Economic Evaluation of Forest Policy Programs

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The purpose of this paper is to present an approach to evaluate the profitableness of a forest policy program and to discover from among the feasible programs the one that best complies with the desired performance of the economy. At first the procedure of forest policy-making in a country like Finland is considered. After that a method to evaluate forest policy programs is derived.

Introduction

Procedure of forest policy-making

The procedure of forest policy-making comprises usually six iterative phases: compilation of forest scenarios, compilation and evaluation of forest policy programs, decision-making, execution and supervision.

Forest scenarios

The forest scenarios are mappings of forest growth possibilities with time spans of even over hundred years. The emphasis is laid on the biological adaptability of the forests to changes in cuttings, silvicultural measures, land use and environmental factors. The forest scenarios serve the government (other policy-makers, too) as a guide in setting targets and restrictions to forestry and forest industry which together are called forest sector in the following.

Forest policy programs

In the *compilation* of the forest policy programs the time span is from 1–3 years up to 20–30 years. At the lower limit of the time span the problem is to regulate the roundwood market under given forest industry capacity. The long time spans are used when all stocks of the forest sector – growing stock, silviculture and forest industry capacity – are variable. The stocks in forestry are always variable (e.g. Vehkamäki 1986, p. 27). The core of a forest policy program is the roundwood market analysis. The aim is to find such a regulation of the demand for and supply of roundwood that the targets of the government are attained by aid of the given means of policy. The targets for the forest sector are set by aid of the above-mentioned stock variables or the flow variables as cuttings, silvicultural measures, production of consumption and investment goods, exports etc. In the compilation work much attention is to be paid to the consistent choice of targets and means of forest policy, i.e. the number of the means is adequate in relation to the targets (e.g. Nyberg-Viotti 1979 and Tinbergen 1966) and the means are efficient enough to attain the targets set (Tikkanen 1983).

The *evaluation* of a forest policy program is carried out in order to assess the effects of the program at the level of society as a whole. In the evaluation work, for example political, environmental, economic and social aspects of the program are taken into consideration. In the *economic evaluation* the economic effects of the program are generalized to the level of the total economy in order to enable the government to pick out the program that best comes up the government's over-all economic target. In this paper a macro-economic method is presented for the economic evaluation of programs.

Decision-making, execution and supervision

The remaining stages: decision-making, execution and supervision belong to the political and administrative realm of the forest policy-making. Excluding the costs, they are outside of the scope of this paper.

Derivation of an economic evaluation method

Assumptions

The following assumptions are made:

1) The government's ultimate aim is to maximize private consumption.
2) The economy is a "second-best economy" in the sense that the discount rate of the government differs from the marginal rate of return on alternative private investment.
3) Stable prices, being due to the demand curves with infinite price-elasticity, free movement and perfect substitution of resources prevail in the relevant range of forest policy.
4) Monetary considerations and changes in income and prosperity distributions can be ignored.
5) Resources of the economy are not fully employed.
6) Stocks of the economy and means of policy as such have no value.

Variables

All variables are defined as annual *differences* caused by the change in policy.

Symbol	Definition
f_t	expenditure on forest sector inputs
y_t	forest sector production (income formation)
c_t	expenditure on consumption goods produced on the forest sector
i_t	expenditure on investment goods produced on the forest sector
x_t	forest sector export
C_t	expenditure on consumption goods produced on other sectors of the economy
I_t	expenditure on investment goods produced on other sectors of the economy
M_t	total import
D_t	expenditure withdrawal arranged by the government and the forest owners in order to finance the program as a result of the policy

The variables f_t, y_t, c_t, i_t and x_t are obtained as outcomes of the forest policy program.

Parameters

Symbol	Definition
m_c	proportion of import in marginal consumption expenditure
m_i	proportion of import in marginal investment expenditure
m_f	proportion of import in marginal forest sector input expenditure
s	marginal rate of return on alternative private investment
r	discount rate of the government
T	time span of the forest policy program

Model

Starting point for the derivation of the evaluation method is the following model containing the equations for the balance of supply and demand equilibrium

$$(1)\quad y_t+M_t+D_t=C_t+I_t+f_t+c_t+i_t+x_t$$

and for the balance of payments equilibrium

$$(2)\quad m_cC_t+m_iI_t+m_f f_t=M_t=x_t\ .$$

If we denote

(3) $d_t = f_t - D_t > 0$,

i.e. a part of the resources required by the program are financed by aid of the excess government spending in a less-than-full-employment economy, and

(4) $m_t = m_f f_t$,

(5) $q_t = d_t + c_t + i_t$

we obtain

(6) $C_t + I_t = y_t - q_t$ and

(7) $m_c C_t + m_i I_t = x_t - m_t$.

The excess government spending is assumed to be consumed, as follows.

Derivation of the evaluation algorithm

When the pair of equations (6) and (7) is solved with respect to C_t and I_t we obtain

(8) $C_t = \frac{m_i (y_t - q_t) - (x_t - m_t)}{m_i - m_c}$ and

(9) $I_t = \frac{(x_t - m_t) - m_c (y_t - q_t)}{m_i - m_c}$

provided that $m_i \neq m_c$.

The annual net benefit of the forest policy program is defined by

(10) $b_t = C_t + c_t + d_t + S(I_t + i_t)$

where

$C_t + c_t + d_t$ = total private consumption,
$I_t + i_t$ = total private investment and
S = the shadow price of the private investment in terms of the private consumption.

The last-mentioned constant is defined by means of the marginal rate of return on private investment (s) and the discount rate of the government (r). If we assume, for example (see Feldstein 1973, p. 5) that an alternative marginal private investment of 1 Fmk, leads to a perpetual annual return stream of s Fmk and all future retuns are consumed, the shadow price of the private investment is

(11) $S = \frac{s}{r}$.

By inserting (8) and (9) into (10) and summing up the discounted annual net benefits over the time span of the forest policy program we obtain the evaluation algorithm

(12) $B = \sum_{t=0}^{T} \left(\frac{(m_i - S m_c) y_t + m_c (S-1)(c_t + d_t) + m_i (S-1) i_t + (S-1)(x_t - m_t)}{m_i - m_c} \right) (1+r)^{-t}$,

i.e. the profitableness of the forest policy program is expressed by aid of the flow variables of the program and the parameters concerning the economy.

Discussion

It should be noted that in the above evaluation procedure it does not matter how the levels of the variables in (10) are reached. What matters are the equilibrium conditions (1) and (2) of the economy. The means of the economic and forest policies must be so chosen and regulated that the equilibrium conditions are fulfilled. When the dynamics of the economy are taken into consideration, it should be noted that usually in the course of the forest policy program, the policy needed to regulate C_t and I_t (i.e. expenditures on consumption and investment goods produced on others sectors of the economy) must be changed. At the beginning of the time span, when the adjustments of the growing stock, silviculture and forest industry capacity are occuring, the regulation is different from the situation when the equilibrium target stocks are reached (e.g. Vehkamäki 1986, p. 22).

The above procedure fits the occasion in which we can make use of the macroeconomic equilibrium conditions. On the level of individual forestry projects we resort to the conventional cost-benefit analysis.

We assume the following numerical values to the parameters

$m_c = 0{,}2$
$m_i = 0{,}4$
$m_f = 0{,}1$
$s = 0{,}03$
$r = 0{,}02$

and by making use of (10) and (11) we obtain from (12)

(13) $B = \sum_{t=0}^{T} \left(0{,}5(y_t + c_t + d_t) + 1{,}0 i_t + 2{,}5 x_t - 0{,}25 f_t \right) (1{,}02)^{-t}$.

It should be noted that the variables of the formula (13) are annual differences in relation to the case with no policy change, and thus they may assume also negative values. The task is to apply (13) to the alternative feasible forest policy programs and to choose from among them the best one.

References

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