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经济危机理论
THEORY OF THE ECONOMIC CRISES

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The author's earlier articles demonstrated that in order to describe the processes taking place within a country's economy this economy can be viewed as the volume of the economic shell. This article considers a country's GDP as the surface area of the economic shell [1].

GDP can be calculated by estimating the surface area S_{su}, which is affected by external forces P. To perform the calculation, we used four variables, i.e. S_{su} (GDP_{su}) = f(X1, X2, X3, X4). Here we have X1, X2, X3 and X4, the variables that influence the country's GDP.

It should immediately be noted that during calculation and plotting of construction drawings, the parameters of X1, X2, X3 and X4 could be constant values, increase or decrease by 10 times. On the basis of the calculations made, 81 graphics were built, which can be divided into the four following groups:

- variable values X1, X2, X3 and X4 increase and are constant;
- variable values X1, X2, X3 and X4 decrease and are constant;
- variable values X1, X2, X3 and X4 decrease and increase;
- variable values X1, X2, X3 and X4 are constant, they decrease and increase.

Figure 1 represents a two-dimensional graph of the dependence S_{su} (GDP_{su}), where X1 = X2 = X3 = 1 and X4 = 0,1…0,99, which shows that the initial values of S_{su} increase gradually from 14,58 to 23,77 in point 9, and then increase considerably to 102,86, i.e. more than three times 3,22. Figure 2 shows one 3D graph, which allows us to see the changes of S_{su} more clearly. In this case, it makes sense for us to have the values of the rightmost points, as at these values the value of S_{su} (GDP_{su}), i.e. GDP, will be at its maximum. Figure 2 is plotted with the use of variables X3 and X4, i.e. S_{su} (GDP_{su}) = f(X3, X4).

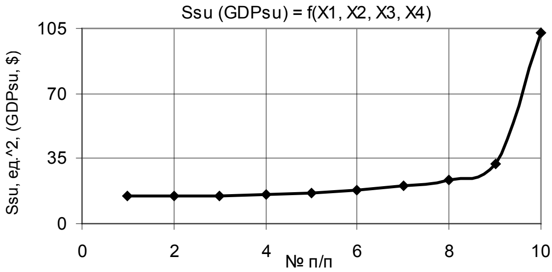


Figure 1. *S_{su} (GDP_{su}) = f(X1, X2, X3, X4)*
when X1 = X2 = X3 = 1, X4 = 0,1…0,99

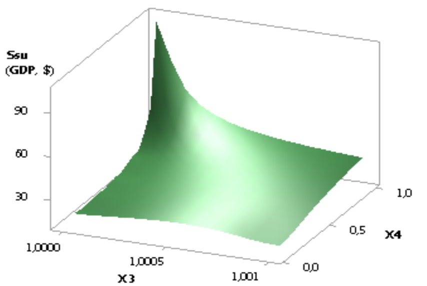


Figure 2. *3D graphic: S_{su} (GDP_{su}) = f(X3, X4)*
when X1 =X2 = X3 = 1, X4 =0,1…0,99

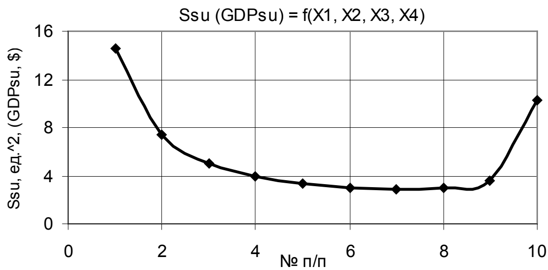


Figure 3. *S_{su} (GDP_{su}) = f(X1, X2, X3, X4)*
when X1 = X2 = 1, X3 = 1…10, X4 = 0,1…0,99

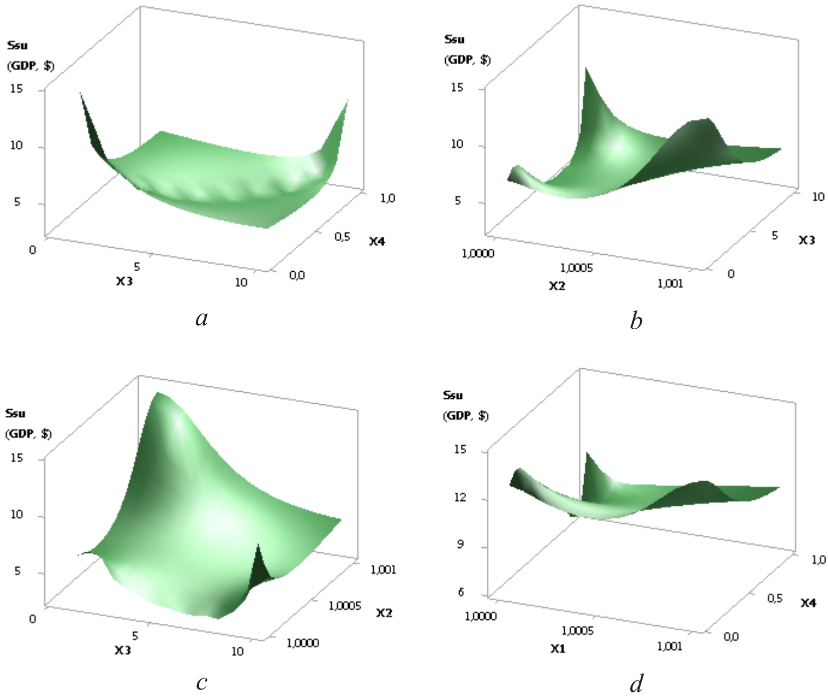


Figure 4. *3D graphics: a - S_{su} (GDP$_{su}$) = f(X3, X4); b - S_{su} (GDP$_{su}$) = f(X2, X3);*
c - S_{su} (GDP$_{su}$) = f (X3, X2); b - S_{su} (GDP$_{su}$) = f (X1, X4)
when X1 = X2 = 1, X3 = 1…10, X4 = 0,1

The following Fig. 3 shows that first, at X1 = X2 = 1, X3 = 1…10, X4 = 0, 1 …0,99, the plotted curve S_{su} decreases fivefold from 14,58 to the minimum of Ssumin = 2,88 in point 7, and then it drastically increases 3,4 times to 10,29. Figure 4 demonstrates four forms of this dependence as three-dimensional graphs. Here we must note that the form of the 3D graph depends on the choice of the applied axes sequence. For example, in Fig. 4*b* and 4*c* we can see 3D graphs with the same variables X2 and X3, but with different axes sequences. As we can see, these two graphs' appearances differ significantly. Based on Fig. 3, it makes sense for us to have the values of the extreme points, as at these values the value of Ssu (GDP$_{su}$) will be at its maximum.

The plotted curve in Fig. 5 demonstrates that here the values of Ssu (GDP$_{su}$) at X1 = X2 = 1…10, X3 = 1 and X4 = 0,99 are rather high, from 102,86 to 102861,38, i.e. they have increased more than 1000 times. Figure 6 shows the plotted 3D graph.

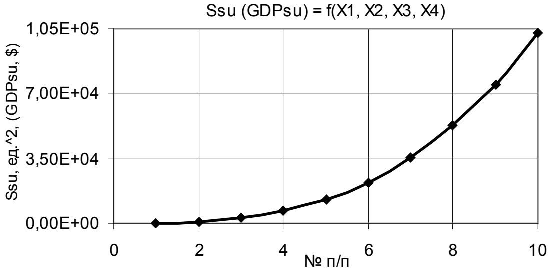


Figure 5. *S_{su} (GDP$_{su}$) = f(X1, X2, X3, X4) when X1 = X2 = 1…10, X3 = 1, X4 = 0,99*

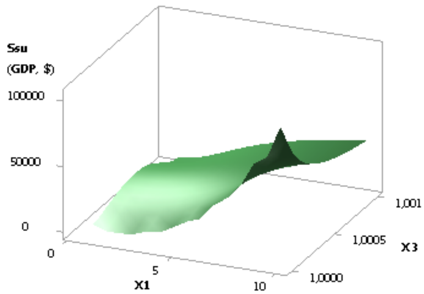


Figure 6. *3D graphic: S_{su} (GDP$_{su}$) = f(X1, X3); when X1 = X2 = 1…10, X3 = 1, X4 = 0,99*

Figure 7 demonstrates the dependence of S_{su} (GDP$_{su}$) at X1 = 1, X2 = X3 = 1…0,1 and X4 = 0,1…0,99. As we see from the Figure, at first the values of S_{su} (GDP$_{su}$) decrease according to the linear dependence from 14,58 to their minimum of 6,39 at point 9. Then they increase in steps up to 10,29. Figure 8 shows two 3D graphs S_{su} (GDP$_{su}$) = f(X2, X1) and S_{su} (GDP$_{su}$) = f(X1, X4) respectively. At the given values of the variables, it also makes sense to choose the extreme point values in Fig. 7, which allows us to have the maximum values of S_{su} (GDP$_{su}$).

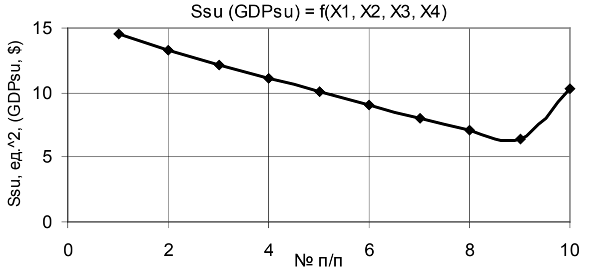
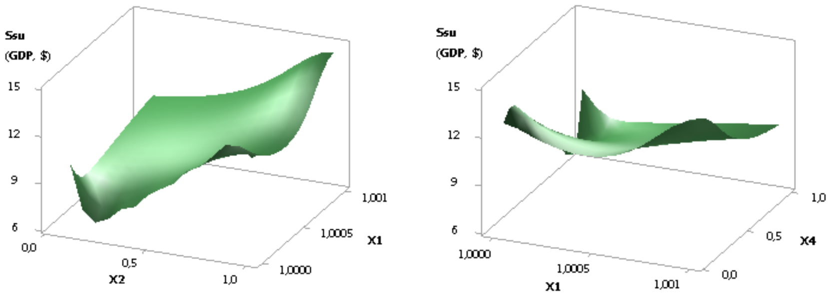


Figure 7. *S_{su} (GDP$_{su}$) = f(X1, X2, X3, X4)*
when X1 = 1, X2 = X3 = 1…0,1, X4 = 0,1…0,99



a *b*

Figure 8. *3D graphics: a - S_{su} (GDP$_{su}$) = f(X2, X1); b - Ssu (GDPsu) = f(X1, X4)*
when X1 = 1, X2 = X3 = 1…0,1, X4 = 0,1…0,99

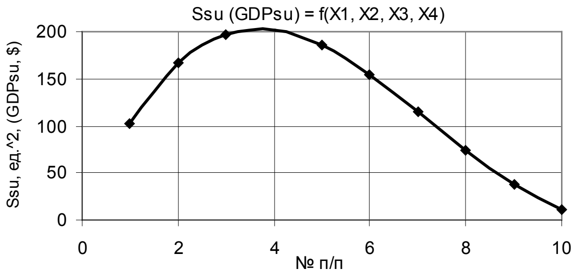
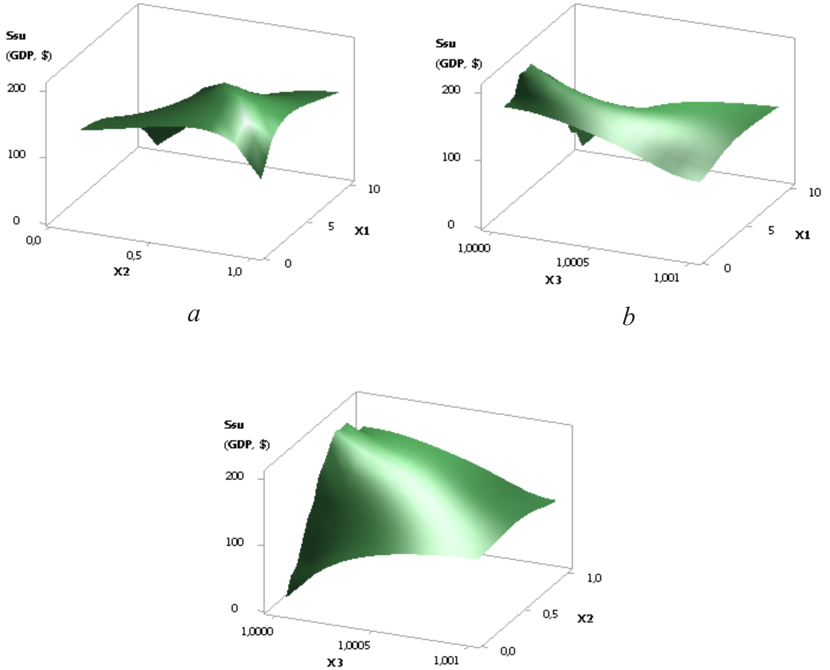


Figure 9. *S_{su} (GDP$_{su}$) = f(X1, X2, X3, X4)*
when X1 = 1…10, X2 = 1…0,1, X3 = 1, X4 = 0,99

The following Fig. 9 shows that first the values of S_{su} here increase from 102,86 to their maximum of 201,64 in point 4, and then they gradually decrease to the value of 10,29, i.e. go down nineteenfold. Figure 10 represents three 3D graphs for S_{su} (GDP$_{su}$) = f(X2, X1), S_{su} (GDP$_{su}$) = f(X3, X1) and S_{su} (GDP$_{su}$) = f(X3, X2) respectively.



a *b*

c

Figure 10. *3D graphics: a - S_{su} (GDP$_{su}$) = f(X2, X1); b - Ssu (GDP$_{su}$) = f(X3, X1);*
c - S_{su} (GDP$_{su}$) = f(X3, X2)
when X1 = 1…10, X2 = 1…0,1, X3 = 1, X4 = 0,99

In Fig. 11 we can see that the plotted curve S_{su} (GDP$_{su}$) increases gradually from the value of 102,86 to its maximum of S_{sumax} = 309,72 in point 7, and then it decreases 2,12 times to the value of 145,82. This Figure was plotted at the following values of the variables: X1 = 1…0,1, X2 = 1…10, X3 = 1, X4 = 0,99…0,1.

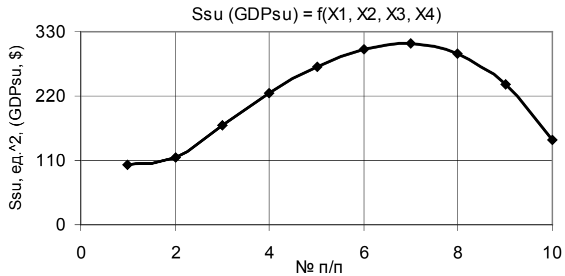
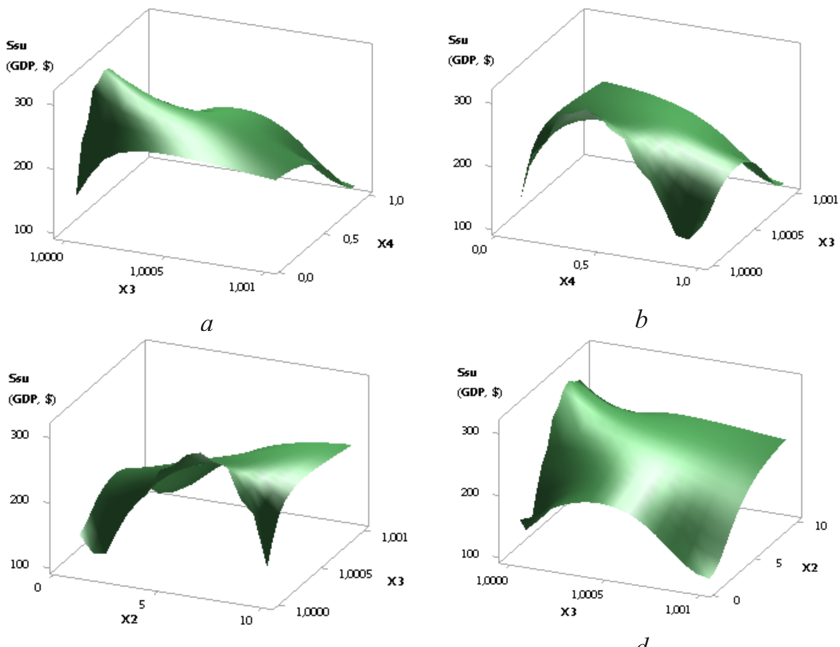


Figure 11. *S_{su} (GDP$_{su}$) = f(X1, X2, X3, X4)*
when X1 = 1…0,1, X2 = 1…10, X3 = 1, X4 = 0,99…0,1



a *b* *c* *d*

Figure 12. *3D graphics: a - S_{su} (GDPsu) = f(X3, X4); b - S_{su} (GDPsu) = f(X4, X3);*
c - S_{su} (GDPsu) = f(X2, X3); b - S_{su} (GDP$_{su}$) = f(X3, X2)
when X1 = 1…0,1, X2 = 1…10, X3 = 1, X4 = 0,99…0,1

For Fig. 9 and 11, it makes sense to choose the values of the variables that are close to their maximum points.

The last Fig. 12 represents four 3D graphs of S_{su} (GDP_{su}), and here Figures 12*a* and 12*b*, as well as 12*c* and 12*d* are plotted with the axes modified.

After the calculations were made, their results were gathered into a summary Table, which contains 95 lines despite the fact that 81 two-dimensional graphs were plotted. The reason for this is a number of plotted graphs having maximums and minimums.

This summary Table includes such ratios as:

- S_{sub}…S_{suf}, where S_{sub} is the initial value of the economic shell surface area, units2; S_{suf} is the final value of the economic shell surface area, units^2;
- S_{suf}/S_{sub} is the ratio of the final value of the economic shell surface area to the initial one.

The ratio of the final value of the economic shell surface area S_{suf} to the initial one S_{sub} shows what fold their values increased (decreased) as affected by various external forces. Thus, having these data we can choose the values of the variables X1, X2, X3 and X4 at which the economic shell surface area will stay unchanged or even increase under the influence of external forces. Thus, during the economic crisis, the selected variable values will allow preserving the country's GDP_{su} at the same level, or even increasing it.

After the summary Table with 95 lines was plotted, it was transformed the following way, and only the values where $S_{suf}/S_{sub} \geq 1$ were left. On the basis of this transformation, we obtained the final summary Table, which included 48 lines. Thus, we obtained 48 variants that allow countries to come out of yet another economic crisis. Below, you can see Table 1, which includes only a part of the summary Table with 22 lines. Here the ratios S_{suf}/S_{sub} in the last column are given in descending order.

Table 1 shows that there are two variants at which GDP of a country will not change in the time of an economic crisis, even if we change the variables. These lines are 21 and 22, where the ratios $S_{suf}/S_{sub} = 1$.

Table 1. *Statistics of theoretical relation S_{suf}/S_{sub} where $S_{suf}/S_{sub} \geq 1$*

No. in sequence	X1, unit	X2, unit	X3, unit	X4, unit	S_{sub} … S_{suf}, unit^2 (GDP_{sub}…GDP_{suf}), $	S_{suf} / S_{sub} (GDP_{suf}/ GDP_{sub})
1.	1…10	1…10	1…0,1	0,1…0,99	14,58…1,029E+06	70539,88
2.	1…10	1…10	1…0,1	0,99	102,86…1,03E+06	10000,00
3.	1…10	1…10	1	0,1…0,99	14,58…1,03E+05	7053,99
4.	1	1…10	1…0,1	0,1…0,99	14,58…1,03E+05	7053,99
5.	1…10	1…10	1	0,99	102,86…1,03E+05	1000,00
6.	1	1…10	1…0,1	0,99	102,86…1,03E+05	1000,00
7.	1	1…10	1	0,1…0,99	14,58…10286,14	705,40
8.	1…10	1	1…0,1	0,99	102,86…10286,14	100,00
9.	1	1…10	1	0,99	102,86…10286,14	100,00
10.	1…10	1	1	0,1…0,99	14,58…1028,61	70,54
11.	1…0,1	1…10	1	0,1…0,99	14,58…1028,61	70,54
12.	1…10	1	1…0,1	0,99…0,1	71,02…1458,20	20,53
13.	1…0,1	1…10	1	0,99	102,86…2016,08	19,60
14.	1	1…10	1	0,99…0,1	102,86…1458,20	14,18
15.	1…10	1	1	0,99	102,86…1028,61	10,00
16.	1	1	1…0,1	0,99	102,86…1028,61	10,00
17.	1	1	1	0,1…0,99	14,58…102,82	7,05
18.	1	1	1…0,1	0,99…0,1	28,75…145,82	5,07
19.	1…10	1	1	0,99…0,1	63,92…145,82	2,28
20.	1…10	1…0,1	1	0,99	102,86…201,61	1,96
21.	1…10	1	1…10	0,99	102,86…102,86	1,00
22.	1…0,1	1	1…0,1	0,99	102,86…102,86	1,00

Now let us transform Table 1 into Table 2, and for this we will group the lines according to the number of variables they include. Thus, Table 2 includes the following four groups: with 1 variable; with 2 variables; with 3 variables and all the variables.

Table 2. *The statistics of constant parameters for Ssuf/Ssub in descending order*

No. in sequence	X1, unit	X2, unit	X3, unit	X4, unit	S_{sub} … S_{suf}, unit ^{2} (GDP_{sub}…GDP_{suf}), $	S_{suf} / S_{sub} (GDP_{suf} / GDP_{sub})
1 variable						
1.	1…10	1…10	1…0,1	0,99	102,86…1,03E+06	10000,00
2.	1…10	1…10	1	0,1…0,99	14,58…1,03E+05	7053,99
3.	1	1…10	1…0,1	0,1 …0,99	14,58…1,03E+05	7053,99
2 variables						
4.	1…10	1…10	1	0,99	102,86…1,03E+05	1000,00
5.	1	1…10	1…0,1	0,99	102,86…1,03E+05	1000,00
6.	1…0,1	1…10	1	0,1…0,99	14,58…1028,61	70,54
7.	1…10	1	1…0,1	0,99…0,1	71,02…1458,20	20,53
8.	1	1…10	1	0,1…0,99	14,58…10286,14	705,40
9.	1…10	1	1…0,1	0,99	102,86…10286,14	100,00
10.	1…10	1	1	0,1…0,99	14,58…1028,61	70,54
11.	1…0,1	1…10	1	0,99	102,86…2016,08	19,60
12.	1	1…10	1	0,99…0,1	102,86…1458,20	14,18
13.	1	1	1…0,1	0,99…0,1	28,75…145,82	5,07
14.	1…10	1	1	0,99…0,1	63,92…145,82	2,28
15.	1…10	1…0,1	1	0,99	102,86…201,61	1,96
16.	1…10	1	1…10	0,99	102,86…102,86	1,00
17.	1…0,1	1	1…0,1	0,99	102,86…102,86	1,00
3 variables						
18.	1	1…10	1	0,99	102,86…10286,14	100,00
19.	1…10	1	1	0,99	102,86…1028,61	10,00
20.	1	1	1…0,1	0,99	102,86…1028,61	10,00
21.	1	1	1	0,1…0,99	14,58…102,82	7,05
all the variables						
22.	1…10	1…10	1…0,1	0,1…0,99	14,58…1,029E+06	70539,88

The obtained Table 2 gives us a clear idea that it suffices to change even one variable out of four for the country to successfully come out of an economic crisis.

Thus, depending on the number of variables applied, Table 2 allows us to use a different number of variants:

- with 1 variable (3 variants);
- with 2 variables (14 variants);
- with 3 variables (4 variants);

- all the variables (1 variant).

As we can see, the largest number of variants is available for two variables. However, if we apply all the variables to come out of an economic crisis, in this case we will have the strongest economic effect.

Reference

1. Pil E.A. Theory of the financial crises. // International Scientific and Practical Conference. Topical researches of the world science (June 20 -21, 2015) Vol. IV Dubai, UAE. – 2015 – p. 44-56.