Price personalization in the Big Data and GDPR context

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THE AIM OF THE PAPER

This study intends to discuss a rather newly observable fact in management practice that is the personalization of pricing. The possibility of this phenomenon is brought up by the rapid industrial development called by scientists and practitioners the fourth industrial revolution.

METHODOLOGY

It is a conceptual paper based not on the results of particular field research. Its methodology is grounded on desk research, which contained the review of the scientific literature and observations of research institutions analyzing the practical development going on nowadays in the different fields of the economy.

MOST IMPORTANT RESULTS

The study proves that as a result of the fourth industrial revolution, the elbowroom of pricing is growing. The growing zone for price-setting makes it necessary for companies to use new and more sophisticated methods among them price personalization. Personalization requires lots of information about the individual behavior of customers. The advanced analytics of Big Data can deliver real-time information; however, if they are used without control, the privacy of customers may become hurt. The paper discusses the effects of the General Data Protection Rules (GDPR) on companies and customers.

RECOMMENDATIONS

The paper concludes that price personalization, which is a kind of price discrimination, should be used by sellers with care. The effects of GDPR will be not limited to the European Union; it will have worldwide consequences.

INTRODUCTION

This study intends to discuss a rather newly observable issue in management practice, which is the *personalization of pricing* and its relation to the Big Data and the General Data Protection Regulations (GDPR) of the EU. The possibility of price personalization is brought up by the rapid industrial development called by scientists and practitioners the fourth industrial revolution.

According to Schwab (2017), the technical development of the world has entered a phase, which can easily be called a revolution, and this is a development, which could transform earlier trends and redefine our whole life. This industrial revolution is triggered by the revolutionary advancement of the information technology or as the experts call it, the digitalization.

These technological advancements will fundamentally transform the *global system of production* (Baur & Wee 2015, Bloem *et al.* 2014, Moavenzadeh 2015). The integration of information technology with operation technology will create new digital technology and the resulting internet-based cyber-physical systems will induce favorable changes in the creation of customer value or – as Francois Barbier (2017) one of FLEXS's managers puts it: *"The fourth industrial revolution will change the way we produce and consume."*

The writings about the digitalized economy emphasize that it will enable manufacturers to produce smarter, with lower costs and increased personalization of the production. This study would like to draw attention to another possible outcome of digitalization, to the personalization of marketing tools and among them *personalization of pricing*, which has become possible by the rapid advancement of the big data analyzing technologies. With the introduction of GDPR as EU regulation for the protection of personal customers' data, the situation with price personalization strategy has become different; companies must adjust their activity according to this regulation. Even the GDPR is protecting only EU customers' data; the impact will be global.

THE EFFECT OF DIGITALIZATION ON PRICING

Companies' pricing decisions have an elbowroom, which is set by two borders: the upper and lower limits. The upper limit is determined by the money customers are willing to pay for the given product or service. This willingness – called by economics the reservation price – is dependent among others on the functional and emotional value of the offering. The lower limit is formed by the costs of the offered product or service. In the long term, prices should cover the total unit costs; in shorter run companies, because of certain marketing reasons, sometimes go below it. In this case, the lower limit is set by the unit variable costs. To go below unit variable costs would result in a loss (Rekettye & Liu 2018).

The literature review of the fourth industrial revolution proves that it will have a determining effect on both borders of the possible zone of pricing decisions. The floor of a pricing decision, i.e., the costs of manufacturing products and services will go down substantially. Röβmann *et al.* (2015) for example, made calculations concerning the production of spare parts in Germany and concluded that

- on the average *direct labor costs* will decrease by 30%, over the present values within the -next 5-10 years;
- a decrease of similar magnitude can be expected in the *costs of operation;*
- *costs of materials* will remain unchanged, but forecasts speak of a 50% decrease in moving goods and materials, and logistics;
- *overhead costs* are supposed to decrease by 30%.
- It takes, however, significant investment to create the "smart factory" and this will increase the rate of *depreciation – by about 40%* forecasts say. Depreciation is the only cost component that is supposed to increase.
- In conclusion, they forecast a 5-7% decrease in total costs, and a 27-30% decrease in conversion costs (with materials excluded).

This cost-decreasing tendency can be forecasted, with smaller or larger percentages, on almost all industries, which are touched by digital technology (see for example the article of Ghotgalkar *et al.* 2017).

As far as the ceiling of a pricing decision is concerned, the scientists' forecasts state that the different means of digitalization will make it possible to

create new products with higher customer benefits and will make it possible to improve also the functional value of the existing products and services. So, it is safe to state that the increased benefits will also increase customer willingness to accept the potentially higher prices. Adding up these two tendencies, it is almost sure that the gap between the two borders of pricing will grow in the future, giving an ever-growing room of price setting. It is true for tangible goods and even truer for services where the fixed costs are usually high, and marginal costs are low, sometimes nearing to zero.

How prices in this growing elbowroom will develop in the different industries will depend on many circumstances. Depending on the bargaining power of the participant, i.e., manufacturers, intermediaries and customers, prices may follow the downward trends of the cost, they may remain stagnant or may go along with the increased benefits of the companies' offerings and may increase.

This growing gap between the floor and the ceiling of pricing decisions gives companies the possibility of using different and more and more sophisticated pricing technics. The newest trend in the digital era is price personalization.

The mainstream literature emphasized that the tools and methods of the fourth industrial revolution made are possible to create a paradigm shift in manufacturing by producing lower product costs and better value creation through product personalization. The use of these tools – like improved analytics, big data, cloud computing, and artificial intelligence – however, will make it possible to personalize not only the products but also the other means of marketing among them pricing (Rekettye & Rekettye Jr. 2019).

Personalization is a new trend in marketing. However, the majority of the studies discuss the personalization of customer relationship or marketing communication (Heimbach 2015, Chung *et al.* 2016, Shani 2018), and only a few deals with personalization of prices.

Before discussing the issue of price personalization, let us first have a look at the process of personalization. According to Murthi and Sankar (2003), the personalization process has three stages: (1) learning about consumer preferences, (2) matching offerings to customers, and (3) evaluation of the learning and matching processes (Figure 1).

Figure 1. The process of personalization
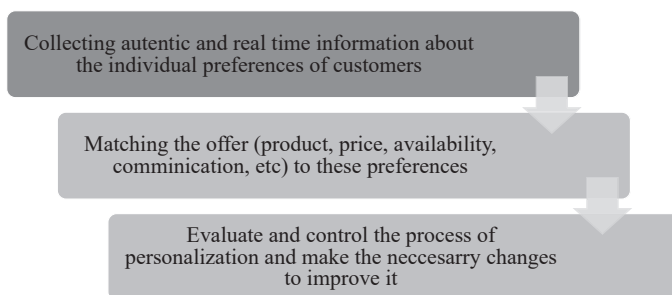
Source: Own construction based on the idea of Murthi and Sankar (2003)

THE INFLUENCE OF BIG DATA ON THE PERSONALIZATION PROCESS

The improvement in the analytical capabilities and the technology to process and use big data creates the opportunity for sellers for collecting customers' data such as location, search history, preference, and behavior on the internet. What the customer like or unlike, purchasing history or the opinion expressed on social media, through blogs, comments, easily can be determined. All this data can be accessed and processed in a near or real-time situation. Collection and using big data requires investment from the users. That is why only larger companies can afford to do the process themselves.

Other companies can buy the necessary information on the secondary market of consumer information. This secondary market has been created by companies like Google and Facebook, both of which earn much of their revenue by selling targeted marketing opportunities to those who cannot afford to produce them in-house. Google and Facebook and similar companies demonstrate the commercial potential of ad-supported internet platforms (The Economist, Sept 13, 2014). The companies that gathered customer data are able with the big data technology to make intelligent predictions in customer moves related to the different demand and pricing schemes. Furthermore, high probability prediction is getting more importance and attention from the side of marketing strategists.

Big data environments represent good opportunities to the sellers but also the buyers.

For sellers, these opportunities can be grouped into the following categories:

- *Exploring the demand curve*. Trough experimentation sellers can explore consumers' behavior and the development of demand. Sellers can offer different prices to different customers, depending on certain customers' attributes. There is, however, the danger that the experimentation can be contra-productive, because, customers may consider this as unethical business behavior which can trigger negative attitudes toward the company and the products.
- *Steering.* In the big data environment, the seller can group consumers into separate segments when web site triggers its search results based on potential consumer's characteristics. The Dell Computer company offers the same computers with different price tags depending on the demographic information that they obtain from the internet about their customer groups.
- *Behavioral targeting and personalized pricing.* Companies use customer information for behavioral targeting which means personalized advertisements and for tailoring the prices of their products (Inside Privacy 2015).

Before the era of big data personal targeting and pricing individualization was possible only on the spots of purchase and it was rather expensive because only skillful salespersons were able to do that. With big data, the process is simpler, cheaper, faster, and more affordable.

The big data environment offers advantages also for customers:

- *E-commerce:* the digital era makes it possible to use the internet for shopping, and it is on the constant rise. According to Statista the global e-commerce sale amounted to 1336 trillion US dollars in 2014 and it has almost tripled by 2019. According to their forecast, this amount will double by 2023 (Statista 2019).
- *Consumer technology*: customers have on their disposal a wide variety of internet tools to explore and compare the prices. They can find the best possible deal. There is a huge number of best price and price tracking web sites, which can produce the price reduction trough arbitrary behavior of the sellers, who use this possibility also for exploring what the competition is doing.
- *Privacy tools:* there are tools available, which protect consumer privacy. The consumers can actively influence what kind of advertisement they want to receive and what kind of information they are willing to share with the sellers. However, many consumers are not aware of the existence of these tools. According to Advisers (2015), only 10% of them know about this possibility.

PRICE PERSONALIZATION VS PRICE DISCRIMINATION

Price personalization is nothing else then price discrimination. The theory and practice of price discrimination have already more than a century old history; it is enough to refer to the book of Pigou in 1920 or Phlips in 1981. Many companies have used price discrimination to capture more of the customer's surplus and increase their profit. The simple definition of price discrimination is that it occurs when the seller charges different prices for the same product to a different customer, and the price differences are not backed by cost differences. Handbooks of economics distinguish three types of price discrimination (Figure 2).

Figure 2. The three degrees of price discrimination

First degree or perfect price discrimination	Second degree or quantity discrimination	Third degree or multi-market price discrimination
• It occurs when the firm charges different prices on every unit sold to every customer.	• It occurs when the company charges different prices on different amounts but does not distinguish between customers.	• It occurs when the company charges different segments of customers different prices.

Source: Own construction

First-degree price discrimination is based on knowledge of the maximum price that the customer is willing to pay. First-degree price discrimination has been perceived as only theoretical category usable only for academic purposes to explain sellers' and buyers' preferences. However, with the development of new technological and analytical big data capabilities, the internet of things (IoT), and machine learning, and with the erosion of data privacy, the precondition has been created that this price discrimination category comes more and more in focus. This technological improvement environment "*induced a shift towards personalized pricing and a close approximation to the mentioned 'ideal'*" (Steppe 2017). In a traditional bazaar, a seller might charge a well-dressed buyer twice as much as another based on visual clues or accents. Now, the use of big data analytics and artificial intelligence offers a scientific approach for selling at different prices, depending on an individual's willingness to pay.

Second-degree price discrimination is the situation where the seller offers its product on special prices and special deals to those buyers who meet special requirements or to those buyers who seek specials qualities. The second-degree discrimination is a situation where the seller offers promotions such as "by two and get one for free," or when buyers buy a certain quantity of certain combination of products (bulk purchase). A seller does this to reward loyal customers or to provide savings to those buyers who appreciate the deals. This form of price discrimination allows savings to customers who value "deals", reward loyal customers with frequent purchase history and increase the company's margin on rare or premium items. In the telecommunication sector, the second-degree price discrimination is in the package offers of internet, TV, and phone, where the price is lower when they are bought all together comparing to the aggregate price when those services are bought separately.

Third-degree price discrimination is a situation when a seller offers special discount prices depending on the affiliation to the groups such as retiaries, students, soldiers, children, etc. Those discounts can be found in public transportation, entrance fee in theatre or zoo. The main reason for offering discounts is that those groups are extremely priced sensitive, and an increase in the prices will result in a drop in demand.

THE USE OF BIG DATA ANALYTICS AND AI TO IMPLEMENT AN EFFECTIVE PRICE DISCRIMINATION STRATEGY – PRACTICAL EXAMPLES

As mentioned earlier in this study, the improvements in the analytical capabilities and technological ways to collect and process big data create the opportunity for easy harvesting of customers' data such as location, search history, preferences, and behavior on the internet. What the customer like or unlike, purchasing history or the opinion expressed on social media, through blogs, comments, easily can be determined. All this data can be accessed and processed in a near or real-time situation.

To implement an effective price discrimination strategy and to carry out an effective daily price setting activity companies need to have the necessary hardware and software for using the above information in creating and constantly changing personalized price tags to achieve the optimal price margins in everyday transactions.

Artificial intelligence (AI) is one of the technologies used in dynamic pricing. In the past years, we have witnessed a revolutionary development in machine learning and its functionality when it has come to data analytics (Sky Tree 2018). Artificial intelligence has been an important subject since the middle of the 20th century (Danyi 2018), but its big popularity in the present time comes from three factors. After many decades it has become an everyday reality that (1) today there are efficient algorithms available, (2) there are enormous big real-time databases and (3) the productivity of computers has become fast enough to handle these processes (Miailhe and Hodes 2017, cited by Danyi 2018). Machine learning techniques, such as deep learning, are viable approaches to exploiting the value of big data (Liang *et al.* 2018).

If we look at the present pricing practice of companies, we can state that the most modern pricing technology is used by the so-called disruptive organizations. Their pricing policy is becoming the major force of their disruptive business models (Rekettye 2020). If we look at the industries, the most plausible example can be found in the field of transportation, tourism, commerce, and amusement and sports industries. Let us show some examples where AI and big data analytics are already used efficiently.

- *Transportation*. Uber, for example, uses price personalization for individual journeys with the help of machine learning. The AI takes into consideration geographical location, the time, the traffic, the weather conditions of the journey and calculates the expected amount the passengers are willing to pay for it. When there is little or no data at all, Uber exploits LSTM (long short-term memory) networks as well as deep learning models to predict the future stance of the market and even the "unexpected" events before they can happen (Didur 2018). A very similar method is used by Lyft a community transport company or the yield or revenue management software used by the low-cost airlines and in the hotel businesses (Danyi 2018).

- *Community hotel business*. One manager of Airbnb writes in a journal article the following: *"We released our latest improvements. We started doing dynamic pricing – that is, offering new price tips daily based on changing market conditions. We tweaked our general pricing algorithms to consider some unusual, even surprising characteristics of listings. And we've added what we think is a unique approach to machine learning that lets our system not only learn from its own experience but also take advantage of a little human intuition when necessary"* (Hill 2015).

- *Commerce*. *"Sears uses big data to help set prices and give loyalty shoppers customized coupons. Sears analyses massive amounts of data about product availability in its stores to prices at other retailers to local weather conditions to set prices dynamically. Also, e-Bay to achieve the highest price possible for items sellers place for auction examines all data related to items sold before (e.g., a relationship between video quality of auction items and bidding prices) and suggests ways to maximize results to sellers"* (Lee 2017). Both companies use Hadoop, big data open source technology to reduce the cost of pricing and to achieve the best possible returns.

- *Amusement and sports industries.* For example, in a baseball league, big data analytics is used to combine ticket price strategy and discrimination. Many
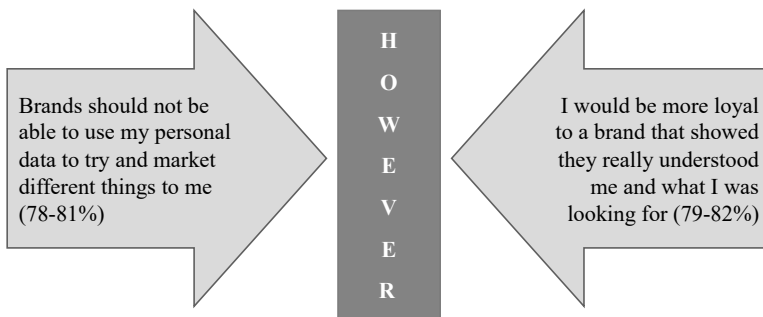
variables are investigated and beside the traditional ones also unconnected and unrelated variables. For example, inputs such as construction around the stadium, teams of the rise, the potential for record-setting events, amount of klicks on social media are used (Erevelles *et al.* 2016)**.**

- Summarizing: big data analytics and AI technology allow the price strategists to change prices of certain products or services even several times per day and to adjust them to the consumer's buying habits. In this process, pricing strategists use not only data got from customers' habits, but also, combine them with the data got from such as weather channels, traffic, mobile phone locators, etc.

CUSTOMERS' PRIVACY — PRICE DISCRIMINATION STRATEGY IN THE GDPR CONTEXT

Personalization of prices – as discussed earlier – requires detailed information about customers. This requirement raises the issue of customer privacy and the issue of privacy protection immediately. This topic has already a wide international literature (Lee *et al.* 2011, Richards *et al.* 2016, Malgieri *et al.* 2018). When discussing personalization, an interesting contradiction must be mentioned: while customers expect from sellers to treat them in a personalized way, they are protecting their privacy. This behavior was demonstrated very clearly in the Acquia research made in 2018 (Figure 3).

Figure 3. The contradiction between customers' expectations and their readiness to give access to their private information

Brands should not be able to use my personal data to try and market different things to me (78-81%)

HOWEVER

I would be more loyal to a brand that showed they really understood me and what I was looking for (79-82%)

Note: the Acquia research was done in several advanced countries; the two percentages under the statements show the lowest and the highest country average agreements with the given statement.
Source: Own construction based on the figures of the Acquia research.

This customer behavior also proved that there was a severe need for personal data protection regulation. This study tries to discuss this question in the context of the GDPR.

The GDPR (General Data Protection Regulation) is an EU regulation (EU 2016) about the protection of personal data. It was adopted on 14 April 2016, and after a two-year transition period, it entered into the force on 25 May 2018. The GDPR is a regulation, and because it is not a directive, it is automatically binding and applicable. According to the relevant EU regulation, the GDPR application does not require EU member states to adopt any enabling legislation. They are obliged to adjust

internal legislation according to the GDPR. To have enough time for EU member states' internal adjustment, the EU gave two years for proper preparation. The sanctions for breaching the GDPR are huge enough, up to EUR 20 million, to be treated seriously.

For marketing experts, GDPR will change the way how to communicate and how to get approval or consent from the customers to use their data (Maxim 2018). The marketing experts will have to reinvent the way how to manage personal advertisements. Even GDPR refers only to the personal data of the EU citizen; the impact will be global. The GDPR contains various provisions related to

price discrimination (Steppe 2017). The GDPR applies to personal data processed wholly or partly by automated means. 'Personal data' is defined as (i) any information (ii) relating to (iii) an identified or identifiable (iv) natural person, regardless of the nationality or place of residence of the person.

The GDPR is connected only with the natural or living persons, and data from the legal persons such as the company are not treated with the GDPR. With the big data techniques, data retrieved from legal persons can be the object of price discrimination targeting. The GDPR defines "objective" and "subjective" types of information. The objective group of information includes data that is gathered as a part of purchase history, and the subjective dimension of the information are the data that are gathered on the internet. Also, GDPR defines its jurisdiction over price discrimination if the personal data are wholly or partly processed by automated means (Steppe 2017).

Price discrimination may bring a lot of benefits for the consumer, one of these is through a price reduction, and it is very important not to allow that rigid data protection provision close possibilities for making this kind of pricing strategy. At the same time, it should be careful because some techniques of the extraction and using personal data can be harmful to the integrity of the individual, for example, children's data. The processing of collected data should be based on lawfulness.

In the GDPR, there are references (article 4 of GDPR) on the lawfulness of price discrimination, such as consent of data gathering and processing, pre-contractual measures, and legitimate interest. In the area of consent, it has to be given by the customer in a freely, specific, informed, and unambiguous way that the data will be collected for processing purposes. The consent has to be specific, explicit, and legitimate. The consent to be lawfulness has to be given and used for specific purposes, not the general one (article 5. GDPR). The purpose must be explicated, meaning that it has to be clearly explained, revealed, or expressed in an intelligible way (Steppe 2017). The consent has to be legitimate, which means that it has to be in accordance with the law in the broadest sense.

In the context of price discrimination, the lawfulness can be established if pre-contractual measures have been taken (Steppe 2017). As the third ground for the lawfulness of the price discrimination in the GDPR context, there should be, as article 6 of GDPR states, "the legitimate interest of the controller or by the third party." This legitimate interest of the controller has to be presented to the customer.

Article 22 of GDPR gives the right to the customer to refuse to be an object of price discrimination. The article defines that customer has right not to be the subject of a decision based on solely on automated processing which either produces a legal effect concerning him or her or similarly significantly affects him or her.

GDPR not only regulated B2C data collection but third party liability, which may influence how personal data are shared and used, but also protected, by the third party in B2B relation (GDPR articles 44-50). It will have a huge impact on the non-EU legal subjects who collect share and process personal data for pricing strategy. They will have to apply all rules coming out GDPR, which can trigger adoption similar personal data protection regulations in the rest of the world.

How it will look like and what impact will on personal advertising and the cost of using the internet remain to be seen. Certainly, for those companies that collect, use, and protect personal data in accordance with GDPR, this will present new costs and organizational burden. As L. Downes (2018) wrote "...calls for regulation in the US, may lead to the end of what has long been internet's grand bargain: the exchange of free or subsidized content for personalized advertising."

CONCLUSIONS

The multiproduct company has to find each product a suitable price. The impact of wrong pricing can be devastating for the company. There are many ways and strategies available to do this. For each pricing strategy, the crucial part is relevant data about the customers. In the big data era, the data are available like never before. The analytical tools enable decision-makers to analyze and process data almost instantly and to discover particularities about customers that were not visible before.

It allows them to be proactive in defining pricing. Big data tools create the precondition for a more affordable and successful price discrimination strategy. The first-degree price discrimination so far has been treated only as a theoretical category for academic purposes. It was an "ideal" price discrimination target. With big data and AI, the first-degree price discrimination, become available, workable, and affordable.

Big data processing is a precondition for personalized advertisement targeting and pricing individualization. With the big data capabilities, profit maximization through first-degree price discrimination is within reach, but to achieve this proper

pricing infrastructure should be established in the company. With GDPR, the EU introduced the new rules in dealing with EU citizen personal data. The impact of GDPR will be global, and the companies have to adjust their practice and internal organization accordingly.

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