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DIAGNOSING PRICE WARS: HOW FIRM STRATEGIES AND CONSUMER REACTIONS DRIVE MARKET TURBULENCE

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ДІАГНОСТИКА ЦІНОВИХ ВІЙН: ЯК СТРАТЕГІЇ ФІРМ ТА РЕАКЦІЯ СПОЖИВАЧІВ ЗУМОВЛЮЮТЬ РИНКОВУ ТУРБУЛЕНТНІСТЬ

General intensification of inflationary processes and aggressive promotional campaigns in many modern highly competitive markets create continuous price noise, which over time can threaten to escalate into a devastating price war. Despite the fact that many works have been devoted to the study of the phenomenon of price wars, businesses today lack applied analytical tools to diagnose the threshold beyond which normal price fluctuations or

competition transform into irreversible escalation. Accordingly, the article is aimed at deepening the analysis of the mechanisms of price wars unfolding and developing an approach for early diagnosis of their prerequisites in the market.

To achieve the goal, a log-linear model of aggregate market demand was proposed, which, unlike more traditional approaches, takes into account the synergy effects. It has been proven that the overall price elasticity is dynamic and directly depends on the average intensity of discounts in the market, which is part of the pricing strategies of individual brands. Within the framework of the developed approach, all brands were classified into three groups: "protagonists" (who increase price fluctuations), "antagonists" (who go into antiphase and stabilize the market) and "inert players". The roles were identified based on the calculation of the expected strategic price promo pressure of market players. To measure the risk of a price war, two indicators have been developed by the author: Price Turbulence Index (PTI), which measures the overall intensity of changes in the price strategies of market players, and Price Promo Shift Index (PSI), which assesses the balance of powers between protagonists and antagonists reflecting the vector of overall price movement in the market.

Empirical verification and econometric modeling were carried out on the data set of the Ukrainian whiskey market for the period 2018–2021. It has been proven that the high frequency of discounts in the market generates constant promotional noise that turns buyers into "discount hunters". This statistically significantly increases price sensitivity at the level of the entire product category, forcing brands to resort to further discounts and, potentially, triggering a destructive "price war spiral". The study revealed a critical structural imbalance in the market: protagonists are mainly leading brands, which together occupy about a half of the market. At the same time, the total weight of antagonists (less than 20%) is absolutely insufficient to extinguish the market promotional noise.

Calculation of the indices revealed that since 2020, the market has moved into an initial state of a dangerous escalation. The peak annual values of the Price Turbulence Index reached 53% during periods of maximum promotional

noise, signaling an extremely high probability of a breakdown into a price war. In summary, the probability of a price war fundamentally depends on the balance of powers of the three categories of players, while a simultaneous growth of the proposed indices (PTI and PSI) has proven its effectiveness as an early warning tool of market destabilization.

Загальне нарощування інфляційних процесів та агресивні промо кампанії на багатьох сучасних висококонкурентних ринках створюють безперервний ціновий шум, який з часом може загрозувати переростанням у руйнівну цінову війну. Попри те, що дослідженню самого явища цінових війн присвячено багато праць, бізнесу сьогодні бракує прикладних аналітичних інструментів для діагностики межі, за якою звичайні цінові коливання або конкуренція трансформуються на незворотну ескалацію. Відповідно, метою статті є поглиблення аналізу механізмів розгортання цінових війн та розробка підходу для ранньої діагностики їх передумов на ринку.

Для досягнення мети запропоновано лог-лінійну модель сукупного ринкового попиту, яка, на відміну від більш традиційних підходів, враховує ефекти синергії. Доведено, що загальна цінова еластичність є динамічною та безпосередньо залежить від середньої інтенсивності знижок на ринку, що є частиною стратегій ціноутворення окремих брендів. У межах розробленого підходу всі бренди класифіковано на три групи: «протагоністів» (які посилюють цінові коливання), «антагоністів» (які йдуть у протифазу та стабілізують ринок) та «інертних гравців». Ролі ідентифікуються на основі розрахунку показника очікуваного стратегічного акційного тиску гравців. Для вимірювання ризику цінової війни розроблено два авторські індикатори: Індекс цінової турбулентності (PTI), що фіксує загальну інтенсивність зміни цінових стратегій гравців ринку, та Індекс зсуву цінових промо (PSI), що оцінює баланс сил між протагоністами та антагоністами та вектор руху ціни на ринку.

Емпіричну перевірку та економетричне моделювання здійснено на масиві даних українського ринку віскі за період 2018–2021 років. Доведено, що висока частота знижок генерує постійний акційний шум, який перетворює покупців на «мисливців за знижками». Це статистично значущо підвищує цінову чутливість на рівні всієї товарної категорії, змушуючи виробників вдаватися до подальших знижок та, потенційно, запускаючи деструктивну «спіраль цінової війни». Дослідження виявило критичний структурний дисбаланс на ринку: протагоністами переважно виступають компанії-лідери, що сукупно займають близько половини ринку. Водночас сумарна вага антагоністів (менше 20%) є абсолютно недостатньою для самостійного гасіння ринкового промо-шуму.

Розрахунок індексів виявив, що починаючи з 2020 року ринок перейшов до початкового стану небезпечної ескалації. Пікові значення Індексу цінової турбулентності сягали 53% у періоди максимального промо-шуму, сигналізуючи про надзвичайно високу ймовірність зриву в цінову війну. Підсумовано, що ймовірність цінової війни фундаментально залежить від балансу сил гравців, а одночасне зростання запропонованих індексів (PTI та PSI) довело свою ефективність як інструмент раннього попередження про дестабілізацію ринку.

Keywords: *price wars, strategies, price competition, pricing, price sensitivity, market, consumers, market analysis.*

Ключові слова: *цінова війни, стратегії, цінова конкуренція, ціноутворення, цінова чутливість, ринок, споживачі, аналіз ринків.*

Statement of the problem

In highly competitive consumer markets, pricing has evolved into the primary instrument for short-term tactical gains. Companies routinely use aggressive promotional campaigns, creating a volatile environment. While these tactical actions are designed to promote immediate sales flows, they collectively

generate continuous promotional noise and severe price turbulence across the market overall.

The core problem arises when these everyday competitive price movements inevitably escalate into a systemic structural imbalance. Market participants frequently face a lack of clear perspective on when tactical promotional moves (such as increasing the depth or frequency of discounts) begin to resonate destructively, shifting from standard competition to a scenario that undermines the overall profitability of the category. Despite the severe financial implications of such market destabilization, businesses sometimes lack functional, data-driven frameworks to accurately diagnose the exact point where routine price variations translate into the onset of a full-scale price war.

Consequently, there is a need for a diagnostic methodology that moves beyond merely observing historical price volatility. Understanding exactly how isolated pricing decisions of individual brands cumulatively destabilize the market overall, and identifying which specific players are driving this escalation versus those attempting to stabilize it still represents an unresolved challenge for researchers.

Analysis of recent publications

In modern economic theory, price wars are considered not only as a form of conscious predatory competition, but also as a destructive consequence of managerial decisions and wrong interpretation of competitive signals [1; 2]. At the same time, empirical studies prove that the active use of price promotions and dynamic pricing fundamentally changes the behavior of buyers [3]. Consumers become more sensitive to prices and form a "strategic" expectation of discounts, which ultimately reduces the overall profitability of the entire market and forces firms to adhere to further aggressive price competition [4; 5].

In addition, the market is significantly destabilized due to asymmetric competitive reactions of individual brands [6]. At the same time, it is the market leaders who often suffer the greatest long-term losses from aggressive pricing,

while mutual copying of strategies to struggle for loyal customers brings the market closer to a price war [8; 9].

Despite the existence of a conceptual paradigm of "early warning signals" [1], there is a certain shortage of practical indicators in the literature that would allow firms to diagnose risks in advance and avoid the destructive consequences of price wars [9]. While some individual aspects might be well studied, the complex relationship between brand pricing strategies, the evolution of price sensitivity and the formation of irreversible prerequisites for price wars remains insufficiently empirically formalized [10].

Goal and objectives of the study

The goal of our study is to deepen the analysis of the price war mechanisms in the market and to develop an analytical approach to diagnose the occurrence of the prerequisites for this phenomenon. Based on this goal, the objectives of the study are (1) to empirically assess the cumulative impact of pricing strategies of individual brands on the price sensitivity of demand in one of the consumer markets, (2) to determine the likely role of individual brands in creating the prerequisites for a price war, and (3) to develop a set of indicators that would allow assessing and tracking the risks of this phenomenon in the market.

Results of the study

Our study consisted of two main parts: development of a theoretical approach to fulfill the defined objectives and its empirical verification based on real data for one of the consumer goods markets.

Development of the theoretical approach. At the first stage, we proposed a theoretical specification of the total market demand model, as well as the concept of a system of indicators that would allow diagnosing the risks of a price war.

In our analysis, we relied on the fact that when it comes to the dynamics of the general market price, it is actually an averaging of prices and price strategies of individual players. Accordingly, the overall market price may fluctuate not only in response to changes in the frequency and/or depth of price promotions of individual players, but also due to the overlap of their pricing strategies. For

example, if two firms do not change the frequency or depth of their own price discounts, but instead just begin to compete more aggressively by running promotions at the same time, the volatility in the market price will increase, since the latter is the sum or interference of price fluctuations of individual players.

An important component of our demand model is the assessment of synergies. According to our hypothesis, the average size and frequency of discounts in the market not only affect demand directly (through the average price), but interact with the price, making the overall price sensitivity dynamic and dependent on these parameters. Thus, within the framework of our approach, the dynamism of the price elasticity is not estimated through the implementation of time-varying coefficients modeling (to catch the evolution in this indicator). Instead, this is done through direct modeling (parameterization) taking into account the factors that may determine the dynamism of the coefficients of impact (price elasticity).

Turning the conceptual model of market demand into a mathematical equation, we use the log-linear form and obtain:

$$\ln(Vol_{mkt}) = \ln(BaseVol_0) + \gamma \cdot Trend_{ref} + \sum_k \delta_k Z_{kt} + E_0 \cdot \ln(P_t) + \alpha \cdot (AMP_{mkt} \cdot \ln(P_t)) + \beta \cdot (Freq_{mkt} \cdot \ln(P_t)) \quad (1)$$

Where:

$BaseVol_0$ is the base market volume,

$\gamma \cdot Trend_{ref}$ – general market development trend

$\delta_k \cdot Z_{kt}$ – influence of exogenous factors (for example, seasonality, household income, macro factors, etc.),

$\ln(P_t)$ is the logarithm of the average market price,

AMP_{mkt} is the average market discount in % practiced by firms in the past quarter,

$Freq_{mkt}$ is the average frequency of price promotions by companies for the past quarter.

The synergy coefficients α and β reflect the increase in price sensitivity in the market with an increase in the depth and/or frequency of price fluctuations in the market over the past three months.

Hence, at the macro level, the signs of a price war can be detected if the parameters AMP_{mkt} and $Freq_{mkt}$ significantly increase the role of price as a choice factor in the market via the synergy effect.

Since the depth and frequency of market price fluctuations is determined by the variations and mutual overlaps of prices of individual brands, it is possible to mathematically determine the contribution of each brand to the overall dynamics. From the point of view of the contribution of brands to the general pricing dynamics, in each time period, within our approach, we propose to classify them into the following three groups:

- “Protagonists” of the price war are those who amplify price fluctuations in the market: increase the depth or frequency of discounts, support the general downward pressure on the price. These are the architects of the price war.
- “Antagonists” of the price war are those who "go against the wave" at a given period of time. They deliberately keep prices, reduce or do not change the frequency of their own price promotions, go into antiphase with other players, etc. They are actually counteracting protagonists.
- “Inert players”, whose price strategies do not have a significant correlation with fluctuations in the market price, respectively, they do not have a specific impact on group price dynamics.

To identify the roles of market players, we propose to measure their "expected strategic pressure". We consider the price war not as a situational (tactical) reaction, but as a systemic change in the strategies of firms, which is expressed in a greater aggressiveness of their planned price actions. The strategic

pressure of a firm i at time t (SP_{it}) is calculated as the product of its market share, planned depth and frequency of price discounts:

$$SP_{it} = Share_{it} \cdot AMP_{it} \cdot Freq_{it} \quad (2)$$

Where $Share_{it}$ is the market share of a brand.

To determine the deviation from the norm for each individual player, we calculate the baseline (the mean value of μ_i and the standard deviation of σ_i of the SP indicator for the first benchmark period of our analysis). The perturbation generated by a firm is defined as delta $\Delta SP_{it} = SP_{it} - \mu_i$. A firm is classified as a protagonist of price war if its current price promo pressure significantly exceeds the norm ($\Delta SP_{it} > \sigma_i$), which indicates that the firm's strategy is becoming more aggressive. Instead, a firm is classified as an antagonist if it exhibits significantly lower promo pressure than its own norm ($\Delta SP_{it} < -\sigma_i$). All other players are classified as inert, since in general at the level of strategy they act within their own norms.

Therefore, based on the analysis of players' contributions to market price dynamics (which, in turn, can form the prerequisites for a price war), it is potentially possible to identify the likely "drivers" of a possible price war. Moreover, we can assess which players' actions (and what kind of actions) can reduce the risk of a price war and avoid the situation when all market participants may suffer.

According to our logic, whether price competition will escalate into a price war depends on the ratio of cumulative "efforts" of protagonists and antagonists. We suggest measuring the risk of a slide into a price war using a set of indicators.

The level of price turbulence (GrossTurb) would reflect the overall intensity of price competition in the market, the frequency and size of players' revisions of their own strategies (depth and frequency of price promotions). Mathematically, we propose calculating this indicator as follows:

$$GrossTurb_t = (\sum_{i \in Protagonists} \Delta SP_{it} + \sum_{j \in Antagonists} |\Delta SP_{jt}|) * 100 \quad (3)$$

The theoretical limits of the GrossTurb index, according to equation (3), are 0 (calm in the market, no player has revised their strategy compared to the base period) and +100 (a theoretical level that characterizes the situation when 100% of players have radically reversed their pricing strategies). However, in real markets, one should understand that the practical upper limit of this indicator will reach about 10 or 15. For example, if 50% of the market players switch from a 5% discount to more aggressive 25% discount as their planned strategy, and do it three times more frequently than before, the GrossTurb index will be about 7. With this in mind, we propose an approach for empirical normalization of the level of price turbulence through calculation of a maximum price turbulence indicator.

The level of maximum price turbulence should reflect the maximum potential for deviation of price strategies from the empirical norm (base-period strategies). Since we are talking about an indicator of general turbulence, the proposed indicator should be symmetrical – taking into account both the potential for an extreme price war and the hypothetical potential for a complete avoidance of discounts in the market. In other words, for each product on the market, we have to calculate two intermediate indicators of hypothetical deviation from its individual strategic norm (SP_{inorm}), the first of which is the maximum escalation (DevUp):

$$DevUp_{it} = (Share_{it} \cdot AMP_{q95} \cdot 1.0) - SP_{inorm} \quad (4)$$

Where AMP_{q95} is the empirically calculated 95th percentile of discounts in the category overall. This value, in fact, reflects the size of the maximum discount ever given by any market player for the entire observation period, cutting off the probable peak noise in the data due to technical errors. DevUp shows what the maximum deviation of the player's promotional activity can be, compared to its base level, if he decides to resort to extreme aggressiveness – constantly offering the maximum historical discount observed in the market.

The second intermediate indicator is the maximum de-escalation (DevDown):

$$DevDown_{it} = SP_{inorm} - 0 = SP_{inorm} \quad (5)$$

DevDown_{it} – shows, therefore, what can be the maximum deviation of the player's promotional activity downwards, compared to his base level – that is, if he decides to completely abandon any discounts on an ongoing basis.

With both of the intermediate indicators described (equations 4 and 5), we can define the indicator of the total maximum turbulence (MaxTurb) in the market, as the sum of the absolute values of the maximum deviations of each player:

$$MaxTurb_t = \sum_i \max(DevUp_{it}, DevDown_{it}) \quad (6)$$

Finally, equation 6 allows us to normalize GrossTurb and estimate the Price Turbulence Index (PTI), which would reflect how far (in %) the current level of price turbulence is from the maximum potential level:

$$PTI_t = \left(\frac{GrossTurb_t}{MaxTurb_t} \right) * 100 \quad (7)$$

It should be noted that the price turbulence index is a measure of the overall intensity of price competition and the dynamism of the market environment (regardless of the direction of the players' revision of their own pricing strategies). However, for a full-fledged diagnosis of a price war, we cannot do without an indicator of the direction of change in the market price promo activities – an assessment of the balance of powers between the protagonists and antagonists of the price war. To do this, we offer the Price Promo Shift Index (PSI):

$$PSI_t = (\sum_{i \in Protagonists} \Delta SP_{it} - |\sum_{j \in Antagonists} \Delta SP_{jt}|) * 100 \quad (8)$$

Where from the aggregate excessive aggression of protagonists (an increase in the depth or frequency of price discounts above the norm adjusted for their market shares), we subtract the aggregate stabilization efforts of antagonists (a decrease in their pressure below their own norm). By definition, the index has theoretical limits of $[-100; +100]$. Depending on the level of the price promo shift index, the market may be in the following states:

- $PSI_t < 0$ (decline): antagonists have great power in the market, their deterrent efforts reduce the overall aggressiveness of pricing, the signal to the consumer becomes mixed, and promotional activity gradually fades away.
- $PSI_t > 0$ (escalation): The power of protagonists is substantial, a discount generates a new discount in return, which creates even more pressure in the next period, there is a self-perturbation of the system – a price war probably begins.
- $PSI_t \approx 0$ can mean two opposite situations: either (1) the market is completely calm (none of the players revise their own strategies compared to the base ones) or (2) the market has temporarily formed a perfect balance of powers between protagonists and antagonists of the price war.

Taking into account specifics of the described indices, diagnostics of the threat of a price war in the market should be based on both indicators – PTI and PSI. The first index measures the aggravation or attenuation of price turbulence (price competition dynamicity), while the second index reflects the direction of movement of price promotions – whether the overall discounts in the market are growing or decreasing. In this case, the sign of a coming price war is the simultaneous growth of both indices, while the growth of one of them may be an early warning of a likely deterioration of the situation and appearance of the prerequisites for a price war.

In a state of destructive resonance ($PSI_t > 0$, especially in the case of a simultaneous movement of the PTI_t value to 100), price escalation can theoretically stop due to (1) the rationality of one or more players who begin to act as

antagonists trying to save the situation in the longer term, even if there is a short-term loss, or (2) due to limited promotional budgets of the main market players.

On the one hand, after a certain time, market leaders may turn out to be rational players, for whom the general market environment and its state are extremely important, and therefore they have direct motivation and resources to "save the market". On the other hand, rationality can come from a few smaller players who realize that the leaders will not stop, and therefore the smaller players will objectively not have enough resources for a long-term confrontation. Their conscious or unconscious joint actions can create a critical mass of antagonists, which will stop the development of the price war.

Empirical verification of the approach. To empirically test our approach and hypotheses, we used a time series of weekly data on prices, distribution and sales of various brands in the Ukrainian whiskey market for the period of 2018-2021.

The market is characterized by a fairly high level of concentration. Thus, the TOP 10 products in total occupy more than 70% of the market in volume. Such a structure creates ideal prerequisites for classical oligopolistic interactions. Under such conditions, players monitor each other's prices, and their strategic and/or tactical actions provoke sales switching, which is manifested in the volatility of market shares of such players, especially in the short term.

Analyzing the price dynamics of different players, we can state that it is pricing that is the main driver of intensive competition. The whiskey market operates in conditions of rather tough promotional pressure and price promotions, where base (or regular) prices are de facto only a kind of anchor that signals about strategic price positioning of brands, and most sales are generated during periods of price promotions. The graph of price volatility in the market (Figure 1) clearly proves that the normalized prices of key players almost constantly fluctuate in the range from 0% to 30% of their average price. Such price dynamics creates the promotional noise which, among other things, allows us to analyze the strategies and tactics of players as factors influencing the overall market dynamics.

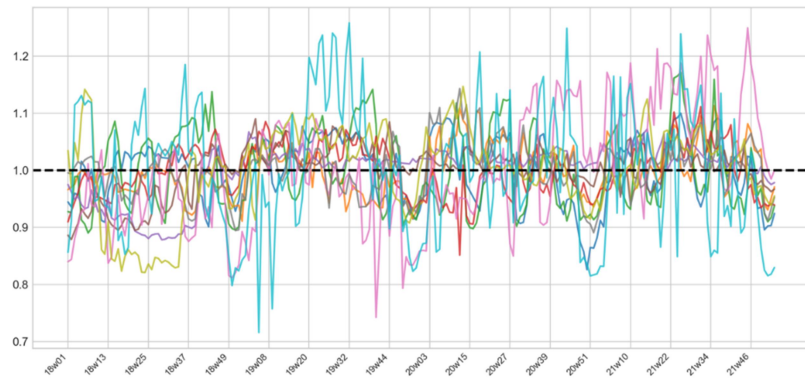


Figure 1. Price dynamics of the main players in the market (index to the average price of the product).

Source: Audit of retail distribution in the category of alcoholic beverages conducted by “Kvadrans-M” LLC in 2018-2021, calculations by the author.

Based on the data described, we have estimated the empirical model of demand in the whiskey category, defined by equation (1) above.

The explanatory power of the estimated equation of aggregate demand in the market turned out to be high (Table 1), which allows us to interpret the results with confidence. Since the equation has been evaluated in logarithmic form, the resulting coefficients already represent elasticity coefficients.

Table 1. Estimated model of aggregate market demand

Factor	Coeff	hdi_5%	hdi_95%	Significance by HDI
Const	8.151	7.911	8.41	+
Category trend	0.005	0.002	0.007	+
Seasonal factor	0.746	0.572	0.916	+
Volume in the past period	0.167	0.133	0.198	+
Base price	-0.301	-0.346	-0.256	+
Synergy of price and depth of discounts in the market during past 3 months	-0.032	-0.254	0.209	-
Synergy of price and frequency of discounts in the market during past 3 months	-0.094	-0.189	-0.015	+
--- Model quality ---				
Pseudo_R2	0.747			
RMSE	0.191			
MAE	0.134			
WMAPE	1.571			

Source: Author's estimate and calculations.

The whiskey category is generally inelastic in price: the corresponding coefficient of base price elasticity is (-0.3) . Therefore, the general demand reacts weakly to changes in the average price in the market. However, an important empirical result was the assessment of the effects of price synergy with the average depth and frequency of price promotions in the market (indicators of the general strategic climate of price competition). Our hypothesis was that the intensification of price competition increases price sensitivity not only at the level of individual brands (choice between products), but also at the level of the whole category.

The analysis of the impact of synergy factors showed that our hypothesis is confirmed: more aggressive price competition leads to an increase in the price sensitivity at the level of the category, which is likely destroying margins of all players. The coefficient of synergy between the price and the depth of discounts has the expected sign, but is insignificant, which indicates that the change in the average depth of discounts at this stage does not have a significant impact on the overall price sensitivity of buyers in the market. On the other hand, the coefficient of synergy between the price and the average frequency of discounts in the market has the expected sign and is significant.

The economic meaning of this result is that when the market goes into a state of constant promotional noise (high market-wide frequency of discounts), the basic price elasticity of the category generally increases. Constant appearance of discounts in retail (regardless of their size) puts consumers in the group of "promo hunters". Therefore, each subsequent tactical price fight leads to the situation when in order to maintain stable sales volumes, the market has to give retailers and consumers an increasing share of its own margin (producer surplus). Thus, a "price war spiral" can potentially appear and act as depicted in Figure 2.

It should be noted that the described effect at the category level is an additional pressure on individual firms, because, as discussed above, excessive promotional activity of individual players and the market as a whole increases the role of price as a choice factor for individual products. Therefore, in the market under consideration, the negative effect of excessive price competition is likely to

manifest itself at two levels at once – micro (choice among products) and macro (price sensitivity of the category as a whole).

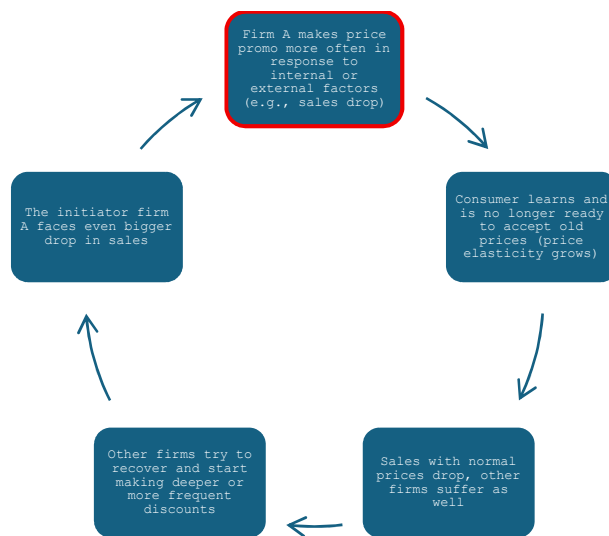


Figure 2. Scheme of the "price war spiral "

Source: Developed by the author.

Classification of brands according to their contribution to market price volatility. For a deeper understanding of the sources of potential general market price turbulence, we used our own classification of players in terms of their contribution and role in the process of price swing of the market. As previously defined, we consider protagonists of the price war to be players who increase the depth and/or frequency of periodic price promotions, thereby provoking price turbulence and a decrease in the average price in the market. Accordingly, we consider antagonists of the price war to be brands whose pricing strategies, on the contrary, "calm down" the market (reduce turbulence, provide greater price stability). After all, the strategies of neutral players generally have neither a positive nor a negative impact on the general market price dynamics in a certain period of time.

It is worth noting that protagonists and antagonists can strengthen or, accordingly, weaken price turbulences not only by changing the frequency or depth of their own price promotions, but also by changing the "schedule" of their promotional activities. For example, the overlap of promotional activity of different brands in

time can increase the amplitude of market price fluctuations, even if individual brands have not changed the average depth or frequency of own price promotions, but simply decided to synchronize the periods of price decline with other market players. Promotional activities of such a brand start overlapping with identical actions of competitors, creating a resonance or "constructive interference". A similar (but with the opposite effect) mechanism is triggered if another brand (e.g., driven by a desire to avoid an increase in the demand price sensitivity) decides to desynchronize its own price promotions with competitors in time. In this case, fluctuations in the total market price disappear due to a decrease in the overlap of promotions of such a brand and its competitors (a "destructive interference" appears).

The role of the same brand can change in time depending on the evolution of its strategy, while our model determines the status of each brand in each time period (e.g., a week). In order to analyze the results by broader time periods (i.e., years), we made a mathematical aggregation to trace the dynamics of the role of players. We assigned a value of (+1) to the periods (weeks) when the brand was a protagonist, a value of (-1) to an antagonist, and a value of (0) to neutral ones. This approach allowed us to calculate the "average role" of each brand when analyzing longer periods (not weekly). The results of the corresponding calculations by years are shown in Figure 3.

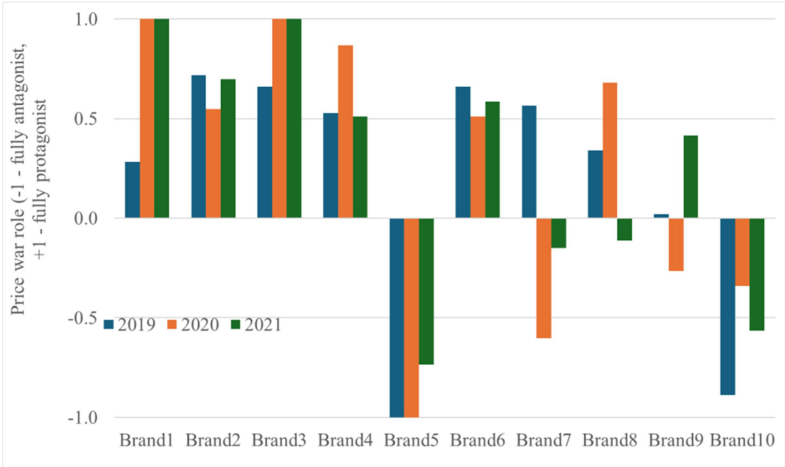


Figure 3. Roles of the TOP10 brands in promoting price war: (-1) – antagonist, (+1) – protagonist.

Source: Author's estimate and calculations.

The empirical analysis showed the presence of a significant structural imbalance in the market under consideration:

- Protagonists of a price war (players who often exceed their own norm of strategic price pressures) are mainly market leaders (for example, brands 1-4), which together occupy about half of the market. It is them who largely form excessive promotional noise.
- Antagonists who balance the market by their actions underusing their own promotional potential (examples are brands 5, 7, 10), occupy less than 20% of the market.
- Since 2020, representatives of the top 3 (brands 1 and 3) together occupying about a quarter of the market, have become stronger protagonists of a price war.
- During 2020-2021, more balanced behavior of some brands (for example, brands 4, 7, 8) was not able to fully compensate for the actions of the protagonists, due to the lower market weight of such brands.

The described imbalance of powers between protagonists and antagonists presumably leads to a gradual shift of the market towards blurring of the value of brands, an increase in the role of price as a choice factor, etc. As discussed earlier, to measure the overall degree of price escalation in the market and the likelihood of a price war unfolding, we developed and suggested two indices: the Price Turbulence Index (Equation 7) and the Promo Price Shift Index (Equation 8).

The price turbulence index shows the general degree of competition intensity in the market: higher values signal that brands are actively modifying their pricing strategies and tactics, price competition in general is becoming stronger and more dynamic. The Price Promo Shift Index reflects the general direction of discount movement in the market, which is the result of the existing balance of powers between protagonists and antagonists of a price war. Higher index values are typical for the situation when the intensity of price promotions increases, respectively, the average actual price on the market decreases. Table 2 shows the results of our calculations for both indices during 2019-2021.

Table 2. Key indicators of the threat of a price war for the market (2019-2021)

	2019	2020	2021
Average values by year			
Price turbulence level, [0, 100]	3.8	4.8	4.6
Maximum price turbulence level, [0, 100]	22.9	23.0	23.1
Price Turbulence Index (PTI), %	16.6	20.7	19.7
Promo Price Shift Index (PSI), [-100, +100]	0.2	2.1	3.2
Annual peak values			
Price Turbulence Index (PTI), %	33.8	32.2	52.5
Promo Price Shift Index (PSI), [-100, +100]	3.5	6.6	6.2

Source: Author's Modeling and Calculations.

Analysis of both indices shows that the market was in a state of relative calm in 2019 with price escalation starting in 2020. Particularly, as shown in Figure 3, this dynamic was due to a change in the behavior of category leaders, who in 2020 revised their own strategies towards more aggressive ones.

In 2020, the average annual price turbulence index increased to 21% (from 17% in 2019) and remained at about the same level in 2021. Such dynamics clearly indicates an intensification of price competition, and the value of the index itself is quite high. In turn, analysis of the peak values of this index showed a significant jump in the indicator for 2021 to almost 53% during the periods of the greatest promotional noise on the market. Such a period on the market, as a rule, is the time of the "high season" before and during the New Year holidays: in December, about 20% of the total annual volume of whiskey is sold, and most brands offer quite aggressive discounts. Such a significant increase in the peak value of the turbulence index suggests that the intensity of price competition during the high season has become incomparably higher relative to previous years.

The Promo Price Shift Index also shows an increase in both the average annual and peak annual values. A positive growing value of the index indicates that price promotions in the market are becoming more and more aggressive, price competition is growing, and the coincidence of brands' promotional activity schedules is intensifying.

Taking into account the described trends, we can conclude that the whiskey market in Ukraine in 2020-2021 was at risk of sliding into a price war due to the critical imbalance in the market power of protagonists and antagonists. Relatively low weight of antagonists led to their inability to extinguish the "price aggression" of protagonists (to balance the market), while the fate of price competition in the market was in the hands of several leaders who would determine the future of the market and all its players via making their strategic pricing decisions.

Conclusions

The empirical analysis confirms that aggressive price competition increases price sensitivity not only when consumers choose among individual products, but at the level of the entire category. A high frequency of market-wide discounts generates constant promotional noise, turning consumers into "discount hunters" and forcing producers to surrender an increasing share of their margin just to maintain stable sales volumes. This dynamic is likely to initiate a "spiral of price war".

Furthermore, the likelihood of a market sliding into a destructive price war depends heavily on the structural balance of powers among market players. By classifying brands into "protagonists" who amplify price fluctuations and "antagonists" who stabilize the market, the study revealed a critical imbalance in the Ukrainian whiskey market. Antagonists possessed relatively low market weight, rendering them unable to extinguish the aggressive promotional noise generated by the market leaders.

To effectively monitor dynamics of price war risks, the suggested Price Turbulence Index (PTI) and Promo Price Shift Index (PSI) serve as practical diagnostic tools. As demonstrated by the data from 2020-2021, simultaneous growth of these indices can be an early warning of a deteriorating market climate and an escalating risk of a price war

Література

1. Heil O.P., Helsen K. Toward an understanding of price wars: Their nature and how they erupt. *International Journal of Research in Marketing*. 2001. Vol. 18 (1—2). P. 83—98. DOI: [https://doi.org/10.1016/S0167-8116\(01\)00033-7](https://doi.org/10.1016/S0167-8116(01)00033-7)
2. Krämer A., Jung M., Burgartz T. A Small Step from Price Competition to Price War: Understanding Causes, Effects and Possible Countermeasures. *International Business Research*. 2016. Vol. 9 (3). P. 1—10. DOI: <https://doi.org/10.5539/ibr.v9n3p1>
3. Srinivasan S., Popkowski Leszczyc P.T.L., Bass F.M. Market share response and competitive interaction: The impact of temporary, evolving and structural changes in prices. *International Journal of Research in Marketing*. 2000. Vol. 17 (4). P. 281—305. DOI: [https://doi.org/10.1016/S0167-8116\(00\)00023-9](https://doi.org/10.1016/S0167-8116(00)00023-9)
4. Levin Y., McGill J., Nediak M. Dynamic Pricing in the Presence of Strategic Consumers and Oligopolistic Competition. *Management Science*. 2009. Vol. 55 (1). P. 32—46. DOI: <https://doi.org/10.1287/mnsc.1080.0936>
5. Liu Q., Zhang D. Dynamic Pricing Competition with Strategic Customers Under Vertical Product Differentiation. *Management Science*. 2013. Vol. 59 (1). P. 84—101. DOI: <https://doi.org/10.1287/mnsc.1120.1564>
6. Steenkamp J.-B.E.M., Nijs V.R., Hanssens D.M., Dekimpe M.G. Competitive Reactions to Advertising and Promotion Attacks. *Marketing Science*. 2005. Vol. 24 (1). P. 35—54. DOI: <https://doi.org/10.1287/mksc.1040.0069>
7. Pauwels K. How retailer and competitor decisions drive the long-term effectiveness of manufacturer promotions for fast moving consumer goods. *Journal of Retailing*. 2007. Vol. 83 (3). P. 297—308. DOI: <https://doi.org/10.1016/j.jretai.2006.03.001>
8. Anderson E.T., Kumar N. Price competition with repeat, loyal buyers. *Quantitative Marketing and Economics*. 2007. Vol. 5 (4). P. 333—359. DOI: <https://doi.org/10.1007/s11129-007-9023-7>
9. Schlosser R., Boissier M. Dealing with the dimensionality curse in dynamic pricing competition: Using frequent repricing to compensate imperfect

market anticipations. *Computers & Operations Research*. 2018. Vol. 100. P. 26—42. DOI: <https://doi.org/10.1016/j.cor.2018.07.011>

10. Cotterill R.W., Putsis W.P. Jr., Dhar R. Assessing the Competitive Interaction between Private Labels and National Brands. *The Journal of Business*. 2000. Vol. 73 (1). P. 109—137. DOI: <https://doi.org/10.1086/209634>

References

1. Heil, O.P. and Helsen, K. (2001), “Toward an understanding of price wars: Their nature and how they erupt”, *International Journal of Research in Marketing*, vol. 18, no. 1—2, pp. 83—98. DOI: [https://doi.org/10.1016/S0167-8116\(01\)00033-7](https://doi.org/10.1016/S0167-8116(01)00033-7)

2. Krämer, A., Jung, M. and Burgartz, T. (2016), “A Small Step from Price Competition to Price War: Understanding Causes, Effects and Possible Countermeasures”, *International Business Research*, vol. 9, no. 3, pp. 1—10. DOI: <https://doi.org/10.5539/ibr.v9n3p1>

3. Srinivasan, S., Popkowski Leszczyc, P.T.L. and Bass, F.M. (2000), “Market share response and competitive interaction: The impact of temporary, evolving and structural changes in prices”, *International Journal of Research in Marketing*, vol. 17, no. 4, pp. 281—305. DOI: [https://doi.org/10.1016/S0167-8116\(00\)00023-9](https://doi.org/10.1016/S0167-8116(00)00023-9)

4. Levin, Y., McGill, J. and Nediak, M. (2009), “Dynamic Pricing in the Presence of Strategic Consumers and Oligopolistic Competition”, *Management Science*, vol. 55, no. 1, pp. 32—46. DOI: <https://doi.org/10.1287/mnsc.1080.0936>

5. Liu, Q. and Zhang, D. (2013), “Dynamic Pricing Competition with Strategic Customers Under Vertical Product Differentiation”, *Management Science*, vol. 59, no. 1, pp. 84—101. DOI: <https://doi.org/10.1287/mnsc.1120.1564>

6. Steenkamp, J.-B.E.M., Nijs, V.R., Hanssens, D.M. and Dekimpe, M.G. (2005), “Competitive Reactions to Advertising and Promotion Attacks”, *Marketing Science*, vol. 24, no. 1, pp. 35—54. DOI: <https://doi.org/10.1287/mksc.1040.0069>

7. Pauwels, K. (2007), “How retailer and competitor decisions drive the long-term effectiveness of manufacturer promotions for fast moving consumer goods”, *Journal*

of Retailing, vol. 83, no. 3, pp. 297—308. DOI: <https://doi.org/10.1016/j.jretai.2006.03.001>

8. Anderson, E.T. and Kumar, N. (2007), “Price competition with repeat, loyal buyers”, Quantitative Marketing and Economics, vol. 5, no. 4, pp. 333—359. DOI: <https://doi.org/10.1007/s11129-007-9023-7>

9. Schlosser, R. and Boissier, M. (2018), “Dealing with the dimensionality curse in dynamic pricing competition: Using frequent repricing to compensate imperfect market anticipations”, Computers & Operations Research, vol. 100, pp. 26—42. DOI: <https://doi.org/10.1016/j.cor.2018.07.011>

10. Cotterill, R.W., Putsis, W.P. Jr. and Dhar, R. (2000), “Assessing the Competitive Interaction between Private Labels and National Brands”, The Journal of Business, vol. 73, no. 1, pp. 109—137. DOI: <https://doi.org/10.1086/209634>

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