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AN ECONOMIC ANALYSIS OF CANADIAN DEEP-SEA SHIPPING OPTIONS (APPENDICES)

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APPENDIX A

ANALYSIS OF THE SENSITIVITY OF RESULTS IN THE COMMERCIAL ANALYSIS TO DIFFERENT INPUT VALUES

1. INTRODUCTION

It is important for several reasons to determine the sensitivity of the commercial results for shipping options to different levels of input variables than those assumed in the "base case" of the consultants.

The primary reason for undertaking such sensitivity tests is to reflect uncertainty with respect to variables entering into the analysis. Thus, some uncertainty is inherent in estimates of the potential costs of Canadian-flag shipping, because of the lack of recent and extensive Canadian-flag experience in deep-sea operations. Estimates of the likely wage levels of Canadian deep-sea crew, for instance, are subject to a margin of error. Similarly, there is uncertainty associated with cost estimates for foreign deep-sea shipping options--such as with respect to the future level of foreign vessel prices.

A second reason for undertaking sensitivity tests is to determine which variables are critical in leading to the outcome of an analysis. In the present study, for instance, different estimates of cost levels may lead to changes in the ranking of particular shipping options or alter conclusions about the commercial viability of particular options.

Sensitivity analyses of variables entering into the commercial analysis were undertaken in the Alships Report. The sensitivity analyses in the consultants' study and the present appendix differ, however, with respect to the variables used to measure commercial viability of shipping options. As described in Chapter 2, the present study uses the required freight rate for Option 1 (RFR1) as the market freight rate in the analysis of Options 3 and 4. The resulting signs of the net present values are taken as indicating whether or not Options 3 and 4 would be commercially viable.

Several of the sensitivity analyses undertaken in the Alships Report were not repeated in the present study as they affect all the options equally, both in terms of size and time pattern, and will therefore have no effect on the rankings of the options. Thus, the effects of different estimates of costs for surveys, repairs, and maintenance; the vessel load factor; days per voyage; port costs; and fuel costs were not examined.

Other variables included in the sensitivity analysis of the Alships Report may change the rankings of the various shipping options as they have differential effects on each of the options. The variables concerned consist of the discount rate, vessel cost, the vessel payment schedule, loan terms for vessel purchase, vessel depreciation rates and portage costs (or the wage bill in shipping).

Many combinations of alternative estimates of levels of the above variables might be examined in a sensitivity analysis. Some of these combinations, however, would be quite illogical. For example, the discount rate reflects the after-tax rate of return assumed to be required by investors in shipping. The discount rate should be identical for all options, as there is no reason to expect the required after-tax rate of return to diverge systematically between options. Furthermore, any changes in financial variables related to vessel acquisition (vessel cost, payment schedule and loan terms) need to be identical for Options 1 and 3, as it is assumed that vessels are financed and purchased from the same foreign sources in both cases. Accordingly, when sensitivity analysis for these parameters was undertaken, changes had to be made to Option 1 resulting in a new RFR1. In cases where the values of the parameters were unique to Options 3 and 4 (portage under Options 3 and 4; loan terms, depreciation, and payment schedule under Option 4), no corresponding change was necessary in Option 1 and the RFR1 used in the analysis was the same as in the base case.

Table A-1 puts the preceding discussion in tabular form. The input parameter which was varied in the sensitivity analysis is indicated on the left of the table. Each of the X's has two coordinates: one which indicates the level of the parameter in Options 3 or 4, and one which indicates the level used in generating RFR1. For example, the upper left hand 'X' in the discount rate section indicates that a sensitivity test was performed where a low discount rate was used in Option 3. Furthermore, a new RFR1 (used in the simulation of Option 3) had to be generated because a low discount rate needs to be used in simulation of Option 1 results to be consistent with the low discount rate assumed for Option 3. All of the 'X's' which are 'mid' for either coordinate are indicative of the consultants' base case results.

Table A-1
Parameters Considered in the Sensitivity Analysis

Input Parameter Varied	Level of Parameter used in Calculating RFR1	Level of Parameter used in Analysis of: Option 3 low	Option 3 mid	Option 3 high	Option 4 low	Option 4 mid	Option 4 high
discount rate	low	X			X		
	mid		X			X	
	high			X			X
payment schedule	low	X					
	mid		X			X	X
	high			X			
loan terms	low	X					
	mid		X		X	X	X
	high			X			
depreciation	mid		X		X	X	X
vessel cost	low	X				X	
	mid		X			X	
portage	mid	X	X	X	X	X	X

2. INDIVIDUAL SENSITIVITY ANALYSES

(i) Discount Rate

The discount rate was allowed to vary from the base case level of 10 per cent per annum for all three options. As described previously, any change in the assumed rate of return for one option has to be accompanied by an identical change in the other options, as there is no reason to expect any systematic divergence in the required after-tax rates of return for the three options.

In none of the situations where the discount rate was varied did a net present value change sign. That is, in all cases, Option 1 retained its competitive advantage over Options 3 and 4. Furthermore, the rankings between the options did not vary with the discount rate. In all situations, Option 4 remained preferable to Option 3.

The average percentage deviations from the base case net present values when the discount rate is varied follow. A negative percentage change indicates that the net present values have become more negative, while a positive percentage change indicates that the net present values have become less negative.

Table A-2
Discount Rate Sensitivity Analysis

	Option 3			Option 4		
Option 1	8%	12%	14%	8%	12%	14%
8%	-8.5%			-24%		
12%		+6.5%			+8%	
14%			+12.4%			+34%

Clearly, there was much greater average variation in the net present values of Option 4 than in those of Option 3. This is because the absolute values of deviations from the base case in Option 4 are greater than those for Option 3 and the base is smaller in Option 4 (i.e., the base case net present value is less negative for Option 4 than Option 3).

When the discount rate is raised above the 10 per cent level assumed in the base case, the present discounted value of the stream of revenues for Options 3 and 4 are reduced. This would of course tend to lower the net present values of the latter options. Option 1, however, is also faced with a higher discount rate. In order to attain the higher return to equity implied by the greater discount rate, therefore, RFR1 must increase. This improves the revenue stream associated with Options 3 and 4. The net positive effect on the net present values of Options 3 and 4 when the discount rate is raised is the result of the latter effect outweighing the former.

(ii) Vessel Payment Schedule

Variations in the vessel payment schedule reflect different payment requirements by domestic and foreign shipyards. On the low side, Options 1 and 3 were assumed to have to pay only 10 per cent of the vessel price in the first year, while on the high side it was assumed that 40 per cent of the vessel price would be paid in the first year. (Both Options 1 and 3 vary identically on this variable as it is assumed that ships for these options are purchased from the same source.) As Option 4 ships are produced domestically, there is no need for its vessel payment schedule to vary in line with that assumed for foreign yards. In fact, the consultants assumed that there would be no variation on the low side of the vessel payment schedule for Option 4. On the high side, it was assumed that 40 per cent of the purchase price of Option 4 vessels would be paid in the first year. The average percentage deviations from the base case net present values when the vessel payment schedule is varied are presented below.

Table A-3
Vessel Payment Schedule Sensitivity Analysis

Option 1	Option 3 10% 1st yr/ 90% 2nd yr.	Option 3 40% 1st yr/ 60% 2nd yr.	Option 4 40% 1st yr/ 60% 2nd yr.
10% 1st yr/90% 2nd yr.	2.2%	-	-
20% 1st yr/80% 2nd yr.	-	-	-15.2%
40% 1st yr/60% 2nd yr.	-	-3.7%	-

With a less onerous payment schedule, the net present values of Option 3 improved slightly. This is a result of the lower cash outflow in the first year of the project. The opposite is, of course, true in the situation of a high payment schedule. The Option 3 results varied by such a small amount because this variable affects Options 1 and 3 in an almost identical manner. That is, in the case of the low (high) vessel payment schedule, the RFR1 and hence revenues of Option 3 are smaller (greater). The effect on Option 4 is more substantial, as the increased costs to the shipowner in the first year of the project's life due to a faster payment schedule are not offset by greater revenues.

Variations in the payment schedule did not affect the ranking of the options. That is, Option 3 always had a more negative net present value than Option 4. Furthermore, none of the variations resulted in a changed sign for the net present value. This means, of course, that Option 1 would provide the lowest private cost shipping services in all situations considered.

(iii) Loan Terms

Loan terms were allowed to vary to simulate situations where credit might be more or less stringent for shipowners than assumed in the base case adopted by the consultants. In the cases of Options 1 and 3, the consultants felt that the interest rate would not vary, but that credit would be restricted or eased by variations in the term of the loan and in the percentage of the vessel price that would be financed by loan funds rather than by equity. In the case of Option 4, the consultants felt that variations in the availability of credit would be reflected in all three variables. The average percentage deviations from the base case net present values when the loan terms are varied are presented below.

Table A-4
Sensitivity Analysis of Loan Terms

Rate/Term/%Financed by Loans	Option 3 8.5%/7yrs/60%	Option 3 8.5%/8yrs/80%	Option 4 11¾%/7yrs/70%	Option 4 11.5/8yrs/90%
Option 1				
8.5%/7yrs/60%	-15.3%	-	-	-
8.5%/8yrs/70%	-	-	-46.1%	29.5%
8.5%/8yrs/80%	-	9.8%	-	-

The table indicates that net present values for Option 4 are much more sensitive to variations in loan terms than are net present values for Option 3. The relatively small variations in net present values for Option 3 result because variations in Option 3 loan terms are accompanied by variations in Option 1 loan terms and thus the RFR1. That is, if Option 3 faces tighter (looser) credit conditions, thereby raising (lowering) its costs, so will Option 1. The resulting increase (decrease) in the RFR1 tends to offset the increase (decrease) in costs for Option 3.

There are, of course, no such offsetting factors in the case of Option 4. When Option 4 faces tighter credit conditions, therefore, the average decline in net present values is more substantial than in the case of Option 3.

Although none of the variations in loan terms resulted in a positive net present value for Options 3 or 4, this sensitivity is one of the few that resulted in changes in the ranking of these options on a number of trade routes. It will be recalled that, in the base case, Option 3 had a smaller negative net present value than Option 4 on only two trade routes. When Option 4 faces more stringent loan terms (11¾%; a loan term of 7 years; 70% of vessel cost financed by loans), however, Option 3 has a net present value less negative or equal to Option 4 on eight out of 23 trade routes. As noted in Chapter 2, there are indications in the consultants' study that credit conditions facing Option 4 operators could be more restrictive than those assumed in the base case analysis.

(iv) Capital Cost Allowance

No sensitivity analysis was undertaken with respect to the depreciation rate for Option 3 vessels, as it was assumed that all Option 3 shipowners would be able to take advantage of the allowable 15 per cent per annum declining balance depreciation rate. As noted in Chapter 2, however, Canadian tax laws offer an incentive capital cost allowance to the purchasers of new Canadian-built vessels. The consultants did not feel, however, that owners of such Option 4 vessels would have a taxable income sufficiently large to take advantage of the ability to write off a vessel in the minimum possible time of three years. Consequently, the base case assumption regarding depreciation for Option 4 was that large vessels (costing more than $30 million) would be written off over 8 years, while it was felt that smaller vessels (costing less than $30 million) would be written off over 5 years. A sensitivity was performed where these variables were allowed to change by plus or minus two years. The average percentage deviations from the base case net present values when the depreciation rate is varied for Option 4 are presented below.

Table A-5
Depreciation Sensitivity Analysis

	Option 4
Depreciation Period	Average percentage change in NPV
Fast Depreciation:	45.6%
Slow Depreciation:	-36.5%

As indicated, the rate of depreciation has a substantial impact on the size of the net present value for Option 4 vessels. When it is assumed that operators can depreciate their vessels at a relatively fast rate, the net present value for Option 4 improves substantially. This improvement results from the ability to reduce taxes in the important early years of vessel operation. The relative improvement, however, is not enough to result in positive net present values for Option 4. Thus, even if vessels could be depreciated at a rate faster than that assumed in the consultants' base case, investment in Option 4 would not appear to be attractive from a commercial viewpoint.

When Option 4 operators are assumed to depreciate their vessels at a slower rate than that incorporated in the base case, the net present values become more negative. The reasoning is just the reverse of the case for a faster write-off period. That is, the ability to reduce taxes is spread over a longer number of years, thereby increasing costs to the ship operator. The decline in net present values, however, was not substantial enough to affect the ranking of the Canadian flag options, as Option 3 still appeared to be less competitive than Option 4.

(v) Vessel Price

As was discussed previously, there is major uncertainty with regard to foreign vessel prices, as the prices offered currently by Asian shipyards are far below the European price levels assumed in the consultants' base case. Consequently, a sensitivity analysis was performed where vessel prices for Option 4 were held constant while vessel prices for Options 1 and 3 were reduced by 15 to 39 per cent below the base case (European vessel price) levels. Changes in the Option 1 vessel price resulted in a new RFR1 which was subsequently used in the commercial analysis of Options 3 and 4. The average percentage deviations from the base case net present values that result when Options 1 and 3 vessel prices are lowered are presented below.

Table A-6
Foreign Vessel Price Sensitivity Analysis

Option 1	Option 3 low vessel price	Option 4 mid
low vessel prices	+15.9%	-108.8%

The table indicates that the net present values for Option 4 vary, on average, substantially more than those for Option 3. The relatively minor changes in Option 3 reflect the fact that any change in Option 3 costs is partially offset by changes in RFR1. When low foreign vessel prices are assumed, however, Option 4 net present values decline, on average, by 109 per cent. This decline in Option 4 net present values is so substantial that, on every trade route, Option 3 has a net present value less negative than that for Option 4.

These findings are rather important, in that they highlight one of the difficulties with the consultants' study. The consultants, it will be recalled, tried to orient the study towards the long run, and in doing so purposely ignored many elements of the current world shipping market. The resulting base case ranking of the options by the consultants (1, 4, 3) reflects this view. If, however, an investment in deep-sea shipping were being undertaken currently, consideration would have to be given to the vessel prices offered by Far Eastern shipbuilders and the freight rates implicitly associated with such prices. In such a situation, net present values for Option 4 would be much worse than those derived in the consultants' base case, and would be more negative than those for Option 3 on all trade routes. In the sensitivity analysis for low foreign vessel prices, however, neither Option 3 nor Option 4 have positive net present values and thus these options are not commercially viable when compared with Option 1.

(vi) Portage

Portage, or the shipping wage bill, was assumed to vary identically in size and timing for Options 3 and 4, as both options are assumed to be crewed by Canadians. The RFR1 was assumed to remain at its base case level, as there is no necessity for the wages of foreign crews to vary with the Canadian wage level. The average percentage deviations from the base case net present values that result when the portage bill is varied are presented below.

Table A-7
Portage Sensitivity Analysis

Option 3		Option 4	
low (-25%)	high (+25%)	low (-25%)	high (+25%)
24.6%	-22.8%	43.9%	-44.6%

The net present values for Option 4 vary by a larger percentage than those for Option 3 because the base level of costs on which the percentage deviation is calculated is smaller in Option 4. Changes in portage, however, had no effect on the rankings of the options in either the high or the low sensitivity analysis. Furthermore, changes in this variable did not produce a positive net present value for Options 3 or 4 on any route.

3. CONCLUSIONS OF THE SENSITIVITY ANALYSIS

The sensitivity analysis indicates that the results for Option 4 are quite sensitive to alternative levels of all variables examined except the discount rate and the vessel payment schedule. The results for Option 3, on the other hand, are sensitive only to assumptions regarding portage. The latter result occurred because changes in Option 3 variables related to vessel acquisition (payment schedule, loan terms and vessel prices) are accompanied by simultaneous changes in the Option 1 level of these variables. The resulting change in the RFR1 works to offset the effects of changes in these variables on the net present value of Option 3.

The size of the portage variations is identical for Options 3 and 4, and thus has no effect on option rankings. Furthermore, while changes in depreciation affect the net present value of Option 4 substantially, they, too, do not affect the rankings of the various options. More stringent loan terms for Option 4 result in Option 4 appearing less competitive than Option 3 on 8 out of 23 routes. A low (current) foreign vessel cost assumption completely reverses the rankings, with Option 3 consistently outperforming Option 4. The latter finding is important, as "bargain" prices are currently being offered by foreign shipbuilders. Thus if one were analyzing investment opportunities in the immediate future rather than over a longer period, Option 4 would definitely appear less attractive, from a commercial viewpoint, than Option 3.

The most important finding from the sensitivity analyses, however, is that commercial results for the Canadian flag options were consistently inferior to those for Option 1 in all situations examined. The uniformly negative net present values of Options 3 and 4 indicate that these options would not be able to compete with Option 1 on any of the trade routes nor under any of the simulated conditions considered.

Appendix B

THE SOCIAL DISCOUNT RATE: THEORETICAL AND EMPIRICAL ISSUES

This appendix reviews the main theoretical and empirical issues associated with the evaluation of a social discount rate applicable to the analysis of Canadian investment projects. In view of the complexity of the issues, an exhaustive summary of the literature in this area is not attempted. Rather, the approach taken is to outline the main strands of the theoretical and empirical arguments, and indicate the source of some remaining controversies. A bibliography of some of the economic literature dealing with this issue is attached (see References).

1. SOCIAL RATE OF TIME PREFERENCE

Two conceptually different bases for determining the social discount rate have been suggested in the literature. Under one approach, costs and benefits are aggregated over time by use of a social time preference rate, which can be defined as the premium "society" is willing to pay for consumption now as opposed to consumption in the future. It is sometimes argued that this premium should be equal to the rate at which individuals are willing to lend or borrow money, and that such a social time preference rate could theoretically be estimated by an examination of time series of past interest rates.

Exactly which interest rates are to be used in this measurement process is often left unspecified, although the rate of interest on government bonds is frequently suggested as a proxy for a risk-free interest rate at which present consumption will be sacrificed for future consumption. It is generally recognized that all data used in benefit-cost analyses should be expressed in constant prices, and this implies that the discount rate used to obtain net present value of benefits and costs should also be a real and not a nominal rate. Only nominal interest rates are observed in practice, of course. Since the real interest rate is approximately equal to the nominal interest rate minus the expected rate of inflation[1], the derivation of a real interest rate requires an understanding of the mechanism by which these expectations are formed. The usual practice in econometric research on this subject has been to represent this expectation-forming process by the use of lag structures which imply the public believes that past inflationary experience will

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[1] More precisely, the real interest rate is given by r, in the following formula

$$(1 + r) = \frac{(1 + i)}{1 + p)}$$

where r = real interest rate
i = nominal interest rate
p = expected rate of inflation

be repeated. Models incorporating such hypotheses performed reasonably well when the observations reflected Canadian experience through the mid-1970's, with estimates of real interest rates on long-term federal government debt being in the order of 2 to 4 per cent. When this research has been extended to incorporate more recent data, however, the estimated real interest rate on long-term federal debt often becomes negative. The main reason for the latter finding relates to the rapid and largely unforeseen increase in the rate of inflation since the mid 1970's, which has tended to undermine the relatively crude hypothesis concerning expectations about inflation embodied in existing research.

These measurement problems, together with a number of unresolved philosophical issues relating to the appropriateness of trading off one generation's welfare against another's, have generally made economists reluctant to specify a social time preference rate with any degree of precision. Rates in the order of 3 to 5 per cent, however, would seem to be implied in much of the writing in this area.

Proponents of the time preference approach have recognized that exclusive reliance on a social discount rate of the above order of magnitude would often lead to the approval of projects whose economic return was considerably less than that earned in the private sector. The total rate of return on capital in Canada is considerably above the interest rates observed in financial markets, as a result of the existence of taxes and allowance for risks which do not exist for society as a whole (see Reference 1). Accordingly, if use of a social time preference rate as the social discount rate results in the approval of public projects which would displace private investment, an economic loss could occur through the diversion of capital from more productive to less productive uses.

In recognition of this dilemma, advocates of a time preference approach have also recommended "shadow-pricing" the capital diverted from private to public investment. This shadow price is greater than the market price observed for capital. The exact magnitude of the appropriate shadow price is difficult to determine, however, and depends on assumptions regarding the pattern of reinvestment from the stream of benefits generated by public projects.

A more thorough discussion of the theoretical issues surrounding use of the social rate of time preference approach to discounting is given in References 2, 3 and 5. This approach was not used in the present analysis in view of the operational difficulties involved in deriving empirical counterparts for the various theoretical constructs.

2. SOCIAL OPPORTUNITY COST OF CAPITAL

The second major approach to estimating social discount rates entails determining the social opportunity cost of the capital used in projects involving public funds. This social opportunity cost can be

estimated by taking a weighted-average of the rates of return earned in various sectors of the economy. Provided these weights accurately reflect the extent to which resources required by the projects in question are diverted from other productive uses, this procedure has the virtue of ensuring that projects involving public funds are deemed efficient only if their returns are greater than otherwise could be expected. Empirical estimates of the social opportunity cost of capital in Canada are available and facilitate the use of this approach to the social discount rate in benefit-cost analysis.

The extent to which benefit-cost results reached with the use of the social opportunity cost approach will differ from those derived using the social time preference/shadow price of capital procedure is not known with certainty. The most recently published theoretical discussion of these issues (see Reference 7) argues that the two approaches are identical if consistent assumptions are made in each case.

Empirical Evidence on the Social Opportunity Cost of Capital in Canada

One of the most comprehensive analyses of the social opportunity cost of capital in Canada is found in a 1972 Ph.D. thesis by Glenn P. Jenkins. (see Reference 3) The empirical evidence in this thesis was subsequently updated through 1974 and published in a recent Discussion Paper issued by the Economic Council of Canada (see Reference 4). The brief summary of Jenkins' work given below is based on the more recent publication.

Jenkins first estimates the total real rate of return on capital in the various sectors of the economy. The total real rate of return on capital in the economy is defined as the total income generated by all non-financial assets divided by the real value of the capital stock. The real value of the capital stock was estimated using information contained in the Statistics Canada publication, Fixed Capital Flows and Stocks, and appropriate inflation indexes.

Total income generated by all non-financial assets includes the net profits generated from the capital stock as well as any other earned revenue which is transferred to the public sector or other institutions in the private sector. In order to determine the total income accruing to capital, therefore, Jenkins added debt charges, taxes, and charitable donations to the profits of firms and subtracted any revenue earned from financial assets.

The profits of firms were in turn estimated by applying a number of technical adjustments to the information contained in firms' income statements as reported in the Statistics Canada publication Corporate Financial Statistics. These technical adjustments were intended to correct for the effects of inflation and special taxation provisions in creating a disparity between "accounting" profits and "economic" profits. True economic depreciation and its replacement

value (based on the life of the asset) were calculated and used to correct published profit figures. (The latter, of course, reflect depreciation allowed by the tax authorities.) Furthermore, the value of inventories was adjusted to reflect replacement costs rather than historic acquisition costs.

The results of Jenkins' analysis indicate that, for all industrial activities,[1] the total weighted average real rate of return on capital was 10.78 per cent over the 1965-74 period.[2] This figure reflects private real rates of return of 5.94 per cent for manufacturing and 5.90 per cent for non-manufacturing; and effective tax rates on the capital stock of 7.23 per cent for manufacturing and 3.53 per cent for non-manufacturing.

Determination of a Social Discount Rate Based on the Social Opportunity Cost of Capital

The estimated real rates of return to private investment were next used by Jenkins to estimate the social opportunity cost of funds in public sector investment. It was assumed that the marginal source of funds for such investment projects is government borrowing in the capital market. This borrowing will tend to drive up interest rates in the capital market, thereby displacing private investment and consumption and increasing capital inflows from foreign sources. The manner in which the various sectors of the economy respond to an increase in government borrowing depends upon the elasticity of the interest rate with respect to incremental government borrowing, the interest rate elasticity of consumption and investment, and the proportion of the real resources supplied by foreign capital inflows.

On the basis of previous empirical work, Jenkins estimated the elasticity of the interest rate with respect to increased government borrowing and predicted interest rate changes associated with such borrowing. The responses of domestic savings and housing investment to the predicted change in the interest rate were also estimated. It was assumed that government borrowing would have no effect on the agricultural sector, on the grounds that most investment in this sector is financed by the federal government at subsidized interest rates and will therefore be unaffected by a rise in interest rates. Higher interest rates resulting from government borrowing will also attract foreign capital inflows. Historically, 20 per cent of gross fixed capital formation in Canada has been financed from abroad, and Jenkins assumes the same proportion of government borrowing would be attracted from abroad.

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[1] Excluding housing, agriculture and public utilities.

[2] The weights used in calculating this average reflected the proportion of the total capital stock in each sector of the economy.

Finally, the portion of government borrowing that is not accounted for by reduced residential construction, increased domestic saving or incremental inflows of foreign capital is assumed to be diverted from industrial investment. It is assumed to come from each industrial sector in the same proportion as the share of that sector in the total capital stock.

Table B-1 indicates the social opportunity cost of funds in the various sectors of the economy and the weights assigned to each sectoral opportunity cost in determination of the social discount rate. As noted in the table, a real rate of interest of 9 per cent represents the economic cost of government funds. To complete the analysis, Jenkins feels that another percentage point should be added to reflect the foreign exchange premium and labour externality associated with displaced private investment. On this basis, Jenkins concludes that

> the social opportunity cost of such funds [used to finance public investments] is at least 10 per cent per year net of inflation. Unless public sector investments yield a real rate of return of at least this magnitude then the implementation of such projects will result in a lower level of economic well-being for Canadians than if the funds were left in the Canadian capital markets.[1]

Table B-1

The Economic Cost of Government Funds

Sector	Gross Return to Capital	Proportion of Government Borrowing Derived from Sector
All Industrial Activities	10.78	0.59
Residential Construction	7.50	0.16
Agriculture	4.48	0.00
Domestic Consumption	4.14	0.05
Foreign Capital Inflows	6.11	0.20

Economic Cost of Government Funds
= 10.78 (.59) + 7.5 (.16) + 4.14 (.05) + 6.11 (.20) = 9.00%

Source: Reference 4, p. 140

[1] See Reference 4, p. 4.

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Appendix C

THE SHADOW PRICING AND CALCULATION OF FOREIGN EXCHANGE EFFECTS

The basic concepts used in deriving a shadow price for foreign exchange have been described in Chapter 3. The first part of this appendix examines arguments for shadow pricing foreign exchange which derive from balance of payments considerations. The second part details the methodology used in deriving estimates of the indirect foreign exchange effects associated with Option 4.

1. THE BALANCE OF PAYMENTS AND THE SHADOW PRICE OF FOREIGN EXCHANGE

Although Chapter 3 described one rationale for shadow-pricing the foreign exchange effects of investment projects based on the distorting effects of import tariffs and export subsidies, other rationales are often advanced. In some cases, observers seem to attach an intrinsic value to the acquisition of foreign exchange which is reminiscent of mercantilist ideas on the subject. In addition, an appeal is often made to "balance of payments" reasons for attaching a premium to the net foreign exchange earning or saving effects of projects. Since these balance of payments arguments are often vague, the purpose of the first section of the appendix will be to give them content and examine their merits.

With a flexible exchange rate the supply of and demand for foreign exchange must, by definition, always be equal. In balance of payments terms, this means that receipts of foreign exchange must always equal payments of foreign exchange. In this situation there can by definition be no 'balance of payments problem' that can serve as a rationale for selective long-term policy actions.

Concern over the balance of payments, however, is frequently oriented to the state of particular accounts in the overall balance. In this respect, Canada usually experiences a deficit on current account which is offset by a surplus on capital account. Some observers view this persistent current account deficit as indicative of weakness in the balance of payments, and hypothesize that difficulties will arise when capital borrowed from abroad eventually needs to be repaid.

This view, however, is somewhat narrow. The inflow of funds borrowed from foreigners typically indicates that there are productive investment opportunities in Canada that cannot be financed by domestic savings. These investments will increase total output in Canada, and only a portion of the resulting incremental product will eventually be

required to repay foreign creditors.[1] A surplus on the capital account must, of course, be offset by a current account deficit.

Artificial stimulation of exports or of import substitution typically will not have any lasting effect on the current account deficit. This is because the current account deficit is a necessary offset to the capital account surplus. The latter reflects levels of domestic savings and investment which are determined independently of particular export and import transactions. In these circumstances, an increase in exports will lead to a rise in the exchange rate as foreigners demand more Canadian dollars to purchase our exports. The result of such a rise is, of course, an increase in imports and a decrease in the demand for exports, with no net change in the current account balance.

Attempts to increase exports in order to reduce the current account deficit would, therefore, seem likely to result in failure as they will put upward pressure on the exchange rate, thereby reducing exports and increasing imports. It appears that the only way to reduce the current account deficit would be to reduce foreign capital inflows, which would have consequences reaching much further than that of simply reducing the current account deficit. The appropriate criteria here relate to the productivity of investment rather than the structure of trade.

Even if it were possible to identify systematic difficulties associated with Canada's balance-of-payments, it is unlikely that the promotion of exports from any particular sector is an appropriate policy response. Aggregate policies which have a more general effect on the economy -- such as fiscal or monetary policies -- are the preferred policy instruments in these circumstances.

There would, therefore, not appear to be any reason from a Canadian point of view to promote foreign exchange earning or saving projects on balance-of-payments grounds. A more appropriate rationale for applying a shadow price to foreign exchange effects of projects is based on the structural characteristics of the Canadian economy and has been described in Chapter 3. The latter rationale for shadow pricing, however, has nothing to do with the level of the current account deficit or with movements in the exchange rate.

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[1] Since the late 1960's, the government sector has generally accounted for an increasing proportion of foreign capital inflows. It cannot be unambiguously stated that the latter foreign borrowing increases the net physical capital stock or future output of the economy. Government borrowings, however, may be used for physical investments such as electrical energy projects or social investments such as health or education which will lead to increased future output. In any case, borrowings by governments, in the aggregate, have generally been below their levels of investment (as defined on a national accounts basis).

2. INDIRECT FOREIGN EXCHANGE EFFECTS: OPTION 4

As indicated in Chapter 3, the consultants estimated the "direct" foreign exchange effects associated with replacing shipping services provided under Option 1 with services provided under Options 3 or 4. While these estimates capture all the differential foreign exchange effects under Option 3, further indirect foreign exchange effects are associated with Option 4. These indirect effects arise because the vessels for Option 4 are produced in Canada. Since some of the resources used in the production of these vessels could otherwise be used to produce exports or import replacing goods, some foreign exchange is forgone when using these resources in shipbuilding.[1]

This appendix will not attempt to estimate the forgone foreign exchange associated with the uses of all factors of production in shipbuilding but will concentrate on that associated with the use of labour in the industry. The research in Chapter 4 on the social opportunity cost of labour in shipbuilding can be used in the latter enquiry. Estimates of the forgone foreign exchange associated with the use of capital and intermediate goods in shipbuilding on the other hand, would involve a major piece of research which is beyond the scope of this paper. It is recognized, however, that restriction of the paper to the foreign exchange forgone by the use of labour in shipbuilding will lead to a minimum estimate of the forgone foreign foreign exchange associated with the construction of Option 4 vessels.

(a) The Model

The research presented in Chapter 4 and Appendix D on the social opportunity cost of labour in shipbuilding has indicated that, in the absence of vessel construction in Canada (i.e. in the immediate termination scenario), most of the workers otherwise employed in shipbuilding would secure alternate employment. Moreover, in the situation where shipbuilding employment is maintained by the construction of deep-sea vessels (the retention scenario) some of the workers employed in shipbuilding also derive income from working in other industries. The difference between the income earned in the immediate termination scenario and the income earned outside of shipbuilding in the retention scenario, represents the forgone labour value added by constructing vessels in Canada.

That is,

$$FLVA = Wo^* - Wo \qquad (1)$$

where FLVA = forgone labour value added
Wo^* = employment income in immediate termination scenario
Wo = non-shipbuilding income in retention scenario

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[1] The concepts used in this section are derived from "The Social Cost of Foreign Exchange and Indirect Taxes Associated with Labour in Nova Scotia and Ontario" by Harvey Schwartz and Chun-Yan Kuo (DREE, Nov. 1976).

The extent to which the construction of deep-sea vessels results in forgone foreign exchange will then depend upon the degree to which the production associated with this forgone labour value added derives from industries producing either export or import-replacing goods. If we let X denote the proportion of forgone labour output in these industries, and assume that foreign exchange has a value of 15 per cent greater than its market price, then

$$VFFE = X(.15)\ (Wo^* - Wo) \qquad (2)$$

where VFFE = value of forgone foreign exchange

In order to estimate the parameter X, it is necessary to conceptualize a division of the economy into two sectors. The first sector, denoted as the "tradeable goods" sector, consists of all those industries producing goods that are traded internationally. The "non-tradeable goods" sector then consists of those industries which produce goods that are traded only in domestic markets. If domestic demand for tradeable goods is fixed, the increased production of <u>any</u> good in the tradeable goods sector serves either to generate exports or replace imports. Accordingly, in order to determine a value for X it is necessary only to know the proportion of the forgone labour value added that would be associated with production in the "tradeable goods" sectors.

(b) Estimation of the Model

Estimates of the income variables Wo* and Wo can be derived from the data used in calculating the shipbuilding labour externality in Chapter 4. Depending upon the precise method of estimation, (Wo* - Wo) is equal to between $7.56 million and $9.06 million per 1000 man years of employment. The first figure corresponds to the assumptions used in deriving the high estimate of the externality, while the latter is coincident with the lower bound externality estimate (see Chapter 4).

The estimate of X, the share of forgone labour value added in the tradeable goods sector, was based on the assumption that this share would equal the relative of value added represented by the tradeable goods sector to total value added in each of the regions where shipbuilding occurs. This assumption implies that the alternative employment secured by individuals in the event of a shipbuilding layoff, and their non-shipbuilding employment in the retention scenario, would both be divided between the tradeable and non-tradeable sectors in the same proportion as the division of value added in the regional economies where shipbuilding takes place.

In order to estimate the proportion of total value added in the tradeable goods sector, it is first necessary to derive estimates of the value added by each industry in each region. Once this has been accomplished, the share of tradeable goods production can be determined by classifying industries according to whether or not their output is traded internationally. In this report, total value added in agriculture, forestry, fishing and trapping, mining, electricity, manufacturing,

construction and services was estimated on a regional basis.[1] The latter two industries were considered to comprise the non-tradeable goods sector, as the product of these industries is generally consumed the point of production. The other industries were considered to constitute the tradeable goods sector of the economy, since the output from these industries is capable of being exported or imported. The following figures indicate the average shares of total value added represented by such tradeable good industries in each of the four regions where shipbuilding activity occurred over the period 1969-74.

Region	Share of Total Value Added in the Tradeable Goods Sector
Atlantic Provinces	.267
Quebec	.346
Ontario	.362
B.C.	.295

A simple average of these shares of tradeable goods production yields an estimate for X equal to .318. When this value, together with the previously determined estimates of (Wo* - Wo), was substituted into equation (2), the value of forgone foreign exchange associated with the construction of vessels in Canada ranged from $.56 million to $.43 million per 1000 man years of shipbuilding employment. An average of these two figures was subsequently scaled to the man years associated with each vessel size, and subsequently entered as a cost in the economic analysis of Option 4.

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[1] The ideal measure of total value added is gross domestic product (GDP) at factor cost. Unfortunately, estimates of GDP by industry are only available for Canada as a whole (System of National Accounts, Statistics Canada, 13-531). Information on census value added (CVA) by industry, however, is available at the provincial level (Survey of Production, Statistics Canada, 13-531). The latter measurement is conceptually similar to GDP, but differs in a number of technical respects. If one assumes that the ratio of the two measurements in each industry at the regional level is the same as the ratio of the two at the national level, regionally disaggregated estimates of GDP at the industry level can be derived by applying the national ratios to the CVA estimates in the following manner:

$$GDP_{ij} = \frac{GDP_i}{CVA_i} \; CVA_{ij}$$

where GDP_{ij} = gross domestic product at factor cost for industry i in region j

GDP_i = national estimate of gross domestic product at factor cost for industry i

CVA_i = national estimate of census value added in industry i

CVA_{ij} = census value added for industry i in region j

This procedure was adopted in order to derive regionally disaggregated estimates of value added in each industry.

Appendix D

MODEL OF EMPLOYMENT AND UNEMPLOYMENT IN THE CANADIAN SHIPBUILDING INDUSTRY

1. OVERVIEW

The unemployment reducing potential of an Option 4 investment was assessed by developing and estimating a model of employment and unemployment in the Canadian shipbuilding industry. Using a data base from information collected by the Unemployment Insurance Commission, it was possible to estimate two scenarios of the labour market affected by the construction of a vessel in Canada. The effect of incremental demand for Canadian vessels was modelled by developing a retention scenario, in which it was assumed that the number of individuals affected, their earnings, and their weeks of unemployment could be predicted on the basis of the average experience of shipbuilding employees in the past. The effect of not constructing a vessel was modelled by developing an immediate termination scenario, in which it was assumed that the individuals otherwise employed in vessel construction would be laid off from the industry. The latter scenario was developed by examining the data available for individuals separated from the industry in the last few years.

The essential distinction between these two scenarios is that the latter envisages an immediate layoff of the persons otherwise employed, while the former involves a postponement of the layoff for a two year period. Accordingly, while a reduction in unemployment is observed during the construction period of the retention scenario, this is somewhat offset by an increase in unemployment when the workers are released in the third year of this scenario.

These scenarios of employment and unemployment were then used to estimate a labour externality associated with the construction of a vessel in Canada. This externality is roughly equal to the difference between, on the one hand, the estimated social product of individuals employed in the shipbuilding industry in the retention scenario and, on the other hand, the social opportunity cost of this labour as estimated in the immediate termination scenario.

In the first year of construction, the size of the externality is determined by the duration of unemployment predicted for individuals expected to subsequently find employment if they were laid off from shipbuilding, and by the predicted probability of their not finding employment within one year. In the second year of construction, the externality is based on the difference between the earnings and values of time predicted if individuals had been retained in the industry, and the predicted values of these variables if the individuals had been laid

off in the previous year. In the third year, however, the externality is negative, and is determined by the difference between the unemployment expected if individuals had been retained for two years and subsequently laid off, and the amount of unemployment predicted if these individuals had left the industry two years previously.

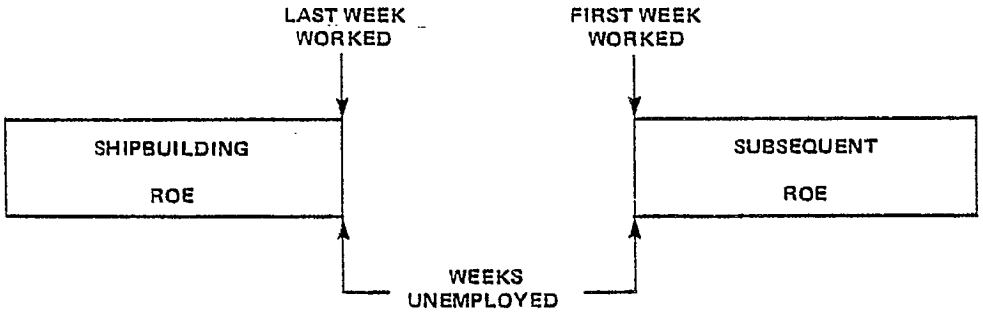
2. DATA SOURCES

The data used to estimate the model outlined below were developed jointly by officials at the Departments of Employment and Immigration and Industry, Trade and Commerce. Information submitted to the Unemployment Insurance Commission from employers in the shipbuilding industry was used to construct two data bases. The first of these data bases, denoted the employment summary file, contained blocks of information on all employees who had worked in the shipbuilding industry in the 1972-75 period and who had a social insurance number ending in 5. In order to maintain confidentiality, the SIN number was replaced by an arbitrary identification number before the information was released for use in the present analysis.

For the purposes of this report, the following information was used in constructing the model of employment in the shipbuilding industry:

(a) age of the individual in 1974,
(b) region of the individual in the year(s) in which shipbuilding income was received,
(c) earnings in shipbuilding in each of the years,
(d) earnings in other industries in each of the years, and
(e) benefit weeks collected from unemployment insurance claims established in each of the years.

A second data base, denoted as the separation file, was also extracted from the information gathered by the Unemployment Insurance Commission. This file contained blocks of information on individuals who had resigned or been laid off from the shipbuilding industry in the 1974-1976 period. Beginning in 1974, employers were required to submit a record-of-employment (ROE) for all individuals separated from the industry. This ROE information was then combined with any information on unemployment insurance claimant activity subsequent to the separation to trace out the experience of individuals in the period after leaving shipbuilding. The ROE data provides information on the demographic characteristics of the individuals (age, region, sex, occupation, etc.), as well as on the prior employment experience with the firm issuing the ROE. The most important piece of information in the latter data is the designation of first and last weeks worked with the firm in question. In cases in which an individual was separated at least twice during the sample period, a subsequent ROE would be found in the data base. In these cases, it was possible to predict the post-separation duration of unemployment by measuring the period of time from the end of the shipbuilding ROE to the beginning of the subsequent ROE (which may or may not have been in the shipbuilding industry). This is illustrated in the diagram below.



In order to model the effect of a shipbuilding layoff, an ideal data source would provide information on the earnings, employment status, and demographic characteristics of individuals on a continuous basis (i.e., week by week) for a period long enough to capture the major portion of the adjustment period. One could then compare the experience of individuals retained in shipbuilding with the experience of those separated from the industry for a two to three year period, and use this information to predict the consequence of potential future layoffs.

In practice, only an approximation to this ideal data source is likely to be available. In the model outlined below, the major limitations imposed by the data are three-fold:

a) The employment summary information is only available on a discrete calendar year basis. While this data can be used to predict the average experience of individuals over successive years, a precise delineation of their employment status or earnings at any given point in a year is not possible.

b) The benefit week information in the employment summary file refers to weeks collected on claims established in the calendar year, while the employment income information refers to earnings within a calendar year. Difficulties arise when the duration of claim spans two successive calendar years. In such cases, too many benefit weeks will be assigned to individuals whose

claims run into the subsequent year, while too few will be assigned to individuals whose claims were established in the previous year but did not terminate until some time into the year in question.

In many cases, the biases introduced by this factor will be offsetting; for example, while estimated total U.I. benefits collected by shipbuilding employees in 1974 will include some benefits actually received in 1975, the total figure will also exclude those benefits collected in early 1974 from claims established in 1973. If the figures are averaged over a number of years, it is expected that any bias remaining will be relatively small.

When attempts are made to distribute the number of U.I. benefit weeks collected in a calendar year over the individuals who receive such benefits (in order to determine average benefit weeks per beneficiary, for example), an additional adjustment is necessary. While we may expect that the total benefit weeks collected by individuals in the sample in each calendar year is measured with reasonable accuracy, the number of individuals actually receiving benefits in the year will be underestimated by considering only those who establish a claim in the year. The adjustment made in this study was to assume that individuals experiencing unemployment in a year included all those who establish a U.I. claim plus all those who received less than $5,000 in employment income.[1] While this adjustment is far from perfect, it is expected that the inclusion of workers earning less than $5000 would capture most of those individuals who were definitely unemployed at some time in the calendar year but who may have established their claim in the previous year.

c) The use of the separation file to estimate unemployment durations is to be preferred to use of information on U.I. benefit weeks for a number of reasons. The period of time between two ROE's can be expected to be a superior measure, in that it will account for any periods of unemployment not covered by U.I. claims. This is important, since many individuals leaving the industry do not establish a claim after separation, and hence will be excluded from any analysis confined to the duration of claims. Furthermore, some individuals will exhaust their eligibility for unemployment insurance, and may thus be unemployed for a longer period of time than would be indicated by an examination of their U.I. benefit claims.

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[1] All income figures contained in this report are expressed in terms of 1975 $. The inflation factor used was an index of wages and salaries in the transportation equipment industries sector. (Source: Employment, Earnings and Hours, 72-002, Statistics Canada.)

The major problem in using the separation file is that a subsequent ROE is not available for all individuals who have left the industry. Since an ROE is issued only when a person has been separated from a firm, the absence of a subsequent ROE may indicate that one of two conditions holds:

(a) the individual did not find work prior to the end of the survey period, or
(b) the individual did find work after the initial period of unemployment and had not left such employment by the end of the survey period.

Obviously, it is very important to distinguish between these two possible circumstances. Since this was not possible using the ROE data, separate estimates were made of the possible long-term unemployment resulting from layoffs in the Canadian shipbuilding industry. These estimates were subsequently combined with estimates of unemployment duration generated from the available ROE information to provide a more complete picture of the adjustment problem faced by individuals subject to layoff.

3. OVERVIEW OF EMPLOYMENT IN THE CANADIAN SHIPBUILDING INDUSTRY

Many of the individuals employed in shipbuilding do not receive all of their employment income from this industry, but rather exhibit a pattern of intermittent employment in different industries (often separated by periods of unemployment or non-labour-force activity). The significant component of temporary employment in the shipbuilding industry can be seen in Table D-1 below. From the employment summary file, it was possible to classify individuals into three "sectors" based on their attachment to the shipbuilding industry and on their unemployment experience in any given year. Individuals in the "Permanent 1" (P1) sector are all those who are employed only in shipbuilding and who generally work a complete year in the industry. Individuals in the "Permanent 2" (P2) sector are those who work in more than one industry in the year, but who appear to employed full-time. Finally, all of those individuals excluded from these categories are allocated to the "temporary" sector.[1] Workers in the latter sector can be expected to be unemployed at least some time over the year. Included in the temporary sector will be individuals who were employed in more than one industry, as well as those who only worked in shipbuilding.

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[1] The P1 sector includes all individuals with over $5000 in shipbuilding income, no other employment income and no U.I. claim. The P2 sector includes all individuals with over $5,000 in total employment income, some employment income in other industries, and no U.I. claim. The temporary sector includes all those with either a U.I. claim or a total employment income of less than $5,000. The proportion of individuals in each of these sectors was determined by calculating weighted averages for the years 1973-1975.

Table D-1

Classification of Workers in Shipbuilding by Attachment to the Industry in an Average Year

P1 Sector[1]

Region	Per Cent of Total Individuals in Sector	Median Age	Average Total Earnings
Atlantic	41.5	38.8	11,035
Quebec	46.2	45.0	11,434
Ontario	36.3	39.3	14,039
B.C.	33.9	45.3	15,451

P2 Sector[2]

Region	Per Cent of Total Individuals in Sector	Median Age	Average Total Earnings	Per Cent of Earnings in Shipbuilding
Atlantic	17.1	29.1	10,842	.45
Quebec	16.4	34.4	12,256	.64
Ontario	20.5	38.5	10,028	.29
B.C.	27.5	35.0	10,892	.34

Temporary Sector[3]

Region	Per Cent of Total Individuals in Sector	Median Age	Average Total Earnings	Per Cent of Earnings in Shipbuilding	Average Benefit Weeks
Atlantic	41.4	25.9	4,781	.68	11.8
Quebec	37.4	28.5	5,921	.76	15.8
Ontario	43.2	30.8	5,595	.39	12.6
B.C.	38.6	30.8	7,137	.54	11.6

[1]The P1 Sector consists of individuals employed full-time and working exclusively in shipbuilding.

[2]The P2 Sector consists of individuals employed full-time and working both in shipbuilding and other industries.

[3]The Temporary Sector consists of individuals unemployed at some time in the year but working in shipbuilding and perhaps other industries for the remainder of the year.

Source: The Employment Summary File.

On average, slightly over 60 per cent of the individuals in the P2 and temporary sectors leave the industry in any particular year, whereas over 98 per cent of the P1 individuals remain attached to shipbuilding in the subsequent year.

From Table D-1 it can be seen that the median age increases when going from the temporary to the P2 to the P1 sectors. Average earnings are of course much higher in the P1 and P2 sectors than in the temporary sector, since individuals only work part of the year in the latter sector. Table D-1 also shows that shipbuilding wages are considerably higher in the Ontario and B.C. than in the eastern provinces. In the P1 sector for example, average earnings in Ontario and B.C. are 27 per cent and 40 per cent above the average in the Atlantic region. For workers in the P2 and temporary sectors shipbuilding earnings form a much higher proportion of total employment income in the eastern provinces than in Ontario and B.C. Average benefit weeks per individual are similar in the Atlantic region, Ontario and B.C., but are considerably higher in Quebec.

The notion of a "sector" outlined above was based on a cross-sectional examination of the employment status of individuals in each of the years 1973 to 1975. When one extends the time frame past one year, however, some individuals will, of course, pass from one sector to the other. That is, some of the individuals in the temporary sector will get permanent jobs (both in and out of shipbuilding), while some of the formerly permanently employed will lose their jobs. Over time, then, we might expect that the earnings differentials will narrow, and that average U.I. benefit weeks will be more evenly distributed among the individuals in the various sectors.

The extent to which this occurs can be measured by examining the earnings and average benefit weeks of the individuals appearing in Table D-1 in the subsequent or "second" year (i.e., by measuring the 1974 average incomes of individuals who were in P1 in 1973, etc.). This information is provided in Table D-2 below. It can be seen that, while a slight shrinkage is evident in the income differentials between sectors, the differences that remain are still substantial. The U.I. benefit weeks collected from claims established in the subsequent year by the temporary sector individuals are approximately half of the weeks collected in the previous year. The amount of unemployment experienced by these temporary sector individuals, however, is still 2 1/4 to 5 1/2 times that experienced by individuals who had permanent shipbuilding jobs in the preceding year.

Table D-2

Earnings and Average Benefit Weeks of Individuals in Second Year by Sector in Previous Year

P1 Sector

Region	Average Total Earnings in Second Year	Average Total Earnings in Previous Year	Ratio of Earnings (Second Year/ Previous Year)	Average U.I. Benefit Weeks in Second Year
Atlantic	10,803	11,035	.98	2.5
Quebec	10,955	11,434	.96	3.5
Ontario	13,331	14,039	.95	1.1
B.C.	15,446	15,451	1.0	1.4

P2 Sector

Region	Average Total Earnings in Second Year	Average Total Earnings in Previous Year	Ratio of Earnings (Second Year/ Previous Year)	Average U.I. Benefit Weeks in Second Year
Atlantic	10,645	10,842	.98	4.7
Quebec	12,080	12,256	.98	3.9
Ontario	14,747	10,028	1.5	3.4
B.C.	13,242	10,892	1.2	4.0

Temporary Sector

Region	Average Total Earnings in Second Year	Average Total Earnings in Previous Year	Ratio of Earnings (Second Year/ Previous Year)	Average U.I. Benefit Weeks in Second Year	Average U.I. Benefit Weeks in Previous Year	Ratio of U.I. Benefit Weeks (Second Year/ Previous Year
Atlantic	5,702	4,781	1.19	6.3	11.8	.53
Quebec	6,544	5,921	1.10	7.7	15.8	.49
Ontario	6,592	5,595	1.18	5.5	12.6	.44
B.C.	8,354	7,137	1.17	6.3	11.6	.54

4. IMPLICATION OF EMPLOYMENT PATTERN FOR ESTIMATION OF EXTERNALITY

This pattern of employment in the shipbuilding industry has several implications for the estimation of the labour externality associated with postponing a decline in employment by constructing a deep-sea vessel. In the first place, the significant component of temporary employment in shipbuilding implies that more individuals would be directly affected by the construction of a vessel than would be employed at any given time in the two year period. Secondly, the effect of a possible shutdown of a shipyard on each individual is not simply equal to the duration of unemployment after layoff, but is rather related to the difference between the amount of unemployment experienced if vessel construction does not take place and the amount of unemployment that would occur in any event.

Finally, the existence of large numbers of individuals who are employed in shipbuilding for a relatively short period of time suggests that one must be careful in using the experience of individuals who have left the industry to predict the consequences of a shutdown of a shipyard. That is, the population of individuals who have left the industry in the past is heavily weighted towards the younger age groups who have not remained with the industry for a long period. The population of individuals potentially affected by closure of a shipyard, however, will include many of the older individuals whose attachment to shipbuilding is stronger. This more permanently employed group may have considerably different skills than the average worker identified as leaving the industry in the past, and this may have important implications for the extent of the adjustment problem following shipyard closure.

The exact direction of these differential effects cannot be predicted beforehand. If the population of more permanently employed individuals has developed specific skills, and is not experienced in job search activity, these individuals may experience a more severe adjustment problem after layoff. On the other hand, many of these individuals may possess highly-valued and more general skills for which there is a good market, and will accordingly be absorbed more readily in other industries. It could also be argued that the more permanently employed have exhibited a marked preference for work activity, while at least some of the unemployment experienced by the short term workers is of a more voluntary nature. If this is the case, we would also expect the permanent workers to find work more quickly.

5. DEVELOPMENT OF THE RETENTION AND IMMEDIATE TERMINATION SCENARIOS

The first step in developing the retention scenario involved predicting the number of individuals[1] affected by the construction of a vessel involving a given number of man-years. A formal explanation of the methodology used is given in Attachment 1. Essentially, the technique used involved predicting the total number of shipbuilding man-years associated with the individuals represented in the employment summary file and then calculating a series of coefficients relating individuals to man-years in each sector-region-age group. Thus, while there is one individual for every shipbuilding man-year associated with the P1 sector, there are generally two to three individuals associated with the corresponding man-years in the P2 and temporary sectors.

The key assumptions used in deriving these estimates are:

(1) the age and sectoral distribution of individuals expected to be affected by the construction of a given vessel will be equal to the average distribution observed in the shipbuilding industry in each region over the 1973-75 period;

(2) the average weekly wage (in shipbuilding) of individuals in each region-age group is invariate to the sector in which the individuals work. That is, it is assumed that the average weekly shipbuilding wages of individuals in the P2 and temporary groups were equal to the average wages of their P1 counterparts, and that, accordingly, differences in the average annual shipbuilding incomes of the individuals in each sector reflected differences in the amount of time worked in shipbuilding.

The former assumption implies that the age structure of the industry in each region is representative of the age structure for particular firms in each region, and that this structure is not expected to change appreciably over the time frame in which this study can be considered applicable. The second assumption is perhaps the most tenuous, and may result in some overstatement of the weekly wages received by individuals in the temporary sector. If this turns out to be the case, the total number of individuals associated with a given number of man-years of work in shipbuilding will be somewhat overstated as well. As shown in Attachment 1, however, the distribution of individuals between the sectors will not be affected by changes in this assumption. If weekly shipbuilding wages of individuals in the temporary sector were only 70 per cent of those in the P1 sector, for example, the number of total man-years would be overstated by 6 to 9 per cent. This would in turn reduce the estimated externalities by the same number of percentage points. Since large variations in the weekly wage assumption produced only minor variations in the regional distribution of the estimated number of man-years, and since the direction of bias in the estimated labour externality can only be in the upward direction, the "equivalent wage" assumption was not felt to affect the main conclusions of the report.

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[1] In the first year of construction.

Table D-3 applies the results of these calculations to a vessel providing 500 man-years of employment in the first year of construction. It can be seen that the different structure of employment in the regions has important implications for the numbers of individuals associated with a given number of man-years of work in vessel construction. In Quebec, the individuals in the P2 and temporary sectors work much longer in shipbuilding (in a given year) than in Ontario, for example, and this is reflected in the figures presented in the last three columns of Table D-3. As a result of the relatively higher attachment to the industry in Quebec, however, the number of people affected by the construction of a vessel is considerably less than in other regions. Thus for the 500 construction man-years envisaged in Table D-3, it is predicted that this would involve 715 people in Quebec as compared to 1010 in Ontario.

The effect of these regional differences in employment patterns on the labour adjustment problem posed by layoffs cannot be determined beforehand. That is, whether the potential disappearance of jobs filled by smaller numbers of people, but with greater attachment to this employment, is likely to be more disruptive than a case where the opposite conditions hold, will depend on the labour market conditions in the various regions of the country.

Table D-3

Number of Individuals Predicted to be Employed in Shipbuilding for an Investment Involving 500 Man-Years

Region	No. of Man-years (proportions of total man-years)			No. of Individuals (proportions of total individuals)			Total No. of Individuals	No. of Individuals per man-year		
	P1	P2	Temp	P1	P2	Temp		P1	P2	Temp
Atlantic	335 (.67)	62 (.12)	103 (.20)	335 (.42)	138 (.17)	333 (.41)	796	1	2.2	3.2
Quebec	315 (.63)	78 (.16)	108 (.21)	315 (.44)	112 (.16)	288 (.40)	715	1	1.4	2.7
Ontario	362 (.73)	56 (.11)	71 (.14)	362 (.36)	208 (.21)	440 (.44)	1010	1	2.9	6.2
B.C.	308 (.62)	103 (.21)	94 (.19)	308 (.34)	249 (.27)	352 (.39)	909	1	2.4	3.7

Having determined the numbers of people potentially involved in constructing a vessel[1], the next step in the analysis involved predicting their incomes and weeks of unemployment in the event the construction did take place, and the corresponding values of these variables in the event that it did not. Calculation of earnings and weeks of unemployment for the first two years of the retention scenario was relatively straightforward, and merely involved tabulating the average incomes and benefit weeks experienced by individuals in the past. These tabulations were disaggregated on the basis of age, region and sector in the first year[2].

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[1]Only those individuals predicted to be employed in the first year of construction were traced through the two scenarios. This results in some understatement of the numbers of individuals affected, since some individuals could be expected to enter the industry in the second year (and be subsequently laid off in the third). On the basis of the average experience in the past, these second year entrants would account for between 5 and 9 per cent of the total man-years involved over the two year period. It was felt that exclusion of these individuals would not seriously bias the estimates, particularly in view of the fact that these late entrants would be laid off in the third year.

[2]The incomes and U.I. benefit weeks allocated in the first year were based on a weighted average of the variables observed for each region-age-sector group in the 1973-75 period. The second year incomes and benefit weeks allocated to each group were based on the average experience of these groups in the subsequent year. Individuals who have left the industry, as well as those who have remained, will be included in these second year tabulations. Since the second year estimates in the immediate termination scenario (see below) were based only on information for those who had left the industry, it can be seen that this latter population is included in both scenarios. This does not present any serious problems, however, since the difference between the estimates in both scenarios will still reflect the different experiences of those who leave, and those who do not. Put another way, the retention scenario acknowledges that some of the individuals will in fact leave the industry in any case; the immediate termination scenario assumes they all will.

It was assumed in the immediate termination scenario that all those individuals who would otherwise be involved in vessel construction would be laid off from the industry. Estimation of the consequences of such a layoff was accomplished by examining the experience of employees who had left the shipbuilding industry in the past. This required the estimation of three different regression equations which related the post-separation employment and unemployment experience of these individuals to their age, region, previous sector status, and to the regional unemployment rate. The first three of these independent variables were included in order to standardize for the fact that the population of those leaving the industry in the past differed from those who remained. That is, these independent variables enable separate estimates to be made of the effects on each region-age-sector group, and thus allow for a linkage to be made between the retention and immediate termination scenarios. The regional unemployment rate variable is included to measure the sensitivity of the adjustment problem to cyclical and regional conditions.

The dependent variables measured by these three regressions are as follows:

(1) the probability of finding subsequent employment;

(2) the number of weeks of unemployment experienced in the first year by individuals identified as finding subsequent employment;

(3) the probability of finding a permanent job after the immediate spell of unemployment for individuals predicted to find subsequent employment.

The use of the equations defined by these regressions, when used in conjunction with information on the earnings of individuals in the year after separation, enables one to calculate the direct externality by linking the termination and retention scenarios and subsequently applying the labour externality methodology outlined in Chapter 4.

In the first year of construction, this externality is equal to 80 per cent of the wage rate for each extra week of unemployment experienced by individuals in the immediate termination scenario. For individuals who were predicted to be unemployed for longer than one year, the externality was set equal to their loss in income.[1] Expressed mathematically:

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[1] Ideally, it would have been preferable to include in this estimate a comparison of the weekly wages earned under the two scenarios. This was not possible due to the discrete nature of the data. The incorporation of differential wage effects was possible in the second year of both scenarios.

$$EX(1) = \Sigma N_i \left[P_i (AU_i - AU_i^R) \, WP_i (.8) + (1-P_i) \, E_i\right]$$

where $EX(1)$ = externality in first year
i refers to the age-region-sector group

N_i = number of individuals

P_i = probability of finding employment in year

AU_i = average weeks of unemployment predicted for first year of immediate termination scenario

AU_i^R = average weeks of unemployment predicted in first year of retention scenario (positive only for temporary employees)

WP_i = weekly wage proxy (annual shipbuilding earnings for P1 workers ÷ 52)

E_i = average annual employment income in retention scenario.

In the second year of construction, the externality is equal to the difference between the "social products" (earnings and value of time) of individuals in the two scenarios. Expressed another way, this externality is equal to the difference in wage rates for each week in which the individual is expected to be employed under both scenarios, plus 80 per cent of the wage rate for each extra week of unemployment in the immediate termination scenario. The size of this externality is heavily influenced by the regression predicting the probability of finding a permanent job.

$$EX(2) = \Sigma N_i \, P_i \left[(E_i^R + V_i^R) - PERM_i \, (E_i^{PIT}) - (1 - PERM_i) \, (E_i^{TIT} + V_i^{TIT})\right] + \Sigma N_i \, (1-P_i) \, E_i^R$$

where $EX(2)$ = externality in second year

E_i^R = average earnings in second year of retention scenario

V_i^R = value of time in second year of retention scenario (average weeks unemployed times 20 per cent of wage rate)

$PERM_i$ = probability of finding a permanent job in year after separation

E_i^{PIT} = average earnings of individuals finding permanent jobs in year after separation

E_i^{TIT} = average earnings of individuals finding temporary jobs in year after separation

V_i^{TIT} = value of time for individuals finding temporary jobs in year after separation.

In the third year, the externality is negative, and is related to the difference between the weeks of unemployment observed after the individuals are laid off in the retention scenario, and the weeks of unemployment expected if these people were laid off two years previously.

$$EX(3) = \Sigma R_i N_i [P_i PERM_i (AU^R_{i3}) + P_i (1-PERM_i)(AU_{i3}{}^R - AU_{i3})] WP_i(.80)]$$

where $EX(3)$ = externality in third year

R_i = probability of working in shipbuilding for a three year period

AU^R_{i3} = average weeks of unemployment predicted for third year of retention scenario

AU_{i3} = average weeks of unemployment predicted for individuals finding temporary jobs in the immediate termination scenario.

For the following reasons, the negative externality in the third year will not completely offset the positive one observed in the first year.

(1) Negative externalities are calculated only for those individuals who would have remained in the industry for the complete construction period. While more people than this would in fact be susceptible to layoff, some of these workers would have only entered the industry in the second year. As explained above, these second year entrants are excluded from the analysis (i.e., neither positive externalities in the second year, nor negative in the third, are estimated for these people).

(2) Negative externalities will result only where individuals are identified as securing subsequent employment by the third year of the immediate termination scenario.[1]

(3) To the extent that the duration of unemployment is sensitive to the unemployment rate, the average weeks of unemployment in the first year of the immediate termination scenario, and the third year of the retention scenario, will differ. The model thus allows for the benefits of postponing a layoff until cyclical conditions are expected to improve to be explicitly incorporated.

(4) Because costs in the future are preferable to costs today, the externalities estimated for each year are discounted at 10 per cent.

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[1] It was felt likely that many of those individuals not identified as securing subsequent employment would in fact have probably found a job by the third year. Since this could not be proved because of the limited time span of the data, the more pessimistic assumption (i.e., that such individuals never get jobs) was used in this analysis. This procedure biases upward the estimated externality.

6. RESULTS OF THE REGRESSION ANALYSIS

A. Probability of Finding Alternative Employment

(a) Data Sources

As noted previously, a major deficiency in the separation file is the lack of a "subsequent ROE" for all individuals. Since the lack of information on subsequent employment may indicate either that the individual did not find a job, or that he found employment and was not separated from this employment before the end of the survey period, this gap is quite serious. In order to avoid underestimating long-term unemployment, a separate estimation procedure was employed to capture this effect.

From the employment summary file, a sample was selected consisting of all individuals who had left the shipbuilding industry in 1973 or in 1974. Sixty-six individuals who did not have any employment income in the calendar year after leaving the industry, and who also did not collect any unemployment insurance benefits in the year of leaving, were excluded from this sample. Since the intention was to use the lack of employment income to estimate long term unemployment, it was not felt that these 66 individuals could be seriously considered as long-term unemployed. Individuals who had died, emmigrated, voluntarily left the labour force or secured self-employment would have no employment income from establishments in the subsequent year. It was felt that these sixty-six individuals would likely be in these special categories.

Individuals who did collect unemployment insurance benefits in the last year in shipbuilding, but who did not have employment income in the subsequent calendar year, were considered to be involuntarily unemployed for more than one year. The sample period was not long enough to determine when, if ever, these individuals found subsequent employment. In order to avoid any possible underestimation of the probability of securing a job, the extreme assumption was made that these individuals would be unemployed for the three-year period covered by the model.[1]

The possible extent of this long-term unemployment was estimated using two different samples: one in which all of the individuals leaving in 1974 or 1975 were represented (excluding the 66 individuals noted above) and one in which only those who collected unemployment insurance benefits were represented. The first of these was termed the complete sample, while the latter was denoted as the beneficiary sample. There were 854 individuals in the former sample, and 383 in the latter.

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[1] One exception to this rule was made in the case of individuals over 60 years of age, when it was assumed that half of the people without employment income were experiencing voluntary retirement. This again would appear to be a conservative assumption.

The complete sample may be overly optimistic in predicting the probability of finding a subsequent job, as it includes individuals who voluntarily left the industry. The beneficiary sample, however, would likely generate overly pessimistic predictions of the probability of securing alternative employment, as all individuals who found jobs almost immediately after layoff (and hence who did not claim unemployment insurance benefits) will be excluded.[1] Thus the results given below for the two samples should be considered as upper and lower bounds.

(b) Estimation Technique

The probability of a particular individual finding alternate employment after layoff can be expected to depend upon the social-economic characteristics of the individual and upon the cyclical conditions prevailing in the regional labour market. Using the two samples referred to above, this probability can be predicted by examining the extent to which success in achieving alternate employment is related to a set of independent variables representing the demographic characteristics of individuals in the sample, and the unemployment rates prevailing at the time of layoff. One statistical technique often employed in estimating these relationships is probit analysis. A brief outline of this technique, and of the manner in which it was applied in the present study, is given below.

A probit analysis is essentially a cross-sectional regression equation in which the dependent variable is binary - taking on a value of 1 for each "positive" observation and a value of zero for each nonpositive observation. The equation estimated from this technique can then be used to determine the probability of a "positive" occurrence for any given combination of values for the independent variables in the regression.[2] Probit analysis is a maximum likelihood estimation procedure in cases where the dependent variable is binary.

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[1] Over 25 per cent of the layoff cases in the separation file did not establish a claim for unemployment insurance benefits.

[2] The values of the dependent variable directly estimated from a probit equation do not indicate the appropriate probabilities. The estimated values must be transformed into their underlying probabilities by means of a table giving the normal distribution. Accordingly, in examining the results of the estimation procedure given below, more attention might be given to the signs of the coefficients and their respective t statistics (which retain their usual meaning) than to their absolute values.

Using the samples of individuals referred to above, the probit technique was applied in the following manner. The dependent variable took on a value of 1 if the individuals received employment income in the year after leaving the industry, and a value of zero otherwise. The independent variables included dummy variables for the age group of the individual and the value of the regional unemployment rate in the year after leaving shipbuilding. In the initial specification, interaction terms reflecting the region and employment status of the individual (e.g. P1-Atlantic) in the year before leaving shipbuilding were also included. These interaction terms were retained in the final specification only if the t statistic exceeded one.

The combination of the constant term plus the product of the assumed unemployment rates and the applicable coefficient captures the estimated probabilities for individuals over 60 years of age who were in one of the region-sectors not included in the interraction terms. The estimated coefficients for the age dummy variables and for the interraction terms then indicate the difference in the estimated values of the dependent variables for individuals in other age-region sector groups.

(c) Results of the Regression

The estimates from both of the samples described above are given in Table D-4 below. The unemployment rate exerted a significant and negative effect on the probability of finding subsequent employment in both samples. Virtually all of the age dummy variables are highly significant in both samples. This is not particularly surprising, however, as the coefficients represent the difference between the probabilities of these age groups and the 60+ age group. The lack of employment income among individuals in this latter group is felt to be indicative of normal retirement in many cases.

With the exception of the 60+ group, no uniform age pattern was detected in the data. Thus, relatively high coefficients were estimated for both the 45-49 and 55-59 age groups while the coefficient for those of the 50-54 group was considerably lower.

The estimates indicated that the probability of finding alternative employment for individuals in the temporary and P2 sectors in the Atlantic region were significantly higher than would be consistent with the unemployment rates in this region. Individuals who were formerly in the P1 sector in Quebec, on the other hand, were predicted to have a lower probability than would be consistent with the unemployment rates in this region. The estimates from the complete sample indicated that individuals formerly in the P1 sector in Ontario had a significantly higher probability of securing subsequent employment. This latter result was not replicated in the beneficiary sample for the simple reason that none of these individuals appeared in this sample.

Table D-4

Coefficient Estimates from Probit Analysis
of Probability of Finding Alternate Employment
(t-statistics in brackets)

Independent Variables		Estimated Coefficients Complete Sample	Beneficiary Sample
Constant		0.73 (1.7)	0.73 (3.9)
Dummy Variables for Age	- Under 20	3.21 (4.9)	3.15 (3.9)
	20-24	1.80 (8.0)	1.51 (4.9)
	25-29	2.04 (8.0)	1.69 (5.0)
	30-34	1.80 (6.8)	1.48 (4.2)
	35-39	2.15 (6.2)	1.69 (3.7)
	40-44	1.83 (5.0)	1.21 (2.4)
	45-49	2.35 (5.2)	1.83 (3.2)
	50-54	1.34 (4.4)	0.60 (1.4)
	55-59	3.16 (3.4)	3.21 (2.3)
Interraction Terms	- Temp - Atlantic	0.68 (2.5)	0.99 (3.0)
	- P2 - Atlantic	2.48 (2.4)	2.63 (2.1)
	- P1 - Quebec	-0.48 (-1.8)	-0.48 (-1.5)
	- P1 - Ontario	1.97 (1.1)	-
Unemployment Rate		-1.31 (-2.5)	-0.146 (-2.19)
No. of Observations		854	383
No. Positive		784	329
Likelihood Ratio Test		160.494	88.14
Psuedo R2		.171	.206

Table D-5

Predicted Probabilities of Finding Subsequent Employment
(evaluated at an 8% unemployment rate; beneficiary sample)

Age Group	Probabilities: Base Case of all individuals other than temporary and P2 in Atlantic and P1 in Quebec	Temporary - Atlantic	P2 - Atlantic	P1 - Quebec	Reduction in Base Case Probabilities for each Percentage Point increase in unemployment rate
Under 20	.99	1.0	1.0	.99	0
20-24	.86	.98	1.0	.73	.029
25-29	.90	.99	1.0	.79	.023
30-34	.85	.98	1.0	.72	.030
35-39	.90	.99	1.0	.78	.023
40-44	.78	.96	1.0	.62	.039
45-49	.92	.99	1.0	.82	.019
50-54	.57	.88	1.0	.62	.050
55-59	.99	1.0	1.0	.99	.001
50+	.33	.72	1.0	.18	.050

Table D-5 indicates the results when the estimated values of the dependent variables are transformed into the underlying probabilities and the unemployment rate is set at 8 per cent. The estimates from the beneficiary sample were used in deriving these probabilities.

The effect of a one percentage point change in the unemployment rate on the estimated probabilities is also indicated in this table. It will be noticed that the estimates of this effect vary with the age-region-sector group being examined. This pattern reflects the non-linear nature of the probit specification, which results in higher unemployment rate effects for individuals near the 50 per cent probability level, and lower effects for individuals near the tails of the distribution.

B. Weeks of Unemployment in First Year After Separation Individuals Finding Alternative Employment

(a) Data Sources

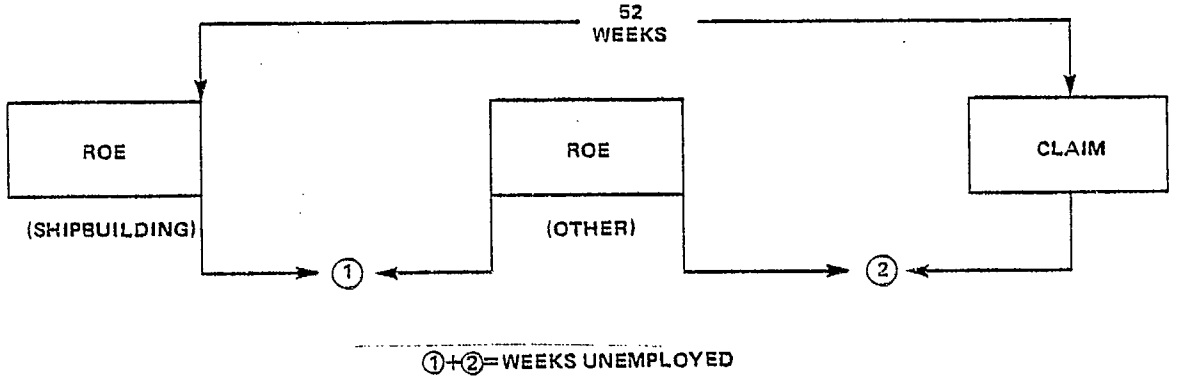
Both the separation file and the employment summary file were used in estimating the average weeks of unemployment in the year after separation from shipbuilding. Using the first data base, a dependent variable reflecting weeks unemployed was constructed in the following manner:

(i) in cases where a subsequent ROE was available, weeks unemployed were estimated by measuring the distance between the two ROE's;

(ii) in cases where there was no subsequent ROE but where an unemployment insurance claim was established, weeks unemployed were estimated by measuring the duration of claim and adding in the time from the end of the shipbuilding ROE to the beginning of the claim;

(iii) cases where neither a subsequent ROE nor a claim was available were dropped from the sample;

(iv) in cases where the subsequent ROE was followed by another claim within the 52 week period from the shipbuilding separation, weeks unemployed were determined as in the diagram below.



The separation file contained information on 10 per cent of the individuals who had resigned or been laid off from the shipbuilding industry in the period between January, 1974 and March, 1977. The file was organized on the basis of "separation-cases" rather than individuals (i.e., individuals who had been separated from shipbuilding more than once during this period will "appear" in the file in at least two different places). Since the intention was to use this information to derive a representative sample of individuals who had permanently left the shipbuilding industry, a number of exclusion criteria were employed. The principal criteria used are indicated below:

(i) all cases associated with individuals who were separated from shipbuilding more than once in the period were excluded. This eliminates most of the cases where individuals were recalled to the same firm;

(ii) all cases involving separations in 1976 and 1977 were excluded. Since some of the individuals separated during this period would not have terminated their claims by the end of the survey period, the weeks of unemployment for these individuals could not be determined. Simple exclusion of these cases, however, would tend to bias the results by sampling only those who had been more successful in finding employment quickly;

(iii) in certain cases, information on the file suggested that the separation was followed by a period of voluntary non-labour force activity. These cases included individuals who were eligible to receive unemployment insurance but who either waited more than 16 weeks before establishing a claim or who did not establish a claim and did not find employment within 16 weeks. Since the intention was to estimate weeks of involuntary unemployment, these cases were excluded from the sample;

(iv) in some cases, no subsequent ROE was available, but other information on the file indicated that the subsequent employer was the same shipbuilding firm. These cases were also excluded from the sample;

(v) all cases in which there was no subsequent ROE and no unemployment insurance claim were excluded. The only information on the file pertaining to these individuals was one ROE, and possibly an indication from the income data that the individual secured subsequent employment;

(vi) all individuals who did not have employment income in the year after leaving the shipbuilding industry were excluded from the sample. Since the intention was to use these samples to estimate weeks of unemployment for individuals who definitely found work, and measure long-term unemployment by the method indicated in section 6.A. above, inclusion of these individuals would constitute double counting.

The final sample selected after applying this exclusion criteria was referred to as the all separations sample. This consisted of 162 individuals who had been laid off from the shipbuilding industry in 1974 and 1975, and 120 individuals who had resigned from the industry in this period. Resignations were included in this sample in an attempt to capture those who had resigned in anticipation of an impending layoff. The first regressions reported below was estimated using this sample.

In the second regression reported below, only 162 lay-off cases were used to estimate the duration of unemployment. As expected somewhat longer unemployment durations were predicted using this sample.

The rather complicated data construction procedure outlined above was intended to capture, as closely as possible, the weeks of unemployment experienced by a representative sample of individuals separated from the shipbuilding industry. The data generated from this process, however, is not as "clean" as would be desired. The principal problems associated with the data source are three-fold:

(i) the exclusion of individuals without a subsequent ROE and without an unemployment insurance claim biases the results towards longer estimated weeks of unemployment, as some of these individuals would find work immediately after separation;

(ii) the use of unemployment insurance claim data to approximate weeks of unemployment in cases where there is no subsequent ROE biases the results toward shorter estimated weeks of unemployment. This problem can be expected to be most serious in cases where individuals have exhausted their unemployment insurance benefits;

(iii) in the course of this inquiry, a not insignificant amount of "ROE-claim overlaps" was detected (i.e., the individual appeared to be working and collecting unemployment insurance simultaneously). In one of the samples selected, this overlap occurred in more than 25 per cent of the cases for which such an overlap was possible (i.e., in cases where there was both a claim and a subsequent ROE). In the time available, it could not be determined whether this apparent overlap reflected fraudulent unemployment insurance collection, part-time earnings, or errors in the designation of first and last weeks worked on the ROE's.

In recognition of the problems associated with the incomplete, and possibly erroneous, information in the separation file, a third sample was constructed from the employment summary information. Included in this sample were all individuals who had left the shipbuilding industry in 1973 or 1974, who had collected unemployment insurance in their last year in the industry, and who had received employment income in the subsequent year. For this sample of 329 individuals, weeks of

unemployment were estimated by adding an assumed two week waiting period to the total unemployment insurance benefit weeks collected in the last year in the industry. While use of this sample will not avoid the problems associated with individuals who do not claim unemployment insurance or who exhaust their benefits, it may produce superior estimates if the ROE information is judged unreliable.

(b) Specification and Results of the Regression Equations

Average weeks of unemployment were estimated by means of an ordinary least squares regression equation. In the initial specifications, the independent variables included dummy variables for the age group and region of the individual, the regional unemployment rate in the year of separation, and a measure of the permanency of the employment in shipbuilding prior to separation. Neither of the last two independent variables exerted a significant effect on the estimated average weeks of unemployment. These variables were accordingly dropped from the equations in the final specification.

Table D-6 below indicates the estimated coefficients derived from the three samples. The constant term in these regressions captures the estimated average weeks of unemployment for individuals over 60 years of age in British Columbia. The combination of the dummy variables for age and for region will then indicate the difference in the weeks of unemployment predicted for individuals in other region-age groups.

In the first two samples, the negative and significant age coefficients for individuals between 20 and 60 indicate that estimated average weeks of unemployment are considerably less for these individuals than for the youngest and oldest workers. In the last sample, all of the age groups under 60 were predicted to experience less unemployment than the oldest age group.

It will be noticed that the signs of the regional coefficients are not consistent across the three regression. In the regressions using the separation file, the estimates indicate that the weeks of unemployment are lower for individuals in Quebec and Ontario than in the Atlantic and B.C. The t statistics for these coefficients are quite low, however, and it is questionable whether these variables should be included. In the regression using benefit weeks from the employment summary file, the regional pattern is considerably different. Individuals in all regions but B.C. are predicted to experience more weeks of unemployment than individuals in British Columbia. The coefficient for Quebec is particularly high and is the most significant in the equation.

This rather surprising pattern may reflect the availability of extended unemployment insurance benefits in regions of high unemployment. That is, the results from the separation file suggest that there is no significant difference in the average weeks of unemployment experienced by individuals separated from shipbuilding in the four regions. If this

were the case, the significantly higher Quebec effect may simply reflect the fact that more of this unemployment is covered by unemployment insurance in regions where extended benefits are available.

Table D-6

Coefficient Estimates from Regressions Estimating Weeks of Unemployment in First Year after Layoff
(t statistics in brackets)

Independent Variables		Separation File: All Separations	Separation File: Layoff Cases	Employment Summary File (benefit weeks)
Constant		32.6	37.9	23.2
Dummy Variables for Age	- Under 20	-3.1 (0.4)	-0.8 (0.1)	-7.8 (3.1)
	20-24	-10.6 (1.8)	-17.6 (2.3)	-9.6 (5.5)
	25-29	-17.1 (2.8)	-20.9 (2.6)	-8.3 (4.0)
	30-34	-17.0 (2.8)	-20.5 (2.4)	-8.8 (4.0)
	35-39	-15.4 (2.5)	-15.0 (1.6)	-7.4 (2.7)
	40-44	-20.2 (3.0)	-22.3 (2.4)	-2.6 (0.3)
	45-49	-14.2 (1.8)	-15.7 (1.5)	-8.0 (2.6)
	50-54	-12.3 (1.6)	-16.8 (1.8)	-9.9 (3.2)
	55-59	-16.9 (2.1)	-20.2 (2.0)	-7.6 (2.0)
Dummy Variables for Region	Atlantic	0.14 (0.1)	3.2 (0.9)	3.8 (4.9)
	Quebec	-3.8 (1.4)	-3.0 (0.9)	8.6 (21.2)
	Ontario	-3.8 (1.0)	-5.6 (1.3)	2.9 (1.2)
F		2.70	2.19	2.45
R2		.107	.150	.08
Sample Size		282	162	329

The unemployment predicted from the separation file is considerably longer than that predicted by the benefit weeks sample. Since these estimates were derived from two entirely different samples, any conclusions regarding the coverage of unemployment by unemployment insurance must be considered very tentative. The results suggest, however, that exhaustion of unemployment insurance benefits may be fairly prevalent, particularly in the youngest and oldest age groups. Further research would be necessary to capture the importance of this effect.[1]

In view of the small number of independent variables used in these regressions, the low predictive power of the equations is not particularly surprising (R^2 varied from .08 to .15). It is important to realize, however, that low explanatory power in this instance refers to the ability of the equations to predict the amount of unemployment experienced by a particular individual, and not the availability to predict average responses over groups of individuals. What the low R^2 implies is that if one uses the equations to predict the amount of unemployment experienced by, say, a 40 year old employee in the Atlantic region, one will be wrong most of the time. If the equations are used to predict the average unemployment experienced by a group of such individuals, however, the estimates will be reasonably accurate.

A second point to be noted is that the absence of significant coefficients can often convey as much information as their presence. In this context, the lack of a significant unemployment rate effect may indicate that, for the large majority of people separated from shipbuilding employment, the number of weeks taken to secure another job is relatively insensitive to regional and cyclical conditions. Where these conditions would seem to be important is in determining the probability of finding a job at all, and in the probability of retaining that job for at least a year. The estimation procedure used to capture the latter effect is outlined below.

C. Probability of Finding a Permanent Job

The probability of finding a permanent job after the immediate spell of unemployment was estimated using the employment summary file. The specification of the equation and the estimation technique (probit analysis) was similar to that used in estimating the probability of finding any job (as reported in section 6.A. above).

The sample of individuals selected included all those individuals who had left the shipbuilding industry in 1973 or 1974 and who had received employment income in the subsequent year.[2] Individuals who

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[1] In the course of this inquiry, an initial exploration of the coverage of unemployment by unemployment insurance was attempted using the separation file. Preliminary evidence suggested that over 20 per cent of the claimants exhausted their benefits.

[2] The regression was intended to evaluate the probability of finding a permanent job for those securing subsequent employment. The overall estimated probability of finding a permanent job can be determined by multiplying the probabilities estimated in this section by the probabilities of finding any job as estimated in Section 6.A.

received over $5,000 in employment income in the calendar year after leaving shipbuilding (i.e., in 1974 and 1975 respectively) and who did not establish an unemployment insurance claim in that year were considered to find permanent employment. All others were considered to find temporary jobs. The dependent variable takes on a value of 1 for the former individuals and a value of zero for the latter. The independent variables included the regional unemployment rate in the year after separation and dummy variables for the age group of the individual. Interraction terms reflecting the region and previous employment status[1] of the individuals were included in the initial specification. These interraction terms were retained in the final run only if the t statistic exceeded one.

The results of this regression are reported in Table D-7. The unemployment rate exerted a significant and negative effect on the probability of finding a permanent job. For most individuals, the estimates indicated a 2 to 4 per cent decline in this probability for every percentage point increase in the unemployment rate. As in the regressions reported earlier in section 6.A., however, this did not necessarily imply that the probabilities were lower in the eastern regions, since the unemployment rate effect was often offset by the effect of the interraction terms.

The estimated probabilities of finding a permanent job exhibited an inverted-U pattern with respect to age - increasing until age 50 and declining thereafter. This is illustrated in Figure D-1, which indicates the predicted probability for individuals in Ontario who were formerly in the P1 "sector". These probabilities were evaluated at an 8 per cent unemployment rate.

The effects of the interraction terms were most interesting. In all regions, the estimates indicated that the probabilities were significantly higher for individuals who were formerly in the P1 sector as compared to those previously holding temporary employment. In three out of four regions (B.C. being the exception[2]), this was also the case for individuals who were formerly in the P2 sector. In many cases, these differential effects were quite pronounced. This is indicated in Table D-8, which indicates the results of transforming the probit coefficients into their underlying probabilities.

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[1] Previous employment status was based on the "sector" of the individual in the year before leaving shipbuilding.

[2] When the probabilities were aggregated over all individuals in the P2 and temporary sectors in B.C., as in Figure 4.5 of Chapter 4, the results indicated that the average probability was higher amongst the formerly P2 individuals. This simply reflected the higher proportion of individuals in the higher probability age groups in the P2 sector.

Table D-7

Coefficient Estimates for Probit Analysis of Probability of Finding a Permanent Job
(t statistics in brackets)

Independent Variables		Estimated Coefficients	
Constant		.06	(0.2)
Dummy Variables for Age Group -	Under 20	-.14	(-0.5)
	20-24	.27	(1.0)
	25-29	.52	(1.9)
	30-34	.54	(1.9)
	35-39	.76	(2.5)
	40-44	.59	(1.8)
	45-49	.90	(2.8)
	50-54	.63	(1.9)
	55-59	.40	(1.2)
Regional Unemployment Rate		-.078	(-2.7)
Interration Terms	P1-Atlantic	1.33	(4.0)
	P2-Atlantic	0.58	(2.0)
	P1-Quebec	0.34	(1.3)
	P2-Quebec	0.31	(1.2)
	Temp-Ontario	-0.29	(-1.5)
	P1-Ontario	0.75	(1.2)
	P2-Ontario	1.78	(1.8)
	P1-B.C.	0.42	(1.4)

Fig. D-1

PROBABILITY OF FINDING A PERMANENT JOB
(P1 – Ontario – 8% unemployment rate)

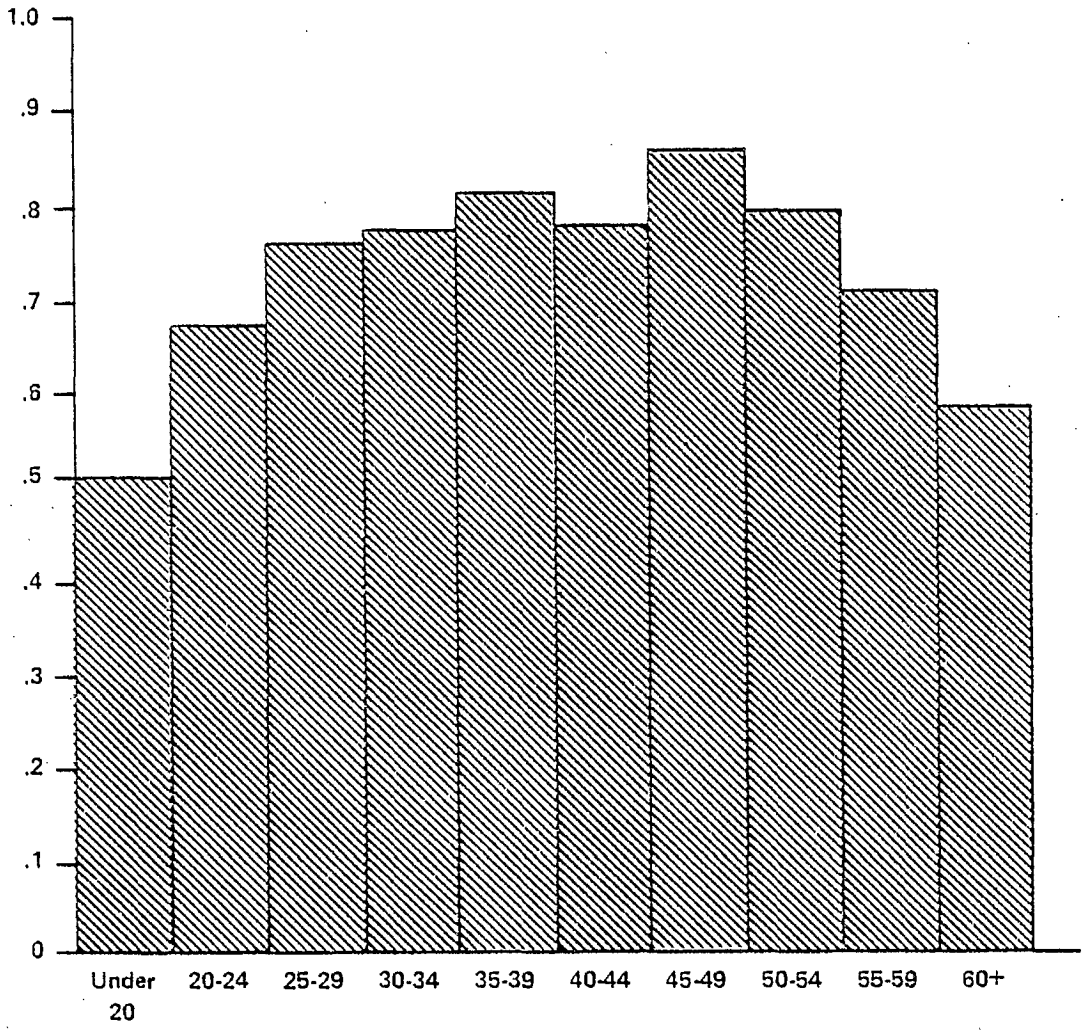

Table D-8

Predicted Probabilities of Finding a Permanent Job
(individuals finding subsequent employment; beneficiary sample; 8% unemployment rate)

Age Group	"Temporary" in Atlantic, Quebec and B.C.[1]	P1 Atlantic	P2 Atlantic	P1 Quebec	P2 Quebec
Under 20	.239 (.024)	.729	.448	.359	.345
20-24	.386 (.028)	.849	.614	.524	.508
25-29	.484 (.032)	.900	.705	.622	.606
30-34	.496 (.032)	.905	.716	.633	.618
35-39	.576 (.030)	.935	.779	.705	.692
40-44	.512 (.032)	.912	.729	.648	.633
45-49	.629 (.030)	.960	.819	.752	.739
50-54	.532 (.032)	.919	.745	.666	.652
55-59	.440 (.031)	.879	.666	.579	.564
60+	.288 (.027)	.776	.508	.599	.401

Age Group	"Temporary" in Ontario	P1 Ontario	P2 Ontario	P1 B.C.
Under 20	.159	.516	.858	.386
20-24	.281	.677	.932	.552
25-29	.371	.761	.959	.648
30-34	.382	.770	.962	.659
35-39	.460	.826	.976	.729
40-44	.397	.782	.965	.674
45-49	.516	.860	.983	.773
50-54	.417	.797	.969	.692
55-59	.330	.726	.948	.606
60+	.198	.576	.889	.444

[1] Bracketed terms represent reduction in probability for each percentage point increase in unemployment rate above 8%. Similar unemployment rate effects apply to the estimates indicated for P1 and P2.

The results suggest that the population of individuals "permanently" employed in shipbuilding is not homogeneous. The estimates given earlier in Section 6.A. indicate that some of the more permanently employed individuals may have great difficulty in securing subsequent employment, particularly in the Atlantic region and in Quebec. Those who do secure subsequent employment, however, appear to have a relatively high probability of finding good jobs.

7. ESTIMATES OF LABOUR EXTERNALITIES

1. Regional Distribution of Estimates

Illustrative calculations of the direct labour externality associated with the construction of a vessel involving 1,000 man-years of work (over 2 years) are given in Table D-9. These calculations were derived by using the three regression equations, together with estimates of the numbers of individuals per man-year, and earnings and weeks of unemployment before and after layoff, to estimate the model outlined above in Section 5.

The externalities given in Table D-9 were derived using the regional unemployment rates that existed in 1977. The average duration of unemployment predictions (for individuals estimated to secure subsequent employment) were determined from the regression using the layoff cases sample. The unbracketed figures in Table D-9, denoted as the upper bound estimates, were derived using the "beneficiary sample" to predict the probability of finding subsequent employment following a layoff from shipbuilding. The unbracketed figures, denoted as the lower bound estimates, were derived by using the "complete sample" to estimate the probability of securing subsequent employment.

The lowest estimates were derived for the Atlantic region and the highest for British Columbia. The influence of high wages in the latter province has an important influence on these results. Since the externality associated with each extra week of unemployment in the immediate termination scenario is equal to a fixed percentage of the previous weekly wage (either 80 or 100 per cent), the larger estimated total externality in B.C. is partially a reflection of these higher wages. This result is to be expected if it is assumed that regional earnings differentials reflect productivity differences; i.e., in this case, the results would simply indicate that higher economic costs are associated with the loss of more productive employment.

While it appears likely that productivity differences explain a portion of the regional earnings differentials, however, it is also probable that some of these differentials simply reflect characteristics of the respective labour market areas that are unrelated to productivity. It is therefore interesting to "strip" the externality estimates of the wage influence by expressing the calculations as a percentage of the estimated shipbuilding wage bill paid for 1,000 man-years of work. The

Table D-9
Illustrative Calculation of Labour Externality
for Vessel Involving 1000 Man-years
(Lower Bound Estimates in Brackets)

(1) Region	(2) Unemployment Rate (1977)	(3) Externality (1975 $)	(4) Externality ÷ Shipbuilding Wage Bill	(5) No. of Individuals	(6) Externality ÷ No. of Individuals (1975 $)
Atlantic	12.7	3,440,274 (2,523,966)	.315 (.231)	806	4268 (3131)
Quebec	10.3	4,325,816 (2,928,664)	.384 (.259)	714	6058 (4102)
Ontario	7.0	4,177,223 (2,168,939)	.305 (.158)	1010	4135 (2147)
British Columbia	8.5	6,165,951 (4,408,996)	.40 (.29)	909	6783 (4850)

resulting regional rankings of the estimates will then more closely reflect differences in the labour adjustment response predicted for different regions. Column 4 in Table D-9 indicates the estimates derived from this procedure. It can be seen that the rankings of B.C. and Quebec are unaltered by this procedure, while the positions of Ontario and the Atlantic region are interchanged.

In addition to the level of wages, the number of individuals per man-year of work has an important influence on the size of the estimated externalities in each of the regions. As noted earlier, the P2 and temporary workers in the Atlantic region and Quebec appear to work much longer in shipbuilding (in a given year) than their counterparts in Ontario and B.C. As a result of this relatively higher attachment in the former regions, the number of individuals per man-year is lower in the eastern regions. This is indicated in Column 5, which indicates the number of individuals predicted to be associated with 1,000 man-years of construction.

The assignment of more individuals to the Ontario and B.C. regions in the calculation of the externalities is a result of the characteristics of employment in the respective regions, and these characteristics will in turn be reflected in the regression equations used to estimated the externalities. To see this point, consider that the estimates given in Table D-1 indicate that individuals in the P2 and temporary sectors in Quebec work approximately twice as long in shipbuilding in a given year as individuals in the same sectors in Ontario.[1] The samples of individuals who have left the industry will also tend to reflect this prior employment pattern. That is, we may expect that the sample of Ontario workers who were formerly in the temporary sector, say, will contain relatively more very marginally attached employees than the corresponding sample of Quebec workers. It is, therefore, not particularly surprising that the former individuals will exhibit higher probabilities of securing alternative employment after leaving shipbuilding, since these individuals had much less dependence on shipbuilding income in the first place. To ignore the differences in the number of individuals per man-year between the two regions would be to bias the results against Ontario, since these effects are already implicitly incorporated in the regression equations predicting the probabilities of employment.[2]

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[1] In Quebec, the percentage of total annual employment earnings in shipbuilding is equal to 64 per cent and 76 per cent for the P2 and temporary sector individuals respectively. The corresponding figures for Ontario are 29 and 39 per cent.

[2] Having said this, the point needs to be made that the estimates given for Ontario are probably the most tenuous of all those given in Table D-9. This province appears to be quite severely under-represented in the employment summary file, and this gave rise to difficulties in estimating the post-separation incomes for individuals leaving the shipbuilding industry. While the number of individuals in each region-age "cell" in the other regions generally exceeded 20, the corresponding number of people in Ontario was often less than 10. As a result, the estimates of average post-separation incomes in Ontario were much more susceptible to bias resulting from persons with abnormally low or high incomes.

Notwithstanding the appropriateness of incorporating different numbers of individuals in the estimation of the total externality in each region, it is illuminating to examine also the average externality per individual in the various regions. Column 6 of Table D-9 divides the total externality by the number of individuals predicted to be directly employed in the construction of a vessel involving 1,000 man-years. It can be seen that the estimates for B.C. and Quebec are approximately $2,000-2,500 higher than the corresponding estimates for the Atlantic region and Ontario.

In Table D-10, the externality per individual is disaggregated by sector, region and year. The discounted totals of these estimates are indicated in Figure D-2. It can be seen that the estimated externalities are considerably lower for the temporary sector individuals than for those in P1 and P2. Much of this, of course, reflects the fact that the former individuals can be expected to be unemployed for a considerable period of time in any event. The quite small externalities for these individuals in the second year are also noteworthy, and indicate a very small income difference between those who remain in shipbuilding and those who leave.

In the other sectors, the second year externalities are more substantial. Between 68 per cent (B.C.) and 81 per cent (Quebec) of these externalities are associated with individuals who were not predicted to have employment income in the first year after separation; the remainder of the estimate is accounted for by lower average wages and/or higher incidence of subsequent unemployment for individuals predicted to find jobs.

Table D-10
Externality per Individual by Year by Sector-Region
(Upper bound Estimates)

P1 Sector

Region	Year 1	Year 2	Year 3
Atlantic	5713	3321	-2028
Quebec	5707	4585	-1108
Ontario	4830	4848	-1622
B.C.	6919	5677	-2464

P2 Sector

Atlantic	3898	2437	-1448
Quebec	5043	5011	-673
Ontario	3578	368	-399
B.C.	5946	4324	-840

Temporary Sector

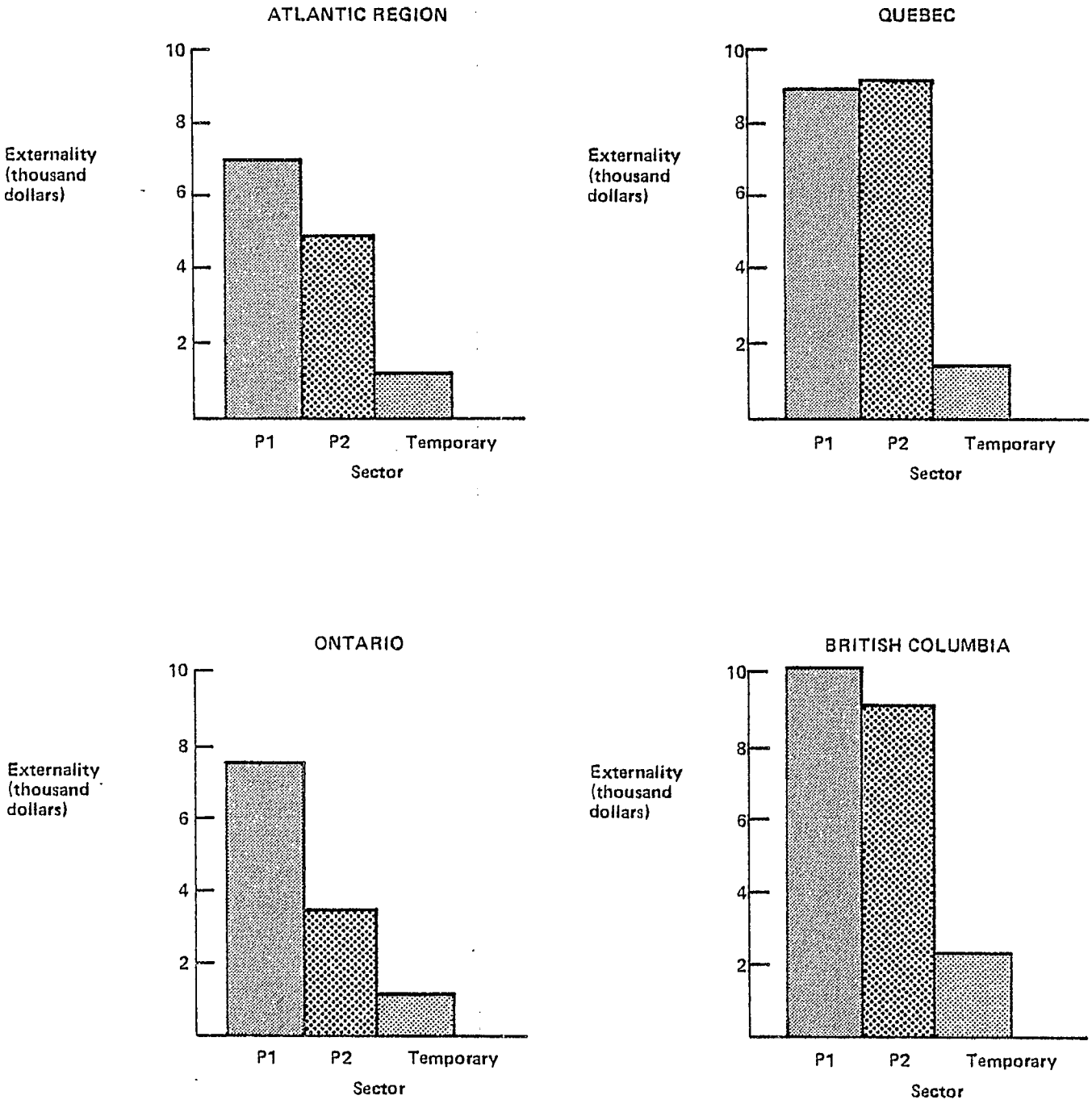
Atlantic	2027	76	-1104
Quebec	1284	754	-698
Ontario	1221	368	-399
B.C.	2573	409	-891

All Sectors

Atlantic	3883	1831	-1548
Quebec	3888	3183	-875
Ontario	3002	1933	-755
B.C.	5612	3271	-1411

Figure D-2

Externality per Individual by Sector — Region
(Discounted Total, 1975 $)



2. Sensitivity Analysis

Figure D-3 indicates the sensitivity of the estimated externalities to changes in the unemployment rate, and to the regressions selected to predict the probability of finding employment, and the duration of unemployment for individuals predicted to find jobs. The upper bound externality on the left hand side was estimated using the beneficiary sample to predict the probability of getting a job, and the layoff cases sample to predict the duration of unemployment. As in Table D-9, these externalities were evaluated at the unemployment rates prevailing in 1977.

The lower bound estimate indicated in the second bar was calculated by using the complete sample of individuals who had left the industry to predict the probability of finding subsequent employment. It can be seen that a considerably lower estimate is derived by using this sample.

The next two bars indicate the effect of raising and lowering the unemployment rate by 1.5 percentage points. The greatest absolute sensitivity to cyclical conditions is observed in Ontario and B.C., and the lowest in the Atlantic region.

The last two bars in Figure D-3 indicate the effects of using the all separation sample, and the benefit week sample, to predict the duration of unemployment for persons predicted to find jobs within two years. In comparison with the other sensitivities, the effect of substituting alternative duration of unemployment estimates is relatively small.

Fig. D-3
SENSITIVITY OF ESTIMATED EXTERNALITY ($ MILLIONS)
to – Unemployment Rate (±1.5)
– Sample Selection for Estimating Probability of finding Employment
– Sample Selection for Estimating Duration of Unemployment

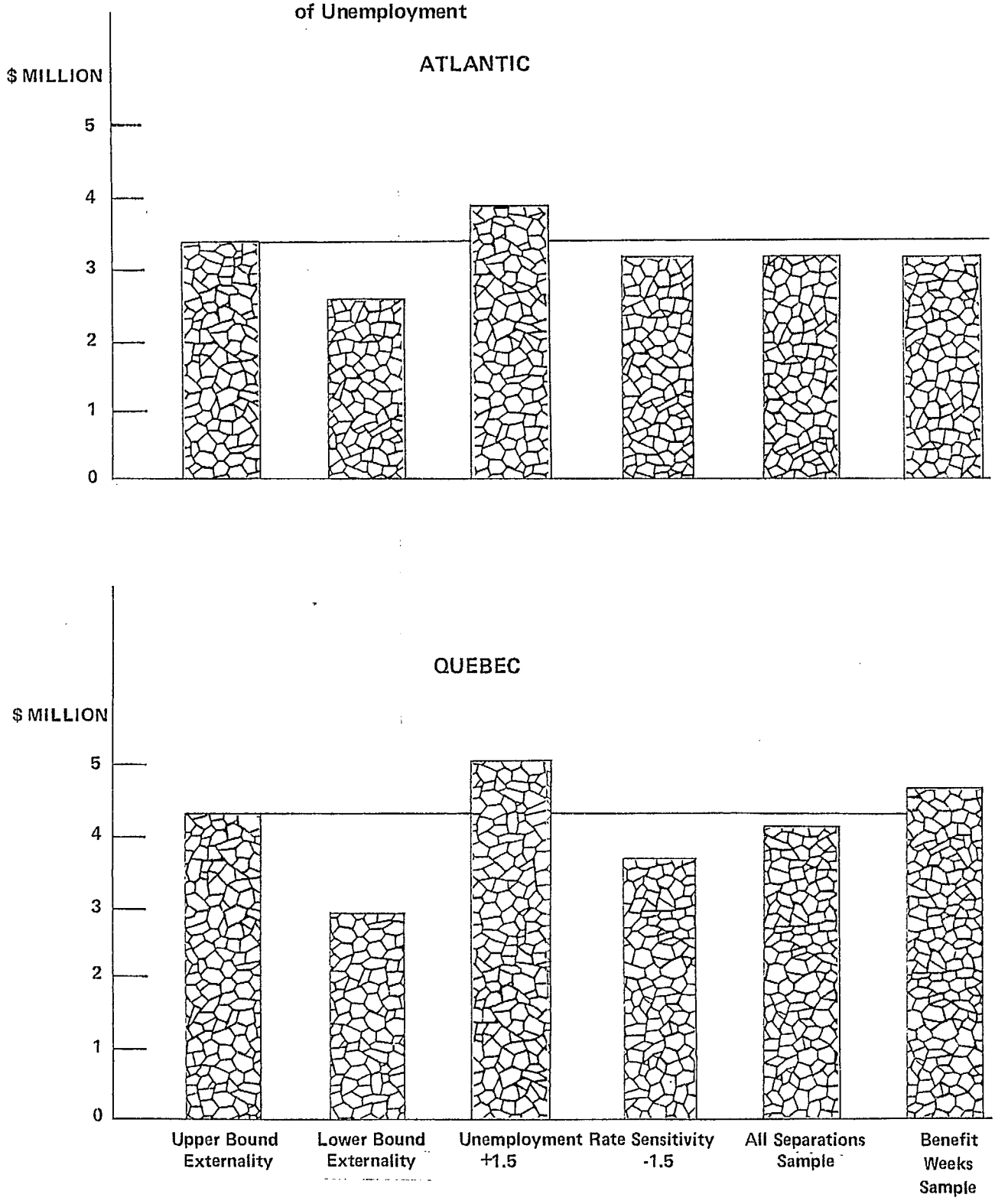
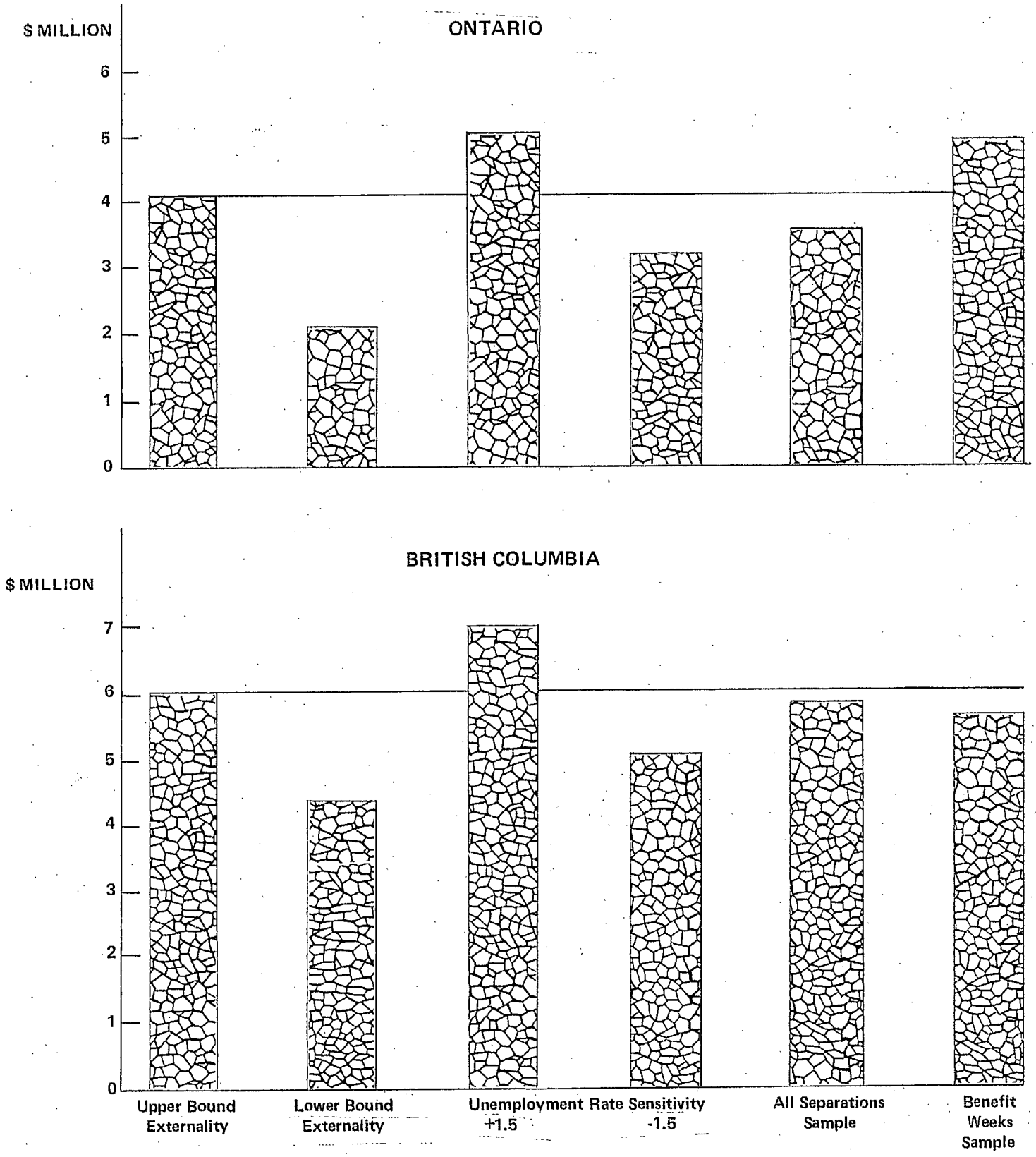


Fig. D-3 (Cont.)

SENSITIVITY OF ESTIMATED EXTERNALITIES



3. Application of Labour Externality Estimates to the Analysis of Option 4

In order to apply the results of the above model to the case of a particular vessel, it would be necessary to know the region in which the vessel was expected to be constructed, the regional unemployment rate prevailing at the time, and the number of man-years of construction involved. The location and timing of any possible future construction of deep-sea vessels, however, will depend on circumstances at the time, and cannot readily be predicted in advance for purposes of the present analysis. Moreover, precise estimates of the number of man-years of construction associated with each vessel size are also not readily available.

In the face of these uncertainties, as well as those associated with the estimation procedure, a range of possible labour externalities was estimated for each vessel identified in the analysis of deep-sea options. In each case, it was assumed that there was an equal probability of the vessels being built in each of the regions. Accordingly, the individual regional estimates were simply averaged.

In the base case estimates, unemployment rates were set equal to those observed in 1977, although it was recognized that these are relatively high and, therefore, for purposes of a longer-term analysis give something of an upward bias to the estimates of externalities. In the low and high estimates these rates were, in turn, varied 1.5 percentage points below and above these levels. This variation in the unemployment rates was designed more to indicate the sensitivity of the results to extreme assumptions (at least on the high side) than to represent probable bounds of uncertainty regarding future unemployment rates.

The base case estimate of the probability of securing subsequent employment was derived by averaging the results achieved with the regressions using the beneficiary sample and the complete sample. In the low case, the complete sample was used to generate this estimate, while in the high case, the beneficiary sample was used to predict the probability of finding employment. Here again, the samples selected for the low and high cases were intended to generate estimates on the extremes.

The indirect externality was assumed to equal 25 per cent of the estimated direct effect in both the low and base case estimates. In the high case, it was assumed that the indirect effect was equal to 50 per cent of the direct externality estimated by the model.

Table D-11 summarizes the assumptions and results achieved through this procedure, where the externalities are expressed on a per-man year basis.

The precise number of man-years associated with the construction of any particualr vessel would undoubtedly vary according to the shipyard securing the order. Given the uncertainties with respect to the location

Table D-11
Estimated Externalities per Man-year

Case	Assumptions				Estimate
	Unemployment Rate	Sample used to predict probability of finding a job	Sample used to predict duration of unemployment	Magnitude of Indirect Effects	
Lower Bound	1.5% below 1977 levels	Complete Sample	Layoff Cases	25% of direct externality	$3400
Base Case	1977 levels	Average of estimates from Complete and Beneficiary Samples	Layoff Cases	25% of direct externality	$5100
Upper Bound	1.5% above 1977 levels	Beneficiary Sample	Layoff Cases	50% of direct externality	$8400

of any possible future construction, detailed man-year estimates would not appear to be particularly productive at this stage. Accordingly, the estimation of the number of man-years associated with each vessel was based on a somewhat crude, but reasonably accurate, aggregate statistic. Based on information available in the Statistics Canada publication, Shipbuilding and Ship Repair (SC 42-001), an estimate of one man year for every $40,000 in vessel construction costs was derived.[1] This figure was then used to determine the total number of man-years associated with each vessel identified in the analysis of deep-sea shipping options. The total externality estimates for each vessel were then tabulated by multiplying these man-year calculations by the estimates given in Table D-11. These total estimates were subsequently incorporated into the economic analysis presented in Chapter 5.

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[1]This figure was estimated by dividing the total value of production in the Canadian shipbuilding and ship repair industry in 1975 by the average number of production and related workers working in the industry in that year.

Attachment 1

Methodology Employed to Determine Number of Individuals per Man-year of Construction

The employment summary file contains information on the annual shipbuilding earnings and on the annual earnings in other industries of a random sample of individuals who had worked in shipbuilding at some time during the years 1972 to 1975. The first step in the analysis involved predicting the total number of man-years in shipbuilding associated with these individuals. In the P1 sector, there is one man-year associated with each individual. In the P2 and temporary sectors, where individuals work only part of the year in shipbuilding, there is of course more than one individual associated with each man-year.

If one assumes that the average weekly wages of individuals in each age-region group are invariate to the sector in which these individuals work, the total number of man-years of shipbuilding employment in the employment summary file can be determined as follows.

Let $WP1_j$ = average weekly shipbuilding wages of individuals in age-region group j in the P1 sector

It can readily be seen that

$$WP1_j = \frac{EP1_j}{IP1_j}/52 \qquad (1)$$

where $EP1_j$ = total earnings of individuals in the P1 sector in age-region group j

$IP1_j$ = nunber of individuals in the P1 sector in age-region group j

(All of the statistics evaluated from the employment summary file are capitalized in this attachment. These statistics were derived by aggregating the number of individuals in the region-sector-age groups observed in the period 1973-75. Thus $IP1_j$ is equal to the total number of "person-years" observed in the P1 sector for age-region group j over the three year period. $EP1_j$ would then represent the total annual income associated with the $IP1_j$ "person-years").

Under the equivalent wage assumption noted above, the total number of man-years in any region-age group is given by

$$MY_j = MYP1_j + MYP2_j + MYT_j$$

$$= IP1_j + \frac{EP2_j}{52x\overline{WP1}_j} + \frac{ET_j}{52x\overline{WP1}_j} \qquad (2)$$

where MY_j, $MYP1_j$, $MYP2_j$ and MYT_j = the total number of man-years in age group j and the man-years allocated to the P1, P2 and Temporary sectors respectively

and $EP2_j$, ET_j = total shipbuilding earnings of all of the individuals in the P2 and Temporary sectors.

The number of individuals per man-year in each region-age sector group can then be estimated by simply dividing the number of individuals by the number of man-years.

$$\text{i.e.} \quad \frac{IP2_j}{MYP2_j} = \frac{IP2_j}{EP2_j} \times WP1_j \times 52 \qquad (3)$$

$$\frac{IT_j}{MYT_j} = \frac{IT_j}{ET_j} \times WP1_j \times 52$$

Once these calculations have been performed, the number of individuals associated with the construction of a vessel involving any given number of man-years can be determined if the following assumptions are made.

(i) the distribution of man-years across the age-sector groups will be equal to that observed in the employment summary file

(ii) the number of individuals per man-year will be the same as that estimated for the employment summary file

Under these circumstances, the number of individuals associated with any given number of man-years is determined as follows.

Let my = given number of man-years
i = number of individuals associated with my

$$i = \sum_{j=1}^{N} \frac{MYP1_j}{MY_j}(my) + \frac{MYP2_j}{MY_j}(my)\frac{IP2_j}{MYP2_j} + \frac{MYT_j}{MY_j}(my)\frac{IT_j}{MYT_j} \qquad (4)$$

where N = number of age-sector groups
MY = total number of man-years estimated from employment summary file = $\sum_{j=1}^{N} MY_j$

Substituting (1), (2) and (3) into equation (4) and reducing yields.

$$i = \frac{my \sum_{j=1}^{N} IP1_j + IP2_j + IT_j)}{\sum_{j=1}^{N} (IP1_j + \frac{EP2_j}{WP1_j \times 52} + \frac{ET_j}{WP1_j \times 52})} \qquad (5)$$

The assumption that the average weekly wages of individuals in each region-age group are the same in each sector is clearly the most tenuous of all those given above.

This assumption is particularly suspect in the case of individuals in the temporary sector. The most likely direction of bias will be towards overestimating the weekly wages of these people. If this is the case, the number of individuals in all 3 sectors will be overestimated by the procedures outlined above. The proportion of individuals in each of the three sectors, however, will not be affected by changes in this assumption.[1]

The effect of changing this assumption can be tested by substituting different estimates of the "wage proxy" (WPl_i) in equation (5) above. Valuation of this formula under the assumption that wages in the temporary sector are only 70% of wages in the permanent sector indicated that the equal wage assumption overstated the number of individuals by 6% in Ontario, 8% in B.C. and 9% in Quebec and the Atlantic region. This would in turn imply that the externality was overstated by the same percentage.

Since the regional differences introduced by changes in the weekly wage assumption were relatively small, and since the bias can only be in the direction of overestimating the externality, this assumption was not felt to affect the main conclusions of this report.

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[1] The proportion of individuals in each of the sectors will always be equal to the proportions appearing in the employment summary file. If the average wages of the temporary sector individuals are overestimated, the number of man-years allocated to this sector will be underestimated, and the number of individuals per man-year will be overestimated. These two effects counteract each other, leaving the proportions of individuals in each of the sectors unaffected.

Attachment 2

Alternative Estimates of Shipbuilding Labour-Externalities[1]

The Department of Industry, Trade and Commerce (IT&C) has developed a general equilibrium model for assessing both the primary and secondary effects of job losses in a region. The model used for the Department of Finance's estimates of the direct labour externalities (chapter 4) measure only those externalities associated with the workers actually laid-off. The Department of Finance estimates presented in Chapter 4 assume that the indirect externalities range between 25 and 50 percent of the direct externalities. The IT&C general equilibrium model captures the externalities associated with all repercussions of the layoffs in a region, including outmigration of workers from the region, changes in participation rates, unemployment durations and spells, early retirees, newly created jobs, and other persons losing jobs in the secondary sectors through possible multiplier effects[2]. The estimates from this model should be comparable to the Department of Finance estimates of direct and indirect labour externalities.

The IT&C model was applied to simulate the total labour externalities that would be associated with delaying layoffs from a particular shipyard for two years. The delay of two years was chosen so as to be consistent with the Department of Finance estimates which were based on the assumption that "the construction of a vessel in Canada would serve to postpone the layoff of a number of shipbuilding employees for a two-year period". To estimate the labour externality, pertinent information on the work force employed by the selected shipyard was obtained directly from the shipyard employer. Given the characteristics of this shipyard, it is probably not unreasonable to assume that the labour externalities estimated for employment in the shipyard would be close to the average for all shipyards. Data describing the labour market in which the shipyard is located were also collected. To estimate the adjustment (unemployment) experience of laid-off workers, data from the IT&C Labour Force Tracking Survey[3] and unemployment insurance statistics for the region were utilized.

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[1] Contributed by the Department of Industry, Trade and Commerce.

[2] For a description of the general equilibrium model refer to: "Trade Adjustment Assistance - The Costs of Adjustment And Policy Proposals" prepared by Econanalysis Incorporated for the Department of Industry, Trade and Commerce, June 1978.

[3] The IT&C Labour Force Tracking Survey was conducted in 1977 and 1978. The purpose of the survey was to collect information on the pre-layoff and post-layoff experiences of workers affected by major plant layoffs. The 1977 survey covered major layoffs in 14 communities while the 1978 survey covered 23 communities.

The crucial assumptions made in applying the IT&C model to estimate the total labour externalities were: 1) the post-layoff experience of shipyard workers would follow the same patterns as those experienced by workers in the Survey with the same socio-economic characteristics; 2) 60 percent of the man-years of employment provided by the shipyard would be filled by permanent workers while 40 percent would be filled by temporary workers; and 3) temporary workers are employed, on average, 42 percent of the year by the shipyard. The last two assumptions were based on conversations with the shipyard employer.

Results

The IT&C estimates for the labour externality associated with delaying a layoff for two years ranged from $11,300 to $13,500 for jobs filled by permanent workers and from $6,900 to $8,000 for jobs filled by temporary workers. These estimates are given in 1976 dollars. Assuming the 60:40 split between permanent and temporary jobs, the IT&C base case estimate of the labour externality is $10,500 - the reasonable range of estimates is $9,500 to $11,400.

The Department of Finance base case estimate of the labour externality is $5,100 per man-year of shipbuilding employment (see Chapter 4 above). This estimate is also given in 1976 dollars and consists of a direct effect of $4,080 and an (assumed) indirect effect of $1,020. Over the two year period of delay then, the Department of Finance estimate of the labour externality would be about $10,000. Thus, the two independent estimates of the labour externality associated with shipbuilding employment compare favourably with one another.

One of the crucial assumptions in estimating the labour externality is the split between permanent and temporary employment in the shipyard. In a layoff situation the 60:40 ratio would approximate a case where all employees are being laid-off - in a situation where only part of the labour force is being laid off one can expect that a greater proportion of temporary jobs would be lost. The following table presents some sensitivities of the IT&C estimates of the labour externality according to varying scenarios.

TABLE 1

Estimates of the Labour Externality per Job Associated with Postponing Layoffs For Two Years In a Selected Shipyard (1976 Dollars)

Scenario	60 percent of Jobs are Permanent 40 percent Temporary	40 percent of Jobs are Permanent, 60 percent Temporary
I BS1M = 1.0 LRE = 0.52 ED = 0	$11,480	$10,610
I BS1M = 1.0 LRE = 0.70 ED = 0	$10,535	$9,500
1 BS1M = 1.3 LRE = 0.70 ED = 0.30	$11,430	$10,380

BS1M = base sector income multiplier in the region.

LRE = the long-run proportion of time ex-employees are employed in the absence of employment from the shipyard.

ED = proportion of the number of man years employed in shipbuilding that are in excess demand.

Appendix E

SHARES OF WORLD TRADING TONNAGE, 1970-77

1. INTRODUCTION

The purpose of this Appendix is to highlight some of the more important trends and changes in world shipping over the past few years. The tables and graphs presented in this section were developed using data from Lloyd's Register of Shipping Statistical Tables, years 1970 through 1977. The breakdown by vessel type is basically that indicated in Lloyd's Register of Shipping, although some regrouping and aggregation of similar vessel types was undertaken.[1] Care has been taken to exclude all fishing, passenger, and other non-trading vessels (e.g., tugs, dredgers, icebreakers and research ships): inclusion of such vessels would bias estimates of shares in the world trading fleet. Japan and the Soviet Union, for example, have significantly larger tonnages in fishing vessels than other countries. The statistics include all steamships and motorships of 100 gross registered tons or more. Included in the statistics are coastal vessels, vessels in the U.S. reserve fleet[2] and vessels laid-up for lack of employment opportunities.[3] The data presented begin in 1970 because a complete breakdown of the world fleet by vessel type is not available prior to that date. A considerably longer time series on the world fleet could be developed, but only on a highly aggregated level: it is not possible, for example, to distinguish between trading and non-trading vessels before 1970.

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[1] See footnote 1, Table E-1, for a complete listing of all vessel categories.

[2] The U.S. reserve fleet of some 1.7 million tons in 1977 was only 0.5% of total world trading tonnage. Some one-third of the reserve fleet is scheduled to be scrapped in 1978.

[3] Concern about the size and distribution of laid-up tonnage may not be relevant in this context in that laid-up tonnage represents available shipping capacity although at some cost and time to reactivate. In any event, an analysis of laid-up tonnage (obtained from the General Council of British Shipping) indicates that, in general, laid-up tonnage is in proportion to the relative size of the trading bloc fleets. In 1977, for example, after omitting all laid-up tonnage, the analysis indicates that the share of total vessel tonnage of Flags of Convenience remains virtually unchanged while the share of total vessel tonnage of the OECD Countries declines marginally by some 0.7%. The small changes in the shares of tonnages of Tanker and Dry Cargo vessels as a result of omitting laid-up tonnage tend to, if anything, accentuate the trends in the shares of the various country blocs indicated in Table E-1 and the accompanying Figures.

Table E-1 presents a breakdown of the world's trading fleet by type of vessel and country grouping. The vessel tonnage indicated for each country grouping is, of course, only that registered under the flags of that country grouping. A particular country grouping may participate in international shipping to a greater degree than indicated in Table E-1 to the extent that they, for example, charter vessels registered under flags of other country groupings. Statistics on overall participation in international shipping are not, however, available.

The five country groupings indicated in Table E-1 were developed from the some 150 countries identified in Lloyd's Register of Shipping and represent the major shipping blocs of the world. A complete listing of the countries represented in each grouping is presented in footnote 2 of Table E-1.

Figures E-1 to 7, based on the information presented in Table E-1, illustrate trends over the 1970-77 period in shares of tonnage of the different country groups by various vessel types. Table E-2 indicates the percentage share of total trading vessel tonnage represented by each vessel type.

2. COMMENTS

The most striking piece of information indicated in Table E-1 is, perhaps, the sizable increase over the period since 1970 in the share of trading vessel tonnage under Flags of Convenience, particularly in comparison to the decreasing or relatively stable shares recorded by the other shipping blocs. As indicated in Table E-1, the share of All Trading Vessel tonnage registered under Flags of Convenience increased from 19.9 per cent in 1970 to some 30.0 per cent in 1977. In contrast, the percentage share of total trading vessel tonnage of the OECD Countries declined significantly over the period, while the remaining country groupings generally maintained or increased only slightly their total share over the period. These trends are illustrated clearly in Figure E-7.

In more detail, Flag of Convenience fleets increased their share of vessel tonnage in all categories of vessel types except Combined Bulk/Oil Carriers. More significantly, however, the increases recorded by Flags of Convenience -- Oil Carriers (8.2 per cent), Ore and Bulk Carriers (7.1 per cent), General Cargo (11.1 per cent), Container Ships (7.0 per cent) and Miscellaneous Trading Vessels (10.0 per cent) -- are greater than those recorded by any other trading bloc in these markets. The increased share of tonnage under Flags of Convenience is particularly large in Oil Carriers and General Cargo vessels. As illustrated in Figure E-1, the percentage share of Oil Carrier tonnage under Flags of Convenience has increased steadily over the period in direct contrast to the declining share of tonnage of the OECD Countries. In General Cargo (see Figure E-4), the increased share of some 11 per cent over the 1970-77 period is particularly significant, in that it is more than double the next largest increase for this type of vessel (i.e., the 4.9 per cent increase for State Trading Nations) and, in addition, is the largest single increase of any country grouping for any

vessel type over the entire period. The Flag of Convenience increase in the share of tonnage of some 10 per cent for Miscellaneous Trading Vessels may not be particularly significant, in that this type of vessel makes up only a small portion of total trading vessel tonnage (see Table E-2).

With respect to State Trading Nations, it is interesting to note that, overall, their share of All Trading Vessel tonnage has remained relatively constant over the period. The largest gain in the share of tonnage experienced by the State Trading Nations for individual vessel types is in the General Cargo vessel category, in which an increase of some 4.9 per cent is recorded.

The OECD Countries are the only shipping bloc which experienced decreases in the shares of tonnages of all vessel types. Overall, the share of All Trading Vessel tonnage for the OECD Countries declined some 12 per cent over the 1970-77 period. Table E-1 indicates that the largest decrease in the share of vessel tonnage recorded by this group -- some 20.3 per cent -- was in General Cargo which has traditionally been dominated by the OECD Countries. The share of Container Ship tonnage for OECD Countries also declined significantly over the period from the near monopoly position of 98.6 per cent in 1970, to 86.2 per cent in 1977, a net decrease of some 12.4 per cent.

The final two country groupings, OPEC Countries and Other Third World Countries, account for only a small portion of total world trading vessel tonnage. Not unexpectedly, the OPEC fleet is heavily concentrated in Oil Carriers, this vessel category accounting for some 60 per cent of total OPEC vessel tonnage in 1977. For this reason, the OPEC fleet was separated from that of other Third World Countries in order to obtain an unbiased picture of the trend in the fleets of Third World Countries. The OPEC Countries more than doubled their share of All Trading Vessel tonnage over the period, but their share only increased from 0.9 per cent to 2.4 per cent.

Table E-1 indicates that the Other Third World Countries share of trading vessel tonnage has, overall, remained relatively constant since 1970. Gains in the shares of tonnages of all vessel types except Miscellaneous Trading Vessels are recorded, but these increases are relatively small.

In summary, by far the largest increases in the shares of vessel tonnages in the world trading fleet were recorded by Flag of Convenience Countries. Over the 1970-77 period, Flags of Convenience increased their share of All Trading Vessel tonnage by some 10 per cent. The next largest increase in this category, and the only other important one, was only some 1.5 per cent recorded by OPEC Countries. These increases were made almost wholly at the expense of OECD Countries. The share of All Trading Vessel tonnage of OECD countries declined by 12 per cent over the 1970-77 period.

Neither the State Trading Nations nor the Other Third World Countries experienced any significant change in their overall share of world trading fleet tonnage in the period 1970-77, although both groups recorded moderate increases in shares for some individual vessel types. The State Trading Nations recorded increases in their shares of tonnage of General Cargo vessels and Ore and Bulk Carriers of 4.9 per cent and 3.2 per cent respectively. The Other Third World Countries recorded the largest increases in their shares of tonnages in Container Ships (3.5 per cent) and Combined Bulk/Oil Carriers (3.2 per cent). The somewhat larger increases in shares of trading vessel tonnage sometimes attributed to Third World countries as a whole would appear to be largely due to growth in the OPEC fleet, and in particular, to growth of Oil Carrier tonnage in the OPEC fleet.

Table E-1

Registry of the World's Trading Vessels, Gross Tonnage
(1970-77)

		Oil Carriers	Ore & Bulk Carriers	Combined Carriers Bulk/Oil	General Cargo	Container Ships	Misc. Trading Vessels	All Trading Vessels
		% Share of Tonnage	% Share of Tonnage	% Share of Tonnage	% Share of Tonnage	% Share of Tonnage	% Share of Tonnage	% Total Trading Tonnage
Flag of Convenience Countries	1970	27.3	21.5	32.0	9.6	1.0	15.5	19.9
	71	27.7	22.6	33.4	11.3	2.9	16.7	21.4
	72	29.1	23.0	30.9	13.6	3.0	10.9	22.8
	73	30.7	24.1	31.8	16.3	3.5	12.5	24.8
	74	31.5	25.2	30.5	18.1	4.5	13.8	26.1
	75	33.6	27.4	30.8	19.4	5.0	15.2	28.1
	76	34.3	28.3	30.2	20.1	6.4	19.3	29.0
	77	35.5	28.6	32.0	20.7	8.0	25.5	30.0
State Trading Nations	1970	5.1	3.1	0.6	13.6	0	0.4	7.4
	71	4.7	3.3	0.6	14.2	0	0.4	7.2
	72	4.4	3.6	0.4	15.1	0.1	0.6	6.9
	73	4.0	3.8	0.5	14.7	0.6	0.8	6.4
	74	4.0	4.6	0.5	17.0	0.8	1.0	6.8
	75	4.0	5.2	0.5	17.9	1.0	0.7	7.0
	76	3.9	5.4	1.1	17.3	1.4	0.7	6.9
	77	4.1	6.3	1.3	18.5	1.7	0.9	7.2
OECD Countries	1970	61.4	70.4	63.7	62.6	98.6	76.6	64.1
	71	61.5	68.2	62.3	60.1	96.6	76.2	62.9
	72	60.4	67.1	65.7	56.0	94.5	82.7	61.7
	73	59.0	65.8	64.1	51.8	94.0	81.1	60.0
	74	58.4	63.4	64.7	49.1	92.2	80.3	58.7
	75	56.1	60.1	64.0	46.4	91.5	79.6	56.4
	76	54.2	59.0	62.8	44.0	89.8	76.0	54.7
	77	50.8	57.3	59.8	42.3	86.2	66.5	52.1
OPEC Countries	1970	0.9	0	0	1.4	0	0.6	0.9
	71	0.9	0	0	1.5	0	1.8	0.9
	72	0.9	0.1	0	1.6	0	1.6	0.9
	73	0.9	0.1	0	1.8	0	1.5	0.9
	74	1.0	0.1	0	2.1	0	1.4	1.0
	75	1.3	0.1	0	2.5	0	1.4	1.2
	76	2.1	0.1	0	3.0	0	1.3	1.7
	77	3.2	0.2	0	3.6	0	2.8	2.4
Other Third World Countries	1970	5.3	5.0	3.8	12.8	.5	6.8	7.7
	71	5.2	5.9	3.7	13.0	.5	4.9	7.7
	72	5.2	6.3	3.0	13.8	2.5	4.1	7.7
	73	5.4	6.3	3.5	15.3	1.9	4.0	7.9
	74	5.1	6.8	4.4	13.7	2.4	3.3	7.3
	75	5.0	7.1	4.8	13.8	2.4	3.2	7.3
	76	5.4	7.1	5.7	15.1	2.4	2.9	7.7
	77	6.4	7.6	7.0	15.0	4.0	4.1	8.4

Source: Lloyd's Register of Shipping Statistical Tables, 1970-77.

Footnotes: 1. Vessel categories composed as follows:

(a) Oil Carriers, Ore and Bulk Carriers, Combined Bulk/Oil Carriers and Container Ships are single-category listings and remain unchanged over the entire 1970-77 period.
(b) General Cargo: in 1970 and 1971, single-category listing of General Cargo (inc. Passenger/Cargo); for years 1972-76, double listing of General Cargo (inc. Passenger/Cargo) and Miscellaneous Cargo Ships (Trading); for 1977, triple listing of General Cargo-Single Deck, General Cargo - Multi Deck, and Passenger/Cargo Ships.
(c) Miscellaneous Trading Vessels: in 1970 and 1971, double listing of Liquified Gas Carriers and Chemical Carriers; for years 1972-77, multiple listing of Liquified Gas Carriers, Chemical Carriers, Miscellaneous Tankers (Trading), Lighter Carriers, Vehicle Carriers and Livestock Carriers.

2. Country groupings as follows:

(a) Flag of Convenience Countries (including Tax Haven Countries): Bahamas, Bermuda, Cyprus, Gibralter, Malta, Sierra Leone, Singapore, Costa Rica, Honduras, Lebanon, Liberia, Morocco, Panama, Somali Republic (latter included in Other Third World Countries category in 1977).
(b) State Trading Nations: Albania, Bulgaria, China, Cuba, Czechoslovakia, Germany (DRG), Hungary, Poland, Rumania, U.S.S.R., Yugoslavia.
(c) OECD Countries: United Kingdom, Greece, Japan, Norway, Australia, Canada, New Zealand, Austria, Belgium, Denmark, Finland, France, Germany (FRG), Italy, Netherlands, Sweden, Switzerland, United States.
(d) OPEC Countries: Nigeria, Algeria, Ecuador, Gaboon, Indonesia, Iran, Iraq, Kuwait, Libya, Qatar, Saudi Arabia, United Arab Emirates (not listed in 1970 and 1971), Venezuela.
(e) Other Third World Countries; some 94 underdeveloped countries in 1977; precise number differs to some extent from year to year (e.g., in 1977, Anguilla and Antigua were added to this country grouping). Names of countries may be found in Lloyd's Register of Shipping, after excluding countries listed in four groupings above.

Table E-2

Composition of World Trading Fleet by Vessel Type, Gross Tonnage
(1970-77)

Year	Oil Carriers %	Ore & Bulk Carriers %	Combined Bulk/Oil Carriers %	General Cargo %	Container Ships %	Misc. Trading Vessels %
1970	41.2	18.3	4.0	34.7	0.9	0.8
1971	42.4	19.0	4.7	31.7	1.2	1.0
1972	42.4	19.5	6.1	28.7	1.7	1.5
1973	43.0	19.8	7.3	26.1	2.2	1.5
1974	44.8	19.9	7.6	23.9	2.2	1.6
1975	47.2	19.4	7.4	22.3	2.0	1.7
1976	48.5	19.2	7.2	21.3	1.9	1.8
1977	47.4	20.4	7.1	21.0	2.0	2.2

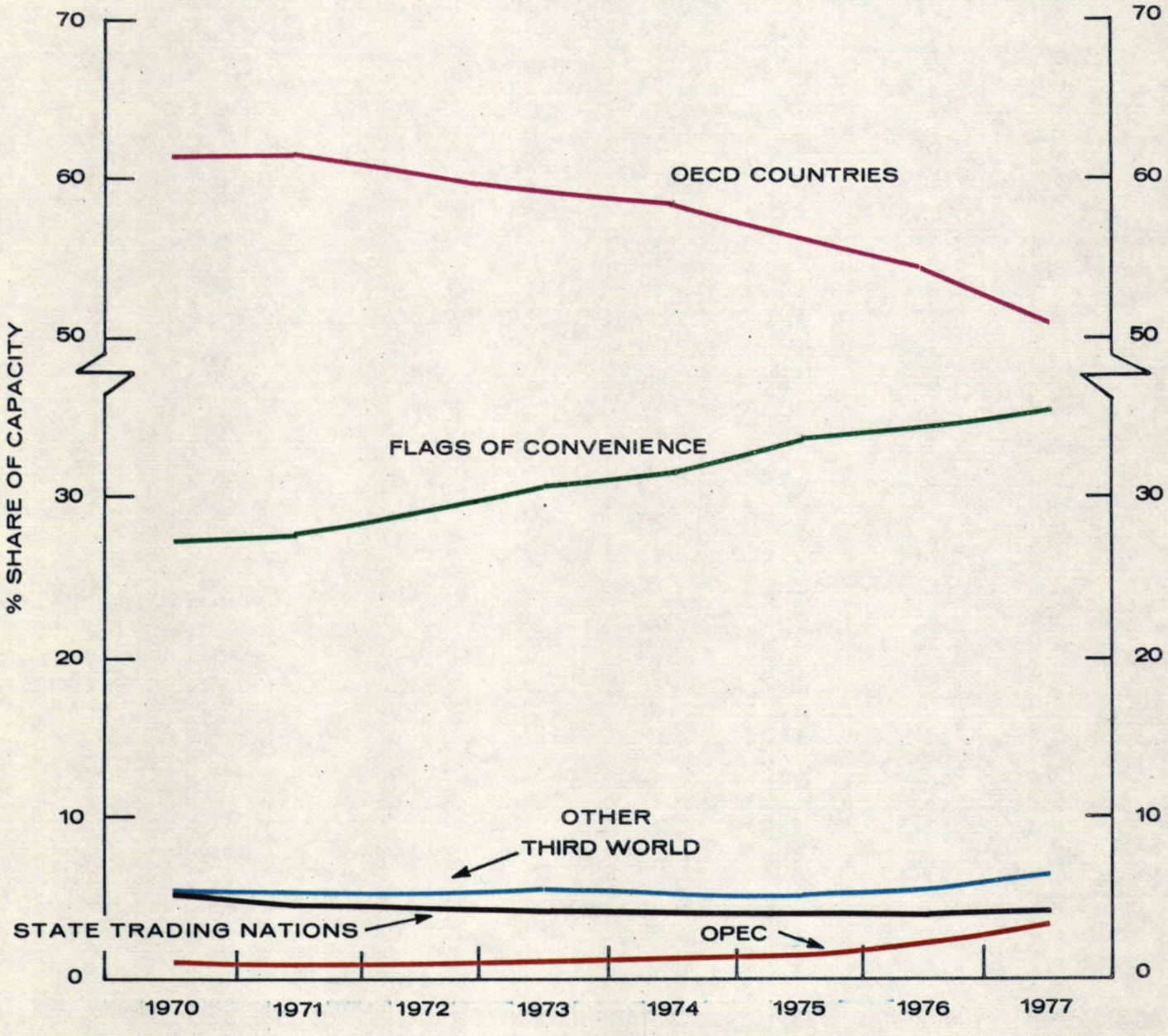
Source: Lloyd's Register of Shipping. Statistical Tables, 1970-77

Footnotes: See Table E-1

FIGURE E-1

OIL CARRIERS

PERCENTAGE SHARE OF GROSS TONNAGE BY COUNTRY GROUPING

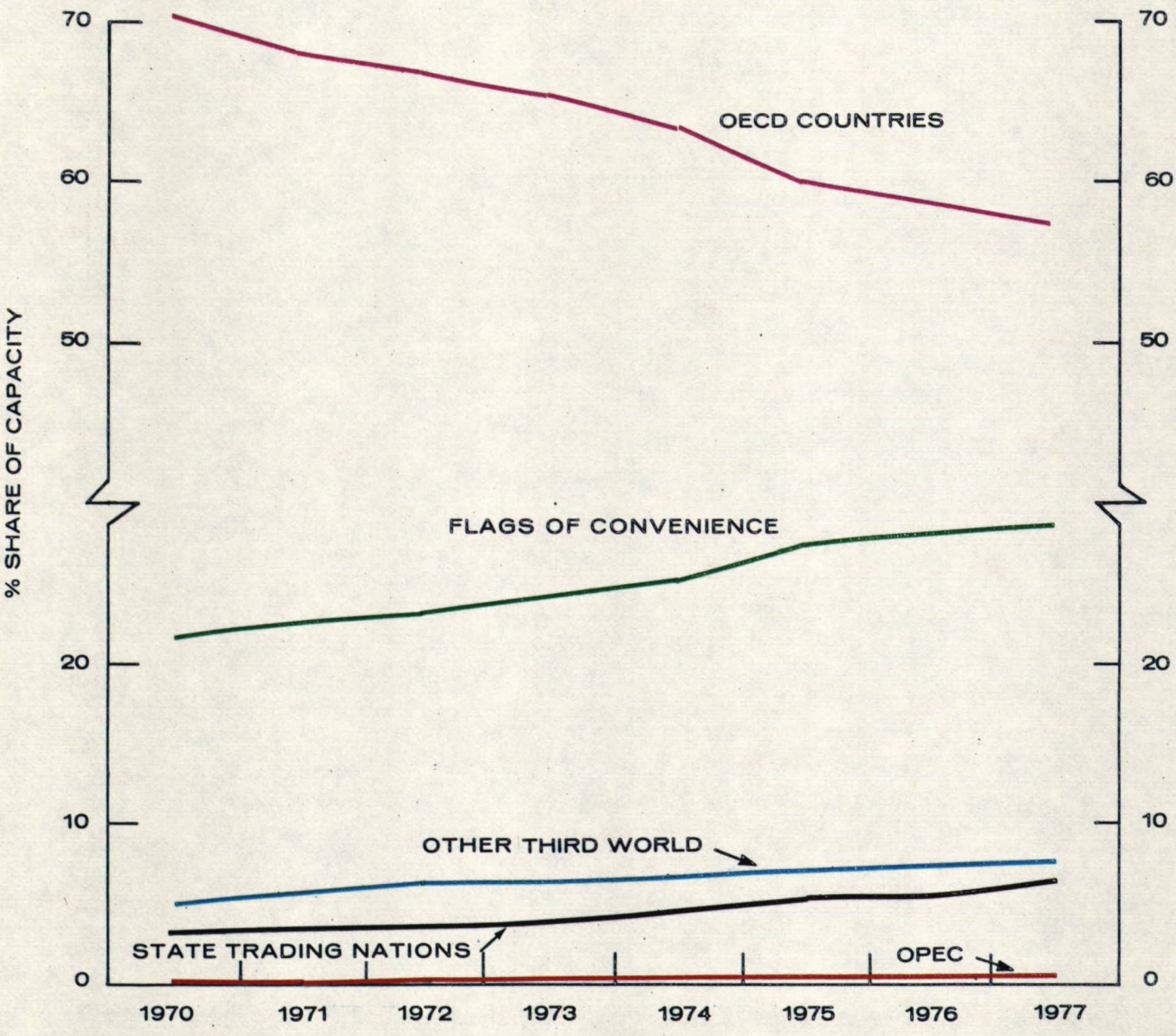


Source: Table E-1.

FIGURE E-2

ORE AND BULK CARRIERS

PERCENTAGE SHARE OF GROSS TONNAGE BY COUNTRY GROUPING

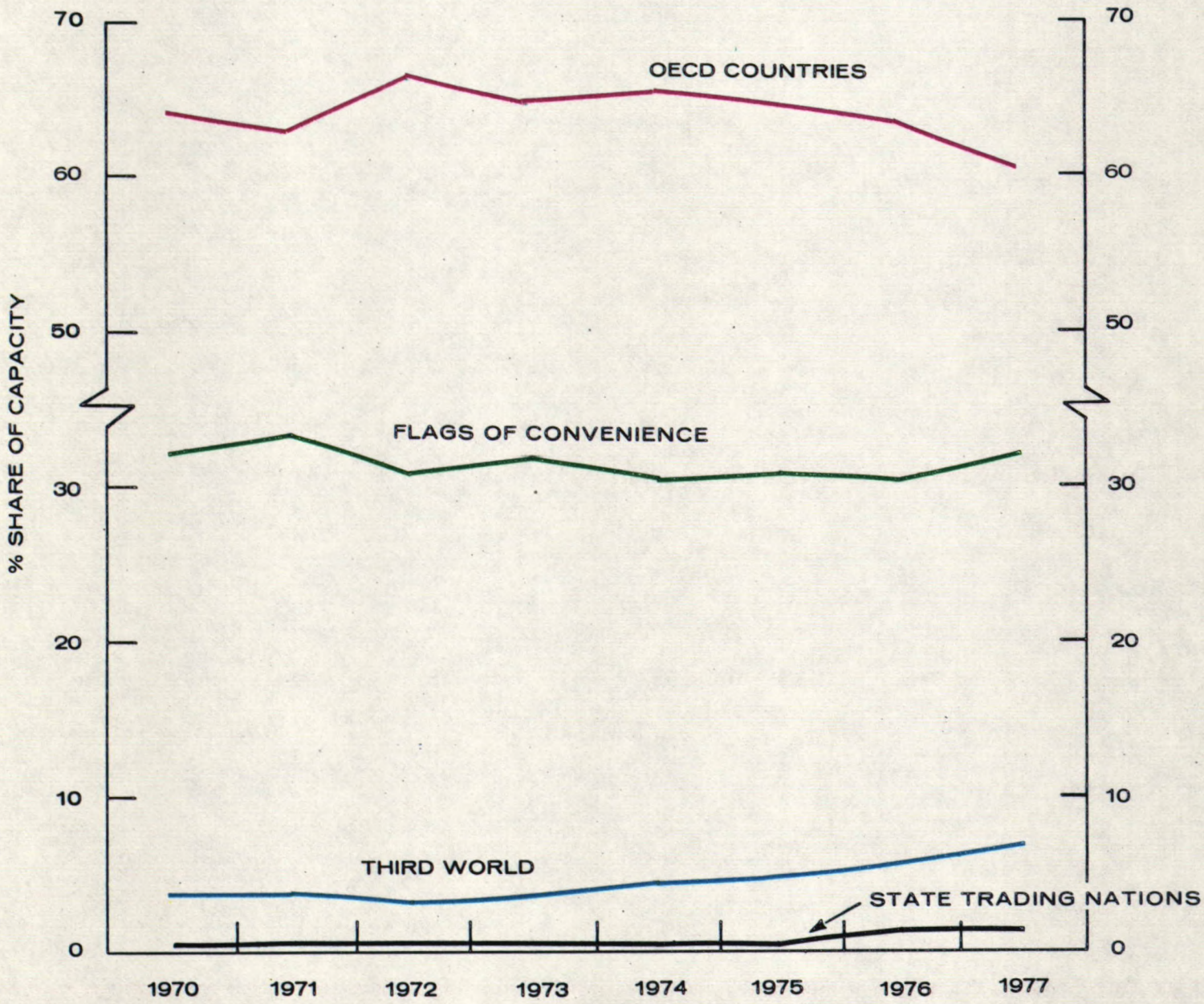


Source: Table E-1

FIGURE E-3

COMBINED CARRIERS BULK/OIL

PERCENTAGE SHARE OF GROSS TONNAGE BY COUNTRY GROUPING

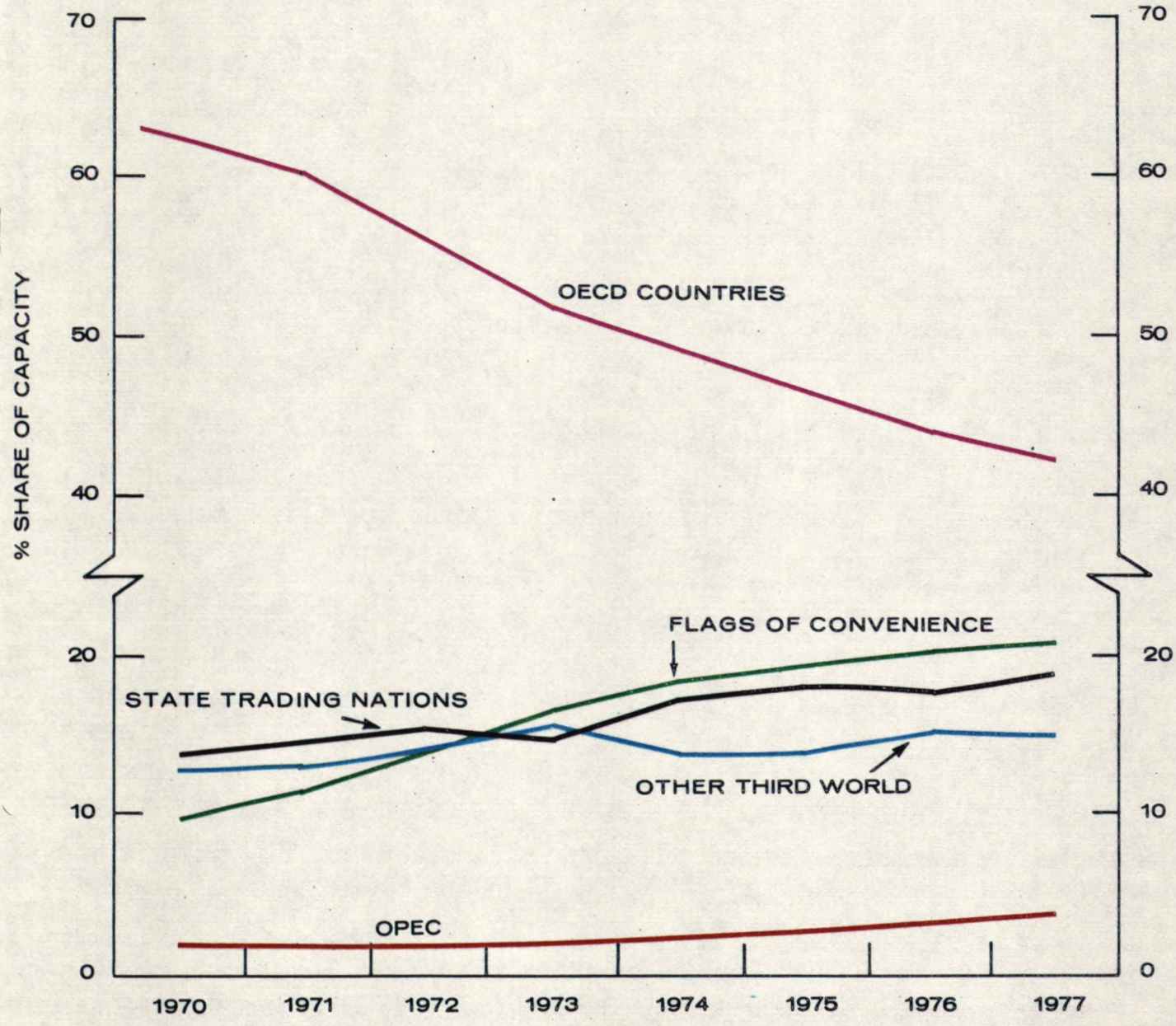


Source: Table E-1.

FIGURE E-4

GENERAL CARGO

PERCENTAGE SHARE OF GROSS TONNAGE BY COUNTRY GROUPING

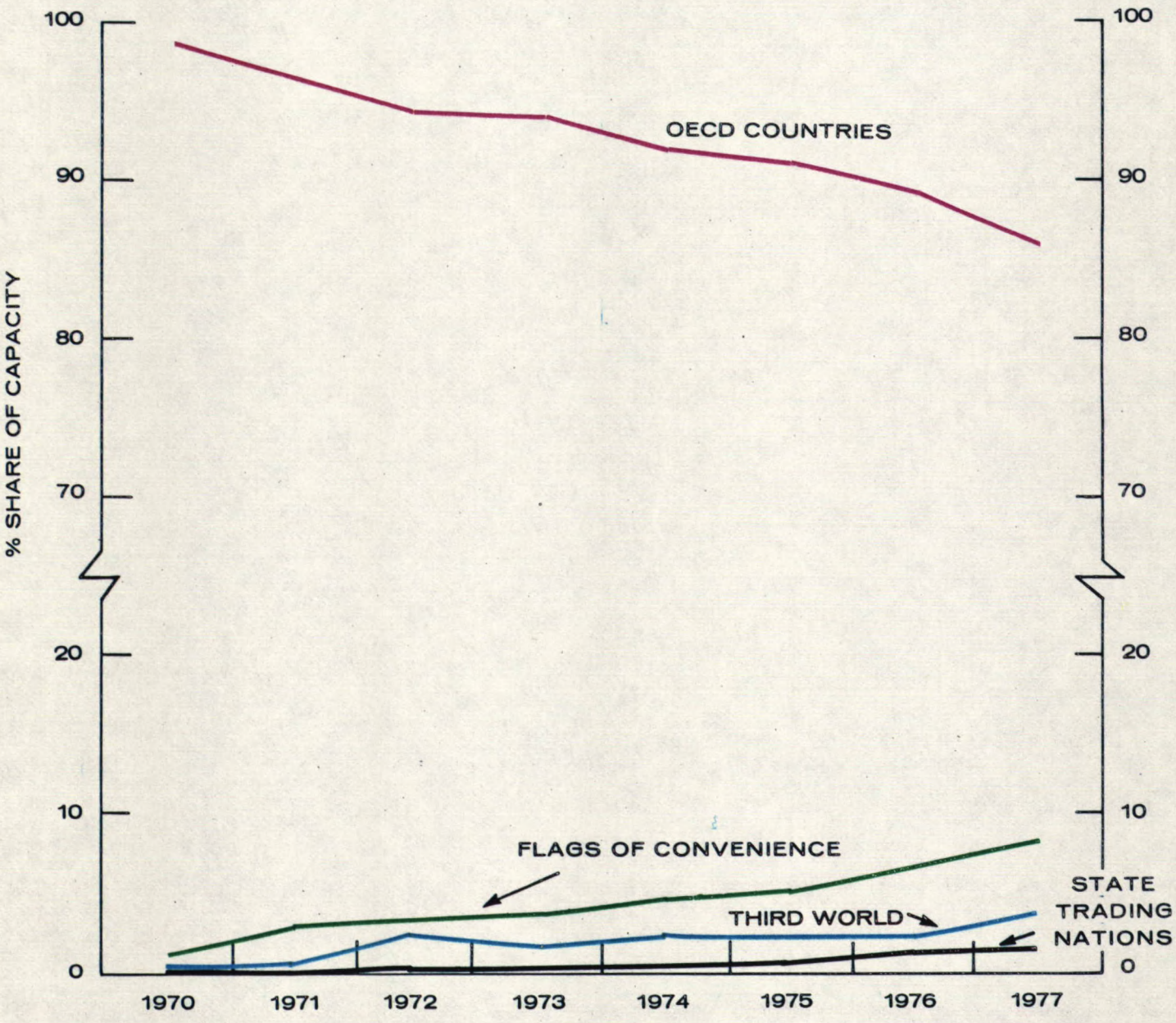


Source: Table E-1

FIGURE E-5

CONTAINER SHIPS

PERCENTAGE SHARE OF GROSS TONNAGE BY COUNTRY GROUPING

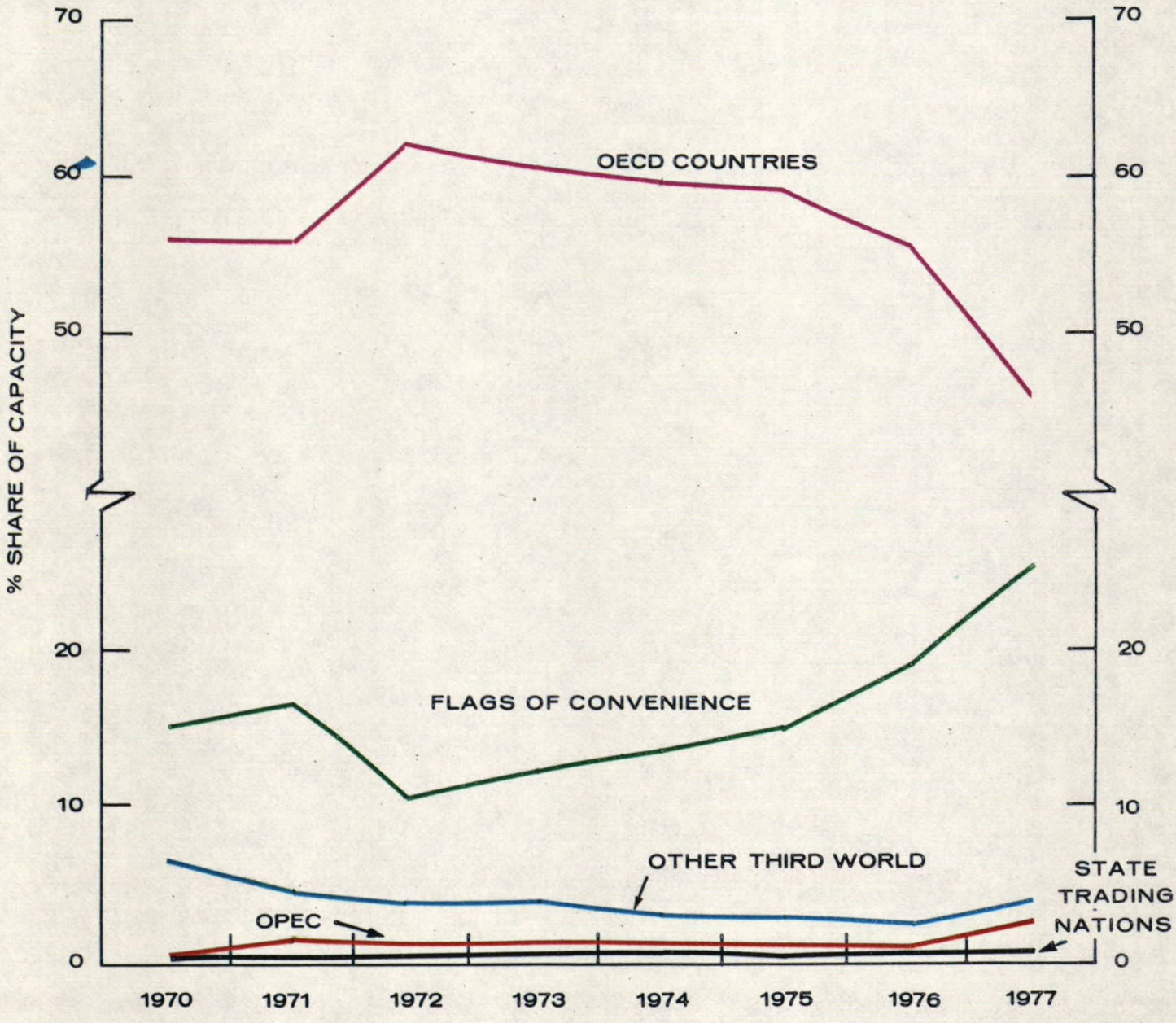


Source: Table E-1.

FIGURE E-6

MISCELLANEOUS TRADING VESSELS

PERCENTAGE SHARE OF GROSS TONNAGE BY COUNTRY GROUPING

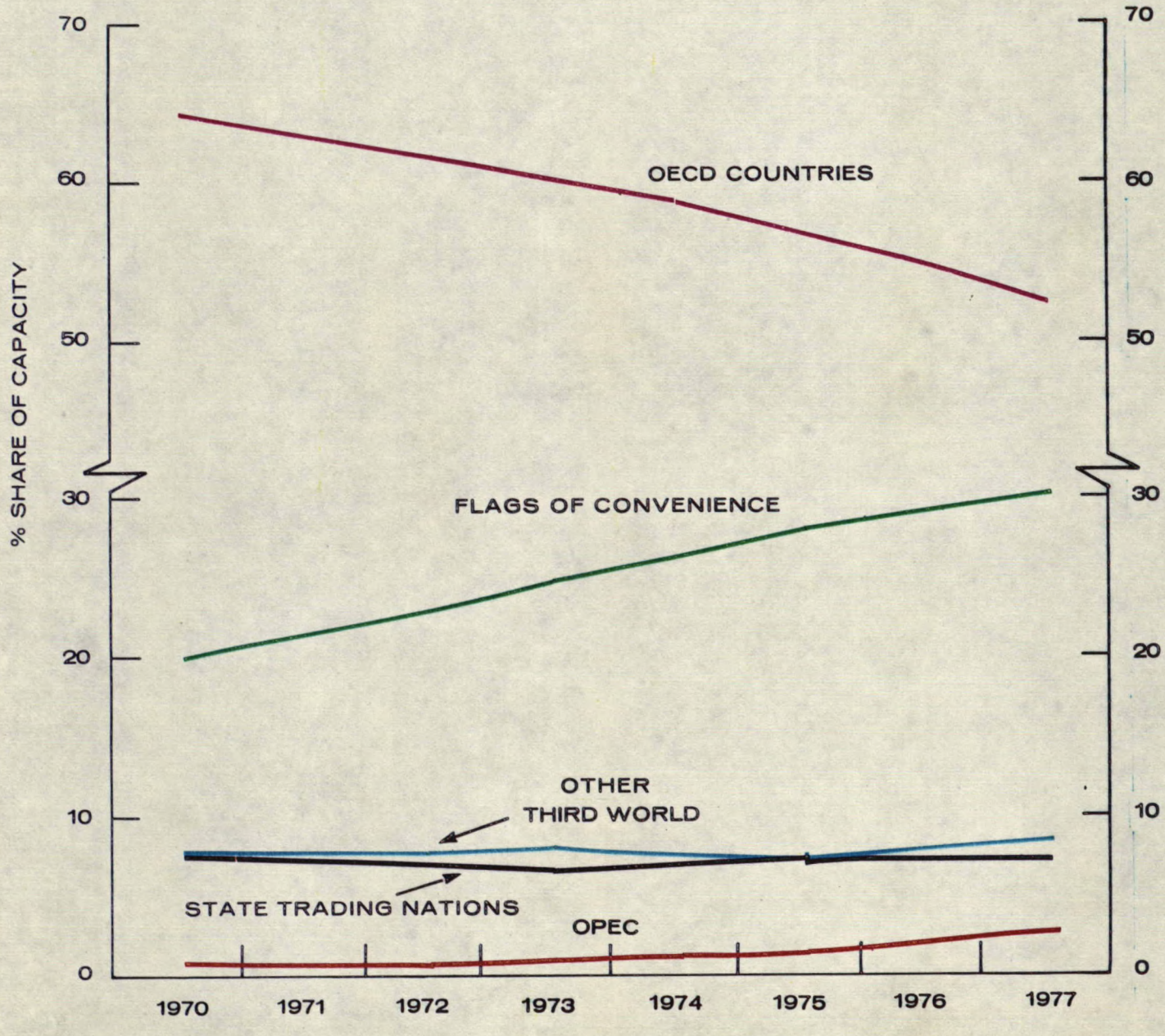


Source: Table E-1.

FIGURE E–7

ALL TRADING VESSELS

PERCENTAGE SHARE OF GROSS TONNAGE BY COUNTRY GROUPING



Source: Table E-1

APPENDIX F

TRENDS IN PRICES OF DEEP-SEA SHIPPING, 1970-78

Table F. 1. provides year-end price levels for new-buildings and second-hand vessels in principal market categories over the period 1970-77. These data (produced by Fearnley and Egers Chartering Co., Ltd.) are widely used in official publications (e.g. UNCTAD, OECD) and attempt to take account of variables which have an important indirect effect on ship prices, such as terms of credit. Although the last observation in this series is for year-end 1977, information from the trade press can be used to provide qualitative indicators of market developments in 1978.

The data on newbuilding prices indicate that such prices generally reached peaks in 1974, and have declined since that time. Price decreases appear to have been largest in 1976, and during 1977 newbuilding price levels declined moderately or remained stable.

It should be noted, however, that Fearnley and Egers' price data are expressed in current dollar terms. Allowance for inflation in the costs of ship production, in other words, would mean that even more substantial reductions in real ship prices have occurred over recent years than are indicated by these data.

Price levels for second-hand vessels are also important in considering prospects for newbuilding, since shipyards are in effect competing with the prices available on existing tonnage. Since price levels for second-hand tonnage reflect shipowners' expectations of future freight rate levels, they also provide an important independent indicator of the expected demand/supply balance for shipping of particular vessel types in future years.

The price level data in Table F.1. indicate that second-hand tonnage values in recent years have declined more precipitously than prices for newbuildings. The declines in second-hand price levels have been particularly marked for larger vessels. The timing of declines in tonnage values has, however, differed according to vessel types -- the largest absolute dollar declines in tonnage occurring for general cargo vessels in 1977, for tankers in 1974 and for dry bulk vessels in 1975. The extremely low price levels for secondhand dry bulk and oil carriers through early 1978 led to some rather spectacular resale values.[1] In the latter part of 1978, there appears to have been an upturn in freight rates in these markets

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[1] For example, the OECD Maritime Transport Committee reports that

> At the end of February, 1978, they (The People's Republic of China) purchased a sophisticated one year old 38,000 dwt bulk carrier, which had cost $14 million to build for $5.9 million.

See OECD, Maritime Transport, 1977, p. 86.

which has led to appreciation in second-hand tonnage values. The implications of this rise in freight rates for newbuildings, however, appear to be limited. Reports in the trade press currently indicate that these freight rates cover only part of capital costs even for lower-cost ship operators, and that the gap between second-hand values and new ship prices is still too wide in most cases to arouse interest in newbuilding.[1]

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[1] According to the Platou Monthly Contracting, Sale and Purchase Report,

> The present rates (on freight for bulk carriers) cover part of the capital cost, at least for free flag owners. It is, however, a long way to go before modern expensive units are making a profit particularly under high cost operation.

Ibid. September, 1978, p. 5.
and

> The latest increase in values for certain ship types has led some owners to investigations whether contracting might prove an interesting alternative. In most cases the conclusion is that there is still a much too wide gap between second-hand values and the newbuilding prices.

Ibid. October, 1978, p. 2.

Table F.1

Representative new building prices, 1970 and 1973-1977

(Prices in $ million at year end)

	1970	1973	1974	1975	1976	1977
30 000 dwt bulk	8.7	12.0	16.5	13.5	11.0	11.0
50 000 dwt product tanker	10.0	17.5	20.0	18.0	15.0	15.0
70 000 dwt bulk	11.9	20.5	25.0	20.0	16.0	16.0
87 000 dwt tanker	17.0	25.0	28.0	22.0	16.0	16.0
96 000 dwt ODO	23.0	29.0	33.0	30.0	23.0	21.0
120 000 dwt bulk	17.2	31.0	35.0	32.0	24.0	22.0
210 000 dwt tanker	31.0	47.0	42.0	38.0	34.0	32.0
400 000 dwt tanker	..	78.0	65.0	62.0	56.0	45.0
125 000 m^3 LNG	..	105.0	125.0	125.0	105.0	115.0
75 000 m^3 LPG	..	45.0	52.0	52.0	42.0	40.0
5 000 dwt ro/ro	5.3	9.9	14.6	16.2	10.0	10.0

Tankers: second-hand prices, average values, 1970 and 1973-1977
(Prices in $ million at end of year)

dwt	Built	1970	1973	1974	1975	1976	1977
20 000	1959/60	3.3	4.0	2.7	1.3	1.0	0.8
25 000	1958/59	4.0	5.0	3.0	1.4	1.2	1.0
35 000	1958/59	6.0	7.5	3.5	1.6	1.5	1.2
50 000	1963/64	10.0	13.0	7.0	2.7	3.5	2.0
60 000	1964/65	12.0	16.0	8.0	3.5	4.0	2.4
80 000	1966/67	19.0	25.0	9.5	4.8	5.0	3.5
100 000	1967/68	26.0	30.0	11.0	5.5	6.0	4.0
150 000	1974/75	..	..	..	15.0	17.0	13.5
200 000	1969/70	40.0	52.0	23.0	10.0	9.0	5.0
250 000	1972/73	..	65.0	28.0	16.0	15.5	9.5
300 000	1971/72	..	78.0	36.0	18.0	18.0	10.0

Dry bulk carriers: second-hand prices, average values, 1970 and 1973-1977
(Prices in $ million at end of year)

dwt	Built	1970	1973	1974	1975	1976	1977
18 000	1963	2.8	4.5	4.8	3.5	3.0	1.5
25 000	1966	4.8	6.5	7.2	6.0	5.3	2.8
35 000	1965	6.0	8.0	9.0	6.5	5.5	2.9
50 000	1967	9.0	11.5	13.0	7.0	6.5	3.1
60 000	1972	11.0	17.0	17.0	10.5	9.5	6.2

Liner-type vessels: second-hand prices, average values, 1970 and 1973-1977
(Prices in $ million at end of year)

dwt	Built	1970	1973	1974	1975	1976	1977
6 600	1958	1.0	1.1	1.5	1.3	1.2	0.7
12 500	1956	1.5	1.5	2.2	1.7	1.4	0.7
13 500	1959	1.7	2.1	3.1	2.6	2.0	1.0
16 000	1963	3.0	3.4	4.5	4.0	3.8	2.1

Source: Fearnley and Egers Chartering Co. Ltd., Review, 1977 (Oslo), Tables 16, 18 and 19.