energies

Article

Development of a Partial Shipping Fees Pricing Model to Influence Consumers' Purchase Intention under the COVID-19 Pandemic

Cheng-An Tsai [1] and Che-Wei Chang [2,*]

[1] Department of Business Administration, Shih Chien University, Taipei 104336, Taiwan; chengan.tsai@msa.hinet.net
[2] Department of Recreational & Graduate Institute of Recreational Sport Management, National Taiwan University of Sport, Taichung City 404401, Taiwan
* Correspondence: chewei@gm.ntus.edu.tw; Tel.: +886-4-2221-3108

Abstract: The COVID-19 pandemic is accelerating the rapid development of the digital economy. Previous studies have indicated that shipping fees are essential in delivery strategies and significantly impact order generation rates. According to market research, 68% of consumers would increase their orders to reach the minimum threshold for free delivery. However, previous studies have focused on the problem of setting free shipping thresholds, so the existing model of the e-commerce platform only allows consumers to choose whether to pay the total shipping fees or conditional free delivery with a free shipping threshold. A lack of literature concerns the partial pay for shipping fees before reaching the free shipping threshold. Therefore, this study proposes a new pricing model for shipping strategy that allows consumers to pay partial shipping fees. This model can increase the flexibility of consumer choice, thus increasing consumers' willingness to purchase, which in turn increases the revenue of the e-commerce platform. The model was validated for 9-month on the e-commerce platform of a Smart-Integration company. The results showed that after introducing the new pricing model, the e-commerce platform's sales grew by about 9%. This proposed model's theoretical extension and empirical results can remedy the research gap in the extant literature.

Keywords: COVID-19; socio-economic factors; e-commerce platform; partial pay; shipping fees

Citation: Tsai, C.-A.; Chang, C.-W. Development of a Partial Shipping Fees Pricing Model to Influence Consumers' Purchase Intention under the COVID-19 Pandemic. *Energies* **2022**, *15*, 1846. https://doi.org/10.3390/en15051846

Academic Editors: Ligita Šimanskienė and Erika Župerkienė

Received: 8 January 2022
Accepted: 24 February 2022
Published: 2 March 2022

1. Introduction

The digital economy has seen a tremendous expansion of e-business in recent years, with most developed countries experiencing double-digit growth rates. Moreover, this increasing trend was accompanied by the chain reaction of the COVID-19 pandemic. As the digital economy grows, successful e-businesses can provide companies with an expanded customer base and new opportunities to extend their markets.

According to a report published by the United Nations, the dramatic growth of e-commerce due to movement restrictions caused by COVID-19 increased the share of online retail sales in total retail sales from 16% to 19% in 2020 [1]. Digital-Commerce-360 [2] estimated that U.S. e-commerce sales reached USD 791.7 billion in 2020, a 32.4% increase from USD 598 billion in 2019, and an even more significant 39% increase in the first quarter of 2021, which is the highest annual growth in online sales since statistics became available.

The pandemic triggers a rethinking of consumption and lifestyles, and for those companies that can successfully capture the new trend, the pandemic becomes an opportunity to grow. Taiwan effectively controlled the pandemic in 2020, but consumption and lifestyles have undergone more dramatic changes than in previous years. According to the Ministry of Economic Affairs of the Republic of China [3], online retail sales in Taiwan grew to USD 94.3 billion in 2019, an annual increase of 12.2%. The COVID-19 pandemic became more severe in 2020, limiting people's physical-economic activities and driving consumption to online sales. As a result, online retail sales increased by 17.5% in 2020, outperforming the 4.8% annual decline in physical retail sales. During the pandemic, Taiwan's e-commerce industry grew 16.09% annually in 2020, making it one of the industries that benefited significantly from the pandemic. It also acted as a locomotive for the non-storefront retail industry and drove many peripheral support services [4].

According to Trans-BIZ [5], the factors that affect consumers' willingness to purchase on the e-commerce platform include: (1) the speed of the website, 57% of consumers will give up browsing the website if they wait for more than three seconds; (2) 80% of consumers will not return to the website; (3) 92.6% of consumers say that the visual enjoyment of the overall design of the website is the main factor affecting the purchase decision; (4) 50% of consumers have more confidence in the product after watching a video; (5) 31% of consumers made a purchase after watching an introductory video; (6) 41% of consumers give up because of hidden extra charges at the time of checking out; (7) 29% of consumers will not buy if they need to register a new account; (8) 11% of consumers will not buy because of the lack of detailed delivery information; (9) 10% of consumers will not buy because the purchase process is too long; (10) 8% of consumers will not buy because there is no telephone information for the provider on the website; (11) 59% of consumers consider whether there are shipping fees when buying; (12) 53% of consumers switch to online purchases because the price is cheaper online, and (13) 44% of consumers will not buy because the shipping fees are too high.

Delivery strategies have become an essential source of differentiation and an essential factor in the operational strategy of e-commerce companies [6]. The shipping fees are one of the most critical factors in the delivery strategy and significantly affect the order generation rate [7,8]. A retail study by American Marketing Research [9] found that free delivery is the most likely reason to convince people to complete the last step of the purchase process; as many as 83% of respondents select the free delivery option, and 68% of consumers will consider increasing the quantity of their order to qualify for free delivery. Therefore, on the e-commerce platform, the platform company sets a threshold for free delivery per order to absorb the shipping fees and encourage consumers to buy more. In order to reach the minimum threshold set by the platform company, consumers usually buy more than their required quantity. Some consumers are willing to partially pay for shipping fees and only buy the actual quantity required. Previous studies have focused on the problem of setting free delivery thresholds [8,10,11], lacking a delivery strategy in which consumers partially pay shipping fees before reaching the free delivery threshold, which is one of the theoretical gaps in the existing literature.

Therefore, this study aims to design a model from the consumer's point of view that allows consumers to pay partial shipping fees before reaching the free shipping threshold so that both the e-commerce platform company and consumers can obtain what they need and achieve reasonable shipping fees formula. This study also defines the partial shipping fees pricing model as a dynamic pricing model for the customer to timely calculate e-commerce order amounts and partial shipping fees to illustrate the delivery conditions for decision-making.

The structure of the article is as follows. The second section presents the literature review. Then, the material and methods express the problem description, notation and assumptions, model illustration, and empirical testing results. The fourth section leads to a discussion. The fifth section is the conclusion.

2. Literature Review

The literature review consists of three sub-sections: economic order quantity model and e-commerce last-mile delivery strategy, e-commerce decision support system and pricing models, and e-commerce delivery strategy with different types of shipping fees.

2.1. Economic Order Quantity Model and E-Commerce Last-Mile Delivery Strategy

Swenseth and Godfrey [12] suggested that each order quantity and freight rate level affect the order quantity and freight rate discount, affecting the overall inventory and logistics costs. The goal of inventory replenishment decisions using the economic order quantity model is to minimize the total annual logistics cost. An accurate solution must appropriately incorporate the relevant factors affecting transportation costs into the logistics cost function to determine the quantity to be purchased. Riza et al. [13] stated that economic order quantity is the number of orders that minimizes total holding costs and booking costs within the scope of operations management. It is one of the oldest classical production scheduling models and the most widely used model to solve the management efficiency problem caused by inconsistent inventory levels. Mendoza and Ventura [14] extended a previous economic order quantity model by considering two modes of transportation, namely truckload and less than truckload carriers, by introducing all-units and incremental quantity discount structures into the analysis to calculate the cost of minimum order interval and reduce the total costs of the supply chain.

Birbil et al. [15] proposed a purchase–transportation cost function for which the model easily solves the one-dimensional convex minimization problem. This model tries to solve out-of-pocket holding costs, unit holding opportunity costs, fixed ordering costs, general purchase–transportation costs under full truckload and less-than-truckload transportation costs, and the well-known carload discount schedule. Jana and Roy [16] proposed a new intuitionistic fuzzy optimization method to solve uncertainty's multi-objective linear planning problem. This approach extends intuitionistic fuzzy sets based on fuzzy optimization, which applies to the capacity transportation problem, and develops a transportation model to minimize costs. Ojha et al. [17] presented the improved sub-gradient method used for optimization and its effectiveness in fuzzy traffic models that accurately calculate transportation costs. The model formulates a multi-item balanced transport problem in the case of imprecise unit transportation costs, and the available space and budget at the destination are also limited but imprecise. The goal is to find a shipment schedule for these items to minimize the total cost subject to imprecise and budgetary constraints of the destination warehouse. Ghosh and Roy [18] proposed an effective model for the transportation problem of mixed fixed costs with truck loading constraints for multi-objective products by inserting transit costs and type-I fixed costs through the transfer station. The model analyzes an additional cost that is considered Type II fixed cost with transportation costs and truck loading constraints when the number of items exceeds the vehicle's capacity to complete the shipment by more than one trip. De and Sana [19] highlighted a new approach to the classical back-ordered economic order quantity model with promotional effort and sales price-dependent demand rates for linguistically dichotomous fuzzy variables. The fuzzy model poses a cost minimization problem by weighing setup, inventory, backorder, and promotional costs and treating the coefficient vector as a fuzzy pentagonal number associated with some coordinates.

Battini et al. [20] examined the integration of factors affecting environmental impacts in the traditional economic order quantity model and proposed a sustainable economic order quantity model. All sustainability factors are associated with material lot sizes from the beginning of the purchase order to the buyer's plant. Therefore, the model incorporates the environmental impacts of transportation and inventory, specific internal and external transportation costs, supplier and vendor locations, and varying freight vehicle utilization to evaluate the impact of sustainability considerations on purchase decisions. Chen and Yu [21] designed an optimal economic order quantity model to explore the total cost minimization for manufacturers within a limited planning horizon. The model also combines the fact that carbon emissions are generated during the transportation and storage of products. The model proposes a heuristic algorithm to analyze the relevant properties of the optimal solution of the model to solve for the optimal number and quantity of orders for manufacturers under the carbon policy constraint. The results show an optimal ordering strategy that minimizes the total cost to the manufacturer within a finite range.

Daryanto and Christata [22] developed an economic order quantity model by considering several sources of carbon emissions, as well as the influence of the defective rates, different demand rates, selling price, and holding costs for defective products, and shortages backorder to solve the problem when the company is still facing problems related to inferior product quality. Daryanto et al. [23] developed an economic order quantity model that leads to higher total expected profits per unit of time by considering carbon emissions from transportation and warehouse operations, including imperfect quality items and assuming complete back-ordering. Teo et al. [24] established a theoretical model to evaluate city logistics schemes for multiple stakeholders before implementing and managing truck operations in the city and keeping pollution levels minimum. This model solves multi-agent systems that use a vehicle routing problem with time windows, electronic freight marketplaces, and Q-learning. Al-nawayseh et al. [25] suggested that last-mile logistics is one of the most critical challenges in e-commerce shopping. Online retailers must respond to customer demands for convenient, highly reliable, and on-time delivery services by providing convenient logistics services while keeping the process as cost-effective as possible. The study proposed to select the most appropriate delivery operating system model using available routing and scheduling online solutions to identify, analyze and compare the cost efficiency of available alternative delivery solutions to provide the best logistics strategy for e-commerce platform providers.

According to Lim et al. [26], consumers care about last-mile delivery because of the convenience and flexibility it offers, and last-mile delivery strategies have become an essential source of differentiation in the e-commerce market. It prompts e-commerce players to invest in countless consumer delivery innovations, such as buy-online-pickup-in-store, automated delivery solutions, lockers, and free delivery with minimum purchases. By offering consumers more flexibility, same-day and on-demand delivery e-commerce platforms are becoming increasingly popular for everyday grocery and retail purchases. This paper presented a comprehensive review and analysis of the literature on e-commerce last-mile logistics distribution structures and their associated contingent variables to propose a design framework to analyze the relationship between the combination of contingent variables and the operational characteristics of the last-mile logistics structure to design a last-mile logistics strategy that suits consumer needs. Leung et al. [27] indicated that because of the irregularity of e-commerce order arrival patterns and the time constraint of platform providers in processing orders, logistics service providers must handle e-commerce logistics orders very efficiently to ensure on-time delivery to customers. Otherwise, it will affect the customer's satisfaction with platform providers and logistics service providers. They apply the genetic algorithm approach to e-commerce orders, grouping decisions and rule-based inference engines to redesign the fulfillment process of e-commerce orders in distribution centers and propose an intelligent model that can efficiently process e-commerce logistics order solutions and significantly reduce order processing time and travel distance. Leung et al. [28] applied the fuzzy association rule mining approach and the fuzzy logic technique to discover the factors influencing the pricing decisions of products published on e-commerce platforms. This new approach of artificial intelligence technology can significantly improve the efficiency and effectiveness of product pricing decisions. The COVID-19 outbreak was an unpredictable event that seriously impacted global shipping. Few studies have examined the key factors affecting port operations in a pandemic. Xu et al. [29] introduced a panel data model to explore the key factors affecting shipping trade in different regions under the COVID-19 pandemic to reveal the effectiveness of government preventive and control measures on shipping trade. Management insights can help shipping companies, port operators, and governments change their strategies to recover from the impact of COVID-19. A panel linear regression model [30] analyzed the shipping trade's key factors. They found that the severity of the pandemic has a significant negative impact on both import and export cargo throughput; the stringent governmental preventive measures have a significant positive impact on export cargo throughput; the industrial added value above the designated size has a significant positive correlation with import throughput.

The above literature is to help logistics and operations personnel calculate the frequency and quantity of orders from a vendor's supply chain perspective, centering on minimizing total logistics costs. It helps determine the optimal order quantity to meet the buyer's needs while considering order quantity, demand rates, order costs, transportation costs, storage costs, and other factors to increase the supplier's profitability. Whether from an e-commerce platform's provider's perspective, offering the best logistics strategy for e-commerce platform providers, or efficiently handling e-commerce logistics orders to improve the effectiveness of product pricing decisions for manufacturers, these are all supply-side perspectives.

2.2. E-Commerce Decision Support System and Pricing Models

Mangiaracina et al. [31] reviewed 75 papers published in international peer-reviewed journals or proceedings between 2001 and 2019. The paper found that the last-mile delivery process, which affects overall logistics costs and the economic sustainability of B2C e-commerce, is the topic of most significant interest for optimization; the review highlights, among the main factors affecting its costs, the likelihood of delivery failure, the density of customers in the delivery area, and the degree of automation of the process. The paper also identified some theoretical gaps and recommendations for future research, including mapping customer behaviors, crowd-sourcing logistics, and dynamic pricing for customers. The e-commerce platform company and customers can derive significant benefits from the implementation of dynamic pricing, and future research efforts can focus on these areas. Silverman et al. [32] noted that e-commerce platforms often fail to support buyers' decisions and searches, resulting in lost sales and customer return purchases, and the authors suggest that any given platform requires significant investment and effort to create the decision support systems needed to support buyers' decisions correctly, and provide a framework to guide such efforts. Zong et al. [33] suggested that a decision support system is a computerized system used to help a company or organization make decisions, judgments, and action plans, especially in e-commerce, to search and analyze large amounts of data, provide customers with easy-to-understand knowledge, and provide an intelligent system to assist the platform company and consumers in problem-solving and decision making. The study identified eight key components that provide a framework for realizing the effectiveness of e-business intelligence systems. Chandra et al. [34] indicated that people start to change their shopping lifestyle by shopping online on e-commerce platforms. The e-commerce platform accumulates big data from product experts and buyers' reviews, which makes potential buyers need more time to read reviews to choose the right product, which leads to consumer disorientation. The authors proposed a conceptual model of a decision support system that integrates all reviews to help consumers choose their desired products on e-commerce platforms.

Wu et al. [35] argued that accurate pricing is one of the ultimate keys to e-commerce success. Some online retailers have tried personalized pricing strategies for some of their inventory products, but consumers' resistance to price discrimination is still significant. The paper proposed a framework for a random pricing strategy that deals with the information asymmetry of product prices among internet users, and the framework formulates product price variation at online retailers as a Markov process. It allows consumers to trade-off between buying immediately at a high price with immediate utility or later at a low price with probability and discounted utility. This random pricing strategy will allow suppliers to generate more profit than a fixed pricing strategy, and it is also a demand-side approach that allows consumers to have more flexibility in their choices. Ji et al. [36] suggested that providing decision support to consumers is essential in electronic commerce. The paper proposed a consumer decision support model based on e-commerce product reviews. The model uses probability multivalued neutrosophic linguistic numbers (PMVNLN) to characterize online reviews and analyzes whether the fuzzy features of reviews (i.e., PMVNLN) can reflect the similarities and differences of positive or negative information. The model also combines the regret theory with the ranking method to consider the bounded rationality of consumers. The simulation results show that this model performs well in terms of accuracy and is a good choice for e-commerce platforms to provide good decision support services to consumers.

Hu et al. [37] argued that the fast-growing e-commerce market provides convenience to customers, and with the increasing number of e-commerce companies, the competition in this market has become more intense. E-commerce companies need to improve the satisfaction of online consumers to maintain their loyalty, where the key is customized logistics services, and this study empirically demonstrated that customized logistics services significantly affect the satisfaction of online consumers. Shao [6] suggested that delivery policy is an essential factor in the operational strategy of e-commerce companies. This study compared the free and the calculated shipping strategies depending on the product item mix. The study's main findings were: although online retailing may result in lower prices and higher supplier availability for customers, no e-commerce companies can benefit from online movement under the calculated shipping strategy, and only e-commerce companies with relatively small local market size may benefit under the free shipping policy. The study also developed a geographic pricing model and a standardized pricing model. Under the geographic pricing approach, there is no distinction between charged or free shipping policies. Under the standardized pricing approach, customers in regions with shipping rates lower than the weighted average shipping rate prefer the calculated shipping policy. In contrast, customers in regions with shipping rates higher than the weighted average shipping rate prefer the free shipping policy. This study confirmed that different delivery strategies of e-commerce companies influence consumers' choices.

The above literature points out that, from the perspective of e-commerce competition, the development of dynamic or intelligent pricing models and decision support systems can help consumers make timely and correct purchasing decisions that improve consumer satisfaction and benefit the revenue or profitability of e-commerce companies. Different pricing models and decision support systems can produce different results in specific situations. Although the above literature has pointed out the importance of the demand-side perspective, the development of the model is still mainly focused on the supply-side perspective.

2.3. E-Commerce Delivery Strategy with Different Types of Shipping Fees

According to scholars [7,8], shipping fees significantly affect the incidence of orders, with market research showing that between 52% and 60% of online consumers will abandon their online purchases when they learn that shipping fees are required. To reduce the negative impact of shipping fees, e-commerce companies implement a variety of shipping-related strategies. The three most common strategies are (i) unconditional free shipping, in which the e-commerce company absorbs the shipping fees for all orders; (ii) conditional free shipping, in which the e-commerce company pays the shipping fees but only if the order amount is equal to or greater than a predetermined threshold; and (iii) all consumers are responsible for the shipping fees that increase with the total amount of the purchase. Lewis [10] found that conditional free shipping is the most effective strategy in increasing the revenue of e-commerce companies. Previous scholars have explored how to set this conditional free shipping threshold, such as Cachon et al. [11], who proposed a data-driven analytical model to (i) evaluate the profitability of e-commerce companies' current shipping threshold strategy and (ii) determine the optimal free delivery threshold strategy for e-commerce companies. Becerril-Arreola et al. [8] adopted publicly available statistics to find the best-fitting distribution of consumer purchase amounts and the best-fitting function of conversion rates (i.e., the probability that an arriving customer places an order with the e-commerce platform). A lack of literature concerns the partial pay for shipping fees before reaching the free shipping threshold.

The highlights of the former three sections of the literature are summarized below. Last-mile delivery strategies have become an essential source of differentiation in the e-commerce market [26]. The key for e-commerce companies to improve online consumer satisfaction and loyalty is to customize their delivery strategy to meet the customers' demand [37], which is an essential factor in the operational strategy of e-commerce companies [6]. That is to say, a customized delivery strategy is one of the most important competitive weapons for e-commerce companies. The shipping fees are one of the most critical factors in the delivery strategy and significantly affect the order generation rate [7,8]. The three most common strategies with shipping fees implemented by e-commerce companies are unconditional free delivery, conditional free delivery with a free shipping threshold, and shipping charges that increase with the purchase amount [7,8,11]. Previous studies have focused on the problem of setting free delivery thresholds [8,10,11], lacking a delivery strategy in which consumers partially pay shipping fees before reaching the free delivery threshold, which is one of the theoretical gaps in the existing literature. Previous studies have also identified the importance of dynamic pricing decision support systems. E-commerce companies must provide decision support to consumers, which is considered an essential competitive tool in the e-commerce market [35]. E-commerce companies and customers can benefit from implementing dynamic pricing [31]. From the customer's perspective, a dynamic pricing decision support system is one of the theoretical gaps in the existing literature.

The literature points to the importance of the demand-side perspective. However, the existing literature lacks a pricing model that considers the shipping fees strategy with partial pay from the consumer's perspective. Therefore, this study proposes a partial shipping fees pricing model to calculate orders and the partial pay for shipping fees. Then consumers have exact and timely information to decide whether they will pay partial shipping fees without exceeding the minimum free shipping threshold. This model echoes the research gaps and future recommendations identified by Mangiaracina et al. [31], expecting significant benefits from intelligently dynamic pricing implementation to e-commerce platform providers and customers. This model also echoes the point made by Zong et al. [33], that a decision support system should be available to provide customers with easy-to-understand information to assist consumers in problem-solving and decision-making.

3. Materials and Methods

This section is divided into four parts. Section 3.1 is "Shipping Pricing Affects Consumer Intent" which illustrates the impact of shipping fees on consumer spending intentions on e-commerce platforms that offer shipping discounts. Section 3.2 is "Definition and Assumptions of Partial Shipping Fees Pricing Model" which uses the Smart-Integration e-commerce platform as a case study to illustrate the formation of pricing model. Section 3.3 is "Model Illustration" which uses three scenarios to demonstrate the meaning of partial shipping fees. Section 3.4 is "Model Simulation and Empirical Testing Results", illustrating the simulation and testing results.

3.1. Shipping Pricing Affects Consumer Intent

Previous studies [7,8,10,11] confirmed that shipping fees affect online consumers' willingness to place orders and that e-commerce companies adopt the most effective conditional free shipping strategy to attract consumers to increase e-commerce companies' revenue. However, previous studies have focused on issues of setting free shipping thresholds. For example, Leng and Becerril-Arreola [7] investigated the joint optimization strategy of product pricing and free shipping threshold by dealing with the different profit ratios of each product, the product item mixes of each order, the expected gross margin of each order, and the free shipping threshold and other related variables. Or Becerril-Arreola et al. [8] dealt with free shipping threshold, gross margin percentage, fixed shipping cost per order, average sales per customer order, average shipping revenue per customer order, the average cost of returns per order, product item mix per order, different profit ratios for each product, and other relevant variables to investigate the free shipping threshold strategy that allows e-commerce companies to obtain the best profit. The existing literature lacks a pricing model for shipping strategy that allows consumers to pay partial shipping fees before reaching the free shipping threshold. Thus, this study formulated the partial shipping fees pricing model regarding the variables in the model proposed by scholars [7,8] as follows.

3.2. Definition and Assumptions of Partial Shipping Fees Pricing Model

This study is based on Smart-Integration's established e-commerce business model and adds the function of partial shipping fees to give consumers more choices to promote order generation rates. This study also defines the partial shipping fees pricing model as a dynamic pricing model for customer to timely calculate e-commerce order amounts and partial shipping fees to illustrate the delivery conditions for decision-making. The limitations of this study are that the model was applied to the Smart-Integration [38] regional e-commerce platform for a 9-month validation period, not considering transnational parameters such as ocean and air freight. The following is the definition of the notations and assumptions of the model and the step-by-step reasoning process for setting up the algorithm and the notation definitions are:

P_i:	Price of ith product
C_i:	Cost of ith product i
Q_i	The quantity of ith product purchased by consumers in the specific order on the ecommerce platform
PR_i:	Profit of ith product
SF:	Shipping fees of the specific order
TP	Total profit of the specific order
ATP:	For the specific order, the ecommerce platform assures a profit.
GTP:	Total gross profit of this specific order
λ:	The assured profit margin set by the ecommerce platform, where: $0 < \lambda < 1$
α:	Dynamic rate of shipping fees of this specific order for consumers
β:	The basic rate of shipping fees for each order set by the ecommerce platform
BSF:	The basic shipping fees per order
$CDSF$:	Dynamic shipping fees of this specific order for consumers

Assumptions

In the marketplace of e-commerce platforms, n products are available for consumers to buy.

Definition 1. *The price of the ith product is P_i, the cost of theith product is C_i.*

Definition 2. *On the e-commerce platform, the profit of the ith product, as shown in Equation (1).*

$$PR_i = P_i - C_i \tag{1}$$

Definition 3. *If the quantity of ith product purchased by a consumer on an e-commerce platform is Q_i, then the total profit of that order is as shown in Equation (2).*

$$SP = \Sigma\ (PR_i \times Q_i) \tag{2}$$

Definition 4. *For each order, the e-commerce platform charges an assured profit margin of λ, then the order is expected to have an assured profit, as shown in Equation (3).*

$$ATP = \lambda \times TP \tag{3}$$

Definition 5. *The gross profit per order, as shown in Equation (4).*

$$GTP = (1 - \lambda) \times SP \tag{4}$$

Definition 6. *The basic shipping fees per order on the e-commerce platform, as shown in Equation (5).*

$$BSF = \beta \times SF \tag{5}$$

where β is the fixed rate set by the e-commerce platform. When $BSF < GTP < SF$, the consumer pays part of the flexible shipping fees.

Definition 7. *For Definition 6, assuming a linear model for the consumer's portion of the shipping fees, the dynamic and flexible rate of shipping fees of this specific order for consumers is α, as shown in Equation (6)*

$$\alpha = (SF - GTP)/(SF - BSF) \tag{6}$$

and the dynamic and flexible shipping fees of this specific order for consumers is CDSF, as shown in Equation (7).

$$CDSF = \alpha \times \mathrm{SF} \tag{7}$$

3.3. Model Illustration

The partial shipping fees pricing model formulated in this study is shown in Figure 1 and illustrated as follows:

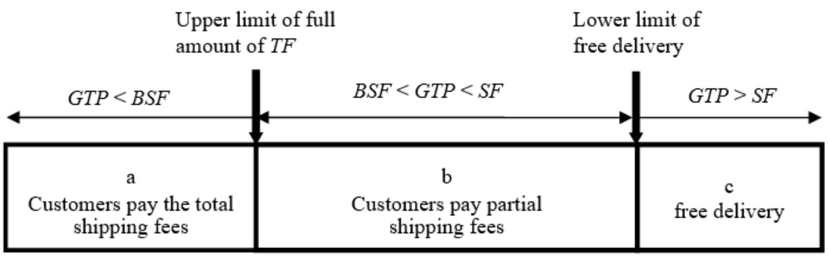

Figure 1. Partial shipping fees pricing model illustration.

Scenario 1: When $GTP > SF$, i.e., area c in Figure 1, the consumer can enjoy free delivery at this time.

Scenario 2: When $GTP < BSF$, i.e., area a in Figure 1, the consumer pays the total shipping fees for the order. The B.T.F is set to encourage consumers to buy more to achieve partial shipping fees or free delivery.

Scenario 3: When $BSF < GTP < SF$, i.e., area b in Figure 1, then the consumer must pay partial shipping fees, CDSF = $\alpha \times SF$ with Equation (6).

3.4. Model Simulation and Empirical Testing Results

We illustrate the partial shipping fees pricing model using 11 products and prices on the Smart-Integration e-commerce platform, and five cases of purchases made by consumers in the three purchase scenarios in Section 3.3. Eleven products are available for consumers to buy, listed in Table 1, and the five cases of consumer purchases with partial shipping fees are explained as follows.

Table 1. Product list on the e-commerce platform.

Product	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
Price	25	30	22	36	40	56	58	80	76	50	42
Cost	12	20	10	20	26	36	30	40	42	24	20

SF is a variable, that is the shipping fees of the specific order. During the examining period, the e-commerce platform company sets the shipping fees per order $SF = 100$, $\beta = 0.4$, $\lambda = 0.2$.

Case 1: Assume that the customer purchases items D, F, I, and J with quantities 2, 2, 3, and 1, respectively.

Calculate $GTP = (1 - \lambda)\Sigma\, PR_i \times Q_{ij} = (1 - 0.2) \times [2 \times (36 - 20) + 2 \times (56 - 36) + 3 - (76 - 52) + 1 \times (40 - 24)] = 132.8 > SF = 100$,

In case 1, the GTP is in area c. Thus, the customer enjoys free delivery.

Case 2: Assume that the customer purchases items A, B, C, and E with quantities 1, 1, 1, and 1, respectively.

Calculate $GTP = (1 - \lambda)\Sigma\, PR_i \times Q_{ij} = (1 - 0.2) \times [1 \times (25 - 12) + 1 \times (30 - 20) + 1 \times (22 - 10) + 1 \times (40 - 26)] = 39.2 < BSF = \beta \times SF = 0.4 \times 100 = 40$.

In case 2, the *GTP* is in area a. Thus, the customer pays the total amount of the shipping fees for the order.

Case 3: Assume that the customer purchases items A, B, C, E, and H with quantities 1, 1, 1,1, and 1, respectively.

Calculate $GTP = (1 - \lambda)\Sigma\, PR_i \times Q_{ij} = (1 - 0.2)\ [1 \times (25 - 12) + 1 \times (30 - 20) + 1 \times (22 - 10) + 1 \times (40 - 26) + 1 \times (80 - 40)] = 71.2 > BSF = \beta \times SF = 0.4 \times 100 = 40$, and $< SF = 100$.

In case 3, the *GTP* is in area c. Thus, the customer pays partial shipping fees for the order. Then calculate

$$CDSF = \alpha \times SF = [(SF - GTP)/(SF - BSF)] \times SF = [(100 - 71.28)/(100 - 40)] \times 100 = 48$$

Case 4: Assume that the customer purchases items B, D, F, J, and K with quantities 1, 1,2,1, and 1, respectively.

Calculate $GTP = (1 - \lambda)\Sigma\, PR_i \times Q_{ij} = (1 - 0.2)\ [1 \times (30 - 20) + 1 \times (36 - 20) + 2 \times (56 - 36) + 1 \times (40 - 24) + 1 \times (42 - 20)\ ] = 75.2 > BSF = \beta \times \mathrm{SF} = 0.4 \times 100 = 40$, and $< SF = 100$.

In case 4, the *GTP* is in area b. Thus, the customer pays partial shipping fees for the order. Then calculate

$$CDSF = \alpha \times SF = [(SF - GTP)/(SF - BSF)] \times SF = [(100 - 75.2)/(100 - 40)] \times 100 = 41.3$$

Case 5: Assume that the customer purchases items C, E, G, J, and K with quantities 2, 1, 2,1, and 1, respectively.

Calculate $GTP = (1 - \lambda)\Sigma\, PR_i \times Q_{ij} = (1 - 0.2)\ [2 \times (22 - 10) + 1 \times (40 - 26) + 2 \times (85 - 65) + 1 \times (40 - 24) + 1 \times (42 - 20)] = 92.8 > BSF = \beta \times SF = 0.4 \times 100 = 40$, and $< SF = 100$.

In case 5, the *GTP* is in area b. Thus, the customer pays partial shipping fees for the order. Then calculate

$$CDSF = \alpha \times SF = [(SF - GTP)/(SF - BSF)] \times SF = [(100 - 92.8)/(100 - 40)] \times 100 = 12$$

Table 2 clearly illustrates that consumers can make purchase decisions in the five scenarios of simulated purchase order analysis by considering the balance of product items, quantity, and shipping fees. For each case simulation, the platform company has developed an intelligent auxiliary system that automatically calculates a variety of required shipping fees scenarios for adding products that consumers have purchased, including free delivery or partial shipping fees, to assist consumers in purchase decisions. In Table 2, there are many different simulations for purchase orders. However, in the practical operation of the e-commerce platform, it is possible to set up multiple dynamic simulations and record the purchase orders in different simulations, allowing consumers to make the most appropriate purchase decision for their needs.

Table 2. Different simulated purchase order scenarios.

Case	1	2	3	4	5
Product Item Mix	A, B, C, E	A, B, C, E	A, B, C, E, H	B, D, F, J, K	C, E, G, J, K
Item Quantity	2, 2, 3, 1	1, 1, 1, 1	1, 1, 1, 1, 1	1, 1, 2, 1, 1	2, 1, 2, 1, 1
Order Amount	452	117	197	288	336
Customer Shipping Fees	0	100	48	41.3	12
Total Amount of the Order	452	217	245	328.3	348
Gross Total Profit (GTP)	132.8	39.2	71.2	75.2	92.8
Shipping Fees (Fixed)	100	100	100	100	100
Basic Shipping Fees (BSF)	40	40	40	40	40
Platform Shipping Fees	100	0	52	58.7	88

The model is tested in real-world operations at the Smart-Integration e-commerce company [36], which most of the products online are daily food, seafood, or grocery. This study obtains relevant data from February to October 2021 to transform into two indicators. The first indicator with orange color (Number Percentage) is the percentage of monthly orders that use the system's simulation function for partial shipping fees to the total number of orders, which shows an increasing trend. The second indicator with blue color (Amount Percentage) is the percentage of monthly orders that use partial shipping fees to the total amount of orders, which also shows an increasing trend. Figure 2 illustrates these two indicators.

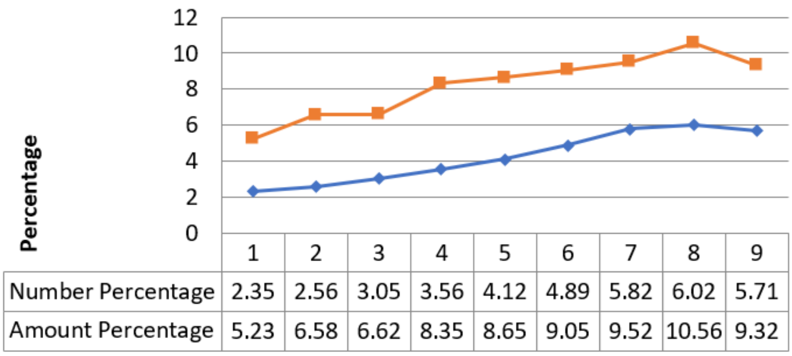

Figure 2. The trends of model testing.

4. Discussion

The simulation results of different model scenarios and preliminarily empirical results can achieve the research objectives. The definition and algorithm of the model setting in Section 3.2 are clear and easy to understand and can convert into programming software for immediate computation. The results of the model simulation in Section 4 are shown in Table 2, which can be divided into two parts: the areas in the upper five rows are the part that consumers can observe, while the area in the bottom four rows is the part that the e-commerce platform company can additionally observe.

This model is a consumer-oriented intelligent procurement model, which is entirely different from the existing supply chain viewpoint dominated by the e-commerce platform company. Consumers can order different combinations of products, knowing the product item, the number of items, the order amount, the amount to be paid for shipping fees, and the total amount of the order plus the shipping fees for each order. This real-time information allows consumers to buy according to their needs, solving inflexible choices.

For the e-commerce platform company, the threshold value of area c in Figure 1 is the shipping fees required for each order. The e-commerce platform company can set the free shipping threshold as in the past. The formula set in the past is that as long as the gross profit of the consumer's purchase quantity exceeds the threshold, the delivery will be free, and if it is less than the threshold, the consumer must pay the total shipping fees.

The new model divides the part smaller than the threshold into two parts, using the basic shipping fees rate set by the e-commerce platform company as the boundary. Area a is where the gross profit of the purchased quantity is lower than the basic shipping fees, and area b is where the gross profit of the purchased quantity is higher than the basic shipping fees.

In area a, the gross profit of consumer purchases cannot absorb the basic shipping fees that the e-commerce platform company is willing to pay. At this time, the model shows that consumers have to pay all shipping fees. This setting is quite critical. The purpose is to encourage consumers to purchase larger quantities. At least the gross profit of the purchased quantity must be higher than the basic shipping fees to enter the b area, in which the shipping fees of the order are shared by the consumer and the e-commerce platform company simultaneously.

The model in area b uses Equations (6) and (7) to calculate the value of shipping fees shared between consumers and the e-commerce platform company, as shown in the row of customer shipping fees and the row of platform shipping fees in Table 2. Total gross profit of case 3, case 4, and case 5 all fall in area b. However, the gross profit of case 3 falls close to area a, case 4 is between case 3 and case 5, and the gross profit of case 5 falls close to area c. The closer to area c, the smaller the shipping fees for consumers. The partial shipping fees for case 3, case 4, and case 5 are 48, 41.3, and 12, respectively. The result shows that the algorithm of this model can support the research objectives of this study.

Figure 2 shows the data of the 9-month trial of this model on the e-commerce platform of Smart-Integration companies, which type of products is primary on daily food, seafood, or grocery. The Number Percentage indicator shows that about 8–10% of consumers will use this model's partial self-pay shipping function. The Amount Percentage indicator shows that consumers use partial self-pay shipping to place orders, accounting for about 5% of the e-commerce company's revenue. Although this 5% of revenue cannot be directly attributed to this new function, it can be reasonably inferred that 3–5% of the 8–10% of consumers who use the new function may have lost revenue without this new function. Such validation results can support the research objectives of this study.

The current rules of the game in Taiwan's e-commerce economy are that consumers are entitled to free delivery for each order that exceeds the e-commerce platform company's pre-determined minimum threshold, i.e., the logistics and shipping fees; if the order is under the minimum threshold, the consumer pays the shipping fees. Under intelligent procurement, consumers should know the total amount of their orders and the partial shipping fees they need to pay when they place their orders.

5. Conclusions

Shipping fees are an essential factor with two perspectives on the e-commerce platforms. From the supply chain perspective of e-commerce platform companies, shipping fees are part of the overall economic order quantity model when considering total costs, order quantity, demand rates, order costs, shipping fees, storage costs, and other factors to calculate the optimal order quantity. However, 68% of consumers would consider increasing their orders to qualify for the free delivery threshold [9]. Therefore, consumers often over-purchase to qualify for free delivery, which is a flawed model that forces consumers to over-purchase and is not consumer-oriented thinking. Some consumers only want to purchase the required quantity and are willing to pay partially for shipping fees. However, the lack of flexibility in the existing literature is a research gap. E-commerce platform companies should be innovative to solve consumers' lack of flexibility of choice due to the limitation of the shipping fees threshold.

Previous literature has made several important points about the development of the e-commerce market. First, consumers in the e-commerce market are very concerned about last-mile delivery, and last-mile delivery strategies have become an essential source of differentiation in the e-commerce market, prompting e-commerce companies to invest in developing delivery innovations that consumers want, intending to provide consumers with greater convenience and flexibility [26]. While the e-commerce market is becoming more competitive, e-commerce companies need to improve online consumer satisfaction to maintain their loyalty, where the key is customized delivery services [37]. Thus, delivery strategy is an essential factor in the operational strategy of e-commerce companies, and different delivery strategies affect consumers' choices [6]. In short, a customized delivery strategy is one of the most important competitive weapons for e-commerce companies.

Second, shipping fees are an essential factor in delivery strategies and significantly impact order generation rates, with more than 50% of online consumers abandoning orders due to the need to pay shipping fees [7,8]. As a result, e-commerce companies implement various delivery strategies related to shipping fees. The three most common strategies are unconditional free shipping, conditional free shipping, and shipping fees that increase with the purchase amount [7,8,11]. Among them, a conditional free shipping strategy with a free shipping threshold is the most effective way to enhance the benefits of e-commerce companies [36]. Thus, previous studies have focused on the problem of setting free shipping thresholds [8,10,11], and previous studies lack delivery strategies in which consumers pay partial shipping fees before reaching the free shipping threshold, which is one of the theoretical gaps of the existing research.

Third, previous studies have also identified the importance of dynamic pricing decision support systems. E-commerce companies are often unable to support customers' decisions, resulting in lost sales, and any e-commerce company requires significant effort to create the decision support systems needed to support customers' decisions correctly [32]. E-commerce companies must provide decision support to consumers, which is considered an essential competitive tool in the e-commerce market [35]. Accurate pricing strategies from the customer's point of view are one of the ultimate keys to e-commerce success, and the ability to provide customers with flexible pricing strategies can enhance the competitiveness of e-commerce companies [35]. Scholars have also suggested that e-commerce companies and customers can gain significant benefits from the implementation of dynamic pricing, which is an important research question for the future [31]. Thus, a dynamic pricing decision support system from the customer's perspective is one of the theoretical gaps in existing research.

Based on the above analysis, this study is in the context of the critical trends of e-commerce market development and the theoretical gaps in the existing research. Therefore, this study proposes a partial shipping fees pricing model for timely calculation of e-commerce order amounts and partial pay for shipping fees and uses simulated results of different scenarios to illustrate the shipping fees payment conditions to achieve a balance between the e-commerce platform company and consumers. The proposed model can solve the lack of flexibility in consumer choice due to the free shipping threshold qualifications to achieve intelligent purchasing for consumers on the e-commerce platform. While previous studies [7,8,11] focused on the free shipping threshold, this study proposes an innovative model in which consumers pay partial shipping fees before the free shipping threshold is reached. The theoretical extension and empirical results respond to the call of Mangiaracina et al. [31] that the implementation of an intelligently dynamic pricing model provides significant benefits to both e-commerce platforms and customers and to the call of Zong et al. [33] that e-commerce platforms should provide an easy-to-understand decision support system to assist consumers in problem-solving and decision making.

The contribution of this study is not in the mathematical formula but is in proposing an innovative business model of delivery strategy. In the highly competitive e-commerce market, a last-mile delivery strategy is a key to the differentiation between e-commerce companies, and a customized delivery strategy that meets consumers' needs is the crucial weapon for competition. The shipping fees are an essential factor in the customized delivery strategy that affects consumers' orders, and previous research on the delivery strategy of shipping fees has focused on dealing with the free shipping threshold. This study proposes an innovative business model of a delivery strategy, a decision support model from consumers' perspective, allowing consumers to pay partial shipping fees before reaching the free shipping threshold. At the same time, the e-commerce platform company increases revenue to achieve a win–win situation. The model has the following strengths: (1) It is not from the supplier's supply chain perspective, but from the consumer's demand-side perspective; (2) It is a customer-oriented perspective that maps customer behaviors, which is in line with the future trend of e-commerce development; (3) It is vital information that can timely and intelligently display the total amount of consumer orders and the number of shipping fees to be paid. It is an online decision support system to assist consumers in decision-making. (4) It is an innovative e-commerce pricing model, which breaks through the limitation of the previous model that consumers must choose between paying all the shipping fees or free delivery and proposes a flexible pricing model to fill the gap in the existing literature.

The model also has some weaknesses: (1) The model's algorithm is a linear equation; if a non-linear equation can be developed, it may be more in line with the behavior of consumers. (2) The free shipping threshold is set assuming that the shipping fees will accumulate depending on the number of products ordered; in practice, different shipping fees ranges depend on the size of the packaging. (3) This model can provide e-commerce consumers with more flexible choices and may improve the revenue of e-commerce companies, but there are still 3–5% of consumers who may give up their orders due to shipping fees; this part needs the design of more effective shipping strategies. (4) This model solves part of the problem of flexibility of consumers' shipping choices and may improve the revenue of e-commerce companies, but more research is needed on how to optimize the shipping choice and the best profit of the e-commerce company. (5) This model can only be implemented in small-scale e-commerce platform companies. Although the result is promising, it will be more valuable if it can be implemented on larger e-commerce platform companies or include transnational variables, such as ocean and air freight. (6) Further research can study dynamic formulas without being constrained by the free shipping threshold so that the e-commerce platform company can obtain the best total profit. As for weaknesses present in this study, it limits the practical usefulness of the presented model. Future research needs more efforts to address the above weaknesses.

Author Contributions: Conceptualization, C.-A.T.; methodology, C.-A.T. and C.-W.C.; formal analysis, C.-A.T.; investigation, C.-A.T.; simulation, C.-A.T.; validation, C.-A.T. and C.-W.C.; writing—original draft preparation, C.-A.T.; writing—review and editing, C.-A.T. and C.-W.C.; visualization, C.-W.C.; supervision, C.-A.T.; project administration, C.-W.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data presented in this study relating to the trend of model testing on Smart-Integration e-commerce platform are available in summarized form on request from the corresponding author. Data are not publicly available due to its proprietary nature. Other data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. UNCTAD. Global Ecommerce Jumps to $26.7 Trillion, COVID-19 Boosts Online Sales. Available online: https://unctad.org/news/global-e-commerce-jumps-267-trillion-covid-19-boosts-online-sales (accessed on 15 December 2021).
2. Digital-Commerce-360. COVID's Impact on Online Shopping. Available online: https://www.digitalcommerce360.com/article/coronavirus-impact-online-retail/ (accessed on 15 December 2021).

3. Ministry of Economic Affairs of the Republic of China. The Fermentation of the "House Economy" Has Led to the Growth of Online Sales. Available online: https://www.moea.gov.tw/MNS/populace/news/News.aspx?kind=1&menu_id=40&news_id=90858 (accessed on 15 December 2021).
4. FDRI: Future Distribution Research Institute. How Did the Consumer & Lifestyle Industry Change in Taiwan during the Peak of the Epidemic? Available online: https://www.mirai.com.tw/2020h1-taiwan-distribution-industry-growth-rate-rank-under-the-pandemic/20210524 (accessed on 15 October 2021).
5. Trans-BIZ. The Psychology of E-Commerce Consumption: Six Rules, the Secret of Making Consumers Buy. 2021. Available online: https://transbiz.com.tw/6-principles-of-ecommerce-consumer-psychology/ (accessed on 15 December 2021).
6. Shao, X. Free or calculated shipping: Impact of delivery cost on supply chains moving to online retailing. *Int. J. Prod. Econ.* **2017**, *191*, 267–277. [CrossRef]
7. Leng, M.; Becerril-Arreola, R. Joint pricing and contingent free-shipping decisions in B2C transactions. *Prod. Oper. Manag.* **2010**, *19*, 390–405. [CrossRef]
8. Becerril-Arreola, R.; Leng, M.; Parlar, M. Online retailers' promotional pricing, free-shipping threshold, and inventory decisions: A simulation-based analysis. *Eur. J. Oper. Res.* **2013**, *230*, 272–283. [CrossRef]
9. Walker Sands. The Future of Retail. 2019. Available online: https://www.walkersands.com/resources/the-future-of-retail-2019/ (accessed on 15 December 2021).
10. Lewis, M. The effect of shipping fees on customer acquisition, customer retention, and purchase quantities. *J. Retail.* **2006**, *82*, 13–23. [CrossRef]
11. Cachon, G.P.; Gallino, S.; Xu, J.J. Free Shipping Is Not Free: A Data-Driven Model to Design Free-Shipping Threshold Policies. 2018. Available online: https://ssrn.com/abstract=3250971 (accessed on 15 December 2021).
12. Swenseth, S.R.; Godfrey, M.R. Incorporating transportation costs into inventory replenishment decisions. *Int. J. Prod. Econ.* **2002**, *77*, 113–130. [CrossRef]
13. Riza, M.; Purba, H.H.; Mukhlisin. The implementation of economic order quantity for reducing inventory cost. *Res. Logis. Prod.* **2018**, *8*, 207–216. [CrossRef]
14. Mendoza, A.; Ventura, J.A. Incorporating quantity discounts to the EOQ model with transportation costs. *Int. J. Prod. Econ.* **2008**, *113*, 754–765. [CrossRef]
15. Birbil, Ş.İ.; Bülbül, K.; Frenk, J.B.G.H.; Mulder, M. On EOQ cost models with arbitrary purchase and transportation costs. *J. Ind. Mamge. Optim.* **2015**, *11*, 1211–1245. [CrossRef]
16. Jana, B.; Roy, T.K. Multi-objective intuitionistic fuzzy linear programming and its application in transportation model. *Notes Intuit. Fuzzy Sets* **2007**, *13*, 34–51.
17. Ojha, A.; Das, B.; Mondal, S.K.; Maiti, M. A multi-item transportation problem with fuzzy tolerance. *Appl. Soft. Comput.* **2013**, *13*, 3703–3712. [CrossRef]
18. Ghosh, S.; Roy, S.K. Fuzzy-rough multi-objective product blending fixed-charge transportation problem with truck load constraints through transfer stations. *RAIRO Oper. Res.* **2021**, *55*, S2923–S2952. [CrossRef]
19. De, S.K.; Sana, S.S. An EOQ model with backlogging. *Int. J. Manag. Sci. Eng. Manag.* **2015**, *11*, 143–154. [CrossRef]
20. Battini, D.; Persona, A.; Sgarbossa, F.A. Sustainable EOQ model: Theoretical formulation and applications. *Int. J. Prod. Econ.* **2014**, *149*, 145–153. [CrossRef]
21. Chen, T.; Yu, S. An EOQ model with stepwise ordering cost and the finite planning horizon under carbon cap-and-trade regulations. *Decis. Sci. Lett.* **2021**, *10*, 337–350. [CrossRef]
22. Daryanto, Y.; Christata, B. Optimal order quantity considering carbon emission costs, defective items, and partial backorder. *Uncertain Supply Chain Manag.* **2021**, *9*, 307–316. [CrossRef]
23. Daryanto, Y.; Wee, H.M.; Wu, K.H. Revisiting sustainable EOQ model considering carbon emission. *Int. J. Manuf. Technol. Manag.* **2021**, *35*, 1–11. [CrossRef]
24. Teo, J.S.E.; Taniguchi, E.; Qureshi, A. Evaluation of distance-based and cordon-based urban freight road pricing in ecommerce environment with multi-agent model. *J. Transp. Res.* **2012**, *2262*, 127–134. [CrossRef]
25. Al-nawayseh, M.K.; Alnabhan, M.M.; Al-Debei, M.M.; Balachandran, W. An adaptive decision support system for last-mile logistics in ecommerce: A study on online grocery shopping. *Int. J. Decis. Support Syst. Technol. IJDSST* **2013**, *5*, 40–65. [CrossRef]
26. Lim, S.F.W.T.; Jin, X.; Srai, J.S. Consumer-driven ecommerce: A literature review, design framework, and research agenda in last-mile logistics. *Int. J. Physi. Distrib. Logis. Manag.* **2016**, *48*, 308–322. [CrossRef]
27. Leung, K.; Choy, K.; Siu, P.K.; Ho, G.; Lam, H.; Lee, C.K. A B2C ecommerce intelligent system for re-engineering the e-order fulfillment process. *Expert Syst. Appl.* **2018**, *91*, 386–401. [CrossRef]
28. Leung, K.; Luk, C.; Choy, K.; Lam, H.; Lee, C.K. A B2B flexible pricing decision support system for managing the request for quotation process under e-commerce business environment. *Int. J. Prod. Res.* **2019**, *57*, 6528–6551. [CrossRef]
29. Xu, L.; Yan, S.; Chen, J.; Shi, J. The effect of COVID-19 pandemic on port performance: Evidence from China. *Ocean Coast. Manage.* **2021**, *209*, 105660. [CrossRef]
30. Xu, L.; Shi, J.; Chen, J.; Li, L. Estimating the effect of COVID-19 epidemic on shipping trade: An empirical analysis using panel data. *Mar. Policy* **2021**, *133*, 104768. [CrossRef] [PubMed]
31. Mangiaracina, R.; Perego, A.; Seghezzi, A.; Tumino, A. Innovative solutions to increase last-mile delivery efficiency in B2C e-commerce: A literature review. *Int. J. Phys. Distrib. Logis. Manag.* **2019**, *49*, 901–920. [CrossRef]

32. Silverman, B.G.; Bachann, M.; Al-Akharas, K. Implications of buyer decision theory for design of e-commerce websites. *Int. J. Hum. Comput. Stud.* **2001**, *55*, 815–844. [CrossRef]
33. Zong, K.; Yuan, Y.; Montenegro-Marin, C.E.; Kadry, S.N. Or-based intelligent decision support system for ecommerce. *J. Theor. Appl. Electron. Commer. Res.* **2021**, *16*, 1150–1164. [CrossRef]
34. Chandra, Y.U.; Karya, S.; Hendrawaty, M. Decision support systems for customer to buy products with an integration of reviews and comments from marketplace ecommerce sites in Indonesia: A proposed model. *Int. J. Adv. Sci. Eng. Inf. Technol.* **2019**, *9*, 1171–1176. [CrossRef]
35. Wu, J.; Li, L.; Xu, L.D. A randomized pricing decision support system in electronic commerce. *Decis. Support Syst.* **2014**, *58*, 43–52. [CrossRef]
36. Ji, P.; Zhang, H.; Wang, J. A fuzzy decision support model with sentiment analysis for items comparison in ecommerce: The case study of http://PConline.com. *IEEE Trans. Syst. Man Cybern. Syst.* **2019**, *49*, 1993–2004. [CrossRef]
37. Hu, M.; Huang, F.; Hou, H.; Chen, Y.; Bulysheva, L. Customized logistics service and online shoppers' satisfaction: An empirical study. *Internet Res.* **2016**, *26*, 484–497. [CrossRef]
38. Smart-Integration Healthsafe Market. Available online: https://si.secda.info/healthsafe/ (accessed on 15 December 2021).