IMPORT COSTS AND OVERSEAS EARNINGS OF

SAWLOG AND EXPORT LOG AFFORESTATION

R. FENTON

Forest Research Institute, New Zealand Forest Service, Rotorua

ABSTRACT

Results of afforesting land of site index 95 with radiata pine are evaluated at interest rates of 7% to 12% in terms of export dollars earned per import dollar, and by weighting all overseas transactions by 10%. An export log, and two sawlog regimes—one direct, and the other requiring production thinning—were evaluated for "normal" rates of afforestation and felling. At 7% interest rate optimistic results for the three regimes are 9.3, 13.1, and 6.9 export dollars earned per import dollar, if social costs of roading and accommodation are included; these rise to 10.3, 14.9, and 8.3 if social costs are excluded. Corresponding "medium" and "pessimistic" results for the direct, and the production thinning sawlog regimes are 11.0 and 5.0; and 12.5 and 6.1.

At 7% interest rate, imports comprise 17, 14 and 13% of total costs for the three regimes respectively. Logging and other vehicles are the highest overseas costs.

The effect of a 10% weighting raises the internal rates of return of the project by ½ to ¾%.

Location affects results and further studies should include all steps until the export produce is loaded on ship.

Results continue to reinforce the marked superiority of the direct regime over one prescribing production thinning, and to demonstrate the economic attractiveness of the export log trade at current prices.

INTRODUCTION

In its report to the New Zealand Government on the country's economy the World Bank Economic Advisory Mission recommended:

"Well-defined criteria should . . . be established by the Government for priorities of development in the major sectors in order to encourage those activities in which New Zealand has a comparative advantage. An appropriate indicator of the comparative advantage could be the domestic costs per unit of foreign exchange saved by imports substitution or earned by exports." (Anon., 1968, p.14).

Results of accelerated rates of afforestation with radiata pine (*Pinus radiata* D. Don) for the export log trade have been evaluated in terms of the World Bank criterion (Fenton and Dick, 1972a) and confirmed earlier favourable results (Fenton *et al.*, 1968). New Zealand is still heavily dependent on overseas trade and a recent (1971) Treasury ruling has been to incorporate a 10% weighting on import costs and overseas earnings

incurred in any project. Further results of afforestation for the log trade (Fenton and Dick, 1972b) and for sawlog regimes (Fenton, 1972a; 1972b) are now available for strictly comparable studies of "normal" afforestation. These analyses are extended here, both in terms of the World Bank "export dollar earned per import dollar", and the Treasury "10% weighting" criteria.

FOREST MANAGEMENT REGIMES

Details of the regimes are in the references cited, and a summary of the yields is in Table 1. All regimes assume a "normal" rate of afforestation of a block of scrub-covered land, of generally easy topography of site index 95 (Lewis, 1954). The base year for the costs and returns is generally that of the Forest Development Conference—1967. All studies were nominative, as no prescriptions have been applied for a rotation to any forests in New Zealand. Only interest rates (7% to 12%) near to those of the internal rates of return (IRR) of the projects are evaluated.

TABLE 1—Yields, cu ft per acre

Regime	Rotation Yr	Intermediate Yields Age	Intermediate Yields Volume	Final Yields Volume	Final Yields Category
Export log	23	—	—	8235	Export Logs
Production thinning	36	18	2100		
			sawlogs	⎰ 3003	Pruned butts
				⎱ 2233	Unpruned seconds
				1540	Unpruned thirds
				2672	Pulp logs
Direct	26	Grazing revenues			
			sawlogs	⎰ 3120	Pruned butts
				⎱ 2320	Pruned seconds
				1600	Unpruned thirds
				1208	Pulp logs

IMPORT COSTS

Details of the origin of all costs are given elsewhere (Fenton and Dick, 1972a). The only additional forest operation in the sawlog regimes, when compared to the export log one, is pruning. In pruning up to 20 ft the cost of tools is less than 1% of the total cost (Thomson, 1970); so any import content of tools is trifling. In second-log pruning (from 20 to 36 ft) in the direct sawlog regime a nominative figure of 1% has been allowed (for lack of other data) to cover the import costs of the ladders required. (The cost of transport for pruning labour has been allowed under gang-truck running).

Overseas costs of direct forest operations, and forest protection are low. Logging machinery and other vehicles are the most important of the overseas costs. The land expectation value (LEV) equivalents, or the present net worth per acre, of direct, protection, administrative, logging, and social costs are given in Table 2; this also includes the proportion of imports in total costs. The percentage of import costs of the major cost groups is given in Table 3. These summarised import costs are based on fuller breakdowns of each constituent element (about 74 per regime).

TABLE 2—Discounted import costs per acre (LEV) by operations

Regime	Interest Rate %					
	7	8	9	10	11	12
Export logs			LEV in cents/acre			
Land clearing, establishment and tending	56	51	47	43	41	38
Protection	99	86	74	66	59	53
Administration	295	259	234	213	195	184
Logging	1306	947	698	521	395	301
Sub-total	1756	1343	1053	843	690	576
% of sub-total costs	17.6	17.0	16.4	15.7	15.1	14.6
Social	188	161	139	124	111	100
% of total costs	16.9	16.4	15.7	15.2	14.6	14.1
Production thinning						
Land clearing, establishment and tending	45	41	38	36	34	32
Protection	76	66	57	51	46	41
Administration	284	251	227	207	192	179
Logging	436	284	184	127	83	57
Sub-total	841	639	506	421	355	309
% of sub-total costs	12.8	11.9	11.3	10.9	10.5	10.2
Social	153	130	113	100	89	81
% of total costs	12.7	12.0	11.4	11.1	10.7	10.5
Direct sawlog						
Land clearing, establishment and tending	63	53	48	44	41	39
Protection	93	80	70	62	56	50
Administration	293	260	235	214	197	184
Logging	992	697	501	365	269	200
Sub-total	1441	1090	854	685	563	473
% of sub-total costs	14.4	13.6	13.0	12.4	11.8	11.4
Social	233	208	184	165	149	136
% of total costs	14.4	13.7	13.1	12.6	12.1	11.8

RETURNS

Three levels of export returns have been calculated for each sawlog regime. The "optimistic" results assume all the produce either generates overseas earnings, or saves them by import substitution. The "medium" results assume all timber listed as export in the realisation statements (Fenton, 1972a; 1972b) is exported and all the pulpwood credits, which comprise sawmill slabs, thinning stumpages and top-log stumpages are counted as export returns. The "pessimistic" level assumes only the clears, and the superior Factory and Dressing grades of the pruned logs and half of the pulpwood returns are credited. Any returns from grazing revenue have been excluded from the direct regime. The overseas returns earned are given in Table 4, and the ratios of export/import dollars are in Table 5. The ratios of export dollars earned per dollar of total—viz. import plus domestic exchange—costs are given in Table 6.

Several levels of returns have also been analysed for the export log model. The first set, which is incorporated in Tables 4, 5 and 6, assumes results as given in the

TABLE 3—Percentages of the total import cost, at various rates of interest

Regime	Interest Rate %											
	7		8		9		10		11		12	
	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs
Export logs												
Logging	67.2	74.4	63.0	70.5	58.6	66.3	53.9	61.8	49.3	57.2	44.5	52.3
Administration	15.2	16.8	17.2	19.3	19.6	22.2	22.0	25.3	24.3	28.3	27.2	31.9
Social	9.6	—	10.7	—	11.6	—	12.8	—	13.9	—	14.8	—
Other	8.0	8.8	9.1	10.2	10.2	11.5	11.3	12.9	12.5	14.5	13.5	15.8
Production thinning												
Logging	43.9	51.8	36.6	44.0	29.7	36.3	24.4	30.2	18.7	23.4	14.6	18.4
Administration	28.6	33.8	32.6	39.3	36.7	44.9	39.7	49.2	43.3	54.1	45.9	58.0
Social	15.4	—	16.9	—	18.3	—	19.2	—	20.0	—	20.8	—
Other	12.1	14.4	13.9	16.7	15.3	18.8	16.7	20.6	18.0	22.5	18.7	23.6
Direct sawlog												
Logging	61.5	68.8	53.7	63.9	48.3	58.7	42.9	53.3	37.8	47.8	32.8	42.3
Administration	18.2	20.3	20.0	23.9	22.6	27.5	25.2	31.2	27.7	35.0	30.2	38.9
Social	10.6	—	16.0	—	17.7	—	19.4	—	20.9	—	22.3	—
Other	9.7	10.8	10.2	12.2	11.4	13.8	12.5	15.5	13.6	17.2	14.7	18.8

TABLE 4—Discounted export dollars earned per acre (correct to nearest $)

| | Interest Rate % | | | | | | | | | | | |
| Regime | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | |
	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs	Incl. Social Costs	Excl. Social Costs
Export logs	180	180	127	127	91	91	66	66	48	48	36	36
Production thinning												
Optimistic	69	70	43	44	28	29	18	19	12	13	8	8
Median	50	51	32	32	21	21	14	14	9	9	6	6
Pessimistic	42	42	26	27	17	17	11	11	7	8	5	5
Direct sawlog												
Optimistic	211	214	144	147	100	102	71	72	51	52	37	37
Median	177	180	121	123	84	86	60	60	43	43	31	31
Pessimistic	164	167	113	114	78	79	55	56	40	40	29	29

TABLE 5—Discounted export dollars earned per imported dollars cost

Regime	Export Assumptions	Interest Rate %					
		7	8	9	10	11	12
		A.	Excluding Social Items				
Export log		10.3	9.5	8.6	7.8	7.0	6.3
Production thinning	O	8.3	6.9	5.7	4.5	3.7	2.6
	M	6.1	5.0	4.2	3.3	2.5	1.9
	P	5.0	4.2	3.4	2.6	2.3	1.6
Direct	O	14.9	13.5	11.9	10.5	9.2	7.8
	M	12.5	11.3	10.1	8.8	7.6	6.6
	P	11.6	10.5	9.3	8.2	7.1	6.1
		B.	Including Social Items				
Export log		9.3	8.4	7.6	6.8	6.0	5.3
Production thinning	O	6.9	5.6	4.5	3.5	2.7	2.1
	M	5.0	4.2	3.4	2.7	2.0	1.5
	P	4.2	3.4	2.7	2.1	1.6	1.3
Direct	O	13.1	11.1	9.6	8.4	7.2	6.1
	M	11.0	9.3	8.1	7.1	6.0	5.1
	P	10.2	8.7	7.5	6.5	5.6	4.8

O = optimistic levels
M = median levels
P = pessimistic levels

TABLE 6—Export dollars earned per dollar of total costs (correct to $0.1)

Regime	Export Assumptions	Interest Rate %					
		7	8	9	10	11	12
		A.	Excluding Social Items				
Export log		1.8	1.6	1.4	1.2	1.1	0.9
Production thinning	O	1.1	0.8	0.6	0.5	0.4	0.3
	M	0.8	0.6	0.5	0.4	0.3	0.2
	P	0.6	0.5	0.4	0.3	0.2	0.2
Direct	O	2.1	1.8	1.5	1.3	0.2	0.9
	M	1.8	1.5	1.3	1.1	0.9	0.7
	P	1.7	1.4	1.2	1.0	0.8	0.7
		B.	Including Social Items				
Export log		1.6	1.4	1.2	1.0	0.9	0.7
Production thinning	O	0.9	0.7	0.5	0.4	0.3	0.2
	M	0.6	0.5	0.4	0.3	0.2	0.2
	P	0.5	0.4	0.3	0.2	0.2	0.1
Direct	O	1.8	1.5	1.3	1.1	0.9	0.7
	M	1.5	1.3	1.1	0.9	0.7	0.6
	P	1.4	1.2	1.0	0.8	0.7	0.6

O = optimistic levels
M = median levels
P = pessimistic levels

original analysis (Fenton and Dick, 1972b) viz. 8235 cu ft net per acre are exported with a forest value loaded on truck of 20.8 c per cu ft. The effects of a 500 cu ft per acre lower yield; a 5% greater price; and of a location only 30 instead of 89 miles from the port are given in Table 7.

The effects of a 10% weighting of all overseas transactions are given in Table 8 at interest rates close to the original internal rates of return (IRRs) of the projects.

TABLE 7—Effect of changes in volume, export price and location—export logs (correct to $0.1)

Interest Rate %	Export Dollar per Import Dollar		
	500 cu ft per Acre Less Volume	5% greater Export Price	Location 30 Miles from the Port
7	8.7	9.7	11.5
8	7.9	8.9	10.4
9	7.2	8.0	9.5
10	6.4	7.2	8.5
11	5.7	6.3	7.5
12	5.0	5.6	6.6

TABLE 8—Effect on LEV of social costs and of 10% weighting of overseas costs and returns in dollars per acre (correct to $0.1)

Regime	Interest Rate %	Effect on LEV of:			
		Excluding Social Cost		Including Social Cost	
		Original	Weighted	Original	Weighted
Export log	10	12.2	18.0	2.9	8.5
	11	2.8	6.9	—5.7	—1.7
	12	—3.6	—0.6		
Production thinning*	7	6.0	10.3	—5.7	—1.7
	8	—8.0	—5.4		
Direct*	10			5.8	10.9
	11	4.6	8.3	—6.1	—2.5
	12	—3.9	—1.3		

* Taking a medium level of export returns

DISCUSSION

The limitations of analysing the forest part alone of an enterprise have been discussed (Fenton and Dick, 1972a) for the log trade, where location directly affects the overseas dollars attributable to the forest. The limitations become more severe when stumpages are used, as for pulp products, and where domestic processing industries—sawmilling and pulp and paper manufacture—are excluded. Few data are available on the costs and profitability of these industries, let alone analyses of import

costs. But results in terms of these criteria are particularly sensitive to the shut-off points—e.g. at stump, on truck, at mill-door etc.—concerned, and consideration of the tree-growing part of the enterprise alone fails to give the overall national result. Furthermore, all results are ratios and are particularly sensitive to the entries in the numerators and denominators concerned; for example a price point "on stump" instead of "on truck" would omit all logging costs and so improve the results for tree growing. It is reiterated that the sites concerned are favourable for low-cost forest establishment, but higher site qualities closer to the port would give better results still. The 1972 currency realignment has not been included; results will need periodic revision.

Results are more sensitive to returns than to costs. The latter are dominated, for export/import criteria, by logging, where the machines involved often require over 80% of their capital cost in overseas exchange. The other major cost is in vehicles and ancillary plant; forest growing and protection costs are low in import content (Table 2). This low import cost in forest growing, including tending, demonstrates where New Zealand forestry has a fundamental competitive edge. Investment of capital in the form of pruning costs involves small expenditure of overseas funds, but could generate large export returns. Hence the direct sawlog regime is, under most assumptions of price etc., as favourable as export log production in export/import criteria. The inferior results of the production thinning regime would decline further if the cost of thinning was included in denominators of the ratios; only stumpages were allowed, hence only entries in the numerators appear for the thinning yields.

The sensitivity analyses made in the sawlog regimes have been on the grades of material which could be exported; these could be extended to cover price if necessary. At "pessimistic" levels the only exports would be completely clear timber, or Factory and Dressing grades with, in general, defects being 5 ft apart on average; such material is of excellent quality.

To maintain comparability the parameters varied in the export log model (of lesser volume, different price, different location) were the same as in the earlier study (Fenton and Dick, 1972a). The accelerated rates of planting give consistently greater export returns and export/import ratios, the difference in the latter being equivalent to about a 1% greater rate of return. This result reflects, again, the modest demands on overseas exchange while building up a production forest, and the greater returns that follow accelerated programmes. The "normal" patterns of afforestation analysed here were adopted to establish strict comparability between different regimes, and not directly as indicators of forest profitability. Accelerated planting and earlier felling gives increased profits as the greater indirect capital expenditure needed is more than offset by earlier returns.

The relative ranking of the three regimes by LEV and IRR, with full (import and export) costs and returns was: Direct sawlog slightly superior to export logs (in practical terms the same), and both much superior to production thinning. This ranking is repeated when export/import dollar ratios are used.

The effects of the 10% weighting of overseas transactions is *ca.* $\frac{1}{2}$% to $\frac{3}{4}$% added to the IRR; no models are increased by a full 1%. Naturally it is more difficult to raise an IRR of 10% to 11%, than one of 6% to 7%. It is, perhaps, surprising that this weighting has not more effect. Again, the ranking of the projects remains unaltered.

CONCLUSIONS

1. All forest regimes had favourable ratios of export dollars earned per import dollar.
2. The export log and direct sawlog regimes are much superior to the production-thinning sawlog proposals.
3. The 10% weighting of imports and exports does not alter ranking of the projects, nor does it affect the IRR by as much as 1%.
4. Results are very sensitive to export prices, grades, and volumes extracted.
5. Analyses confined to an "on-truck" basis are of limited utility for these criteria.
6. Ratios should be used in conjunction with more absolute values, such as dollars per acre earned.

ACKNOWLEDGMENTS

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