AN INPUT-OUTPUT ANALYSIS OF TRANSPORT EXPENDITURE

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ABSTRACT: *This paper reports on a study of transport expenditure in the New Zealand economy for the years ended March 1972 and 1977. The prime objective of the analysis is to identify the ancillary component of transport services, both private and commercial, and for this purpose published (1971-72) and provisional (1976-77) input-output data is used to evaluate the structural relationship between transport and other sectors of the economy.*

For 1971-72 total expenditure on transport (both internal and external) is assessed to be approximately 23 per cent of total final demand expenditure in the New Zealand economy; approximately 81 per cent of these estimates constitute ancillary services.

For 1976-77 total expenditure on transport is assessed to be approximately 22 per cent of total final demand expenditure; approximately 79 per cent of these estimates constitute ancillary services.

The opinions expressed in this paper are entirely those of the authors and should not be construed as necessarily representing those of the Ministry of Transport or of the Urban Transport Council.

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INTRODUCTION

OVERVIEW

Deriving estimates of the magnitude of transport expenditure in the New Zealand economy is a difficult exercise; complicated by the fact that a considerable amount of transport activity comes under the heading of ancillary, or 'own account', operations and as such escapes the purview of official statistics.[1] Such ancillary operations consist of expenditure by households on private motoring, and the use of commercial vehicles in the interests of promoting production or sales in another field of economic activity. This latter category of commercial ancillary transport is significant and is not counted as part of the official transport and storage industries because the "own account" operations are not conducted as separate enterprise structures for accounting purposes and do not comprise the major economic activity of the enterprise concerned.

Furthermore, official statistics concentrate on the value-added to production by the transport industry selling its service for hire or reward and income generated from such activity is measured net of commodity inputs required to provide the service. Consequently, the national income measure of expenditure on gross domestic product (gdp) does not take account of current expenditure on inputs such as fuel, oil, tyres and tubes, vehicle repair and the assortment of overhead expenses required to support the service which fall within the current financial year. Indeed, a significant group of commodity inputs in the form of transport imports are subtracted from the aggregate national expenditure account in order to derive the value of expenditure on gdp.

A number of estimates in terms of gross national product (gnp)[2] have been suggested in the past. Polaschek (1960) estimated that 21 percent of gnp for 1958 represented internal transport, and updated this figure to 29.4 percent for 1962 (Polaschek, 1964). In 1972 the then Minister of Transport the Rt. Hon J.B. Gordon provided an estimate of total expenditure on transport as "close on one-third .." of gnp for 1968 (Westport News, 29 April 1972), while a former Executive Director of the N.Z. Road Transport Association (D.M.Wilson, 1975), writing for the Canterbury Chamber of Commerce "Economic Bulletin", placed this estimate as "more than one third" of gnp for 1970. A subsequent, albeit cursory and unpublished, analysis of the 1968 estimate conducted within the Ministry of Transport's Economics Section suggested that a more realistic figure for 1968 would be in the order of 27 percent of gnp.

At the most, all that can be drawn from these estimates is that total expenditure on transport comprises a large segment of New Zealand's economic output; anywhere between one-fifth and one-third of gnp on the basis of the above estimates. In view of the range of possible estimates and their dubious basis, however, a much more rigorous approach for estimating the magnitude of total transport expenditure in the New Zealand economy is called for. In this paper the authors' attempt to provide such an approach, using as a basis the Department of Statistics publication Inter-Industry Study of the New Zealand Economy 1971-72 (Statistics, 1980) to provide an estimate for the year ended March 1972, and updating this estimate to 1976-77 using as yet unpublished data from the 1976-77 Inter-Industry Study programme[3].

DEFINITIONS

A few definitions are in order to explain the rationale for inter-industry analysis and to reconcile the input-output transactions tableau with the more familiar national account measures of production and expenditure found in Department of Statistics' publications such as the Monthly Abstract of Statistics.

The Input-Output Tableau

The culmination of the inter-industry study programme conducted by the Department of Statistics is the input-output transaction tableau summarising total ouput, or sales, (by row) and inputs, or expenditure, (by column) in the national economy. Further mathematical manipulation of this tableau enables the derivation of a number of additional descriptive tables which, while useful for individual industry and final demand analysis, are not the prime concern of this evaluation.

Essentially, the input-output tableau consists of four quadrants:

1. Intermediate Production and Demand.

2. Final Output of Production.

3. Primary Inputs to Production.

4. Primary Inputs to Final Demand.

These quadrants are illustrated in Table 1[4]. The symmetry of this tableau ensures that the column expenditure on inputs to industry i, both intermediate and primary, matches the sum of output from industry i contributing to intermediate and final demand (these transactions are described in quadrants 1,2 and 3 of the transactions tableau). Some expenditure on primary inputs (notably indirect taxation and imports) on the other hand, comprise purchases by final demand and are not allocated over output by the production sector (these transactions are shown in quadrant 4). In all cases transactions are expressed in producer prices (i.e., basic values).

TABLE 1

Framework of a Typical Input-Output Tableau

For the disposition of output of an industry read the row for that industry For the origin of input into an industry read the column for that industry		INTERMEDIATE DEMAND											FINAL DEMAND									
		Agriculture	Hunting and Fishing	Forestry	...	Transport and Storage	...	Personal and Domestic Services	INTERMEDIATE DEMAND (Sub-Total)		Household Consumption	Government and Private non-profit organisations' services produced for own use	Gross fixed capital formation	Stock Change	Exports	FINAL DEMAND (Sub-Total)	TOTAL DEMAND	TOTAL OUTPUT			
		1	2	3		107/113		130														
INTERMEDIATE INPUTS	Agriculture 1 Hunting and Fishing 2 Forestry 3 : Transport and Storage 107/113 : Personal and Domestic Services 130	Quadrant No. 1 Intermediate Production and Demand									Quadrant No. 2 Final Output of Production										
	INTERMEDIATE INPUTS (Sub-Total)																					
PRIMARY INPUTS	Compensation of Employees Operating Surplus Indirect Taxes Subsidies Consumption of Fixed Capital Secondhand Assets Imports	Quadrant No. 3 Primary Inputs To Production									Quadrant No. 4 Primary Inputs To Final Demand										
	PRIMARY INPUTS (Sub-Total)																					
	TOTAL INPUT																					

Reconciling the 1971-72 input-output transactions table with the corresponding New Zealand System of National Accounts (SNA) for the period reveals the following discrepancies.[5]

TABLE 2

Reconciling Input-Output and National Accounts Estimates of Final Demand Expenditure

	1971-72 I/O Table($m)	1971-72 SNA ($m)	Difference ($m)
C	4,231.0	4,210.0	21.0
G	968.7	898.0	70.7
I	1,786.0	1,725.0	61.0
X	1,562.2	1,556.0	6.2
(-)M	1,497.9	1,512.0	-14.1
Statistical Discrepancy	-	11.0	-11.0
GDP	7,050.0	6,888.0	162.0

Briefly, these discrepancies are due to differing treatments used in the Inter-Industry Study compared to the SNA analysis, namely:

1. Imputed bank service charges - In the Inter-Industry Study the value of these charges is allocated to the intermediate consumption of industries and to household consumption, while in the SNA analysis this expenditure is lumped into intermediate consumption of a 'dummy industry'.

2. Commodity indirect taxes and subsidies - Expenditure on commodities in the Inter-Industry transactions tableau includes the value of taxes and subsidies placed on these commodities as a payment by the consumer. In the SNA analysis ,on the other hand, the producer pays the taxes or receives the subsidies.

3. Work done on others' materials - The Inter-Industry Study adopts the product-flow approach for valuing transactions and shows the value-added to a commodity actually passing through the establishment that performs work on the commodity without actually owning it. The SNA adopts the money-flow approach, however, and thereby regards the establishment owning the goods as buying and selling them and paying a commission for the work done on them[6].

The Transport Industry : Official and Ancillary

Four aspects of transport activity are identified and defined as follows:

T_1i = Official transport services, sales to intermediate demand.

T_1f = Official transport services, sales to final demand.

T_2i = Ancillary transport services, sales to intermediate demand.

T_2f = Ancillary transport services, sales to final demand.

T_1i and T_1f pose no great difficulty and can be read directly from the input-output transactions table. Transport activities falling within these categories are those classified as "Transport and Storage", defined by Division 71 of the New Zealand Standard Industrial Classification (NZSIC), namely:

Rail Transport
Passenger Road Transport
Freight Transport by Road
Supporting Services to Land Transport
Water Transport
Air Transport
Storage, Warehousing and Services Incidental to Transport

Brief descriptions of these industries can be found in Statistics (1980).

T_2i and T_2f are considerably more difficult to estimate, however, and by far the bulk of the analysis concentrates on defining these components of expenditure on ancillary transport. A number of general assumptions are applied from the outset:

1. The road transport mode is assumed to predominate in the area of ancillary transport services. All rail transport operations are assumed to be included in the defined official industry. In the case of both air and sea transport, however, some allowance is made for ancillary operations where recognisable inputs to these modes are consumed outside the official industry.

2. The general approach adopted is to count all expenditures incurred in the provision of transport operations as a valid representation of transport expenditure. In the case of the official industry such expenditures (the column co-efficients of quadrants 1 and 3 in Table 1) are automatically included in the value of the individual industry's output. However, for ancillary operations, in addition to recognisable transport inputs, some allowance must be made for other items of current expenditure, office and

administrative overheads, factor payments, etc. Building on the assumption outlined in 1. above the composition of commodity and primary inputs represented in the official road freight transport industry is used to apportion these expenses to ancillary operations; the assumption being that ancillary road transport expenditure will resemble that of the official industry. This assumption is considered reasonable, although there is some evidence to suggest that average vehicle utilisation may differ between the two. Fortunately, variable expenditure related to vehicle use can be isolated out to remove this distortion.

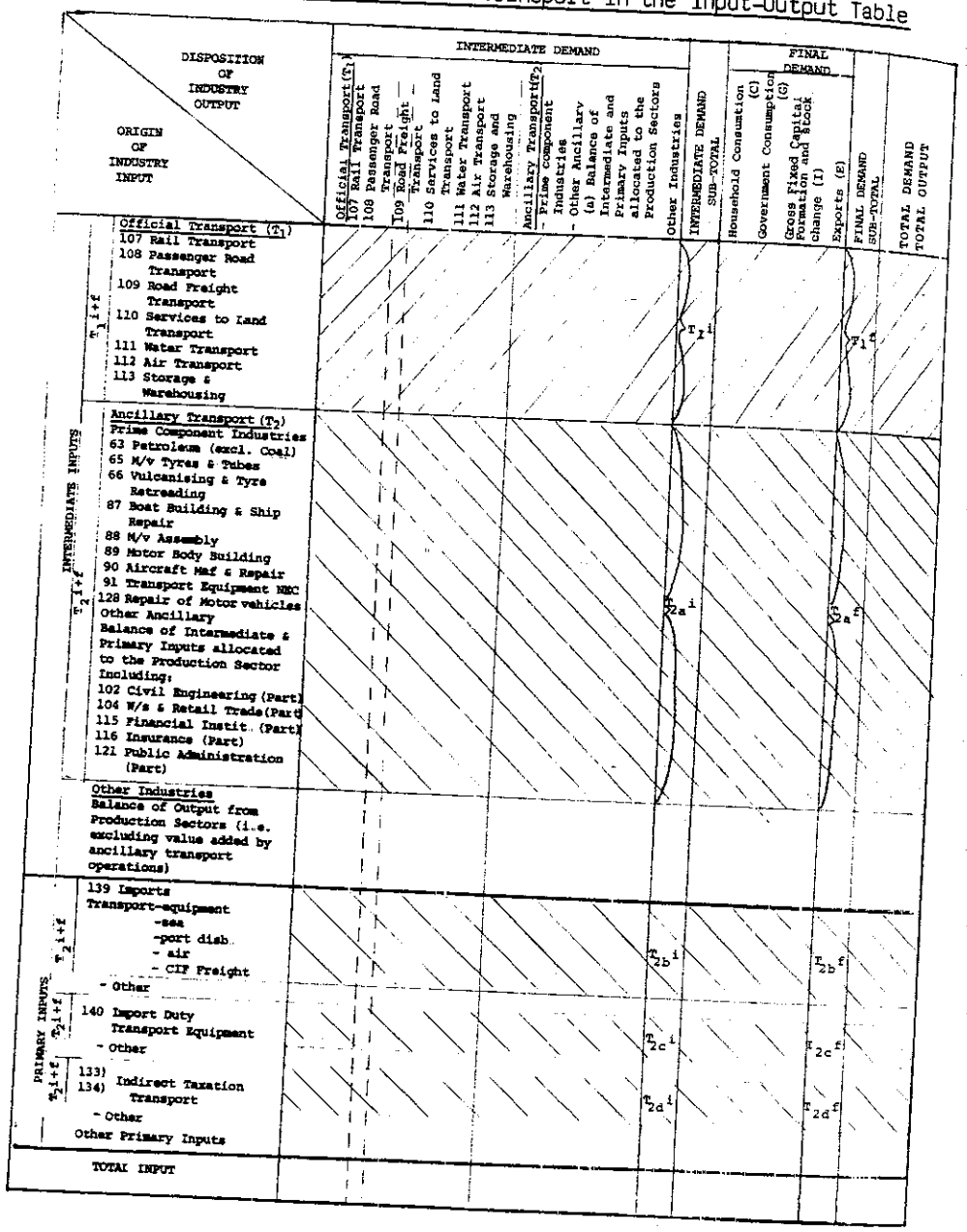
3. No allowance is made for the use of transport facilities for activities other than strictly transport (e.g. pleasure boating, rally driving, etc). Expenditure on these pursuits is considered not to be transport expenditure.

More detailed assumptions are explained in the text as they arise. The general approach adopted can be illustrated using a modified version of the transactions tableau shown in Table 1 above, illustrated in Table 3.

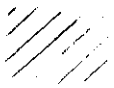
Table 3 focuses on those components of the published transactions table which provide clues to the magnitude of official and ancillary transport services in the economy. In the case of ancillary transport services the picture is built up slowly by defining inputs of varying significance to transport (these are shown in the column of "Origin of Industry Inputs"). For some industries the output of the industry is judged to be entirely devoted to transport, whereas in other industries only a proportion of an industry's output is absorbed by transport, and assumptions of the type outlined in 2 above are required to estimate this proportion.

TABLE 3

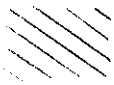
Schematic Representation of Transport in the Input-Output Table



The end result is an estimate of the row totals for official and ancillary transport services with the balance of output from intermediate and primary input categories shown as net of output value represented by ancillary transport. In Table 3 these are represented as hatched rows:



for official transport



for ancillary transport.

Within these rows, the expenditure aggregates of particular interest are those denoted T_1f and $T_2f_{(a-d)}$ in the tableau; representing, respectively, sales of official transport services to final demand and sales of ancillary transport services to final demand. The sum of these expenditures, divided by gdp or gnp for the period, are used to derive the estimates of total transport expenditure in the economy as a percentage of both gdp and gnp for 1971-72 and 1976-77.

THE 1971-72 INTER-INDUSTRY STUDY

The 'OFFICIAL' INDUSTRY (T_1i+f)

Intermediate and final demand for services of the official transport industry are extracted directly from the published 1971-72 input-output transactions table[7].

TABLE 4

Sales From The Official Transport Industry 1971-72

Row/Column No	Industry Name	Intermediate Sales (T_1i) ($m)	Final Sales (T_1f) ($m)	Total Sales ($m)
107	Rail Transport	67.1	33.4	100.5
108	Passenger Road Transport	9.0	42.6	51.6
109	Road Freight Transport	172.8	52.3	225.1
110	Services to Land Transport	12.1	61.7	73.8
111	Water Transport	53.4	114.0	167.4
112	Air Transport	44.0	62.7	106.7
113	Storage and Warehousing	19.9	5.9	25.8
TOTAL	Transport & Storage	378.3	372.6	750.9

THE ANCILLARY INDUSTRY ($T_2 i+f$)

The problem of identifying ancillary transport operations is approached from a number of different angles. Central to the assumptions applied is the symmetry of input-output transactions referred to above. Using this symmetry, transport operations can be defined either by their output (eg. in the case of the official industry) or by their inputs. The ancillary industry is defined principally by its inputs.

Prime Component Industries

An examination of the transactions table at the 130 industry level reveals a number of industries which, while not part of the official industry, are clearly those whose sole, or predominant, reason for existence is to provide inputs for transport operations. Obvious examples of these industries are:

Row/Column No.	Industry
63	Petroleum and Coal Products
65	Motor Vehicles Tyres and Tubes.
66	Vulcanising and Tyre Retreading.
87	Boat Building and Ship Repair.
88	Motor Vehicle Assembly.
89	Motor Body Building.
90	Aircraft Manufacture and Repair.
91	Transport Equipment NEC
128	Repair of Motor Vehicles.

In addition to these, significant components of the output of Civil Engineering (Ind. 102), Wholesale and Retail Trade (Ind. 104), Financial Institutions and Services (Ind. 115) and Insurance (Ind. 116) may be attributed to transport activities.

The nine industries listed, however, are assumed to be directly and, except for Petroleum and Coal Products, entirely related to transport operations. Expenditure on these industries is assumed, therefore, to reflect transport expenditure. Moreover, in the case of industries 63, 65, 66, 88, 89 and 128 the expenditures conveniently make up the standard variable cost components of road transport operations. The output of all nine industries can be used, therefore, to approximate a substantial component of ancillary transport; although, to avoid double counting, the output of these industries which is absorbed directly by the official road transport industry must be excluded.

Before extracting this data from the transactions table, the Petroleum and Coal Industry is adjusted to represent petroleum output only. A major component of this industry's inputs are classified as imports ($52.5m), the bulk of which ($45.4m) comprise petroleum crude and partly refined[8] and the remainder associated products plus transport. Coal mining and natural gas inputs, on the other hand, represent only $2.5m of total expenditure on the product of the industry ($85.0m). These expenditures ($52.5m for oil, and $2.5m for coal and natural gas) therefore are assumed to represent direct expenditure on the oil, coal and natural gas components, and the balance of expenditure in column 63 ($30.0m) is allocated proportionally between these components, namely:

(a) Petroleum $\quad \$30.0m \times \frac{52.5}{52.5+2.5} = \$28.6m$

(b) Coal and natural gas $\quad \$30.0m - \$28.6m = \$1.4m$

The value of the petroleum industry's output is therefore:

$$\$52.5m + \$28.6m = \$81.1m$$

and the remainder ($3.9m) is attributed to the coal and natural gas industry. These outputs are allocated to intermediate and final demand in proportion to sales to these categories by the combined petroleum and coal industry.

Finally, in order to translate intermediate demand expenditure on prime component inputs into a true allocation of this expenditure margin over intermediate and final demand, intermediate purchases (excluding those of the official transport industries) of the prime component inputs are allocated to intermediate and final demand according to the sales pattern of the purchasing industry.

Intermediate and final demand sales for the nine industries listed are summarised in Table 5, with intermediate sales to the official transport industry shown separately.

TABLE 5

Sales From The Prime Component Industries 1971-72

Row/ Column No	Industry Name	Intermediate Sales		Final Sales	Total Sales
		Ancillary Transport	Official Transport		
		($m)	($m)	($m)	($m)
63*	Petroleum	18.6	6.7	55.8	81.1
65	Motor Vehicle Tyres & Tubes	4.6	1.9	14.9	21.4
66	Vulcanising & Tyre Retreading	2.5	1.5	6.6	10.6
87	Boat Building & Ship Repairing	1.7	3.6	19.8	25.1
88	Motor Vehicle Assembly	0.5	0.3	176.6	177.4
89	Motorbody Building	0.8	1.3	15.9	18.0
90	Aircraft Manufacture	3.6	14.5	2.5	20.6
91	Transport Equipment NEC	4.6	13.4	25.2	43.2
128	Repair of Motor Vehicles	15.4	10.3	48.6	74.3
	TOTALS	52.3	53.5	365.9	471.7

(*As amended)

Other Ancillary Intermediate and Primary Inputs.

With the above prime component inputs isolated out, the remaining intermediate and primary inputs attributable to ancillary transport are apportioned according to the cost structure of the official road freight transport industry[9] (pro rata on the basis of vehicle sales shown in the final demand column, Gross Fixed Capital Formation). Unfortunately, this procedure does not provide an adequate assessment of all remaining ancillary transport expenditure, namely sales directly to final demand, and for this reason the following inputs are given further attention in the areas noted.

Row/Column No.	Industry/Input	Notes
102	Civil Engineering	Capital inputs (GFCF) only
104	Wholesale and Retail Trade	Household Comsumption only.
115	Financial Institutions and Services	Household Consumption only.
116	Insurance	Household Consumption only.
121	Public Administration	Balance of Ministry of Transport Road Transport Division Expenditure.
133) 134)	Indirect Taxation	Final Demand only.
139	Imports	As required.
140	Import Duty	As required.

Ancillary Road Transport Expenditure in Intermediate Demand

The transaction table for GFCF in 1971-72[10] shows that out of $83.4m sales to GFCF by the motor vehicle assembly industry (Ind.85), $11.3m were for the official road freight industry, $8.1m were for other official transport industries, and the remaining $64.0m were purchases for ancillary transport operations (Note, not including private motor vehicles). Total expenditure on inputs to the road freight transport

industry came to $225.1m 1971-72[11], $16.9m of which were inputs from the nine prime component industries isolated above. The remaining $208.2m therefore represents expenditure on other intermediate and primary inputs. Since investment on new vehicles in 1971-72 for the ancillary road freight transport industry was

$$\left(\frac{\$64.0m}{\$11.3m} = \right) \quad 5.66 \text{ times that of similar investment in}$$

official transport operations, the corresponding expenditure on other intermediate and primary inputs is assessed to be (5.66 x $208.2m = $1,179.2m). On a similar basis to purchases of prime component inputs, this estimate is allocated between intermediate and final demand sales according to the sales of each industry investing in new vehicles[12]:

Intermediate Demand Sales	$ 573.1m
Final Demand Sales	$ 606.1m
TOTAL	$1,179.2m

Civil Engineering

Output of the civil engineering industry (Ind. 102) includes the construction of roads, bridges, tunnels, wharves, aerodromes, etc. Although intermediate demand for the output of this industry is included in intermediate expenditure by the official industry ($81.5m) and accounts for all intermediate expenditure on civil engineering that can be reasonably attributed to transport operations, final demand expenditure is shown separately under gross fixed capital formation. Expenditure on transport investment in this category is shown as at $79.4m[13].

Wholesale and Retail Trade

A large proportion of this industry's output is in the margin on sale of motor vehicles and associated services; in particular, motor vehicle sales and petrol sales to the final demand category, household consumption. The proportionate assumption applied for other intermediate and primary inputs above is considered appropriate as an estimate for intermediate sales, however the significance of final demand sales, that is by motor vehicle dealers (new and second hand), petrol stations, and motor vehicle parts and accessories store types, justified further attention.

Census of Distribution Statistics (Statistics, 1975) for 1972-73 show trade by the various retail store types, including those noted above. The proportion of value-added[14] contributed by the selected store types (19 percent) was considered an appropriate measure of their contribution to the output of wholesale and retail trade going to household consumption[15], namely:

$768.9m x 0.19 = $146.1m

Financial Institutions and Services

The provision of hire purchase for motor vehicles is a significant component of the services provided by the financial institutions and services industry. Hire purchase finance for motor vehicles represented approximately 55 percent of total hire purchase agreements made in 1971-72.[16] Household consumption (CPI) purchases from this industry were $18.0m of which ($18.0m x 0.55) $9.9m is assumed to represent services for ancillary transport.

Insurance

A similar procedure is adopted for the insurance industry. Third party insurance and motor vehicle comprehensive insurance represented approximately 18 percent of premium and claims action in 1971-72[17]. Applying this percentage to the value of insurance services purchased by households ($45.7m) suggests that expenditure in the order of $8.2m can be attributed to motor vehicle insurance.

Public Administration

The relevant expenditure item under this heading is Ministry of Transport expenditure. Large components of this expenditure are already accounted for within the official transport industry transactions group (vis. all Civil Aviation Division, Marine Division, Harbours and Foreshores section, and some aspects of the Road Transport Division such as expenditure on the MOT testing stations), whereas the balance of Road Transport Division expenditure ($10.9m) is identified from public expenditure accounts for the period[18]. All of this expenditure is allocated to the government services category of final demand consumption.

Indirect Taxation

The Motor Industry Year Book[19] provides an estimate of total motor vehicle taxation in 1971-72 of $202.5m (excluding Customs Duty on motor vehicles and parts).

Of this, approximately $16.0m is accounted for in indirect taxation expenditure by the official road freight transport industry and from this

$$\left(\frac{64.0}{11.3} \times \$16.0m = \right) \quad \$90.6m$$

is estimated to represent indirect taxation expenditure in intermediate demand for ancillary transport[20]. This estimate is allocated over intermediate and final demand in proportion to the total sales of ancillary road transport estimated earlier.

The balance ($95.9m) of indirect taxation outstanding is accredited to final demand expenditure.

Imports and Import Duty

Finally, a very important category of expenditure, as an input to both intermediate and final demand, is expenditure on imported transport services and components, and the indirect tax (import duty) attached to such expenditure. Some of this expenditure has already been accounted for in the preceeding analysis, namely:

(a) as an input to the official transport industries and therefore included in the value of their sales to intermediate and final demand. Expenditures on imports and import duty in this category are shown in the transactions table[21] as $56.0m on imports and $0.4m on import duty;

(b) as an input to the prime component industries of which $181.7m is shown as expenditure on imports, and $6.4m is shown as expenditure on import duty; and

(c) as an input to ancillary road transport operations assessed on a proportionate basis as $30.0m on imports, and $1.1m on import duty.

For the remaining expenditure on imports and import duty into intermediate demand, and for similar expenditure (as yet unassessed) into final demand, however, Table 3 in the inter-industry publication provides a breakdown of imports across the board. From Table 3, items 49 - transport equipment, 58 - sea transport, 59 - port disbursements, and 60 - air transport, are selected as expenditure on transport related imports, in addition to the transport component of the CIF value of imports not accounted for in the preceding analysis.

Table 6 below, summarises expenditure on these items according to intermediate and final demand categories with, in the case of intermediate demand, expenditure on (a), (b) and (c) above excluded. Customs duty is apportioned on the basis of proportionate sales of transport equipment imports to various categories of intermediate and final demand, multiplied by an estimate of customs duty collected from such imports (i.e. $24.0m) in 1971-72[22].

The freight component of the CIF value of imports shown in Table 3 of the inter-industry publication is an extremely difficult value to estimate; requiring as it does information on both the country of origin of each commodity imported and the freight rate applicable for each commodity imported at the time. Chudleigh (1980) uses a "rule of thumb" of 10 percent of the CIF value of imports to estimate the import freight bill in 1979-80. For convenience, we apply the same "rule of thumb" in the current exercise.

The total CIF value of imports for 1971-72 was $1,497.9m[23]. Of this (a), (b) and (c) noted on page 16 are subtracted as are the total sales shown below in Table 6 under the headings of Transport Equipment through to Air Transport. 10 percent of the balance ($1,044.8m) results in a freight component value of imports of $104.5m and is allocated over intermediate and final demand according to the sales of output to each category for each of the industries concerned.

TABLE 6

Additional Expenditure on Imports, Import Duty and Freight

	Intermediate Sales ($m)	Final Sales ($m)	Total Sales ($m)
Transport Equipment	4.7	96.5	101.2
Sea Transport	7.5	28.6	36.1
Port Disbursements	0.5	0.8	1.3
Air Transport	9.0	37.8	46.8
Freight Component of CIF	23.0	81.5	104.5
TOTAL 'Transport' Imports	44.7	245.2	289.9
Customs Duty (on transport equipment)	1.1	22.9	24.0

Consolidation

Table 7 draws together the above analysis in terms of expenditure on the 'official' industry in intermediate (T_1i) and final (T_1f) demand categories, and expenditure on the ancillary industry in intermediate (T_2i) and final (T_2f) demand categories.

TABLE 7

Summary of Official and Ancillary Transport Sales

		T^i ($m)	T^f ($m)	T^{i+f} ($m)
T_1	Official Industry	378.3	372.6	750.9
T_2	Ancilliary Industry: Prime Components	52.3	365.9	418.2
	Road Ancillary	573.1	606.1	1,179.2
	Civil Engineering		79.4	79.4
	Wholesale & Retail Trade		146.1	146.1
	Financial Inst.		9.9	9.9
	Insurance		8.2	8.2
	MOT Balance		10.9	10.9
	Indirect Taxation		95.9	95.9
	Transport Imports	44.7	245.2	289.9
	Import Duty	1.1	22.9	24.0
	(T_{1+2})	1,049.5	1,963.1	3,012.6

For the year ended March 1972 national accounts estimates of expenditure on gross domestic product, excluding imports of goods and services (i.e., aggregate final demand expenditure), came to $8,400.0m. Final demand expenditure on transport represents, therefore,

$$\left(\frac{\$1,963.1m}{\$8,400.0m} \times 100 = \right) \quad 23 \text{ percent of gdp.}$$

Of this estimate, $\left(\frac{\$\ 372.6m}{\$8,400.0m} \times 100 = \right)$ 4 percent represents expenditure on official transport services, and the balance of 19 percent represents ancillary transport services.

THE 1976-77 INTER-INDUSTRY STUDY

The preceding analysis is repeated for 1976-77, using as yet unpublished data from the 1976-77 inter-industry study programme. The authors stress, however, that the estimates are highly provisional and can be confirmed only on release of the full 130 industry transactions table for the period.[24]

Table 8 summarises estimates of official and ancillary transport expenditure in 1976-77 on a comparable basis to that shown in Table 7.

TABLE 8

Summary of Official and Ancillary Transport Sales

		T^i ($m)	T^f ($m)	T^{i+f} ($m)
T_1	Official Industry	867.4	867.4	1,734.8
T_2	Ancillary Industry:			
	Prime Components	134.7	942.4	1,077.1
	Road Ancillary	913.8	966.4	1,880.2
	Civil Engineering		124.7	124.7
	Wholesale & Retail Trade		374.7	374.7
	Financial Institutions		17.5	17.5
	Insurance		17.0	17.0
	MOT Balance		33.3	33.3
	Transport Imports	148.1	665.5	813.6
	Import Duty	1.6	34.3	35.9
	(T_{1+2})	2,065.6	4,043.2	6,108.8

For the year ended March 1977 national accounts estimates of expenditure on gross domestic product, excluding imports of goods and services, came to $18,040m. Final demand expenditure on transport represents, therefore,

$\left(\frac{\$\ 4,043.2m}{\$18,040.0m} \times 100 = \right)$ 22 percent of gdp

Of this estimate, $\left(\frac{\$\ 867.4m}{\$18,040.0m} \times 100 = \right)$ 5 percent

represents expenditure on official transport services, and the balance of 18 percent represents ancillary transport services.

CONCLUSION

SUMMARY

This paper estimates total expenditure on transport as a proportion of total final demand for the economy using published input-output tables for 1971-72 and provisional input-output data for 1976-77. Total expenditure on transport (both internal and external) is assessed to be 23 percent and 22 percent, respectively, of total final demand expenditure for 1971-72 and 1976-77.

The study focuses on a detailed picture of transactions in the economy using published input-output tables at the 130 industry level. Sales or output from each industry are shown as table rows, and expenditure on inputs to each industry are shown as columns.

Using this framework, official transport sales are first identified and are attributed to either intermediate demand (T_1i) or to final demand (T_1f). Second, all other forms of transport expenditure are identified and are attributed to the general category referred to as "ancillary transport" (namely, the value of this operation in both intermediate demand (T_2i) and final demand (T_2f)).

The bulk of the analysis relates to this definition of ancillary transport and draws heavily on the symmetry of input-output tables (i.e. total expenditure on inputs to industry i equals total output from industry i). By identifying total expenditure on transport, therefore, the value of total transport output can be assessed; excluding inputs absorbed by the official transport sector (i.e. Major Division 71 "Transport and Storage" of the New Zealand Standard Industrial Classification) leaves a balance identified as expenditure on ancillary transport.

A number of approaches are adopted to define expenditure on transport operations. With each approach careful attention is given to excluding expenditure items already assessed.

First, a number of industries whose sole or predominant reason for existance is to enable transport operations (eg. the motor vehicle assembly industry) are identified and the sales of these industries (net of sales to the official transport sector) are recognised as inputs to ancillary transport operations.

Second, the expenditure pattern of the official road transport industry is used to approximate ancillary road transport expenditure by using a multiple of new vehicle investment in each category. This procedure provides an estimate of additional operating and overhead expenses peculiar to ancillary transport activity engaged in by production sectors in the economy.

Third, predominantly final demand components of ancillary transport expenditure (particularly relevant when referring to expenditure in terms of gross domestic product) are given further attention, and in this category final demand consumption of outputs from civil engineering, wholesale and retail trade, financial institutions and services, insurance and public administration are examined.

Finally, a very important category of expenditure, expenditure on imported transport services, components and associated import duty is assessed and is allocated to intermediate and final demand as appropriate.

Table 12 summarises expenditure under the two categories of transport for the inter-industry study years 1971-72 and 1976-77.

TABLE 9

Summary of Transport Expenditure for 1971-72 and 1976-77

Transport Category	Expenditure ($m)					
	1971-72			1976-77		
	Intermediate	Final	Total	Intermediate	Final	Total
Official	378.3	372.6	750.9	867.4	867.4	1,734.8
Ancillary :						
Prime Components	52.3	365.9	418.2	134.7	942.4	1,077.1
Road Ancillary	573.1	606.1	1,179.2	913.8	966.4	1,880.2
Civil Engineering... (etc)	-	350.4	350.4	-	567.2	567.2
Imports & Import Duty	45.8	268.1	313.9	149.7	699.8	849.5
TOTAL TRANSPORT	1,049.5	1,963.1	3,012.6	2,065.6	4,043.2	6,108.8

Table 13 summarises final demand expenditure on transport in terms of total final demand expenditure for the two study years.

TABLE 10

Transport Expenditure in Terms of Total Final Demand Expenditure

	1971-72 %	1976-77 %
Official Transport	4	5
Ancillary Transport	19	18
Total Transport	23	22

Over this period the ratio of official to ancillary services has increased from approximately 19:81 for 1971-72 to approximately 21:79 for 1976-77.

COMMENT

The approach adopted in this paper, and summarised above, is an attempt to prepare a tally of transport expenditure moving from explicit transport services to transport services implied by consumption of goods and services generally associated with transport.

Throughout the exercise every endeavour has been made to identify unambiguous items of transport expenditure. To this extent, therefore, the estimates probably underate full expenditure on transport in the economy. Take the private car for example. Published estimates prepared by this Ministry and others present an array of running and standing charge cost elements which, while substantially represented in the costs identified in this paper, cover items such as garaging costs, cost of driver's time, automobile association fees, etc, not included in the analysis. Because of this the authors feel confident that the estimates, while significant, remain conservative.

The assessment of expenditure on ancillary transport serves to highlight the significance of this category of transport in the sector. Over the five year period 1972 to 1977 the magnitude of this category vis a vis total transport has dropped slightly from 81 percent to 79 percent. This drop may merely reflect the speculative nature of 1976-77 estimates compared to those based on published input-output tables for 1971-72. On the other hand, the drop may indeed indicate some structural readjustment in the industry following the first waves of the 1973 oil crisis; if so, an update of these estimates following the second wave of imported oil price hikes in 1978 would be desirable.

The accuracy of the expenditure estimates for ancillary transport services can be traced through the major components of the exercise - the sensitivity of the assumptions used suggests areas of further research. An examination of Table 9 above shows that the approach used to derive ancillary road freight transport expenditure has a major influence on the total estimate of expenditure (around one quarter of the total estimate). Closer attention to the validity of this approach is therefore an important area of further research (for example, see footnote 12 to this paper). In comparison, some of the more arbitrary assumptions adopted in areas such as financial institutions and insurance services are far less critical to the final result.

Finally, the results of the exercise have a number of important implications for transport planning, and any assessments based solely on an "official" definition of the industry size and structure. From a planning point of view, labour, capital and other economic resources committed to transport must be viewed in the context of <u>total</u> transport, whether or not public administration of the industry concentrates on a much smaller definition.

FOOTNOTES

[1]The term 'official statistics' in this sense refers to those classified as major division 71 - Transport and Storage - in the New Zealand Standard Industrial Classification (NZSIC).

[2]Gross Domestic Product (gdp) measures total income generated in the economy. Gross National Product (gnp) measures this income net of interest, profits and other forms of transfer accruing to non residents.

[3]The authors are grateful for the assistance of Mr I.R. Gordon of the Department of Statistics in this respect. The 1976-77 Inter-Industry Study data used in the analysis is provisional, and the authors take full responsibility for the interpretation applied to both the published 1971-72 and provisional 1976-77 data.

[4]Statistics, 1980, op cit, p.6.

[5]Statistics, 1979, p.83.

[6]For a more detailed explanation of the differing treatments between Inter-Industry analysis and the SNA analysis the reader is referred to: Department of Statistics bulletin, Provisional New Zealand Input-Output Tables 1976-77; and N.Ruth, The New System of National Accounts (SNA). Both references are listed in the Bibliography to this paper.

[7]Statistics, 1980, op cit, Table 1, pp 75-76.

[8]ibid, Table 3, p.104.

[9]Inclusion of the road passenger transport industry in the estimation procedure was considered a distortion in view of the peaking phenomenon associated with public transport operations.

[10]Statistics, 1980, op cit, Table 2, p.78.

[11]ibid, Table 1, p.49.

[12]Alternative factors to base this proportionate assumption would have been vehicle stock or vehicle depreciation for each industry vis a vis the official road freight industry. The three factors (investment, stocks and depreciation) are of course interdependent. Implicit in the use of these factors is the assumption that the capital maintenance programme between official and ancilliary fleets is similar; certainly, a preview of 1976-77 input-output data shows the investment ratio (ancillary/official) to be constant. Investment was chosen because it was readily available from the published transactions table. Stocks and depreciation data on the other hand would have required a more complex investigation, such as reviewing stocks and depreciation data over the whole range of production censuses and adjusting to base years corresponding to this study. It remains an interesting question, however, whether the capital maintenance programme is similar, and this could form the substance of further study.

[13]Statistics, 1980, op cit, Table 2, p.78.

[14]Value-Added = total trading income - total trading expenditure.

[15]Although the census data referred to does not coincide with the 1971-72 inter-industry year under consideration, 1972-73 was considered preferable to data for the preceding census of Distribution held in 1967-68.

[16]Statistics, 1975, op cit, p.583.

[17]Statistics, 1973, p.851.

[18]Ministry of Transport, 1973.

[19]New Zealand Motor Trade Federation, 1977, p.142.

[20]Motor vehicle purchases are again used as the factor for apportioning indirect tax to official and ancillary transport intermediate demand.

[21]Statistics, 1980, Table 3, p.104.

[22]New Zealand Motor Trade Federation, 1979, p.137.

[23]Statistics, 1980, op cit, Table 3, p.104.

[24]This caution applies in particular to the split between intermediate and final demand for the output of the selected industries. In the absence of a full industry transactions table, sales to intermediate and final demand are apportioned on the basis of commodity sales to each category. In some instances commodities produced by the selected industries were not unique to those industries and this factor may lead to some distortions - the extent to which will not be known until the full transactions table is available (possibly early in 1983).

In view of this difficulty it was not considered practical to isolate the individual industry components within the official and prime component industry aggregations, particularly as this level of detail is not required for the current investigation.

A further problem arose with respect to indirect taxation. The published transactions table for 1971-72 enabled an estimate of indirect taxation on transport services to be derived. However, the 1976-77 data available was not defined in sufficient detail to provide such estimates and therefore indirect tax is incorporated in the value of transactions estimated under each transport heading. Although the aggregate figure used to estimate expenditure on transport in gdp is not affected, any comparison between transactions in 1971-72 and 1976-77 using Tables 7 and 8, respectively, should be approached with caution.

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GLOSSARY OF TERMS

Ancillary Transport - Transport operations not included within major division 71 "Transport and Storage" of the New Zealand Standard Industrial Classification (NZSIC). Transport services within this category include "own account" operations of a firm, and private transport consumed by households.

Dummy Industry - A fictitious industry introduced in the SNA methodology to provide for residual expenditure not included in the 25 sectors defined for deriving national accounts.

Final Demand - The consumption of a sector's net output together with primary inputs as expenditure under the national aggregates : household consumption (C); local and central government (G); investment and stock change (I); and exports (X).

G.D.P. - Gross Domestic Product - A measure of the total flow of goods and services produced by the economy over a particular time period, normally a year.

G.N.P. - Gross National Product - A measure of national productivity net of interest, profits and other forms of transfer occuring to non-residents which are included in the measure of domestic productivity (GDP).

Intermediate Demand - The consumption of intermediate and primary inputs as factors of production.

Official Transport - Transport operations defined under major division 71 "Transport and Storage" of the N.Z.S.I.C.

Own Account - A firm's transport activities for promoting operations in a field of economic activity other than hire or reward for transport services. Vehicles and facilities involved are used solely for transporting the firm's personnel and produce.

SNA - The New Zealand System of National Accounts for measuring overall economic activity. It relies on estimates of production derived from surveys of the relevant transactions of 25 production sectors, including four "non-market" sectors to cover public services and non-profit activities.

Value-added - Alternatively referred to as net output, is the difference between total revenue of a firm, and the cost of bought-in raw materials, services and components. It thus measures the value which the firm has added to these bought-in materials and components by its processes of production.