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Anastasia Kovalenok

Consumer orientation towards healthy diet: coordination of the multidirectional interests of the parties involved

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I. GENERAL CHARACTERISTICS OF THESIS RESEARCH

Topicality and problem

Since the 50s. 20th century Income levels of consumers in developed and developing countries have risen, allowing them to significantly expand their range of food and beverage consumption. Regular advertising campaigns of brands such as McDonald's, Coca-Cola, for example, have formed an appropriate consumer culture based on the active promotion of often unhealthy food products, which, over time, could not but affect the public health[1]. According to the World Health Organization (WHO) data, in 2016, over 1.9 billion adults over the age of 18 were overweight, and over 650 millions of those were obese[2]. Besides, the worldwide number of obese people grew threefold from 1975 to 2016, and the number of children and teenagers (aged 5–19) with the disease increased tenfold[3]. Obviously, sedentary lifestyle and environmental pollution have affected public health, but nutrition played a major role[4].

Apart from obesity, people often face such health issues as malnutrition, growth inhibition, low levels of vitamins and minerals, and other non-infectious diseases caused by malnutrition (heart disease, stroke, diabetes, some cancers). It's important to note that the advertising and price policies of food manufacturers and retailers largely define the consumer preferences. Most companies often promote unhealthy food products, as they are more profitable than healthy ones[5].

However, during the last decade, an increasing number of people have been tending to follow healthy lifestyle principles. This trend can be expressed, for instance, in regular physical activities[6,7] , or in abandonment of unhealthy food and their substitutions with products rich in nutrients[8]. One of the research[9] also claims that consumers have been increasingly conscious of

[1] Seiders K., Petty R. D. Obesity and the role of food marketing: A policy analysis of issues and remedies // Journal of Public Policy & Marketing. – 2004. – Vol. 23. – №. 2. – PP. 153-169.
[2] https://www.who.int/ru/news-room/fact-sheets/detail/obesity-and-overweight (Date of access: 1.06.2022).
[3] Abarca-Gómez L. et al. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128· 9 million children, adolescents, and adults // The Lancet. – 2017. – Vol. 390. – №. 10113. – PP. 2627-2642.
[4] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.
[5] https://www.who.int/ru/news-room/fact-sheets/detail/malnutrition (Date of access: 1.06.2022).
[6] Zhang R. et al. Physical activity and chronic prostatitis/chronic pelvic pain syndrome // Medicine and science in sports and exercise. – 2015. – Vol. 47. – №. 4. – PP. 757.
[7] Khera R. et al. Association of pharmacological treatments for obesity with weight loss and adverse events: a systematic review and meta-analysis // Jama. – 2016. – Vol. 315. – №. 22. – PP. 2424-2434.
[8] Vilarnau Compte C. et al. Worldwide adherence to Mediterranean diet between 1960 and 2011 // European Journal of Clinical Nutrition, 2019, 72 (Suppl 1). – 2018.
[9] Nielsen N. V. We Are What We Eat: Healthy Eating Trends Around the World // The Nielsen Company. – 2015.

their health, practicing full or partial abandonment of unhealthy food, and often paying attention to the ingredients list, and preferring organic food[10].

It would seem, that such consumer behavior changes should attract attention of businesses, including both food manufacturers and retailers. However, currently on the number of markets the focus has been mainly on side aspects of the food shopping experience, not on consumers' health in general[11]. This focus expresses itself in higher variety in certain product groups, more convenient parking lots, making more pleasant atmosphere in a supermarket, etc. Furthermore, on some developing markets (e.g., Russian) The business processes targeted at client focus often exist only on paper and are not implemented in real life[12]. At the same time, long-run client focus in a broader sense cannot be solely limited to the creation of the best shopping conditions, but should consider consumption and the effect it has on the consumer's life quality and health as well[13]. This is undoubtedly relevant for food products. Researchers note that real client focus, targeted at improving the consumers' health, can help companies increase customer loyalty, which will later positively affect the customer lifetime value[14].

Usually, marketing activities of manufacturers and retailers are targeted at increase of the sales volume [15]. Companies produce and sell various food, including ones that are bad for people's health, but consumers are not well-informed about this[16]. As a result, the unhealthy ingredients are listed in a small font on the back side of a package.

Of course, food giants like Nestle S.A., PepsiCo Inc., Coca-Cola, Mondelez International, Danone SA and others[17] integrate corporate social responsibilities (CSR) in their strategies and publish ESG reports, where they highlight their actions regarding improving the composition of the product (expansion of plant-based range, make whole grains the number one ingredient[18],

[10] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.
[11] Popov, N. I., & Tretyak, O. A. Economic Antecedents of Low Customer Orientation of Firms in BRIC Countries // Russian Management Journal. – 2014. – Vol. 12. – №. 1. – PP. 109-138.
[12] Gulakova O., Rebiazina V. Is customer orientation of companies in the Russian market real or declared? // Vestnik of Saint Petersburg University. Management. – 2017. – №. 3. – PP. 398-423.
[13] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.
[14] White K., Dahl D. W. To be or not be? The influence of dissociative reference groups on consumer preferences // Journal of Consumer Psychology. – 2006. – Vol. 16. – №. 4. – PP. 404-414.
[15] Wood B. et al. Market strategies used by processed food manufacturers to increase and consolidate their power: a systematic review and document analysis // Globalization and health. – 2021. – Vol. 17. – №. 1. – PP. 1-23.
[16] Tempels T., Verweij M., Blok V. Big Food's ambivalence: seeking profit and responsibility for health // American Journal of Public Health. – 2017. – Vol. 107. – №. 3. – PP. 402-406.
[17]https://www.forbes.com/sites/chloesorvino/2022/05/12/the-worlds-largest-food-companies-in-2022/?sh=323f4574db91 (Date of access: 1.10.2022).
[18] https://www.nestle.com/sites/default/files/2022-03/creating-shared-value-sustainability-report-2021-en.pdf (Date of access: 1.10.2022).

investing in products with added nutrition[19], reduction of refined sugar and saturated fats[20]) and limiting marketing communications aimed at vulnerable groups of the population[21]. But there are two problems here. Firstly, only the biggest food producers try to follow ESG principles and publish results of their achievements. Secondly, it is hard to control those activities, which are aimed at changing composition of the product. As a result, we have a situation where only small part of producers changed the composition for the better. For instance, one of the research projects showed[22] that less than half of leading food brands have significantly reduced the sugar content of their products. Another survey found over half of all the 'bestseller' products surveyed should be considered 'unhealthy', i.e. high in fat, salt and/or sugar[23]. Taking into account the results of research, we can conclude that reality on the food market somehow differs from the information in the ESG reports.

These uncontrolled 'unhealthy' marketing activities could be regulated by government. In the government programs for consumer health, there is a variety of monetary and non-monetary regulatory forms that can regulate activities of all food companies, not only giants. Among the non-monetary forms, labeling, obliging the companies to use large fonts when listing ingredients, and certification can be mentioned. Monetary forms typically include taxes, subsidies, and setting minimum or maximum prices. These methods allow consumers to make a more conscious choice[24,25,26,27].

On the one hand, for maximum efficiency of the regulation process, all the parties should be involved: a government, manufacturers, and retailers. Governments and the food industry should work together to create an environment where consumers will select healthy food

[19] https://www.coca-colacompany.com/content/dam/journey/us/en/reports/coca-cola-business-environmental-social-governance-report-2021.pdf (Date of access: 1.10.2022).
[20] https://www.pepsico.com/docs/default-source/sustainability-and-esg-topics/2020_sustainability_report_summary.pdf?sfvrsn=e61ca1f0_4 (Date of access: 1.10.2022).
[21] https://www.coca-colacompany.com/content/dam/journey/us/en/reports/coca-cola-business-environmental-social-governance-report-2021.pdf (Date of access: 1.10.2022).
[22] https://www.ndph.ox.ac.uk/news/most-food-brands-a-long-way-from-meeting-sugar-reduction-targets (Date of access: 1.10.2022).
[23] https://shareaction.org/news/call-for-worlds-largest-food-companies-to-prioritise-health-after-new-survey-exposes-bad-practice (Date of access: 1.10.2022).
[24] Grunert K. G., Wills J. M. A review of European research on consumer response to nutrition information on food labels // Journal of public health. – 2007. – Vol. 15. – №. 5. – PP. 385-399.
[25] Ingwersen W. W., Stevenson M. J. Can we compare the environmental performance of this product to that one? An update on the development of product category rules and future challenges toward alignment // Journal of Cleaner Production. – 2012. – Vol. 24. – PP. 102-108.
[26] Minkov N. et al. Type III environmental declaration programmes and harmonization of product category rules: status quo and practical challenges // Journal of Cleaner Production. – 2015. – Vol. 94. – PP. 235-246.
[27] Zasimova L. C., Kolosnicyna M. G. Formirovanie zdorovogo obraza zhizni u rossijskoj molodezhi: vozmozhnosti i ogranicheniya gosudarstvennoj politiki (po materialam vyborochnyh issledovanij) // Voprosy gosudarstvennogo i municipal'nogo upravleniya. – 2011. – №. 4. – PP. 116-129.

options[28,29,30]. On the other hand, interests of consumers and businesses do not always align. For instance, consumer's attention to their health and the companies' desire to create and sell high-margin food products may be contradictory. Here, there is a problem of coordinating contradictory interests of various players on the food market for consumer's independent choice facilitation, and for more benefit of the latter[31].

To regulate the degree of public awareness and take into account the interests of both consumers and companies, the participation of the state is necessary, which can coordinate the actions of the parties in such a way that each of them receives the maximum possible benefit. In turn, the state should also be interested in solving this problem, since malnutrition increases health care costs, reduces productivity and slows down economic growth. These consequences, in turn, are the basis for high levels of poverty and bad health[32]. Eventually, this forms a complex three-level mechanism of interaction between the market players, where each player takes care of its own interest. Without coordinating them, stimulation of production of healthy food, their availability to consumers, and consumers' choice motivation may be inefficient. It follows from this line of thinking that the consumer's orientation towards healthy eating depends not only on their awareness (knowledge and skill to consciously choose products that are good/bad for one's health[33]), but also on the ability to make this choice --- the availability of a sufficient quantity and quality of healthy food, which can be ensured by aligning the activities of the companies and the government[34]. In other words, in this thesis, "consumer orientation toward healthy food" shall mean: (1) the consumer's desire to select healthy food (those having a positive effect on their well-being)[20]; (2) the creation of the conditions to make this choice possible, both by the government and the companies.

The two above-mentioned components of consumer orientation towards healthy food are expressed in factors influencing consumer choice. The information about these factors is important for several groups of market players, including the manufacturers of products and providers of services, the retailers, and the national and municipal regulators. Besides, it can help various

[28] Seiders K., Petty R. D. Obesity and the role of food marketing: A policy analysis of issues and remedies // Journal of Public Policy & Marketing. – 2004. – Vol. 23. – №. 2. – PP. 153-169.
[29] Traill W. B., Koenig A. Economic assessment of food safety standards: Costs and benefits of alternative approaches // Food Control. – 2010. – Vol. 21. – №. 12. – PP. 1611-1619.
[30] Gortmaker S. L. et al. Changing the future of obesity: science, policy, and action // The Lancet. – 2011. – Vol. 378. – №. 9793. – PP. 838-847.
[31] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.
[32] https://www.who.int/ru/news-room/fact-sheets/detail/malnutrition (Date of access: 1.06.2022).
[33] Sproesser G. et al. The eating motivation survey: results from the USA, India and Germany // Public health nutrition. – 2018. – Vol. 21. – №. 3. – PP. 515-525.
[34] Willett W. et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems // The Lancet. – 2019. – Vol. 393. – №. 10170. – PP. 447-492.

market players design their marketing strategies and tactics or to create a government policy with regard to consumers.

The relevance of the consumer choice factor studies is explained by the constant changes of the environment in which the consumers make their purchase decisions. In 2020, the government, the businesses and the consumers have faced abrupt market changes, caused by the novel coronavirus pandemic and the economic recession as a consequence. These changes have not been studied yet and will continue to accrue, but they have already affected the customer choice, attracting attention to health and immunity, sharply limiting the demand in certain categories of consumers, and shifting consumers to buying online. In turn, the observed changes inevitably affect the composition and ranking of the consumer choice factors.

The knowledge of consumer choice factors and trends is particularly important in the sphere of food production and retail. Consumer preferences and choices in food have a direct effect on the health, the life quality of each individual, and on the national healthcare expenses[35]. This shows that the government should be interested in solving this problem, since malnutrition can lead to reduced productivity and slower economic growth as a result. In other words, if consumers choose healthy food, it will allow the government to improve its economic efficiency. In turn, businesses can increase customer loyalty by being truly customer-focused, which can manifest itself as caring about the consumer's health and their orientation towards healthy food, which has a positive effect on the customer life-cycle and the company bottom line[36].

This consumer choice can be stimulated in several ways including monetary and non-monetary regulations. Group of monetary regulations mainly consists of different kinds of taxes and subsidies, while non-monetary regulations comprise information provision, banning unhealthy ingredients and advertising, limiting availability in distribution channels[37]. Regulations of both groups are used by many countries, but it is more difficult to assess the direct impact of non-monetary regulations on the final gain. Monetary regulations are more straightforward and allow to rearrange the expenses of the state budget in favor of healthy food. These facts are the reason for their greater use by governments. In turn, in the group of monetary regulations taxes are primary, since they first go to the budget and only then are distributed to subsidies. Moreover, taxes directly influence pricing policy and revenue of a company that helps to evaluate potential effects. In turn, pricing is an effective tool to change consumer choice when so desired[38]. As for

[35] Rashad I., Grossman M. The economics of obesity // Public Interest. – 2004. – PP. 104-113.
[36] White K., Dahl D. W. To be or not be? The influence of dissociative reference groups on consumer preferences // Journal of Consumer Psychology. – 2006. – Vol. 16. – №. 4. – PP. 404-414.
[37] Ananthapavan J. et al. Assessing cost-effectiveness of obesity prevention policies in Australia. – Deakin university, 2018.
[38] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.

consumers, it is worth noting here that due to the COVID-19 pandemic in 2020, the world unemployment rate increased, which negatively affected household incomes and purchasing power, and the situation in Russia was even worse due to the depreciation of the ruble. Based on these facts, we have chosen the taxes as the most widespread regulation to decrease production and sales of unhealthy goods and the prices as the ultimate tool influencing consumer behavior at the company's level.

Thus, in this work, the marketing function is used in a somewhat non-standard formulation, expressed in the reduction or regulation of sales of unhealthy food products. This orientation, linked with socially responsible marketing, helps companies build long-term relationships with the consumer through true customer focus and improved quality of life, which contributes to the sustainable development of companies[39,40] and complies with the ESG agenda and CSR principles.

This work is multidisciplinary, where the marketing problem is solved using multi-level modeling in order to coordinate the interests of companies and consumers through regulation at the state level.

Research goal and objectives

The **goal** of this work is to develop an approach to ensure consumer orientation to healthy eating through the coordination of the multidirectional interests of the parties involved. To achieve this goal, we solve the following tasks:

1. Determination of the overlap of the concepts of unhealthy and healthy food: definition, classification, promotion practices;
2. Critical analysis of the mechanisms of governmental regulations of the consumption of unhealthy and unhealthy food products, ensuring the orientation of the consumer towards a healthy diet, namely monetary (taxes and subsidies) and non-monetary instruments (information provision, ban on ingredients harmful to health, ban on advertising, restriction accessibility);
3. Classification of factors influencing the consumers' food choice and the allocation of price as one of the most important factors;

[39] Integrate E. S. G. How Investors Integrate ESG: A Typology of Approaches. – 2017. – P. 102
[40] Wilburn K., Wilburn R. ESG reporting using UN sustainable development goals // Journal of Strategic Innovation and Sustainability. – 2020. – Vol. 15. – №. 2. – PP. 109-128

4. Development and testing of an optimization model for regulating sales of unhealthy food products by calculating the optimal sugar tax rate and prices as one of the most common and controversial practices and key factors influencing consumer food choice;
5. Discuss the results and develop recommendations in order to justify the coordination of interests of companies and governments in promotion and restriction of healthy and unhealthy food.

The subject and the object of the research

The *object* of the study is the process of interaction between companies and consumers with the help of government regulation to guide consumers to a healthy diet by limiting sales of unhealthy food products, while the *subject* of the study is marketing incentives that reduce the sale of unhealthy food.

Theoretical contribution to the existing literature

The problem of consumer orientation towards a healthy diet has been sufficiently studied and mainly considered from the point of view of norms[41,42,43] of healthy eating,[44,45] and of psychological and sociological aspects of consumer behavior[46,47]. At the same time, this problem can be considered from a marketing point of view, where healthy eating is the subject of promotion by companies. At the same time, both companies and consumers have their own interests, expressed in increasing income and utility, respectively, where the maximum level of performance can be achieved in the sale of opposite (unhealthy) products. Then the state can intervene in the process, correcting the behavior of consumers and companies with the help of regulatory tools. It is important to note that most studies take into account the interests or consumers[48], or

[41] Yashina M. L. Zdorovoe pitanie naseleniya Rossii: realii i perspektivy // Ekonomicheskie issledovaniya. – 2013. – №. 4. – PP. 5.
[42] Golubev V. C., Berkovich M. I. Zdorovoe pitanie: vospriyatie, dinamika, populyarizaciya // Teoreticheskaya ekonomika. – 2020. – №. 3 (63). – PP. 9–25.
[43] Robinson E. et al. What everyone else is eating: a systematic review and meta-analysis of the effect of informational eating norms on eating behavior // Journal of the Academy of Nutrition and Dietetics. – 2014. – Vol. 114. – №. 3. – PP. 414-429.
[44] Korytova V. E., Garbuz C. A., Budrin A. G. Issledovanie potrebitelej na rossijskom rynke zdorovogo pitaniya // Gumanitarnye, social'no-ekonomicheskie i obshchestvennye nauki. – 2017. – №. 8-9. – PP. 287-290.
[45] Pedersen S., Grønhøj A., Thøgersen J. Following family or friends. Social norms in adolescent healthy eating // Appetite. – 2015. – Vol. 86. – PP. 54-60.
[46] Zhuravlyova I. V., Ivanova L. YU., Ivahnenko G. A. Studenty: povedencheskie riski i cennostnye orientacii v otnoshenii zdorov'ya // Vestnik instituta sociologii. – 2013. – №. 6. – PP. 112-129.
[47] Kondrat'ev C. V. Psihologicheskie determinanty personificirovannogo pitaniya // Aktual'nye problemy social'no-gumanitarnogo znaniya. – 2019. – PP. 46-51.
[48] Ouyang Y., Sharma A. Consumer-citizen willingness to pay for healthy eating messages // International Journal of Contemporary Hospitality Management. – 2019.

companies[49], or government[50] separately, which does not allow to reconcile the interests of all parties involved. This raises the problem of contradictory interests of different parties, for example, when companies focus solely on financial performance, while governments seek to improve social welfare.

In this thesis, the above problem is considered through the restriction of sales of unhealthy food among consumers, taking into account the interests of the state and companies.

The interests of several parties at the conceptual level are considered in the article by Fritz & Schiefer, where special attention is paid to the differences between the interests of society and the state as a whole and individual entities, which may include enterprises, individual consumers. However, the emphasis is on the need to transform the processes aimed at the exchange of information between these levels in the context of providing the necessary information about food[51].

As a multi-stakeholder approach to solving a problem, multi-level modeling can be used, which allows the situation to be defined as a mathematical program with multiple participants[52]. For example, earlier three-level mathematical modeling was used to calculate the optimal roaming prices in the telecommunications market of the European Union[53]. Another example of the application of multi-level programming is the development of optimal state certification programs in the electronics market, where the environmental component is important[54].

Taking into account that earlier in the literature consumer orientation towards healthy eating was considered without taking into account the consistency of interests of the parties, in this thesis an attempt was made to use a multi-level approach to ensure consumer orientation towards healthy eating, taking into account the interests of companies and the state.

Theoretical, methodological, and empirical basis of the research

The theoretical basis of the thesis research is scientific articles and monographs by both Russian and foreign researchers devoted to such topics as marketing in healthy eating, consumer food choice, governmental regulations in the food market, and multi-level modelling. We selected

[49] Hawkes C. Identifying innovative interventions to promote healthy eating using consumption-oriented food supply chain analysis // Journal of Hunger & Environmental Nutrition. – 2009. – Vol. 4. – №. 3-4. – PP. 336-356.
[50] Evers C. et al. Citizen approval of nudging interventions promoting healthy eating: the role of intrusiveness and trustworthiness // BMC public health. – 2018. – Vol. 18. – №. 1. – PP. 1-10.
[51] Fritz M., Schiefer G. Food chain management for sustainable food system development: a European research agenda // Agribusiness: An International Journal. – 2008. – Vol. 24. – №. 4. – PP. 440-452.
[52] Kalashnikov V. V. et al. Bilevel programming and applications // Mathematical Problems in Engineering. – 2015. – Vol. 2015.
[53] Grigoriev A., Loon J., Uetz M. Algorithms for optimal price regulations // International Workshop on Internet and Network Economics. – Springer, Berlin, Heidelberg, 2008. – PP. 362-373.
[54] Danilina V., Grigoriev A. Information Provision in Environmental Policy Design // Journal of Environmental Informatics. – 2020. – Vol. 36. – №. 1.

375 articles from the scientific citation databases Scopus, Web of Science and eLibrary, as well as from open information sources as sources for the theoretical study. The results of studies of international consulting companies and research companies that include the relevant topics were also used. The information is used in order to determine the overlap of the concepts of unhealthy and healthy food, analyze the mechanisms of governmental regulations of the consumption of unhealthy and unhealthy food products, classify factors influencing the consumers' food choice, develop an optimization model for regulating sales of unhealthy food products.

The methodological base of desk research is formed by such methods of scientific knowledge as analysis, synthesis, systematization, methods of classification and description, comparison, induction and deduction. Also, the methodological basis of the empirical study is the use of (1) multilevel modeling to adjust the eating behavior of end consumers; (2) multinomial choice model as a way to build real-life consumer utilities.

The analysis of empirical research data is based on multilevel mathematical modeling using utility functions formed on the basis of secondary data – the two consumer panel data – and using multinomial choice model. The data was collected by the international agency Kantar in the UK and the Netherlands.

Significance of the research

Significance of the work lies in the development of a three-level mathematical model that allows to determine optimal tax rate on the category of unhealthy foods that (1) maximizes social welfare, (2) and selects optimal prices for taxable category. At each level, players (government, companies, and consumers) are aimed to maximize their utility. Thus, the work has a scientific novelty, which is the simultaneous consideration of all parties involved in solving aforesaid problem.

Arguments of the research to be defended

The main arguments of the research to be defended are formulated as follows:

1. We have identified overlap of concepts of unhealthy food (food consisting mainly or exclusively of sugar, fats or oils, and alcoholic beverages) and healthy food (food that provide a complete set of nutrients) based on a review of existing definitions
2. Based on a review of current practices of state regulation in the field of healthy eating, it was revealed that taxes and information programs are the most common tools of state monetary and non-monetary regulation, respectively, which was used to substantiate the methodology;

3. Analysis of existing studies in the field of monetary and non-monetary regulation revealed a predominant concentration on the interests of consumers without coordination of the interests of the state and companies, which weakens the results of regulation;

4. As a marketing tool, the possibility of considering the reduction or regulation of sales of unhealthy food products is shown;

5. As a result of a critical review of the literature, the factors influencing the choice of food by the consumer are classified, as well as the foundation was formulated for comparative analysis of factors influencing consumer food choice in case of rapid environmental change;

6. An analysis of the existing literature made it possible to prove the possibility of using a multi-level modeling model of balancing interests, which allows you to determine the optimal tax rate and prices for a category of products that are unhealthy, maximizing public welfare, company income and consumer utility;

7. As a result of testing the model on the data of consumer panels, optimal prices and tax rates were obtained, calculated taking into account the agreed interests of the parties involved - companies, consumers and the state.

Scientific novelty of the research

The novelty of the work is expressed in the following points:

1. The restriction of sales of unhealthy food products is considered for the first time as a marketing tool, where increasing the transparency of information helps to increase brand confidence, which increases the level of consumer loyalty. Companies that care about the health of consumers show true, not declared customer focus, improving the target utility function of consumers.

2. Based on the results of the analysis of scientific publications, the author's definitions of the terms "unhealthy food" and "healthy food" are operationalized, which most fully reflect the main theoretical approaches in existing studies;

3. Based on a review of existing academic and consulting research, a general set of factors influencing the choice of food products by consumers (thinking style, knowledge, motivation, attitude to food, environment, packaging, price) is identified, and factors specific to the youth are identified among them. in the youth segment (stress, the influence of society), as well as their operationalization is justified. Price is highlighted as the most important external factor;

4. A model has been developed that makes it possible to coordinate the multidirectional interests of market players (the state, companies and consumers) while simultaneously considering

all the parties involved. This harmonization makes it possible to calculate the optimal prices for the category of soft drinks (sugar-containing drinks and their substitutes) and the sugar tax rate;

5. As a result of testing the model on examples of consumer panel data on purchases in the category of soft drinks (Great Britain, 2009-2012; The Netherlands, 2016-2018), the possibility of using it to calculate optimal prices and tax rates, taking into account the agreed interests of the parties involved, was confirmed. These countries have been selected as examples of countries that have and have not introduced a sugar tax.

The validity of the research results and their approval

The validity of the study is confirmed by a broad approach to the study of the literature, including literature on healthy eating, approaches to regulating the sale of unhealthy and unhealthy foods, as well as factors influencing consumer food choices. The reliability of the empirical study lies in the approbation of the developed model on the data of the consumer panel.

The results of this dissertation research were tested at the following scientific conferences:

1. 11.04.2017 – 14.04.2017: XVIII April International Academic Conference on Economic and Social Development. Presentation: “Prospects for the Development of Neuromarketing in Russia”. Moscow, Russia.
2. 10.04.2018 – 13.04.2018: XIX April International Academic Conference on Economic and Social Development. Presentation: “The opportunities of using neuromarketing as way of studying brand perception”. Moscow, Russia.
3. 18.06.2018 – 20.06.2018: CBIM Academic Conference (Center for Business & Industrial Marketing). Presentation: “Neuromarketing research as method for brand associations perception”. Madrid, Spain.
4. 09.04.2019 – 12.04.2019: XX April International Academic Conference on Economic and Social Development. Presentation: “Multi-level modelling as a tool to optimize pricing policies of companies and state tax policy”. Moscow, Russia.
5. 20.06.2019 – 22.06.2019: 41st Annual ISMS Marketing Science Conference. Presentation: “Multi-level Modelling as a Tool Governing Consumer Buying Behavior”. Rome, Italy.
6. 13.04.2021 – 30.04.2021: XXII April International Academic Conference on Economic and Social Development. Presentation: “Optimization of companies’ pricing policy and state’s tax policy as a way to achieve sustainable development on healthy eating”. Moscow, Russia.

Logic and structure of the thesis research

The thesis is structured as follows. Chapter 1 discusses the theoretical aspects of unhealthy and unhealthy foods. It is shown that the consumer orientation towards healthy nutrition depends not only on the awareness of the consumer, but also on the possibility of making this choice, which is ensured by the coordinated actions of companies and the state. As a result, it was found that the motivation of consumers to buy healthy food is not clear and requires further study.

Chapter 2 provides a critical literature review of the internal and external factors influencing consumer choice, including the proposed transformation of the composition and priority of factors in the context of the economic downturn and pandemic. As a result, a classification of factors by types of information is obtained, as well as a starting point for a comparative analysis of the factors influencing the choice of food by consumers, especially in the case of rapid environmental changes. In addition, based on the analysis of secondary information, it is assumed that the price is one of the most important factors that encourage consumers to buy a particular product.

Price and taxes are then considered in combination as one of the most common factors and practices. Chapter 3 presents a decision support tool for determining the optimal price and tax rate for sugar, the most common form of unhealthy food regulation. This tool maximizes public welfare and encourages healthier consumer choices.

It should be highlighted that in this work, we focus on the essence of the mechanism of interaction between the parties involved to ensure consumer orientation towards healthy eating, not on each party involved separately. That is the reason why: (1) we do not discuss government's and company's interests in detail. Instead, any information about government or companies is used to justify the choice of one or another regulatory tool, or to show that the model can work when it is necessary to ensure that consumers are guided by a healthy diet; (2) we bundle producers and retailer into one group despite the fact that they may have contradictory interests.

II. ARGUMENTS OF THE RESEARCH TO BE DEFENDED

1. We have identified overlap of concepts of unhealthy food (food consisting mainly or exclusively of sugar, fats or oils, and alcoholic beverages) and healthy food (food that provide a complete set of nutrients) based on a review of existing definitions

The thesis considers the theoretical aspects of unhealthy and healthy food. It is shown that the consumer orientation towards a healthy diet depends not only on the awareness of the consumer (knowledge and ability to consciously choose food products), but also on the possibility of making this choice, which is ensured by the coordinated actions of companies and the state. We discuss approaches to the definition of unhealthy and unhealthy foods, as well as existing state regulations in this area.

The most commonly used terms in the unhealthy food category are "empty calories" and "bad food" because they cover the largest number of food categories. The rarest term is "energy-rich snacks", while "junk food", "energy-rich, nutrient-poor foods" and "high-calorie, nutrient-deficient foods" cover about the same number of categories and have a lot of overlap between them[55].

Healthy food category includes all grains, legumes, dairy products, meat, fish, vegetables and fruits, 100% juice. The concept of "functional food" makes sense to separate from healthy foods, since it is not limited to individual food categories, but can include any foods that are artificially enriched with useful substances, including vegetable cholesterol, omega-3, probiotics, vitamins and minerals[56,57,58.] In turn, the category of organic products is determined by the commonality of production technologies.

The current work uses the broadest concepts of unhealthy and unhealthy food. The unhealthy food category includes "empty calories" and "bad" foods, and consists of foods and non-alcoholic beverages containing mostly or only sugar, fats, or oils, and alcoholic beverages. They are rich in kilocalories but almost completely devoid of other nutrients such as vitamins, minerals, protein, fiber, or essential fatty acids. The category of healthy foods includes "nutrient rich foods", "organic foods" and "functional foods" and can be defined as food and drinks that provide a complete set of nutrients (inherently contain or fortify) and are used to

[55] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.
[56] Katan M. B. et al. Efficacy and safety of plant stanols and sterols in the management of blood cholesterol levels // Mayo Clinic Proceedings. – Elsevier, 2003. – Vol. 78. – №. 8. – PP. 965-978.
[57] Plat J., Mensink R. P. Plant stanol and sterol esters in the control of blood cholesterol levels: mechanism and safety aspects // The American journal of cardiology. – 2005. – Vol. 96. – №. 1. – PP. 15-22.
[58] Breslow J. L. n− 3 Fatty acids and cardiovascular disease // The American journal of clinical nutrition. – 2006. – Vol. 83. – №. 6. – PP. 1477S-1482S.

sustain life. They can also be produced within a regulated and certified manufacturing process[59].

As a result of the analysis of the variety of concepts used to designate unhealthy and healthy products, the boundaries of each of them were determined (Fig. 1).

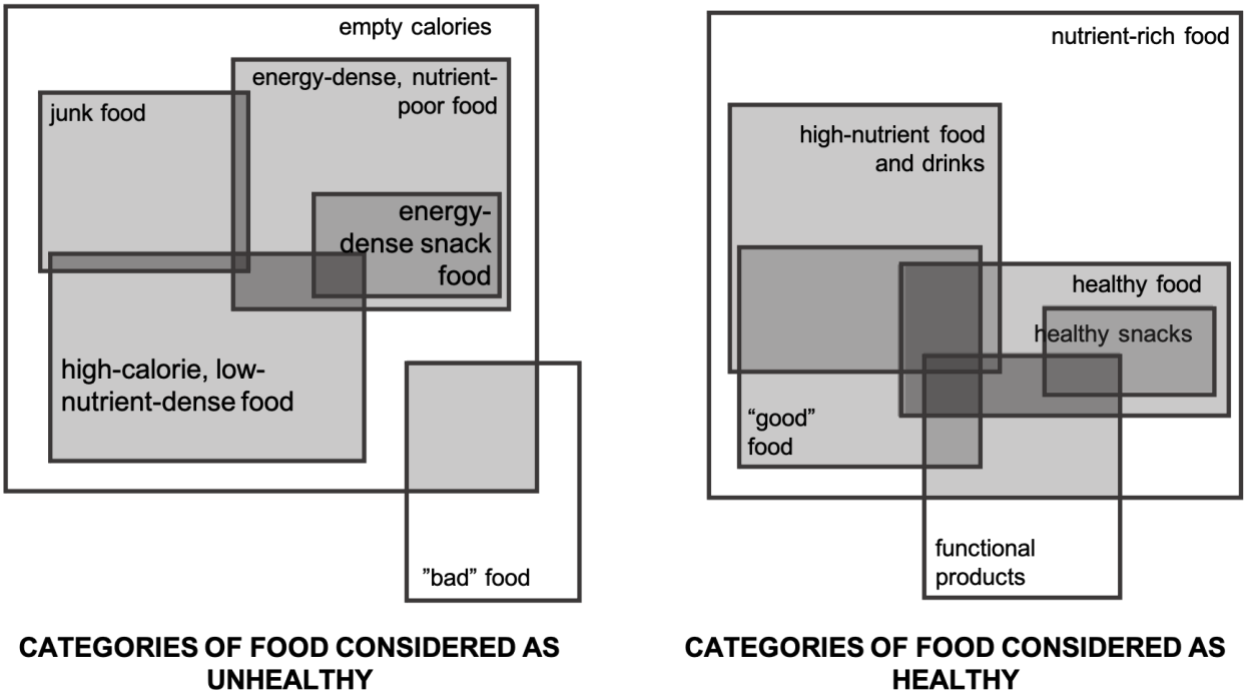


Fig. 1. Overlap of healthy and unhealthy food categories

Source: Compiled by the author based on a literature review

Based on the review, it is discussed what algorithms can be used to effectively solve the problem of coordinating the multidirectional interests of the involved parties (state, companies and consumers) to ensure the regulation of the sale of unhealthy products.

2. Based on a review of current practices of state regulation in the field of healthy eating, it was revealed that taxes and information programs are the most common tools of state monetary and non-monetary regulation, respectively, which was used to substantiate the methodology

It was found that, firstly, among the types of voluntary regulation at the country level, monetary regulation is more common than non-monetary regulation, despite its ambiguous effectiveness. This can be explained by the fact that such instruments bring additional revenues to the state budget. Secondly, monetary regulation is mainly expressed in the introduction of various taxes, the types of which vary greatly between countries.

[59] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.

Various forms of taxes on sugary drinks are the most common taxation tool used to limit the production and marketing of unhealthy products. This product category is most often subject to additional taxation, since the price of sugary drinks, adjusted for inflation, has decreased over the past decades, while the prices of fruits and vegetables, which are used to produce these products, have increased[60].

The most popular form of taxes on unhealthy foods is the sugar tax, which is levied on sugar-sweetened soft drinks. The sugar tax implies that an additional tax (currently up to 50%) is charged for each liter of sugary drink, depending on the sugar content[61]. Tax rates are determined by government policy and can be expressed as a percentage of the price (increased VAT) or applied directly to the unit of output (production tax)[62]. However, if applied incorrectly, taxation can do more harm than good. In recent years, many governments have given increased attention to this tool, as evidence has emerged of its ineffectiveness[63]. The question of exactly how monetary regulation should be carried out also remains open[64,65], as there is no publicly available information about the criteria for choosing the type and amount of tax.

The analysis revealed that a significant number of measures are aimed at limiting the sale of unhealthy food products. As for the process of stimulating the sale of healthy food products by the state, they are under development and exist in the form of pilot projects. Further, the practices of stimulating healthy eating are considered, which can be conditionally divided into monetary and non-monetary. Monetary practices are more common than non-monetary ones, so further emphasis will be placed on monetary instruments of regulation[66].

Among the non-monetary regulations aimed at reduction of consumption of unhealthy products are the ban on sales in schools, special marking on packages, the introduction of rules to restrict advertising in children's time, etc. In general, these tools can be divided into four categories: (1) information provision (special designations on the packaging, color of the price tag); (2) prohibition of unhealthy ingredients; (3) ban of advertising; (4) limited availability

[60] Hagenaars L. L., Jeurissen P. P. T., Klazinga N. S. The taxation of unhealthy energy-dense foods (EDFs) and sugar-sweetened beverages (SSBs): an overview of patterns observed in the policy content and policy context of 13 case studies // Health Policy. – 2017. – Vol. 121. – №. 8. – PP. 887-894.
[61] Triggle N. Sugar tax: how it will work // BBC website. – 2016 (Date of access: 1.10.2022).
[62] Sharma A. et al. The effects of taxing sugar-sweetened beverages across different income groups // Health economics. – 2014. – Vol. 23. – №. 9. – PP. 1159-1184.
[63] Berardi N. et al. The impact of a 'soda tax'on prices: evidence from French micro data // Applied Economics. – 2016. – Vol. 48. – №. 41. – PP. 3976-3994.
[64] Chaloupka F. J., Powell L. M., Chriqui J. F. Sugar-sweetened beverages and obesity: the potential impact of public policies // Journal of Policy Analysis and Management. – 2011. – PP. 645-655.
[65] Fletcher J. M., Frisvold D. E., Tefft N. Are soft drink taxes an effective mechanism for reducing obesity? // Journal of Policy Analysis and Management. – 2011. – PP. 655-662.
[66] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.

(distribution channels)[67]. The overall prevalence of various types of regulation is presented in the table (Table 1).

Table 1

Most Common Practices for Regulating the Sales of Unhealthy Products

Regulation type		Country
Monetary	Taxes	Denmark, Hungary, France, Chile, Mexico, Belgium, Colombia, India, Portugal, Saudi Arabia, UAE, USA, South Africa, Thailand, Ireland, UK, Japan
Non-monetary	Information provision	Israel, USA, European Union countries, Russia
	Prohibition of unhealthy ingredients	Developed and developing countries (ingredients vary)
	Advertizing ban	Canada (Quebec), Norway, Russia, Chile
	Limited availability	USA, Chile

Source: Compiled by the author based on a literature review

Thus, consumer choice of healthy food is more often determined by the restriction on the production and promotion of unhealthy products by companies. Therefore, unhealthy food is more interesting for the implementation of the research goals. In this regard, it is necessary to focus on limiting the production and promotion of unhealthy food products to the market.

It was found that, firstly, among the types of voluntary regulation at the country level, monetary regulation is more common than non-monetary regulation, despite its ambiguous effectiveness. This fact can be explained by the fact that such instruments bring additional revenues to the state budget. Secondly, monetary regulation is mainly expressed in the introduction of various taxes, the types of which vary greatly between countries. Thirdly, the most popular type of tax is the sugar tax, as a result of which an increased tax rate is imposed, for example, on non-

[67] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.

alcoholic sugar-containing drinks. Fourth, there is no publicly available information about the criteria for choosing the type and amount of tax.

There are many open questions that have not been resolved even at the government level. A variety of methods and tools of state regulation aimed at limiting the production and promotion of products harmful to health on the market makes it possible to draw a conclusion only about the prevalence and the highest frequency of use of individual tools.

In order to get a more holistic view regarding the effectiveness of monetary and non-monetary regulations, scientific studies on the topic were also considered. Research in the field of monetary regulation confirms the impact of existing state regulation measures on changing the structure and priorities of consumption. It was possible to identify a specific combination of measures and instruments of monetary regulation, which brings the greatest effect, as well as to determine the minimum level of the tax rate. On the other hand, non-monetary regulatory mechanisms most often serve to increase consumer awareness and influence their utility functions, although the effect of their application can only be determined in the long run.

3. Analysis of existing studies in the field of monetary and non-monetary regulation revealed a predominant concentration on the interests of consumers without coordination of the interests of the state and companies, which weakens the results of regulation

At the moment, existing practices often take into account the interests of consumers and almost never – other parties involved. The usefulness and harm of food products are manifested not at the time of the transaction (purchase and sale), but in the process of their consumption. Likewise, state regulation, which is ultimately aimed at limiting the introduction of unhealthy food, is aimed at the companies that produce and promote it. Companies, acting in their own interests, can also influence consumer choice, shifting it not in favor of healthy products.

As a result of the analysis of the literature, it was revealed that in most studies the interests of consumers are taken into account, and all other points are ignored. At the same time, there is also no information on taking into account the interests of companies and consumers during the introduction of certain monetary instruments by governments. It can be assumed that the interests of all involved parties are not consistent. Nevertheless, as already noted, it is extremely important to take into account the interests of all three players interacting in the market (state, companies and consumers) at the same time in order to fully assess the consequences and effectiveness of tax regulation.

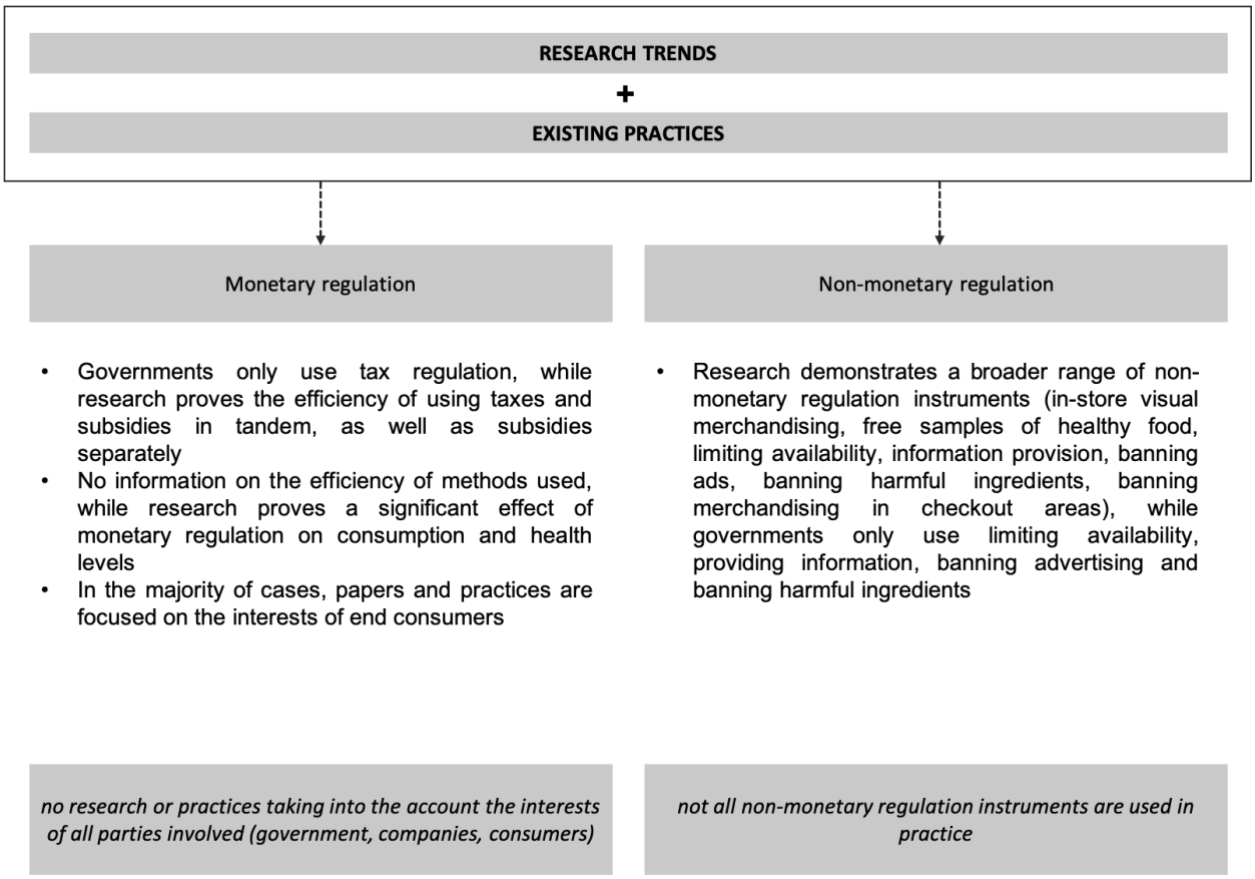


Fig. 2. Current practices and lines of research in monetary and non-monetary regulation of food product consumption

Source: Compiled by the author based on a literature review

4. As a marketing tool, the possibility of considering the reduction or regulation of sales of unhealthy food products is shown

Despite the fact that usually marketing increases sales, sometimes it can also be aimed at reducing or regulating them. In this formulation of the problem, marketing is considered as a set of tools aimed at limiting the sale of unhealthy food products. Such an orientation of marketing activities is legitimate, since one of the aspects of building a successful brand is building long-term relationships with the end consumer. In this situation, increasing the transparency of providing any, including negative, information to the consumer can serve as an indicator of brand reliability. More open brands that actively communicate with their audience (for example, informing them about which products are unhealthy) are more likely to increase consumer confidence. In turn, this can lead to several long-term benefits such as increased perceived and

behavioral loyalty and commitment.[68]. In the case of hiding information from the consumer, the company receives immediate benefits instead of long-term loyalty.

5. **As a result of a critical review of the literature, the factors influencing the choice of food by the consumer are classified, as well the foundation was formulated for comparative analysis of factors influencing consumer food choice in case of rapid environmental change.**

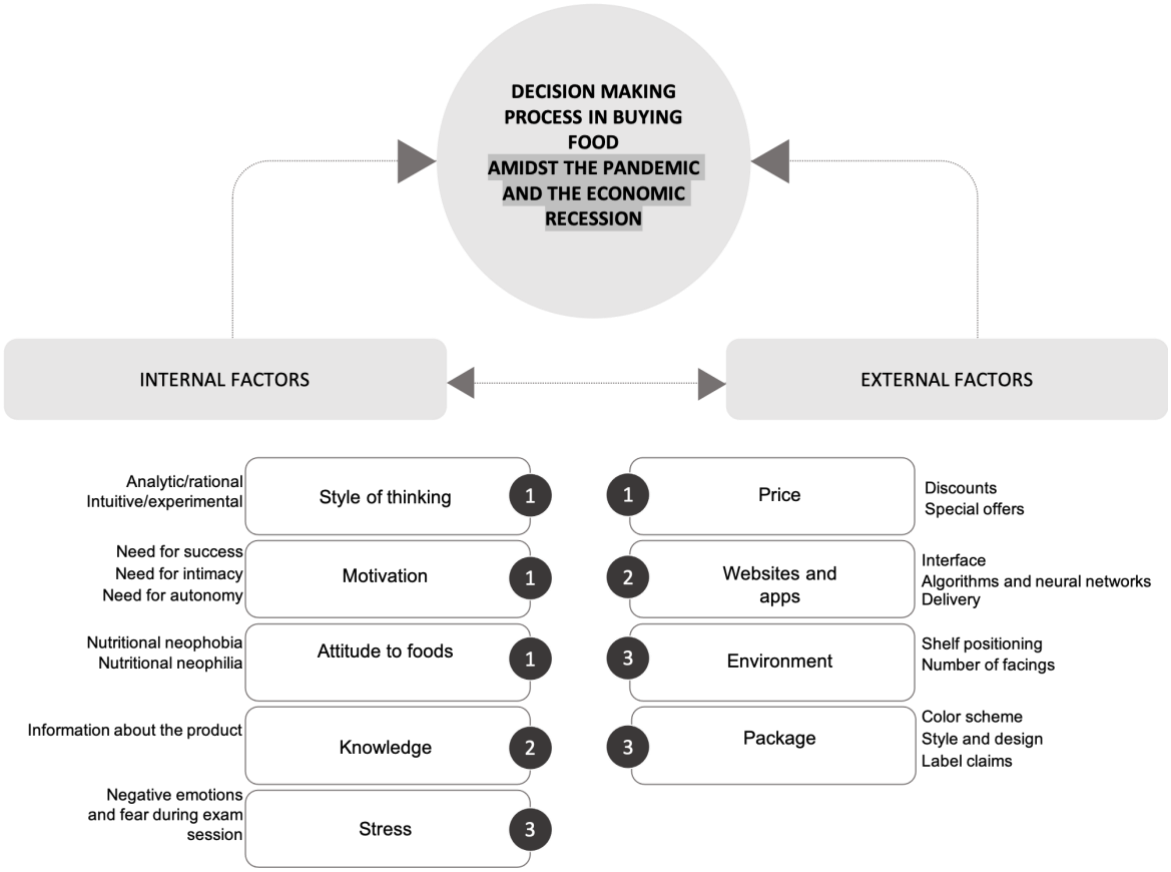
A consumer food choice is based on many factors. As income restrictions are reduced, non-price choice factors are added to price ones. We provide a critical overview of the internal and external factors influencing consumer food choice, as well as the expected transformation of their composition and priority in the context of economic recession and pandemic. As a result, we obtain a classification of factors, where they are considered on the basis of declared, behavioral and physiological methods of information collection. The need for classification is explained by the lack of structured data that would allow a holistic consideration of the factors influencing consumer choice.

Based on studies that used different approaches to data collection, we developed a scheme that groups and visualizes the internal and external factors that influence consumer food choices. It also shows the different types of information used to study a particular factor, which allowed us to highlight the factors that require further study using certain data collection methods. Separately, specific factors influencing the choice of food among the youth, which are necessary for the formation and adjustment of eating habits in adulthood, are considered - stress and social pressure. An attempt to single out the factors specific to the youth consumer segment has shown a clear lack of such studies. However, they are extremely necessary, since most of the habits are formed and corrected during adolescence, which, in turn, form the conscious need of an adult for a healthy diet and a healthy lifestyle. Despite the variety of works devoted to the factors of food choice, studies of changes in these factors in connection with socio-economic conditions in 2020 – 2022 has not yet been carried out. For this reason, we describe possible changes in the priority of these factors and outlines some of the assumptions that will need to be tested in further research. In addition, it has been suggested that price is one of the most important factors that motivate consumers to buy a particular product[69].

The expected transformation of the composition and priority of factors is shown in Fig.3.

[68] Maltz E., Kohli A. K. Market intelligence dissemination across functional boundaries // Journal of marketing Research. – 1996. – Vol. 33. – №. 1. – PP. 47-61.
[69] Nedelko, A. Y., Tretyak, O. A., & Lavrova, A. Y. Consumer food choice: Factors, current state and expected changes // Russian Journal of Management. 2020. Vol. 18. № 4. PP. 605-642.

Fig. 3. Grouping of internal and external factors affecting the consumer choice in the



conditions of economic recession and pandemic

Source: Compiled by the author based on the literature analysis

As a result, the foundation is laid for a comparative analysis of the factors influencing the choice of food by consumers, especially in the case of rapid environmental change. The results can be useful for manufacturers and retailers developing their marketing strategies, as well as for adjusting government restrictions on the consumption of unhealthy and stimulating healthy food.

6. An analysis of the existing literature made it possible to prove the possibility of using a multi-level modeling model of balancing interests, which allows you to determine the optimal tax rate and prices for a category of products that are unhealthy, maximizing public welfare, company income and consumer utility

Since price is the most important external factor in the choice of food, and taxes are one of the most common tools for regulating food sales, price and taxation were considered in combination, taking into account the interests of all parties involved. One way is to regulate unhealthy products by introducing an additional tax that can be imposed on unhealthy food in

particular. Consumer orientation towards healthy food is largely dependent on the ability of the consumer to make rational choices, the activities of companies offering products, and government policy. Consequently, public well-being in this case is determined by the concerted actions of consumers, companies and the state.

The thesis presents a decision support tool for determining the tax rate on unhealthy products, which allows maximizing public welfare and incentivizing healthier consumer choices. The task is modeled as a sequential process represented by a three-level mathematical program.

It is worth to note that the interests of market players can be expressed through utility, considered from the point of view of a particular player. Therefore, we can define utility as a form of expression of interests, which is used in the model.

Firstly, given the goals of companies and consumers, the government determines the tax rate. This rate is set based on the maximization of social welfare (SW)[70]:

$$SW = (U_{consumers} + U_{companies} + taxes) \rightarrow max, \quad (1)$$

where $U_{customers}$ is the total utility of all consumers; $U_{companies}$ is the total utility of all companies, and *taxes* is the total tax collected.

Then, given the tax rate and the potential choice of consumers, a company prices products by maximizing its utility:

$$U_{companies} = (\sum_i \sum_j \left(D_{i,j} \cdot P_{\text{j}} \cdot x_{i,\text{j}}\right)) - \text{taxes} \rightarrow max, \quad (2)$$

где $D_{i,j}$ is demand of i consumer on product j; P_j is the price on the product j; $x_{i,j}$ is a binary decision of consumer i o buy or not to buy the product j (1 – to buy, 0 – no to buy).

Taxes (*taxes*) are computed as follows[71]:

$$taxes = \alpha \cdot \left(\sum_i \sum_j \left(D_{i,1} \cdot P_1 \cdot x_{i,1}\right)\right), \quad (3)$$

where $0 \leq \alpha \leq 1$ is the sugar tax rate established by the government, $i = 1$ is the index of unhealthy product.

Finally consumers choose a product based on their individual preferences. Marketing research uses various approaches to describe consumer behavior and their individual utility functions, but most of the models are linear in product price. For example, in one study, the

[70] Bernoulli D. Exposition of a new theory on the measurement of risk // The Kelly capital growth investment criterion: Theory and practice. – 2011. – PP. 11-24.

[71] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.

proposed consumer utility function consists of three components. These include: (1) a constant that includes various psychological, economic, and sociological factors such as brand loyalty, consumer budget, willingness to pay, etc.; (2) visual cues on packages, such as "low-fat", "high-fiber" labels, and others, that may influence consumer choice; (3) price related factor.

Combining visual designations with one of the constants, we get the following function:

$$u_{i,j} = \left(\beta_{i,j} - \beta_0 \cdot p_j\right)^+, \qquad (4)$$

где $\beta_{i,j}$ и β_0 are determined by a multinomial choice model[72]; p_j is the price of product j. It is important that the function takes only positive values, since consumers buy a product only in case of positive utility (the designation "+" in the formula), and the variable $\beta_{i,j}$ is a constant reflecting the heterogeneity of consumer choice.

So, the total utility of all consumers can be expressed as follows:

$$U_{consumers} = \left(\sum_{i,j} ln(1 + u_{i,j}) \cdot x_{i,j}\right) \rightarrow max, \qquad (5)$$

under a classic assumption of diminishing marginal utilities of individual consumers[73].

All utility functions are taken from existing literature[74,75,76]. This ensures the universality of the proposed approach and its applicability not only to tax, but also to other types of monetary regulation that help improve the health of the nation. It is important to note that the model can be potentially applied to any product category.

The model presented in the thesis is built using linear mathematical programming and is aimed at coordinating the interests of the state, companies and end users. It is noteworthy that the model considers all parties simultaneously in their interaction, allows maximizing the overall welfare, company income and consumer utility[77].

[72] Petrin A., Train K. Omitted product attributes in discrete choice models. – 2003. – P. 120.
[73] Risk O., Bernoulli D. Exposition of a new theory on the measurement // Econometrica. – 1954. – Vol. 22. – №. 1. – PP. 23-36.
[74] Houthakker H. S. Revealed preference and the utility function // Economica. – 1950. – Vol. 17. – №. 66. – PP. 159-174.
[75] Petrin A., Train K. Omitted product attributes in discrete choice models. – 2003.
[76] Holtrop N. et al. The Impact of Nutrition Claims on SKU Choice: An Investigation of the Moderating Impact of SKU and Category Characteristics // Available at SSRN 3443413. – 2019.
[77] Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.

In order to determine the optimal prices and tax rates, a number of steps must be taken. First of all, potentially optimal prices and company incomes are calculated without tax, taking into account the utilities of consumers. Then, at the points obtained in step 1, potentially optimal tax rates are determined. After that, optimal prices and revenues are recalculated, taking into account potentially optimal tax rates. For each potentially optimal bid, those prices are selected where the company's income is maximum. As a result, the optimal tax rate is set, at which social welfare is maximized (Fig. 4).

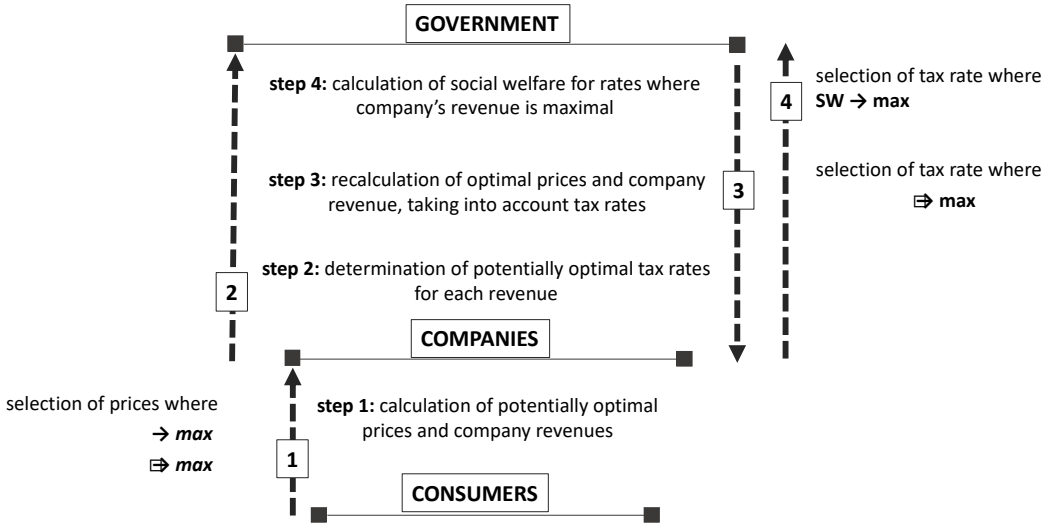


Fig. 4. Sequence of steps to coordinate the interests of the state, companies and consumers.

Примечания: *SW* – social welfare (utility of the state); $U_{\text{companies}}$ – utility (revenue) of the companies; $U_{\text{consumers}}$ – utility of the consumers; Arrows with numbers are used to indicate the order of steps in the model.

Source: compiled by the author

As a result, the thesis presents an approach to calculating the optimal sugar tax rate and prices for unhealthy food products and their healthy substitutes, which takes into account the heterogeneity of consumers. It is important that individual utility functions are used in the model at the consumer level. This avoids inaccuracies associated with data aggregation, which often arise when building regression models. The model takes an intuitive and easy-to-implement approach that is built taking into account businesses' and consumers' interests. The developed model was tested using consumer panel data for a specific local market, after which conclusions were drawn regarding the sugar tax rate.

7. **As a result of testing the model on the data of consumer panels, optimal prices and tax rates were obtained, calculated taking into account the agreed interests of the parties involved - companies, consumers and the state.**

The model has been tested with Kantar consumer panels collected in the UK and the Netherlands. The motivation for choosing two different panels is due to the fact that on the data of one of the panels (Netherlands), which were the most detailed, consumer utility functions were developed that are the most complex and close to reality. Further, more aggregated data for the UK were taken in order to build the most simple and well-known utility functions for companies, consumers and the state in order to test the model as a whole.

Utility functions at the consumer level are the most difficult to model, as they involve the inclusion of different variables depending on the consumer segment, so these functions were worked out separately. To calculate utilities, a three-stage model was used, consisting of determining the fact of purchases (whether to buy), brand choice (what to buy), number of purchases (how much to buy) to calculate coefficients at the household level[78]. The calculation used data from the Kantar consumer panel provided by AiMark and containing information on purchases in three categories - "Cola", "Lemonade", "Other carbonated drinks" - which were made by 7400 households from the beginning of 2016 to the end of 2018. Panel members shopped in 100 stores in the Netherlands.

Further, to simplify the perception of the algorithm of the three-level model, aggregated utility functions built on the basis of the UK consumer panel were used, which were integrated into the model. As a result of the enumeration of all potentially optimal tax rates, it was found that the maximum social welfare is achieved at a tax rate $\alpha = 0$[79], when a company sets prices of CU4.7/L for Coca-Cola and CU5.47/L for Coca-Cola Zero. It should be noted that at this point, consumers who prefer sugar-free drinks are still buying Coca-Cola Zero, while consumers of sugar-sweetened drinks continue to buy Coca-Cola at these prices, and indifferent consumers switch to Coca-Cola Zero. The optimal price for Coca-Cola Zero can be 16% higher than for Coca-Cola. This result can be explained by consumer preferences, where consumers have a less elastic demand for Coca-Cola Zero.

These prices may be considered as recommended prices for companies that manufacture or sell this product. Companies will be able to calculate deviations from the actual price, as well

[78] Andrews R. L., Currim I. S. Multi-stage purchase decision models: Accommodating response heterogeneity, common demand shocks, and endogeneity using disaggregate data // International Journal of Research in Marketing. – 2009. – Vol. 26. – №. 3. – PP. 197-206.

[79] A sugar tax (soft drinks industry levy) was introduced in the UK in 2018 and is described as follows: drinks with a sugar content of more than 8 g / 100 ml (high level) are taxed at 0.24 pounds sterling / l, and drinks with a sugar content over 5g but less than 8g/100ml (low level) are taxed at £0.18/l. Drinks with a sugar content of less than 5 g/100 ml (no fee) are not taxed.

as the effective price difference between sugary and unsweetened beverages, based on model-calculated best prices and internal information about costs. With the help of the prices calculated in the model, which are built taking into account the agreement of the parties, companies will be able to identify the presence of inefficiencies in the market (for example, too high or low price) and, if necessary, adjust their pricing strategies.

The proposed model has some limitations. First, the most popular but simple utility functions were chosen. Social welfare may also include a component of health care costs and other external factors, companies also incur additional costs after changing the product portfolio, and consumer choice factors are not limited to price. Although all formulas are taken from classical economic theory, they are simplified and can be supplemented with other variables. Second, consumers were grouped into three groups based on their sugar preferences, rather than using heterogeneous utility functions to avoid model overload. However, real heterogeneous functions have also been developed based on consumer panel data. Finally, it was assumed that demand shifted only between two goods, while in reality consumers could find other substitutes. During a pilot test based on real purchase data, it was found that the actual prices of Coca-Cola and Coca-Cola Zero are very low compared to the recommended optimal prices that maximize the company's revenue (Coca-Cola). This phenomenon can be caused either by oversimplification of the social welfare function, or by oversimplification of consumer behavior, or by market inefficiencies caused by the irrationality of players, for example, underpricing of their products by companies, or a combination of these factors.

It should be noted that in Russia there are heated debated regarding imposing the sugar tax. The government has already returned to discussing the introduction of an excise tax on drinks with sugar several times[80]. The main problem with the introduction of this tax is the lobby of companies that are unprofitable for the introduction of the tax. At the moment, business considers this topic untimely, recalling the "crisis state" of the sugar industry and the promises of the authorities to support companies against the backdrop of sanctions[81]. Alignment of interests can help to reach a consensus in this situation.

[80] https://russian.rt.com/russia/article/831185-gosduma-sahar-napitki-nalog (Date of access: 1.06.2022).
[81] https://www.forbes.ru/biznes/462305-vlasti-vernulis-k-obsuzdeniu-akciza-na-napitki-s-saharom (Date of access: 1.06.2022).

III. THE MAIN CONCLUSIONS OF THE STUDY

As a result of the literature review, the boundaries of the concepts used in the work were determined, namely:

– Unhealthy food is food that consist mainly or exclusively of sugar, fats or oils, as well as alcoholic beverages. They are high in kilocalories but almost completely lacking in other nutrients in the form of vitamins, minerals, protein, fiber, or essential fatty acids.

– Healthy food is food that provide a complete set of nutrients (originally contained or fortified) and are used to sustain life. It can also be produced within a regulated and certified production process.

As a result of the analysis of approaches to limiting the sale of unhealthy food products as a tool of state regulation:

– It was revealed that taxes are the most common instrument, of which the most popular is the sugar tax. At the same time, sugar tax rates vary greatly from country to country, which indicates that there is no single approach to determining the optimal rate.

– Determined that information provision programs are the most common non-monetary instrument;

– Shows the effectiveness of instruments under certain conditions (implementation at the federal level, combination of monetary and non-monetary instruments);

– It was revealed that studies consider sales limitations one-sidedly, concentrating on maximizing the interests of consumers without taking into account the interests of the state and companies;

– It is shown that true customer focus can be expressed in the honest provision of negative information, which positively affects the trust level. Increasing customer confidence can lead to long-term benefits for the company.

As a result of the analysis of factors influencing consumer choice of food:

– It has been determined that most studies do not focus on the youth segment and usually combine it with other age groups, which does not allow studying segment-specific factors influencing food choice;

– It was revealed that many studies are based solely on the declared data. Behavioral data is rarely used, and is mostly limited to experiments that do not reflect actual consumer behavior at the point of sale. Research using neuromarketing methods to collect physiological data is also gaining popularity, but for now, they mostly describe external factors that influence food choices;

– Assumptions are formulated regarding changes in the priority of factors, where price is the most important external factor influencing consumer choice.

As a result of defining an approach to developing an optimal tax policy for unhealthy foods:

– An optimization model for coordinating the interests of the state, companies and heterogeneous consumers is presented and tested, based on a consistent game represented by a three-level mathematical program. The model allows you to determine the optimal prices for unhealthy foods and their healthier substitutes, taking into account the interests of all parties involved. The proposed methodology can be used to implement a whole range of tasks in the research area under consideration: (1) choosing the optimal type of monetary regulation; (2) comparative analysis of social welfare at different levels of tax rates or subsidies, as well as company income and consumer utility at each individual level; (3) checking for market inefficiencies (e.g., too high or low price of a product).

The model is practice-oriented and can be used by the government to determine the optimal taxes or subsidies in the area of nutrition, but its use requires regular consumer panels, as well as cooperation with interested companies in order to correctly assess their utility in terms of income. This methodology is very fruitful for solving a number of related problems, it allows to substantiate the development trajectories of new research in this extremely important area of providing opportunities for the end consumer to implement a healthy lifestyle orientation.

– It has been found that to be effective, the sugar tax rate must be high enough to influence consumer purchasing decisions. Otherwise, this intervention simply reduces the income of companies. During pilot testing of the model using data from the UK buying panel, it was found that the optimal tax rate at which the maximum level of welfare is observed is zero, but the optimal price for the studied products should be several times higher than the current one.

IV. LIST OF ARTICLES

Publications in the list D of HSE

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2. Nedelko, A. Y., Tretyak, O. A., & Lavrova, A. Y. Consumer food choice: Factors, current state and expected changes // Russian Journal of Management. 2020. Vol. 18. № 4. PP. 605-642.
3. Nedelko, A. Y., & Tretyak, O. A. Consumer Orientation toward Healthy Foods: Literature Review and a Model of Market Players Coordination // Russian Journal of Management. 2019. Vol. 17. № 2. PP. 203-232.

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4. Nedelko A.Yu. Perspectives and Limitations of Neuromarketing Research Methods // Management Sciences. 2018. Vol. 8. № 4. PP. 77-83.