

# DYNAMIC PRICE AS BARGAINING RESULT FOR REVENUE MAXIMIZATION IN RETAIL

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**Abstract.** *The application of dynamic price and its modeling was an authentic revolution for the traditional concept of price setting in business environment. The article reviews the essence and the main principles of dynamic price as a bargaining basis. Dynamic price fluctuation range in this paper is collated with the zone of agreement and introduced as an overlap between the maximum purchase price that the buyer is willing to pay and the minimum sell price that the seller is willing to accept. Therefore, the aim of this paper is to analyse the dynamic price as the bargaining basis, research problems, and to assess the dynamic price efficiency based on the dynamic price setting model experiment results. The experimental results suggest that dynamic price is a successful tacit bargaining practice.*

**Key words:** *dynamic price, bargaining, dynamic price model, experiment, zone of agreement, revenue maximization*

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## Introduction

In the research literature and organizations' practice, more and more attention is paid to the price setting based on current product demand and supply conditions – a *dynamic price* and its modelling. *Appropriate price setting still remains a very challenging task* requiring the organization's knowledge not only of their operating costs, but also of the possibility to understand the dynamic price based on the product demand and supply parameters.

Research on dynamic price modelling has been undertaken by economists and operational researchers from a range of perspectives, and the benefits of dynamic price methods have long been known in airlines, electricity, and other industries. Nowadays, there has been an increasing adoption of dynamic price in the retail sector when selling a fixed inventory over a finite selling horizon.

Due to the development of information technologies and e-commerce, many-sided information about the customer has become easier available and thus has determined an increased interest to the dynamic price setting research and its application in various sectors of services and industries. Dynamic price setting has been caused both in

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scientific field and in practice by the following factors: availability of statistical data on the demand of a good; the possibility quickly to change goods' prices, caused by the IT development, reliability, and availability of mathematical decision-making methods to analyze demand and supply data. The experience of foreign companies (IBM, Inditex, Compaq, Hewlett-Packard, Dell, etc.) has revealed that companies which apply the dynamic approach in their price setting may achieve the best results in business. Therefore, the increasing competition, uncertain demand, shortening lifecycles of goods, surplus stocks of goods, the growing economic risk of companies have induced trade companies to examine their current price-setting methods and to start looking for dynamic price-setting methods which would allow for revenue maximization.

The bargaining mechanism itself is the vast literature subject, *but the relation between dynamic price and bargaining is rarely purified in practice*. While the majority of dynamic price researchers assume that buyers and sellers are uncertain about each other's valuations of the good, we state that dynamic price is the concept where two parties bargain over a surplus split – the difference between the total surplus and the sum of their reservation utilities.

The **purpose** of this paper is to analyse the dynamic price as the bargaining basis, its research problems, and to assess dynamic price efficiency based on the dynamic price-setting model experiment results. In the article, we solve the research **problem** how and what type of bargaining influences dynamic price, and how dynamic price setting affects the company's results. The main research **methods** include both qualitative and quantitative methods. The dynamic price forming factors were evaluated using the Analytic Hierarchy Process (AHP) method. This decision-making method, originally developed by T.L. Saaty, allows some small inconsistency in judgment where the main idea is to derive ratio scales from paired comparisons. For dynamic price modelling, due to the existing categorical variables, it was decided to use the general linear model (GLM). In fact, it is the ordinary linear regression and analysis of variance models' compound that allows using the quantitative and qualitative variables and their various interactions instead of the explanatory variables.

The paper begins with an overview of the dynamic price conception and its research problems from the theoretical standpoint. It is followed by a discussion on the link between dynamic price and bargaining. Then, based on the purpose of this paper, we apply the AHP method to identify the dynamic price forming factors and GLM modelling to assess the dynamic price efficiency.

## **The perception of dynamic price and problems in its research**

Dynamic price (hereafter DP) has been analyzed and tried to be defined in various research areas (Fig.1): *economics* (Reagan, 1982; Philips 1983; Aguirregabiria, 1999; Krugman, 2000; Harrison et al., 2011; Sweeting, 2012; Varian, 1980, 2007; and more),

*management, marketing* (Kalish, 1983; Grewal, Compeau, 1999; Braden, Oren, 1994; Zettelmeyer et al., 2006; Desiraju, Shugan, 1999; and more), *operations* (Belobaba, 1987; Gallego, van Ryzin, 1994; Williams, 1999; Popescu, Wu, 2007; Zhang, Cooper, 2006; Ziya et. al., 2004; Ahn et. al., 2007; and more).

We should note that to define DP reliably is still a complex task for several reasons, most important being the following: different interpretations of this conception by representatives of various scientific spheres, and the orientation of DP researchers towards different academic branches. Therefore, the DP concept analysis suggests that up to now in the literature there is no unanimous and widely used DP definition.

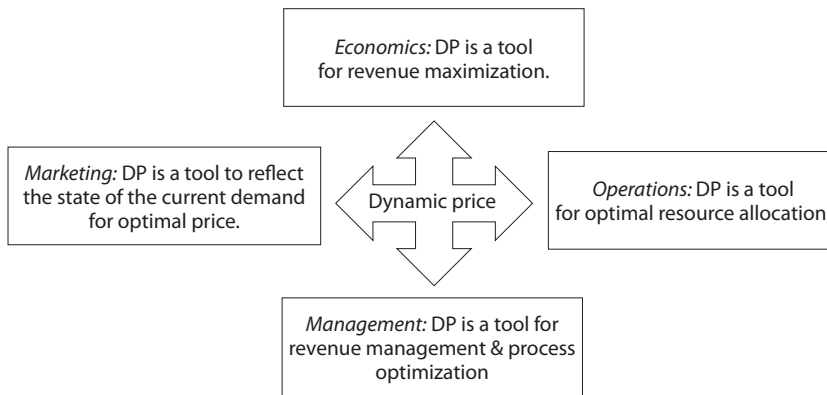


FIG.1. Dynamic price research objects in different research fields

Source: compiled by authors.

In the context of *economic research*, DP is often associated with the price discrimination: DP is understood as an attempt of a seller to force a customer to pay the highest price he is ready to pay. An important contribution of this scientific direction is presenting DP as the best reflecting product demand / supply balance, (Bitran, 2002; Schwind, 2007; and more). A conclusion was formulated by P. Krugman (2000), H. Varian (1980, 2007) that DP is a new practice of the old price discrimination. According to researchers, modern technologies made DP useful not only for different areas of industries/services, but also for economics.

L. Philips (1983) summarizes a typical economist attitude towards price discrimination and states that DP is necessary in order to allocate resources in the optimum way in real-life situations. This statement may sound strange, because usually the economic analysis states that in the competitive market the price is equal to marginal costs and thus maximizes welfare. However, based on the modern true-life situations, many sectors of industry such as pharmacy, telecommunications and information technologies, experience high fixed costs and lower marginal costs. When prices are set according to

marginal costs, it would be impossible to retrieve the initial investment, so in this case DP is assessed positively.

We state that DP definition has a tendency to show which academic field governs the knowledge of this research problem. I. Yeoman et al. (1999) claimed that the widely accepted DP definition is the allocation of resources and inventory for the right buyer, for the right price in order to maximize revenue and profitability (Ng, 2005). Despite the influence of other disciplines, operational research still clearly dominates in the literature concerning revenue management.

In the nowadays operation management, researchers state that product demand is the integral part of DP research (Boyd, Bilegan, 2003); the definitions are still concentrated on supply as evidenced by S.E. Kimes and G.M. Thompson's (2004) definition: DP is the form of resource management where supply is controlled by manipulating useful life and price. This is not consistent with the definition of M. Fleischmann et al. (2004): DP is related to price-fixing for perishable resources taking into account the demand so that to maximize the revenue or profit (according to Ng, 2005).

*This paper defines DP as a bargaining form and as a dynamic price regulation for consumers, evaluating the current product demand / supply to maximize the revenue. Using DP, the seller dynamically, over time and in response to parameters such as product demand and supply, adjusts the product prices.* This understanding is the opposite of DP definitions in the operations management research provided by K.T. Talluri and G.J. van Ryzin (2004), L. Weatherford and S. Bodily (1997) where the demand profile is separated from both the resource allocation and a company's price policy.

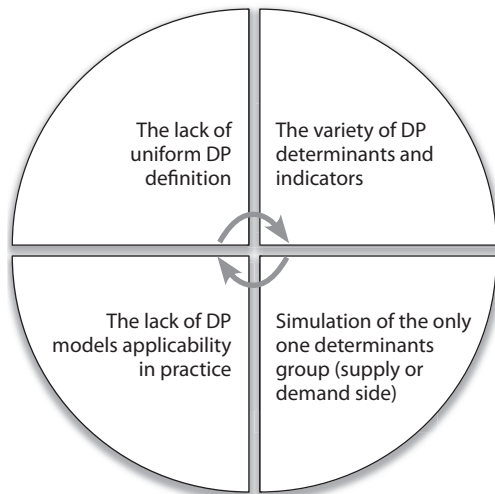


FIG. 2. The main problems in dynamic price research

Source: compiled by authors.

We state that not only the lack of a uniform DP definition is the only problem in the DP research (Fig. 2). Most of the DP models are rarely purified in the practice. The majority of them remains only on the theoretical level; as also the mathematical algorithm modelling complicates their application. As a result, in this paper, we argue that DP models should be based on the practice, versatility, and simplicity principles. Another DP research problem is the variety of DP determinants and indicators. An abundance of research in various areas of science has led not only to the lack of a unified concept of DP, but also to the abundance of its forming factors.

In most studies, DP is modelled in a specific area, and the model is constructed on the basis of factors that are only important for a particular researcher or a specific business area, resulting in the lack of DP models' versatility. In this context, it is worth to analyze W. Elmaghraby and P. Keskinocak (2003) research papers which indicate that before modelling DP it is important to define and evaluate the following characteristics:

- *replenishment or no replenishment of inventory.* The inventory policy plays an important role in revenue management models. If inventory replenishment is allowed by the time horizon, the retailer should make a joint inventory and price decision during the time horizon; if the replenishment is not allowed, the retailer should make the price decision based on the given inventory;
- *dependent or independent demand over time.* If a retailer has a durable product to sell, the demand for the product might be a dependent function across multiple periods of time. For this type of product, the benefit duration of the product is longer than the selling horizon. On the other hand, if the costumers' knowledge about the product plays an important role in their decision to buy the product, the demand would also be dependent on time;
- *myopic or strategic customers.* The retailers should take into account the purchasing behavior of the customers in order to have an efficient price policy. If a customer makes his decision based only on the price he sees when he arrives, we call this customer a myopic customer. In the opposite case, we call it a strategic customer.

TABLE 1. Dynamic price application areas and results

Research	DP testing area/organization	DP effect on sales revenue
A. Andersen, 1997	Carlton Beach Hotel	20%↑
S. Goksen, 2011	British Airways	X%* <sup>1</sup> ↑
R. Cross, 1997	Austrian Airlines	X%* ↑
R. Cross, 2010	Delta Airlines	+\$300 mln. ↑
J.V. Marriot, 2000	Marriot Hotel	+\$150–\$200 mln ↑
J. Peyton, 2009	Starwood	X%* ↑
C. Neville, 2007	Ford Motors	+\$100 mln.↑
W. Elmaghraby & P. Keskinocak, 2003	Amazon.com	X%* ↑
R. Cross, 2010	PeoplExpress	+\$1 bl. ↑
R. Cross, 2010	American Airlines	14.5% ↑
R. Cross, 2010	KLM	+1.4 bl. ↑
R. Cross, 2010	UPS	+>100 mln. ↑
R. Cross, 2010	Ford Motor	+100 mln. ↑
K. Larson, 2009	Chicago Symphony	1.5–2% ↑
K.Larson, 2009	Pacific Northwest Ballet, Palm Beach Opera, San Diego Opera	1.5–2% ↑

Source: compiled by authors.

<sup>1</sup> For confidentiality reasons, organizations do not provide the exact parameters (X) and only indicated the direction of variability.

The literature analysis has confirmed that, although organizations give a higher importance to DP, its systematic application in practice is limited (Bitran, 2002; Caro, Gallien, 2012; Schwind, 2007; Cross, 1997; Smith, Achabal, 1998; Walker, 1999). Practical DP models results are also rarely presented (Andersen, 1997; Chan, Seetharaman, 2004; Cleophas, 2012; Desiraju, Shugan, 1999; Elmaghraby, Kesinkocak, 2003; Florian et al., 2006). The successful applicability in business (Table 1), especially in retail, aviation, hospitality services, confirms that DP has been quite an innovative method whose advantage is the fact that, compared with other price methods such as static price, business income has increased, while costs have remained unchanged (Feng, 2010).

### Dynamic price as the bargaining result

Very few economic research papers to date have considered and analyzed DP as a bargaining form. We should note that DP in economics is analyzed as a revenue management form with a limited research on the buyer and seller interactions. M. Schwind (2007), M. Bichler et al., (2003) argue that it is a two-way process in which the buyer–seller, according to different purposes, seek a mutually satisfactory price level (beneficial agreement). Here, the buyer’s and the seller’s power is equivalent. For this reason, the price bargaining is difficult to manage, and misunderstandings abound.

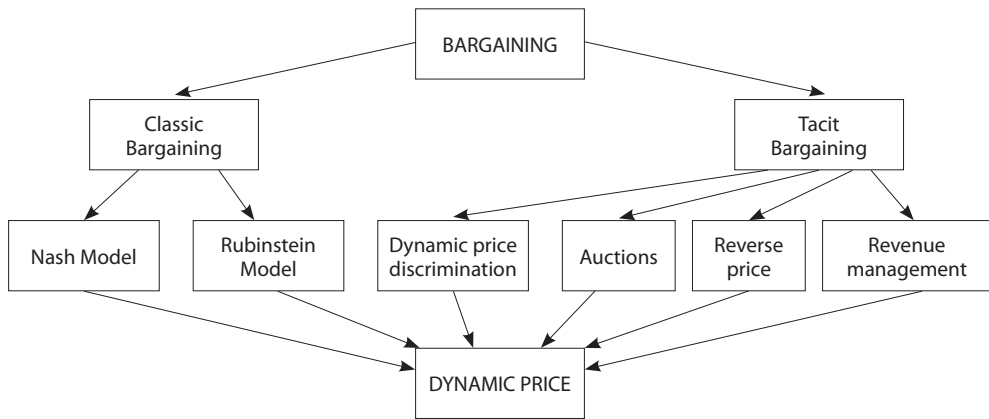


FIG. 3. Bargaining typology

Source: compiled by authors.

Basically, in economics there are two classical bargaining models: the Nash bargaining solution and the Rubinstein model (Fig. 3). Under the Nash bargaining solution, two parties bargain over a surplus split the difference between the total surplus and the sum of their reservation utilities (also known as disagreement payoffs). The Rubinstein model, on the other hand, regards bargaining as a series of alternating offers between the two parties bargaining over a surplus. In its most basic form, the Rubinstein model

assumes that the two parties have full information regarding each other's utilities, and they make alternating offers with a fixed time interval between two successive offers to maximize the discounted utility (Kuo, 2008). Researchers (Cope, 2007; Cross, 1997; Elmaghraby, Keskinokak, 2003; Bitran, 2002, and more) also wish to model the situations in which some of the parties are not certain of the characteristics of some of the other parties (a Bayesian game).

In Fig. 3, auctions are resource allocation mechanisms based on a competitive bidding process over a single issue (e.g., price) of a single well-defined object, and involve Bichler et al. (2003). Reverse pricing enables both buyer and seller to influence the final price of a product or service, if a buyer's bid does not surpass the seller's threshold price, the option to place additional bids depends on the characteristics of the mechanism design as defined by the seller or a third party. DP discrimination in its basic form is defined when different customers are quoted for the same product at different prices. And finally, the revenue management is designed to find the optimal revenue management for perishable assets (Schwind, 2007).

DP of supply and demand response based on bargaining is highly dependent on the frequency of the bargaining process. The high cost of the bargaining process leads to the small share of the market. According to M. Schwind (2007), the efficiency and equity of this DP form is also highly dependent on the bargaining agents' talent. To avoid all the price bargaining problems, researchers started to build electronic bargaining tables and systems.

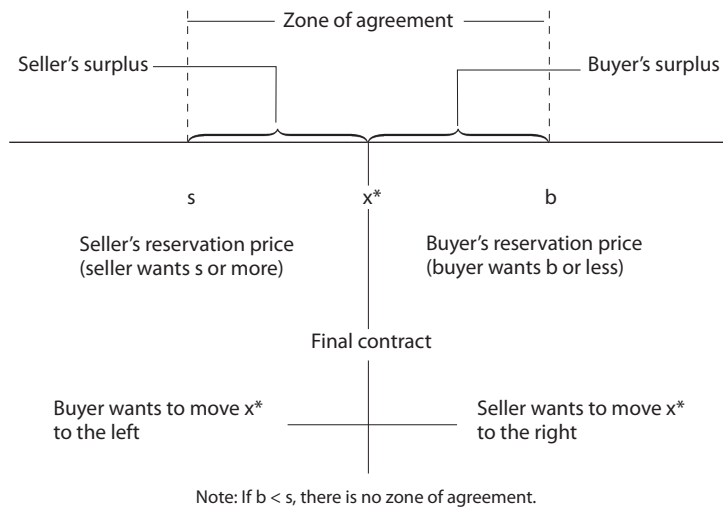


FIG. 4. Geometry of bargaining

Source: J.C. Usunier (2002).

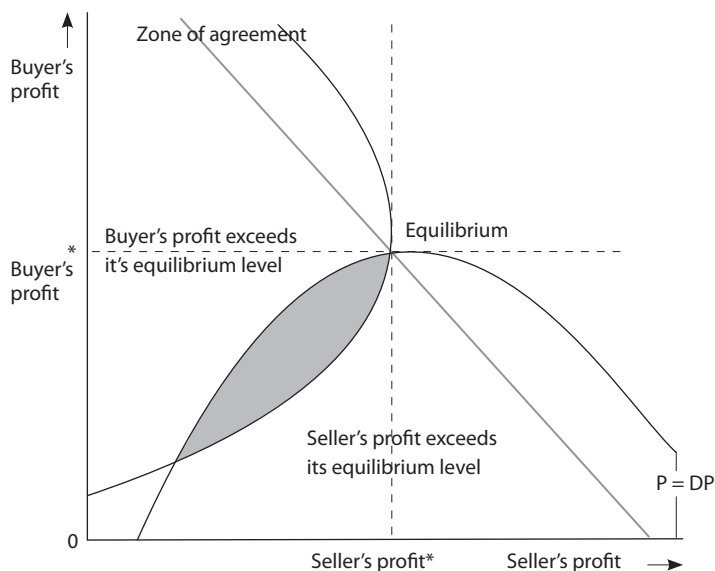
Bargaining is any process through which the players try to reach an agreement. This process is typically time-consuming and involves the players making offers and counter-offers to each other (Muthoo, 1999). Here are two options stated: the possibility not to reach agreement or reaching it after a costly delay.

M. Schwind (2007), M. Bichler et al., (2003), K. Chatterjee and W. Samuelson (1983), P.V. Balakrishnan and J. Eliashberg (1995), R. Wang (1995), N.L. Stokey and R.E. Lucas (1989) and other dynamic economics researchers assume that DP is an effective method to reach the optimal agreement stage. Bargaining is an inherently dynamic process; for instance, a low-ball early offer by the buyer will affect the course of the whole bargaining interaction. Any estimation must incorporate these dynamic considerations, and techniques for the analysis of dynamic games have become available only recently. We should note that buyers and sellers have different future outcomes if trade occurs. Sellers are professional traders and always return to the market and begin bargaining with a fresh buyer at the conclusion of a successful or unsuccessful trade. Buyers, on the other hand, are temporary participants in the market. Upon completion of a successful sale, they exit the market permanently. However, if bargaining with a given seller fails to result in trade, the buyer seeks out another seller (Keniston, 2011)

W.F. Samuelson (2006) argues that bargaining inevitably produces tension between the forces of competition and cooperation. To reach a mutually beneficial agreement, both sides (here buyer and seller) must cooperate. An overlap between the maximum purchase price that the buyer is willing to pay and the minimum sell price that the seller is willing to accept, the pair is said to possess a *Zone of Agreement or Zone of Possible Agreement*. A graphical representation of a zone of agreement is given in Fig. 4. If the negotiators are successful, they will come to an agreement somewhere within this range, and thus both come out better than they would have had they gone elsewhere. If, on the other hand, the maximum buy and minimum sell prices do not overlap, then no agreement zone exists (Usunier, 2002; Samuelson, 2006). We state that the Zone of Agreement is the DP fluctuation zone where the buyer and the seller are looking for the mutually beneficial agreement point. In this view, we agree with T. Alfredson and A. Cungu (2008) that the relative power of each party affects their ability to secure their individual goals through bargaining. Structural theories offer varying definitions of power. For example, power sometimes is defined as the ability to win or, alternatively, as the possession of 'strength' or 'resources'.

We assume that the bargaining process is *tacit* in the sense that the buyer and the seller can communicate only by making a price over that directly affects their payoffs. We refer to K.M. Murnighan's (1992) "*tacit bargaining*" definition as "bargaining in which communication is incomplete or impossible". Put this way, any set of terms falling inside the zone of agreement can be supported as an equilibrium outcome.





**FIG. 5. Buyer and seller interactions**

*Source:* compiled by authors based on M.J. Osborne (2000).

Our approach is supported by D.E. Keniston (2011): at the beginning of the game, sellers decide once and for all whether to enter the market by comparing the expected returns to the trader profession with some exogenous external option. In contrast, a new round of buyers enters the market each period to replace those that have traded in the past period and exited the market. Entering buyers first decide whether to participate or not in the market; if not, they exit and are replaced in the next period. Buyers who do select to participate remain in the market until they have successfully completed the trade.

Via the dynamic process, the parties will arrive at some final outcome; however, the multitude of equilibrium outcomes makes it difficult to predict to which one. Clearly the final outcome depends significantly on the bargainers' expectations — expectations that are modified via the offers exchange and counteroffers during the bargaining (Fig. 5).

The optimal agreement zone is the most desirable point to be reached by both sides (see the grey plot in Fig. 5). In some sense, bargaining ceases when expectations converge, at a point where neither side can expect the other to concede further. Then, either an agreement is signed or, if the sides stubbornly hold to conflicting expectations, a disagreement follows (Samuelson, 2006).

## Methods

In this paper, we suggested to analyze DP as a bargaining form. For this reason, the DP model was formed and tested in the real business environment – the international retail

companies' group XYZ. The main experiment goal was to evaluate DP performance based on the bargaining aspect and to compare regular vs. DP performance results based on the successful bargains' number.

The research stages are as follows: identification of the most significant DP forming factors and justification of the corresponding parameters; construction of an econometric model to evaluate DP setting; verification and justification of the model. *The created econometric model integrated the demand and supply factor groups that met the economic logic related with the DP setting formation.*

Forming the DP model, first it is necessary to select and justify the determinants and their reflective indicators. For this purpose, expert survey was selected as the instrument to obtain judgments from experts about the importance of DP-forming factors. This questionnaire was directed to get the priority weight of each factor used for ranking the DP-forming factors. The methodology used is Analytic Hierarchy Process (AHP). The factors here should be rated by the method of a pairwise comparison where the preference of one factor over the other is given a numeric value (scale 1–3–5–7–9). The method brings the possibility of a qualitative evaluation to be transformed into quantitative evaluation. The comparison result is a square matrix  $P = ||p_{ij}|| (i, j = 1, \dots, m)$ .

The comparison matrix mathematical expression:

$$P = \begin{pmatrix} p_{11} & p_{12} & \dots & p_{1m} \\ p_{21} & p_{22} & \dots & p_{2m} \\ \vdots & \ddots & & \vdots \\ p_{m1} & p_{m2} & \dots & p_{mm} \end{pmatrix} = \begin{pmatrix} \frac{\omega_1}{\omega_1} & \frac{\omega_1}{\omega_2} & \dots & \frac{\omega_1}{\omega_m} \\ \frac{\omega_2}{\omega_1} & \frac{\omega_2}{\omega_2} & \dots & \frac{\omega_2}{\omega_m} \\ \frac{\omega_1}{\omega_1} & \frac{\omega_2}{\omega_2} & \dots & \frac{\omega_m}{\omega_m} \\ \vdots & \ddots & & \vdots \\ \frac{\omega_m}{\omega_1} & \frac{\omega_m}{\omega_2} & \dots & \frac{\omega_m}{\omega_m} \end{pmatrix} \quad 1.1$$

More than ten international experts were interviewed in 2012 December – 2013 April. The first phase was carried out in a pilot study to determine the adequacy of the study and to verify measuring instruments and adapted procedures. The survey data were computed by the “Make It Decision Rational Tool” program. As a result authors evaluated the main DP forming factors:  $f_n$  – inventory level,  $BrAssort_n$  – partial assortment effect,  $PLC_{it}$  – product lifecycle,  $SEASw$  – seasonality,  $COO_{it}$  – origin country,  $PD_{it}$  – product discount,  $QA_{it}$  – product quality,  $Brand_{it}$  – brand attractiveness (for more, see Deksnyte, Lydeka, 2012, 2013).

Due to existence of categorical variables it was decided to use the general linear model (GLM). In fact, it is the ordinary linear regression and analysis of a variance models' compound that allows, instead of the explanatory variables, to use the quantitative and qualitative variables and their various interactions. *The application of the GLM model and optimization methods were selected in this study, because they allow to determine and identify the impact of the factors and to implement the DP setting model idea in a real business environment in order to maximize the retail trade company revenue.*

## Results

The experiment involved ten different products, and the results were compared to the identical product control group. The control and experimental groups were formed on the basis of several criteria: first, both groups belong to the same brand, and second, the experimental and control groups of goods are the same in the number of items that are dependent on one or another group based on historical data from international retail companies' group XYZ. The experiment period: May–August 2013.

The static price setting for the control group resulted in regular demand fluctuations (Fig. 6). Otherwise, in the experimental group, demand shocks were identified. It can be argued that the 90–101 days of the experiment have a relatively higher demand influenced by the DK model: at the right time the demand–supply factors formed the more appropriate price. In the control group, we found that the lowest price limit during the experiment did not summon such a demand rate as in the experimental group. It can be said that the lowest price was unattractive for the buyers. This supports I. Weatherford and S. Bodily (1992), S. E. Kimes and E. Sheryl (1989), K. Pak and N. Piersma (2002), S. E. Kimes and G. M. Thompson (2004), I. Yeoman et al. (1999), R. S. Upchurch et al. (2002) ideas and the DP concept formulation: the DP is a tool to maximize the revenue for the right product and the right customer, at the right time and at the right price.

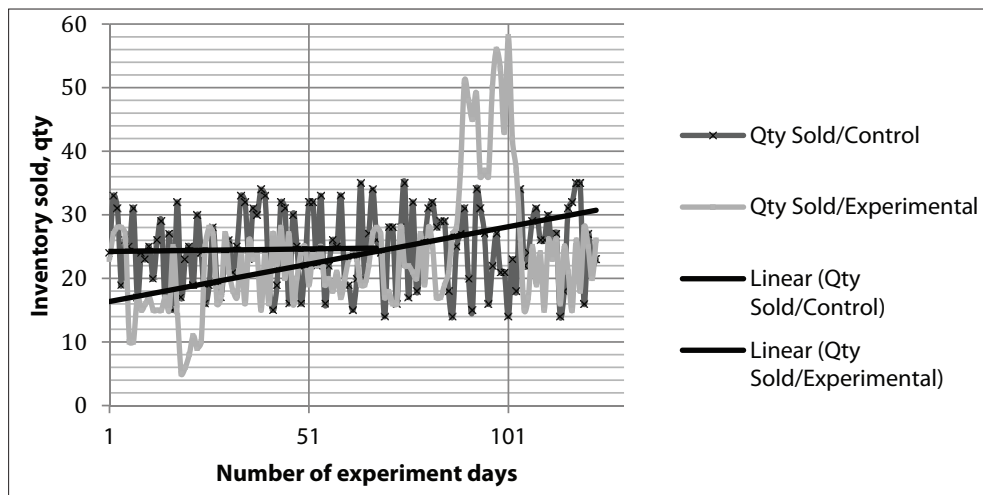


FIG.6. Comparison of the control and experimental groups regarding the amount of sold stock

Source: compiled by authors based on the international retail companies group XYZ data.

DP researchers briefly analyze the greedy algorithm definition – the notion that one of the main DP principles – is based on the factors included in the DP model that the output should be the optimal price set, a rare case in which this can be achieved using

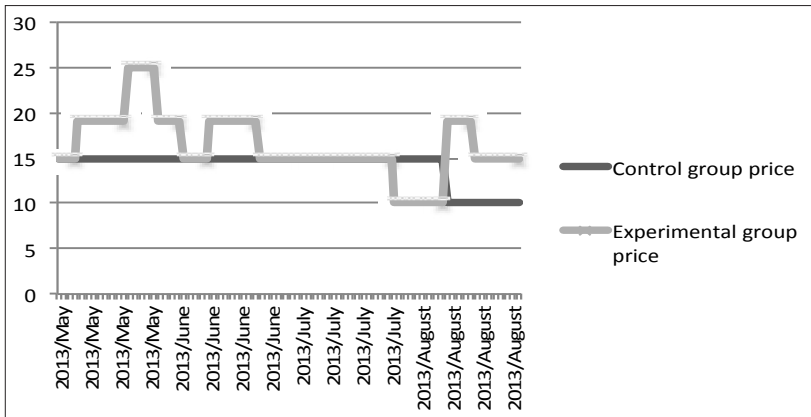


FIG.7. Experiment and control groups, comparison based on average price variation

Source: compiled by authors based on the international retail companies group XYZ data.

the regular – static pricing setting. The static price in the control group often leads to delays: as analyzed above, in our experiment case the lowest price limit had no such effect as in the DP case (Fig. 7).

The empirical results show that the old / slow selling inventory can reduce the overall organization profitability when the total assets increase due to investments in stocks. As a result, the decline in asset turnover, the lack of working capital and thus the opportunity to invest in other, more profitable, asset class will be limited. These problems often cause the company to seek additional investment sources.

In assessing the amount of stock sold in both experimental groups, the DP case resulted in a +2% (+55 units) higher number of units sold. According to the international retail companies group XYZ statistics, the total category turnover, taking the results of the experimental group increased from 4.21 to 4.24. Thus, the experimental results show that the DP effected the inventory management efficiency. Based on this reasoning, we conclude that the DP reduces the risk of excess inventory.

In DP research studies, an integral part of the debate is the effect on organization profit. B.P. Reagan (1982), L. Weatherford, and S. Bodily (1992), V. Aguirregabiria (1999), I. Yeoman et al. (1999), M. Fleischmann et al. (2004) identify DP as one of the factors influencing the performance of an organization, emphasizing the impact on company profit. An experimental study confirmed that DP leads to sales growth, inventory management efficiency, but not in all cases; the profit was obtained as compared with the control product group (Figs. 8, 9). Experiment results in this study have shown that the product lifecycle indicator is statistically significant and identifies obsolete inventory which would weaken the position of the variable in question. The product quality

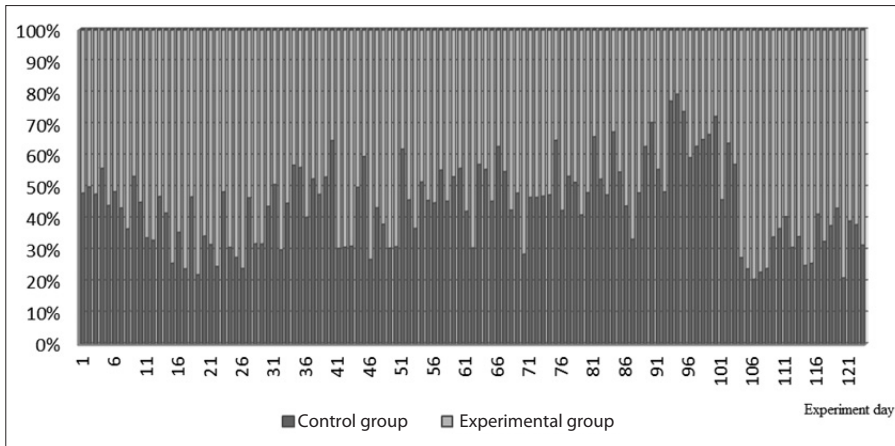


FIG. 8. The experimental and control groups, comparison based on profit variation by day

Source: compiled by authors based on the international retail companies group XYZ data.

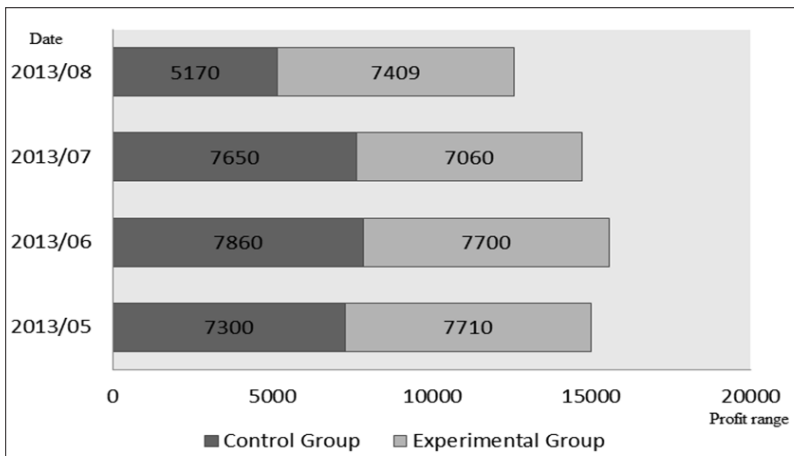


FIG. 9. The experimental and control groups, comparison based on profit variation by months

Source: compiled by authors based on the international retail companies group XYZ data.

characterizing parameter also leads to the a negative impact in the model: the returned / poor quality inventory affects the lower DP rate. Thus, the experimental results have proved that the DP not always has a greater impact on the company’s profit growth than in the regular static price case. On the contrary, the greater number of successful bargains in the DP case indicated that the DP tacit bargaining practice was successful.

## Conclusions

In the literature and in organizations' practice, more and more attention is paid to the price setting based on the current product demand-and-supply conditions – the DP and its modelling. Appropriate price setting still remains a very challenging task requiring the organization's knowledge not only about their operating costs, but also the possibility to understand the DP-affecting product demand and supply parameters.

The bargaining mechanism itself is a vast literature subject, but the relations between DP and bargaining are rarely purified in practice. While the majority of DP researchers assume that buyers and sellers are uncertain as to each other's valuations for the good, we state that DP is a concept where two parties bargain over a surplus split as the difference between the total surplus and the sum of their reservation utilities.

The DP concept analysis states that up to now in the literature there has been no unanimous and widely used DP definition. In this paper, the authors have defined DP as bargaining form and as a dynamic price regulation for consumers, evaluating the ability of the current product demand / supply parameters to maximize the revenue. Using DP, the seller dynamically over time and in response to parameters such as a product demand and supply adjusts the product prices.

This paper contributes to the field of research on DP analyzed as a bargaining form in which the existing analyses are more often empirical and multinational. It suggests that the Zone of Agreement is the DP fluctuation zone where the buyer and the seller look for a mutually beneficial agreement point. The relative power of each party affects their ability to secure their individual goals through bargaining.

Following the methodology of our research, we propose to use the AHP method for the identification of DP-forming factors and GLM modelling to assess DP efficiency.

The results of our research indicate that in comparing the dynamic and regular (static) prices, the experimental study has shown that DP leads to sales growth, inventory management efficiency, but not in all cases: the profit was lower as compared with the control product group. The greater number of successful bargains in the DP case has indicated that the DP is a successful tacit bargaining practice. Via the dynamic process, parties will arrive at some final outcome, but the multitude of equilibrium outcomes makes it difficult to predict at which one. The final outcome depends significantly on the bargainers' expectations – expectations that are modified via the exchange of offers and counteroffers during the bargaining.

## REFERENCES

- Aguirregabiria, V. (1999). The dynamics of markups and inventories in retailing firms. *Review of Economic Studies*, Vol. 66.
- Ahn, H., Kaminsky, P., Gumus, M. (2007). Pricing and manufacturing decisions when demand is a function of prices in multiple periods. *Operations Research*, Vol. 55, No. 6.
- Alfredson, T., Cungu, A. (2008). *Negotiation Theory and Practice. A Review of the Literature*. Maryland: Food and Agriculture Organization of the United Nations.
- Andersen, A. (1997). Yield management in small and medium-sized enterprises in the tourism industry. General Report. European Communities.
- Balakrishnan, P.V., Eliashberg, J. (1995). An analytical process model of two-party negotiations. *Management Science*, Vol. 41.
- Belobaba, P. P. (1987). Air travel demand and airline seat inventory management. Working paper.
- Bichler, M., Kersten, G., Stecker S. (2003). Towards a structured design of electronic negotiations. *InterNeg Research Papers*, Vol. 12, No. 4.
- Bitran, G., Caldentey, R. (2002). An overview of pricing models for revenue management. *Manufacturing and Service Operations Management*, Vol. 5.
- Boyd, E.A., Bilegan, I.C. (2003). Revenue management and e-commerce. *Management Science*, Vol. 49, No. 10.
- Braden, D.J., Oren, S.S. (1994). Nonlinear pricing to produce information. *Marketing Science*, Vol. 13, No. 3.
- Caro, F., Gallien, J. (2012). Clearance pricing optimization for a fast-fashion retailer. *Operations Research*, Vol. 60.
- Chan, T., Seetharaman, P.B. (2004). Estimating dynamic pricing decisions in oligopolistic markets: an empirical approach using micro- and macro- level data. *Conference Proceedings on Economic Dynamics*, Washington.
- Chatterjee, K., Samuelson, W. (1983). Bargaining under incomplete information. *Operations Research*, Vol. 31.
- Cleophas, C. (2012). Multi-agent modelling for revenue management. *Journal of Revenue & Pricing Management*, Vol. 12, No. 2.
- Cope, E. (2007). Bayesian strategies for dynamic pricing in E-commerce. *Naval Research Logistics*, Vol. 54, No. 3 (2007).
- Cross, R. (1997). *Revenue Management: Hard-Core Tactics for Market Domination*. New York: Broadway Book.
- Cross, R., Hignite, J.A., Cross, Z. (2010). Milestones in the application of analytical pricing and revenue management. *Journal of Revenue and Pricing Management*, Vol. 1, No. 11.
- Deksnyte, I., Lydeka, Z. (2012). Dynamic pricing and its forming factors. *International Journal of Business and Social Sciences*, Vol. 3 No. 23, p. 213–220.
- Deksnyte, I., Lydeka, Z. (2013). Dynamic pricing modelling and its methodological aspects. *Tai- komoji ekonomika: sisteminiai tyrimai = Applied Economics: Systematic Research*, Nr. 7 (2). Kaunas: Vytauto Didžiojo universitetas, pp. 143–153. ISSN 1822-7996.
- Desiraju, R., Shugan, S.M. (1999). Strategic service pricing and yield management. *Journal of Marketing*, Vol. 63.
- Elmaghraby, W., Keskinocak P. (2003). Dynamic pricing in the presence of inventory considerations: Research overview, current practices, and future directions. *Management Science*, Vol. 49, No. 10.
- Feng, Q. (2010). Integrating dynamic pricing and replenishment decisions under supply capacity uncertainty. *Management Science*, Vol. 56, No. 12.
- Fleischmann, M., Hall, J.M., Pyke, D.F. (2004). Smart pricing. *MIT Sloan Management Review*, Vol. 45, No. 2.

- Florian, Z., Morton, F.S., Silva-Risso, J. (2006). How the Internet lowers prices: Evidence from matched survey and automobile transaction data. *Journal of Marketing Research*, Vol. 43, No. 3.
- Gallego, G., van Ryzin, G. (1997). A multiproduct dynamic pricing problem and its applications to network yield management. *Operations Research*, Vol. 45.
- Goksen, S. (2011). *Implementing Revenue Management*. Amsterdam: BMI Thesis.
- Grewal, D., Compeau, L. D. (1999). Price and public policy: An overview and a research agenda. *Journal of Public Policy & Marketing*, Vol. 18.
- Harrison, J.M., Keskin, N.B., Zeevi A. (2011). Dynamic pricing with an unknown linear demand model: asymptotically optimal semi-myopic policies. Access: <http://faculty-gsb. Stanford.edu/harrison/hkz-2.pdf>.
- Kalish, S. (1983). Monopolist pricing with dynamic demand and production cost. *Marketing Science*, Vol. 2, No. 2.
- Keniston, D. (2011). *Bargaining and welfare: A dynamic structural analysis*. Mimeo: Massachusetts Institute of Technology.
- Kimes, S. E., Thompson, G.M. (2004). Restaurant revenue management at Chevys: Determining the best table mix. *Decision Sciences*, Vol. 35, No. 3.
- Krugman, P. (2000). What Price Fairness? *New York Times*, October 4th.
- Kuo, C.V. (2008). *On the Role of Negotiation in Revenue Management and Supply Chain*. Michigan.
- Larson, K. (2009). Can you use dynamic pricing? *Arts Professional Magazine*, No. 207.
- Marriot, J.V., Cross, R. (2000). Room at revenue inn-maximizing revenue. An article from: Chief Executive (U.S.).
- Murnighan, K.M. (1992). *Bargaining Games : A New Approach to Strategic Thinking in Negotiations*. New York: HarperCollins Publishers.
- Muthoo, A. (1999). *Bargaining theory with applications*. Cambridge, UK: Cambridge University Press.
- Neville, C. (2007). From intuition to data-driven pricing. 3rd Annual Revenue Management & Price Optimization Conference, Atlanta, 2007.
- Ng, I. (2005). A Theoretical Framework of Advanced Demand and a critical analysis of revenue management// *Manufacturing and Service Operations Management*, discussion paper.
- Osborne, M.J. (2000). *Introduction to Game Theory*. Toronto: Oxford University Press.
- Pak, K., Piersma, N. (2002). Overview of OR techniques for airline revenue management. *Statistica Neerlandica*, Vol. 56, No. 4.
- Peyton, J. (2009). Mobilizing global resources to transform the revenue management discipline. 5th Annual Revenue Management & Price Optimization Conference, Atlanta.
- Philips, L. (1983). *Economics of Price Discrimination*. Cambridge: Cambridge University Press.
- Popescu, Y., Wu, Y. (2007). Dynamic pricing strategies with reference effects. *Operations Research*, Vol. 55, No. 3.
- Reagan, P.B. (1982). Inventory and price behavior. *Review of Economic Studies*, Vol. 49, No. 1.
- Samuelson, W.F., Marks, S.G. (2006). *Managerial Economics*. Boston: John Wiley & Sons.
- Schwind, M. (2007). *Dynamic Pricing and Automated Resource Allocation for Complex Information Services*. Frankfurt: Johann Wolfgang Goethe Universität.
- Smith, S., Achabal, D. (1998). Clearance pricing and inventory policies for retail chains. *Management Science*, Vol. 44, No. 3.
- Stokey, N.L., Lucas, R.E. (1989). *Recursive Methods in Economic Dynamics*. Harvard: Harvard University Press.
- Sweeting, A.T. (2012). *Dynamic Pricing Behavior in Perishable Goods Markets: Evidence from Secondary Markets for Major League Baseball Tickets*. Chicago: Duke University.
- Talluri, K.T., van Ryzin, G.J. (2004). *The Theory and Practice of Revenue Management*. Dordrecht: Kluwer Academic Publishers.



- Upchurch, R. S., Ellis, T., Seo, J. R. (2002). Revenue management underpinnings: An exploratory review. *Hospitality Management*, Vol. 21.
- Usunier, J.C. (2002). *An Open Electronic Bargaining*. Lausanne: IUMI.
- Varian, H. (2007). Position auctions. *International Journal of Industrial Organization*, Vol. 25.
- Varian, H. (2011). *Mikroekonomika: šiuolaikinis požiūris*. Vilnius: Margi raštai.
- Varian, H. (1980). A model of sales. *American Economy Review*, Vol. 70.
- Walker, J. (1999). A model for determining price markdowns of seasonal merchandise. *Journal of Product & Brand management*, Vol. 8, No. 4.
- Wang, R. (1995). Bargaining versus posted-price selling. *European Economic Review*, Vol. 39.
- Weatherford, L., Bodily, S. (1992). A taxonomy and research overview of perishable-asset revenue management: Yield management, overbooking and pricing. *Operations Research*, Vol. 40.
- Williams, P.S. (1999). *Supply Chain Configuration and Part Selection in Multigeneration Products*. Massachusetts: Massachusetts Institute of Technology.
- Yeoman, I., Ingold, A., Kimes, S. E. (1999). Yield management: Editorial introduction. *Journal of Operational Research Society*, Vol. 50.
- Zettelmeyer, F., Morton, F.S., Silva-Risso, J. (2006). How the Internet Lowers Prices: Evidence from Matched Survey and Automobile Transaction Data. *Journal of Marketing Research*, Vol. 43, No. s2.
- Zhang, D., Cooper, W.L. (2006). Revenue management for parallel flights with consumer-choice behavior. *Operations Research*, Vol. 53.
- Ziya, S., Ayhan, H., Foley, R.D. (2004). Relationships among three assumptions in revenue management. *Operations Research*, Vol. 52, No. 5.