

Niskanen Classical Model Implementation of the Office's Operations Evaluation

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Abstract. The economic downturn has caused fiscal tension in the country in recent years. Budget revenues decreased and it indicated the need for the revision and control of expenditure. Therefore, the issues related to the evaluation opportunities of governmental expenditure are becoming particularly urgent. It is emphasized that a key factor in public sector's performance is the public good, which ensures services of government institutions, and encompasses both quantitative and qualitative aspects. However, economic researches on the public sector's performance efficiency focus on problems related to the determination of the public good as well as activate the possibility for its practical application. The US economist W.A. Niskanen mathematically grounded the bureau performance balance-shaping principles in the context of possibilities for evaluation of public administration, i.e. the situation in which the institution's performance can be evaluated as effective. In order to evaluate efficiency aspects of the public sector's performance as well as their potential impact on the formation process of the state budget spending part, the authors of the research put forward the following objective – to perform mathematical calculations of bureau performance balance-shaping principles, grounded by the US economist W. A. Niskanen, and to assess the model's potential opportunities for practical application. As a research novelty, the developed practical application software of Niskanen's classical model of bureau performance is presented in MATLAB environment.

Keywords: governmental expenditure, Matlab, Niskanen model, public good, public sector's performance efficiency.

I INTRODUCTION

The state budget reflects governmental expenditure and the income ensuring the expenditure. However, in the state finance theory and practice the biggest attention is paid to the expenditure, emphasizing the most important argument - the most efficient budget reforms are possible exactly in the sphere of governmental expenditure, because states' budget expenditure traditionally include so called unproductive expenses as well as uncontrollable expenses and the main task of governments is to reduce them.

It should be emphasized that it is especially important for a number of developed countries because they cannot ensure sufficient income from taxes if the economic situation gets worse. Consequently there is an increase in the budget deficit and loans become the main source of income. Thus, governmental expenditure and potential possibilities of reducing it have become topical in the aspect of state finances.

In the present situation the problems of forming budget expenditure have become highly topical in Latvian state finance sphere. They are related to following aspects:

- categorical terms of fiscal consolidation set a clear necessity for the reduction of budget expenditure;
- structural reforms of state administration aimed to limit governmental expenditure.

It should be stressed that in course of time different opinions were offered in order to reflect this issue in the context of planning budget expenditure. The most popular one is the model of budget maximization or the classical model of bureau performance offered by the American economist W.A. Niskanen [1], in which the author studies the influence of clerks' performance on public finances; studies of French economists J.L. Migue and G. Belenger where the most essential attention is paid to unproductive budget expenditure that negatively influences the efficiency of budget expenditure [1],[2],[6]. At the beginning of the 21st century there appeared new opinions on the formation of budget expenditure where potential solutions were offered by Japanese economists H. Shibata and A. Shibata, marking them as possibilities of minimizing budget bureaucracy [4].

Thus, one of the most dominant issues in the state finance theory and practice is the issue of productivity of the state budget expenditure and its evaluation options. The aforementioned aspects are especially topical in the present situation of economic and

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financial crisis when in the context of conditions of fiscal consolidation countries pay bigger attention to the management of state expenditure. Limited resources of state finances accentuate the problems of expenditure of state functions and their efficiency. Therefore, the most essential task is to carry out structural reforms in the state administration. The authors declare that they have to ensure not only the evaluation of the structure of state expenditure but also the revision of those management systems, which in course of time influenced the broadening of governmental functions and consequently the increase of states' budgets. Thus, the aspect of the results of public sector activities and the necessity of their evaluation becomes important.

The strengthening of the opinion that in the state administration there are limited possibilities to use evaluation elements of efficient and purposeful performance characteristic to the private sector caused the developed countries to gradually elaborate and introduce the system of productivity indices during the process of budget reforms with a purpose to ensure efficiency evaluation of the public sector administration. The conformity of the state administration performance to the needs of the society was set as its main criteria. According to the system of productivity indices the approach to the amounts of state budget finances and their efficiency should be justified, indicating the target of the use of financial funds, in the context of which the target results are planned and determined [3],[5].

It is emphasized that the most essential index in the evaluation of the public sector performance is the public benefit that ensures services of state institutions. It includes both quantitative and qualitative aspects. However, economic researches on the efficiency of the public sector performance indicate the problems of determining the public good as well as emphasize the possibility of its practical application [5].

In order to evaluate aspects of the efficiency of the public sector performance and their potential influence on the process of making state budget expenditure, the authors of the research set a target – to do mathematic calculations of the balance principles of bureau performance grounded by the American economist W.A. Niskanen and evaluate their possibilities of practical application.

The tasks of the research are subordinated to the aim of the research:

- To study the theoretical ground of W.A. Niskanen's classical model of bureau performance.
- To make the program realization of the practical application of the model.
- To summarize the results and draw conclusions.

In order to achieve the aim and implement the tasks the following research methods are used: content analysis, logically-constructive, mathematical

modelling on the basis of the study of opinions existing in economic literature.

II THEORETICALLY MATHEMATIC SUMMARY OF W.A.NISKANEN'S CLASSICAL MODEL OF BUREAU PERFORMANCE

In the 90s of the 20th century the American economist W.A. Niskanen, after having studied the factors influencing the formation of the governmental budget expenditure, emphasized the importance of the civil service or bureaucracy, which is characterized by distinctive instincts of self-protection and self-preservation and all of it influence the possibilities of clerks in the formation of the state budget expenditure. In the context of evaluation possibilities of the state administration performance, the economist mathematically grounded the balance principles of bureau performance, that is, a situation when the performance of an institution can be evaluated as efficient [2].

The classical model of bureau performance offered by W.A. Niskanen accentuates main indices that influence efficiency of the institution's performance: expenditure, amounts of allotted budget funds, services of the institution and the public good in general ensured by results of the institution's performance. The following aspects are emphasized in the model:

- Bureau is a monopolist in providing certain services.
- Bureau work is financed from the budget funds and is allotted by authority organs: government, parliament.
- The bureau has an essentially better access to the information on service costs than authority organs and such asymmetry of information creates a situation when the bureau is allotted bigger funds than it really needs.

The following aggregates are introduced:

- B – budget funds allotted to the bureau (*Budget*) that the society sees as a benefit from the amount of provided services Q , therefore, B is a function from bureau activities or the amount of services provided by the bureau.
- C – costs of the bureau (*Costs*), which also depend on Q .

Niskanen's model is based on the assumption that a complete information about $C=C(Q)$ is available only to the bureau, which tries to get the maximum amount of budget funds, but the dependence $B=B(Q)$ can be conceived only by those who grant finances.

The mathematical description of Niskanen's model is as follows. The formulas are introduced:

$$V = a - 2bQ \quad (1)$$

$$C = c + 2dQ \quad (2)$$

where V – the maximum good for consumers;

C – the maximum costs of the bureau;

Q – the amount of services provided by the bureau;

a – the government readiness to pay for services of the bureau;
 b – the potential amplitude of changes of the parameter “ a ”;
 c – costs of the bureau;
 d – the potential amplitude of changes of the parameter “ c ”.

One can conclude that parameters a and b are related to the amounts of budget funds granted and used, but parameters c and d - to the costs ensuring the institution’s work. Regarding given conditions:

$$B = aQ - bQ^2 \quad (3)$$

$$TC = cQ + dQ^2 \quad (4)$$

where B – the total budget of the bureau and TC – total minimal costs of the bureau.

Regarding these conditions the Q balance level is determined in the following way: maximization gives the highest limit of Q : $Q = a/b$. The limitation that $B > TC$ gives the lowest level of Q : $Q = 2(a-c)/b + 2d$. These Q levels are the same at $a = 2bc/b - 2d$. Thereby, the balance level of services provided by the bureau is achieved at these conditions:

$$Q = \begin{cases} \frac{a-c}{b+d} & a < \frac{2bc}{b-d} \\ \frac{a}{2b} & a \geq \frac{2bc}{b-d} \end{cases} \quad (5)$$

Thus, W.A. Niskanen grounds mathematically the optimal amount of services provided by the bureau and accordingly granted budget funds and real costs of bureau actions. But it should be emphasized that the economist has accepted the following conditions as the most favorable ones: $a = 100$, $b = 1$, $c = 75$, $d = 0,3$, and has set the parameter “ a ” as the most important.

W.A. Niskanen’s classical principle of bureau performance balance at different values of the parameter “ a ” was verified in practice in the experimental part of the research. There is also included the calculation of the optimal value, which indicates the efficient work of the institution, that is, when the maximum good is provided to consumers of institution’s services. It is related to the maximal difference of the total budget of the institution and ultimate costs ($B-C$).

III PROGRAM REALIZATION OF PRACTICAL APPLICATION OF NISKANEN’S MODEL

A program support in *Matlab* environment was made in order to illustrate the classical model of bureau performance grounded by W.A. Niskanen. The programming language *Matlab* (www.mathworks.com) was used to implement the program environment. At Niskanen’s accepted conditions where $a = 100$, $b = 1$, $c = 75$ and $d = 0,3$, according to formulas (2), (3), (5) the following

optimum values were acquired: $Q = 124,2857$, $B = 4687,3469$ and $C = 149,5714$. It is graphically shown in Figure 1.

Figure 2 presents the interface of our program. After it is run, the main window will appear where fields for entering basic information are pictured (initial values are given by default).

The program requires entering parameters a , b , c , d indicated in Niskanen’s model and their increase values. Then the calculation process of the values Q , B , C of the given model is started and the optimal values of bureau performance balance accentuated in the model and their appropriate graphical diagram appear on the screen. At the same time all parameters a , b , c , d of the model and the calculated values of Q , B , C are written in the text file, which can be used to analyze the model numerically.

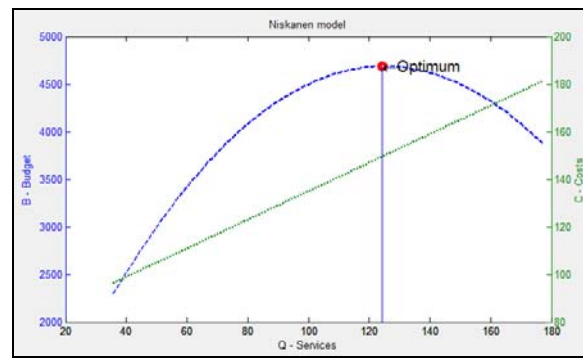


Fig. 1. Optimal values of the amount of services provided by the institution, budget funds and ultimate costs at Niskanen’s determined

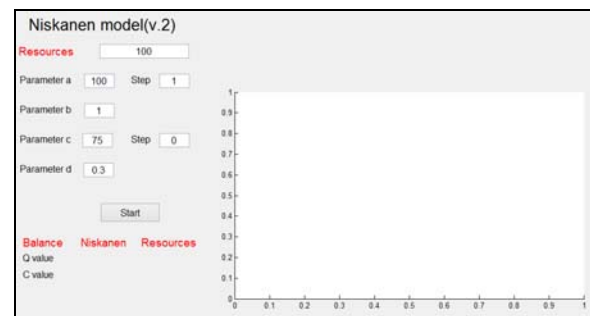


Fig. 2. Window of main basic information

If the data are entered correctly, one can begin the calculation procedure of values actualized in the model by clicking on *Start*. If the process is successful, the window will appear where the results of operation will be shown (Figure 3).

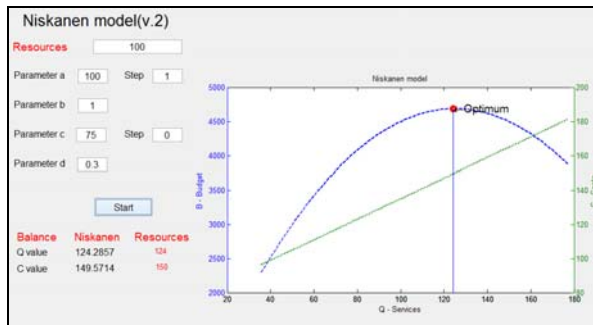


Fig. 3. Window of operation results

In the left bottom corner of the window the calculation results can be seen. They characterize Niskanen's principles of optimal balance of bureau performance at the initial values of a , b , c , d , that is, the values of Q and C (Figure 4).

Balance	Niskanen	Resources
Q value	124.2857	124
C value	149.5714	150

Fig. 4. Optimal values of the balance principle of the model

On the right side of the window the diagram is made, which shows the functions $B(Q)$ and $C(Q)$ (Figure 1). The dependency of B on Q is shown on the left side of the diagram; the calculated values of B appear on the left axis of coordinates. The function $B(Q)$ is shown by the blue stripy line. Accordingly, the dependency of C on Q is shown on the right side of the diagram and the calculated values of C are given on the right axis of coordinates. The dotted green line displays the function $C(Q)$. Simultaneously the optimum point is being calculated. It shows the maximum $B-C$ value (on the diagram it is shown as a red circle with a word *Optimum* next to it).

If the parameters of the model are changed, for instance, if the value 0,25 is entered in the box of *Parameter d*, the following results are acquired (Figure 5).

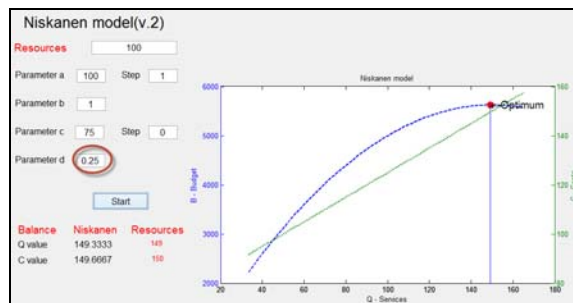


Fig. 5. Graphical interpretation of the model at the condition where $d=0,25$

After experimenting with different parameter values of a , b , c , d , it can be established that in the

most cases Niskanen's model does not achieve a balance and the optimum is not calculated. The diagram is made but it does not correspond to the balance principles of the model. For instance, after changing the parameter value of b to 10, the following results are acquired (Figure 6).

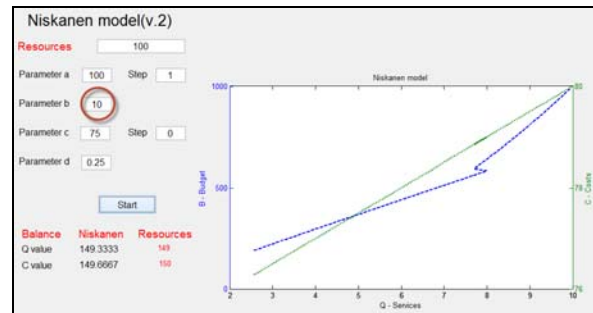


Fig. 6. Graphical interpretation of the model at the condition where $b=10$

Thus, it can be concluded that a trustable interpretation of Niskanen's model of bureau performance depends on the certain proportional changes of initial parameter values of a , b , c and d .

The results of program operation were written in the text file after each entering. The initial parameter values were determined: $a=100,00$ with a step = 1; $b=1$; $c=75$, with a step = 0; $d=0,30$. At these conditions the optimal situation, when the difference between B and C is the biggest, is achieved when the value of " a " is 162,00, the value of Q - 124,29, C - 149,57, B - 4687,35, and the difference of $B-C$ is 4537,78.

IV APPROBATION OF PROGRAM REALIZATION OF PRACTICAL APPLICATION OF NISKANEN'S MODEL

In order to approbate principles of Niskanen's classical model of bureau performance, the authors used financial indices of Latvian Ministry of Economics for the year 2011. They are structured in the following way (explanation of the law of the Republic of Latvia "On the state budget for the year 2011", part 5.3 [7]):

- Resources for covering the costs (111,6 millions monetary units), including:
 - Income from charged services - 0,78.
 - Financial aid from abroad - 0,65.
 - Grants from general income - 110,2.
- Expenditure - in total (114,8 millions monetary units).
- Financial balance: - 3,2 millions monetary units (it is planned to "cover" it with the increase or reduction of funds balance from charged services and other income).

Interpreting the above mentioned quantitative indices one can say that the index " a " (*the readiness of the government to pay for bureau services*) is 110,2 millions monetary units, but the costs of the bureau or

the index “ c ” -114,8 millions monetary units are bigger than the government is ready to ensure.

The task is to use Niskanen’s balance principles of bureau performance in order to find out which values of Q and C correspond to them. The result of the program realization were the following values of indices: Q – 136,9 millions monetary units, C – 164,8 millions monetary units (see Figure 7).

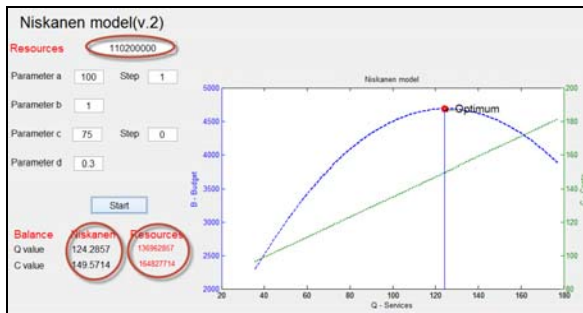


Fig. 7. Graphical interpretation of the financial indices of Latvian Ministry of Economics

It can be concluded that:

- According to the evaluation of the financial operations of the ministry, it needs 111,6 millions monetary units .
- 110,2 millions monetary units are granted from the state budget to ensure its work.
- On the basis of Niskanen’s balance principles of bureau performance, the optimal amount of services provided by the ministry is 136,9 millions monetary units (Q), but the ministry could declare 166,9 millions monetary units as the maximum cost (C).

Thus, it can be said that the amount of services provided by the ministry in the situation of balanced performance exceeds the amount of funds determined by the ministry and envisaged in the budget for covering necessary costs. It means that bigger financial resources are needed to ensure the functions of the ministry than they are at the moment. However, it should be stressed that according to Niskanen’s assumption, the ministry, when demanding budget funds, could operate with a bigger amount of necessary costs.

V THE RESULTS OF PROGRAM REALIZATION OF PRACTICAL APPLICATION OF NISKANEN’S MODEL OF BUREAU PERFORMANCE

1. After checking experimentally balance principles of the classical model of bureau performance with different values of parameters a , c and their increases b , d , it can be established that in the most cases Niskanen’s model does not reach the balance and correspondingly it is not possible to calculate optimal values. Curves are graphically constructed but they do not show the optimal situation (Figure 6).

2. On the basis of Niskanen’s balance principles of bureau performance at constant values of b , c , d , it can be concluded that after gradually increasing values of the parameter “ a ” and recording corresponding values of the amount of services (Q), maximal costs (C), total budget (B) and the difference between granted budget funds and costs ($B-C$), there can be seen a proportional increase in amounts of services provided by the bureau and its costs, as well as in the difference between common budget funds and maximal costs

3. The increase values of the parameter “ a ” are clarified, when, firstly, the difference between granted budget funds and costs is the biggest, which indicates the most favourable situation in bureau’s work and, secondly, when the corresponding index begins to decrease, which indicates the negative character of the efficiency of bureau’s work.

It can be concluded that the balance principle of bureau performance grounded by W.A.Niskanen works only at certain parameter values.

Possibility of practical application of Niskanens’s model:

1. Institutions that receive funds from the state budget can determine the amount of services provided and consequently the efficiency of their performance, which will be showed by the balance point of provided services, when the difference between granted budget funds and service-ensuring costs increases and reaches the maximum.
2. Niskanen’s model of balance principles of bureau performance can help to analyze the situation at certain parameters, creating a system-approach to the evaluation of state institutions’ work and consequently to the improvement of making budget expenditure. Thus, it can serve as a base model for the improvement of planning state budget expenditure.

VI CONCLUSIONS AND SUGGESTIONS

The conclusions and suggestions of the research follow from the evaluation of the possibility to apply Niskanen’s model of bureau performance in theoretical and practical ways.

1. Niskanen’s classical model of bureau performance accentuates main indices that influence the efficiency of institution’s work: costs, amounts of granted budget funds, services provided by the institution and the social good ensured by the performance of the institution in total.
2. Determining concrete initial parameter, that is, values $a=100,00$ with a $step=1,00$; $b=1,00$; $c=75,00$ with a $step=0$; $d=0,30$, the optimal situation, when the difference between B and C is the biggest, is achieved when the value of “ a ” is 162,00, the value of Q - 124,29, C – 149,57, B – 4687,35 and the difference $B-C$ is 4537,78.

3. With a help of the program realization for checking Niskanen's balance principles of bureau performance, it is possible to determine the efficiency of provided services and bureau performance from an institution financed from the state budget. It will be showed by the optimal point of provided services when the difference between granted budget fund and service-ensuring costs increases and reaches the maximum.
4. With a help of Niskanen's model of balance principles of bureau performance it is possible to analyze the situation according to certain parameters, thus ensuring a system-approach to the evaluation of state institutions' work and consequently to the improvement of making budget expenditure. Thus, it can serve as a base

model for the improvement of planning state budget expenditure.

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