Dynamic Pricing Strategies on the Internet

Yuchen Liu
Department of Computing
Xi'an Jiao tong-Liverpool University
Suzhou, China
Yuchen.Liu21@student.xjtlu.edu.cn

Gangmin Li
Faculty of Creative Arts,
Technologies and Science
University of Bedfordshire
Luton, United Kingdom
Gangmin.Li@beds.ac.uk

Yong Yue
Department of Computing
Xi'an Jiao tong-Liverpool University
Suzhou, China
Yong.Yue@xjtlu.edu.cn

Ka Lok Man
Department of Computing
Xi'an Jiao tong-Liverpool University
Suzhou, China
Ka.Man@xjtlu.edu.cn

Terry Payne
Department of Computer Science
University of Liverpool
Liverpool, United Kingdom
T.R.Payne@liverpool.ac.uk

Abstract—**Pricing on the Internet is becoming more dynamic due to low menu costs and easy access to competitors' information, allowing different pricing strategies to respond to environmental change. There are many pricing strategies currently in practice in web commerce. It is difficult to grasp the various applications quickly. This paper presents a "5+1" categorisation of pricing strategy. With different strategies explicitly revealed, our "1+5" model includes a traditional strategy that directly changes posed prices and five novel pricing strategies to adjust prices invisibly in the background. A comparison is provided to show their differences and similarities.**

Keywords— Dynamic Pricing; Menu Cost; Posted Price; E-coupon; Deal; Bundle Pricing; Group Buying; Auction; Priceline; Early bird; Price Discrimination; Cashback

I. INTRODUCTION

Dynamic pricing is a strategic revenue management tool for adjusting prices continuously in response to fluctuations in demand and maximizing revenue [1]. The application of dynamic pricing strategies on the Internet has been widely studied due to the transformation of the physical value chain(product-based) offline to the virtual value chain (information-based) online, leading to lower menu costs for changing prices [2]. The products that deploy dynamic pricing have been categorized into natural products, such as retail goods, automobiles, accommodations, and visual products, such as insurance, stock, and bitcoin. Based on the trading environment, it includes pricing in the physical market and pricing online. This paper focuses on the dynamic of pricing online. In the next section, we propose our categorization as a taxonomy of dynamic pricing strategies on the Internet, which contains one traditional strategy and five novel pricing strategies-namely: dynamic updating of the posted price, auction pricing, bundle pricing, first come, first served, customers segmentation and cashback model.

II. TRADITIONAL DYNAMIC PRICING STRATEGY

A. Changing Posted Price

The traditional dynamic pricing strategy is changing the posted price directly. It always accompanies by the rival's price and the inventory itself. Due to the seller's menu costs cut-down by the information efficiency and easy access to customer information based on their look through behaviour data, the Internet environment is quite suitable for a dynamic posted-pricing strategy. One of the popular e-market websites-Amazon reported that some retailers change their post price several times a day [3], and many product categories' prices are adjusted much more frequently on the Internet than on conventional channels because it is also easy to access competitors' prices. Some products are due to the perishable feature, such as food and fixed-term services. E-retailers are willing to adopt the dynamic pricing strategy to deal with close-to-expiration products. Typically, with the time nearby,e-retailers will drop prices accordingly. In addition, companies with the emergency of price-comparison sites and software allow e-retailers to use pricing matching. Those websites list all the identical products from different sellers, and consumers can select the e-retailer to match the lowest price. This matching option is optional, which means some customers may not use this price bot to purchase the product [4]. One of the largest e-commerce platforms, Amazon, adopted the Buy Box algorithm, similar to price matching, a specified product sold by several sellers. However, from all the sellers listed in the Buy Box, only one seller who performed better than others will be chosen on the product's landing page. The chosen seller will be changed due to the various factors Amazon considers, e.g.lowest price, quickest shipment, and higher volume of feedback [3].

B. E-coupons and Deal

There are another two extensional types of changing the posted price. One is coupons, which does not directly change post price but provides different discounts that customers can redeem. The posted prices remain the same for everyone, but the final payments differ. E-retailers can take advantage of dynamic coupon systems to attract appropriate consumers with varying sets of face values. Another extension strategy similar to coupons is Deal, which typically occurs during the holiday season. Black Friday and Cyber Monday are well-known to most clients. It always accompanies with clearance of redundancy inventories. Amazon holds a Prime day promotion annually, which provides a fixed day for e-retailers to launch their Deal. Usually, there are two mains channels on the Amazon platform, a one-day lightning deal (4-6 hours in a pre-defined time) that needs at least 20% off all the promotion products, and another 7-day deal will promote for the whole week that the discount should be more than 15%. The Deal will lead a massive session quickly to stimulate the sales volume and boost the product's rank in a short time.

III. NOVEL DYNAMIC PRICING STRATEGIES

With the emergence of e-commerce platforms, novel dynamic pricing strategies are applied widely in different scenes. According to the different presentations on the product page, the novel dynamic pricing strategies contain bundle pricing, auction, first come-first served, price discrimination and cashback. However, the core idea among them remains the exact dynamic pricing.

A. Bundle Pricing

The first type of dynamic pricing is bundle pricing, in which e-retailers pack different products, and consumers can enjoy a lower price than purchasing separately. Amazon provides a "Make it a bundle" channel to stimulate customers' purchase appetite, and when customers add all the products to their cart and decide to check out, the e-commerce system will also recommend special-offer products to guide clients to purchase together. Meanwhile, the quantities discount also belongs to bundle pricing. In most categories of FMCG on Amazon, there are two types of purchase modes. One is a one-time purchase, and another is subscribe&save. Those clients choose the latter, whose product will be delivered regularly and can enjoy a 10% discount for frequent purchases. Thus, for Pampers baby wipes, $3.71/100 Count for a one-time purchase, $3.40/100 Count for Subscribe & Save. The bundle pricing is parallel with the posted price, so it is not contradictious. Another Bundle type is Group Buying which is popular among Chinese community residents. The e-retailers set the conditions of purchase that should satisfy the minimum of the consumer's amount. Then buyers can enjoy the special offer. Otherwise, they should purchase based on the actual price. Thus, for that discount, customers should invite more friends. One of the successful websites is "Buy together" in China, and it also has an oversea version named"Temu", launched in 2022 summer. In general, bundle pricing not only can gather products but also can gather people.

B. Auction

The second type of dynamic pricing is the auction, which always occurs in second-hand products that want to list lower prices to attract buyers to bid, luxury accessories, and limited edition collections. One of the famous auction websites is eBay. In that platform, sellers offer items and set the starting price initially. During the auction, buyers bid on the listing items. Finally, the highest bidder will win in a limited time. Various used electronic items and antique currencies are listed on the eBay webpage. There are two extension ways similar to an auction. One is Priceline mode, which is a reverse auction-"name your own price" that rather than requiring consumers to find the supplier with the lowest offering. Priceline takes a bid from a consumer and then searches to find suppliers who match that bid [5]. It is widely used in airline, car rental, and hotel accommodations.

Meanwhile, the exchange market is similar to the auction type. With the explosion of the concept of "metaverse", the infrastructure technology in the metaverse-NFT (Non-fungible token) has frequently appeared on the auction website. "The Merge" by artist Pak sold for $91.8 million at the NFT trading platform Nifty Gateway auction. Before "The Merge", the top NFT art price was "Everydays: The First 5000 Days", created by Beeple. It was auctioned for $69 million for the hammer, which not only allowed Beeple to set a record for the third highest price of a living artist has sold works but also set a new record for the highest price of digital art auctions and special online auctions [6]. The auction empowers customers, leading them to pay at a premium price Spontaneously.

C. First Come, First Served

The third type of dynamic pricing is "First come, first served", a common pricing strategy on crowdfunding websites, e.g. Kickstarter and Indiegogo. The launched party sets different price levels for purchasers and always sets a few vacancies at a bottom price for the earliest few consumers, called the" Early bird". Furthermore, the launcher sets relative enough vacancies at the original price for the typical consumer. Meanwhile, some service-based websites are also widely used, e.g. training courses, accommodations, airline tickets, and concert tickets. Airbnb only offers some particular room types for the first few people. The purpose is to attract many people to those campaigns and persuade buyers to scramble for the limited vacancy. However, if the original price is not attractive, customers would be willing to wait for the first few vacancies and not care about the later activities.

D. Price Discrimination

The fourth type of dynamic pricing is based on price discrimination. In formal recognition, if customers purchase repeatedly, they would become members of the given e-retailers website and enjoy some extra discount for the privilege. However, recent literature shows that called" Big data killing", e-retailers set differentiated marketing strategies for different devices and users. For instance, customers who log in iPhone version will be charged higher than the android customer and charge loyal clients higher than new users. E-retailers analyze the characteristic of consumers that maximize

the profit in the firm client and meanwhile try to win the potential clients spare no effort. In the online travel market also occur that problems. The price of tickets for tourist attractions is different between locals and foreigners. Since foreigners are not sensitive to the price of tickets, retailers seize this character to earn more from foreigners. Meanwhile, airline ticket prices also increase as travel time approaches because it is not sensitive for people with urgent travel arrangements [7].

E. Cashback

The fifth type of dynamic pricing is "Cashback", which means that after purchasing, retailers encourage customers to leave positive feedback or to experience the product in depth for repurchasing. In return, e-retailers would refund part of the order amount or give away a large amount coupon that can be valid for the next purchase. It is an excellent way to form an interactive mode between sellers and buyers, in which, during the whole loop, sellers guide buyers to trust their products and service that incentivize them. In addition, the feedback left on the website will also attract more people involved.

IV. DIFFERENCES IN PRICING STRATEGIES

In this section, traditional and novel dynamic pricing strategies for consumer goods and services on the Internet would make a comparison, and retailers could use those strategies in different scenes (see Fig. 1). One specific product can be implemented in different strategies, which determine the seller's consideration. For instance, in the previous section, airline ticket appears in the dynamic dropping of posted prices, priceline, and price discrimination. If the stock of tickets remains enough, e-retailers prefer to select the former two choices. If the tickets remain few that sellers could choose price discrimination. Ultimately, the seller realizes the maximize the total revenue.

TABLE I.   COMPARISON OF DIFFERENT PRICING STRATEGIES

Type	Category	Side Effect for Seller
Change posted prices	Fierce competing	Loss of loyal customers
Drop posted prices	Perishable	Loss of brand recognition
E-coupons	Higher-Priced	Reduce margin profit
Deal	Clearance, Seasonal	Less frequent, affect sales on a typical day
Auctions	Used, Collections	Difficult to control the final transaction price
Priceline	Accommodation, Airline ticket	Difficult to be chosen
Exchange	Stock, Futures, foreign currency, Bitcoin	The error may be amplified
Quantity discount	Combo Accessories	Reduce margin profit
Bundled	FMCG	Reduce margin profit
Group buying	Community product	The consumer loses interest due to the difficulty of forming a group

Type	Category	Side Effect for Seller
Early bird	Crowdfunding, Accommodation, Concert	Attractive in the first few vacancies, lose attractive later vacancies
Customer Segmentation	Global product, Travel-related products	Loss of loyal clients, Infringed business ethics
Positive feedback	Online Platform	Infringe website police

V. CONCLUSIONS

This paper has proposed a new mode for different dynamic pricing strategies online. Our mode is based on the different presentations on the product page. We divided all available strategies into traditional strategies that directly change the posted price and five novel dynamic pricing strategies, which adjust the price to be more invisible. Although some products can be categorized into different types, they are not contradictious. Some strategies would be implemented in the particular scene. A seller adopts the posted pricing model leading to price fluctuation. Usually, it would be hard for customers to know the dynamic pricing in advance, and they could use the price bot to keep track of the trend. However, due to the lag of the pricing change, consumers are still confused about the pricing. They expect posted prices to remain constant over time and would like to cease to trust the vendor if they are discriminated against through dynamic pricing. Some products are perishable, whose price will be cut down customers would accept that.

Other dynamic pricing types are transparent in that consumers can use the rule to get goods at a relatively lower price. Nevertheless, some clauses are difficult to realize, e.g. bundle pricing, first come and first served, and cashback. Thus, the customer could choose to avoid those tricks. The consumer could wait to go shopping intensively on some specific on-sale holidays. Auction dynamic pricing recently used in blockchain, those also are worthwhile noting.

Various factors determine, all in all, the success of dynamic pricing. Furthermore, the research would be committed to exploring how to design the algorithm to serve the pricing strategies in the future.

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