OPTIMAL PRICING POLICY AND INDIGENOUS FOREST MANAGEMENT IN NEW ZEALAND

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ABSTRACT

This paper arises from recent discussion of the extent to which changes in the price system applying to New Zealand native timbers might lead to better utilisation of native forest resources. The main conclusions are that indigenous forestry is a sector in which market failure is generally recognised to be inevitable; that government intervention in the past has not been designed to cope with major elements of this market failure; that the main result of past policies has been to bias prices in a direction which encourages overexploitation of the resource; and that although improvements in the present pricing system are urgently necessary (e.g., some form of conservation levy), the general philosophy of government and the Forest Service concerning conservation will be the really crucial factor in determining the future of our native forests.

INTRODUCTION

New Zealand's indigenous forests are a rapidly diminishing natural asset, having been mined as a depleting resource for well over a century. In contrast to the sustained-yield management of forests in Europe and North America, native forest management in New Zealand has been limited to a process of rationing the original forest (apart from the special cases of kauri, Southland beech and West Coast terrace podocarps). The assumption underlying this management strategy has been that only a single crop of timber can be harvested from many of the native forests, and that future timber supplies must come from plantations of exotic species. Orthodox forestry economics is applicable to these new planted crops which can be produced on a permanent rotation system. Native-forest management, on the other hand, requires that supplies of timber from a fixed and irreplaceable stock, obtained as a free gift of nature, be allocated over time in such a way as to maximise the benefits to society.[2]

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[2] This statement oversimplifies the reality, since there is in fact a steady process of regeneration and growth in native forests. The period of rotation is so long, however (frequently of the order of 200 years plus), and the rate of increment so slow, that to date decisions have been made as though the resource were a fixed quantity.

As the stock of standing forest has shrunk, debate within the New Zealand community has sharpened over the proper use of these trees. Standing forest has, of course, some value to the community as recreational amenity, scientific reserve, aesthetic experience and source of national pride, quite apart from more mundane (and more easily measured) functions with respect to erosion control and microclimate. Few if any of these values find any expression in the operations of private markets. Rather, they are collective goods, the elimination of which is a negative externality of forest logging. Because of the existence of these unmeasured values it is possible to defend a wide variety of positions with respect to continued logging of native forests, ranging from the call for an immediate total halt to logging, across to the belief that the value of native timber as a raw material for industry outweighs all other considerations and that all forests should therefore be available for felling as required.

Throughout this paper the principle is adopted that forests are managed for the benefit of man, not of trees. Total preservation, sustained-yield management, or clearfelling are management options to be evaluated according to how well they meet the present and future needs of the human community. The optimal level of timber extraction, from this point of view, is not directly related to biological constructs such as sustained yield. Forests may be exploited at above or below the sustained-yield level, depending upon the use which the community wishes to make of its resources. The early history of New Zealand clearly required that the rate of destruction of forest should exceed the rate of regeneration, since large areas of land were required to be cleared for farming; thus in many areas standing forest had a negative rather than a positive social value, and destruction by burning was normal and aroused little or no opposition. As land clearance has proceeded, the social value of a hectare of virgin forest has risen at an increasing rate, and the optimal rate of timber extraction is converging rapidly to the sustained-yield rate, if indeed it has not already passed it. The bias inherent in the present price system is such as to make it virtually certain that actual rates of exploitation are considerably greater than the optimum, and this has probably been the case for at least the past 20 years.

MARKET FAILURE

In theory, the optimal rate of production of timber from forests is easily determined, using Fig. 1. The demand curve for timber, which slopes down to the right, reflects the community's valuation of additional units of output, assuming
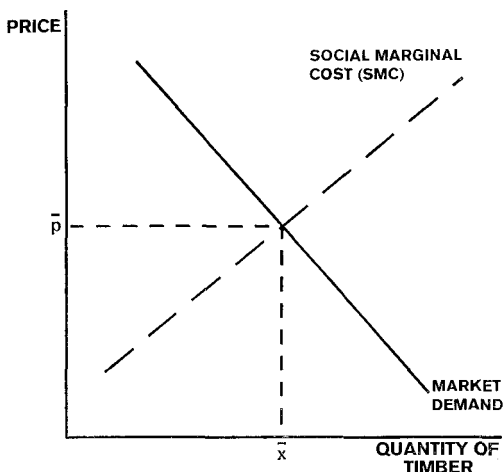
FIG. 1: *The change in market demand and social marginal cost with change in price and availability of timber.*

that the ideal income distribution prevails, and that other markets (for complements and substitutes) are optimally organised. The upward-sloping social marginal cost curve reflects the rising cost of increased output, in terms of the commitment of society's resources to timber production. Because the true preferences of the community, correctly weighted, underlie these two curves, the optimal price and quantity will be found at their point of intersection, at price $\bar{p}$ and quantity $\bar{x}$.

Let us assume for simplicity that the market demand curve fairly represents the community's preferences so far as sawn timber is concerned. The requirement for optimality then becomes the requirement that the supply curve of the sawmilling industry should be identical to the curve SMC in Fig. 1 — that is, the private costs of putting sawn native timber on to the market must equal the social costs. This will be true only if millers take into account, as part of their costs of operation, the full social opportunity costs of the resources which they use.

Obviously enough, if there are social costs associated with logging which are not expressed in the market, the private supply curve of the sawmilling industry will lie below the social marginal cost curve in Fig. 1. The situation shown in Fig. 2 then exists, where the actual price and quantity settle at a larger quantity and a lower price than the optimum, and where the appropriate policy intervention would be the imposition of a tax or levy equal to AB on output, such as to

raise the supply curve up to equality with the social marginal cost curve. Such a policy can be designed and applied with precision only if the planners are able to determine exactly the full social costs of logging, and know the position and shape of the demand curve. Otherwise, although the *direction* of market failure may be clear (as is argued to be the case with New Zealand native timbers), the actual *size* of levy required can only be guessed at.
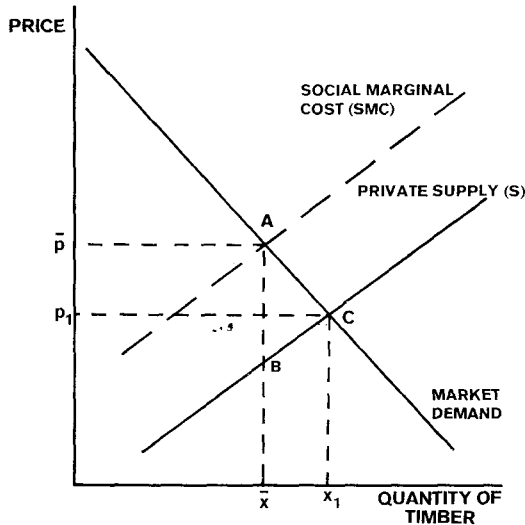

FIG. 2: *The influence on social marginal cost of social costs which are not expressed in the market.*

There are two categories of costs whose exclusion from market prices tends to bias the private supply curve (S in the diagram) downward relative to the social marginal cost curve which the planner should use. They are firstly the inability of the market to value many of the benefits yielded by standing forest, and secondly the fact that unless a natural resource is owned by profit-maximisers who collect the full "unearned increment" or rent on their property, there will be an incentive for users of the resource to overexploit it.

Value of Standing Forest

The first problem is the value of standing forest in terms of non-marketable uses: recreation, environmental quality, wildlife, aesthetics and other similar benefits of forests which have the character of public goods. The correct way to bring these into a pricing system would be to impose a charge on logs extracted from the forest sufficient to compensate for

the amenity and other values thus destroyed. The problem is that there is absolutely no way of putting a precise, measured value on these types of public goods; any assessment of the value of a forest amenity to the present generation, let alone the next, must inevitably be very crude.[3] (In the case of a non-renewable resource, the only safe rule of thumb is probably to err on the side of conservationist caution.)

Despite the impossibility of precise measurement, we can be absolutely clear about the *direction* of the bias which results from failure to take explicitly into account the true social opportunity cost of forest resources destroyed by logging. If the value of a standing forest to the community is V, and the commercial value of the same area of forest committed to logging is C, then logging should be permitted only where C is greater than V, or (with selection logging) where C is greater than the *reduction* in V due to logging.

Until very recently, the debate over the logging of native forest in New Zealand tended to be between those who believed that V is zero or insignificant (so that logging has no external costs), and those who believed that V is a large positive amount, usually greater than C. In the 1978 debate over Pureora, for example, figures widely circulated by the Government and the Forest Service indicated a value of the standing forest to the community of zero and appraised the returns from logging using, without correction, the distorted market prices then ruling.[4] Conservationists countered with less precise (but in our view more plausible) claims that the forest embodied social values which would be lost if logging proceeded. To date, no clear quantitative comparison between these values and the commercial worth of the timber from Pureora has been made, but the decision to place a moratorium on logging indicates a political decision to give non-market benefits greater weight than the commercial returns.

Casual observation suggests that the Forest Service has in the past had a tendency to underestimate rather than overestimate the social values of standing forest relative to the value of that forest exploited for timber. Native forest reserves have generally been established and defended only where public pressure in their favour has been overwhelmingly clear, and milling pressure relatively slight. In marginal cases, until very recently, the dominant lobbying pressures came from

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[3] For some discussion of the problems which arise, see for example Clawson (1975) and Fisher *et al.* (1972).

[4] See Higham and Menzies (1978).

the milling interests rather than conservation groups. This situation seems to have changed dramatically in the past 3 years, with a resultant expansion of the areas planned as reserves. This appears to be more a response to intense political pressure than a result of economic calculation *per se.* Frequently, decisions concerning the rate of logging in production forest zones have resulted from a shifting emphasis in silvicultural method, pressure from sawmillers, and a steady though often muted conservation interest among foresters.

The Unearned Increment

It was recognised by 19th century economists that the owner of land received an income, related to the productivity of the resource which he possessed, which was obtained solely because of the rights of ownership and not because of any active contribution to production. Land or other resources which were not privately owned, but were available freely to all, were common-property resources, and the rent which would have been collected by a private owner was instead distributed among the users of the resource, in the form of higher productivity and income. Gordon (1954) has demonstrated that in these cases where no exclusive owner controls a resource there will be a tendency towards overexploitation, since no charge must be paid for its use. The phenomenon is familiar in the case of fisheries, and can be expected to occur in forestry if there is no charge (or too low a charge) imposed on loggers for the right of access. Gordon's solution to the problem is to suggest that the government, or some similar agency, should act in the way a private profit-maximising owner would do, collecting a rental from all users of the resource equal to the rent which would naturally come into the hands of an owner in a perfect market.

It is clear enough that this rent, reflecting the direct contribution of the natural resource to the value of final production, can be easily calculated by taking the free-market price of the final product and subtracting the value of capital, labour and other inputs (other than the resource) used in the production process. The residual is then the unearned increment which the government should capture as rent or royalty. This calculation will be accurate, however, *only* if the price obtained for the final product reflects its true value in a perfect market. If the final price is too high, then the unearned increment will be exaggerated; and if the final price is too low, the unearned increment, calculated as a residual, will be too low. This latter case gives us the situation in New Zealand native forest today.

NATIVE TIMBER STUMPAGES

The collection of rent on native forest resources used for timber production takes place by means of the charge made to logging and milling companies for the logs which they extract from the forest.[5] Both private owners and the New Zealand Forest Service sell logs to millers. The weight of the Forest Service, however, is so great as to give it major power as a price leader; and private stumpages in practice are determined by those of the Forest Service. Since the establishment of the Forest Service in 1920, the guiding principle of its stumpage policy has been that the forest owner should capture the "unearned increment". Until 1939 this was achieved by putting blocks of bush up for private tender, subject to an upset price apparently based upon the current commercial stumpages being paid in private bush. In 1939 a change was made to use of the so-called "residual value formula", which again corresponds in principle to the idea of the unearned increment. Starting from the value of the product (sawn timber) in the marketplace, the Forest Service subtracts the costs of production (log extraction, milling and distribution), including normal profit at 15% on assets, to obtain a residual which is taken as the value of the trees extracted. Allowance is made for regional and local cost differences due to transport problems, topography, and so on. Two features of this system stand out immediately:

(1) The market for sawn timber is the sole arbiter of the value of standing forest logged; there is no attempt actually to measure the opportunity cost of forest in terms of its potential for the production of non-marketable public goods. The residual-value system would lead to an optimal allocation only if landowners were explicitly aware of the value of these alternative uses of their land, and released forest for logging only where that was the option with the highest (social) return. Although this issue as it applies to stumpage has received growing attention among forestry economists in the United States, it has not been much discussed in Australia or New Zealand, where the objectives of stumpage tend to be limited to recovery of an assessed residual which it is hoped may suffice to finance the cost of growing trees for harvest.[6] (In the case of virgin forest, of course, this cost is

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[5] The best published history of government policy on stumpages and timber sales appears to be Ward (1967), pp. 44-66.

[6] This narrow focus is evident in Hanson and Leslie (1965), especially in their "Criteria for an Ideal Stumpage Determination System" (p. 100). Repeated comments in the annual reports of the Director-General of Forests during the past 20 years make it clear that the New Zealand

zero or very low — even if we include costs of management prior to logging such as fire protection and roading.)

(2) The market price of sawn timber (which, as already noted, takes no account of the true social value of forest destroyed) is used without question as the basis for calculation of the "residual value" or unearned increment. Now, even if there were no non-marketed benefits from standing forests, this would be an acceptable procedure *only* if the final price corresponded to the full free-market valuation of the timber. In practice, the price of sawn timber in New Zealand is nothing of the sort, and the stumpages calculated on the basis of the residual formula are therefore not equal to the true residual value. Furthermore, the bias here is in the same direction as that noted in the preceding paragraph — *i.e.*, in the direction of an undervaluation of the natural resource. Timber in New Zealand has been under price control since 1936 (and for an earlier period in the 1920s),[7] and the domestic price of native timber has been deliberately insulated from international market values in order to ensure supplies of cheap timber for the New Zealand consumer.[8] Both of these points deserve further discussion.

Price control on native timber follows the usual cost-plus criteria applied by the Department of Trade and Industry and its predecessors. The controlled price, in other words, is calculated by adding on normal milling costs to the stumpage.[9] The basic stumpage, of course, is calculated by subtracting normal milling costs from the controlled price. Market demand has thus no direct means of affecting stumpages; indeed, it has been theoretically impossible to raise stumpages significantly for the past 40 years under this system. To complete the picture, it should be noted that although stumpage is the base cost on which the price control system rests, until 2 years ago increased stumpages could not be passed on as price increases under the price control regulations.[10] Short of abandoning the established residual system, the Forest Ser-

Forest Service's concern for higher stumpages rests first and foremost on the desire to make forestry investment profitable for the private sector, especially farmers. In the early 1950s, and again in the past couple of years, conservation arguments have also figured, however.

[7] For a history of price control on native timber, see Ward (1967), pp. 76-95.

[8] This policy originated with Sir Francis Bell, Minister of Forests in 1919 (Report of the Director-General of Forests for the Year Ending March 31, 1976, p. 9). See also Ward (1967), p. 76.

[9] Milling costs as used here include the costs of logging, transport and distribution. For the criteria as applied to timber, see Department of Industries and Commerce (1972), pp. 54-5.

vice had no means of raising indigenous timber stumpages, and pressure from the sawmilling industry was naturally aimed at retaining the system. (Both the 1969 Forestry Development Conference and the 1972 Stumpages Working Party declared in favour of retention of the existing residual system.) Possibly more significantly, so long as price control remained effective, private forest owners could not raise their stumpages to any great extent, as sawmillers were not legally permitted to pass on such increases. This may have deterred some private landowners from logging their forests, but it must also have contributed to the willingness of others to clearfell forest on their land in order to convert it to more profitable agricultural production. Which response has been the more important poses an interesting question for future research.

Table 1 and Fig. 3 provide some indicators of the long-run trend of stumpages and indigenous timber prices since 1920. The values used are by no means perfect. The stumpage series covers only Forest Service sales of standing trees, excluding sales at the mill, and excluding also stumpages paid in private bush; and of course there has been some downward bias added to the trend by the declining quality and accessibility of trees felled, although this bias is probably not of great significance for our purposes. For timber prices, the only published unit-value series known to us is for various grades of rimu. The Forest Service native timber price index was constructed with unknown weights on the basis of sales at Mamaku, and was discontinued at the end of the 1960s, since when we have only Abel's updating to 1974. Overall trends, however, seem clear enough.

The story told by these figures is straightforward. Over the 50 to 60 years covered, the wholesale price of native timber moved very closely with wholesale prices in general in the economy, with the result that the deflated series for native timber prices, on base 1926 = 100, ended the series in 1974 at 124 (Fig. 3a) — only a slight rise in relative price of native timber, corresponding entirely to gains during the 1950s. Since 1960 the relative price trend has been absolutely horizontal.

Stumpage rates have shown more fluctuation (Fig. 3b), having increased roughly two-and-a-half times in real terms between 1950 and 1967, after which they declined rapidly during the early 1970s, falling below the 1926 level in real

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[10]This ruling dates from decisions of the Price Tribunal in the 1930s and 1940s; see Ward (1967), p. 84. The purpose may have been to make it impossible for private forest owners to push their stumpages up far above the Forest Service stumpages, on which the controlled timber price was based.

TABLE 1: SOME BASIC DATA ON STUMPAGES AND NATIVE
            TIMBER PRICES ($/m³), 1920-1978

Year	Stumpage on NZFS Sales of Standing Native Timber	Building A Rimu Price	Dressing A Rimu Price	Dressing Heart Rimu Price	Price Index for Indigenous Sawn Timber (1926 = 100)
1920		6.53[a]	7.59[a]	12.54[a]	90
1921	1.14	(6.18)	(7.59)	(13.07)	96
1922		5.83[b]	7.59[b]	13.59[b]	93
1923		5.83[a]	7.59[a]	14.65[a]	95
1924		5.83[c]	7.59[c]	16.42[c]	98
1925					102
1926	0.50	5.12[d]	6.71[d]	16.42[d]	100
1927		4.23[a]	5.64[a]	15.54[a]	90
1928					87
1929					90
1930					91
1931	0.46				76
1932					73
1933					71
1934		3.53[e]	5.12[c]	10.06[e]	65
1935		3.88[d]	6.70[d]	13.06[d]	73
1936	0.59	6.36[e]	8.47[e]	16.24[e]	88
1937	0.53				101
1938	0.48	6.89[f]	8.65[f]	17.30[f]	106
1939	0.53				108
1940	0.55				113
1941	0.59				118
1942	0.63	7.67[g]	9.88[g]	18.89[g]	121
1943	0.64				122
1944	0.62	8.12[h]	10.32[h]	19.69[h]	122
1945	0.63				133
1946	0.63	9.71[d]	11.74[d]	20.66[d]	148
1947	0.79				149
1948	0.70				156
1949	0.80				172
1950	0.74	12.97[c]	15.18[c]	26.31[c]	177
1951	0.84				191
1952	0.99				198
1953	1.03	17.83[h]	20.13[h]	33.37[h]	232
1954	1.16				246
1955	1.33				252
1956	1.57	19.24[i]	21.54[i]	36.01[i]	255
1957	1.70				294
1958	1.97				294

Year	Stumpage or NZFS Sales of Standing Native Timber	Building A Rimu Price	Dressing A Rimu Price	Dressing Heart Rimu Price	Price Index for Indigenous Sawn Timber (1926 = 100)
1959	1.92	22.42[c]	27.01[c]	43.43[c]	300
1960	1.80				308
1961	2.14	24.89[j]	30 36[j]	46.96[j]	339
1962	2.25				345
1963	2.57				352
1964	2.78	26.13[d]	33.10[d]	50.49[d]	356
1965	2.95				367
1966	3.17				372
1967	3.30	27.54[j]	40.25[j]	55.35[j]	386
1968	3.68	33.07[b]	50.88[b]	69.75[b]	391
1969	3.80	33.92[g]	52.15[g]	71.02[g]	405
1970	3.35	34.34[a]	62.03[a]	76.19[a]	422
1971	3.00	37.74[d]	64.11[d]	84.16[d]	473
1972	2.86				575
1973	3.22				619
1974	2.85	48.38[a]	74.75[a]	95.35[a]	617
1975	2.87				n.a.
1976	3.28				n.a.
1977	3.66				n.a.
1978	7–8 est.	97.81[c]	154.90[c]	218.08[c]	n.a.

Sources: Column 1 from *Statistics of the Forests and Forests Industries of New Zealand to 1977* (N.Z.F.S., Wellington, 1978) Table 79, Column 3. Data are for March years.

Columns 2-4 calculated from W. C. Ward, *50 Years — A History* (Dominion Sawmillers Federation, 1967), p. 97, for the period 1920 to 1967. Data thereafter from wholesale price lists issued by the Sawmillers Federation. We acknowledge with thanks the Federation's permission to use these figures. All prices are f.o.r. Mamaku or Ongarue. BA rimu is 150 × 50 until 1970, 100 × 50 thereafter. DA rimu is up to 9in. until 1970, then 150 × 25, green sawn. DAH rimu is 6in. flooring to 1970, then 150 × 25 plus airdrying charge.

Column 5 from *Statistics of the Forests and Forest Industries of New Zealand to 1970* (N.Z.F.S., Wellington, 1970). Table 78, for the series up to 1969. The index for 1970-74 is from D. B. Abel (1977), p. 42.

Notes: [a]June/July, [b]August, [c]October, [d]September, [e]February, [f]March, [g]April, [h]December, [i]November, [j]January.
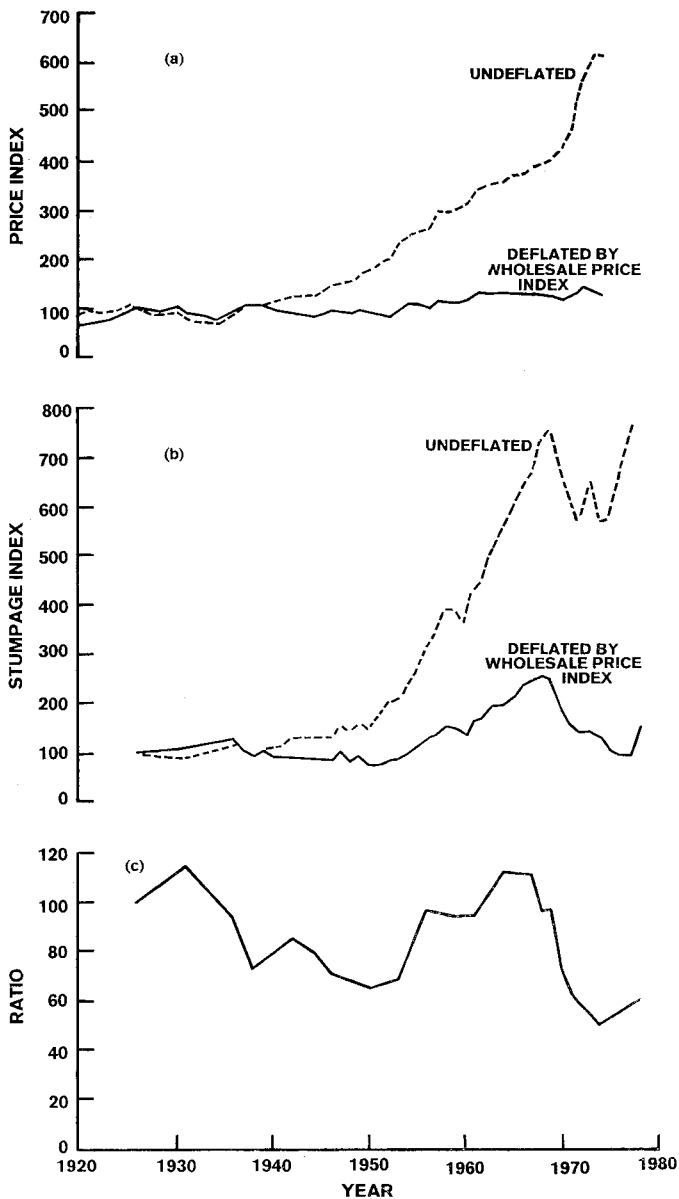
FIG. 3: *Trends in stumpages and indigenous timber prices since 1920.*
(a) *Price index of indigenous timber* (1926 = 100); (b) *Indigenous timber stumpages index* (1926 = 100); (c) *Ratio of indigenous timber stumpage to rimu DA price* (1926 = 100).

terms by 1977. In 1978 a doubling of stumpage rates in nominal terms took the deflated index up to only 150, still well below the normal level for the 1960s. Overall, the ratio of stumpage rates to native timber prices (Fig. 3c — represented here by rimu DA, but similar results are obtained with other series) has shown a long-run downward trend, reversed for a time during the 1950s and the first half of the 1960s.

These results appear to be at odds with what might have been expected in the case of a natural resource becoming scarcer over time. A simple model would suggest that the increasing scarcity value of native forests should be reflected in both the wholesale price of sawn timber and the stumpages paid; and that as the resource became scarcer, raw material costs should tend to rise as a proportion of the total costs of the indigenous-timber sawmilling industry. In fact, the opposite has occurred, as the result of government policy on price control and stumpage derivation. These trends in prices during the 1970s have certainly provided no incentive for sawmillers or timber users to adopt a conservationist stance with respect to native forests.

From 1950 to 1967 it does look as though market forces reflected the growing scarcity of native forest resources relative to demand. Although price control prevented any rise in the relative price of native timber, the strong demand derived from economic growth during this period fed through to competition among sawmillers for access to areas of bush, and hence to upward pressure on stumpages. The turnround in 1967, and the declining trend through the subsequent decade, can probably be explained by several factors:

(a)   Derived demand for native logs fell in the late 1960s, with a slackening of growth in the economy and rapid substitution of exotic timbers for natives in the building industry.

(b)   The quality of logs available, and accessibility of logging areas, fell considerably as the best bush areas were finally worked out; but this trend had been perceptible at least since the 1950s, and it is not clear that it could have produced the 1967 about-face.

(c)   Probably of greatest significance is the fact that in the mid-1960s the sawmillers and the Forest Service reached agreement on a new system of long-term sales of timber cutting rights which provided security for the leading sawmilling companies and may thereby have reduced competitive pressures on stumpages. The sawmillers' official history indicates that the two decades after the Second World War were a period when upward pressures on stumpages caused considerable friction between sawmillers and the Forest Service;

but the establishment of the Indigenous Timber Advisory Committee in 1965 and the subsequent long-term sale contracts were followed by an evident easing of tension. This was presumably not unconnected with the downward trend in stumpages.

Turning now to the relationship between domestic timber prices and those in the international market, we have assembled figures for five imported timber varieties in Table 2, and Fig. 4 graphs two of these (oregon pine and oak) against the domestic wholesale price of rimu DA. Other combinations could be selected from Tables 1 and 2, without affecting the broad patterns which emerge. It will be seen that, in the 1920s, prices for native and imported softwoods were very close together, and since tariff and other restrictions on imports were relatively slight, the competition from imports was keenly felt by the industry.[11] After the depression, however, price control was used to hold native timber prices down (partly in order to keep the first Labour Government's state house prices low). Import and indigenous prices began
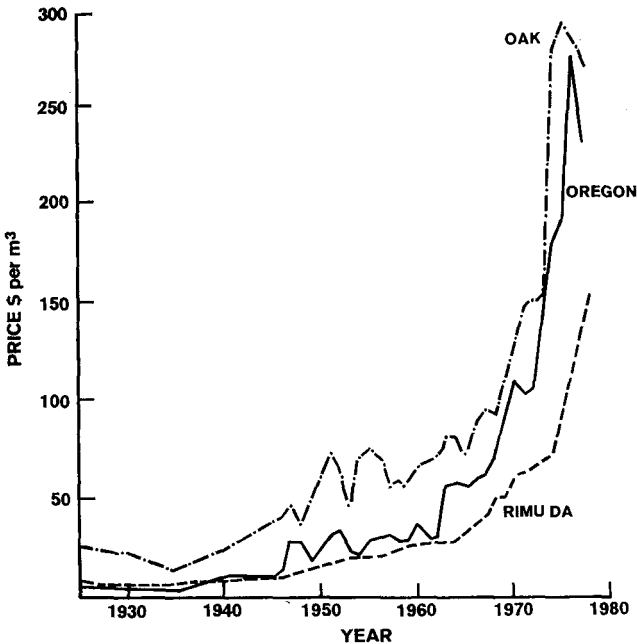

FIG. 4: *Price comparison: rimu vs. imported oak and oregon.*

[11]Ward (1967), pp. 116-20.

TABLE 2: C.I.F. UNIT VALUES ($/m³) OF SOME IMPORTED
TIMBERS, 1925-78

Year	Oregon	Redwood	Cedar	Oak	Eucalypts	Tropical Hardwoods
1925	6	11	11	26		
1930	5	11	10	23		
1935	5	11	10	14		
1940	12	19	17	24		
1945	11	25	41	41		
1950	25	54	n.a.	72		
1955	28	53	48	75		
1960	37	42	51	67	n.a.	n.a.
1965	57	68	72	86	66	76
1970	119	114	121	99	94	109
1975	194	201	214	293	182	172
1978	208	283	n.a.	518	212	204

Source: Calculated from the annual N.Z. trade statistics.

to diverge, and the difference became dramatic after the
Second World War, when oregon pine, for example, rose to
double the price of competing rimu grades. Through the 1960s
the gap again widened steadily, and in the 1970s the inter-
national price explosion carried imported timber prices with
it, while indigenous timber prices were held back. By 1974,
thus, rimu wholesale prices ranged between about $50 and
$100/m³, depending on grade and size, while c.i.f. prices for
oregon had reached between $160 and $200; for redwood $200;
for cedar $215; and for oak $290. Other competing species,
the importation of which had developed more recently (Aus-
tralian eucalypts and tropical mahogany), were priced around
$170 to $180/m³. At a minimum, we could guess that rimu was
priced at least $100/m³ below those imported timbers which
could fill similar specialty and decorative roles. Without too
much inaccuracy, it can be stated that the implicit subsidy
of around $100/m³, or over 100% of the wholesale price, was
being paid to users of the native timber (sawmillers and con-
sumers).

By 1978, despite increases in indigenous timber prices, the
differential remained of similar magnitude, and was showing
signs of growing.

CONCLUSIONS

The available data suggest the following conclusions about
government intervention in the market for native timbers:

(1) Stumpage policy has been designed (inadequately) to
capture only the "unearned increment" on forest; there has

been no attempt to measure or capture the true social opportunity costs of forest land. While the latter may well have been zero or negative at the beginning of the 20th century, there can be no doubt that they are now positive and growing rapidly, and it is extremely unlikely that present stumpage levels capture more than a fraction of this rent component, which consequently accrues to sawmillers and timber users as an implicit subsidy.

(2)   The stumpages charged on forest land have been systematically depressed over the past 40 years by the operation of the price control system, with the result that there has been an incentive to overexploit the resource. The significance of this becomes particularly evident if imported materials are included among the potential substitutes for native timber: the effect of price control has been to hold native timber prices progressively further below the international prices of competing timbers, which amounts to saying that the true return on New Zealand timber in its international context was being dissipated to timber users in the form of below-optimal price and above-optimal quantity.

. (3)   Adherence to an inappropriate residual formula has tied the hands of the Forest Service so far as higher stumpages are concerned, leading to increasing undervaluation of the resource which the relevant government agency considers itself powerless to correct. In December 1978 the Forest Service appeared before a Commerce Commission hearing asking that price control be removed in order that higher stumpages could be imposed without abandoning the residual value formula. This appears to have been a misplaced exercise in a sector where market failure is acknowledged and where the failure has two components, not just one. The removal of price control (which would, of course, have to include the removal of import restrictions on timber) would adjust the market-valued "unearned increment", but would do nothing whatever about the simple inability of the market mechanism to take account of the true social value of standing forest.

(4)   This brings us to the final, inescapable point, that the impersonal forces of the market can handle only a part of the problem of correctly valuing New Zealand's native timber resources. Because the social values destroyed or damaged by logging are non-marketed, the process of estimating, and correcting for, these values is a political process, which places upon the relevant governmental agencies the responsibility of setting out some explicit principles of estimation, and taking these into account in decision-making. This is not an issue that can be avoided by pretending that the market can solve

the problem, or that forests have no value except as timber sold now. It must be dealt with directly, and will require some intervention in the market by means of taxes or levies, to correct a distortion which is built-in to the market mechanism itself.[12]

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[12]The operation of a levy system is discussed in Bertram (1978).