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MEASURING SALES RESILIENCE VALUE: A NEW APPROACH ON DISCOUNT PRICING STRATEGY TO DEVELOP THE SALES PROMOTION PROGRAM

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Abstract. Economic shocks such as pandemics and natural disasters like floods and earthquakes can disrupt the market supply chain. In this study, we address the impact of both negative and positive market disruptions on product demand, and the subsequent need for adaptive strategies by marketing managers. We introduce a novel approach for measuring sales resilience value (SRV), which assists in selecting optimal discount pricing strategies during sales promotion programs. Our approach considers various states of demand disruption and is underpinned by research literature concepts and mathematical methods. A sensitivity analysis was conducted to understand the key drivers of our model, providing valuable insights for decision-making. We examined the effects of positive demand disruption on resiliency by altering the level of demand for a product of online platform in Iran during promotion while keeping other parameters constant. Our findings reveal that an increase in demand due to promotion, decreases the company's resiliency, defined as the ratio of recovery to loss. However, by employing appropriate pricing strategies and promotion policies, companies can adapt to increased demand and improve resiliency over time through actions such as increasing production capacity. This continues until the company reaches its tolerance threshold. These results help offering significant managerial insights for effectively utilizing this concept in real-world applications.

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1. Introduction

A system is usually designed to behave in a certain way under normal conditions, a disturbance event, deviates the performance from its design level. An economic shock, such as epidemic diseases (*e.g.*, COVID), causes problems in the business environment and creates new principles and rules for buying and selling through online platforms. For example, the shock in the market can affect the supply and demand of products due to the change in the supplier sales channels [12]. Epler and Leach [11] examined salesperson bricolage during a critical sales disruption. This study shows that salesperson bricolage relates positively to sales performance under conditions shaped by the COVID-19 disruption; with salesperson bricolage becoming more strongly related to

Keywords. Sales resilience value, Threshold of sales resilience, Demand disruption, Sales Promotion Program, Discount pricing strategy.

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sales performance when sales environments are more highly disrupted by the pandemic. Abolghasemi *et al.* [3] consider promotions as a positive disruption and used different methods to predict sales and examined sales volatility.

System resilience is its ability to reduce the amount and duration of deviation in the best possible way to reach the target level of normal performance [23]. After the terrorist attacks of September 11 and Hurricane Katrina, the need to use the concept of resilience to secure systems against natural or human disturbances has intensified. The term resilience refers to strength and flexibility that can be absorbed in a unit of volume without causing permanent deviations [22]. In a complex system with many interconnected elements, the failure of one element can indeed have a cascading effect on other elements in the system. The concept of resilience can minimize the impact of disturbances. To make systems safer, resilience engineering tries to (1) identify sources of complexity, (2) define individual, team, and organizational strategies for dealing with identified complexities, and (3) create better pathways for people to succeed [14].

Disruptions can have positive and negative effects on the marketing and sales of products/services. Wu *et al.* [34], Bigdellou *et al.* [9], Sharma *et al.* [27], and van Heerde and Neslin [32] investigated the impact of demand disruptions on marketing and sales. In addition to natural events such as earthquakes, epidemics, storms, and similar natural disasters that cause disruptions in the supply chain, investigated by Belhadi *et al.* [8], Umar *et al.* [31], Sharma *et al.* [27], and Beckers *et al.* [6], sales promotions for customers will also cause sudden changes in sales. Our study focuses on the concept of sales resilience in the face of demand disruptions, which can occur due to various factors such as economic shocks, natural disasters, and sales promotions. Despite the prevalence of these disruptions in today's volatile market environment, there is currently no quantitative measure that organizations can use to assess their sales resilience value (SRV) and guide their decision-making. To address this gap, we propose a formula for calculating SRV in different states. This formula can serve as a foundation for future performance strategies, such as pricing strategies and promotional considerations. By applying this formula, organizations can assess their resilience in the face of demand disruptions and make informed decisions about their pricing and promotional strategies. Therefore, our study is guided by two main research questions:

(1) What is sales resilience in the context of demand disruptions?
(2) How can we calculate SRV in different states with respect to these disruptions?

In this article, we have presented a new formula inspired by Henry and Emmanuel Ramirez-Marquez [14] for calculating SRV considering both positive and negative disruption. The formula offered to determine the ratio of recovery to loss (resilience) considers both positive and negative disruption in the demand process. The article presents the general shape of the demand process with disruption. Then, based on the general case, the probable cases for selling the firm in reality were examined and the SRV formula was calculated for each state.

To the best of our knowledge, this paper is one of the first to discuss sales resilience during both negative and positive demand disruptions. Some novel findings are revealed. These findings not only contribute to the current literature but also throw light on the ability of the sales system when disruptions occur. In addition, the numerical study using real data can provide a direct guide for Understanding Company performance during the disruption period.

The remainder of this paper is organized as follows. In Section 2, the literature review of the paper in the field of resilience and sales promotion during demand disruption will be examined. Section 3 describe the research methodology. In Section 4, the model formulation of the research inspired by Henry and Emmanuel Ramirez-Marquez [14], is presented. Section 5 presents the numerical studies based on the real data of the sale platform of an online store. Section 6 concludes the paper and provides possible research directions in the future.

2. Literature review

Sales resilience has been a topic of interest in recent research. A systematic literature review by Saad *et al.* [26] offers an overview of SMEs resilience literature from 2000 to November 2018, comprising 118 articles. The review concludes that resilience literature is varied in its definitions and measurements and is inconclusive about its influencing factors.

Shekarian and Mellat Parast [28] conducted a comprehensive systematic literature review to assess the impact of each of the most widely known practices to enhance resilience (flexibility, agility, redundancy, and collaboration) on mitigating each type of supply chain disruption (demand, supply, process, control, and environmental disruptions).

Moosavi *et al.* [18] conducted a systematic literature review on supply chain (SC) performance under the COVID-19. The conducted analyses reveal that resilience and sustainability are the primary SC topics. Furthermore, the major research themes are found to be food, health-related SCs, and technology-aided tools (*e.g.*, artificial intelligence (AI), internet of things (IoT), and blockchains). Various disruption management strategies focusing on resilience and sustainability themes are extracted from the most influential studies that were identified as a part of this work.

Júnior *et al.* [15] develop a theoretical model of the relationship between maturity and resilience in supply chains. The authors identified key constructs related to maturity and resilience by analyzing existing literature and selected 13 constructs and 3 maturity stages to construct their maturity and resilience model.

Korber and McNaughton [17] review existing literature at the intersection of resilience and entrepreneurship. The authors identified six scholarly conversations, each drawing on distinct notions of resilience and entrepreneurship. Based on these conversations, shortcomings in the existing literature are discussed and avenues for future research are outlined.

A comprehensive literature review on the topic of resilience has been provided by Ostadi *et al.* [21]. This article examines resilience in literature. This article aims to explore the articles and investigate the gaps and challenges in the areas of resilience, business continuity, risk, and process safety, to provide insights for future research to understand different research perspectives in these areas. The insights provided in this article could also be used to guide future research in marketing and related fields.

Kahiluoto *et al.* [16] contribute to the theory and practice of supply chain management in terms of how an organization should structure its supply base to be resilient to supply uncertainties and disruptions. Their findings show that response diversity is positively related to the maintenance of sales, more positively than diversity of individual suppliers is.

Abidi *et al.* [1] uses firm-level data to investigate whether digitally-enabled firms have been able to mitigate economic losses arising from the pandemic better than digitally-constrained firms in the Middle East and Central Asia region using a difference-in-differences approach. Controlling for demand conditions, they find that digitally-enabled firms faced a lower decline in sales by about 4 percentage points during the pandemic compared to digitally-constrained firms, suggesting that digitalization acted as a hedge during the pandemic. Against this backdrop, their results suggest that policymakers need to close the digital gap and accelerate firms' digital transformation. This will be essential for economies to bounce back from the pandemic, and build the foundations for future resilience.

Multi-objective models for resource allocation in crises has been presented by Ostadi *et al.* [20] and Ebrahimi-Sadrabadi *et al.* [10]. These models aim to increase organizational resilience and maximize business continuity value while considering event interactions. The paper presents a quantitative model for resource allocation that can minimize the loss of organizational resilience and maximize the business continuity value (BCV) in the shortest possible time.

Disruptions can also be considered in the marketing and sales of products/services. Resilience assessment in economic and social systems can be implemented in the following steps (Tab. 1).

Resilience concept in different infrastructure systems is shown in Table 2.

In a sales and marketing system, after disruptions occur in each of the system's components, including profitability, changes in supply and demand, etc., sales managers decide to adopt policies to prevent lost sales and adapt the sales system to They take the existing conditions in the market, which are considered as sales promotions [32]. AboElHamd *et al.* [2] investigated the indicators that affect the customers' lifetime value, and among these indicators, the expected income from sales has also been mentioned. As mentioned, sales promotions will have effects on product demand, which are mentioned in the article by van Heerde and Neslin [32] in the form of the Table 3.

Table 1. Assessing resilience of social-economic systems [23].

Steps	Explanation
System definition	Understand the components of the system and how resilience applies to the system
Identify critical resilience components	Demarcate the boundaries of the system, identify appropriate scales to examine resilience, and identify the variables of concern
Identify sector resilience needed	Identify external shocks and relevant internal parameters, through stakeholders, and historical log
Identify stakeholders	Identify the key players and the external critical parameters
Assess resilience	Identify the recovery path and recovery efforts through models
Management implication	Informs policy makers/managers how the system might react to the shocks
General assessment resilience	Synthesize the finding of the previous steps

Table 2. Resilience concept in different infrastructure systems [23].

Infrastructure system	System performance metrics
Food and Agriculture	Average food prices; exposure to food contamination
Chemical	Pollution
Communications	Number of dropped calls
Emergency Services	Lives saved; average response time
Energy	Consumption; profitability of energy companies
Information Technology (IT)	Number of cyber-attacks; internet speed
Health Systems	Mortality rate; patient presence
Transportation Systems	Average speed and cost of transportation; traffic length

Table 3. Effects of sales promotions on consumers [32].

Sudden change due to sales promotions	Existing resources due to a sudden change in sales due to promotion	Long-term effects regardless of sales promotion
Category growth	Increase in consumption rate	Purchase event feedback
	Outsides industries	Competitive or reference price
Sudden effects within the category	Introduction of a similar product	Customer learning
	Brand change	Long-term effects
	Product category change	Competitive response
	Store switch	
Mid-term changes within the category	Increase in sales speed	
	Decrease in sales speed	

van Heerde and Neslin [32] point out that the sales elasticity (η_s) is affected by the three parts including switching the brand of the product the customer ($\eta_{(C|I)}$), deciding to buy the product (η_I), and buying a certain amount of the product ($\eta_{(Q|I,C)}$), which is stated in the following formula.

$$\eta_s = \eta_I + \eta_{(C|I)} + \eta_{(Q|I,C)}. \tag{1}$$

Promotions may no longer represent simply an economic incentive to purchase but also have other effects on consumers' deal evaluations (positive or negative attitudes towards a consumer promotion) and purchase intentions only some of which may be intended by the manufacturer or retailer [24].

Ostadi and Abdollahi [19] have presented a model for customers' perceived value based on Taguchi's loss function. The model investigates and calculates the perceived value of customers by considering stakeholders such as the final consumer and the retailer. Additionally, the model utilizes Taguchi's loss function to equate the mentality of customers with its impact on perceived value.

Demand disruption and sustainability are issues that have an augmented literature review in the field of marketing. Especially recently, after COVID-19, many researchers tend to study the impact of these issues. As stated in the introduction section, considering sales promotions can disrupt demand and also the supply chain of goods or services. Therefore, articles that have addressed this issues include Behzadi *et al.* [7], Ali *et al.* [5], Xu *et al.* [35], Yan *et al.* [36], Ziari and Sajadieh [37], Wallin *et al.* [33], Shih [29], Moosavi *et al.* [18] and Gupta and Chutani [13] are some examples of investigating demand disruption and sustainability in literature.

Investigating the literature review, to our best knowledge, no article has been seen in the direction of presenting a new formula for calculating resilience in sales. Therefore, in this article, based on Song *et al.* [30] article, sales are examined in two normal and sales promotion cases and the resilience for an online store platform will be calculated inspired by the resilience formula of Henry and Emmanuel Ramirez-Marquez [14].

3. Methodology

This research employs a novel approach to calculate SRV value in the face of demand disruptions. The methodology is divided into several key stages: data collection, variable identification, application of statistical methods, and analysis.

In the Data Collection stage, we gathered data from an online platform during both non-promotion and promotion periods. This data served as the foundation for our analysis, providing insights into demand patterns under different market conditions.

In the Variable Identification stage, we focused on demand as the key variable in our study. We manipulated this variable to observe its effects on sales resilience, which we defined as the ratio of recovery to loss.

In the Application of Statistical Methods stage, we employed mathematical concepts such as integration to calculate recovery and loss from the sales curve. These values were then used to compute sales resilience according to our proposed formula.

Finally, in the Analysis stage, we examined the impact of increasing demand on sales resilience. Our findings revealed that as demand increases, the organization's resilience decreases. This observation aligns with real-world scenarios and validates the effectiveness of our proposed formula.

4. Model formulation

Numerous articles have been presented in the field of sales and marketing considering the concept of lost sales during a disruption in demand or product supply chain such as Ailawadi *et al.* [4], Wu *et al.* [34], Sharma *et al.* [27]. Therefore, in this article, considering the concepts of research literature, we are trying to present a formula for calculating SRV. As Pishnamazzadeh *et al.* [22] who have presented a formula for calculating resilience in the health field and using the presented pattern, we will present a formula for calculating SRV inspired [14]. The presented pattern for calculating resilience will be based on the ratio of recovery to loss. In this formula, $\phi\left(t|e^{j}\right)$ is the system performance function at time t when a destructive event (in the sales concept including demand disruption or sudden sales change) e^{j} occurs. $\phi\left(t_d|e^{j}\right)$ is the system performance function in the failure state and $\varphi(0)$ is the initial system performance. $\text{я}\left(t_f|e^{j}\right)$ represents the resilience index that calculates the system performance function after stability. Therefore, to calculate this index we have:

$$\text{я}\left(t_f|e^{j}\right) = \frac{\phi\left(t|e^{j}\right) - \phi\left(t_d|e^{j}\right)}{\varphi(0) - \phi\left(t_d|e^{j}\right)}. \tag{2}$$

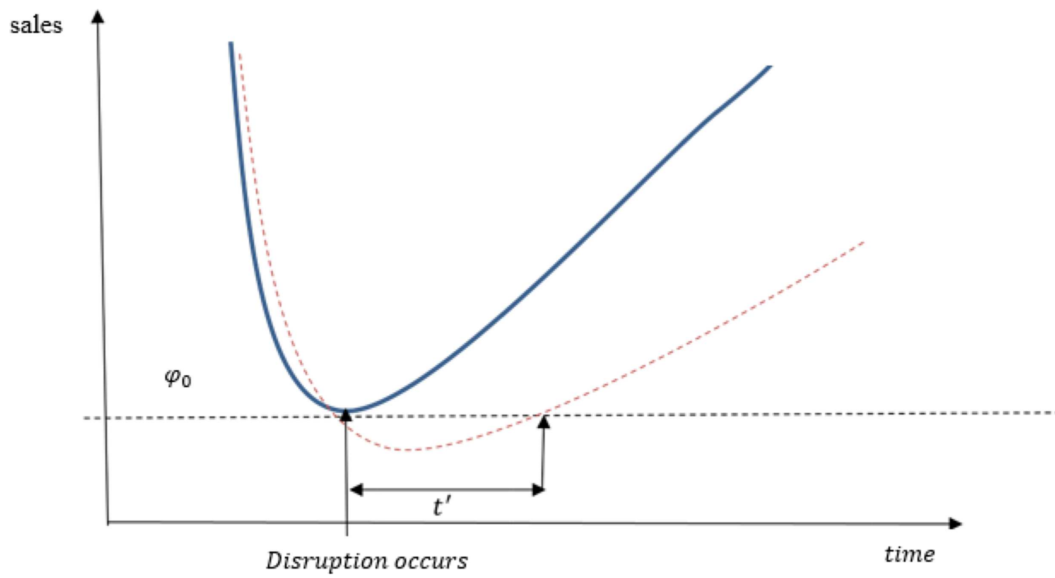

FIGURE 1. Sales overtime during the disruption.

4.1. Sales resilience value

To explain the concept of sales resilience, it is necessary to identify examples of resilience in sales. Rajesh *et al.* [25] describe resilience in four stages: resistance, recovery, reorientation, and reconstruction.

In this article, the ratio of recovery to loss is used to calculate resilience based on the theoretical foundations presented in Section 3 of the article. This is shown in the figure below.

In Figure 1, a threshold for a company (φ_0) has been determined based on the company's sales history. At the time of disruption, sales reach a certain amount and then this disruption continues and sales also adopt certain values during the disruption period. The distance between sales during the disruption period at a specific time from the sales threshold is an indicator that is calculated as the ratio of recovery to loss under the title of sales resilience in this article.

The sales/demand behavior for a company, considering the positive and negative disruptions mentioned earlier, is shown in Figure 2. The demand has a specific value of $\varphi_{(t_0)}$ in the range $(0,t_e)$. At t_e, with a positive disruption, demand increases, and sales are disturbed. This process continues until the next disruption at the time t_m until the firm's sales fall below its initial value (negative disruption). At t_s, the recovery actions are initiated, and the sales process returns to the previous state at t_f (completion of recovery). In Figure 2, the difference in sales in the recovery period from the initial sale is calculated to obtain recovery. Also, the loss is the sale difference in two disruption periods from the initial sale. In the following, these two values are calculated (Tab. 4).

$$y = \varphi_{(t_k)} + \frac{\varphi_{(t_k)} - \varphi_{(t_0)}}{t_k - t_e}(t - t_k) \tag{3}$$

$$y' = \varphi_{(t_m)} + \frac{\varphi_{(t_m)} - \varphi_{(t_d)}}{t_d - t_m}(t - t_m) \tag{4}$$

$$y'' = \varphi_{(t_r)} + \frac{\varphi_{(t_t)} - \varphi_{(t_s)}}{t_r - t_s}(t - t_r) \tag{5}$$

$$\text{Recovery} = \int_{t_s}^{t_r} \left(\varphi_{(t_0)} - y''\right) \mathrm{d}_t \tag{6}$$

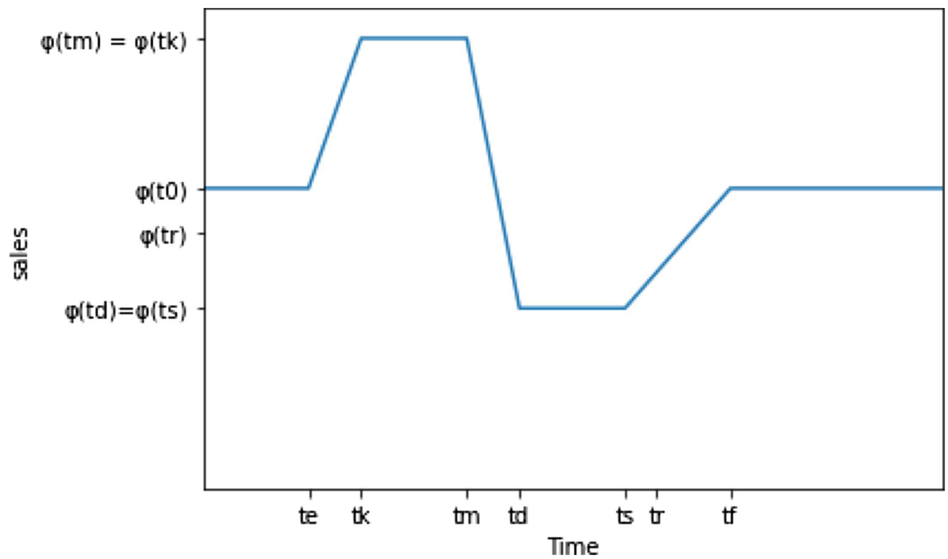

FIGURE 2. Sales behavior.

TABLE 4. Symbols description.

Parameters	Description
$\varphi_{(t)}$	Sales at time t
y	Sales between (t_e, t_k)
y'	Sales between (t_m, t_d)
y''	Sales between (t_s, t_f)

$$\text{Loss} = \int_{t_e}^{t_k} \left(y - \varphi_{(t_0)}\right) \mathrm{d}_t + \int_{t_k}^{t_m} \left(\varphi_{(t_k)} - \varphi_{(t_0)}\right) \mathrm{d}_t - \int_{t_m}^{t_d} (\varphi_0 - y') \,\mathrm{d}_t + \int_{t_d}^{t_s} \left(\varphi_{(t_0)} - \varphi_{(t_d)}\right) d_t \tag{7}$$

in formula (2) we have:

$$я = \frac{\int_{t_s}^{t_r} \left(\varphi_{(t_0)} - y''\right) \mathrm{d}_t}{\int_{t_e}^{t_k} \left(y - \varphi_{(t_0)}\right) \mathrm{d}_t + \int_{t_k}^{t_m} \left(\varphi_{(t_k)} - \varphi_{(t_0)}\right) \mathrm{d}_t - \int_{t_m}^{t_d} (\varphi_0 - y') \,\mathrm{d}_t + \int_{t_d}^{t_s} \left(\varphi_{(t_0)} - \varphi_{(t_d)}\right) d_t}. \tag{8}$$

In Figure 2, different situations for disruption of sales and its recovery occur according to the company's actions, and in this article, three situations that the company is facing, in reality, are examined.

4.2. Case 1

When after a drop in sales, the company immediately takes the necessary measures to return to the initial state. In this case, the disruption period for the company is almost zero. After a while, it returns to the initial sales. This case is shown in Figure 3.

With the same method used for я in Figure 2, we have:

$$я = \frac{(t_r - t_s)\left[\varphi_{t_0} - \varphi_{t_r} - \frac{(\varphi_{t_0} - \varphi_{t_d})}{(t_f - t_s)}\left(\frac{(3t_r + t_s)}{2}\right)\right]}{(\varphi_{t_0} - \varphi_{t_d})\left(\frac{-(t_s + t_e)}{2}\right)}. \tag{9}$$

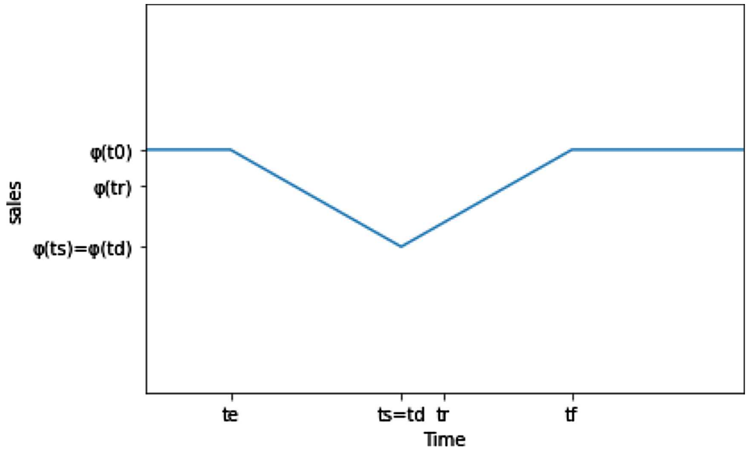

FIGURE 3. Sales behavior without disruption period.

4.3. Case 2

After the disruption, the company will achieve a better performance than before, which is examined in case 2. After the disruption, resilience measures are started and after a while, the company reaches a better performance than before. For example, the sale of masks during the COVID-19 reached more than the initial sales after a while. Measures such as increasing the production capacity, changing the brand, changing the supplier, and using more labor force will cause this situation. In this case, recovery and loss are calculated with the concept of the general state mentioned in Figure 2. Promoting products and creating more demand for that product, in promotions such as Black Friday, Valentine, etc., are other examples that can happen in this situation. The company has an initial sale at a certain time. With the occurrence of disruption, sales will be less than the initial amount. Resilience measures, bringing the sales higher than the initial sales. Figure 4 shows this case.

$$Я = \frac{\frac{(t_r - t_s)\left(\varphi_{t_k} - \varphi_{t_0}\right)(2t_f - t_r - t_s)}{2(t_k - t_f)}}{\left(\varphi_{t_k} - \varphi_{t_0}\right)\left(\frac{t_k - t_f}{2}\right) - \left(\varphi_{t_0} - \varphi_{td}\right)\left(\frac{t_s - t_e}{2}\right)}. \tag{10}$$

4.4. Case 3

State 3 occurs when the company returns to the initial sales immediately after the disruption. Figure 5 shows this state.

$$Я = \frac{2(2t_s + \varepsilon)}{t_s - t_e} \tag{11}$$

which ε is a very little number, we consider. In reality, it is impossible for the company that recovers at the same time the disruption occurs.

5. Numerical examples

To calculate Я, we consider an online store famous platform in Iran for a mobile holder product that has the most sales for the platform. Considering the sales promotion for the product available on Black Friday, the SRV for this product, which was one of the best-selling products on this platform, has been calculated. An online store receives a fixed commission of 6 percent (regardless of product categorization). For-profit functions we inspire [30]. In this article, a bump in sales is a disruption which is a positive disruption as shown in Figure 2. Tables 5 and 6 describes and shows the variables and parameters used in the numerical example, respectively.

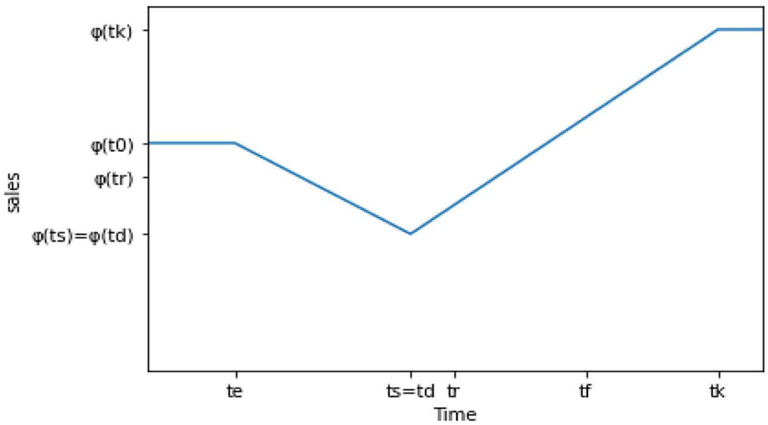

FIGURE 4. Sales behavior with better performance after disruption.

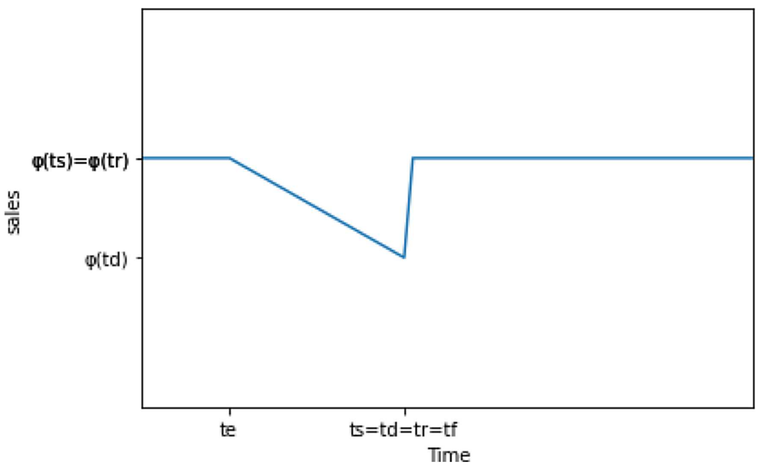

FIGURE 5. Sales behavior with instant recovery.

The profit function in the nonpromotional state is equal to:

$$\pi_p = \lambda \sum p_i D_i = 0.06(14000 * 600000 + 23000 \times 470000) = 1152600000T.$$

In the sales promotion mode, the existing demand for the desired product is equal to D_1^B and equal to 1 million requests have been registered. Buyers will buy a product with the same brand that includes promotion, so we have:

$$\begin{aligned} \pi_p^B &= \lambda p_1^B D_1^B + \lambda\big(p_1^B - \eta t\big) D_{12}^B + \lambda p_2^B D_2^B + (1-\varepsilon)\lambda\big(p_2^B - (1-\eta)t\big) D_{12}^B \\ &= 0.06 \times (9800 \times 1000000) + 0.06(9800 - 0.3 \times 0.5) \times 0 + 0.06 \times 23000 \times 470000 + 0 = 1236600000T \end{aligned}$$

which π_p^B is the profit function at the promotional state, The average profit in the initial state for an online store is equal to 980 000 000. Therefore, the SRV for this platform is calculated as a recovery-to-loss ratio as follows:

$$Я = \frac{\pi_p - \pi_p^B}{\varphi(0) - \pi_p^B} = \frac{1152600000 - 1236600000}{980000000 - 1236600000} = \frac{-84000000}{-256600000} = 0.33.$$

Table 5. Symbols used in the profit functions of the stakeholders of the sales process.

Symbol	Description
EP	Online commercial platform
R_i	Retailer $i = 1, 2$
λ	Commission rate
p_i	Product price $i = 1, 2$
p_{12}	Promotion price for buying two products $p_{12} = p_1 + p_2 - t$
C_i	The unit cost of product i
t	Discount amount
η	The ratio of discount allocated to product 1
θ	The coefficient for two complementary products
β	Price elasticity coefficient relative to product demand
γ	Cross elasticity coefficient relative to the demand for buying two products and buying only one product
ε	Share of speculative customers (customers who make extra purchases to be eligible for promotion)
h	The cost incurred by the retailer from returning the product
D_i	Demand for the product i

Table 6. The amount of product parameters studied to calculate the platform profit.

Symbol	Value
λ	0.06
p_1	14 000
C_1	4000
t	0.5
β	1
D_1	600 000
η	0.03
p_2	23 000
θ	0.8
D_2^B	470 000
D_{12}	0 It is assumed that there is no simultaneous demand for both products

5.1. Sensitivity analysis

Sensitivity analysis is a tool that allows us to understand how changes in input variables affect the output of a model. By systematically varying the values of input variables and observing the resulting changes in output, it is possible to identify which variables have the greatest impact on the model's results. In this article, we will conduct a sensitivity analysis to better understand the key drivers of our model and to provide insights for decision-making. We rewrite the profit functions of an online store platform in promotional and non-promotional states.

$$\pi_p = \lambda \sum p_i D_i$$
$$\pi_p^B = \lambda p_1^B D_1^B + \lambda\big(p_1^B - \eta t\big) D_{12}^B + \lambda p_2^B D_2^B + (1-\varepsilon)\lambda\big(p_2^B - (1-\eta)t\big) D_{12}^B.$$

For an analytical examination of sensitivity, a positive demand disruption is considered. Therefore, given that other parameters in the profit functions remain constant, we changed the level of demand for product 1 at the

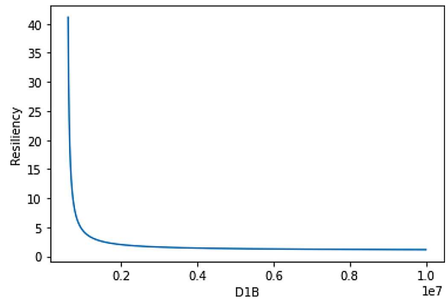

FIGURE 6. Resiliency changes due to changes in product demand in promotion mode.

time of promotion with different values and examined its effects on resiliency. The results are shown in the chart below (Fig. 6).

As can be seen in the chart, with an increase in demand due to promotion, the company's resiliency, which is the ratio of recovery to loss, decreases. The reason can be, because with the occurrence of a disturbance and an increase in demand, the company has less ability to recover. Using other influential parameters such as appropriate pricing strategies and suitable promotion policies, it can adapt to the demand that has arisen. Therefore, resiliency can be improved over time with resilience actions such as increased production capacity and continues until the company's tolerance threshold.

6. Conclusion

6.1. Summary

In this article, by examining the disruption in demand and introducing the concept of resilience, it was stated that events such as diseases and natural disasters can lead to disruption in demand and supply chain. Sales promotions can also lead to sudden changes in demand and can be considered a disruption in demand for businesses. Thus, the notion of sales resilience is significant and, as observed, can alter the sales trajectory based on demand and serve as an appropriate benchmark for determining sales promotions. A formula for calculating SRV was presented to provide insight to managers to better understand the ability of their sales system. The general condition for sales was checked with two positive and negative disruptions. Three modes were examined based on the overall mode for the company's sales and resilience was calculated for each mode. By calculating the recovery and loss for each case, the value of recovery to loss (resilience) was calculated in the Analysis stage, we examined the impact of increasing demand on sales resilience. Our findings revealed that as demand increases, the organization's resilience decreases. This observation aligns with real-world scenarios and validates the effectiveness of our proposed formula.

6.2. Managerial insights

In today's rapidly changing business environment, disruptions in demand and supply chain are becoming increasingly common. Events such as diseases, natural disasters, and sales promotions can all lead to sudden changes in demand, making it essential for businesses to develop sales resilience. By introducing the concept of resilience and providing a formula for calculating it, this article offers valuable insights for managers looking to better understand the ability of their sales system to recover from disruptions. By examining different modes of sales and calculating the recovery and loss for each case, managers can determine the value of recovery to loss (resilience) and make informed decisions about sales promotions. This can help businesses better prepare for and respond to sudden changes in demand, improving their ability to succeed in a dynamic market.

6.3. Future research

Several limitations exist in this work, which can be possible research directions in the future. The data used in this study was collected from a single online platform, which may limit the generalizability of the findings to other platforms or sales contexts. Additionally, the study focuses on demand disruptions due to promotions and does not consider other types of disruptions, such as supply chain issues or changes in consumer behavior, that could impact sales resilience. The proposed formula for calculating SRV, while insightful, may not capture all factors influencing sales resilience in real-world scenarios, such as competition, market trends, or changes in consumer preferences.

Future research could focus on calculating a threshold for sales resilience, which would provide managers with a clear benchmark for determining the minimum threshold of resilience required for their sales system to effectively recover from disruptions. This could involve conducting empirical studies to gather data on the recovery and loss of sales in different industries and under different conditions and using this data to develop a model for calculating the threshold for resilience. Such research would have important implications for businesses looking to improve their sales resilience and better prepare for disruptions in demand and supply chain. In terms of limitations, it is important to note that the concept of sales resilience is still relatively new, and further research is needed to fully understand its implications for businesses. Additionally, the threshold for resilience may vary depending on factors such as the industry, the size of the business, and the nature of the disruption, making it challenging to develop a one-size-fits-all model. Further research is needed to address these limitations and provide more nuanced insights into the concept of sales resilience.

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