Tax Policy as One of Instruments of Innovative Development of Macroeconomic System

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Abstract: Management of development is impossible without development of macroeconomic transformations strategy. In modern conditions instability, imbalance of economic system with subsystems and elements which constantly change are inherent in the states. Base of tax regulation strategy is connection of system, synergetic and cybernetic approaches, mathematical modeling, the qualitative and quantitative analysis. Approach is based at connection of marginal, neoclassical and Keynesian approaches. The problem is solved by instruments of mathematical modeling of a tax policy of the state through functioning of economic objects. The model of optimization of taxation is based on the conceptual scheme of process of the economic objects activity analysis by instruments of the mathematical modeling, developed for the description of the economic system. The conceptual multicriteria optimizing and imitating mathematical model is developed for determination of optimum macroeconomic parameters of a tax policy.

Key words: Management strategy of development • Macroeconomic modeling tax system • Dynamic multicriteria optimizing and imitating model

INTRODUCTION

Tax regulation of economy is the most important lever of development of the country. World financial crisis made this problem of one of the most important for many countries.

Action of taxes on a chain "savings investment" is one of the central problems of the theory of economic policy of the state. In the short-term period growth of savings influences employment and in long-term-accumulation of the capital and rates of economic growth. Three directions can be allocated in the literature devoted to a role of taxes in stimulation of economic growth. Works in which influence of taxes on separate elements of a chain savings-investments [1; 2-6] belong to the first direction. Theoretical, empirical and imitating researches of cumulative rate of taxation belong to the second direction. So-called "the tax gap" is studied within this approach. "The tax gap" is a difference between the limit productivity of investment projects and the limit final income which will be gained by the subject who financed investments [7-9]. Imitating researches of influence of taxes on dynamics of economy join this direction [10; 11]. The third direction includes works in which action of taxes directly on endogenous growth rate of economy [1, 12, 13].

Connection of system, synergetic and cybernetic approaches will allow to find optimum values of managing directors of parameters. Application of descriptive approach will give us sequence "problems – system – system structure – the purpose – resources that processes – environment – a result assessment – a choice of options of achievement of the purpose".

Analysis of a Problem of Tax Regulation of Economy Development: Object of research-state economy-opened additive dynamic system with three contractors: consumers, producers and the government representing the state.

Each contractor has the purposes and tasks. The main thing for the population is welfare, for the enterprises-profit. The profit is the main source of investments in the conditions of limitation of sources of the loan capital. Producers in economy are divided into
industries, each of which has their proper conditions of production. Vital task for the state is collecting taxes in sufficient volume for performance of functions. The state is carrying out fiscal and regulating functions and also has to solve problem of a combination of interests of all contractors.

Formalization of such purposes leads us to a task with opposite to the directions. For example, the increase in the income of the population will lead to reduction of profit of the enterprises or reduction of taxation by the enterprises conduct to considerable reduction of tax revenues in the budget. For the accounting of the difficult purposes and their mathematical formalization methods of multicriteria conditional optimization are used.

Environment is the world market. On it export-import transactions are performed and loans undertake.

Elements of system correspond to properties of system: completeness, integrity and unity are subsystems from the elements and communications. In particular, production is the additive subsystem, consisting of industries.

The theoretical model is a combination of marginal, neoclassical and Keynesian approaches to economic policy.

Mathematical Modeling of Tax System and Optimization of Rate of Taxation: The mathematical model looks like (1–5)

The condition of system in a timepoint of \( t \) is set to indicators:

**State:**

- \( G_t \) = Expenses of the state budget in a year of \( t \);
- \( M_t \) = The real monetary remains in a year of \( t \);
- \( G_t^* \) = Expenses of the state budget on needs of the population in a year of \( t \);
- \( G_t^f \) = State budget expenses in favor of the \( i \)-industry enterprises in a year of \( t \);
- \( M_{t+1} \) = The real monetary remains in a year of \( t+1 \);
- \( I_{t+1} \) = pure investments into fixed capital in a year of \( t+1 \);
- \( B_{t+1} \) = The state one-year bonds of a domestic loan in a year of \( t+1 \);
- \( B_t \) = The state one-year bonds of a domestic loan in a year of \( t \);

**Production:**

- \( \rho \) = Ratio of payment of dividends to owners of the enterprises;
- \( r_t \) = A percent rate on the capital in a year of \( t \);
- \( K_t \) = The capital in a year of \( t \);
- \( w_{it} \) = An average salary in a year of \( t \) in branch \( i \);
- \( \Pi_t \) = profit of the enterprises to year of \( t \);

**Population:**

- \( C_t \) = Final consumption of households in a year of \( t \);
- \( L_t \) = Number of the population in a year of \( t \) minus children;
- \( L_f \) = Number of pensioners in a year of \( t \);
- \( L_i \) = Number of the population in a year working in industry \( i \);

**The All-System:**

- \( \tau_i \) = A rate of a tax on the income of citizens;
- \( \xi \) = A rate of a social tax on a salary;
- \( z_i \) = Coefficient of pension insurance in a year of \( t \);
- \( x_i \) = A free minimum in a year of \( t \);
- \( b_i \) = A rate of a social tax on a salary which the enterprise in a year of \( t \) pays;
- \( \alpha \) = A rate of a profit tax of the enterprises;
- \( \beta \) = A value added tax rate;
- \( \gamma_i \) = Coefficient of discounting (usefulness);
- \( \delta_i \) = An interest rate for bonds of a domestic loan in a year of \( t \);
- \( E_t \) = Pure export in a year of \( t \);
- \( r_t \) = A percent rate on the capital in a year of \( t \);
- \( \delta \) = Norm of depreciation of the capital;
- \( \sigma \) = Coefficient of discounting (profit).

Functioning of dynamic system in time were found by the reflection in such interrelations.

**Production:** In the country \( n \) industries work. The main indicator defining a condition of the enterprises in a timepoint of \( t \) is its profit \( \bar{I}_t \), which depends on their functioning, actions of the government and preferences of consumers. Function of profit is set through a composition

\[
\Pi_t = \sum_{i=1}^{n} (1-\alpha_t)(F_t(K_{it}, L_{it}, C_{it}^f, \sigma_t, \rho_t, r_t, w_{it}, \delta_t, \beta_t, t)) - (1+\delta_t)\nu_tL_{it} - r_tK_{it} - \delta_tK_{it}
\]

After payment of profit taxes, the VAT, social taxes and expenses on a salary we have

\[
\Pi = \int_0^\infty (1+\sigma t)^{\gamma} dt \to \max
\]

(1)

(2)
The profit of the enterprises is discounted for the last period.

Gross domestic product in the i-industry in the year \( t \) is determined by a production function \( F_i(K_{iti},L_{iti},G_{iti}^F) \).

**Dynamics of the Capital Is Set by the Equation:**

\[
K_{iti+1} = K_{iti}(1-\lambda_i) + b_i K_{iti} + I_{iti+1}, \quad \lambda_i - \text{rate of disposal of the capital;}
\]

The sinking fund for i- industry of economy in a year of \( t \) makes \( b_i K_{iti} \); these means are used on capital expansion.

The size of fund of compensation in i-industry is equal \( (1+b_i)w_{iti}L_{iti} \).

In the middle of a subsystem additive communications between industries take place:

\[
I_{iti} = \sum_{i=1}^{n} I_{iti} \quad K_{iti} = \sum_{i=1}^{n} K_{iti} \quad L_{iti} = \sum_{i=1}^{n} L_{iti} \quad G_{iti}^F = \sum_{i=1}^{n} G_{iti}^F
\]

**Population:**

The financial flow of citizens is defined by a train

\[
(w_{iti},z_{iti},x_{iti},L_{iti},\xi_{iti},L_{iti}^F,\tau_i,\rho_i,\Pi_i,\tau_j,\lambda_i,\xi_{iti},\Pi_i)
\]

\[
\sum_{i=1}^{n+1} ((1-\tau_i)(w_{iti} - z_{iti} - x_{iti})L_{iti} - \xi_{iti}w_{iti}L_{iti} + z_{iti}w_{iti}L_{iti}) \equiv \sum_{i=1}^{n+1} (L_{iti}^F - L_{iti})
\]

- it is net income, people which get paid, working at the enterprises and civil servants. Those who don't work in real sector concern them. The first element is a payment minus a tax-free minimum, a contribution to pension insurance and payment of a tax on the income of citizens multiplied on number of the working population in i-industry. The second element is a size of a social tax which citizens pay from the salary. The fourth element is a size of a tax-free minimum. \( z_{iti}w_{iti}L_{iti} \) contribution to pension insurance. It is calculated on a salary and not taxed. It is used on investment. It is an essential source of formation of \( I_{iti+1} \).

Pensioners receive receipts in volume \( w_{iti}^P L_{iti}^P \).

This income isn't taxed.

The population receives money from the enterprises. They consist of two parts and are assessed with a tax \((1-\tau_i)(\rho_i\Pi_i + \tau_iK_{iti})\). The enterprises pay part of the profit in the form of dividends \( \rho_i\Pi_i \). For compensation of functions of a banking system absent in model it is provided that all capital in economy belongs to citizens who give it to using to the enterprises, for it they gain income \( r_iK_{iti} \). Means after payment of dividends of the enterprise \((1-\rho_i)\Pi_i \) invest in capital expansion.

For the description of consumers were used marginal approach. Integrated function of usefulness which characterizes satisfaction of consumers is maximized.

\[
U = \int_0^\infty [u(C_t, M_t, L_t, G_t^F) + (1+\gamma_i)^{-t}] dt \rightarrow \max
\]

In integrated function of usefulness (3) \((1+\gamma_i)^{-t}\) means that usefulness is given to an initial stage.

**State:**

The state in model is set by the budgetary restriction which realizes balance of the income and expenses:

\[
G_i = G_i^C + G_i^P + w_i^P L_i^P + (1+b_i)w_i^P (L_i - L_i^F - L_i^P) = \\
B_i + \sum_{i=1}^{n+1} (\tau_i(w_{iti} - z_{iti} - x_{iti})L_{iti} + \xi_{iti}w_{iti}L_{iti}) + \tau_i(\rho_i\Pi_i + \tau_iK_{iti}) + \\
-(1+\tau_i)D_{iti} + \eta_i M_{iti}
\]

The revenues of the budget are formed at the expense of the taxes collected from the population and the enterprises, a gain of monetary weight and loans.

The government supervises the size of the state budget, an external and internal debt, rate of monetary issue and a rate of taxes.

Means of the state budget are spent on: salary for employees of government and the budgetary establishments \((1+b_i)w_i^P L_{iti}(t+1)\); provision of pensions of citizens \(w_i^PL_i\); support of the state enterprises and infrastructure \(G_i^F\); requirements of the population \(G_i^C\).

Funds for science, education, medicine, transfers and social losses are considered as expenses on needs of the population.
In model the assumption was made that the pension fund doesn't function separately, as off-budget. All social taxes gather the state, it pays pensions and the social help, adding means from the budget necessarily.

All expenses of the state budget are compensated for the account of its income or internal and external loans.

Both types of a loan are modelled through one-year bonds from different sources and with different interest rates. At the beginning of every year the government repays last year's bonds and pays percent on them \((1+i_{t-1})B_{t-1}\). At the same time the government issues new bonds this year. Transactions of external bonds are carried out according to the same scheme-the government emits new and redeems the last year's. The difference \(D_t = (1+i_{t-1})D_{t-1}\) is used for financing of a budget deficit or goes on reduction of an external debt, where \(D_{t-1}\) – the state one-year bonds of an external loan in a year of \(t-1\), \(D_t\) – the state one-year bonds of an external loan in year of \(t\) and \(i_{t-1}\) – an interest rate for bonds of an external loan in a year of \(t-1\).

The state can instantly react to change of demand of consumers on monetary weight and bonds, by purchase and sale of bonds through the Central bank. It is considered that the external debt exists, but it isn't catastrophic and doesn't influence national economy.

The main receipts in the budget from citizens: tax on the income of individuals \(n \sum_{i=1}^{n} \tau_i(w_{it} - z_{it}w_{it} - x_i)L_{it}\);

\[\tau_i(\rho \Pi_t + r_iK_t); \text{unified social tax } \xi_{it}w_{it}L_{it}\].

The enterprises also pay a social tax on the uniform rate, depending on a salary \(b_iw_{it}L_{it}\). The main taxes which the enterprises pay, the VAT and a profit tax is

\[\alpha \sum_{i=1}^{n} (F_i(K_{it},l_{it},G_{ot}) - F_i(K_{it},l_{it},G_{ot}) - \eta K_{it} - 1) + \beta (F_i(K_{it},l_{it},G_{ot}) - \eta K_{it} - \delta K_{it})\] .

The value added tax is paid from the income of the enterprises minus expenses on payment of the loan capital

\[\beta_t \sum_{i=1}^{n} (F_i(K_{it},l_{it},G_{ot}) - \eta K_{it})\].

Important the source of replenishment of the budget is monetary issue which increases quantity of cash \(n(M_t)\).

Process of integration of system to come to the end after accession of communications (5-8).

Conditions of balance (5-6):

\[C_t = I_t + G_t + E_{xt} = \sum_{i=1}^{n} F_i(K_{it},l_{it},G_{ot}) + G_t\] .

\[M_t + I_t = B_{t+1} + C_t = \sum_{i=1}^{n} ((1-\tau_i)(w_{it} - z_{it}w_{it} - x_i)L_{it} - \xi_{it}w_{it}L_{it} + z_{it}w_{it}L_{it} + x_t(I_t - L_{it}^P) + w_{it}L_{it}^P + (1-\tau_i)(\rho \Pi_t + r_iK_t) + (1+i)tB_t + M_t + (1-\rho)t\Pi_L + Ex_t\] .

Restriction (6) reflects balance of the income and expenses. The left part (6) is expenses of citizens and the enterprises in economy during \(t+1\). The \(t+1\) index means that funds are used in the period of \(t+1\), receipts for these expenses occurs in the period of \(t\). The rights the sum (6) contains all income which receive the enterprises and citizens during period \(t\). \(M_t\) are real monetary remains for the beginning of \(t+1\) period which are formed at the expense of \(M_t\) and the income which are gained by citizens in the period of \(t\). Pure investments \(I_t\) into fixed capital are formed in a year of \(t\) at the expense of the income of the enterprises and citizens and used next year \(t+1\).

At the beginning of a year of \(t\) the state emits the state one-year bonds of a domestic loan in volume of \(B_t\), at the end of the same year it returns to citizens on bonds already the sum \((1+i_t) B_t\) at the expense of which and also the income citizens buy at the beginning of a year of \(t+1\) the state bonds for \(B_{t+1}\) sum.

The model will be complete if we add two constraints "No Ponzi game":

\[\lim_{t \to \infty} B_t(1+\gamma_t)^{-t} = 0\] (7)

\[\lim_{t \to \infty} D_t(1+\gamma_t)^{-t} = 0\] (8)

The constructed system answers such property as an emergence. The state, citizens and production had the communications. Having connected them in uniform system, we received new communications. Existence of the budgetary restriction (4), testifies to condition and coherence with environment, that is system about inherent. The system constructed answers dynamic properties of systems: stimulated and functionality. By changing of such parameters as \(\alpha, \beta, \tau, \xi, \zeta, b_i\) is provided its variability regarding influence on the external and internal environment.
CONCLUSIONS

The dynamic multicriteria optimizing and imitating mathematical model is developed for determination of optimum macroeconomic parameters of a tax policy. Developed on the principles of descriptive approach the system can be used for definition of optimum tax rates, as from the point of view of the enterprises of various industries and the population and also for an assessment of various strategy of tax reforms, comparison of efficiency of various tools of a tax policy, influence of system of pension insurance and also influence of separate taxes and their set on each industry.

REFERENCES