski and Ostroy combine the question of market price dynamics in Perfect Competition and the fact that all firms have to accept market-determined prices and improve their performance to maximize profits [7]. In this case, the work of Feinberg uses the example of non-profit-maximal behavior which can still be compatible with competitive market behavior [8-10].

These tasks, cost efficiency, optimal volume, and smart money management have been outlined as the top priorities of profit maximization standings in perfect competition for a few years. Classical economic theories are backed by empirical data, where they have been utilized in different sectors of the economy. Further research can focus on the use of technological advances in the industry, their contribution to cost structures, and lasting efforts to gain profits.

In conclusion, the existing literature on profit maximization in perfectly competitive markets provides valuable ideas from both theoretical and practical perspectives. While these studies offer substantial theoretical and practical contributions, there is still space for further research, particularly in formula derivation, sustaining long-term profitability in competitive markets, and analysis of real-life examples.

3. Methodology

3.1. Key Concepts and Definitions

Total Revenue (TR): The amount of money a firm receives by selling its products or services, which can be calculated as TR=P (price) × Q (quantity).

Total Cost (TC): The amount of money incurred in producing a certain unit of goods, encompassing both fixed and variable costs.

Economic Profit: The disparity between TR and economic costs (both explicit and implicit costs).

Marginal Revenue (MR): The change in TR by selling an additional unit of product or service, calculated as$MR = \frac{\Delta TR}{\Delta Q}$.

Marginal Cost (MC): The change in TC by producing an additional unit of product, calculated as$MC = \frac{\Delta TC}{\Delta Q}$.

Several crucial assumptions should be made before analyzing a perfectly competitive market. First, the products produced by all firms are homogeneous, making them perfect substitutes for one another. Besides, the price in the market is determined by the intersection of supply and demand, and each firm has to accept this market price. Finally, all the firms and consumers behave rationally, aiming to maximize profit and utility respectively.

3.2. Graphs of Perfect Competition.

The price of a specific product is determined in a large market. That means the price is determined by the market, and each firm has to accept the “market price” [1]. As a result, a graph is needed to

indicate the market price. According to the law of demand, a product's quantity demanded decreases with an increase in its price, and vice versa, the demand curve is a curve with a negative slope. Similarly, due to the law of supply, it is easy to explore that the supply curve is always a curve with a positive slope. The price at the intersection point of these two curves is called the equilibrium price, and the quantity there is called the equilibrium quantity [2]. Therefore, the two curves can be plotted in Figure 1 below:

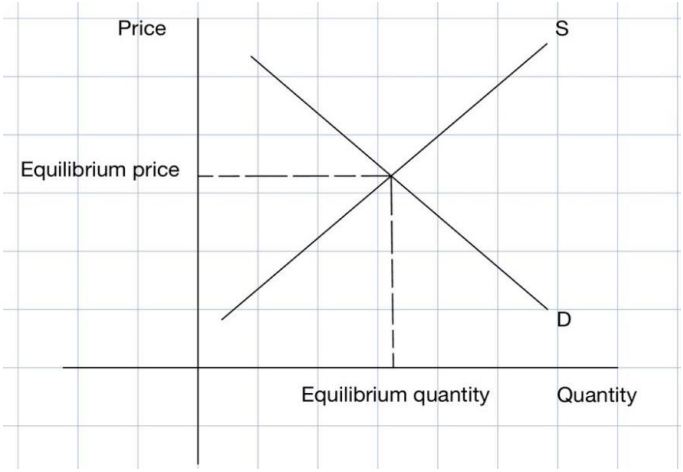

Fig 1. Market Equilibrium Point.

According to Figure 1, the equilibrium price can be easily found.

Then we need to investigate the graph of a single firm in the market. Since the price in Perfect Competition is fixed, a horizontal line, whose ordinate is equal to the equilibrium price, can be used to indicate the firm's marginal revenue——when the firm sells an additional product, it can receive the same amount of money as the price. Next, it is needed to plot the marginal cost. The Law of Diminishing Returns states that when additional units of input are added, they will contribute less and less to the total output, leading to a marginal cost increase. Initially, firms may experience increasing returns to scale, where adding more inputs leads to proportionately higher outputs and lower MC. However, after a certain point, diminishing returns set in, causing MC to rise [6]. As a result, on a graph, the MC curve is typically U-shaped, reflecting the actual trend. Finally, average total cost (ATC) should be considered. ATC equals to average variable cost (AVC, like raw material) plus average fixed cost (AFC, like rent). When the business begins, the ATC is high because of the FTC. However, with the growing production number, the FTC will spread over more and more units, leading to a reduction in ATC. However, after one point, the ATC starts to increase due to diseconomies of scale. In specific, as the firm expands, inefficiencies such as overcrowding, overuse of resources, and increased complexity in management drive up costs [6]. In conclusion, the graph of a single firm in Perfect Competition can be drawn in Figure 2 below:

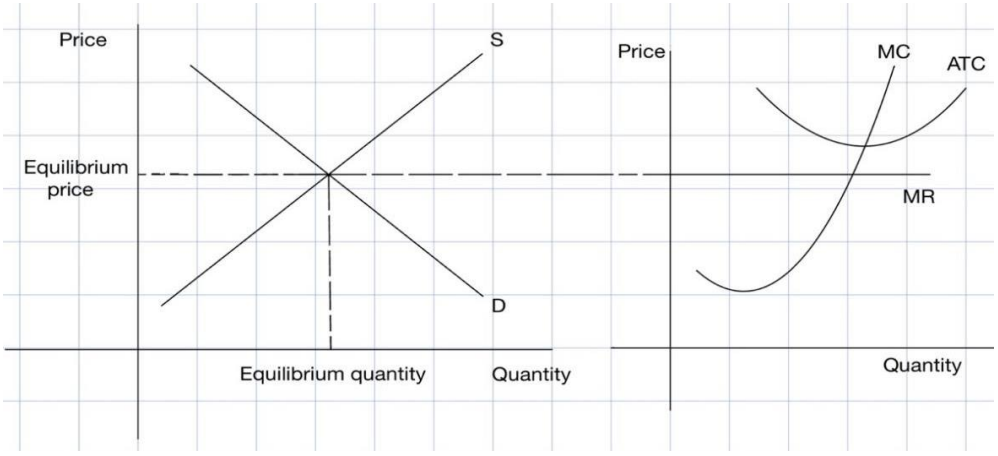

Fig 2. A Single Firm in Perfect Competition.

3.3. Derivation of the Profit-Maximizing Condition

With the graphs above, it is feasible to analyze each factor and derive a formula to maximize the profit. To maximize profit, a firm should set its production level where the difference between total revenue and total cost is maximized. Mathematically, derivatives can be used to find where the point of maximized difference between TR and TC. According to Mathematics LibreTexts, "A local extremum is where the function's derivative equals zero"[9]. As a result, calculating the derivative of the function of profits concerning quantity is zero can discover the profit-maximizing point.

$$\mathbf{P = TR - TC} \tag{1}$$

Taking the derivative of profit:

$$\frac{dp}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ} \tag{2}$$

Since $\frac{dTR}{dQ}$=MR, $\frac{dTC}{dQ}$=MC:

$$\frac{dp}{dQ} = MR - MC \tag{3}$$

Let the derivative equal zero:

$$\frac{dp}{dQ} = MR - MC = 0 \rightarrow MR = MC \tag{4}$$

As the process of calculability above, it is obvious that profit is maximized where MR=MC. In figure 3, it is the point of intersection of the marginal revenue curve and the marginal cost curve.

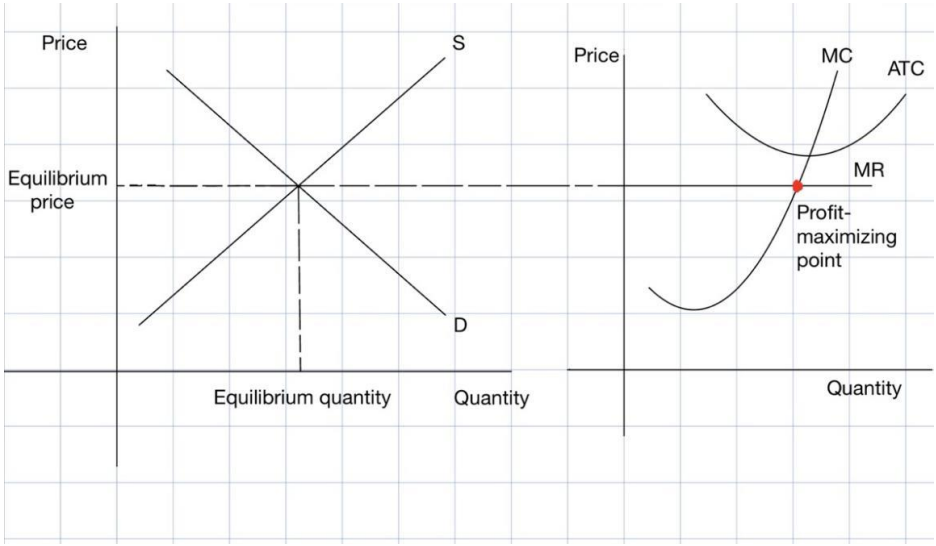

Fig 3. Profit-maximizing Point.

The profit-maximizing point is marked with a red dot in Figure 3.

3.4. The Amount of Maximized Profit in the Graph

It is worth discovering how to find the amount of profits through these graphs. As profit = TR-TC, the amounts of TR and TC are necessary.

Marginal revenue is the derivative of the total revenue function:

$$\frac{dTR}{dQ} = \mathbf{MR} \tag{5}$$

Finally, to find TR, integrate the marginal revenue function concerning Q

$$TR = \int MR dQ \tag{6}$$

A definite integral calculates the signed area under a curve between two points on the x-axis. Thus TR can be calculated by MR×Q*(the profit-maximizing quantity), representing the area between MR and the x-axis from 0 to Q*.

Then, TC =ATC×Q*

Consequently, the profit can be shown in figure 4:

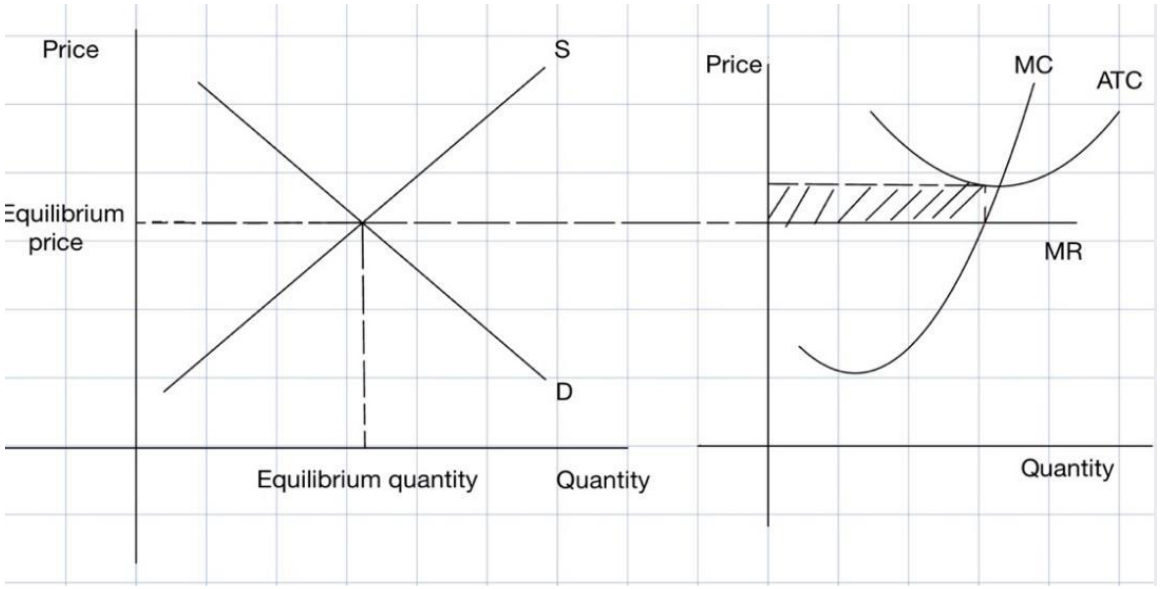

Fig 4. The Shade of Profit.

The area representing the profit is shaded.

4. Result

4.1. Overview of Profit Maximization

Profit maximization is a key point in economics since it can help firms make production and sales strategies rationally. This rule states that profit is maximized when a firm produces at the intersection point of MR and MC. For instance, when a firm finds that The benefits of each additional product produced exceed the cost of that product, it will continue to produce more products until MR=MC. Moreover, this rule is also suitable for other market structures, including monopolies and oligopolies.

4.2. Real-life Example: Bakery

Fixed cost: Regardless of the level of production and the quality of products, the fixed cost, including rent and utility bills, remains constant. For a typical bakery, rent and utilities can range between $4,750 to $5,750 per month, while staff costs may be around $20,000 per month for a team of 4 employees [10].

Variable cost: The variable cost will change with the increase or decrease in production, mainly because of the raw material cost, which constitutes around 28-35% of sales. In specific, a bakery with monthly sales of $48,000 might spend approximately $13,400 to $16,800 on raw materials [10].

Marginal cost: Suppose the cost of producing 100 loaves of bread is $200. The cost of producing an additional loaf may be $4, making the marginal cost $4 for the 101st loaf

Marginal revenue: Suppose the market equilibrium price of a loaf is $5.

Thus, the barkery should continue to produce more loaves until MR=MC since $5 > $4. Assume the bakery finds that production of the 1,100th loaves results in a marginal cost of $5, which equals the marginal revenue, 1100 is the optimal production quantity.

4.3. Examples of Real Events

Though the Air transport market belongs to an oligopoly, as it has a barrier for firms to enter, there are some real events in which Air transport companies use the rule MR=MC to adjust their strategies.

In the early 1960s, Continental Airlines applied a strategy by running flights even when additional revenues were below average costs but still covered the marginal costs. In the early 1960s, Continental Airlines employed a similar strategy, operating flights even when additional revenue was below average but still covering marginal costs. This resulted in significant profits and influenced the strategy adopted by other airlines [11].

5. Conclusion

This essay has thoroughly examined how firms can maximize profits in a perfectly competitive market using the principles of calculus, particularly focusing on the critical condition where marginal revenue (MR) equals marginal cost (MC). In the investigation of multiple economic concepts, total revenue, total cost, and marginal analyses provide a compelling explanation of how companies operate optimally when deciding an ideal production level to become more and more profitable. The application of this rule was exemplified through a practical analysis of a bakery, demonstrating how fixed and variable costs interact to influence the marginal cost and ultimately profit. The argument from the case of Continental Airlines in the 1960s, discovering that the MR = MC rule is useful by different industries, in their policymaking, has a broad applicability. However, the paper mainly leaves the subsequent question about market dynamics undiscussed. Feasible research could continue with the analysis by integrating wider economic factors that affect the profit maximization decisions in perfectly competitive markets of firms. Another important aspect that should be looked into is the profound effect of technological advancement as well as digital transformation on cost structures and profit margins. The importance of the essay is illustrated through its detailed coverage of the principles of profit maximization, which combines theoretical literature with some practical aspects that are able to improve the performance of small businesses via increasing operational efficiency. With a deeper and clearer understanding of those economic basics, companies always need strategies that work best in competitive markets, continuous improvement of production processes, and achievable and sustainable growth.

Reference

[1] Musgrave, Frank, et al. AP Microeconomics/Macroeconomics with Online Tests. Simon and Schuster, 2020.

[2] Mankiw, N. Gregory, and Nicholas Gregory Mankiw. Principles of Macroeconomics. Thomson, 2007.

[3] Brigham, Eugene F., and Joel F. Houston. Fundamentals of Financial Management, Concise Edition. South-Western College, 2019.

[4] Marshall, Alfred. Principles of Economics. 1890.

[5] Smith, Adam. The Wealth of Nations. Modern Library, 2000.

[6] Pindyck, Robert S., and Daniel L. Rubinfeld. Microeconomics. 2018.

[7] Makowski, Louis, and Joseph M. Ostroy. “Perfect Competition and the Creativity of the Market.” Journal of Economic Literature, vol. 39, no. 2, June 2001, pp. 479–535. https://doi.org/10.1257/jel.39.2.479.

[8] Feinberg, Robert M. “On the Consistency of Non-Profit-Maximizing Behavior with Perfect Competition.” Southern Economic Journal, vol. 46, no. 4, Apr. 1980, p. 1163. https://doi.org/10.2307/1057249.

[9] Michael Corral. Maxima and Minima. Libretexts, 2023. https://math.libretexts.org/Bookshelves/Calculus/Vector_Calculus_(Corral)/02%3A_Functions_of_Several_Variables/2.05%3A_Maxima_and_Minima

[10] SharpSheets Team. How To Build a Financial Model For a Bakery. January 3, 2023. Retrieved on August 21, 2024. Retrieved from https://sharpsheets.io/blog/financial-model-bakery-pastry-shop/

[11] Mary Hall. How to Maximize Profit with Marginal Cost and Revenue. Investopedia, 2023. https://www.investopedia.com/ask/answers/041315/how-marginal-revenue-related-marginal-cost-production.asp