

CANADIAN INTERNATIONAL TRADE
1930 - 1973

Showing the Position of Commodity
Groups Classified by Technological
Content

G. H. O. (Dines)
K. Bochert

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SUMMARY

This study makes an analysis of Canadian international trade in a form designed to bring out the influence of technology in this field. Total commodity trade has been divided into four groups:

- Group 1 Agricultural products, drink and tobacco;
- Group 2 Raw Materials;
- Group 3 Manufactured goods of a low technology content;
- Group 4 Manufactured goods of a higher technology content.

Over the period reviewed, 1930 to 1973, Group 4 products have increased in relative importance and now dominate Canadian foreign trade. In 1973 they accounted for 34.7 percent of exports and 58.8 percent of imports. This resulted in an unfavourable balance in these products of \$5.1 billion, compared with the overall favourable balance of \$1.3 billion.

CONCLUSION

Any action which will strengthen the technical competitive position of the Canadian industries producing these products will have a profound effect on the overall balance of Canadian international trade. The position could be improved either by replacing imports or by expanding exports, or by a combination of the two.

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CANADIAN INTERNATIONAL TRADE 1930-1973

Showing the Position of Commodity Groups Classified by Technological Content

The purpose of this paper is to examine those changes which have taken place in Canadian foreign trade over a long time period which are of significance for the formation of science and technology policy. For this purpose foreign trade has been divided into four groups. The first group includes agricultural products, both crude and manufactured foodstuffs, tobacco and drink. The second group is composed of raw materials either as extracted or very simply worked. For example, it includes mineral ores and concentrates but not primary metals, natural fibres but not yarn and lumber but not wood pulp. The third group is made up of manufactured goods in which the technology content is relatively low. This has been taken to include primary metals and the simpler metal manufactures. It includes, too, items such as textiles, pulp and paper, leather and rubber manufactures. The fourth group contains all those items in which technology plays a more important part in their design or production. The decision as to which products to allocate to this group is necessarily arbitrary. It has been influenced by subjective judgements. The group not only contains the products of those industries which are known to be at least moderate investors in research and development but also those which it was thought could benefit from such an effort. It includes all the products of the chemical industry and the petroleum refining industry, all machinery and transport equipment except ships and boats which were included in the third group. It includes, too, electrical and electronic equipment, instruments and control equipment. A fuller list of items included in each group is given in the appendices.

It will be appreciated that the division, particularly between the items allocated to the last two groups, has been less than perfect. Illogicalities will be apparent from the fuller list in the appendices. These have been dictated by the amount of research effort that could be devoted to the study necessitating the use of the Canada Yearbook for the years up to and including 1970. The Canada Yearbook has often combined items which would otherwise have been placed in different groups. In cases where the values involved were substantial it was possible often to estimate the split, but where the amounts were small or where reasonable estimates were not possible, arbitrary decisions were made. Trade returns were used for 1973.

A further limitation was introduced because the scale of effort which could be applied precluded the adjustment of values to the general trade system. Thus both exports and imports are shown on a f.o.b. basis, as reported in the Canada Yearbook and trade returns.

Despite these shortcomings it is felt that the overall picture which emerges is reliable and not unduly distorted. It ought to provide a useful guide to past trends and give a good basic guide to the way that Canadian foreign trade has been developing in the categories selected. Because trends of this type take a considerable time to develop, the period surveyed has been made to extend from 1930 to 1973. An analysis was made of trade at each five-year interval during the period 1930 to 1970. The year 1973 was added to bring the survey up to date.

Total Canadian foreign trade in commodities, imports plus exports, amounted to \$2.4 billion in 1930. It fell heavily during the depression. It had not recovered fully even by the end of the first year of World War II and was still only \$2.3 billion in 1940. In the next five years it more than doubled to \$4.8 billion in 1945. After the war the rate of growth slackened somewhat but was still substantial. 1950 showed a 31.0 percent gain over 1945 to reach \$6.3 billion, and a further 42.9 percent gain was registered in 1955 when total trade reached \$9.0 billion. In the late 1950's there was some easing in the pace of growth and 1960, at \$10.8 billion, was only 19.6 percent higher than in 1955. Subsequently the growth resumed a rapid acceleration and total trade in 1965 was 59.5 percent above that of 1960. 1970, at \$30.4 billion, was 77.2 percent above that of 1965. In 1973 it reached \$48.0 billion.

Canada was a net importer of merchandise in 1930 to the extent of \$128 million, which represented 5.4 percent of total merchandise trade. By 1935 the position had changed drastically and net exports, \$234 million, amounted to 18.3 percent of the greatly reduced total merchandise trade. By 1945 net exports had grown to \$1.6 billion, or 34.0 percent of total trade. Wartime conditions gave a great impetus to all Canadian exports and while net exports of Group 1, agricultural products, had a \$913 million increase most in absolute terms, net exports of manufactures, both of Group 3 at \$501 million and of Group 4, at \$281 million, showed even greater relative gains. It is of particular interest to see that exports of Group 4 products, \$699 million, amounted to 21.7 percent of total exports, a proportion which was not equalled in the series of years examined until 1970. By 1950 Canada had reverted to a marginal net import position. Exports of Group 4 products fell to \$298 million, under 43 percent of their value in 1945. Imports of Group 4 products on the other hand had risen by more than 160 percent to reach a net import position of \$792 million. Thus in 1950 total trade in Group 4 products had grown to a level where it exceeded total trade in all merchandise only fifteen years earlier by a substantial margin. This is all the more remarkable when it is remembered that total trade in Group 4 products formed less than 13 percent of total trade in all merchandise in 1935. Canada remained a small net importer overall during 1955, 1960 and 1965 but regained a favourable balance in 1970 when net exports, at \$2.5 billion, amounted to 8.3 percent of total trade. The position had deteriorated somewhat by 1973 when the favourable balance fell to \$1.3 billion and net exports amounted to no more than 2.8 percent of total trade. The importance of Group 4 products increased markedly over this period. In 1955 they represented 26.9 percent of total trade; by 1973 they had advanced to 46.4 percent. In the latter year they amounted to 58.8 percent of imports but only 34.7 percent of exports. Thus there was an imbalance in trade in this group of \$2.4 billion at a time when the total imbalance amounted to \$2.5 billion. By 1973 total exports had increased by almost a half compared with 1970, but imports increased by just over two-thirds. As a result the net export balance fell from \$2.5 billion to \$1.3 billion. This was brought about partly by a decline of \$923 million in the balance of Group 3 products but principally by a massive decline, amounting to \$2.8 billion, in the balance of trade in Group 4 products. These declines far more than outweighed the modest gain of \$616 million in Group 1 products and the substantial improvement of \$1.9 billion in the trade in Group 2 products.

By 1973 total exports had risen to a level of some 22 times that of 1930. Whereas in 1930 exports of Group 1 products dominated the picture, accounting for 40.2 percent of the total, by 1973 they had become the smallest group, accounting for only 14.6 percent. Group 3 products were the second in value in 1930 representing 29.7 percent of the total. In the intervening years they rose to a peak of 44.8 percent in 1955 but their proportion of the total fell steadily thereafter and the group became the second smallest in 1973, when they formed only 24.8 percent. Group 2 products were the second smallest of the groups in 1930 when they formed 21.9 percent of the total. Subsequently their share declined heavily until in 1945 they formed no more than 7.4 percent of the total. Since 1945 they have increased in relative importance again and by 1973 they reached 25.9 percent of the total making them the second largest in terms of value. Group 4 products formed the smallest group of exports in 1930 when they amounted to only 8.2 percent. They fell even further, to 6.8 percent in 1935, during the depression, but rose during World War II to 21.7 percent in 1945. After the war they declined once more to 9.6 percent in 1950 but recovered slowly to 11.0 percent in 1960. Since 1960 they have increased rapidly in importance and in 1973 they came to represent 34.7 percent of all exports making them easily the largest group.

EXPORTS (Percent)

	<u>1930</u>	<u>1973</u>
Group 1	40.2	14.6
Group 2	21.9	25.9
Group 3	29.7	24.8
Group 4	8.2	34.7
TOTAL	100.0	100.0

Over the same period, 1930 to 1973, imports rose a little over eighteen and a half times. In 1930 Group 3 products were, by value, easily the most important. They formed 36.0 percent of the total value. They increased somewhat to 39.9 percent in 1945 but subsequently they have followed a generally declining trend and by 1973, although still the second most valuable group, they accounted for no more than 23.5 percent of all imports. Group 4 products were second in value in 1930, accounting for 25.6 percent of the total. Throughout the period they have shown a strong overall tendency to rise and by 1973 they completely dominated imports by forming no less than 58.8 percent of the total. In contrast, imports of Groups 1 and 2 products have always been a minor part of imports. In 1930 they amounted to 19.6 percent and 18.8 percent of the total respectively. Despite some increase in relative importance in some of the intervening years, by 1973 they accounted for only 9.3 percent and 8.4 percent of the total respectively.

IMPORTS (Percent)

	<u>1930</u>	<u>1973</u>
Group 1	19.6	9.3
Group 2	18.8	8.4
Group 3	36.0	23.5
Group 4	25.6	58.8
TOTAL	100.0	100.0

It is not possible for any country to achieve a balance of trade in each group of commodities. Indeed, it is not desirable that it should, for to do so would be to deny itself, or at least severely restrict, its potential benefit from international trade. However, the fact that cannot be ignored is that the long-term trend of Canadian exports of Group 1 products is strongly downward. So, too, was that in Group 2 products until the 1950's when the advent of large-scale Canadian exports of crude fuels changed the picture drastically. If a policy of meeting Canadian energy requirements from domestically produced was to be adopted, the downward trend would probably be resumed. Exports of Group 3 products, the manufactured goods with a lower technological content, have also exhibited a downward trend though a fairly modest one. On the other hand, Group 4 products have shown a strong overall trend to rise and by 1970 represented 35.6 percent of the total. A small relative fall in 1973 still left the group a share of 34.7 percent of the total.

In imports the trends have been even more dramatic. Both Groups 1 and 2 have declined steeply relative to total imports. Those of Group 3 have followed a generally declining pattern also, though less markedly so than was the case of the other two groups. Group 4, on the other hand, has been exceptionally buoyant and reached 59.3 percent of the total in 1970. A slight fall-back in 1973 still left this group accounting for 58.8 percent of the total.

In view of the above, it is not possible to ignore Canada's position in international trade in these products, nor the sector of Canadian manufacturing industry that is responsible for producing them. It is obvious that any advance in output of these products, either to replace some of the imports or to add to the exports, must have an important impact on the overall Canadian balance of payments and on the Canadian standard of living. It is important, therefore, to examine the content of Group 4 in recent years.

In 1965 Group 4 had a net import balance of \$2.9 billion. By 1970 this had improved slightly to \$2.4 billion, but the position declined rather drastically to \$5.1 billion in 1973. Transportation equipment as a whole moved from an unfavourable balance of \$840 million in 1965 to a favourable one of \$1.0 billion in 1973. Road transportation equipment, which had accounted for 13.0 percent of all imports in 1965 rose to 25.8 percent of the total in 1973. Despite the massive increase in exports of this item, which formed 21.2 percent of all exports in 1973 compared with a mere 4.2 percent in 1965, the net trade balance in road transportation equipment fell from a deficit of \$769 million in 1965 to one of \$806 million in 1973. This was disappointing after a favourable balance in these products of \$333 million had been achieved in 1970.

Machinery is an area of considerable importance in Canadian trade. The level of exports has been relatively low, \$322 million in 1965 and \$541 million in 1973. Imports, on the other hand, have been substantial and increasing rapidly in recent years. In 1965 they amounted to \$1.4 billion rising to \$2.8 billion in 1973. Thus in 1973 the adverse balance in machinery, \$1.9 billion, compares with the \$806 million for road transportation equipment. Communication equipment is another area where Canada's

position is weak and deteriorating. In 1965 the adverse balance was \$109 million; by 1973 it had become \$511 million. Medical and pharmaceutical products followed a somewhat similar course but at a rather lower level. Their adverse balance grew from \$45 million in 1965 to \$165 million in 1973. In the group "other products", a group which contains a wide variety of products not included under any of the other sub-headings, the position deteriorated also. The group had a net import balance of \$542 million in 1965. By 1973 this had increased to \$1.4 billion. Alone among the Group 4 products, chemicals showed some improvement, although a net import position was maintained. In 1965 net imports were \$264 million but by 1973 they had declined to \$183 million.

G. H. O. Dines
April 3, 1974

TABLE I

VALUE OF CANADIAN TRADE BY GROUP
1930-1973 (\$Millions)

Year	Group	Exports	Imports	Net Exports	Net Imports
1930	1	450.8	244.0	206.7	-
	2	245.9	234.8	11.1	-
	3	332.1	449.5	-	117.4
	4	91.5	319.9	-	228.4
Total		1,120.3	1,248.3	-	128.0
1935	1	278.3	106.7	171.6	-
	2	104.9	140.3	-	35.4
	3	322.2	163.8	158.4	-
	4	51.2	111.7	-	60.5
Total		756.6	522.4	234.2	-
1940	1	341.3	135.0	206.3	-
	2	210.4	263.7	-	53.4
	3	490.2	393.6	96.6	-
	4	137.1	289.6	-	152.5
Total		1,179.0	1,082.0	97.0	-
1945	1	1,147.3	234.6	912.7	-
	2	238.8	300.4	-	61.6
	3	1,133.4	632.6	500.9	-
	4	698.8	418.2	280.6	-
Total		3,218.3	1,585.8	1,632.6	-
1950	1	941.5	470.3	471.2	-
	2	541.6	645.5	-	104.0
	3	1,336.9	968.0	368.9	-
	4	298.4	1,090.5	-	792.0
Total		3,118.4	3,174.3	-	55.9
1955	1	955.1	547.8	407.3	-
	2	987.2	678.1	309.2	-
	3	1,919.8	1,484.9	434.9	-
	4	419.6	2,001.6	-	1,582.0
Total		4,281.8	4,712.4	-	430.6
1960	1	1,089.7	681.6	408.1	-
	2	1,362.5	745.9	616.5	-
	3	2,233.3	1,621.9	611.4	-
	4	578.6	2,442.9	-	1,864.3
Total		5,264.1	5,492.3	-	228.3
1965	1	1,859.2	906.7	952.5	-
	2	2,197.3	844.3	1,353.0	-
	3	2,943.6	2,506.1	437.5	-
	4	1,525.0	4,376.1	-	2,851.1
Total		8,525.1	8,633.1	-	108.1
1970	1	2,088.2	1,282.1	806.1	-
	2	3,626.2	1,057.2	2,569.0	-
	3	4,886.8	3,333.6	1,553.2	-
	4	5,872.6	8,266.8	-	2,394.2
Total		16,473.9	13,939.8	2,534.1	-
1973	1	3,606.3	2,184.5	1,421.7	-
	2	6,373.2	1,949.2	4,424.0	-
	3	6,102.6	5,472.4	630.1	-
	4	8,561.5	13,710.7	-	5,149.2
Total		24,643.6	23,316.8	1,326.8	-

SOURCES: Canada Yearbooks and Statistics Canada "Imports by Commodities" (65-007) and "Exports by Commodities" (65-004).

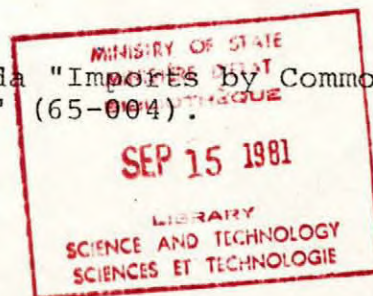


TABLE II
(Appendix "A")

INDICES OF VALUE OF INTERNATIONAL TRADE IN THE GROUPS IN CURRENT DOLLARS (Base 1930 = 100)

Year	EXPORTS					IMPORTS				
	Group 1	Group 2	Group 3	Group	Total	Group 1	Group 2	Group 3	Group 4	Total
1930	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1935	61.7	42.7	97.0	56.0	67.5	43.7	59.8	36.4	34.9	41.8
1940	75.7	85.6	147.6	149.8	105.2	55.3	112.3	87.6	90.5	86.7
1945	254.5	97.1	341.3	763.7	287.3	96.1	127.9	140.7	130.7	127.0
1950	208.9	220.3	402.6	326.1	278.4	192.7	275.0	215.4	340.9	254.3
1955	211.9	401.5	578.1	458.6	382.2	224.5	288.8	330.3	625.7	377.5
1960	241.7	554.1	672.5	632.3	469.9	279.3	317.7	360.8	763.6	440.0
1965	412.4	893.6	886.4	1,666.7	761.0	371.6	359.6	557.5	1,368.0	691.6
1970	463.2	1,474.7	1,471.5	6,418.1	1,470.5	525.5	450.3	741.6	2,584.2	1,116.5
1973	800.0	2,591.8	1,837.6	9,356.8	2,199.7	895.3	830.2	1,217.4	4,285.9	1,867.9

SOURCE: Based on Table I.

TABLE III
(Appendix "A")

PERCENTAGE DISTRIBUTION OF TRADE BY GROUP FOR 1930-1973

YEAR	GROUP I		GROUP 2		GROUP 3		GROUP 4		TOTAL	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
1930	40.2	19.6	21.9	18.8	29.7	36.0	8.2	25.6	100.0	100.0
1935	36.8	20.4	13.8	26.9	42.6	31.3	6.8	21.4	100.0	100.0
1940	29.0	12.5	17.8	24.3	41.6	36.4	11.6	26.8	100.0	100.0
1945	35.7	14.8	7.4	18.9	35.2	39.9	21.7	26.4	100.0	100.0
1950	30.2	14.8	17.3	20.3	42.9	30.5	9.6	34.4	100.0	100.0
1955	22.3	11.6	23.1	14.4	44.8	31.5	9.8	42.5	100.0	100.0
1960	20.7	12.4	25.9	13.6	42.4	29.5	11.0	44.5	100.0	100.0
1965	21.8	10.5	25.8	9.8	34.5	29.0	17.9	50.7	100.0	100.0
1970	12.7	9.2	22.0	7.6	29.7	23.9	35.6	59.3	100.0	100.0
1973	14.6	9.3	25.9	8.4	24.8	23.5	34.7	58.8	100.0	100.0

SOURCE: Based on Table I.

TABLE IV
(Appendix "A")

EXPORTS OF GROUP 4 PRODUCTS
(\$Millions)

<u>Product</u>	<u>1965</u>	<u>1970</u>	<u>1973</u>
Chemicals, etc.	373	656	1,054
Machinery	322	577	841
Transportation Equipment & Parts			
Road	356	3,572	5,221
Aircraft	207	379	414
Other	<u>11</u>	<u>40</u>	<u>164</u>
Total	574	3,992	5,799
Communications Equipment	71	232	301
Medical & Pharma- ceutical Products	15	31	47
Other Products	171	385	519
TOTAL	<u>1,525</u>	<u>5,873</u>	<u>8,562</u>

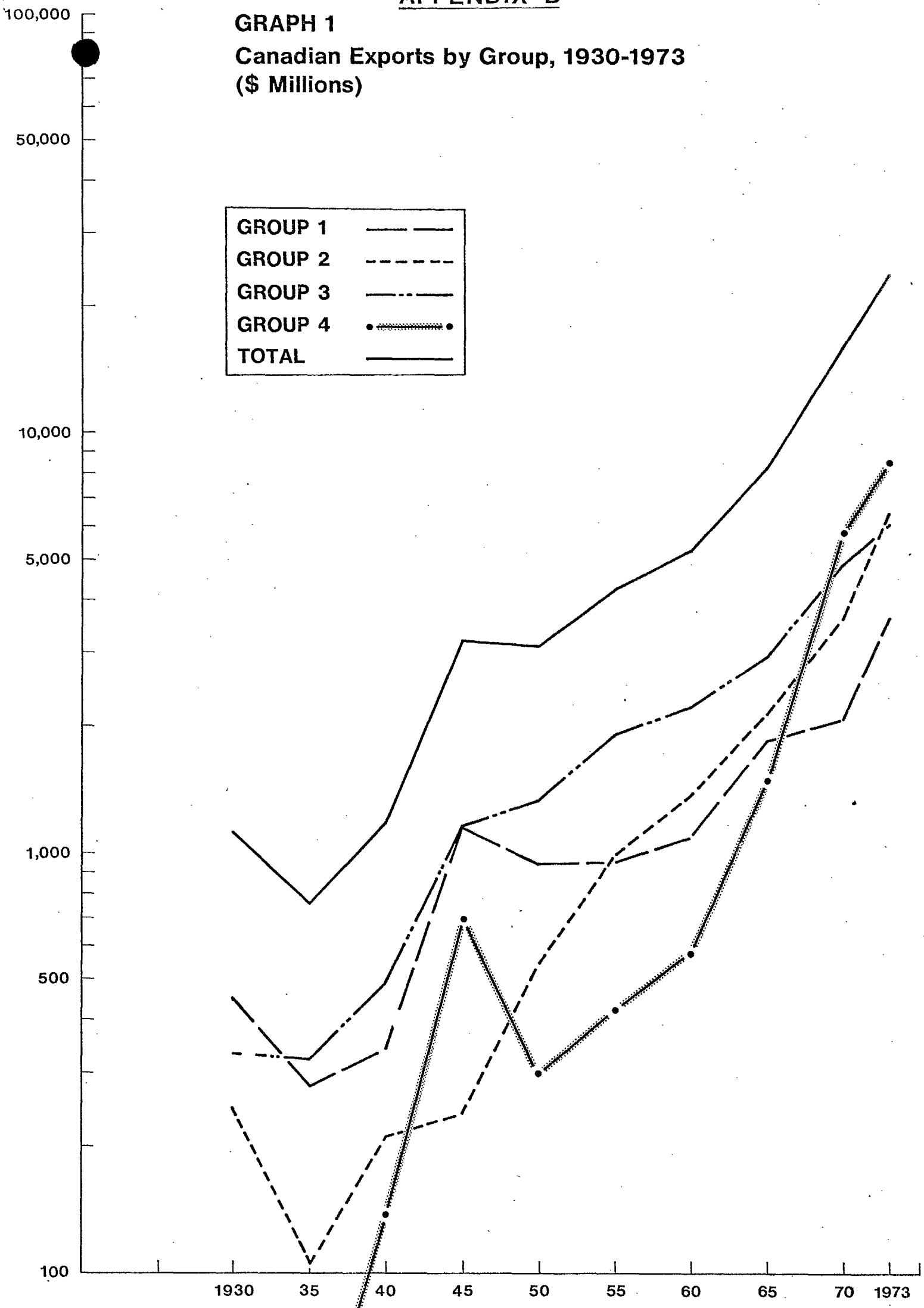
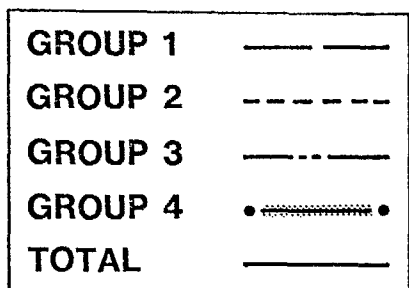
IMPORTS OF GROUP 4 PRODUCTS
(\$Millions)

<u>Product</u>	<u>1965</u>	<u>1970</u>	<u>1973</u>
Chemicals, etc.	637	917	1,237
Machinery	1,372	1,783	2,759
Transportation Equipment & Parts			
Road	1,125	3,239	6,027
Aircraft	206	384	540
Other	<u>83</u>	<u>133</u>	<u>235</u>
Total	1,414	3,757	6,802
Communications Equipment	180	379	812
Medical & Pharma- ceutical Products	60	140	212
Other Products	713	1,291	1,888
TOTAL	<u>4,376</u>	<u>8,267</u>	<u>13,711</u>
<u>NET IMPORTS</u>	<u>2,851</u>	<u>2,394</u>	<u>5,149</u>

SOURCE: Statistics Canada "Imports by Commodities" (65-007)
and "Exports by Commodities" (65-004).

APPENDIX B

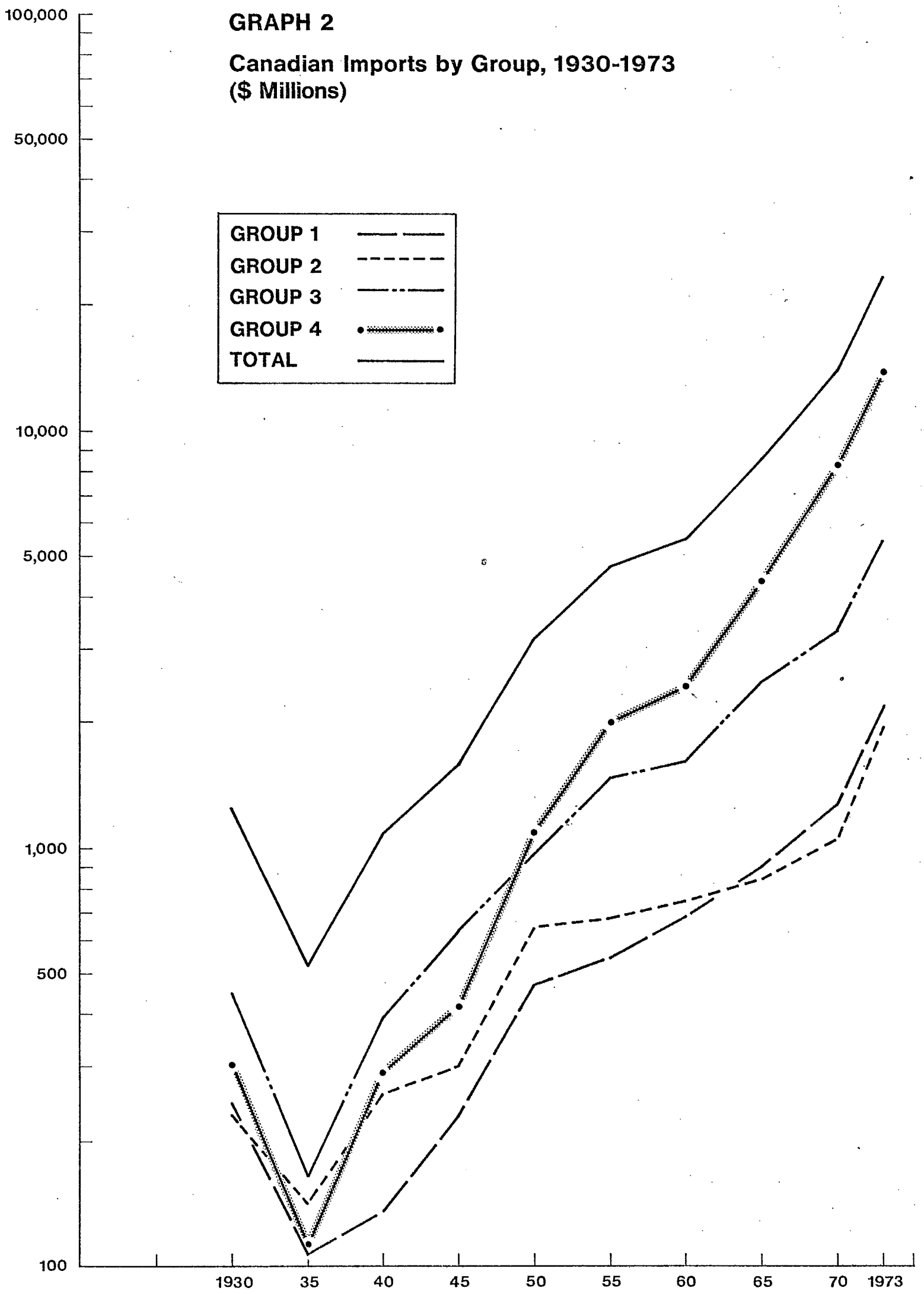
GRAPH 1
Canadian Exports by Group, 1930-1973
 (\$ Millions)



APPENDIX B

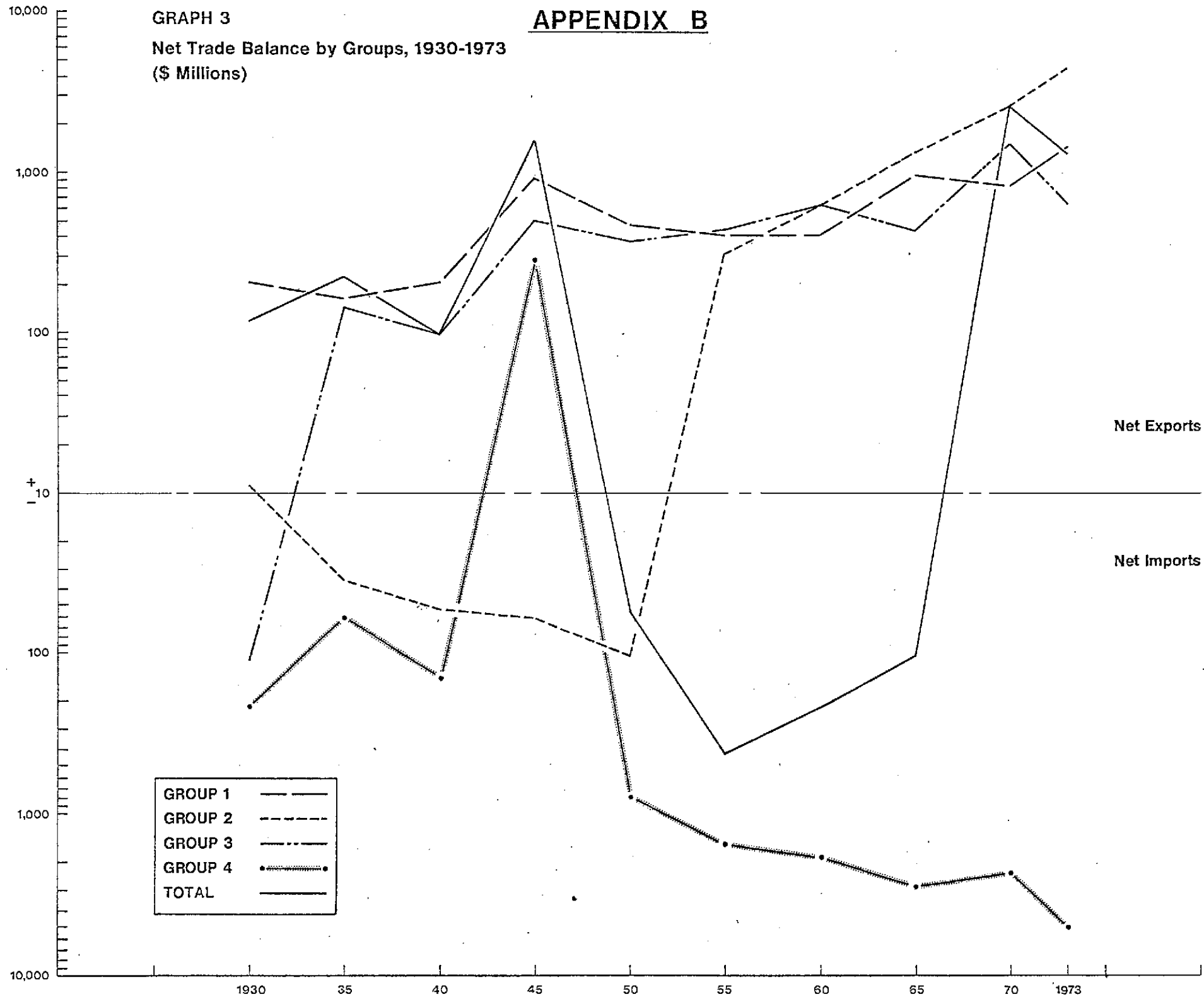
GRAPH 2

Canadian Imports by Group, 1930-1973
(\$ Millions)



APPENDIX B

GRAPH 3
Net Trade Balance by Groups, 1930-1973
(\$ Millions)



APPENDIX C

COMPONENTS OF GROUP 1

Agricultural and Vegetable Products:

- | | |
|-------------------|--|
| Mainly Food - | Fruits and Fruit Preparations
Vegetables and Vegetable Preparations
Nuts
Grains and Grain Products
Sugar and Sugar Products
Tea, Coffee, Cocoa, Spice and Allied Products |
| Other than Food - | Alcoholic and Non-Alcoholic Beverages
Gums and Resins and Allied Products
Oil Cake and Meal
Seeds
Tobacco
Fodders and Allied Products
Plants, Trees and Allied Elements
Inedible Agricultural and Vegetable
Oils or Products |

Animal and Animal Products:

- Live Animals
- | | |
|-------------------|---|
| Animal Products - | Bones, Horns and Hooves
Fish, Fishery Products and Other
Marine Products
Meats and Meat Preparations
Oils, Fats, Greases, Waxes, Extracts
and Derivatives
Dairy Produce, Eggs, Honey and Other
Animal Products |
|-------------------|---|

COMPONENTS OF GROUP 2

Agricultural Products:

- | | |
|----------|--|
| Rubber - | Raw and Waste
Recovered, Powdered and Substitutes |
|----------|--|

Animal Products:

- | | |
|-------------------------|-----------------------------|
| Furs and Fur
Skins - | Undressed or Unmanufactured |
| Hair and Bristles | |
| Hides & Skins - | Undressed or Raw |
| Leather - | Unmanufactured |

Fibres & Textiles:

- | | |
|--------------------------|--|
| Cotton - | Raw and Unmanufactured (Including Linters)
Rags and Waste |
| Flax, Hemp
and Jute - | Raw and Unmanufactured |
| Silk - | Raw and Unmanufactured |

GROUP 2Fibres and Textiles (continued):

Wool - Raw and Unmanufactured
Noils and Worsted Tops
Rags and Waste

Mixed Textile
Products - Rags and Waste

Wood, Wood Products and Paper:

Wood - Unmanufactured:
Logs, Lumber, Poles, Veneers,
Pulpwood, Plywoods, etc.

Paper - Waste and Mutilated - all kinds

Iron and Iron Products:

Iron - Unmanufactured:
Ore, Scrap Iron or Steel

Non-Ferrous Metals and Products:

Metallic Ores
& Concentrates - Aluminum:
Alumina, Bauxite, Cryolite and Scrap

Brass:
Old and Scrap

Copper:
Ores, Blister and Scrap

Lead:
Ores, Concentrates and Scrap

Nickel:
Ores, Matte, Concentrates and Scrap

Precious Metals:
Gold Dust, Gold-bearing Quartz,
Platinum Ore, etc.

Silver:
Ores and Concentrates

Tin:
Ores and Concentrates

Zinc:
Ores, Concentrates, Spelter and Scrap

Other:
Metals in Ores, Concentrates and
Scrap (Including Radioactive Elements)

Non-Metallic Minerals and Products:

Asbestos - Crude, Sand, Waste and Unmanufactured

Clays - China, Fire, etc.

Coal - Anthracite, Bituminous, etc.

GROUP 2Non-Metallic Minerals and Products: (continued)

- | | | |
|---|---|---|
| Gas | - | Natural, Propane, etc. |
| Graphite &
Mica | - | Splittings and Crude |
| Petroleum &
Asphalt | - | Crude |
| Natural and
Synthetic
Gem Stones | | |
| Stones, Rocks
& Other Non-
Metallic
Minerals | - | Crude Gypsum, Lime, Feldspar, Sand
and Gravel, Talc, Building and Paving
Stones, Diamond Dust, etc. |
| Ice | | |

COMPONENTS OF GROUP 3Agricultural Products:

- | | | |
|--------|---|---|
| Rubber | - | Rubber manufactures (i.e. Belting,
Tires, Boots and Shoes, etc.) |
|--------|---|---|

Animal Products:

- | | | |
|-----------------------|---|---|
| Furs and Fur
Skins | - | Wholly or Partially Dressed or
Manufactured |
| Leather | - | Manufactured (ie. Gloves, Boots
and Mitts, etc.) |

Fibres, Textiles and Textile Products:

- | | | |
|-------------------------------------|---|--|
| Cotton | - | Manufactured (i.e. Yarns, Clothes,
Linens, etc.) |
| Flax, Hemp
and Jute | - | Manufactured (i.e. Yarns, Bags, Towels, etc.) |
| Silk | - | Manufactured (i.e. Velvets, Ribbons,
Clothes, etc.) |
| Wool | - | Manufactured (i.e. Yarns, Tweeds, Apparel,
etc.) |
| Artificial &
Synthetic
Fibres | - | Manufactured (i.e. Twines, Clothing, etc.) |
| Mixed Textile
Products | - | Manufactured (i.e. Twines, Garments, Hats, etc.) |
| Vegetable
Fibres | - | Manufactured (i.e. Kapok, Manila, Sisel, etc.) |

GROUP 3Wood, Wood Products and Paper:

- Wood - Manufactured:
Barrels, Doors, Sashes, Furniture,
Wood-Pulp, etc.
- Paper - Paper Board and Related Products
Newsprint, and Related Paper Products
- Books and
Printed Matter - Books
Newspapers, Pamphlets and Allied
Products

Iron and Iron Products:

- Iron Products - Manufactured:
Pigs, Ingots, Blooms and Billets
Castings and Forgings
Rolling Mill Products (Bars, Rods,
Rails, Structural Steel, etc.)
Pipes, Tubes, Wire, Valves and Fittings
Chains, Stoves and Springs
Hardware and Cutlery (Nails, Razors,
Needles, Pins, etc.)
Stamped and Coated Products
Drums, Tanks and Cylinders
Firearms, Furniture and Other Manu-
factured Products
Ships and Boats

Non-Ferrous Metals and Products:

- Metallic Products - Aluminum:
Ingots, Bars, Blocks, Rods and Other
Manufactures
- Brass:
Valves, Bars, Rods, Plates, Tubing, etc.
- Copper:
Ingots, Bars, Tubes, Plates,
Insulated Wire, etc.
- Lead:
Pigs, Blocks, Bars, etc.
- Nickel:
Oxides, Bars, Rods, Sheets, etc.
- Phosphorus:
Tin and Bronze Manufactures
- Precious Metals:
Electro-plated Ware and Other Products
- Tin:
Blocks, Bars, Pigs, Foil, etc.
- Silver:
Bullion and Bars
- Zinc:
Bars, Rods, and Other Manufactures
- Other:
Alloys and Non-ferrous Metal Fabrication
- Manufactures - Clocks, Watches and Parts, Printing
Materials and Other Metallic Products

GROUP 3Non-Metallic Minerals and Products

- Mineral Products - Asbestos, Manufactured
- Clays:
Pottery, Chinaware, Bricks, Tiles, etc.
- Glass and Glassware:
Bottles, Tableware, Window Panes, etc.
- Stone Products:
Abrasives
Cement, Plaster and Whiting, etc.
- Carbon and Graphite Products:
Insulators, Carbons, Electrodes, etc.
- Salt, Unset Diamonds and Other Products

Other End Products

- Products - Apparel and Apparel Accessories
Footwear
Toys, Games, Sporting and Recreation
Equipment
Trunks, Crates, Containers, etc.
Other Personal and Household Equip-
ment and Parts
Musical Instruments and Parts
Photographic and Printed Material
and Goods
Scientific and Educational Equipment
and Parts
Works of Art, etc.
Electrical Energy
Settlers Effects
Other Special Trade Transactions

COMPONENTS OF GROUP 4Iron and Iron Products

- Manufactured - Engines, Locomotives, Boilers and Parts
Farm Implements and Related Machinery
and Parts:
Harrows, Ploughs, Tractors, etc.
- Machinery and Parts:
Household
Office and Business
Mining and Logging
Pulp and Paper and Printing
Construction
Bulldozers and Other Industrial
Equipment
- Tools and Parts
- Transportation Equipment and Parts:
Automobiles and Trucks
Railcars and Related Products
Aircraft and Other Transport
Equipment

GROUP 4Non-ferrous Metals and Products

- Electrical Apparatus and Parts - Batteries, Generators, Dynamos, Motors and Spark Plugs
Electric Lighting and Distribution Equipment
Measuring and Controlling Equipment
Switchgear and Protective Equipment
Navigation and Scientific Equipment
Electronic Computers and Other Office Machines and Equipment
- Communication Equipment - Telephone and Telegraph Equipment
Television, Radio and Phonograph Sets
Electronic Tubes and Semi-conductors
Other Telecommunication and Related Equipment
- Gas Apparatus and Parts - Furnaces, Air-Conditioning and Refrigeration Equipment
- Metallic Oxides and Products - Manganese Oxide, Mercury, etc.

Non-Metallic Minerals and Products

- Mineral Products - Coal Products:
Cokes, Tars, Pitch, Oils, etc.
Petroleum Products:
Gasoline, Kerosene, Fuel Oil,
Oils and Greases, etc.
Sulphur and Brimstone

Chemical and Allied Products

- Products - Acids
Alcohols (industrial)
Drugs and Medicines
Dying and Tanning Materials
Explosives
Fertilizers
Paints, Pigments, Varnishes, etc.
Perfumes and Cosmetics
Soaps
Organic Chemicals
Inorganic Chemicals:
Arsenics, Ammonias, Chlorines, etc.
Synthetics:
Rubber, Plastic and Related Products
Other Chemicals and Related Products

Other End Products

- Products - Medical and Pharmaceutical Products
Medical, Ophthalmic and Orthopaedic Supplies

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The 1971 Census showed that the population of Canada numbered 21.6 million. The population had a total personal income of \$66.1 billion in 1970 and produced a value added by manufacturing of \$21. billion. Neither personal income nor value added by manufacturing were evenly distributed either between provinces or relative to their populations (see Table I). Ontario was easily the most populous and, with the exception of British Columbia, it was the only province to have an above-average personal income. Ontario accounted for 35.7 percent of the population and 42.3 percent of the personal income. British Columbia had 10.1 percent of population and 10.6 percent of personal income. Ontario was easily the most industrialized of the provinces and was responsible for over half (53.5 percent) of the value added by manufacturing industry. The only other province where the share of the value added by manufacturing exceeded that of personal income was Quebec which had 27.9 percent of the population, 25.6 percent of personal income and was responsible for 28.4 percent of the value added by manufacturing. Ontario and Quebec together provided over four-fifths (81.9 percent) of the value added by manufacturing.

Of the remaining 18.1 percent, 14.5 percent arose in the Western Provinces and a bare 3.5 percent in the Atlantic Provinces. Thus the Atlantic Provinces, which together had about a third of the population of Quebec or a quarter of that of Ontario, generated about one-eighth of the value added by manufacturing of Quebec and less than a fifteenth of that of Ontario. The Western Provinces combined had a population only slightly lower than that of Quebec, 5.7 million compared with 6.0 million, but produced a value added by manufacturing of barely more than half Quebec's, \$3.1 million compared with \$6.1 million. And with a population of slightly under three-quarters of that of Ontario (5.7 million compared with 7.7 million) they produced only between a third and a quarter (27.1 percent) of the latter province's value added by manufacture.

Not only do Ontario and Quebec provide the major part of the country's value added by manufacturing, both in absolute terms and relative to their population, but they are far more dependent on manufacturing as a source of wealth. In Ontario the value added by manufacturing was of a size equivalent to 41.9 percent of that of the personal income. In Quebec, the equivalent figure was 36.1 percent. These compare with 32.4 percent for the country as a whole. In the Atlantic Provinces, the proportion was only 17.0 percent and in the Western Provinces 18.1 percent. The provinces least dependent on manufacturing were Saskatchewan, where the proportion was 8.9 percent, and Prince Edward Island, where it was 10.1 percent. In the Yukon and Northwest Territories combined the proportion was 2.7 percent.

In passing, it is worth noting that there is no correlation between the degree of dependence on manufacturing and the level of personal income per head. In Quebec (where the dependence on manufacturing is second highest), the level of personal income is below that of the Western Provinces where dependence on manufacturing is low.

Expenditure on research and development varies substantially between industries. Of the fifteen industrial groups shown in Table II, one, the electrical products industry, accounted for \$91.9 million out of a total expenditure of \$307.3 million on current intramural research and development

in 1970. Not only was research and development expenditure very uneven absolutely, it also was uneven in terms of research intensity and in terms of numbers employed. The research intensity, or current intramural expenditures on research and development expressed as a percentage of value added, varied between 10.6 in the case of the aircraft and parts industry, where technology is advancing rapidly and the necessity to build prototypes raises the costs of research and development, and 0.26 percent in metal fabrication, where technological changes are less frequent and research and development tends to be less rewarding. The national average for manufacturing industries was 1.93 percent. The group "other manufacturing" had a research intensity of 0.11 percent, but this was a residual group containing a wide range of often small industrial activities.

In terms of research and development expenditure per employee, the range was large too. The aircraft and parts industry was again the largest with an expenditure of \$1,108 per employee. This compared with \$33 in the metal fabrication group and \$262 for the national average. The degree of technological change in an industry and the level of capital intensity were both reflected in the research and development expenditure per employee. The degree of technological change influences the level of expenditure and the capital intensity the number of employees to which the expenditure was related. Thus the chemical and petroleum products industries both had a relatively high expenditure per employee, \$642 and \$842, respectively. The aircraft and parts industry level of \$1,108 again reflects the high cost of research and development in that industry due in part at least to the necessity to build prototypes. The figure for the electrical products industry, \$700, reflects mainly the general high level of expenditure, as the industry is not capital intensive. The value added per employee is only \$11,752 compared with the national average of \$18,303. Value added per employee has no direct relationship to research intensity and the aircraft and parts industry has the highest research intensity, 10.60 percent, as well as the highest research and development expenditure per employee, \$10,097. Only marginally higher, in terms of value added per employee, was the textile industry where the figure was \$10,100. But the textile industry's research intensity was, at 0.73 percent, little more than half the national average of 1.93 percent. The textile industry's expenditure on research and development per employee was very low, \$73, compared with the national average of \$262 and the aircraft and parts industry's \$1,108.

Probably the simplest and least sophisticated estimate that could be made of industrial research and development expenditure on a provincial basis would be to assume that the total Canadian expenditure was divided between the provinces in the same ratio as is the value added by manufacturing. If this method of making the estimate of provincial industrial research and development expenditure is adopted, then there are two important factors which should be borne in mind as probably exerting a modifying influence.

There is a tendency for industrial concerns with more than one manufacturing establishment to carry out research and development activities at or near their headquarters. Headquarters tend to be situated in Toronto or Montreal; thus to the extent that this factor is important, the distribution of value added will tend to understate the positions

of Ontario and Quebec in respect of industrial research and development effort. Another factor which may cause a divergence between the geographical distribution of value added and of the research and development performed by industry is the tendency for larger firms to carry out relatively more research and development than smaller ones. The larger firms tend to be situated more frequently in Ontario and Quebec than in the other provinces. This, too, might mean that the industrial research and development was more concentrated in those two provinces than the value added. Nevertheless, in the absence of better information the provincial split of the value added is probably the best indication of the provincial split of industry's research and development effort.

With the above in mind, Table III was drawn up showing the value of current intramural research and development in 1970 by industry group and indicating also the percentage of the industry groups' value added by manufacturing arising in Ontario, Quebec, the Atlantic Provinces and the Western Provinces. From the distribution of the total value added by manufacturing on a provincial basis, it will be seen that Ontario was responsible for over half the total (53.5 percent) and that, combined with Quebec, these two provinces are responsible for over four-fifths (81.9 percent) of the total value added by manufacturing. Only 14.5 percent arose in the Western Provinces and a mere 3.5 percent in the Atlantic Provinces. Thus, had the current intramural research and development effort in industry been divided between provinces in the same proportion as the value added by manufacturing arose, it would have been distributed as follows:

	<u>\$Million</u>
Atlantic Provinces	10.8
Ontario	164.6
Quebec	87.3
Western Provinces	44.6
All Canada	307.3

As has been pointed out above, these figures may even understate the positions of Ontario and Quebec and overstate the positions of the Atlantic and Western Provinces.

But the above assumes that the industrial groups were distributed evenly between provinces or that research and development had a constant relationship to value added by manufacturing in all industries. Neither are correct assumptions. Now, if it is assumed that the research intensity is constant within an industrial group, a somewhat different answer is obtained. This assumption, too, will not be correct. But it will, or ought to, be much closer to the true position. Furthermore, it has a greater logical potential to be correct.

In Table IV the current intramural expenditure on research and development for each industrial group has been divided between the provincial groups in the same proportion as the value added by manufacturing was divided. This suggests that in 1970 the current intramural expenditure on research and development in the provincial groups was as follows:

	<u>\$Million</u>
Atlantic Provinces	6.6
Ontario	174.5
Québec	90.0
Western Provinces	36.4
Canada Total	307.3

This approach reduces the expenditures in the Atlantic Provinces by 39 percent and of the Western Provinces by 18 percent, while the share of Ontario was increased by 6 percent and that of Quebec by 3 percent. The change was due to the proportionally greater weighting of the research intensive industries in the industrial mix of Ontario and Quebec compared with that of the Atlantic and Western Provinces. Possibly this phenomenon is shown more clearly in Table V. Well over half the current intramural expenditure on research and development (56.8 percent) took place in three industrial groups - electrical products, the chemical industry and aircraft and parts. These three groups contributed only 15.1 percent of the value added by manufacturing, of which some three-fifths (60.1 percent) arose in Ontario and a little under one-third (31.2 percent) in Quebec. The average for all industries in these two provinces was 53.5 and 28.4 percent respectively. In contrast, the Atlantic Provinces contributed only 1.5 percent of the value added in those three research intensive industrial groups compared with their average for all manufacturing of 3.5 percent, and the Western Provinces 7.1 percent compared with 14.5 percent. So, not only are the Atlantic and Western Provinces much less dependent overall on their manufacturing activities, but their industrial mix is heavily weighted away from the more research performing industries. Again Table VI shows that only 6.5 percent of the manufacturing activities of the Atlantic Provinces took place in the three industrial groups undertaking over half the research and development, and, for the Western Provinces it was only 7.4 percent. In contrast, 17.0 percent of Ontario's manufacturing activity was in these three groups as was 16.6 percent of that of Quebec.

In April 1973, Statistics Canada, in an unpublished note, gave estimates of current expenditures on research and development for eight regions for 1971. It is useful to compare the estimates made by Statistics Canada for research and development performed in the industrial sector with the estimates given above. The figures are as follows:

	<u>MOSST Estimate for 1970</u>		<u>Statistics Canada Estimate for 1971</u>	
	\$Mn.	%	\$Mn.	%
Atlantic Provinces	6.6	2.15	2.2	0.59
Quebec	90.0	29.24	111.0	29.92
Ontario	174.5	56.78	181.7	48.98
Capitol Region	.. a)	.. a)	40.0	10.78
Western Provinces	36.4	11.85	36.1	9.73
Canada Total	307.3	100.00	371.0	100.00

a) Capitol Region not shown separately.

The two sets of estimates agree fairly well, especially if the figure shown for the Capitol Region in the Statistics Canada estimates is added to that for Ontario, where observation would lead one to expect most to be performed. It is interesting to see that the Statistics Canada estimates give marginally even more weighting to Ontario at the expense of the Atlantic and Western Provinces than do those of MOSST. But the overall picture produced by the two estimates are almost identical.

Canadian industry is by no means unique in placing the major part of its research and development effort in these three industrial groups. Table VII shows the distribution of research and development effort in six industrially developed countries in 1969. In that year the proportion of the total research and development effort in the three industrial groups amounted to 57.1 percent in Canada compared with 56.8 percent in 1970. Of the countries shown only in Japan did these three industrial groups form a lower proportion of the total, 53.1 percent. Japanese figures show no separate expenditure for research in the aircraft and parts industry. In the remaining four countries the proportion varied between a low of 64.6 percent in the United Kingdom and a high of 66.4 percent in the United States. It looks, therefore, as if industry is more convinced of the return obtainable from research and development effort in these industries. These industries, too, are the ones in which government support of research and development is most common.

The policy implication, from the point of view of regional expansion of industrial research and development effort, is that while the industrial mix of the provinces and the attitudes of the industrial groups towards undertaking research and development remain unchanged, a system of incentives which does not take these factors into account will only increase the disparity between provincial groups. Indeed, the more it is successful the more will it increase the regional disparities. Policy must be aimed at either changing the industrial mix of the provinces or increasing the research and development intensity of industrial groups where it is at present low. Factors making for the present industrial mix are liable to be difficult to overcome because of the complex reasons which have led to the establishment of industries in their present localities. The increase in research intensity in industries where it is at present low would probably be an easier course and is one in which the appropriate distribution of government incentives might be more rewarding.

August 31, 1973

George Dines

TABLE I

SOME ECONOMIC INDICATORS OF PROVINCIAL ACTIVITY

PROVINCE	POPULATION ^{a/}		PERSONAL INCOME ^{b/}		VALUE ADDED BY MANUFACTURING INDUSTRY ^{c/}	
	Thousands	Percentage	\$Millions	Percentage	\$Millions	Percentage
Newfoundland	522	2.4	924	1.4	136.1	0.6
Prince Edward Island	112	0.5	215	0.3	21.8	0.1
Nova Scotia	789	3.7	1,901	2.9	318.5	1.5
New Brunswick	635	2.9	1,420	2.1	283.4	1.3
ATLANTIC PROVINCES	<u>2,058</u>	<u>9.5</u>	<u>4,460</u>	<u>6.7</u>	<u>759.8</u>	<u>3.5</u>
Ontario	<u>7,703</u>	<u>35.7</u>	<u>27,370</u>	<u>42.3</u>	<u>11,459.5</u>	<u>53.5</u>
Quebec	<u>6,028</u>	<u>27.9</u>	<u>16,893</u>	<u>25.6</u>	<u>6,091.8</u>	<u>28.4</u>
Manitoba	988	4.6	2,939	4.4	522.7	2.4
Saskatchewan	926	4.3	2,252	3.4	200.7	0.9
Alberta	1,628	7.5	4,919	7.4	716.9	3.3
British Columbia	2,185	10.1	7,037	10.6	1,663.1	7.8
WESTERN PROVINCES	<u>5,727</u>	<u>26.5</u>	<u>17,147</u>	<u>25.9</u>	<u>3,103.4</u>	<u>14.5</u>
Yukon	<u>18</u>	<u>0.1</u>	{ <u>128</u>	{ <u>0.2</u>	<u>1.1</u>	-
Northwest Territories	<u>35</u>	<u>0.2</u>	{	{	<u>2.3</u>	-
TOTAL CANADA	<u>21,568</u>	<u>100.0</u>	<u>66,100</u> ^{c/}	<u>100.0</u>	<u>21,417.7</u>	<u>100.0</u>

1971

1970

Includes \$102 millions of personal income of Canadians temporarily resident abroad.

SOURCES: Canada Yearbook 1972 and The General Review of Manufacturing Industries in Canada, 1970, both Statistics Canada publications.

TABLE II

THE OVERALL POSITION OF INDUSTRIAL GROUPS IN 1970

INDUSTRY	Current Intramural R&D Expenditures a/ (\$ million)	Research Intensity, b/ (Percentage)	R&D Expenditure Per Employee (\$)	Value Added Per Employee (\$)
Electrical Products	91.9	6.46	759	11,752
Chemical Industry	49.4	3.30	624	18,911
Aircraft and Parts	33.2	10.60	1,108	10,097
Primary Metals	28.4	1.56	241	15,462
Textiles	20.7	1.69	254	15,017
Machinery	18.9	1.54	233	15,099
Nuclear Products	13.5	3.73	842	22,563
Scientific Instruments	10.5	2.27	299	13,171
Food and Beverages	9.6	0.30	42	14,063
New Transportation Equipment	8.8	0.46	74	16,084
Textiles	5.1	0.72	73	10,100
Plastic Fabrication	4.7	0.25	33	12,083
Other	4.5	0.76	102	13,386
Non-metallic Minerals	3.8	0.50	77	15,327
Other Manufacturing	4.3	0.11	32	28,734
All Manufacturing	307.3	1.43	262	18,353

a/ Preliminary figures

b/ Current intramural expenditures on research and development as a percentage of value added.

SOURCE: General Review of the Manufacturing Industries in Canada, 1970, Volume I, and Industrial Research and Development Expenditures in Canada 1969, both Statistics Canada publications.

TABLE III

SHARE OF INDUSTRIAL CURRENT INTRAMURAL RESEARCH AND DEVELOPMENT EFFORT
COMPARED WITH PROVINCIAL SHARE OF VALUE ADDED BY MANUFACTURING
(1970)

INDUSTRY	Current Industrial Intra- mural R&D Effort (\$.mn) <u>a/</u>	(Percentages)				Canada Total
		Atlantic Provinces	Ontario	Quebec	Western Provinces <u>b/</u>	
Electrical Products	91.9	1.4	63.4	30.6	4.6	100.00
Chemical Industry	49.4	1.9	60.0	29.3	8.8	100.0
Aircraft and Parts	33.2	-	46.0	43.5	10.5	100.0
Primary Metals	28.4	-	61.0	25.6	13.3	100.0
Paper	20.7	7.2	33.4	34.0	24.4	100.0
Machinery	18.9	3.9	79.1	12.5	4.4	100.0
Petroleum Products	13.5	-	29.9	27.4	42.4	100.0
Scientific Instruments	10.5	6.1	49.7	9.8	34.5	100.0
Food and Beverages	9.6	8.2	42.9	27.9	21.0	100.0
Other Transportation Equipment	8.8	2.9	77.7	14.0	5.4	100.0
Textiles	5.1	1.7	44.6	50.8	3.0	100.0
Metal Fabrication	4.7	1.8	59.9	23.6	14.8	100.0
Rubber	4.5	0.2	69.4	26.3	4.1	100.0
Non-metallic Minerals	3.8	3.3	51.0	25.3	20.4	100.0
Other Manufacturing	4.3	3.4	41.1	39.3	16.3	100.0
All Manufacturing	307.3	3.5	53.5	28.4	14.5	100.0

a/ Preliminary figures

b/ Contains unofficial estimates where figures unobtainable for reasons of disclosure.

SOURCES: General Review of the Manufacturing Industries of Canada and Industrial Research and Development Expenditures in Canada, both Statistics Canada publications.

TABLE IV

INDUSTRIAL CURRENT INTRAMURAL RESEARCH AND DEVELOPMENT EXPENDITURE OF
INDUSTRIAL GROUPS DISTRIBUTED AMONG PROVINCIAL GROUPS ON THE BASIS OF
VALUE ADDED BY MANUFACTURING - 1970

INDUSTRY	Industrial Current Intra- mural R&D Expenditure a/ (\$Million)	Distributed Between Provinces on Basis of Value Added by Manufacturing b/				
		(Percentages)				
		Atlantic Provinces	Ontario	Quebec	Western Provinces	Canada Total
Electrical Products	91.9	1.3	58.3	28.1	4.2	91.9
Chemical Industry	49.4	0.9	29.6	14.5	4.4	49.4
Aircraft and Parts	33.2	-	15.3	14.4	3.5	33.2
Primary Metals	28.4	-	17.3	7.3	3.8	28.4
Paper	20.7	1.5	7.0	7.1	5.1	20.7
Machinery	18.9	0.7	15.0	2.4	0.8	18.9
Petroleum Products	13.5	-	4.0	3.7	5.9	13.5
Scientific Instruments	10.5	0.6	5.2	1.0	3.6	10.5
Food and Beverages	9.6	0.8	4.1	2.7	2.0	9.6
Other Transport Equipment	8.8	0.3	6.8	1.2	0.5	8.8
Textiles	5.1	0.1	2.3	2.6	0.2	5.1
Metal Fabrication	4.7	0.1	2.8	1.1	0.7	4.7
Rubber	4.5	-	3.1	1.2	0.2	4.5
Non-metallic Minerals	3.8	0.1	1.9	1.0	0.8	3.8
Other Manufacturing	4.3	0.2	1.8	1.7	0.7	4.3
All Manufacturing	307.3	5.6	174.5	90.0	36.4	307.3

/ Preliminary Figures

/ On the basis of unofficial estimates where figures were unobtainable for reasons of disclosure, 2.7% of total was estimated.

SOURCES: Based on information in General Review of the Manufacturing Industries of Canada 1970 and Industrial Research and Development Expenditures in Canada 1969, both Statistics Canada publications.

TABLE V

CUMULATIVE SHARE OF INDUSTRIAL CURRENT INTRAMURAL RESEARCH AND DEVELOPMENT
EFFORT COMPARED WITH CUMULATIVE SHARES OF PROVINCES IN VALUE ADDED
BY MANUFACTURING 1970

INDUSTRY	Cumulative Share of Current Industrial Intramural R&D Effort ^{a/} (Percentage)	Cumulative Shares of Provinces in Value Added by Manufacturing ^{b/}				Canada Total
		Atlantic Provinces	Ontario	Quebec (Percentages)	Western Provinces	
Electrical Products:	29.9	0.058	4.207	2.031	0.303	6.639
Chemical Industry	46.0	0.229	8.395	4.071	0.920	13.615
Aircraft and Parts	56.8	0.229	9.067	4.706	1.074	15.076
Primary Metals	66.0	0.229	14.222	6.873	2.199	23.522
Paper	72.7	0.840	17.093	9.758	4.314	32.006
Machinery	78.9	1.065	21.613	10.472	4.566	37.716
Petroleum Products	83.3	1.065	22.117	10.935	5.281	39.401
Scientific Instruments	86.7	1.195	23.186	11.145	6.023	41.554
Food and Beverages	89.8	2.386	29.443	15.216	9.081	56.130
Other Transport Equipment	92.7	2.638	36.269	16.444	9.557	64.917
Textiles	94.4	2.694	37.739	18.120	9.655	68.218
Metal Fabrication	95.9	2.839	42.744	20.091	10.888	76.571
Rubber	97.4	2.843	44.654	20.814	11.000	79.321
Non-metallic Mineral Products	98.6	2.960	46.442	21.701	11.714	82.828
Other Manufacturing	100.0	3.548	53.502	28.443	14.506	100.000

^{a/} Based on preliminary figures.

^{b/} Based on estimates when figures not available for reasons of disclosure; 2.7% of total was estimated.

SOURCES: Based on information in General Review of the Manufacturing Industry of Canada and Industrial Research and Development Expenditures in Canada 1969, both from Statistics Canada.

TABLE VI

CUMULATIVE SHARE OF CURRENT INDUSTRIAL INTRAMURAL RESEARCH AND DEVELOPMENT EFFORT
 COMPARED WITH CUMULATIVE DISTRIBUTION OF VALUE ADDED BY MANUFACTURING WITHIN PROVINCES 1970

INDUSTRY	Cumulative Share of Current Industrial ^{a/} Intramural R&D Effort (Percentage)	Cumulative Distribution of Value Added By Manufacturing in Provinces b/ (Percentages)				
		Atlantic Provinces	Ontario	Quebec	Western Provinces	Canada Total
Electrical Products	29.9	2.76	7.86	7.14	2.09	6.64
Chemical Industry	46.0	6.45	15.69	14.31	6.34	13.62
Aircraft and Parts	56.8	6.45	16.95	16.55	7.40	15.08
Primary Metals	66.0	6.45	26.58	24.16	15.16	23.54
Rubber	72.7	23.68	31.95	34.31	29.74	32.01
Machinery	78.9	30.00	40.40	36.82	31.48	37.72
Petroleum Products	83.3	30.00	41.34	38.44	36.40	39.40
Scientific Instruments	86.7	33.68	43.34	39.18	41.52	41.55
Food and Beverages	89.8	67.24	55.03	53.50	62.60	56.13
Other Transportation Equipment	92.7	74.34	67.79	57.81	65.88	64.92
Trucks	94.4	75.92	70.54	63.71	66.56	68.22
Textile Fabrication	95.9	80.00	79.89	70.63	75.06	76.57
Rubber	97.4	80.13	83.46	73.18	75.83	79.32
Non-metallic Mineral Products	98.6	83.42	86.81	76.30	80.75	82.83
Other Manufacturing	100.0	100.00	100.00	100.00	100.00	100.00

^{a/} Based on preliminary figures.

^{b/} Based on estimates where figures unobtainable for reasons of disclosure; 2.7 % of total was estimated.

SOURCES: Based on information in General Review of the Manufacturing Industries of Canada and Industrial Research and Development Expenditures in Canada 1969, both Statistics Canada publications.

TABLE VII

PERCENTAGE OF R&D EXPENDITURE IN MANUFACTURING INDUSTRY - 1969

<u>INDUSTRY</u>	<u>FRANCE</u>	<u>WEST GERMANY</u>	<u>U.K.</u>	<u>JAPAN</u>	<u>U.S.A.</u>	<u>CANADA</u>
Electric and Electronic	26.4	29.3	24.9	29.3	24.1	29.1
Chemicals (incl. drugs)	14.7	29.4	13.0	23.8	9.8	13.8
Petroleum Refining	4.0	0.6	1.9	1.2	3.2	7.4
Aircraft	25.2	7.3	26.7	-	32.5	14.2
Other Transport Equipment	9.1	15.4	7.7	12.1	9.2	2.5
Iron and Steel	1.0	3.6	1.8	5.2	0.8	2.0
Non-ferrous Metals	1.5	1.2	1.1	2.4	0.7	6.1
Fabricated Metal Products	1.0	0.4	1.2	1.3	1.0	1.5
Instruments	1.0	1.5	2.5	2.4	3.7	3.2
Machinery	8.1	7.9	8.8	9.2	9.8	5.3
Food, Drink and Tobacco	1.4	0.4	3.2	3.7	1.0	2.8
Textiles	2.0	0.3	2.3	1.7	0.3	1.4
Rubber and Plastic Products	1.1	1.0	1.0	1.3	1.3	1.2
Non-metallic Minerals	2.2	0.8	1.9	2.3	1.1	1.0
Paper and Printing	-	0.2	1.2	1.3	0.6	6.7
Wood and Cork	-	0.7	0.1	-	0.1	0.3
Other Manufacturing	-	-	0.5	2.4	0.5	1.2
TOTAL MANUFACTURING	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: O.E.C.D.

