FURTHER COMMENT ON THE FORESTRY DEVELOPMENT PLAN FOR OTAGO

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Abstract  
Volume 22, No. 1 (1977) of this journal contained disagreement between Grant and Collins et al. over the evaluation of social benefits in the Forestry Development Plan for Otago. An examination of the main points supports Grant's criticism. The population forecast used to derive migration data which form the basis for the evaluation of social benefits is found to have been misused. This error is compounded by the misinterpretation of the derived migration pattern. In the absence of data specific to the establishment of a forest industry in Otago, it is impossible to predict the exact value of the employment multiplier. This uncertainty should have been recognised in the Plan, and the sensitivity of the results tested. Allowance should have been made for the overvaluation of the exchange rate in calculating the saving in protection costs resulting from the establishment of an export-orientated forest industry. Moreover, the framework of the cost-benefit analysis is incomplete, mainly because of the omission of the costs and benefits directly associated with processing. As a result, the case for afforestation and wood processing in Otago is found to be not proven.

INTRODUCTION  
The Forestry Development Plan for Otago Planning District (N.Z. Forest Service, 1975) examines a range of options for forestry development in Otago. Three forest-management alternatives are considered and, for each of these, two options are examined:  
(1) Log exports.  
(2) Log supply to an integrated sawmill/refiner-groundwood pulpmill.  
Forest management Alternative 1 is based on an annual planting rate of 2060 ha. This would provide sufficient raw material for a 100-tonnes-per-day refiner-groundwood mill from 1986 to 1990, rising to 200 tonnes per day in 1991-95, 400 tonnes per day in 1996-2000, and 700 tonnes per day in 2001-2005. In addition, sawmill production is projected to expand...  
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dramatically after 1991-95, reaching 393,000 m$^3$ in 2001-2005. In Alternative 2 the planting rate is 2870 ha per annum. The resulting forest resource can support a 200-tonnes-per-day mill from 1986 to 1990, rising to 400 tonnes per day in 1991-95, 500 tonnes per day in 1996-2000, and 1000 tonnes per day in 2001-2005. Sawn timber output is projected to reach 365,000 m$^3$ in 2001-2005. In Alternative 3 the planting rate of Alternative 2 is increased in the periods 1976-80 and 1981-85. As a result of the higher planting rate and the early felling of stands, pulp output starts at the increased level of 300 tonnes per day, again rising to 1000 tonnes per day in 2001-2005. The increased output of pulp is initially at the expense of sawn timber production which, up to 2001-2005, is at a lower rate than in Alternative 2.

From the grower’s point of view, the export of logs was found to be more profitable than the growing of sawlogs or pulp logs for local industry. This means that if logs are supplied to local industry the Government, as the principal grower, will incur a cost in terms of revenue forgone. However, the Otago Development Plan looks beyond forest profitability. It attempts to justify afforestation on the basis of secondary benefits arising from the establishment of forest industries in Otago.

It was argued that the employment and investment opportunities created through industrialisation would lead to regional development and to a reduction in northward population drift, particularly to Auckland, South Auckland-Bay of Plenty, and Hawke’s Bay. This was assumed to give rise to a number of benefits, including a saving in traffic congestion costs in Auckland, a delay in the timing of expenditure on a rapid rail system in Auckland, and a saving in transport costs to and from work (pp. 54-6, 116-9). In addition, it was argued (p. 56, pp. 121-2) that workers employed in the export-orientated forest industry in Otago would otherwise be employed in industries producing mainly for the domestic market. This, it was reasoned, would result in a large saving in protection costs which would otherwise be incurred.

In Volume 23, No. 1 of this journal the methodology of the analysis and the conclusions drawn were questioned by Grant (1977). A reply in the same issue, by Collins, Donnelly and Francis (1977), rejected Grant’s criticism and concluded that the calculation of the benefits of the Otago forestry scheme was “both valid and conservatively estimated”.

The argument centres on a number of assumptions underlying the analysis, particularly those relating to inter-regional migration, the employment multiplier, and industrial protection. This paper examines the main points relating to
the assumptions made on these three issues and attempts to resolve the arguments. Another major issue raised by Grant related to the need to integrate regional and national planning. However, as Collins et al. apparently agreed in principle with Grant's comments, no further comment is necessary here. A brief comment is included on the methodology of the cost-benefit analysis of the Otago Plan and some social costs of forest industries development are listed.

THE PATTERN OF MIGRATION

The social benefits evaluated in the Otago Development Plan are related to the reduction of the net migration from Otago and to a reduction of the growth rate of Auckland, South Auckland-Bay of Plenty, and Hawke's Bay. Consequently, the Plan includes a derived migration pattern which is used as a basis for evaluating social benefits.

Regional population estimates used in the Otago Development Plan were taken from forecasts made by the Ministry of Works (1972). From these estimates a pattern of internal migration was derived "such that for each net loss of 100 people from the Otago region, Auckland, South Auckland-Bay of Plenty, and Hawke's Bay ... gain directly or indirectly an additional 80, 16 and 4 people, respectively" (p. 53).

Grant (1977) found this derived migration pattern unconvincing and argued that other patterns were equally plausible. Collins et al. (1977) in reply rejected Grant's argument on the grounds that the migration pattern was based on published Department of Statistics and Ministry of Works and Development (MWD) figures. However, those published figures represent regional population forecasts, not projected patterns of inter-regional migration. They are consistent with a very large number of possible migration patterns and thus the reason given by Collins et al. for rejecting Grant's argument is spurious.

Moreover, it is questionable whether the authors of the Otago Development Plan should have used the MWD forecasts in the way that they did. According to R. J. Lowe of the Town and Country Planning Division, MWD (pers. comm.) the possibility cannot be excluded that some or all of the employment in the Otago Development Plan was already implicitly included in the MWD forecasts. Employment estimates in the Plan therefore do not necessarily represent a net addition to employment or population projections made for Otago. This means that population-related benefits cannot be evaluated with any degree of certainty.
Regardless of whether or not the use of the MWD population forecasts is valid, the interpretation of data within the framework of the derived migration pattern is open to criticism. On p. 106 of the Plan it is stated that “from Table 34 it can be seen that Auckland will be the recipient of the bulk of net migrants from regions experiencing an average annual percentage change in population less than their net natural increase”. This statement is incorrect. Table 34 shows derived net regional migration changes in 5-year periods from 1966-71 to 1986-91. These regional figures include an allowance for net annual immigration of 5000 people from overseas, most of whom will go to Auckland and Wellington, according to the Plan (p. 105). The existence of immigrants from overseas in the figures can be shown by addition of the migration changes for all regions. If no foreign immigrants are involved these figures should sum to zero, with deficit regions cancelling out those with positive gains. The figures do not sum to zero; instead there is a net gain of some 25,000 for each 5-year period, representing migrants from overseas. As Table 34 does not distinguish between foreign immigrants and New Zealanders it is not correct to claim that it shows Auckland as the destination of migrants from low growth regions. Auckland’s migration gain could quite plausibly be made up of immigrants to New Zealand and migrants from New Zealand’s other growth regions.

Even if, in working out the ratio 80:16:4, allowance has been made for migrants from overseas (despite the implication to the contrary) the relationship between migration from Otago and that into the three growth regions is untenable. The ratio 80:16:4 relates to migrants from all regions moving into Auckland, South Auckland-Bay of Plenty, and Hawke’s Bay, not specifically to migrants from Otago. It is most unlikely that all migrants from Otago will go to these three regions. Those migrants from Otago who go to regions other than Auckland, South Auckland-Bay of Plenty, and Hawke’s Bay can be said to add to the growth of these three regions only if they cause migrants from other areas to move there.

The following example may help explain this point. A recent study of internal migration (Rowland, 1976), which was not available to the authors of the Plan, showed that between 1966 and 1971 the main population outflow from Otago was to Canterbury. Census data for 1966 and 1971 given in Appendix 1 of this paper show that between these years only 27% of the migrants from Otago moved directly to the growth regions. The other 73% went to a number of other regions. The main components of northward drift in the years 1966-71 were net shifts of population from Otago to Canterbury,
from Canterbury to Wellington, and from Wellington to the three growth regions (Rowland, 1976). If this pattern were to continue, the main effect of a scheme designed to reduce migration from Otago would be a drop in the number of migrants entering Canterbury. Unless Otago people migrating to Canterbury cause Canterbury people to migrate to Wellington, who in turn cause the Wellingtonians to move northward, the effect on the growth rates of Auckland, South Auckland-Bay of Plenty, and Hawke’s Bay will be minimal.

Similarly, unless future migration within New Zealand is caused by migrants from Otago, then keeping people in Otago will have minimal impact on the growth rate of Auckland, South Auckland-Bay of Plenty, and Hawke’s Bay. Even if the causal relationship exists it would be logical to expect a time lag between, say, a person migrating from Otago to Canterbury and one moving from Wellington to Auckland. As demonstrated in Appendix 2 of this paper, the Otago Development Plan contains no discounting of benefits to allow for a time lag. In other words, it has been tacitly assumed that if the number of migrants from Otago is cut by 100 there is an immediate and equivalent reduction in net migration to the growth regions.

For these reasons we hold that the authors of the Otago Development Plan have misused the published regional population projections and have misinterpreted their own derived migration pattern. As a result, those benefits which depend directly on the migration pattern are in doubt. The benefits directly affected are those relating to electricity savings, traffic congestion, delaying the introduction of Auckland’s rapid rail, travel time savings, and the cost of operating cars. For Alternative 1 these benefits account for between 46 and 56% of all social benefits, depending on whether the unfavourable or favourable combination of assumptions is used. In addition, because of the way in which protection has been measured, any variation in the migration pattern will affect the benefits associated with the savings in protection. Because the derived migration pattern is open to question those benefits also are in doubt.

EMPLOYMENT MULTIPLIER

An employment multiplier is a measure of the total increase in employment resulting from an increase in employment in one sector. It can be defined as the ratio of total employment generated (direct and indirect) to the amount of direct employment. For example, Grant (1976) found that for every job in the pulp industry in Kawerau there were 0.1 to 0.4 jobs in servicing activities (i.e., the multiplier was 1.1 to 1.4).
The larger the multiplier for a particular industry, the greater will be the impact on total employment of expanding employment in that industry.

The value chosen for the employment multiplier in the Otago Development Plan is important because, the greater the number of people employed in Otago, the greater will be the social benefits relating to any consequent reduction in the population growth in Auckland, South Auckland-Bay of Plenty, and Hawke's Bay. The authors of the Plan chose a multiplier of 2, assuming it "to be reasonable" (p. 110), although no reasons were given in support of this assumption.

Grant has argued, partly on the basis of his own work on the pulp and paper industry in Kawerau (Grant, 1976), and partly on the basis of information in the overseas literature (Greig, 1971; Garrison, 1972; Reilly, 1974), that a multiplier of 2 is too high. Collins et al. counter-argue that the references cited by Grant are inappropriate to the Otago situation. By the same token, it is difficult to understand why they see a multiplier relating to all forest industries in southern United States (Kaiser and Dutrow, 1971) as being appropriate to Otago.

As further justification of their use of 2 for the multiplier, Collins et al. quote a national multiplier of 2.7 for all industries in New Zealand in the period 1973-75. Their criticism of Grant's multiplier was that it was a local one and therefore inappropriate for a region; yet they then proceeded to give a national multiplier as being appropriate to their case. If Grant's multiplier is inappropriate, so too is the national one given by Collins et al. Even if they were to give a regional multiplier calculated in the same way as their national multiplier, this would not necessarily be relevant to forest industries development since it would be a weighted average for all the industries in the region. In the Otago Plan the appropriate multiplier is one relating specifically to the pulp and paper industry and sawmilling.

The only forest industries multiplier calculated for New Zealand is in the range 1.1 to 1.4, calculated by Grant (1976). Collins et al. contend that as this multiplier relates to the town of Kawerau rather than to a region it is not an appropriate indicator of a multiplier for Otago. They claim (p. 135) that a regional employment multiplier such as they used in the Otago Development Plan would be much higher than a local multiplier such as that for the town of Kawerau which would have leakages to surrounding districts.

There is some substance in this argument. At the same time it is equally possible that in a region with a declining or static population the work force employed in trade, finance,
and services may be under-utilised (Garrison, 1972). If this is true of Otago then existing firms could possibly absorb some additional work without any increase in staff. This would tend to limit the multiplier effect of new industries.

As there is no evidence relating specifically to the development of forest industries in regions such as Otago, there is no clearcut answer to the argument as to what is an appropriate multiplier for Otago. Figures in the overseas literature indicate the possibility that multipliers may be greater or less than 2. A multiplier of 2 was one of the key assumptions of the Otago Development Plan, and the assumption is clearly subject to uncertainty. Thus, it would have been logical to test by sensitivity analysis the effect on the results of multipliers less than and greater than 2.

Quite apart from the debate on the magnitude of the multiplier, its application in calculating the social benefits of processing has also been questioned. In the Plan the multiplier has been applied to the total project work force. However, as pointed out by Grant (1977), the bulk of the project work force is in forestry and logging. A sizable proportion of the indirect employment generated and of the social benefits are therefore attributable to forestry and logging. As employment in forestry and logging is common to both processing and log exports, some social benefits should be credited to log exports. In Table 19 of the Plan no allowance is made for social benefits generated by log exports. To correctly estimate the social benefits of processing, either the multiplier should be applied only to the work force engaged in processing or, alternatively, the social benefits attributable to forestry and logging should be subtracted from the total benefits of the project. As neither of these adjustments has been made, the analysis is biased in favour of processing.

**EXPORT ORIENTATION AND THE SAVINGS IN PROTECTION COSTS**

In the Otago Development Plan (p. 121) it is assumed that industries that will develop in Auckland, South Auckland-Bay of Plenty, and Hawke's Bay will be mainly domestically orientated and protected. The industry proposed for Otago, on the other hand, is totally export-orientated. This gives rise to a saving on protection costs. Of all the social benefits evaluated in the Plan, those attributed to export orientation and savings in protection costs were the greatest. They arise because of “a fundamental difference between production for the domestic market and production for export” (p. 121). If this is so, then any export-orientated industry would give
rise to these benefits. Yet the Plan fails to credit benefits relating to export orientation to the log export alternative.

Grant questioned the assumption that the only alternative to an export-orientated industry in Otago is a domestically orientated, protected industry in the North Island. In reply, Collins et al. stated that the labour force is projected to increase by some 60 to 70% in the period to 2001, that forestry even on an extremely large scale will require a very small fraction of this increase, and that at the turn of the century protected industry will still employ a substantial proportion of the labour force. All this may be true, but it fails to answer Grant's question. It also fails to address Grant's claim that New Zealand is unlikely to have sufficient resources to be able to establish processing industries for all the wood that will be available at the turn of the century. Any one of the plants which could be established in other regions would be an alternative to the Otago development.

The measurement of the social benefit from export orientation via the effective rate of protection proved to be the most contentious point in the discussion on the Otago Plan. Grant holds that failure to include an exchange rate adjustment invalidates the benefit, while Collins et al. claim this is not so. Both cite Balassa (1971) as justification for their point of view.

The nominal rate of protection measures how much a product's domestic price is raised above the world price (Balassa, 1971). The effective rate of protection, on the other hand, indicates the percentage excess of domestic value added* over the world market value added (ibid.).

For example, suppose the price of an imported radio is US$10.00 and the materials used to make the radio cost US$7.00, the value added to these materials in manufacturing the radio is then US$3.00. At an exchange rate of NZ$1.00 = US$1.00 the New Zealand price of the radio would be $10.00. If there was a 40% tariff on the import of radios the New Zealand price would be raised to $14.00. Local manufacturers of similar radios would be able to sell their product at this price ($14.00) without losing sales to the imported product — i.e., the tariff would give the local manufacturer a nominal rate of protection of 40%.

If the materials used in manufacturing the product were subject to a tariff of 10% they would cost the New Zealand radio manufacturer $7.70. The tariffs would allow the local

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*Value added is the difference between the value of production and the cost of materials. Value of production represents the selling price at the factory of all articles manufactured, assembled, or processed.
manufacturer to operate with a value added of $6.30 (i.e., $14.00 - $7.70), compared with $3.00 if the tariffs were removed. The effective rate of protection for the local radio manufacturer is thus

\[ \frac{(6.30 - 3.00)}{3.00} \times 100\% = i.e., 110\% \]

When a large number of industries are protected, the demand for foreign exchange will fall and the exchange rate will consequently be overvalued compared with the free trade situation. The effective protection rate calculated at the existing exchange rate will then overstate the extent and the absolute cost of protection. An exchange rate correction is thus necessary in calculating the absolute value of net protection on industries in New Zealand. In the example above, if the New Zealand currency were overvalued by 20%, the free trade equilibrium rate would be NZ$1.20 = US$1.00. Making an adjustment for this overvaluation, the net effective rate of protection is 100/120 X 110%, i.e., 91.7%, compared with 110% when no adjustment is made in the exchange rate.

But what of the justification by Collins et al. for not making an adjustment? The justification consists of three quotes from Balassa (1971). The first states: “the degree of discrimination against export activities is understated since export activities are penalised by the low (overvalued) exchange rate”. In using this quote they appear to be arguing that any errors arising through a failure to correct for overvaluation would be compensated by an understatement of the true value of export receipts. This is not necessarily so. Collins et al. fail to produce any evidence to support the contention that forest product exports are penalised by the overvaluation of the exchange rate. Export incentives, for which forest product exports qualify, would at least partially offset any discrimination. Export incentives are not mentioned in the Plan though Collins et al. (p. 138) claim that they are fully allowed for. In the absence of supporting data it is impossible to accept the claimed exact compensating effect. As measurement of the costs of protection was undertaken to establish “the economic benefits from establishing an export-orientated industry” (Otago Plan, p. 56), not the extent to which such an “industry was being penalised” (Collins et al., p. 137), the quotation from Balassa is inappropriate.

The second quote from Balassa used in the rebuttal of Grant states: “as we contrast domestic value added obtainable in import substitution and in exporting, no adjustment is made for overvaluation as compared to the hypothetical free trade situation” (Balassa, 1971, p. 9). The quotation, which is incomplete, actually refers to a single industry. By
contrast, in the Otago Development Plan the analysis is concerned with an export industry and a combination of protected industries producing mainly for the domestic market. Again the quotation is inappropriate.

Thirdly, Balassa is said to have explained that it is necessary to adjust for the overvalued exchange rate only when making international comparisons. Balassa did not say that the adjustment was necessary only when making international comparisons, nor is this meaning implied. His exact words were: "It also follows that averages of effective rates, calculated at the going exchange rate, will not appropriately indicate the extent of protection in individual countries, and international comparisons need to be made by adjusting for the extent of overvaluation of their currencies as compared to the hypothetical free trade situation" (Balassa, 1971, p. 8).

Balassa (1971) presents a number of studies of developing countries. In valuing protection in some of these studies, an adjustment is, in fact, made for the overvaluation of the exchange rate, as advocated by Grant. For example, in the study of the Philippines, he states (p. 281): "Effective rates of protection measured at actual exchange rates indicate the extent of discrimination among domestic activities. But, in order to estimate net protection against imports and net discrimination against exports, adjustment has to be made for overvaluation as compared to the free trade situation."

It could be claimed that it is not the responsibility of an agency such as the New Zealand Forest Service to decide whether or not the currency is overvalued and therefore to put a shadow price upon it (Prest and Turvey, 1965). In this case, however, an adjustment should have been made because there is a Treasury instruction* that all Government departments use a shadow exchange rate in project evaluation. This has the effect of making an allowance (albeit arbitrary) for the overvaluation of the exchange rate.

Collins et al. have thus not answered Grant's criticism of the failure to make an exchange rate adjustment — a criticism which we find to be completely justified.

THE ECONOMIC ANALYSIS

On pp. 11 and 57 of the Otago Development Plan the economic analysis is described as a "national cost-benefit analysis". This type of analysis is usually understood to include an evaluation of all identifiable costs and benefits viewed from the standpoint of the nation as a whole (Jensen, 1968; Pearce,

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Thus, a national cost-benefit analysis incorporates indirect (social) costs and benefits as well as costs and benefits directly associated with a project. The net benefit or cost of the project to the nation is the difference between total discounted benefits and total discounted costs.

However, on p. 57 of the Plan it is conceded that the analysis was a "limited rather than an exhaustive study" and in fact the net benefit of the project was calculated as the difference between discounted social benefits and the discounted cost of not exporting logs (Plan — Table 19). The costs and benefits directly associated with wood processing were omitted from the analysis. As a negative present value for processing could more than offset the calculated net social benefit, some discussion in the Plan of this omission would have been appropriate. Thus regardless of any other criticism, the inadequate framework of the analysis is sufficient to cast doubt on the conclusions drawn in the Plan. A more logical (and less contentious) approach would involve, first, the evaluation of costs and benefits directly associated with the project, followed by an analysis of social costs and benefits. An analysis carried out in this way would provide a measure of the total economic impact of the project, including the direct economics of the project as well as the social effects.

The Otago Plan evaluates a number of social benefits of afforestation and wood processing. However, there are also a number of obvious social costs which are not mentioned. These include:

— High incidence and severity of accidents in logging and sawmilling compared with other industries (Fenton and Terlesk, 1971; Department of Statistics, 1977).

— Lack of cultural, educational, medical and commercial facilities in expanding forestry towns (Fenton and Terlesk, 1971).

— Poor industrial relations in single industry towns (ibid.).

— Narrow employment base in forestry towns and therefore a lack of employment opportunities for women (Department of Statistics, 1974, 1975).


Viewed individually these costs may not be large, but in total they could be significant. It is true that some of the costs listed are not readily measured in monetary terms. Nevertheless, they should at least be recognised as social costs of forest industries in Otago.
CONCLUSION

An examination of the main points of disagreement reinforces Grant's criticism of the Otago Development Plan. The Ministry of Works population forecasts, used to derive a migration pattern, are unsuitable for this task. These population forecasts are consistent with a large number of migration patterns. The Plan fails to demonstrate that its migration pattern is the correct one or that the development of an integrated processing industry in Otago will have any impact on population growth in the North Island. For this reason all the social benefits which depend upon the migration pattern must be regarded as being of doubtful validity. Failure to adjust the costs of protection for overvaluation of the currency introduces a further source of error. In addition, no allowance is made for the possibility that the employment multiplier may be different from the assumed value of 2. Because of the way in which the multiplier has been applied the analysis is biased in favour of processing. Finally, the analysis provides only a partial evaluation of the project and is not a complete cost-benefit analysis.

The benefits calculated in the Otago Development Plain are therefore neither "valid" nor "conservatively estimated". This does not necessarily mean that afforestation and wood processing are not justified as a means of promoting regional development in Otago. It simply means that, as presented, the case is not proven.

ACKNOWLEDGEMENTS

The assistance of Elizabeth Wilson and David Hart is gratefully acknowledged.

REFERENCES


APPENDIX 1
Net Migration from Otago, 1966-1971

<table>
<thead>
<tr>
<th>No. of Migrants</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otago to Auckland</td>
<td>1268</td>
<td>1292</td>
<td>2560</td>
</tr>
<tr>
<td>Otago to South Auckland-Bay of Plenty</td>
<td>972</td>
<td>918</td>
<td>1890</td>
</tr>
<tr>
<td>Otago to Hawke's Bay</td>
<td>281</td>
<td>289</td>
<td>570</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5020(A)</td>
</tr>
<tr>
<td>Auckland to Otago</td>
<td>748</td>
<td>713</td>
<td>1461</td>
</tr>
<tr>
<td>South Auckland-Bay of Plenty to Otago</td>
<td>542</td>
<td>415</td>
<td>957</td>
</tr>
<tr>
<td>Hawke's Bay to Otago</td>
<td>192</td>
<td>189</td>
<td>381</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2799(B)</td>
</tr>
<tr>
<td>Otago to all regions</td>
<td>80075</td>
<td>82564</td>
<td>162639(C)</td>
</tr>
<tr>
<td>All regions to Otago</td>
<td>75876</td>
<td>78394</td>
<td>154270(D)</td>
</tr>
</tbody>
</table>

Net migration from Otago to three growth regions = A — B = 2221
Net migration from Otago to all regions = C — D = 8369
Net migration from Otago to the three growth regions represents 26.5% of total net migration from Otago.

Source: Department of Statistics (1976).

APPENDIX 2
Derivation of Cost of Operating Cars
Alternative 3, Table 46.3 of Otago Development Plan

The following calculations relate to data for 1990-99, with 30% of the work force travelling by car a weighted average distance of 22.2 km/day. Assuming 210 working days per annum the cost per worker per year, using data on p. 118 of the Plan, is:

\[ \frac{(240 \times 22.2 \times 6.2)}{100} = 350.34 \]

Then for "No Otago Development" the discounted costs for 1990-99 are calculated as shown in the table opposite.

The total discounted cost differs from the published figure of $354,000 by 1.6%. The reasons for this small variation are not known, but they could be accounted for by slight differences in the basic assumptions and the discount factors used. It is clear, however, that the figures in the Plan are derived on the assumption that if there is no forestry development in Otago the exodus of 100 migrants from Otago will immediately result in an equivalent influx of migrants into Auckland, South Auckland-Bay of Plenty, and Hawke's Bay.
**CALCULATION OF DISCOUNTED COSTS**

<table>
<thead>
<tr>
<th>Years</th>
<th>Population Associated with Forestry and Wood Processing</th>
<th>Work Force in Forestry and Wood Processing</th>
<th>30% of Work Force</th>
<th>Cost per Worker per Year ($)</th>
<th>Total Cost per Year ($)</th>
<th>Discounted Cost per Year ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>3248</td>
<td>1624</td>
<td>487</td>
<td>330.34</td>
<td>160,876</td>
<td>31,822</td>
</tr>
<tr>
<td>1991</td>
<td>5028</td>
<td>2514</td>
<td>754</td>
<td>&quot;</td>
<td>249,077</td>
<td>44,809</td>
</tr>
<tr>
<td>1992</td>
<td>5112</td>
<td>2556</td>
<td>767</td>
<td>&quot;</td>
<td>253,371</td>
<td>41,426</td>
</tr>
<tr>
<td>1993</td>
<td>5196</td>
<td>2598</td>
<td>779</td>
<td>&quot;</td>
<td>257,335</td>
<td>38,240</td>
</tr>
<tr>
<td>1994</td>
<td>5280</td>
<td>2640</td>
<td>792</td>
<td>&quot;</td>
<td>261,630</td>
<td>35,346</td>
</tr>
<tr>
<td>1995</td>
<td>5364</td>
<td>2682</td>
<td>805</td>
<td>&quot;</td>
<td>265,924</td>
<td>32,655</td>
</tr>
<tr>
<td>1996</td>
<td>6512</td>
<td>3156</td>
<td>947</td>
<td>&quot;</td>
<td>312,852</td>
<td>34,943</td>
</tr>
<tr>
<td>1997</td>
<td>6396</td>
<td>3198</td>
<td>959</td>
<td>&quot;</td>
<td>316,796</td>
<td>32,150</td>
</tr>
<tr>
<td>1998</td>
<td>6480</td>
<td>3240</td>
<td>972</td>
<td>&quot;</td>
<td>321,090</td>
<td>29,637</td>
</tr>
<tr>
<td>1999</td>
<td>6564</td>
<td>3282</td>
<td>985</td>
<td>&quot;</td>
<td>325,385</td>
<td>27,300</td>
</tr>
</tbody>
</table>

Total discounted cost 348,328

Population data are taken from Table 39, page 113 of the Plan.