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THE IMPACT OF RISKS ON THE ECONOMIC SECURITY OF AIRLINES

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Abstract. *The paper considers the efficiency of measures to ensure the economic security of airlines. These measures are aimed at mitigating the risks related to committing acts of unlawful interference with civil aviation.*

Key words: airline, an act of unlawful interference, aviation security, economic security, efficiency, risk, threat.

1. Introduction

The recent terrorist attacks in France on November 13, 2015, the tense situation in the area of the anti-terrorist operation in Eastern Ukraine, committing an act of unlawful interference with civil aviation regarding the aircraft of 'Kogalymavia' Airlines on October 31, 2015, and the constant threat from the militants of "Islamic State" specify the relevance of economic security at the state level enterprises as well as at the level of the aviation industry and air companies. The theoretical study of this problem makes it possible to determine the lack of economic security based on common approaches to the economic measures aimed at mitigating the risks. Therefore, the security of airlines is the most urgent problem which directly affects the economic security of the state, city or region.

2. Analysis of recent studies and publications

Efficiency of economic security in transport companies, including airlines, is described in the publications of the Ukrainian and foreign authors, among them O. Arefyeva, S. Arefyeev, I. Averichev, V. Zagorulko, O. Kazachenko, P.Klymenko, S.Deminskyi, S.Dovbnya, O.Kiriyenko, O.Kyrychenko, G.Kozachenko, T.Kuzenko, N.Kapustin, S.Miziuk, V.Miziuka, V.Muntian, V.Ponomariov, G.Suslova, S.Shkarlet, V.Shlykov, O.Schtanhret and others.

The objective of the paper is to determine how efficiently airlines implement the measures aimed at mitigating the risks related to committing acts of unlawful interference with civil aviation in order to ensure the economic security.

3. Main part

An effective response to the constant threat of international terrorism is implemented by identifying, understanding and prevention of possible risks of committing acts of unlawful interference (AUI) with civil aviation. Identification of risks enables the States to identify and implement preventive measures aimed at eliminating each type of risk. The effective economic security of airlines can be achieved only if risks are considered in the global context.

International Civil Aviation Organization (ICAO) in their instruments once considered the possible risks to international civil aviation in a global context and stressed the need for:

– Constant describing the current situation pertaining to global risks;

– Providing the ICAO Member States with assistance in their efforts to protect international civil aviation against acts of unlawful interference;

– Practical implementation of the requirements regarding national programs of civil aviation safety;

– Assistance in improving ICAO guidance materials on the implementation of standards and recommended practices (SARPS);

– Informing the States about the criteria for risk assessment at the national level.

To ensure the economic security, it is necessary to create an effective system of risk assessment to identify the types of threats and their risk levels and develop effective measures to prevent acts of unlawful interference with civil aviation.

The system of risk assessment consists of the following elements: analysis of possible risks connected with the threat fulfillment and the possible consequences; risk assessment; recommendations for further activities aimed at minimizing risks.

To determine the costs to ensure the appropriate level of economic security of airlines, there is a classification for the types of threats, risk levels and the costs of measures aimed at reducing the threats. This classification is given in Table 1.

Risk levels are determined by competent state authorities that implement the requirements of national aviation security programs. The measures aimed at reducing the threats are implemented by airlines in agreement with state authorities and in accordance with the type of threat (the activities in Tab.1 are marked as Y_i, which displays the cost of a particular type of measure to reduce a threat level. Table 1 analyzes the types of threats that were used for terrorist attacks against International Civil Aviation in the past.

Table 1

The economic costs of airlines on the security measures in accordance with the risk levels and the types of threats

№	Type of threat	Risk level (X_i)	The costs of measures to reduce risks (Y_j .)
1.	The use of improvised explosive devices (IED) on:		
	- - A human;	Moderate	$Y_{1.1}$
	- - A vehicle;	Moderate	$Y_{1.2}$
	- - Cargo;	High	$Y_{1.3}$
	- - Mail;	Moderate	$Y_{1.4}$
	- - Board supplies;	Moderate	$Y_{1.5}$
	- - Catering food.	Moderate	$Y_{1.6}$
2.	- The use of standard ammunition by/in:		
	- - A human;	Moderate	$Y_{1.1}$
	- - A vehicle;	Moderate	$Y_{1.2}$
	- - Cargo;	Moderate	$Y_{1.3}$
	- - Mail;	High	$Y_{1.4}$
	- - Board supplies;	Moderate	$Y_{1.5}$
	- - Catering food.	Moderate	$Y_{1.6}$
3.	Man-portable air defense systems (MANPADS)	Moderate High	$Y_{1.1}$ $Y_{1.2}$
4.	Threats in flight	Moderate High	$Y_{1.1}$ $Y_{1.2}$
5.	Cyber Attacks via air traffic management systems	High	$Y_{1.1}$
6.	Threats of committing an act of unlawful interference in an uncontrolled area	Moderate High	$Y_{1.1}$ $Y_{1.2}$
7.	Chemical, biological and radiological (CBR) threats	Moderate High	$Y_{1.1}$ $Y_{1.2}$
8.	Improvised explosive devices or weapons, hidden in catering food, board supplies or service items	Moderate High	$Y_{1.1}$ $Y_{1.2}$
9.	Other possible threats	Low Moderate High	$Y_{1.1}$ $Y_{1.2}$ $Y_{1.3}$
10.	False threat	Low	$Y_{1.1}$

A matrix of aviation security measures depending on risk level can be constructed using the tensor approach. The tensor analysis is recommended to apply on the basis of the theoretical approaches to defining symmetric and antisymmetric tensors, and the generalized Kronecker symbol of rank 2. This symbol is determined under the following conditions:

$$\delta_j^i = \begin{cases} 0, & i \neq j, \\ 1, & i = j. \end{cases}$$

Kronecker symbol δ_j^i has two values "0" and "1". Value $\delta_j^i = 0$ if at given X_i risk level (i = 1; 2; 3) Y_j aviation security measure (j = 1, ..., n) is not applied. If at X_i threat level Y_j aviation security measure is applied, Kronecker symbol $\delta_j^i = 1$. The next step is to determine risk level X_i and the appropriate aviation security measures.

The efficiency of the economic security system of an airline depends on the management of security measures. This type of management is based on the allocation of the most important security tasks in this period, in particular reduction (or elimination) of risk according to the type of threat. These actions are carried out by the management of an organization in order to form an effective set of security measures.

Using the data in Table 1 allows us to define a set of human, material, technical and information resources to ensure aviation security levels in accordance with the measures. For each risk level, this set of resources can be determined with the help of the following expression:

$$Y^i = \sum_{j=1}^{m} \delta_j^i$$

where δ_j^i is a Kronecker symbol; m is the number of proposed actions; $i = 1,2,3$ is risk levels.

For different risk levels applying to airlines, the set of resources can be determined using the following expression:

$$Y = \sum_{i=1}^{n} Y_j^i = \sum_{i=1}^{n}\sum_{j=1}^{m} \delta_j^i$$

Thus, these methods allow to manage the resources of airlines in order to ensure security in the event of a certain level of risk, and these approaches will help us to determine the total cost of an airline when providing security for a certain type of threat.

The studies regarding the application of aviation security measures for a certain level of risk allows us to calculate the total amount of costs on organizing aviation security measures for a particular flight, taking into account the relationship between the type of threat, set of tactical measures and value of expenses. This dependence can be described using the following expression:

$$TC^i = \sum_{j=1}^{m} \delta_j^i C^i(Y_j)$$

where TC^i is the total cost at the first level of risk; δ_j^i is a Kronecker symbol; $C^i(Y_j)$ is costs on *j* aviation security measure at *i* risk level; *m* is the number of security measures; $i = 1,2,3$ is the number of risk levels.

To implement the formula of total costs, it is necessary to determine the costs on *j* aviation security measure at *i* risk level. Each airline may change the character of variable and fixed costs on the aviation security measures, taking into consideration the specifics and conditions in accordance with which this airline operates.

According to the analysis of the types of threats and risk levels, the aviation security policy of an airline is substantiated and an appropriate action plan is developed. The structure of an action plan is proposed. This plan is called the plan for a crisis case and this structure is as follows:

1. Evaluation of the current state of the formation of a real or potential hazard.
2. Recommendations. The selection of the main security means due to which the aviation security policy is implemented.
3. Responsibility. The list of responsible persons and determination of areas of responsibility.
4. The tactics of aviation security is an application of specific procedures and implementation of specific actions to ensure aviation security and to determine security mechanisms, including aviation security controls in the context of the development and implementation of security measures.

The efficient security measures of an airline are only possible when using an integrated and systematic approach. The systematic approach is certainly associated with the general objective of the organization of aviation security measures and the development of a set of measures to protect an airline from threats connected with acts of unlawful interference and others. The integrated approach pertains to combining conditions of protection from threats connected with acts of unlawful interference. These conditions are as follows: risk assessment, development of tactical measures of aviation security, and substantiation of the costs associated with these aviation security measures. The interconnection of these conditions ought to be proven using the method of constructing a three-dimensional model of the complex aviation security system. This model is described as "risks - measures - costs."

The components of the model are determined as follows: *Xi* is an aviation security risk; *Yj* is tactical measures to ensure a standardized level of aviation security; *Cij* is the value of costs on the organization of aviation security measures.

Applying this model allows to calculate the amount of costs on the organization of aviation security measures, taking into consideration the relationship between the risk level, set of tactical measures and largest expenses. Thus, to apply the model, it is necessary to verify the aviation security risk level. This verification should be carried out using the matrix method in order to define the valuation of aviation security risks in the context of its differentiation (Table 2).

Table 2

Matrix of the valuation of aviation security threats differentiated in reference to acts of unlawful interference

Risk information / Risk probability level	«Low» (no data on risks available)	«Moderate» (data on potential risks available)	«High» (specific data on risks available)
«Potential» (there is a potential risk)	a	b_1	c_1
«Possible» (there is a possibility of risk)	a_1	b	c_2
«Concrete» (There is a concrete risk)	a_2	b_2	c

The subject of the matrix contains the equal probability of a risk. Accordingly, the risk level ("low", "moderate", and "high") determines three types of risk probability, in particular "potential", "possible" and "concrete". To objectively define the "value" of risk prevention in reference to acts of unlawful interference, it is necessary to consider the information pertaining to the availability of such threats. Three categories of this information are given in the predicate of the table-matrix, namely Category 1 – No information available; Category 2 – Information is available, but not confirmed and there are doubts about its veracity; Category 3 – There is specific and confirmed information about upcoming acts of unlawful interference.

Values *a, a1, a2, b, b1, b2, c, c1, c2* are factors that are taken into account when correcting (increasing) the cost on aviation security measures. The minimum value of factor *a* equals 1. This means that the total costs on aviation security measures are not increased because the potential acts of unlawful interference is already taken into account in the calculation of the costs required to ensure the standardized level of aviation security (no confirmation on threats).

Values *b* and *c* are determined as factors the total cost increasing on providing the "moderate" and "high" risk levels (see Table 2). These factors are calculated in [6] and have the following values: *b = 1,30; c = 1.79.*

Values *a1, a2, b1, b2, c1, c2* are determined in [6], considering the structure of the costs and their dependence on the risk level (see Table 1):

$$a_1 = b_1 = 1 + (1,3 - 1) \cdot (0,2304+0,2545) = 1,15;$$

$$a_2 = c_1 = b = 1,3;$$
$$b_2 = c_2 = 1,3 + (1,79 - 1,3) \cdot (0,2506 + 0,3769) = 1,61$$

Using the matrix allows to substantiate a factor value multiplied by the value of a standardized cost on aviation security measures and to adjust the amount of costs taking into account the risk level in reference to committing acts of unlawful interference. Owing to the fact that each airline has its own capabilities to provide special technical means of security control, it is possible to adjust this factor, but its value should not be below the minimum standardized level.

Standard methods of cost accounting can barely be applied to solve the problems related to the determination of the value of processes taking place in airlines. The method of functional cost analysis estimates the process and functions being performed, determines the cost of services provided by airlines, and suggests opportunities for improving the efficiency of the processes being analyzed.

To establish the connection to a period of time, we use annual data on aviation security costs of an airline.

Being an element of the price for an air service, the fee for aviation security measures is part of gross income (revenue from the sale of air services) of an airline. Consequently, it is a factor which helps to determine the total cost of airline services.

The existing technical and economic method of determining the amount of the fee for aviation security measures is applied to analyze the current information about the possible changes in the costs of an airline in the short term (for example, in the following year). The summation of the expected quantities of expenses allows to determine the expected cost on an aviation security service. These expenses ought to be reflected in the short-term forecast of the cost, taking into account the possible number of air services, which an airline is actually able to provide.

On the basis of the constructed matrix of the valuation of aviation security threats differentiated in reference to acts of unlawful interference, statistical and expert data on the probability of each of the specific types of threats are analyzed, the qualitative and quantitative risk analysis and the quantitative assessment of a risk extent are carried out, as well as the conditions that increase the possibility of an optimal (rational) decision-making are determined.

To attain this goal, the following mathematical model can be constructed. According to the theory of risks, rules of behavior for a subject of decision-making and criteria for selecting the optimal strategy by a subject of decision-making are formed on the basis of a functional assessment:

$$F = \left(f_{ji}: \quad j = 1,...,m; \quad i = 1,...,n\right) = \begin{pmatrix} f_{11} & \cdots & f_{1j} & \cdots & f_{1n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ f_{k1} & \cdots & f_{kj} & \cdots & f_{kn} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ f_{m1} & \cdots & f_{mj} & \cdots & f_{mn} \end{pmatrix}$$

where f_{ji} is a measure of the efficiency of strategy s_j, implemented by a subject of decision-making when the environment is in a state described as θ_i $(j = 1,..., m; \quad i = 1,..., n)$. The probability to adapt to the state of environment θ_i is expressed as q_i, де $\sum_{i=1}^{n} q_i = 1, \; q_i \geq 0, \; i = 1,..., n.$

It is assumed that j-row of the matrix of fees F determines discrete random variable $F(s_j)$ (*vector of estimation*), which has the following distribution order:

$F(s_j)$	f_{j1}	f_{j2}	…	f_{jn}
Q	q_1	q_2	…	q_n

In other words, vector of estimation of variable $F(s_j)$ is characterized by strategy s_j, implemented by a subject of decision-making. The columns of the matrix of fees F, in turn, display the value of assessments pertaining to the effectiveness of all strategies applied by a subject of decision-making in terms of adaptation to the relevant state of the environment. J-column is marked as $F(\theta_i)$ and subsequently called the estimation vector of i-state (i = 1,…, n) of the environment.

Generally speaking, the subject of decision-making can use not only its own strategies. Under certain conditions, a mixed strategy determined by the vector (distribution) can be used.

$$P = (p_1;...;p_m) \quad \left(\sum_{k=1}^{m} p_k = 1; \; p_k \geq 0, \, k = 1,..,m\right)$$

where p_k is the possibility for the subject of decision-making to apply its own strategy.

Different criteria of decision-making regarding the main informational situations can be used for the subject of decision-making to select an optimal solution (optimal strategy or optimal mixed strategy s_P^*,), where $P^*=(p_1^*;...;p_m^*)$; $\sum_{k=1}^{m} p_k^*=1$; ($p_k^*\geq 0$, $k=1,...,m$), or a set of equivalent optimal solutions.

Let's consider the Bays' criterion for selecting optimal strategies. Strategy s_j corresponds to the vector of estimation F_j $(j=1,..., m)$ (it is considered as a real random variable). This fact leads us to conclude that this strategy has the following numerical parameters:

$$B_j = B(s_j;Q) = M(F(s_j)) = \sum_{i=1}^{n}(q_i f_{ji}),$$
$$j=1,..., m;$$
$$\sigma_j^2 = D(s_j;Q) = D(F(s_j)) = \sum_{i=1}^{n}(q_i f_{ji}^2) - B_j^2,$$
$$j=1,..., m;$$
$$\rho_{kl} = \rho(F(s_k);F(s_l)) = \frac{\operatorname{cov}(F(s_k);F(s_l))}{\sigma_k\sigma_l} =$$
$$= \frac{\sum_{i=1}^{n}(q_i f_{ki} f_{li}) - B_k B_l}{\sigma_k\sigma_l},$$
$$k=1,..., m,\ l=1,..., m.$$

Since $F(s_1),...,F(s_m)$ are valid random variables, $F(s_P)$ is also a random variable, which has the following numerical characteristics:

$$B_P = B(s_P;P) = M(F(s_P)) = \sum_{j=1}^{m}(p_j B_j) = \sum_{j=1}^{m}\sum_{i=1}^{n}(p_j q_i f_{ji});$$
$$\sigma_P^2 = D(s_P;P) = D(F(s_P)) =$$
$$= \sum_{k=1}^{m}\sum_{l=1}^{m}(p_k p_l \sigma_{ki}) = \sum_{k=1}^{m}\sum_{l=1}^{m}(p_k p_l \sigma_k \sigma_l \rho_{ki}),$$

де: $\sigma_{kl} = \operatorname{cov}(F(s_k);F(s_l)) = \sigma_k\sigma_l\rho_{kl}$, $k=1,...,m$, $l=1,...,m$; B_P is Bays' estimation of mixed strategy s_P; σ_P is the standard deviation relative to B_P.

Taking into account that $\min_{k=1,...,m} B_k \leq B_P \leq \max_{k=1,...,m} B_k$, , it is appropriate to choose a criterion of minimum variance as a criterion for selecting the optimal mixed strategy. In other words, the subject of decision-making considers a mixed strategy s_{P^*}, to be optimal. The fact that $P^*=(p_1^*;...;p_n^*)$, complies with the conditions:

$$\sigma_{P^*}^2 = D(s_{P^*};P^*) = \sum_{k=1}^{m}\sum_{l=1}^{m}(p_k^* p_l^* \sigma_{kj}) =$$
$$= \min_{P\in\Delta_P}\sum_{k=1}^{m}\sum_{l=1}^{m}(p_k p_l \sigma_{kl}) = \min_{P\in\Delta_P}\eta(p_1;...;p_m);$$
$$p_1+p_2+...+p_m=1;$$
$$p_k \geq 0,\ \ k=1,...,m.$$
$$\Delta_P = \left\{P=(p_1;\ldots;p_m) : \sum_{k=1}^{m} p_k = 1;\ p_k \geq 0,\ k=1,\ldots,m\right\}.$$

To solve the optimization problem (considering the structure of the objective function), it is appropriate to use methods of quadratic programming. To implement the developed model, it is assumed that the probability to select each level of costs will be proportional to the potential threats. On the basis of the empirical values, the following assumptions can be accepted:

$p_1=q_1=0{,}96$ is the probability of the "green" level of threat;

$p_2=q_2=0{,}03$ is the probability of the "yellow" level of threat;

$p_3=q_3=0{,}01$ is the probability of the "red" level of threat.

The functional assessment is expressed in the form of expenses, i.e.

$$F=F^- = \begin{pmatrix} 1 & 1{,}15 & 1{,}3 \\ 1{,}15 & 1{,}3 & 1{,}61 \\ 1{,}3 & 1{,}61 & 1{,}79 \end{pmatrix}$$

Let us determine the main numeric characteristics of the model. According to the previous formula, the values of mathematical expectation can be obtained: $B_1=1{,}0075$; $B_2=1{,}1591$; $B_3=1{,}3142$.

According to the formula, the values of variance can be calculated: $\sigma_1^2=0{,}0015$; $\sigma_2^2=0{,}0027$; $\sigma_3^2=0{,}0051$, where we get the standard deviations: $\sigma_1=0{,}0390$; $\sigma_2=0{,}0520$; $\sigma_3=0{,}0713$.

According to the previous formulas, the correlation matrix is found:

$$\rho = \begin{pmatrix} 1 & 0,9796 & 0,9929 \\ 0,9796 & 1 & 0,9487 \\ 0,9929 & 0,9487 & 1 \end{pmatrix}$$

It is assumed that p_1^*, p_2^*, p_3^* are optimal frequencies of the probability to use costs for each level. Then, a risk optimization mathematical model can be constructed according to the formulas:

$$\sigma_{P*}^2 = (p_1^*)^2 + (p_2^*)^2 + (p_3^*)^2 + 2 \cdot 0,9796 p_1^* p_2^* +$$
$$+2 \cdot 0,9929 p_1^* p_3^* + 2 \cdot 0,9487 p_2^* p_3^* \to \min$$

under the condition that $p_1^* + p_2^* + p_3^* = 1$, $p_i^* \geq 0$.

The optimal values to be found are as follows:

$$p_1^* = 0,89494; \ p_2^* = 0,06302; \ p_3^* = 0,04204.$$

Consequently, in determining and predicting the expected level of losses based on consideration of the risk optimization model, it is appropriate to use the found frequencies. Taking into account these results and the formula of total costs, we obtain the expected total costs with the optimal frequencies considered. This fact makes it possible to define the level of costs by the following formula:

$$TC = \sum_{i=1}^{n} p_i^* TC^i = \sum_{i=1}^{n} \sum_{j=1}^{m} p_i^* \delta_j^i C^i(Y_j)$$

where TC^i is the total costs at *i*-level of threat; δ_j^i is a Kronecker symbol; $C^i(Y_j)$ is the costs on *j* aviation security measure at *i*-level of threat; p_i^* is the optimum frequencies determined by taking into account the level of threat; n is the number of levels of threats; m is the number of organizational measures.

Economic efficiency of security is that an airline involves economically substantiated resources (human, logistical and information) for the implementation of regulatory security measures, and can use them effectively under conditions of changing the type of threat and passenger traffic. In our case, to determine the costs of resources for security measures, we construct a matrix of costs depending on the level of risk, in terms of the fact that the independent variables are the volumes of expenses regarding the resources to implement security measures. To construct the matrix showing the dependence of aviation security measures on risk levels, we use the data of Table 1.

The first step to study the set of threats and relevant measures is to determine the matrix of relationship between risk levels and aviation security measures. The components of this matrix are determined as follows: $X_i = (X_1, X_2, X_3)$ – aviation security risks; $Y_J = (Y_1, Y_2, \ldots, Y_n)$ – aviation security measures.

Let us classify the components of the economic security model:

These components are the economic security risks, which are discussed in Table 1 and classified into three levels:

X1 - high

X2 - moderate;

X3 - low.

Component Y_J denotes risk mitigation measures to provide economic security of an airline, see Table 1.

To implement aviation security measures to reduce the risk level, it is necessary to use resources. The set of resources for each risk level can be determined with the help of the following formula:

$$Y^i = \sum_{j=1}^{m} \delta_j^i$$

where δ_j^i is a Kronecker symbol; *m* is the number of proposed measures; $i - 1,2,3$.

The set of resources for different levels of risks to airlines can be determined using the following formula:

$$Y = \sum_{i=1}^{n} Y_j^i = \sum_{i=1}^{n} \sum_{j=1}^{m} \delta_j^i$$

Thus, these methods allow airlines to manage resources to ensure security at a certain level of risk, and these approaches will help us to determine the total cost of an airline while providing aviation security measures at a certain level.

Research activities on economic security measures at a certain level of risk allows us to calculate the total amount of costs on the organization of economic security measures for a particular flight taking into account the relationship between the type of risk, complex tactical measures and largest expenses.

This dependence can be described by the following formula:

$$TC^i = \sum_{j=1}^{m} \delta_j^i C^i(Y_j)$$

where TC^i is the total costs at *i*-level of threat; δ^i_j is a Kronecker symbol; $C^i(Y_j)$ is the costs on *j* aviation security measure at *i*-level of threat; *m* is the number of aviation security; i – 1,2,3.

Each airline may change the variables and fix the costs on its activities in connection with the specific terms of the operation of a particular airline.

Furthermore, when determining the efficiency of the economic security of an airline, we propose to use a relative indicator of the economic efficiency of security measures, which can be represented as the following expression:

$$E_i = \frac{n_i}{F_i}$$

where E_i is a relative performance indicator of the economic security of an airline; *i* is a certain type of event (act of unlawful interference; decease resulted in by an act of unlawful interference; pollution as a result of aircraft accidents, etc.); n_i is a number of alerts of this type of event (the number of acts of unlawful interference, which are avoided; the number of survivors after committing an act of unlawful interference; the number of saved aircraft, etc.); *Fi* is a range of measures involved.

The level of efficiency regarding the measures to ensure economic security in an airline depends on many factors. Therefore, to solve the problem of efficiency management, it is important to identify and analyze this problem.

The efficiency of economic security of an airline depends on compliance with applicable legislation.

The problem of improving the efficiency of the economic security system of airlines is to achieve the maximum possible result when the minimally sufficient number of resources (human, material and financial) are involved in compliance with the requirements of legislation on aviation security, aviation safety and environmental safety, in particular to prevent acts of unlawful interference, to reduce risks related to acts of unlawful interference, to prevent pollution as a result of aircraft accidents, to avoid incidents of aviation safety and to mitigate the consequences, etc.). Therefore, only the skillful use of the entire system of these factors can provide the desired efficiency level of economic security in an airline.

Thus, the efficiency of the economic security system in an airline can be considered as the ratio of the results of the performance of components integrated in this particular system to the costs on economic security.

4. Conclusions

After analyzing the theoretical studies of economic security, it is possible to make the following conclusions:

– In the area of the economic security of airlines, there is no complex approach to the definition of economic security in combination with specific components of the economic security of airlines. These components are aviation security, aviation safety, and environmental security.

– The paper has met the requirements of regulations concerning the specific components in the system of economic security of airlines;

– The economic security risk analysis allowed us to determine the efficiency indicators and their functional dependence;

– The efficiency of the economic security system of airlines depends on the development of the system of preventive measures that are fully substantiated.

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В.В. Мізюк, С.Г. Мізюк. Вплив ризиків на ефективність забезпечення системи економічної безпеки авіатранспортних підприємств.
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У статті досліджено ефективність забезпечення заходів економічної безпеки авіатранспортних підприємств від впливу ризиків скоєння актів незаконного втручання в діяльність цивільної авіації.

Ключові слова: авіатранспортне підприємство; авіаційна безпека; акт незаконного втручання; економічна безпека; ефективність; загроза; ризик.

В.В. Мизюк, С.Г. Мизюк. Влияние рисков на эффективность обеспечения системы экономической безопасности авиатранспортных предприятий.
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В статье исследована эффективность обеспечения экономической безопасности авиатранспортного предприятия от влияния рисков совершения актов незаконного вмешательства в деятельность гражданской авиации.

Ключевые слова: авиатранспортное предприятие; акт незаконного вмешательства; авиационная безопасность; риск; угроза; экономическая безопасность; эффективность.

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