ISSN NO: 2770-4491
Date of Publication:10-11-2023

The Solution of Economic Tasks with the Help of Probability Theory.

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Abstract. The article deals with economic problems, the solution of which occurs using probability theory. The process of solving some economic problems with the help of probability theory is shown. The authors, using the example of an economic problem solved with the help of the formula of total probability, described in detail the course of its solution. An example of an economic problem solved using the Bernoulli formula with a complete description of the problem solution itself is also given. The article noted the importance of economists owning this material, since the correct application of the methods of probability theory helps to correctly predict the possibility of success or failure with maximum accuracy. In this regard, the authors boldly emphasize that economists need knowledge of the theory of probabilities for application in their professional activities, which will help improve the efficiency of the economy.
Keywords: probability theory, probability, total probability, Bernoulli formula, economics, economic tasks

At all times, people had needs for benefits. In the modern world in connection with the increasing needs of the population, there is a need to expand the market of goods and services, which entails the development of economic science.

The economy is a science that studies, how people use existing limited resources to satisfy their unlimited needs for life benefits.

- what goods and services should be produced and in what quantity
- how and with the help of what resources goods and services will be produced

for whom to produce services and goods.

Despite the fact that economic science has existed for more than a century and has a large theoretical base, it is not able to anticipate changes in the future and give accurate forecasts. This is due to the fact that many economic indicators are of the nature of random deviations. therefore economists calculate the most profitable option with high accuracy, it is necessary apply knowledge of probability theory.

Probability theory is a science that studies patterns in mass random events. The random event is called any fact that may or not occur under a certain set of conditions. The totality of all conditions under which one or Another event is defined as experience or experiment.

The probability is considered as a certain criterion of the possibility a certain event. Possible probability values change in the range from 0 to 1. The event, the probability of occurrence which is equal to 0, called impossible, that is, this event will never happen under given conditions. The event with Vegs 1 is considered reliable, we are talking about events that must will occur under these conditions

Events, one of which is necessarily It will occur as a result of experience, make up a full group. The sum of the values of the probabilities of the occurrence of events from the complete groups are equal to one. For example, if the probability of increasing the price of goods in the coming month is $0,3$, and the probability the fact that the price will remain unchanged $-0,65$ The probability of price reduction is easy to find. Since these events make up full group (one of them is required will happen), then the probability that the price the goods will decrease, equal to $0,05$, since $1-0,3-0,65=0,05$.

The amount of the probability of the occurrence of the event and the likelihood that it will not happen, also equal 1 since only one is possible of the options: an event will come or not.

In practice, we are dealing with independent events, that is, one event is not affects the appearance of another, and dependent, when the onset of events is interconnected.

To solve problems, they use the formulas for folding probabilities when it is necessary to find the probability of at least one event, and the formula for multiply probabilities, if the joint occurrence of events is important.

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When solving problems with independent events, we work with the probabilities of the appearance of one or more events outside depending on others. There are situations When it is necessary to find the probability of a certain number of events.

Consider the task with independent events. Two organizations produce the same products. The probability that AC “Stroystaya” will come out not the world market, equal to $0,6$ and the probability of access to the world the level of PJSC “Stroyopttorg” is $0,7$. Find the likelihood that only one organization will enter the world market

To solve this problem, we note the events mentioned in the problem:

$A-$ an event that the organization JSC will enter the world market,

$B-$ an event that PJSC “Stroyopttorg”

The organization will reach the world market.

We are dealing with the events:

A_1 - an event that the organization JSC will enter the world market, while PJSC “Stroyopttorg” will not enter the world market,

B_1 - event that PJSC “Stroyopttorg” the organization will enter the world market, and JSC “Construction” will not reach the world market.

We determine the probability of these events:

$$P(A_1)=P(A)\cdot P(B)=0,6\cdot(1-0,7)=0,6\cdot 0,3=0,18$$

$$P(B_1)=P(B)\cdot P(A)=0,7\cdot(1-0,6)=0,7\cdot 0,4=0,28$$

Now we will find the sum of these probabilities, since it does not matter to us which exactly the event out of two will occur:

$$P(A_1+B_1)=0,18+0,28=0,46$$

Answer: the probability that only One of the organizations will come to the world the market is $0,46$.

Often the likelihood of an event depends on another event. If an event and can only occur together with one of the other events $(H_1,H_2,...,H_n)$, forming a full group, then the formula finding probability will look like in the following way:

$$P(A)=P(H_1)\cdot PH_1(A)+P(H_2)\cdot PH_2(A)+...+P(H_n)\cdot PH_n(A)$$

This formula is called the formula of complete probability, and the events $H_1,H_2,...,H_n$ gypotheses.

We give an example of an economic problem solved using the formula of complete probabilities. The economist believes that the likelihood of an increase in the value of shares of some the company next year will be equal $0,75$, if the country’s economy is on the rise; And this same probability will be $0,3$, If the country's economy is not successful develop. The probability of economic the rise in the new year is $0,8$. Estimate the probability that the company's shares will rise in price next year.

To solve this problem, it is necessary to choose the events in question in the problem:

$A-$ is an event that the company’s shares will rise in price next year.

Next, we determine the hypotheses:

H_1- a hypothesis that the country's economy will be on the rise,

H_2- hypothesis that there will be no successful development of the economy.

We determine the probability of hypotheses:

$P(H_1)=0,8$ (according to the condition); $P(H_2)=1-0,8=0,2$ since these events form a full group.

From the condition, the probability of the occurrence of an event in the implementation of hypotheses is known:

$$PH_1(A)=0,75 \quad PH_2(A)=0,3$$

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Applying the formula of complete probability, we find the probability of increasing price the company's shares next year:

$$P(A)=P(H_1)\cdot PH_1(A)+P(H_2)\cdot PH_2(A)$$

$$P(A)=0,8\cdot 0,75+0,2\cdot 0,3=0,66$$

Answer: The probability that the company's shares will increase in price next year, equal to $0,66$.

Also in economic practice, one has to work with the sequence events whose probability does not depend From the onset of others. The probability of such events is calculated by the Bernoulli formula

$$P(A)=C_n^m\cdot p^m\cdot q^{n-m}$$

where $n-$ is the total number of outcomes

$m-$ is the number of favorable outcomes,

$p-$is the likelihood of a favorable outcome,

$q-$ probability of the opposite outcome occurring

C_n^m- is the number of ways to choose a combination, which includes the necessary combination of favorable and opposite their events.

An example of an economic problem solved using the Bernoulli formula. There are 10 commercial banks in the city. Everyone has it the risk of bankruptcy during the year is 10 %. What is the probability that more than one will go bankrupt during the year jar?

In this task, 11 events can be distinguished: an event that will go bankrupt 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 banks. All these events make up a full group, since one of them will certainly occur. Hence, the amount of probability of all events is 1. Thus, to answer the question tasks, you can find the probability that 1 bank will go bankrupt and the likelihood that more than one bank will not go bankrupt, and subtract them the amount from the unit

We will define the events that we will consider:

$A-$ an event that more than one bank will go bankrupt during the year,

$B-$ an event that during the year there are not one the bank will not go bankrupt

$C-$ *an event that 1 bank will go bankrupt during the year.*

We found out that

$$P(A)=1-\left(P(B)+P(C)\right)$$

We will use the Bernoulli formula for finding the probability of event b, substituting the necessary values

$n=10$, since in total 10 banks;

$m=0$, since we consider the option that more than one bank will not go bankrupt;

$p=0,1$, since it is said that

the probability of an event that the bank will go bankrupt is 10% (10% of $1-0,1$);

$q=1-0,1=0,9$ - the probability that the bank Do not go bankrupt.

$$P(B)=C_{10}^0\cdot 0,1^0\cdot 0,9^{10-0}\approx\frac{10!}{0!(10-0)!}\cdot 1\cdot 0,349\approx 0,349$$

Now we find the probability of the event C. In this case, the variables take the following values: $n=10,\ m=1,\ p=0,1\ \ q=0,9$

$$P(C)=C_{10}^1\cdot 0,1^1\cdot 0,9^{10-1}\approx\frac{10!}{1!(10-1)!}\cdot 0,1\cdot 0,387\approx 0,387$$

We find the probability of event a:

$$P(A)=1-(0,349+0,387)=0,264$$

Answer: The probability that during more than one bank will go bankrupt, equal to $0,264$.

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We examined some cases of the application of probability theory when solving economic tasks. In practice, economists often encounter tasks for which the knowledge of the theory of probabilities is needed for solving.

Thus, the economy is closely intertwined with the mathematical sciences, the theory of probability is no exception. This section of mathematics is widely used in the economy, helps to calculate the possibility of success or failure with maximum accuracy. Therefore, we can say that economists need knowledge Probability theory for use in their professional activities, which will help increase the efficiency of the economy.

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