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Index of the Economic Interaction Effectiveness between the Natural Monopoly and Regions. II. Numerical Experiments

Alexander Ivanov

Ural Federal University
Office 607, Turgeneva str. 4,
Ekaterinburg, Russia, 620075
ardenIvanov@gmail.com

Abstract

In this paper, we perform verification methodology for determining economic interaction effectiveness index. That indicator determines the quality of the interaction regions with natural monopolies, assessing the effect of the implementation of projects of the program interaction.

Keywords: Natural monopoly, interaction index

1 Introduction

Let's consider the simplest case of the relationships among the sandwich-model (layered model) elements when interaction takes place within the selected elementary tube between two economic entities – nodes P_0 and P_1, lying on the different functional planes – the natural monopoly plane and the other economic entities plane, fig. 1.

The proposed method of the effectiveness index k calculation based on next factors: the revenue $S_{\mathrm{d}}^{(1)}$ from indirect lending of the node P_1; p_1 is the stability factor [1 - 9] of the involved enterprise; $\Delta V^{(1)}$ is the total increase of the produced production volume at the invested enterprise P_1 planned in the result of project implementation; $\frac{\Delta v^{(1)}}{t}$ is the aftereffect, the measure of the expected benefits; D_{dep} is the possible guaranteed income; $0 < \lambda < 1$ is the extent of linkage the invested project with other projects and programs of the region.

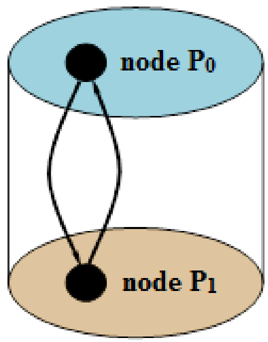

Fig. 1.An elementary tube. The simplest case.

It is obvious that the effectiveness index k determined by the given above expression is a dimensionless value. It is easy to understand because there are values of the same "physical" dimensions in the numerator and denominator – ruble per unit of time. Beside that the linkage coefficient and the stability factor, that are multiplicands in the proposed expression, are dimensionless values.

It is clear that all multiplicands enclosed in the square brackets in the expression

$$k = \left[\frac{\frac{1}{T}\sum_{i=1}^{T}\left((S_{\text{d}}^{(1)})_i + \alpha \cdot (\Delta v^{(1)})_i\right)}{\frac{1}{T}\sum_{i=1}^{T}\left((S_{\text{d}}^{(1)})_i + \alpha \cdot (\Delta v^{(1)})_i\right) + \frac{1}{T}\sum_{i=1}^{T}(D_{\text{dep}})_i}\right] \cdot [p_1] \cdot \left[\frac{1+\lambda}{2}\right]$$

2 Numerical experiments

It is easy to observe that the growth of the total sum profit $\sum_{i=1}^{T}\left((S_{\text{d}}^{(1)})_i + \alpha \cdot (\Delta v^{(1)})_i\right)$ of the node P_0 (the natural monopoly) leads to the effectiveness ratio increase (fig. 2).

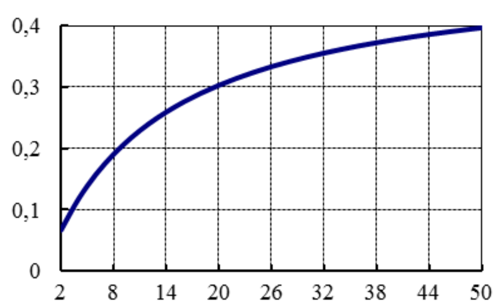

Fig. 2.7. Dependence of the effectiveness ratio from the total profit

Here are the graphs of the proposed effectiveness index dependence not from the total sum profit but from its individual components – from the indirect lending income and from the measure of projects consequences (benefits from the project implementation) (fig. 3.a,b).

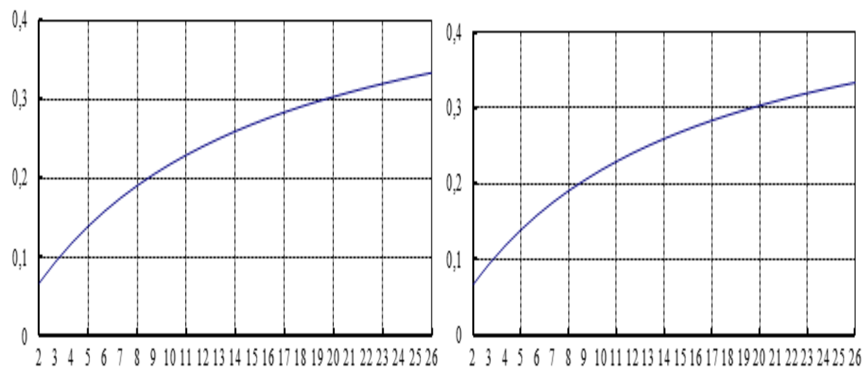

Fig. 3. a) Influence of the total sum profit on the stability factor,
b) Influence effectiveness index and the income from the project aftereffects

It should be noted that the effectiveness index depends from the measure of the project consequences in the same way.

Fig. 4 shows the surface over the definitional domain in coordinates (the direct income from the funds redirection; profit from an aftereffect). It is easy to see the ratio of the significance for the effectiveness index of the one and another argument. Let's also note that the income from funds redirection is always a basically limited value, whereas the benefit from project aftereffect could be arbitrarily high.

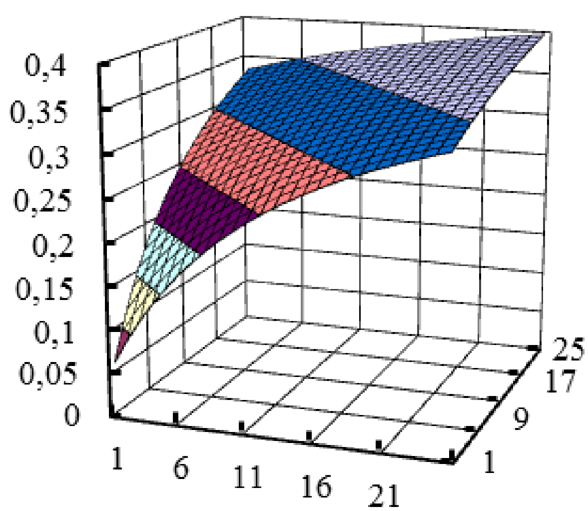

Fig. 4. Dependence of the effectiveness index
from the loan's incomes and aftereffects

The same qualitative dependence (effectiveness ratio increases with parameters growth) is available for the proposed effectiveness ratio relative to the stability factor of the implementer p_1 (fig. 5) and the linkage coefficient λ (fig. 6). The effectiveness index increases with their growth. There are only linear dependences. However, one should notice that the effectiveness ratio linearity from these parameters is a subject of the following researches.

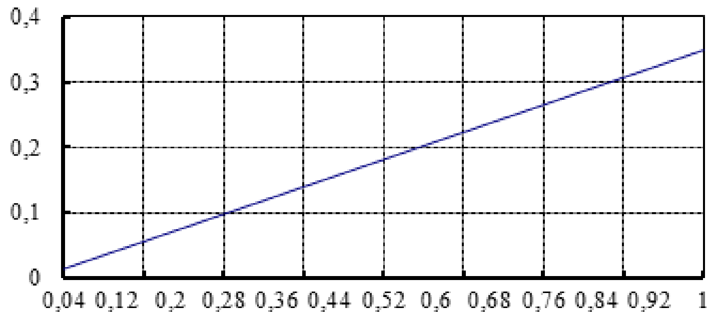

Fig. 5.The effectiveness index changing connected with the change of implementer p_1

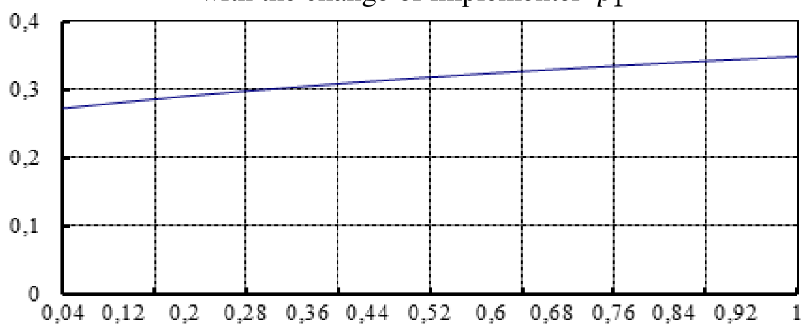

Fig. 6. The effectiveness index changing depends on the change of the linkage coefficient λ

On the contrary, the greater the sum of guaranteed alternative income $\sum_{i=1}^{T}(D_{\text{dep}})_i$ is, the smaller value of the total effectiveness ratio k is. The qualitative inverse dependence is shown at the fig. 7.

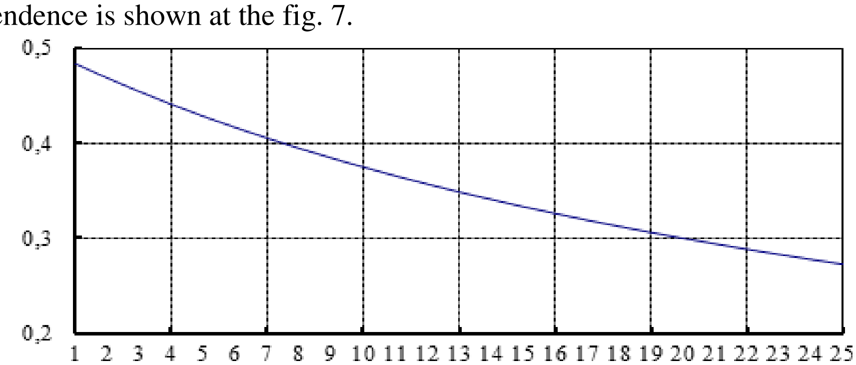

Fig. 7. Dependence of the stability factor on the level of the possible alternative profit $\sum_{i=1}^{T}(D_{\text{dep}})_i$

3 Conclusion

In conclusion it has to be noted that the carried out numerical experiments demonstrate the correspondence of the intuitive ideas about effectiveness of the one or another interaction and results received by means of the proposed method of effectiveness calculation.

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