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Financial programming model and sustainable development

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Abstract. In this article an attempt to examine sustainable development in the framework of financial programming model will be considered. In this connection the financial programming approach will be described on the whole and the place of sustainability in it will be determined.

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The base of the financial programming model consists in accounting macroeconomic framework, which covers the main sectors of national economy: private, government, monetary and foreign. Economic identities describe budgetary constrains of each mentioned sectors and formed a basis of accounting framework. In order to obtain closed system of equations from mentioned identities, behavioural equations, determining interrelation between principal economic variables are specified. The behavioural equations determining interrelation between economic variables are specified so that to add accounting identities up to the closed system of equations. The variables identified in this framework are subdivided on exogenous, endogenous and policy. The combination of variables, economic relations and identities forms economic model, which is called to prove policy decisions. For the realisation of financial programming model (development a the financial program) it is necessary to execute the forecast of exogenous variables, to define precisely values of target variables and to solve model for policy variables which will provide desirable values for the target variables.

Will be considered generalized approach of financial programming model, which gathered, monetary and grows approach [1]. The resulting merged approach contains three fundamental purposes of financial programs: the balance of payments, inflation and growth rate of real gross domestic product inside the consistent framework. Dynamic aspects of this model will be presented in finite differences. Four investigated sectors are production, government, monetary and foreign. The production sector will be defined by Cobb-Douglas production function, relationships between population and environmental degradation like [2], capital and prices. The monetary sector will be determined by demand and supply for money. The government sector will be defined by budgetary constraint. The foreign sector will be specified by equations for export, import, net foreign assets and change in international reserves.

In a sequel the model will be presented. We start with the production sector, which is assumed to own all factors of production and earn all income.

Production sector

$$\Delta y_t^* = \Delta K_t^{1-\alpha} \Delta L_t^{\alpha} / (P_{t-1} + \Delta P_t), \tag{1}$$

$$\Delta I_t^p = s(Y_{t-1} + \Delta Y_{t-1} - T_t) - \Delta M_t^d - \Delta F_t^p + \Delta D_t^p, \tag{2}$$

$$\Delta I_t^g = (T_t - C_t^g) - \Delta F_t^g + \Delta D_t^g = 0, \tag{3}$$

$$\Delta Y_t = P_{t-1} \cdot \Delta y_t^* + y_{t-1}^* \cdot \Delta P_t, \tag{4}$$

$$\Delta P_t = (1-\theta) \cdot \Delta P_{dt}^* + \theta \cdot \Delta \hat{e}_t \bar{\cdot} P_t^z, \tag{5}$$

$$\Delta K_t = I_t - \delta \cdot \Delta K_t, \tag{6}$$

$$\Delta I_t = \Delta I_t^p + \Delta I_t^g, \tag{7}$$

$$\Delta L_t = P_{cr} \cdot (L_t - Emigr_t) - P_{dc} \cdot L_t, \tag{8}$$

$$\Delta E_t = P_{dez} \cdot Y_t + P_s(L_t + L_{ue}) - Cur_{ef} \cdot K_t - Auto_{cur} \cdot E_t. \tag{9}$$

First equation says that the change in real GDP is equal to the well-balanced change in capital and labor, deflated by price index. Here K_t is the nominal capital in year t, L_t is the number of employer in year t, L_{ue} is the number of unemployment, $0 \leq \alpha \leq 1$ is the coefficient of Cobb-Douglas production function with constant retain to scale; Δy_t^* is the change in real GDP in year t-target variable, P_t, ΔP_t are the GDP deflator and inflation in year t.

Second equation asserts that the change in private investment $\Delta I_t^p$is equal to savings (nominal $GDP - Y_{t-1} - T_t$) mines the change in demand for money ΔM_t^d and the change in foreign assets to private sector ΔF_t^p plus the change in domestic credits to private sector $\Delta \hat{D}_t^p$ in year t; $\Delta \hat{D}_t^p$ is the policy variable. Third equation declares that the change in government investment $I_t^g$is equal to collected taxes T_t mines the government consumption C_t^g, mines the change in net foreign assets to government sector ΔF_t^g plus the change in domestic credits to government sector $\Delta \hat{D}_t^g$ in year t. Fourth equation states that the change in nominal GDP – ΔY_t is equal to the change in real GDP in current year Δy_t^* (target variable), multiplied by the price index in previous year P_{t-1} plus the inflation in current year ΔP_t multiplied by the real GDP in previous year y_{t-1}^*. Fifth equation announces that ΔP_t which is equal to a linear combination between the domestic price index $(1-\theta) \cdot \Delta P_{dt}^*$ – the target variable, and the price index for import in local currency $\Delta \hat{e}_t \cdot \bar{P}_t^z \quad (0 \leq \theta \leq 1)$, $\Delta \hat{e}_t$ is the exchange rate modification – the policy variable. Sixth equation declares that the change in capital ΔK_t is equal to the investment in current year I_t discounted by the corresponding rate of depreciation ΔK_t, $\Delta \hat{e}_t$ is the rate of depreciation, θ is the share of importable in domestic prices. Seventh equation represents the investment identity, which states that the total investment ΔI_t is equal to the sum of private ΔI_t^p and government ΔI_t^g investment. Eighth equation asserts that the change in the employment population ΔL_t is equal to the population growth $P_{cr}(L_t - Emig)$

mines the population decease $P_{dc} \cdot L_t$, P_{dc}, P_{cr}, $Emig$ are the population decease, population growth, and emigration rate, respectively. Ninth equation states that the change in the environmental degradation ΔE_t is equal to the environmental degradation owing to economic development $P_{dez} \cdot Y_t$ and environmental degradation owing to social development $Pl_s \cdot L_t$ mines the environmental clean up due to the state protection $Cur_{ef} \cdot I_t$ and due to self clean up $Auto_{cur} \cdot E_t$.

Monetary sector

$$\Delta M_t^d = \nu \cdot \Delta Y_t, \tag{10}$$

the change in money demand ΔM_t^d is equal to the change in nominal GDP ΔY_t multiplied by the constant inverse to the income velocity of money ν.

$$\Delta M_t^s \equiv \Delta R_t^* + \Delta \hat{D}_t^p + \Delta \hat{D}_t^g, \tag{11}$$

the change in money supply ΔM_t^s is equal to the change in foreign reserves ΔR_t^* plus the change in domestic credits to private $\Delta \hat{D}_t^p$ and government $\Delta \hat{D}_t^g$ sectors

$$\Delta M_t^d = \Delta M_t^d = \Delta M_t \tag{12}$$

and the money flow equilibrium is mentioned continue on the money market.

Foreign sector

From the budgetary constraint of foreign sector the balance of payment is defined:

$$\Delta R_t^* \equiv X_t - Z_t - (\Delta F_t^p + \Delta F_t^g). \tag{13}$$

The net foreign assets are exogenously expressed in the foreign exchange:

$$\Delta F_t^p = \Delta \bar{F}_t^p \cdot (1 + \Delta \hat{e}_t), \tag{14}$$

$$\Delta F_t^g = \Delta \bar{F}_t^g (1 + \Delta \hat{e}_t). \tag{15}$$

Here $\Delta \bar{F}_t^p$ and $\Delta \bar{F}_t^g$ are exogenously determined net foreign assets expressed in the foreign exchange, destined to private and governmental sectors, respectively, $\Delta \hat{e}_t$ is exchange rate modification-policy variable.

$$X_t = X_{t-1} + (X_{t-1} + c) \cdot \Delta \hat{e}_t - c \cdot \Delta P_{dt}^*, \tag{16}$$

$$Z_t = Z_{t-1} + (Z_{t-1} - b) \cdot P_t^{*z} \cdot \Delta \hat{e}_t + b \cdot \Delta P_{dt}^* + a \cdot \Delta y_t^*, \tag{17}$$

X_t is the export volume, Z_t is the import volume, $\bar{P}_t^{*z}$ is the exogenously determined price index for import, ΔP_{dt}^* is the change in domestic price index -– the target variable, a is the marginal propensity to import, b is the coefficient of response of import to relative prices, c is the coefficient of response of export to relative prices, X_{t-1}, Z_{t-1} are the previous year volume of export and import, respectively.

Model extension

The ceiling on expansion of total domestic credit is accompanied by a subceiling on the expansion of credit of the governmental sector. This subceiling assists in monitoring the overall credit ceiling, and ensures that the availability of credit to the public sector subseiling is not be diminished by the overall credit ceiling. Formally, this implies a secondary target such as ΔD_t^{p*} which can be achieved, according to $\Delta \hat{D}_t^g = \Delta \hat{D}_t - \Delta D_t^{p*}$.

The targeted expansion of private credit would be derived from the relationship such as $\Delta D_t^{p*} = (D_t^p / Y_t)_{n-1} \cdot \Delta Y_t$.

Since, from the government budget constraint, $T_t - C_t^g \equiv \Delta \bar{F}_t^g - \Delta \hat{D}_t^g$, the governmental sector must adjust to this programmed deficit by increasing revenue and/or reducing expenditures.

References

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