Universitatea Națională de Știință și Tehnologie POLITEHNICA București

11th International Conference of Management and Industrial Engineering 2023, Bucharest

ISSN 2344-0937
ISSN-L 2344-0937
Volume 11
Website: https://icmie-faima-upb.ro

MAKING THE CASE FOR PRICE AUTOMATION IN TRADITIONAL RETAIL OUTLETS

Evgeniya TONKOVA
University of Economics – Varna, Bulgaria
ORCID: https://orcid.org/0009-0005-2986-988X
Email:tonkova@ue-varna.bg

Abstract: *The purpose of the conducted research is to present specific aspects of consumer behaviour when purchasing fresh milk and to present arguments in favour of pricing automation in retail outlets. The tasks that have been set are systematized in two directions: clarifying the factors that influence the choice and the understanding of consumers about the determination of a "fair" price for fresh milk. The importance of the study stems from the changes in the technological and competitive environment over the last decade, which influence the pricing decisions of retailers, as well as the importance of the fresh milk product to end consumers.*

The results of the conducted empirical research can support management at the retail outlet level with ideas for developing marketing models for pricing automation with respect to food staples. The implementation of such models would lead to dynamism of prices over time and would provide greater access to the product at an affordable price for consumers.

In recent years, researchers have alerted about problems related to the realisation of foods. Perishable products among foods are particularly affected. In this regard, the role of pricing as a tool for influencing consumer behaviour and the possibilities of managing sales at the retail outlet level is of interest and, therefore, the focus of the conducted research. The study has practical implications and presents specific arguments in favour of pricing automation and its benefits.

Keywords: *pricing automation, consumer behaviour, fresh milk*

INTRODUCTION

Price is an important factor that influences the consumer's purchasing behaviour in retail outlets. There are several pricing aspects that have been studied by researchers and are widely applied in pricing at the level of retail establishments: price elasticity of demand, cross-price elasticity, own-price elasticity of demand for a product [1], competitor price sensitivity [2], dynamics in price, etc. From microeconomic perspective, consumer behaviour is fully explained by these three factors together: income, consumer taste and prices of goods [3]. Special attention is given to defining consumer price sensitivities and supply side price strategies for national brand and private label products [4]. In a report by McKinsey & Company (2023) about the European grocery retail market, an increasing consumer price sensitivity was identified [5]. The studies so far show that price is an important factor for purchasing dairy products [6] (according to the study within the product group, 84% of the consumers mentioned that they took the price into consideration when buying milk products).

There are also some interesting studies that show that online groceries exhibit higher non-uniform pricing and higher price dispersion across chains, compared to offline retailers [7].

From consumers' perspective, the price in retail outlets is a significant factor in their decisions about what to buy, where to buy it from, when to buy it, what to combine it with and the quantity they buy.

The ability of consumers to compare prices in real-time is also noted in research, with an emphasis on the implications for in-store staff, as they need to be aware of competitors' offers [8].

On the other hand, from the retailer's perspective, price is an important factor for generating revenues and earning profit from a particular brand and for the product category as a whole. There are several considerations taken into account for pricing, which are key with respect to the results. First, this is the price the consumer is ready to pay and the total costs for realising a unit of product. This is followed by considerations, such as consumer alternatives, product specifics, alternative buying channels for consumers, seasonality, cross-sell effects and many others. Researchers focus on key value categories (KVCs) and key value items (KVIs) and the changes that take place in today's digital retail environment [9].

Selling at one and the same price over time, however, cannot ensure flexible reflection of the changes in the environment and often results in retailers facing the problem of overstocking and a problem with the realisation of food

products. The objective of this study is to provide arguments in favour of application of pricing automation for achieving dynamism in the price in traditional retail outlets.
The aim of this study is to investigate price aspects in the context of consumer behavior when purchasing fresh milk and to generate ideas for variables that could be incorporated into the pricing automation algorithm in traditional retail establishments.
The research encompasses new areas in the field of marketing, such as the possibilities of price automation, variables that could be included in the pricing automation algorithm, and their justification with specific results from the study conducted for this purpose.
The study is focused on justifying variables for the purposes of marketing automation that relate to a single product category (fresh milk), which represents a limitation in scope. However, the research methodology could be successfully applied to other product categories that are essential food items.
The results of this research can find application in the following areas: providing arguments for pricing automation, selecting variables for inclusion in a pricing automation algorithm, and developing marketing and mathematical models for pricing automation in the retail industry. On one hand, price automation is a prerequisite for addressing multiple distribution-related issues, such as inventory management, reducing food wastage, and optimizing inventory control in traditional retail establishments. On the other hand, automation offers numerous opportunities for real-time sales management, increasing the average selling price of specific products, and maximizing revenue within the product category.

1. PRICING AUTOMATION IN RETAIL AUTLETS

The possibilities for application of pricing automation offline have not been sufficiently studied from the perspective of marketing. Although the new technologies provide a possibility for automated pricing in traditional retail outlets, this possibility has not been completely utilised yet. A significant step toward shifting to real-time pricing and pricing automation would be the wide application of electronic shelf labelling (ESL) in brick and mortar stores. Electronic shelf labels (ESLs) allow for quicker and more dynamic pricing methods, such as automated price reductions for items close to the expiration date [10]. In the pricing and decision-making process at the point of sale, retailers can utilize dynamic pricing strategies that enable easy price adjustments based on customer feedback [11]. Practically, pricing automation and its application with respect to the product varieties in the retail establishment allows to define a price that is adequate to the specific moment or period of time by using multipliers and the constant price for the period.
Among the a priori changes that could be included in the model are the product shelf life, the seasonality in demand, the competitors' prices, the acquisition cost, the quantity available, the quality of the product and many other variables, which, of course, could be specific for the product at issue within the product variety.
Pricing automation models can differ based on the different classification criteria. For instance, models with just one variable could be the easiest to apply. This variable could be the purchase price of the product or the currency exchange rate, if the product is imported from another country. Even the inflation rate could be calculated in the price of the products within the range in real time. Of course, this one-variable model can also include variables, such as air temperature, shelf life, availability by sizes, availability by colours, etc. The advantage of these models is that they are easy to apply due to the simplicity of the algorithm used to define the price.
The models with multiple variables are of particular interest for retail outlets, because they cover different variables related to the formation of the product final price. Part of these variables could influence the price by increasing it, while others may decrease it – all this is calculated by means of an algorithm that defines the price for the final consumers. The number of variables to be included in the algorithm for automation depends on the product specifics, the establishment, the market, as well as other factors. The more these variables influence consumer behaviour, the more adequate to the consumers' expectations the price determined for the specific product will be.
Another criterion for classification of the pricing automation models is the number of products included in the algorithm. We distinguish between single-product models and multi-product models. Single-product models are based on information about the specific product only that is subject to pricing automation. Or, the information in the form of variables only pertains to the specific product. By contrast, multi-product models also include variables that pertain to other products within the range. In this way, the complex relationships between the products are identified, which are demonstrated in the process of demand, purchase and consumption. These are, for example, the cross-sell relationships, the cross-price elasticity, the shelf lives within the product category, availability in the retail outlet, etc. These types of models have an extremely high potential for impact on consumers and for adequate management of sales at the level of the retail outlet. If we have a product with a high cross-sell effect on other products, we could use this specific feature of the product and use a variable multiplier that leads to a decrease in its price, which will have a positive reflection on the sales of the other products. Furthermore, we would be able to measure the expected positive effect in advance. The multi-product model can be applied in three aspects: with respect to different product range items within the range, with respect to the product range items within the product category and with respect to the two groups of products. The last type is actually the most complex one, because it accounts for the specifics of the products within the product category and all other product categories.
Concerning the data that will feed the automation model, one can use data from the past, real data, data about the future and combinations of these.
Another criterion for classification of the pricing automation models is from the perspective of the distribution site/channel. Models that refer to only one retail establishment or one distribution channel can be applied, but it is also

possible to have multi-site/multi-channel models for pricing automation. Such models could be used, for example, by companies with multi-channel distribution that are willing to refer or redirect consumers to purchase from one site/channel to another.
The choice of pricing automation model for a specific product or product category will largely depend on the sales results, the specifics of the product range and the relationships therein.

2. ARGUMENTS FOR PRICING AUTOMATION IN RETAIL OUTLETS

Pricing automation can be viewed as a real-time marketing instrument. It is particularly important for products with a short shelf life, wide assortment within the product category and high dependence on factors like demand, competition, currency exchange rates, etc.
There are several things that should be taken into consideration, especially when designing pricing automation of staple foods. First, there are global warnings about their oversupply in certain countries and difficulties in their market realisation, which is one of the prerequisites for their disposal and treating them as waste. These problems are further aggravated by setting stable prices that do not correspond to the current conditions on the market and could be defined as inadequate for the specific retail outlet. Special attention should be given to new technologies and the possibility for rapid response to changing market conditions and greater visibility over production and consumer demand [12].
Second, the availability of alternatives for consumers in terms of offers and places for purchasing is strongly represented. The consumers' possibility to choose make sellers more responsible in defining the prices within the assortment and the relevant location. Another important aspect here is consumers' possibility to seek information about prices and characteristics in real time, resulting in referring them to a specific product/channel and product/retail outlet.
Third, the dynamics in price would keep consumer active in seeking a more favourable price and price/quality/quantity ratio. From the perspective of retailers, pricing automation would lead to an increase in the weighted average price obtained in the retail outlet.
Fourth, studies have demonstrated that the predominant part of people in households purchase milk from retail outlets, such as supermarkets, hypermarkets, specialised retail outlets and convenience stores. This is crucial for the significance of product pricing at the level of the retail outlet. Flexible pricing would lead to more favourable pricing conditions for purchase, including price-based promotions.
Fifth, the speed of processes in retail marketing is of paramount importance for achieving success, especially considering that pricing is defined as one of the most critical levers to increase profitability in retail [13].

3. RESEARCH METHODS

Fresh milk is one of the staple foods regularly purchased by households, and its consumption remains relatively stable despite increased competition. The multitude of brands, package sizes, and offerings provides consumers with alternatives to choose from but also presents additional challenges for retail outlets, including compliance with product shelf life and maintaining adequate stock levels.
The study was conducted in two phases. The first phase involved gathering secondary information regarding the importance of the product category and the primary issues related to market implementation in traditional retail establishments for retail in Bulgaria. The research was conducted by searching for keywords "fresh milk" and "sales" in Bulgarian in the largest search engine, followed by content analysis. Initially, problems were identified, and subsequently, a brief description related to the research subject was provided.

Table 1: Key Issues Affecting the Distribution of the "Fresh Milk" Product Category

Issues in the Media (Related to the "Fresh Milk" Product Category)	Description
Increase in Sales at Major Retail Chains	The increasing value of market concentration indices in the retail sector is not favorable for either consumers or producers.
Distribution through traditional retail outlets losing ground	The share of hypermarkets and online sales is increasing.
COVID effect on consumer behavior	Consumers are buying the fresh milk product category less frequently but in larger quantities.
Aggressive price discounts	Increase in the frequency of price-based promotions and the size of price reductions.
Change in consumer price sensitivity	Increasing price sensitivity among consumers and variations in geographically formed segments.
Low share of industrially produced fresh milk in household consumption	Only 35% of consumers in the country purchase industrially produced fresh milk.

Increasing number of brands and packaging options available in the fresh milk product category on the market.	The increase in the number of brands and packaging options in retail outlets creates additional inventory management challenges. It also leads to increased competition, primarily based on price. This is especially true for establishments that offer most of the brands/packaging options produced by domestic manufacturers and those imported from other countries.

Source: conclusions made by the author based on secondary sources of information.

The second phase of the study is based on the survey method conducted through an online questionnaire using volunteer sampling. The online survey is completed by individuals who are buyers of the product category. The goal of the survey is to gather information from buyers regarding specific aspects of the consumer behavior model during purchase and their attitudes toward pricing and the possibility of price dynamization in the "fresh milk" product category. The sample includes individuals with different levels of education and different places of residence. The sample is not balanced by gender (individuals of the female gender predominate).

4.RESEARCH RESULTS AND JUSTIFICATION OF THE VARIABLES IN THE PRICING AUTOMATION MODEL FOR FRESH MILK

To provide arguments for pricing automation and the variables to be included in the model, a study among 110 buyers of milk in Bulgaria was conducted. It used an online survey based on volunteer sampling. The objective is to identify significant aspects of consumer behaviour related to the price of milk and to highlight arguments in favour of applying pricing automation in retail establishments.

As a whole, the results are promising regarding pricing automation and its acceptance by consumers. The results from the study show that when they buy milk from a retail establishment, the most important thing consumers take into consideration is the product quality, the brand, the quantity/price ratio, the price of the brand they usually buy, the shelf life of the milk and the price of the brand they usually buy as compared to the prices of the other brands offered.

The results obtained are promising regarding the application of pricing automation models within the product category, since the variables indicated are either in relation with the price or contain it.

Table 2: Distribution of respondents by answers to the following question: When you buy milk from a retail outlet, you are most likely to (the distribution is based on one response):

Most likely for the buyer	% of respondents
Make price comparisons with other outlets	24.8
Make price comparisons between the different brands	36.7
Make comparison between the price of the same product during past periods	6.4
I do not make price comparisons	18.3
I do not take the price into account	13.8

Source: results from a study conducted by the author

The data collected show that most respondents would make a comparison between the different brands and other retail outlets. This demonstrates the significant importance of the pricing of milk at retail outlet level.

Table 3: Distribution of the respondents' answers to the following questions: Would it be fair, if the price of milk was influenced by the following factors? (These were asked as separate questions)

Factors	% of respondents who answered "Yes"
By the producer's price	79.4
By the shelf life	76.1
By the price of competitive products	45.0
By the price of the same product in nearby retail establishments	51.9
By the demand and supply of the specific product on the market	41.3

Source: results from a study conducted by the author

The result that shows that only 13% of the respondents would accept a higher price of the product "milk" in the retail outlet, if demand for the product on the market is lower than supply (in the context of reduced consumption) is interesting. 32.4% of the respondents would accept a higher price of the product "milk" in the retail outlet, if demand for the product on the market is greater than supply (in the context of deficit). The predominant part of the respondents (51.4%) support dynamism in the price of milk over time.

5.DISCUSSIONS

The results from the study are promising with respect to the possibility for applying pricing automation for milk in retail outlets. A large part of the buyers is not indifferent to the product price and make price comparisons when purchasing the product.

There are multiple options for the development of a pricing automation model, however, we will present a matrix here that illustrates the basic models.

Table 4: Basic models for pricing automation for milk in a retail outlet

	Single-product model	Multi-product model
Model with one variable	V	V
Model with multiple variables	V	V

Source: the table was developed by the author.

Let's assume that we adopt a single-product model with one variable. This could be, for example, the shelf life of the respective product. The more the expiration date of the specific product approaches, the lower the price will be. The only thing taken into account would be the product shelf life that will determine the price.

The second model, which is a multi-product model accounting for just one variable (e.g. shelf life) is applicable to the pricing of milk at the level of product category. This model will account for the shelf life of all products from the "milk" product category that are offered. The multipliers will be of different values and will be determined by the shelf life.

The third model that can be defined as a single-product model with multiple variables uses a pricing automation algorithm that refers to the specific product, however, with the inclusion of multiple variables. The complexity of the model depends on the selection of the variables and on the identification of the values of the specific multipliers. Part of the variable multipliers might lead to an increase in the product price, while others might lead to its decrease.

The fourth model, which is the most complex one, uses multiple variables by taking into account the complex sale relationships between the different products from the product category and products from other categories. For instance, the complex cross-sell relationships in the context of related and complementing demand could be taken into account here. Of course, the use of this model cannot be justified with the possibility to obtain the highest weighted price for the product, but should be justified by means of other arguments, such as maximising sales revenues, profit, etc.

In summary, it can be stated that using the new technologies in the field of marketing and trade will help apply pricing automation for overcoming certain specific challenges in the sale of perishable foods. In the context of high competition and advanced legislation about the food business, price will remain the main instrument for influencing consumers and their choices. The price will continue to be an important factor for overcoming the problems of overstocking and for the difficulty of forecasting demand in the context of a constantly changing environment. And since consumers accept the dynamism of price over time, companies cannot help but take advantage of this flexible and low-cost instrument for influencing the markets for food products.

CONCLUSIONS

The interest in using new technologies in retail will increase as their accessibility and efficiency improve. The speed at which price changes are made will be a significant factor in sales management. Automated pricing determination and announcement in offline retail establishments are still in their early stages, but difficulties in finding and retaining personnel in the sector will guide managers toward the implementation of marketing automation.

The dynamics in the fast-moving product market and regulations concerning unsold items with expired shelf life will drive companies to move toward real-time marketing, including real-time pricing.

Consumer acceptance of dynamic pricing is a prerequisite for the successful use of algorithms that include variables and multipliers with different influences on the price of specific products. In the specific study related to fresh milk, the results obtained are promising regarding the application of pricing automation models within the product category. The variables included in the study, which show a significant influence on consumer decisions when purchasing fresh milk, could be used in the development of automated pricing algorithms.

Justifying the variables in the algorithm is an important aspect of the project for each specific pricing automation, and it is a prerequisite for developing working models that incorporate one or multiple variables related to retail prices. However, pricing automation algorithms need to change over time because environmental conditions change, and consumers adapt to them when they are used for an extended period. Therefore, periodic studies on different pricing aspects and consumer behavior are necessary.

References

[1] Marioni, L. et al.: Estimating Food and Drink Demand Elasticities, (2022), p.16, *Available from* https://www.niesr.ac.uk/wp-content/uploads/2021/11/Estimating-Food-and-Drink-Demand-Elasticities.pdf *Accessed:* 2023-09-17
[2] QuickLizard Ltd.: Price Elasticity & the Challenges in Retail. (2022), p.11, *Available from* https://www.quicklizard.com/wp-content/uploads/2021/12/price-elasticity-ebook.pdf *Accessed:* 2023-09-17
[3] Szwacka-Mokrzycka, J. et al.: A study on consumer behavior in the food market Eastern European countries case, (2021), p.13, *Available from* https://www.ieif.sggw.pl/wp content/uploads/2021/12/Szwacka_Rivza_Lemanowicz_Uljanova.pdf *Accessed:* 2023-09-17
[4] Cotterill, R.W., & Putsis, W.P.: Market Share and Price Setting Behavior for Private Labels and National Brands. Review of Industrial Organization, (2000), 17, pp. 17-39.
[5] McKinsey & Company: The State of Grocery Retail 2023–Europe, (2023), pp.1-40, *Available from* https://www.mckinsey.com/~/media/mckinsey/industries/retail/our%20insights/state%20of%20grocery%20retail%20europe%202023/living-with-and-responding-to-uncertainty-the-state-of-grocery-retail-2023-europe_mid.pdf *Accessed:* 2023-09-17
[6] Pelau, C. & Stamule, T.: Analysis of the consumer's reasons and driving factors for buying. International Journal of Economic Practices and Theories. (2013), 3, p.63, *Available from* https://www.researchgate.net/publication/285850019_Analysis_of_the_consumer's_reasons_and_driving_factors_for_buying *Accessed:* 2023-09-17
[7] Aparicio, D., Metzman, Z. & Rigobon, R.: The pricing strategies of online grocery retailers, (2021), *Available from* https://www.nber.org/system/files/working_papers/w28639/w28639.pdf *Accessed:* 2023-09-17
[8] Hunt, W. & Rolf, S. ARTIFICIAL INTELLIGENCE AND AUTOMATION IN RETAIL Benefits, challenges and implications (a union perspective), Friedrich-Ebert-Stiftung, (2022), p.4, *Available from* https://library.fes.de/pdf-files/bueros/bruessel/19054.pdf *Accessed:* 2023-10-27
[9] Kilroy, T., MacKenzie, M. & Manacek, A.: Pricing in retail: Setting strategy KVCs and KVIs in the new digital retail era Retail Practice, McKinsey & Company, (2015), pp. 1-10, *Available from* www.mckinsey.com/~/media/McKinsey/Industries/Retail/Our%20Insights/Pricing%20in%20retail%20Setting%20strategy/Pricing_in_retail_setting_strategy.pdf *Accessed:* 2023-09-17
[10] Winsight Grocery Business, "Ahold Delhaize Rolling Out Electronic Shelf Tags Across Europe", (2019), Available from https://www.winsightgrocerybusiness.com/retailers/ahold-delhaize-rolling-out-electronic-shelf-tags-across-europe *Accessed:* 2023-10-27
[11] Disruptions in Retail through Digital Transformation Reimagining the Store of the Future, Deloitte Touche Tohmatsu India LLP, (2017), p.10, Available from https://www2.deloitte.com/content/dam/Deloitte/in/Documents/CIP/in-cip-disruptions-in-retail-noexp.pdf *Accessed:* 2023-10-27
[12] PwC, Driving growth and value creation amid high food prices, (2021), p.3, Available from https://www.pwc.com/sg/en/publications/assets/page/driving-growth-and-value-creation-amid-high-food-prices.pdf *Accessed:* 2023-09-17
[13] 7Learnings Blog, Why you need to think about Optimization – not just Automation – when it comes to retail pricing, (2022), Available from https://7learnings.com/blog/why-you-need-to-think-about-optimization-not-just-automation-when-it-comes-to-retail-pricing/ *Accessed:* 2023-10-27

Corresponding Author:
Name and surname, Title: Evgeniya Tonkova, Assoc. prof. PhD
Full address: University of Economics – Varna, Varna, Bulgaria
Email: evgeniyatonkova@abv.bg
Email: tonkova@ue-varna.bg