Outcomes of Forest Improvement Work in Finland

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This paper discusses public subsidies aimed at intensifying timber production as an initial part of an evaluation of the profitability of forest investment subsidies in Finland. In many countries there are very few proper ex post evaluations of the forest policy instruments in economic terms. The scarcity of timber among users and their attempts to construct new forest policy are discussed first. The increments in annual growth and growing stock as well as its valuation are then evaluated. The final gross utility increments due to forestry investments are measured through their importance in the forest industry products. The direct and indirect changes in GDP are calculated by using the input-output method.

Keywords forest improvement work, subsidies, forest policy, input-output method, allowable cut

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1 Introduction

This investigation examines the economic outcomes of public forestry assistance and extension programmes by using the input-output method. The analysis examines how public subsidies have been used to intensify timber production in Finland and what have been the major impacts of these subsidies.

Public interventions in forestry and their evaluation in economic terms have been an important topic of forest research in the United States. Literature reviews of research in this field can be found in Boyd and Hyde (1989). They test the efficiency of different public intervention instruments with econometric tools. Alig et al. (1990) reviews the results concerning timber management behaviour of nonindustrial private forest owners. Forest policy in general, including public assistance to forestry, is addressed by e.g. Cubbage et al. (1993), who compare incentives and regulation in the United States, Canada and Europe, and find interesting differences. According to Cubbage et al. (1993), the European countries regulate all land use strictly, including forest management, the latter especially to encourage timber production.

The Organisation for Economic Co-operation
2 Forest Policy for Investment Subsidies

The scarcity of timber has to be considered in any attempt to understand the forest policy activities for timber management intensification in Finland. Forecasts of forest industry timber famines have typically preceded the initiatives to increase public subsidies for the intensification of timber production in Finland. Increased investment activities have been subsidized to produce more timber, not to make the timber production more profitable.

There have been two types of investment subsidies so far: a) annual financing through the Budget and b) national forestry programs to expand investments. The areas in the annual investment activities have increased rapidly during the national programs (MERA 1965–75, METSÄ 2000 1985–).

Investments on forestry can be divided into two categories: obligatory and voluntary. In Finland most of the investments such as pruning, fertilisation, tending of seedling stands, road construction and draining are voluntary. Regeneration after final felling can be taken as an obligatory investment (Hänninen 1998). Forest road construction and peatland drainage are investments which are normally carried out as cooperative projects due to small average size of forest holdings. Public support for and participation in these projects can be taken as a necessary condition for their execution on a larger scale. Peatland drainage projects require that all the landowners in the effected area must be considered. In the case of drainage, the returns from the investments occur after a longer period than the average ownership of forest holding (30 years, Ripatti 1998). Public support is therefore needed to get all the forest owners to carry out such cooperative projects.

The total investments in silvicultural and forest improvement work between 1963 and 1996 amounted to 37.0 bill. FIM, expressed in 1996 money. Most of the forest improvement work has been executed in private forests. In the early 1960’s, the total costs of these investments in private forest were less than 300 mill. FIM annually. During MERA-period (1965–75), invest-
ments increased until 1972, when the 800 mill. FIM level was reached. Since then, investments in private forests have varied between 800 and 1000 mill. FIM. Since the 1950’s, all investments in wood production in non-industrial private forests have totalled about 28.5 bill. FIM. In the 1990’s, investments in forest improvement have decreased remarkably (Fig. 1). The difference between investment plans and actual costs is particularly striking. One explanation is, that plans tend to be overoptimistic.

3 How Forest Improvement Contributes to Forest Increment and Allowable Cut

In the 1970’s, those young stands that developed on the drainage and regeneration areas reached a phase of development where the increasing growth on those areas began to contribute to the total increment of Finnish forests.

According to Kuusela and Salminen (1991), when measured similar way, total increase in increment in the late 1980’s was 12 mill. m³/a compared to the level of increment at the beginning of the 1950’s. The part of this additional increment resulting from drainage activities was about 7 mill. m³/a. The total effect of the forest extension programs on growth and allowable cut is almost impossible to determine unambiguously. Increases in the increment from the mid-1970’s to the early 1990’s were about 16.8 mill. m³/a, of which about 10.9 mill. m³/a were in Southern Finland and about 5.9 mill. m³/a in Northern Finland. Drainage and the fertilisation of drainage areas accounted for was about 10 mill. m³/a (Tomppo and Henttonen 1996).

Increases in the increment do not directly translate to allowable cut. The MELA-group at the Finnish Forest Research Institute has estimated that the allowable cut in the 1990’s is about 66.6 mill. m³/a, which is an increase of about 10 mill. m³/a compared with the early 1980’s. The present paper estimates that this increase has been the result of forest improvement work, because most of that increase has taken place on the drained peatlands (Nuutinen et al. 1998).
4 Data

4.1 Input-Output Tables for Year 1993

The basic data derives from a 33-industry input-output table for 1993, where the forest sector is divided into seven industries by Toropainen (1996). The input-output table used here is prepared from a 65 industry table constructed by Statistics Finland (see Toropainen 1998). The forest sector industries in the table are sawmilling, other woodworking, furniture manufacturing, pulp, paper and paperboard, paper and paperboard products.

Employment multipliers have quite short-term effects, about a year or two, and they do not include long-term impacts of new factories which change the character of the economy. Employment multipliers also become obsolete sooner than other tables (Toropainen 1998). In this paper, the multipliers were updated for 1996, because after the recession period, the rise of productivity was especially high and using old employment multipliers would have caused over-optimistic estimates of employment effects.

4.2 The Effects of Forest Improvement Work on Production of Forest Industry

In trying to estimate how forest improvement works have increased the allowable cut and via that, the production possibilities of forest industry, we have to keep in mind other factors effecting production possibilities. The three most important factors are the reduction of fuelwood consumption in dwellings and other buildings, the change in the area of nature conservation area, and the more effective use of wood raw material in the pulp and paper industry. However, these effects are very difficult to quantify.

In 1993, wood consumption in dwellings and other buildings was 7.3 mill. m³ less than in 1964. This amount is released for other users and has partly been used by the forest industries. Another major change has been the increasing efficiency of the pulp and paper industry in its use of wood raw material. Assuming that the efficiency of production was the same in 1993 as it had been in 1965, an extra 15.7 mill. m³ of roundwood would have been needed to achieve the corresponding production (19.3 million tonnes).

Using input-output tables, a hypothetical situation is investigated in which it is assumed that the use of wood raw material in 1993 would be 10 mill m³ less than the level in that particular year. Following to the results of MELA-group (1998) we assume that 10 mill. m³ equals the increase in increment resulting from forest improvement work. Without this additional increment, the forest industries would be using that much less roundwood and producing less than it actually did in 1993.

The input-output analysis only deals with domestic markets. Mechanical and chemical pulp are produced mainly for domestic markets and are used as inputs in paper making. Thus, the corresponding effects of changes are included in the figures for the paper industry. In other words, increasing cutting potentials have an effect on the paper industry and on exports via the pulp industry.

Roundwood consumption by the sawmill industry was 22.15 mill. m³ in 1993 and by the pulp industry 38.45 mill. m³ (Forest Statistical yearbook 1997). The assumption for the analysis is that the present corresponding wood consumption level would have been 17.56 mill. m³ in sawmilling and 33.04 mill. m³ in pulp production. This assumed total reduction of 10 mill. m³ in wood consumption of these industries is in relation of their use of domestic roundwood in 1993.

It is assumed that the value of production of the sawmill industry would be less in relation to wood consumption. The value of the sawnwood production would be 2100 mill. FIM less or 7200 mill. FIM in 1993. When the effect of the pulp industry’s wood consumption on paper production is taken into account, the value of the paper production would be 4900 mill. FIM less or 30 200 mill. FIM.

If the reader wishes to try different wood consumption estimates, simply multiply the figures presented in the tables by the ratio of his or her own estimates and 10 mill. m³.
5 Direct and Indirect Effects of Forest Improvement

5.1 Effects of Forest Improvement Work on Domestic Production

Input-output analysis is used here for the investigation of direct and indirect effects of changes in forest sector production between industries and in the national economy, value-added and employment. It is a normal ceteris paribus-situation: one thing is changed and other things stay equal. In this analysis, it also assumed, that imports would not have been increased at all. As calculated earlier, the effect of forest improvement work estimated through wood consumption would be visible in the value of the end production. The direct and indirect effects of reduced production of end products of domestic production we get by using normal inverse matrix.

In input-output analysis, the exogenous variable is the production of final products, not total output. Direct and indirect effects on output, value added and employment in different industries is generated by the purchases of intermediate inputs used in the final production, not by selling those inputs. As Table 1 shows, sawmilling needs few inputs from other forest industries. In that respect, the paper industry is very different. The “same industry” row in the table consists of both the final products and the intermediate inputs produced by paper industry itself as well as those produced by combined pulp and paper industry. The “other forest industries” row consists of the intermediate inputs purchased from the mills producing only pulp and from sawmilling.

The reduction of total production here describes the decrease of economic activity in different industries (see Toropainen 1998). Indirect effects are most important in the case of the forest industries. If the value of final products in the sawmill industry would be 2100 mill. FIM smaller, it would mean indirect effects of 90 mill. FIM less in the same industry, 930 mill. FIM less in forestry and 20 mill. FIM less in other forest industries as well as a total of 850 mill. FIM less in other industries (Table 1). For every directly lost million FIM 0.9 mill. FIM would be lost indirectly. The corresponding figure for paper industry is 1.0. The total effect of a change in the production value of sawmill and paper industry would be 13.9 bill. FIM.

Table 1. The effects of reductions in the sawmill and paper industries’ end production on domestic production.

<table>
<thead>
<tr>
<th>Reduction of the value of production of end-products:</th>
<th>Sawmill industry, 2100 mill. FIM</th>
<th>Paper industry, 4900 mill. FIM</th>
<th>Total, 7000 mill. FIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in production, million FIM:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forestry</td>
<td>930</td>
<td>590</td>
<td>1520</td>
</tr>
<tr>
<td>Same industry</td>
<td>2190</td>
<td>5080</td>
<td>8420</td>
</tr>
<tr>
<td>Other forest industries total</td>
<td>20</td>
<td>1130</td>
<td></td>
</tr>
<tr>
<td>Forest sector total</td>
<td>3140</td>
<td>6800</td>
<td>9940</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>10</td>
<td>270</td>
<td>280</td>
</tr>
<tr>
<td>Metal products, machinery</td>
<td>50</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>Electricity, heating, water</td>
<td>130</td>
<td>1170</td>
<td>1300</td>
</tr>
<tr>
<td>Trade</td>
<td>70</td>
<td>140</td>
<td>210</td>
</tr>
<tr>
<td>Transportation</td>
<td>310</td>
<td>400</td>
<td>710</td>
</tr>
<tr>
<td>Business and real estate service</td>
<td>90</td>
<td>290</td>
<td>380</td>
</tr>
<tr>
<td>Other industries (20) total</td>
<td>190</td>
<td>660</td>
<td>850</td>
</tr>
<tr>
<td>Total</td>
<td>3990</td>
<td>9930</td>
<td>13920</td>
</tr>
</tbody>
</table>
5.2 Effect of Forest Improvement on Value-added

The change in total production is gross value. For the national economy the net gain is value-added, or the GDP share of the industry of total production. The intermediate inputs are excluded. At market prices, it is sum of the wages, employers’ contribution to social security, indirect net taxes, wear-and-tear of fixed capital and operating surplus (Toropainen, 1998).

A reduction of the final production of the forest industries has a strong impact on value-added. A reduction in the value of final production by 2100 mill. FIM in sawmill industry would decrease value-added directly by 610 mill. FIM and indirectly by 1320 mill. FIM (Table 2). Indirect effects are considerable in forestry, where the direct share of the value-added of production value is 90 percent.

5.3 Employment Effects of Forest Improvement Work

Employment is here defined by numbers of employed persons. The employment multipliers (= number of employed persons needed for the production worth one million FIM) are updated to the level of 1996 using fixed price changes in the productivity of work. These multipliers are also counted in 1993 prices. In this case, the base year is important. Employment multipliers change when price levels change, even if relative prices stay constant. Conversely, in the analysis of total production and value added, which is based on cost shares, the base year is not so important. However, the relative prices of both inputs and outputs must stay constant.

Considerable changes occur in employment in the production of final products. Forest industries are important employers, especially indirectly. Reduction in sawmill industry of 2100 mill. FIM causes a direct reduction in employment in the same industry of about 1950 persons and indirectly about 80 persons. In forestry the reduction is 2020 persons and in other industries 1450 persons (Table 3). For every job lost in the sawmill industry, 1.8 indirect jobs will be lost. In the paper industry, the corresponding coefficient is 1.7. The total effect of reduced final production in the sawmill and paper industries would have been 15 330 direct and indirect jobs.

6 Discussion

This paper is an initial evaluation in an analyses of the profitability of forestry investment subsidies in Finland. The most difficult aspect of the investigation has been to find reliable data on the increase in increment. Consequently no regional analysis has been attempted, even though these are important in a country where differences in growing conditions are considerable.

When the results of this study are further ana-

Table 2. The effects of reductions in sawmill and paper industries’ end production on value-added at market prices.

<table>
<thead>
<tr>
<th>Reduction of the value of production of end-products:</th>
<th>Sawmill industry, 2100 mill. FIM</th>
<th>Paper industry, 4900 mill. FIM</th>
<th>Total, 7000 mill. FIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diminishing portion of value-added, million FIM:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wages and employers’ contribution to social security schemes</td>
<td>740</td>
<td>1700</td>
<td>2440</td>
</tr>
<tr>
<td>Indirect net taxes</td>
<td>-20</td>
<td>-30</td>
<td>-50</td>
</tr>
<tr>
<td>Wear-and-tear of fixed capital</td>
<td>420</td>
<td>1180</td>
<td>1600</td>
</tr>
<tr>
<td>Operating surplus</td>
<td>790</td>
<td>930</td>
<td>1720</td>
</tr>
<tr>
<td>Value-added total, million FIM</td>
<td>1930</td>
<td>3780</td>
<td>5710</td>
</tr>
<tr>
<td>of which direct effect</td>
<td>610</td>
<td>1280</td>
<td>1890</td>
</tr>
<tr>
<td>and indirect effect</td>
<td>1320</td>
<td>2500</td>
<td>3820</td>
</tr>
</tbody>
</table>
In analyzing the reader must bear in mind the direction of the causality. Forest improvement work as such has not created the economical impacts. They are created by the increased demand for the end-products of forest industries. Forest improvement investments have helped to fulfill the forecasted increased demand for roundwood by increasing the amount of forest resources in a wood shortage situation. Such an investment at the present time would not necessarily lead to similar results which would occur only if the demand for forest products would increase in the future and supply of roundwood would not be high enough to fulfill the needs of increasing production without public subsidies.

Possibilities to increase imports of roundwood instead of using more from domestic sources have been ignored in this analysis. A challenge for future research will be to extend the analysis to include imports. Input-output methodology also has its own restrictions, which can disturb the interpretation of the results. In reality, products, inputs and production methods are not as homogenous as they are assumed to be in this paper (see Miller and Blair 1985, Toropainen 1993). Input-output methodology can be used in this kind of cross-sectional analysis, but not directly for long-term analysis. The effects in year 2003 are certainly different than those ten years earlier. Technology and the productivity of industries will change due to the investments in production.

It is also impossible to estimate the extent of forest improvement in the absence of subsidies and cost-share programmes. It is also clear, that the benefits from forest improvement work take their time. In the 1970´s there would have been few benefits compared to the late 1990´s. More benefit-cost type evaluation is needed to provide more information on the profitability and time aspects of all kinds of forest improvement investments. The opportunity costs were not included in this analysis. In coming studies it might be worth evaluating what would have happened if subsidies were given to other sectors. Would that have led to higher national economic benefits?

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References


Total of 20 references