Customs Qualitative Impact on the System of Enterprise Economic Security: Modeling and Evaluating the Results

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Abstract **– The quality of interaction between enterprises and institutional agents in most world countries stipulates the conditions to ease doing business. For entities engaged in foreign trade operations one of the main subjects of such interaction is customs. It is customs that control the movement of goods through the country customs border, perform part of the state fiscal functions and directly affect the economic security of enterprises-subjects of foreign economic activity. The study formed a model of the customs influence on the enterprise economic security system based on the use of the game theory. For two participants of the game – customs and enterprise – the indicators that determine the strategy of the participant in the game and its behavior in such a game are proposed. It has been empirically proven that the customs does not use the optimal strategy when interacting with business entities, causing a negative impact both on individual subjects and on the results of customs activities. This situation adversely affects the enterprise economic security and makes them adapt to the existing realities.**

Keywords **– customs, interaction quality, economic security, modelling, interests of business entities.**

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1. Introduction

The quality of the business environment in most countries depends significantly on the institutional impact of state structures and the protection of the interests of business entities. Customs becomes one of the main institutional agents in the process of establishing foreign economic activity by economic entities, as modern tendencies of the world economy development show the erosion of borders and the intensification of international trade. Not only the speed and availability of foreign trade operations, but also directly the enterprise economic security depends on the quality of interaction between enterprises-subjects of foreign economic activity and customs. The realities of the customs functioning in Ukraine indicate a number of problems to be solved. To do this, it is necessary to determine the significance of the customs influence on the enterprise economic security and the formation of an appropriate economic mathematical model. The basis for modeling the impact of customs on the enterprise economic security system was the identified zero-sum game, and at the same time, the complementarity of interests of the subjects of the state fiscal function (the customs is also the subject of the fiscal function) and enterprises, and the unidirectional margin of such negative influence.

Since the interaction of business entities and customs is most often in uncertainty, according to the specificity of the choice of tools used in modeling, there may be fuzzy sets, utility theory and game theory. In our opinion, taking into account the zero-sum game nature and strategic direction of the interaction of the above-mentioned parties, the game theory, which some experts [12] consider as mathematical device for modeling coordination of the parties' interests, it is the most suitable for simulation of such interaction.

In general, the game theory is a well-known and tried-and-tested instrument that has a significant

theoretical foundation and is often used to solve various tasks. Game theory did not really exist as a unique field until John von Neumann published the paper On the Theory of Games of Strategy in 1928 [9]. The book "Theory of Games and Economic Behavior" by John von Neumann and Oskar Morgenstern was published later [1]. Moreover, this book at the time of its publication was innovative, and later became classical in the research of game theory. The book is based partly on earlier research by von Neumann, published in 1928 under the German title "Zur Theorie der Gesellschaftsspiele" ("On the Theory of Parlor Games") [9]. Also, among the founders of the above-mentioned theory are Nobel Prize winners in economics 1994 as John Nash, Reinhard Selten, John Harsanyi [3], [6], [8]. John Nash proposed the concept of a situation of equilibrium (the Nash equilibrium), which is used in solving non-cooperative games [7], [8]. In 1965, Reinhard Selten introduced his solution concept of subgame perfect equilibria, which further refined the Nash equilibrium (later he would introduce trembling hand perfection as well) [10], [11] John Harsanyi is best known for his contributions to the study of game theory and its application to economics, specifically for its developing the highly innovative analysis of games of incomplete information, so-called Bayesian games [2].

Application of game theory solves a wide range of problems is also considered in the works by Ukrainian scientists [4], [5], who explore the specifics of interaction between government institutions and business entities, as well as search for optimal strategies for such interaction in the medium and long term.

2. Research Method

The model of the customs influence on the enterprise economic security system is built using the game theory principles. For each of the two participants in the game – customs and enterprises – the proposed indicators determine the party's strategy for the game and its behavior in such a game (Table 1). For each of the proposed indicators, their content was considered and the ways the values could be obtained (from open sources or calculated) was shown.

Table 1. Indicators of the model of the customs impact on the enterprise economic security system

Indicator	Level	Marking	Indicator essence
Fiscal pressure ratio	Macro	x_1	The share of income that the state takes as direct and indirect payments
Fiscal impact turbulence indicator	Macro	x_2	The rate of change in the fiscal area
Evaluating customs operational processes indicator	Macro	x_3	The complexity for enterprise of conducting operations with customs
Shadowing indicator	Micro	y_1	Share of income from using shadow operations
Protective expenses indicator	Micro	y_2	The share of income that the company is forced to spend to protect the business from the state negative impact

The proposed indicators for both participants in the game are given on a single scale. Indicators of the zero-sum game model between the enterprise and the customs are defined as the basis for constructing the game model, which is a tuple:

$$\langle \mathbf{S}, \mathbf{E}, P(x, y)\rangle = \langle \mathbf{S}, \mathbf{E}, P(x_1, x_2, x_3, y_1, y_2)\rangle, \quad (1)$$

in which **S** – set of state pure strategies; **E** – set of enterprise pure strategies; *P(x,y)* – the function of five variables, which characterizes the gain (level of benefit) of the state in the situation *{x,y}*, when the following strategy is used

$$x = \left[x_1 x_2 x_3 \right] \in \mathrm{S} \subset R^3, \quad (2)$$

From the set of its pure strategies, and the company used the strategy

$$y = \left[y_1 y_2 \right] \in \mathrm{E} \subset R^2; \quad (3)$$

from the set of its pure strategies.

The function *P(x,y)* describes the losses (costs) of the enterprise in the situation *{x,y}*. This function is set on a single hypercube:

$$S \times E = \prod_{k=1}^{3} [0;1] \times \prod_{j=1}^{2} [0;1] = \prod_{l=1}^{5} [0;1] \subset R^5. \quad (4)$$

With fixed indicators of shadowing and defensive expenditures, the state gain is the amount of revenues to the state budget that will increase with an increase in one (or all at once) of the components of the pure strategy x. With a fixed fiscal pressure x_1, fiscal impact turbulence indicator x_2 and evaluating customs operational processes x_3, the benefit for the state will increase if one (or both) of the shadows and protective costs decrease. Thus, the core of the game

(1) can be provided in a multiplicative form:

$$P(x_1, x_2, x_3, y_1, y_2) = \left(\prod_{k=1}^{3} x_k^{\eta_k(x_k)}\right)(1-y_1)^{\mu_1(y_1)}(1-y_2)^{\mu_2(y_2)} - \\ -\left(\prod_{k=1}^{3}\left(x_k - x_k^{\langle \text{the regulatory limit}\rangle}\right)^{\eta_k(x_k)}\right)\left(y_1 - y_1^{\langle \text{the regulatory limit}\rangle}\right)^{\mu_1(y_1)} \times \\ \times\left(y_1 - y_1^{\langle \text{the regulatory limit}\rangle}\right)^{\mu_1(y_1)}\left(y_2 - y_2^{\langle \text{the regulatory limit}\rangle}\right)^{\mu_2(y_2)} \times \\ \times\left(\min_{k=\overline{1,3}}\left\{\text{sign}\left(x_k - x_k^{\langle \text{the regulatory limit}\rangle}\right)\right\}\right)\times \\ \times\left(\min\left\{\text{sign}\left(y_1 - y_1^{\langle \text{the regulatory limit}\rangle}\right), \text{sign}\left(y_2 - y_2^{\langle \text{the regulatory limit}\rangle}\right)\right\}\right) \quad (5)$$

where $\eta_k(x_k)$ - assessment of the *k*-th component influence strength of the state pure strategy (1) in the state win game $P(x_1, x_2, x_3, y_1, y_2)$; $x_k^{\langle \text{the regulatory limit}\rangle}$ - the regulatory limit value of this component; $k=\overline{1,3}$; $\mu_1(y_1)$ – assessment of the shadowing indicator negative influence strength with its normative limit values $y_1^{\langle \text{the regulatory limit}\rangle}$; $\mu_2(y_2)$ – assessment of the negative impact strength of the protective expenses indicator in the game (1) with its regulatory limit value $y_2^{\langle \text{the regulatory limit}\rangle}$ for the state win $P(x_1, x_2, x_3, y_1, y_2)$.

The results of using the developed model are visualized (Fig. 1).

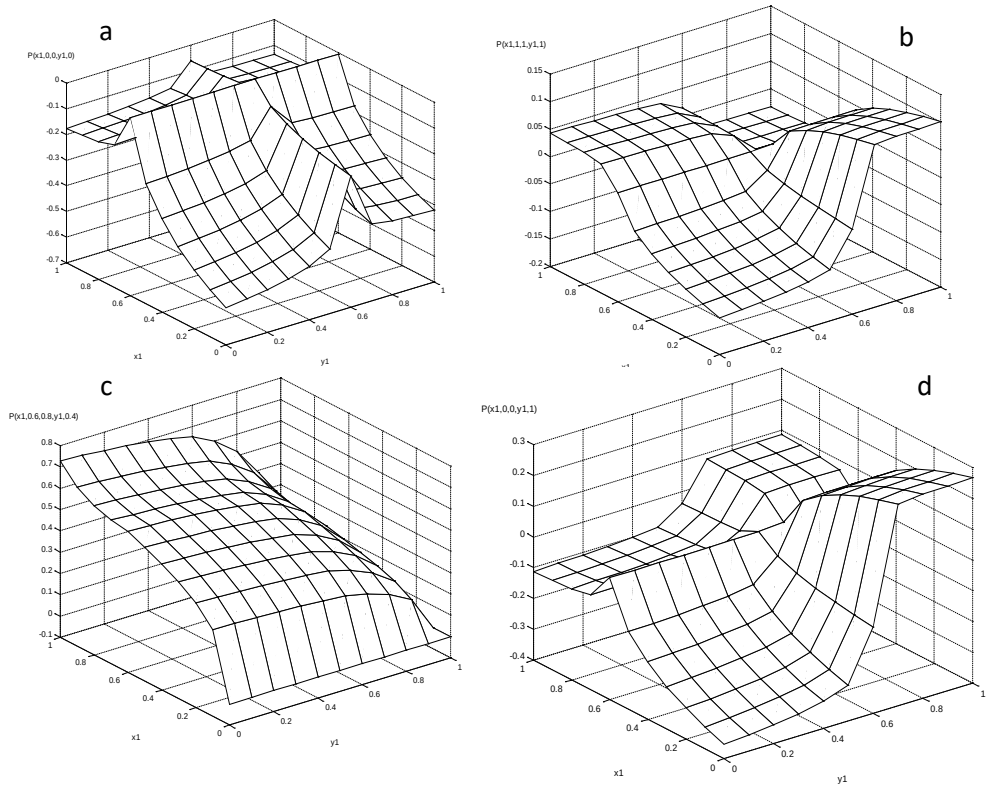

Figure 1. Limit surfaces in the model of the customs influence on the enterprise economic security system: a) surface $P(x_1, 0, 0, y_1, 0)$*; b) surface* $P(x_1, 1, 1, y_1, 1)$*; c) surface* $P(x_1, 0.6, 0.8, y_1, 0.4)$*; d) surface* $P(x_1, 0, 0, y_1, 1)$

3. Results

Testing the developed model on the example of specific enterprises requires the use of specific information and this actualizes the question of the sources of such information and its search. Since there are no official data characterizing the indicators of fiscal impact turbulence, shadowing, protective costs in the model of analyzing the customs impact on the economic security system of business entities, it is advisable to use information obtained through an expert survey of the enterprise management that are subjects of foreign economic activity and directly interact with customs. Of course, the information obtained using the expert survey does not have absolute reliability, but at the same time such information cannot be obtained from official sources. Moreover, official sources can underestimate information on negative impact of any subjects of state regulation comprising domestic enterprises. At least the official point of view and the point of view of the entrepreneurs themselves may differ significantly. But for the approbation of the developed model and for the assessment on the example of real enterprises of interaction between customs and business entities, the point of view regarding business representatives is

in interest. So, due to the lack of official reliable sources of information and the interest in information on the position of the business, the use of an expert survey seems quite reasonable. Moreover, the number of enterprises whose representatives took part in such a survey (30 Ukrainian enterprises) allows you to avoid personal subjectivity in assessing the interaction of domestic enterprises and customs, and allows us to form a fairly objective point of view, that reflects interaction of not one single subject or the established according to a specific group criterion, but characterizes the interaction between such parties in general.

Describing the information originally obtained from the results of the expert survey, the following should be said: there were almost no problems with the oriented value of the turbulence indicator ща the fiscal impact X2 in the survey and most of the answers ranged within the values given in Table 2. That is explained by the macroeconomic nature of such an indicator and the general impact on all business entities. In this case, the values of the indicators of shadowing and protective costs of enterprises had significant differences in the estimates. Therefore, for a more adequate reflection of the situation in Table 2, three variants of the gradation of the indicator values within each year were presented. These indicators characterize the minimum, maximum and most probable level according to experts' assessments.

Table 2. The actual indicators values of the analysis model of the customs impact on the business entity economic security system in 2016-2018

Year	Fiscal pressure ratio X1	Fiscal impact turbulence indicator X2	Evaluating customs operational processes indicator X3	Shadowing indicator Y1	Protective expenses indicator Y2
2016	0,5	0,8	0,5	0,2	0,2
				0,5	0,3
				0,7	0,4
2017	0,5	0,7	0,7	0,2	0,1
				0,4	0,3
				0,6	0,5
2018	0,6	0,6	0,8	0,3	0,2
				0,6	0,4
				0,9	0,6

Analyzing the data presented in Table. 2 it is necessary to note in 2018 the growth of the most probable values of the given indicators, except for the fiscal impact turbulence indicator. However, unfavourable business conditions and the response of the enterprise economic security system to increased administrative pressure manifested themselves in the gradual growth of the most probable values of indicators X1, X3, Y1, Y2.

Despite the fact that the intuitively used rating scale is continuous, for the convenience of expert assessments and further modeling (taking into account the essence of the presented model), a discrete grading scale from 0 to 1,0 in step 0,1 was actually used. On the one hand, these discretization calculations simplify further modeling and generally form the basis for further use tree of options in the developed model. On the other hand, the discretization of the developed scale does not interfere with the accuracy of the estimate, since the chosen discretization step corresponds to the ability of the intuitive qualitative distinction. For example, traditionally, experts can explain qualitatively and meaningfully the difference between estimates of 0,7 and 0,8, or 0,8 and 0,9, but it’s almost impossible to clearly identify the difference between such expert values as, for example, 0,7 and 0,73. The use of indicator values with a sampling frequency of 0,1 in the process of modeling is explained by a sufficient level of visualization of trends and phenomena, as well as by the possibility of prompt calculations with standard information computer software that most enterprises have. It should be emphasized that the essence of the model and the used mathematical mechanisms of information aggregation make it possible to use a continuous scale (which for calculations will simply be transformed into a discrete one with the necessary size of the intermediate step), but increasing the discretization step significantly increases the number of possible final variants of the model. When using a larger degree of discretization, the time required to make the necessary calculations and the requirements for information computer software increase significantly, although with the rapid development of technology this temporary phenomenon will not be a significant problem for the general public and even for small businesses in the future. For testing the developed model, it is possible to use a discretization step of 0.05 principally, though this will complicate the calculations, but at the same time, the additional benefit of such an increase in the discretization step will be almost invisible.

Using the data from Table 2, it is necessary to determine whether the optimal strategy of behavior of the state and business entities was used, and what results from their actions (or inaction) in certain directions and areas led to the corresponding changes. The advantages of the developed model in this case are that it allows not only to form a complete picture of the interaction, but also to identify ways to improve the situation through optimizing the result of the model on the chosen criterion.

As the real situation shows, in the interaction between enterprises and customs there is a set of prerequisites that contribute to the fact that the real strategy does not categorically coincide with the calculated optimal strategy. At the same time, which is the saddest thing, both participants of the game – the state and the enterprise lose. The state chooses a strategy aimed to maximize the results (in the form of the consequences of the implementation of the fiscal function) in the short term, but at the same time, it loses in the long term. If the existing situation is described in more detail – quantitatively, using models developed, and then it should be noted that in 2016 - 2018 with the optimal strategy with the calculated spectrum (6):

$$\begin{gathered}\operatorname{supp}\left\{\mathbf{R}_1^*, \mathbf{R}_2^*, \mathbf{R}_3^*\right\} = \{[0.1 \quad 0.6 \quad 0.1], [0.2 \quad 0.6 \quad 0.1], [0.3 \quad 0.5 \quad 0.8], \\ [0.4 \quad 0.1 \quad 0.8], [0.5 \quad 0.1 \quad 0], [0.5 \quad 0.8 \quad 0.2], [0.6 \quad 0.4 \quad 0.1], \\ [0.6 \quad 0.4 \quad 0.3], [0.6 \quad 0.5 \quad 0.1], [0.6 \quad 0.6 \quad 0.8], [0.6 \quad 0.8 \quad 0.9], \\ [0.7 \quad 0 \quad 0.8], [0.7 \quad 0.9 \quad 0.9], [0.9 \quad 0.8 \quad 0.9], \\ [0.9 \quad 1 \quad 1], [1 \quad 0.5 \quad 0.9], [1 \quad 1 \quad 0.9]\}\end{gathered} \tag{6}$$

and the corresponding definite probabilities (7):

$$\begin{gathered}\omega_{\text{опт}}^{\langle x\rangle}(a_{198}) = 0.0510, \ \omega_{\text{опт}}^{\langle x\rangle}(a_{310}) = 0.0064, \\ \omega_{\text{опт}}^{\langle x\rangle}(a_{427}) = 0.0446, \ \omega_{\text{опт}}^{\langle x\rangle}(a_{504}) = 0.0446, \\ \omega_{\text{опт}}^{\langle x\rangle}(a_{617}) = 0.0191, \ \omega_{\text{опт}}^{\langle x\rangle}(a_{696}) = 0.0255, \\ \omega_{\text{опт}}^{\langle x\rangle}(a_{772}) = 0.0255, \ \omega_{\text{опт}}^{\langle x\rangle}(a_{774}) = 0.0892, \\ \omega_{\text{опт}}^{\langle x\rangle}(a_{792}) = 0.0127, \ \omega_{\text{опт}}^{\langle x\rangle}(a_{801}) = 0.3185, \\ \omega_{\text{опт}}^{\langle x\rangle}(a_{824}) = 0.0318, \ \omega_{\text{опт}}^{\langle x\rangle}(a_{856}) = 0.0127, \\ \omega_{\text{опт}}^{\langle x\rangle}(a_{956}) = 0.1847, \ \omega_{\text{опт}}^{\langle x\rangle}(a_{1187}) = 0.0127, \\ \omega_{\text{опт}}^{\langle x\rangle}(a_{1210}) = 0.0127, \ \omega_{\text{опт}}^{\langle x\rangle}(a_{1275}) = 0.0064, \\ \omega_{\text{опт}}^{\langle x\rangle}(a_{1330}) = 0.1019,\end{gathered} \tag{7}$$

was not used by a state. So, in 2016, the state (represented by the relevant parties) used a pure strategy (2):

$$x_{(2016)} = [0.5 \quad 0.8 \quad 0.5]. \tag{8}$$

In 2017, the pure strategy (8) was slightly changed – the fiscal impact turbulence indicator and operational processes evaluation indicator were equal and the state strategy in such a situation according to the current model can be described as follows:

$$x_{(2017)} = [0.5 \quad 0.7 \quad 0.7]. \tag{9}$$

Describing the state's choice of strategy (according to the content of the developed model) in dynamics, it is necessary to analyze the strategy in 2018 and make a set of conclusions about the change dynamics of such a strategy. In 2018, the fiscal pressure ratio and the fiscal impact turbulence indicator with an elevated operational process evaluation indicator were levelled out, and the state strategy within the developed model was as follows:

$$x_{(2018)} = [0.6 \quad 0.6 \quad 0.8]. \tag{10}$$

Analyzing the change of the state strategy in the formed game (according to the developed model), it is necessary to draw some conclusions. First, the state strategy does not remain unchanged: the indicators chosen for its characterization change each year, indicating that the state as a player in the game has increased its winnings. But such efforts in terms of balancing interests should be considered unsuccessful while the state as a player in this game seeks to maximize its gain in the short run. Despite a certain increase in the operational processes evaluating indicator and a certain decrease in turbulence (which, of course, should be considered extremely positive for domestic enterprises), the fiscal pressure indicator is even more increased.

Undoubtedly, the main reasons for the growth of the fiscal pressure as the choice of the state-player in the game are known and situated in the macroeconomic plane - the need to overcome the general macroeconomic crisis and fill the country's budget with a limited tax base continues to decrease, the easiest choice is the growth of the tax load. Although it is the simplest choice, according to possible trajectories of players in the model, in fact leads to the state's loss - business entities begin to close activities, transfer production (if possible) to other countries and go into the shadow sector of the economy.

To form more complete conclusions, it seems appropriate to analyze the reaction of business entities to the actions of the state, which according to the developed model also shows itself in a particular strategy of behavior. Thus, the leading Ukrainian enterprises did not use the indicators of shadowing and protective costs from the spectrum (11):

$$\operatorname{supp}\left\{\left\{\mathbf{Q}_1^*, \mathbf{Q}_2^*\right\}\right\} = \left\{\left[0.1 \quad 1\right], \left[0.2 \quad 1\right], \left[0.4 \quad 1\right], \left[0.5 \quad 1\right], \left[0.7 \quad 1\right], \left[0.8 \quad 1\right], \left[0.9 \quad 1\right], \left[1 \quad 0\right], \left[1 \quad 0.1\right], \left[1 \quad 0.2\right], \left[1 \quad 0.3\right], \left[1 \quad 0.4\right], \left[1 \quad 0.5\right], \left[1 \quad 0.6\right], \left[1 \quad 0.7\right], \left[1 \quad 0.8\right], \left[1 \quad 0.9\right], \left[1 \quad 1\right]\right\}, \quad (11)$$

in their optimal combination with probabilities (12):

$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{22}\right) = 0.0904, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{33}\right) = 0.0344,$$
$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{55}\right) = 0.0357, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{66}\right) = 0.1070,$$
$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{88}\right) = 0.0484, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{99}\right) = 0.0675,$$
$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{110}\right) = 0.0471, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{111}\right) = 0.0318,$$
$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{112}\right) = 0.0127, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{113}\right) = 0.0268,$$
$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{114}\right) = 0.0548, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{115}\right) = 0.0854,$$
$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{116}\right) = 0.0624, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{117}\right) = 0.0229,$$
$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{118}\right) = 0.0408, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{119}\right) = 0.1019,$$
$$\omega_{\text{опт}}^{\langle y\rangle}\left(b_{120}\right) = 0.0459, \ \omega_{\text{опт}}^{\langle y\rangle}\left(b_{121}\right) = 0.0841. \quad (12)$$

That is, the strategy of domestic enterprises is also not optimal. But it should be noted that this is largely due to the actions of the state, determines the "rules of the game" and tries to maximize the share of income payable in the form of taxes. Typical options for the strategies of domestic enterprises within the selected indicators of the model were as follows (three options for each year):

$$y_{(2016),1} = \left[0.2 \quad 0.2\right], \quad (13)$$
$$y_{(2016),2} = \left[0.5 \quad 0.3\right], \quad (14)$$
$$y_{(2016),3} = \left[0.7 \quad 0.4\right], \quad (15)$$
$$y_{(2017),1} = \left[0.2 \quad 0.1\right], \quad (16)$$
$$y_{(2017),2} = \left[0.4 \quad 0.3\right], \quad (17)$$
$$y_{(2017),3} = \left[0.6 \quad 0.5\right], \quad (18)$$
$$y_{(2018),1} = \left[0.3 \quad 0.2\right], \quad (19)$$
$$y_{(2018),2} = \left[0.6 \quad 0.4\right], \quad (20)$$
$$y_{(2018),3} = \left[0.9 \quad 0.6\right]. \quad (21)$$

In such a situation regarding the behavior of domestic enterprises within the developed model, it seems appropriate to make a set of useful conclusions even before calculating the overall result of the game. Firstly, there are three groups of enterprises among the analyzed ones that choose different strategies of behavior in interaction with the customs. The first group seeks maximum transparent activity and has small values of shadowing indicators and, accordingly, bears not very large protective costs (but in this group in 2018 the shadowing indicator was 0.3), such a group of enterprises either cannot transfer part of the operations to shadow sector, or can afford to work as transparently as possible. The second group due to the influence of state regulation and a combination of other reasons is forced to work combining legal and shadow operations (however, it should be emphasized that such operations are not necessarily criminal in nature or subject matter, and they are often caused by an attempt to reduce excessive tax and customs payments, although at the same time, of course, they also violate the law). Finally, the third group of enterprises works with a significant level of shadowing (in 2018, for some enterprises its rate was 0,9). In fact all three groups of companies operate in almost the same conditions, but the reaction of each group of the companies to the strategy is different – from obeying the law to shadowing the activity.

Secondly, there is a non-deterministic but significant relationship between the degree of shadowing of the enterprise's activity (which is expressed by the shadowing indicator in the developed model) and the amount of money spent on ensuring the safe enterprise operation in the existing organizational and legal conditions of the activity. The strength of such dependence within the correlation-regression analysis is not significant (especially, it is different for different enterprises), which allows using both indicators within a single model in the absence of multicollinearity, but the dependence of the indicators change at the level of the sign of such a change objectively exist.

Thirdly, the change in the shadowing and protective expenses indicators is fully described by the provisions of the institutional theory and the bio-evolutionary approach, which serves as an additional argument in favor of the justification of the use of the institutional theory and the provisions of the evolutionary approach for describing the interaction between business entities and the customs: the shadowing indicator reflects the "measure of disagreement" of business entities with regulatory norms of state institutions, and indicator of protective costs reflects "the price of disobedience". In terms of institutionalism, the measure of shadowing characterizes the degree of inconsistency of the enterprise with existing norms and institutions. The greater the degree of inconsistency, the greater the "price of disobedience to the law" is to be paid by the entity. Moreover, the following indicators, which characterize the choice of a particular strategy of behavior by Ukrainian enterprises, are fully explained by the provisions of institutionalism in

balancing the "price of obeying" the law (in the form of legal fiscal payments) and the price of disobedience (in the form of unlawful protective expenses as a consequence of shadowing of the enterprise's activities) is : enterprises will massively choose the legal way of action only if the price of obeying the law will be less than the price of disobedience. Otherwise, in fact, the state itself stimulates destructive enterprise behavior in terms of the normative field by its economic methods. But in this case, state should be responsible for this as a regulatory institution because of the contradictory nature of its actions, as administrative and regulatory methods stimulate one behavior – obedience to the law, and economic methods – a completely different behavior – disobedience to the law and payment of the corresponding fees for such disobedience.

Fourthly, the analysis of strategies chosen by domestic enterprises during 2016-2018 (in all three groups of enterprises based on the indicators used) clearly illustrates the time trend: in 2017 due to a certain simplification of activities and weakening of the regulatory impact, the shadowing indicator and the protective expenses indicator decreased in all three groups of analyzed enterprises, but in 2018 the situation worsened again, since in all three groups of analyzed enterprises increased both an shadowing and protective expenses indicator.

Fifth, in the Ukrainian economy, due to the influence of the customs, there is a tendency of the general shadowing of business. This is confirmed by the analysis of the dynamics of the selected indicators that characterize the enterprise strategy in all groups – in spite of some improvement in 2017, in 2018 the enterprises' attempts to work in the shadow sector are supported by the growth of both shadow indicator and protective expenses indicator for all three groups of enterprises. Moreover, characteristic and threatening at the same time is the value of the shadowing indicator in the third group of enterprises in 2018 – 0,9. In fact this value indicates an attempt to minimize its activities in the legal sector of the economy. But, it should be emphasized once again that from the point of view of the legal field this is an offense and is a specific initiative of domestic enterprises. But from the standpoint of the laws of economic interaction between the state, in particular customs and business entities, this situation is a direct indication of an ineffective state policy that "pushes" the company into the shadow sector, through the growth of the fiscal loan, which is not compensated by even a slight decrease in turbulence and the improvement of the operational interaction of enterprises with the customs.

Below, the expenses of excess resources on the part of enterprises are calculated on the basis of the use of the developed model in the appropriate situations, combining the strategies of enterprises and customs, which personify the state through the influence of subjects of customs regulation in such a game:

$$\left\{x_{2016},\, y_{(2016),1}\right\}, \tag{22}$$

$$\left\{x_{2016},\, y_{(2016),2}\right\}, \tag{23}$$

$$\left\{x_{2016},\, y_{(2016),3}\right\}, \tag{24}$$

$$\left\{x_{2017},\, y_{(2017),1}\right\}, \tag{25}$$

$$\left\{x_{2017},\, y_{(2017),2}\right\}, \tag{26}$$

$$\left\{x_{2017},\, y_{(2017),3}\right\}. \tag{27}$$

When combining the actually chosen strategies in the current game – strategies on the part of the state and an adequate response from the enterprises – actually, in each of the situations the enterprises suffer additional losses and lose.

It should be noted that:

$$\left\{x_{2018},\, y_{(2018),1}\right\}, \tag{28}$$

$$\left\{x_{2018},\, y_{(2018),2}\right\}, \tag{29}$$

$$\left\{x_{2018},\, y_{(2018),3}\right\}, \tag{30}$$

are calculated as:

$$P\left(x_{2016},\, y_{(2016),1}\right), \tag{31}$$

$$P\left(x_{2016},\, y_{(2016),2}\right), \tag{32}$$

$$P\left(x_{2016},\, y_{(2016),3}\right), \tag{33}$$

$$P\left(x_{2017},\, y_{(2017),1}\right), \tag{34}$$

$$P\left(x_{2017},\, y_{(2017),2}\right), \tag{35}$$

$$P\left(x_{2017},\, y_{(2017),3}\right), \tag{36}$$

$$P\left(x_{2018},\, y_{(2018),1}\right), \tag{37}$$

$$P\left(x_{2018},\, y_{(2018),2}\right), \tag{38}$$

$$P\left(x_{2018},\, y_{(2018),3}\right). \tag{39}$$

in accordance with the essence of the developed model as a result of the game from combining the strategies of the game participants in the formed

multidimensional space with a discrete scale with a step of 0,1. In the current model in accordance with (40):

$$P(x_1, x_2, x_3, y_1, y_2) = \left(\prod_{k=1}^{3} x_k^{\eta_k(x_k)} \right) (1-y_1)^{\mu_1(y_1)} \times$$
$$-(1-y_2)^{\mu_2(y_2)} (x_1 - 0.6)^{\eta_1(x_1)} (x_2 - 0.6)^{\eta_2(x_2)} \times$$
$$\times (x_3 - 0.8)^{\eta_3(x_3)} (y_1 - 0.6)^{\eta_1(x_1)} (y_2 - 0.4)^{\eta_2(x_2)} \times$$
$$\times \left(\min \left\{ \text{sign}(x_1 - 0.6), \text{sign}(x_2 - 0.6), \text{sign}(x_3 - 0.8) \right\} \right) \times$$
$$\times \left(\min \left\{ \text{sign}(y_1 - 0.6), \text{sign}(y_2 - 0.4) \right\} \right), \quad (40)$$

such losses are quite significant. Actually, these losses are not less than 0,42, which should be considered rather substantial value (within the existing scale of the developed model).

The advantage of the developed model is the possibility not only to evaluate the results of the game with the two players selected, but also to conduct a scenario analysis to determine the result of the game with different strategies of participants' behavior. When performing scenario analysis, it should be noted that in case of choosing enterprises in each of the situations (22) – (30) instead of pure strategies (13) – (21) other strategies with indicators of shadowing and protective expenses on the spectrum (11) in their optimal combination with probabilities (12), then the losses of enterprises would be close to zero with a bias in very small gains.

Explicitly, choosing the mentioned strategy by the customs (with actually existing indicators of fiscal pressure ratio, fiscal impact turbulence and evaluating customs operational processes), and choosing other strategies by the enterprises, as the developed model shows, could not only avoid unreasonable losses, but get at least minimal, but still extra economic benefit.

At the same time, the profitability and feasibility of using by the enterprises the optimal strategy of the game solution (1) on a single hypercube (4) with unchanged government strategies (8) – (10) consist of a significant reduction in losses of excess resources.

4. Conclusions

Consequently, the use of the developed model and the assessment of its customs system impact on the economic security of domestic enterprises allowed us to make a set of important conclusions. Firstly, today the strategy chosen by the subjects of customs regulation almost does not take into account the interests of economic entities. It is unidirectional and focused on maximizing the results of the fiscal function implementation. That is, despite the declaration of a stimulating effect on the economy, the subjects of customs regulation actually carry out exclusively fiscal function, protecting only the interests of the state.

Secondly, the strategy chosen by the customs does not significantly coincide with the calculated combination of optimal strategies for the participants in the game. This leads to a combination of negative consequences both from the position of the state - enterprises are eager to shadow, and in the long run the amount of fiscal revenues will be reduced because of the reduction of the tax base, the domestic economy is forced to at least simply provide simple reproduction in the legal sector of business instead of expanded reproduction, and a significant number of enterprises are forced to enter into a restricted reproduction mode in the legal sector; and from the position of business entities – the share of income that is withdrawn by state structures does not allow for normal economic activity and actually "pushes" the enterprise to shadowing its activities.

Thirdly, in fact, enterprises cannot really and in the medium term influence the state's choice of a certain strategy (within the game, which is being considered), and the state's chosen strategy, although is aimed at meeting state interests, but only in the short term. In the long-term period – paradoxically, but this is a real fact – such a strategy negatively affects both the public interest and the interests of business entities.

Fourthly, since today's customs strategy is fundamentally non-optimal for a balanced interaction, and enterprises cannot influence to adjust such a strategy, the developed model and calculated results of the customs impact on the economic security system of domestic enterprises confidently indicate that domestic business entities not only can adapt to such an impact, but they *have to* make such an adaptation for further normal functioning within the framework of the strategy chosen by the customs authorities regulation.

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