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## CHAPTER I

### INTRODUCTION

The proportion of an industry's output concentrated in a few of the largest firms is an important characteristic of industrial structure. There has been much discussion of the influence of concentration on business policy, and the resulting influence on prices, output, and profits.<sup>1</sup> In a more general sense, the study of concentration is the study of firm-size distributions, and the factors determining firm size have long been a major object of investigation and controversy.

The measurement and analysis of concentration can thus be expected to make a significant contribution to our understanding of the forces that shape business policy. The present study measures concentration in a large sample of Canadian manufacturing industries and attempts to account for the observed differences. We also compare concentration in Canada with concentration in the United States, and after a comparison of concentration by plants with concentration by firms, investigate the major trends in plant concentration since 1890.

#### 1. *The Canadian Manufacturing Industries*

Manufacturing as a whole plays as great a role in the Canadian economy as it does in the United States. In 1950, 30 per cent of national income originated in manufacturing industries in both countries.<sup>2</sup>

<sup>1</sup> See, for example, J. S. Bain, "Price and Production Policies" in *A Survey of Contemporary Economics*, H. S. Ellis, editor, Blakiston, 1948, pp. 129-173, especially pp. 134-137, 145-149; Fritz Machlup, *The Political Economy of Monopoly*, The Johns Hopkins Press, 1952, Chap. 12; Tibor Scitovsky, *Welfare and Competition*, Irwin, 1951, pp. 323-324 and *passim*.

Among the few significant statistical investigations are A. C. Neal, *Industrial Concentration and Price Inflexibility*, American Council on Public Affairs, 1942; and J. S. Bain, "Relation of Profit Rate to Industry Concentration," *Quarterly Journal of Economics*, August 1951, pp. 293-324.

<sup>2</sup> Computed from *National Accounts, Income and Expenditure, 1926-1950*, Ottawa, Dominion Bureau of Statistics, 1952, p. 51; and *National Income Supplement, 1951*, *Survey of Current Business*, Dept. of Commerce, p. 159.

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The Canadian economy, however, is much smaller, more dependent on foreign trade, and more recently industrialized than that of the United States. In 1951 the population of Canada was 14 million and that of the United States 154 million.<sup>3</sup> Exports of goods and services amounted to 23 per cent of the Canadian gross national product in 1950 while the corresponding figure for the United States was only 5 per cent.<sup>4</sup> As recently as 1911, manufacturing occupations accounted for only 14 per cent of the labor force in Canada and agriculture for 34 per cent, while in the United States at about the same time (1910) manufacturing occupations accounted for 21 per cent of the labor force and agriculture for only 31 per cent.<sup>5</sup> Even today, although the percentage of national income originating in manufacturing is the same in both countries, the proportion originating in agriculture, forestry, and fishing is 15 per cent in Canada and 7 per cent in the United States while the proportion originating in trade, finance, and services is 30 per cent in Canada and 36 per cent in the United States.<sup>6</sup> According to Colin Clark's well-known thesis these relations are symptoms of the relative economic immaturity of Canada.<sup>7</sup>

The dependence of Canada's economy on export of a limited range of staple products is frequently stressed.<sup>8</sup> As a result one may underestimate the degree to which the economy, and the manufacturing sector in particular, have already achieved diversification. It is true that a

<sup>3</sup> *Ninth Census of Canada, 1951*, Ottawa, Dominion Bureau of Statistics, Vol. I, 1953, Table I; and *Statistical Abstract of the United States, 1952*, Bureau of the Census, p. 10.

<sup>4</sup> *National Accounts, Income and Expenditure, 1926-1950*, p. 27; *Statistical Abstract of the United States, 1952*, pp. 23 and 827. Government aid to foreign countries is excluded from these exports.

<sup>5</sup> Data from *The Rise in Prices and the Cost of Living in Canada, 1900-1914*, Ottawa, King's Printer, 1915, p. 39; and Alba M. Edwards, *Comparative Occupation Statistics, 1870-1940*, Bureau of the Census, 1943, reproduced in Colin Clark, *The Conditions of Economic Progress*, 2nd ed., London, Macmillan, 1951, pp. 404-405.

<sup>6</sup> *National Accounts, Income and Expenditure, 1926-1950*, p. 51; and *National Income Supplement, 1951, Survey of Current Business*, p. 159.

<sup>7</sup> Clark, *op. cit.*, p. 395. "The most important concomitant of economic progress . . . [is] the movement of working population from agriculture to manufacture and from manufacture to commerce and services."

<sup>8</sup> A recent example: "Canada's gold and nonferrous metals, pulp and paper, have gone largely to the United States. There has been, at the same time, a marked reduction in the relative importance of wheat, a staple marketed principally in Europe. These changes in industry and in markets have meant for Canada a somewhat more diversified economy. On the other hand, reliance on the income from a few export staples destined for external consumption is fundamentally unchanged, and it is doubtful whether the pattern of Canadian economic development has been significantly altered." (H. A. Innis and W. T. Easterbrook, "Fundamental and Historic Elements," in *Canada*, G. W. Brown, editor, University of California Press, 1950, Chap. VII, p. 161.)

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very small number of staples still furnish a very high proportion of exports. In 1951 the relatively few goods listed below accounted for more than 60 per cent of the value of exports of domestic products.<sup>9</sup>

Newsprint, pulpwood, and wood pulp	24%
Wheat and flour	14
Nonferrous metals and their products (including some manufactures but excluding electrical apparatus, clocks, and watches)	17
Planks, boards, and shingles	8
	63%

Yet the manufacturing industries are much more diversified than one would expect in an "underdeveloped" economy based on staple exports. This diversification is illustrated by Table 1. Industries belonging to the first three groups would be found even in a country with little industrialization, but over half of manufacturing employment is in the fourth group, the size and diversity of which indicates a high degree of industrial development.

The industrialization of Canada has been a goal of national policy since the establishment of the Dominion in 1867. Canadian statesmen believed that political independence would not be possible if Canada continued to be economically dependent on Britain or the United States. In the early years of the new Dominion it was widely held that industrialization would come about in a free-trade world on the basis of Canada's "natural advantages."<sup>10</sup> But the renewed emphasis on protection in the United States and the rapid development of American manufactures after the Civil War, combined with the depression in the 1870's, turned Canada toward a frankly protective tariff policy in 1879. Since that time, while there have been important changes in the level and structure of tariff rates, the policy of protecting manufacturing industries has persisted. Together with the development of a transcontinental Canadian railroad network this policy served to separate the Canadian economy from that of the United States, and to increase the interdependence among the different regions of Canada.

In the Canadian tariff structure British goods enjoy preferential rates, while Canadian goods have preferential treatment in Britain and Empire countries. Parts and materials required by Canadian manufacturers are frequently admitted free or at lower rates than the finished products that compete with those produced in Canada. Many

<sup>9</sup> Computed from *Canada Year Book 1952-53*, Ottawa, Dominion Bureau of Statistics, pp. 932, 954 ff. Exports include net exports of non-monetary gold.

<sup>10</sup> Cf. Brown, *op. cit.*, pp. 226-227.

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## TABLE 1

Distribution of Employment in Canadian Manufacturing Industries, 1948

<i>Industry Group</i>	<i>Employment (thousands)</i>	<i>Percentage of Total Manufacturing Employment (%)</i>
1. <i>Primary Processing of Agricultural Products</i>	<u>89.5</u>	8
Meat products	22.7	
Dairy products	25.3	
Fruit, vegetable, and fish processing	28.9	
Grain mill products	12.6	
2. <i>Processing of Other Domestic Raw Materials Largely for Export</i>	<u>128.4</u>	11
Pulp and paper	51.9	
Nonferrous metals smelting and refining	19.7	
Sawmills	56.8	
3. <i>Basic Consumer Goods Industries with Pre- dominantly Small-Scale Enterprises</i>	<u>300.6</u>	26
Bakery products	37.2	
Beverages (excluding distilleries)	15.8	
Footwear and other leather products	34.3	
Clothing	115.1	
Planing mills, sash and door factories	17.8	
Furniture	25.9	
Printing, publishing, and allied trades	54.5	
4. <i>Other Industries</i>	<u>637.4</u>	55
Tobacco and tobacco products	10.5	
Distilleries, confectionary, cocoa and misc. food industries	26.4	
Primary textiles and misc. textile industries	75.3	
Tires and other rubber products	21.7	
Plywood, wooden and paper boxes and misc. wood and paper industries	47.9	
Primary iron and steel, machinery, agricul- tural implements and other iron and steel products	170.1	
Automobiles, railroad rolling stock, and other transportation equipment	102.6	
Electrical apparatus and other nonferrous metal products	80.2	
Petroleum products, coke and gas products, glass and other nonmetallic mineral prod- ucts	40.9	
Chemical products	39.5	
Miscellaneous industries	22.3	
Total, All Manufacturing Industries	<u>1,156.0</u>	<u>100</u>

*Source: The Manufacturing Industries of Canada, 1948, Dominion Bureau of Statistics, 1951, pp. 27-31.*

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articles are admitted free or at lower rates when "of a class or kind not made in Canada."

This policy has not only stimulated Canadian manufacturing, but also United States investment in Canadian industries. By the establishment of branch plants in Canada, American manufacturers can in effect jump the tariff barrier and not only sell on better terms in Canada, but also gain entry to British markets under the system of Empire preferences. One incidental effect of the policy of protection has therefore been to reduce the degree of concentration of domestic output. There are some indications that as a result Canadian manufacturers do not regard protective customs duties as an unmixed blessing.<sup>11</sup>

Canadian governments have at times regarded the attraction of foreign capital as one of the major benefits derived from high customs duties,<sup>12</sup> since it was generally recognized that Canadian economic development was dependent on capital imports. Up to the time of World War I Great Britain was the main source of foreign capital invested in Canada, but since then the United States has taken the lead. During World War II United States investments in Canada increased further, while British holdings declined.<sup>13</sup> In 1948 about 45 per cent of the total assets of Canadian manufacturing corporations were owned abroad.<sup>14</sup> This percentage of foreign ownership is somewhat higher than that for the economy as a whole, since in distribution and services, foreign ownership is much less important:

Estimated Percentage of Nonresident Ownership of Canadian Corporations<sup>15</sup>

	1939	1946
	%	%
Manufacturing	42	44
Mining and smelting	40	36
Railroad and public utilities	45	43
Merchandising	9	8
Total above sectors	<u>38</u>	<u>35</u>

Of the 44 per cent foreign ownership of Canadian manufacturing corporations in 1946, the United States accounted for 35 per cent,

<sup>11</sup> Cf. L. G. Reynolds, *The Control of Competition in Canada*, Harvard University Press, 1940, pp. 194-195; see also H. Marshall, F. A. Southard, Jr., and K. W. Taylor, *Canadian-American Industry*, Yale University Press, 1936, pp. 275, 281 ff.

<sup>12</sup> Marshall, Southard and Taylor, *op. cit.*, p. 275.

<sup>13</sup> *The Canadian Balance of International Payments, 1926-1948*, Ottawa, Dominion Bureau of Statistics, 1949, p. 74 ff.

<sup>14</sup> *Canada Year Book*, 1951, p. 340.

<sup>15</sup> *The Canadian Balance of International Payments*, p. 80.

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Great Britain for 7 per cent, and other countries for the remaining 2 per cent. Ownership does not, of course, necessarily involve control, but it is estimated that Canadian manufacturing firms controlled in the United States accounted for about 37 per cent of the assets of all Canadian manufacturing firms in 1946. Some of the implications of United States control in the Canadian manufacturing industries are discussed in Chapter IV.<sup>10</sup>

### LOCATION OF MANUFACTURING INDUSTRIES

While the total area of Canada is larger than that of the United States, the population is concentrated in a relatively narrow strip of territory along the United States border. Manufacturing employment is even more highly concentrated than the population as a whole (Table 2).

**TABLE 2**  
Regional Distribution of Population and Labor Force in Canada, 1951  
(as per cent of total)<sup>a</sup>

	POPULATION	LABOR FORCE	
		Total	Manufacturing Industries
Maritime Provinces <sup>b</sup>	12	10	6
Quebec	29	28	33
Ontario	33	36	45
Prairie Provinces	18	18	8
British Columbia	8	8	8

<sup>a</sup> Excludes Yukon and North West Territories.

<sup>b</sup> Includes Newfoundland.

Source: *Ninth Census of Canada, 1951*, Ottawa, Dominion Bureau of Statistics, Bull. 4-4, Table 16, and Vol. I, 1953, Table 1.

The Central Provinces, Ontario and Quebec, have 62 per cent of the population and 64 per cent of the labor force, but 78 per cent of the labor force of manufacturing industries. There is a secondary concentration of manufacturing in British Columbia, where the percentage of the manufacturing labor force is nearly equal to that of the total labor force.

Within the Central Provinces manufacturing is highly concentrated in a few metropolitan centers. In the Province of Quebec, 55 per cent of manufacturing employment is in the Montreal metropolitan area,

<sup>10</sup> Data from *ibid.*, p. 185, and *United States Direct Investments in Canada*, Ottawa, Dominion Bureau of Statistics, 1949, p. 4. Firms controlled in the United States are defined as those in which 50 per cent or more of the capital stock is owned in the United States, plus certain known instances of United States control through a minority stock holding.

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while in Ontario 32 per cent of manufacturing employment is concentrated in the Toronto area and an additional 16 per cent in the metropolitan areas of Hamilton and Windsor. These four cities together account for 41 per cent of total employment in manufacturing industries.<sup>17</sup>

### GROWTH OF MANUFACTURING INDUSTRIES

Population growth and rising real income per capita were accompanied by a rising trend in the proportion of national income originating in manufacturing (Table 3). Population growth was most spectacular in the first decade of the twentieth century, when a large number of immigrants settled the prairie provinces. The expanding domestic market stimulated the rapid growth of factory production. World War I led to the establishment of new industries, and the rise in per capita income in the 1920's largely reflected rapid increases in manufacturing output per worker. Stagnation in the 1930's was followed by very rapid expansion of employment, capacity, and output to meet the needs of World War II. While employment in 1948 was below the peak level reached during the war, it remained at about twice the level of the 1920's.

Before World War I, sawmilling was the most important manufacturing industry, followed by various food processing industries such as butter and cheese production and flour milling. By 1922 pulp and paper, and automobile manufacture had greatly increased in relative importance, the former outranking sawmills in terms of the gross value of output. During the 1920's nonferrous metals and electrical apparatus rose to prominence; the former, unchecked by depression, became the second largest industry in 1933 and the largest in 1937. Automobiles and the primary iron and steel industry also became increasingly important in this decade. By 1939 the grain mill and sawmill industries were smaller than pulp and paper, nonferrous metals, meat packing, automobiles, and petroleum refining. During the war aircraft and shipbuilding expanded abnormally, but these industries shrank again with the end of war production. In 1948 the leading ten industries ranked in terms of gross output were the following:<sup>18</sup>

Pulp and paper  
Slaughtering and meat packing  
Nonferrous metals smelting and refining

<sup>17</sup> Data for 1948, from *The Manufacturing Industries of Canada, 1948*, Ottawa, Dominion Bureau of Statistics, 1951, pp. 7, 8, 93, 100, 101. Figures for Montreal exclude nonferrous metals smelting and refining.

<sup>18</sup> *The Manufacturing Industries of Canada, 1948*, p. 45.

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TABLE 3  
Time Series Related to Manufacturing in Canada

	Population at Census Dates (millions) (1)	Increase in Population over Preced- ing Census (2)	Gross National Product in Con- stant Dollars <sup>a</sup> (billions) (3)	GNP per Capita in Constant Dollars <sup>a</sup> (4)	National Income (billions) (5)	Income Originating in Manufacturing (billions) (6)	Col. 6 as Per Cent of Col. 5 (7)	Manufacturing Gross Value of Production (billions) (8)	Manufacturing Employment A B C (thousands) (9)
1871	3.7								188
1881	4.3	17%						2.5	255
1891	4.8							2.7	370
1901	5.4	11						3.1	339
1911	7.2	34						3.9	515
1917								\$2.8	607
1921	8.8	22						2.5	439
1923								2.7	506
1926			\$4.5	\$481	\$4.2	\$0.91	21.8%	3.1	559
1929			5.3	532	4.8	1.18	24.5	3.9	667
1931	10.4	18	4.5	431	3.3	0.75	22.6	2.6	529
1937			5.2	471	4.1	1.09	26.8	3.6	660
1941	11.5	11	7.5	650	6.6	1.98	30.2	6.1	961
1944			9.7	814	9.8	2.89	29.4	9.1	1,223
1948			9.4	736	12.6	3.83	30.5	11.9	1,156
1951 <sup>b</sup>	14.0	19	10.9	781	17.1	5.16	30.1	16.4	1,258

<sup>a</sup> Based on 1935-1939 prices.

<sup>b</sup> Newfoundland included in all entries except col. 2.

Column	Source	Column	Source
1,2	<i>Ninth Census of Canada, 1951, Ottawa, Dominion Bureau of Statistics, 1953, Vol. I, p. 1-1.</i>		tawa, Dominion Bureau of Statistics, 1954, sec. III, p. 5.
3	<i>National Accounts, Income and Expenditure, 1926-1950, Ottawa, Dominion Bureau of Statistics, 1951, Table 3, and 1949-1952, 1953, Table 47.</i>	9B	<i>Canada Year Book, 1921, Ottawa, Dominion Bureau of Statistics, pp. 362, 364, and 1919, p. 275. Includes construction, custom and repair, hand trades, laundries and cleaners. Excludes nonferrous metals.</i>
4	Same as Column 3 and <i>Canada Year Book, 1955, p. 137, 1952/53, p. 143, 1946, p. 127.</i>	9C	<i>Census of Canada, 1911, Ottawa, Dominion Bureau of Statistics, Vol. III, p. v. Includes same industries as col. 9B. Excludes establishments with less than five workers.</i>
5,6	<i>National Accounts, Income and Expenditure, 1926-1950, Table 20, and 1950-1953, Table 20.</i>		
8,9A	<i>The Manufacturing Industries of Canada, 1951, Ot-</i>		

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Electrical apparatus and supplies  
Sawmills  
Automobiles  
Petroleum products  
Butter and cheese  
Flour and feed mills  
Primary iron and steel

### 2. *The Measurement of Concentration*

Concentration, as the term is used in this study, means the degree to which a small number of firms account for a large proportion of an industry's output. A variety of indexes have been used to measure concentration in this general sense.<sup>19</sup> Some are based on the percentage of an industry's output (or employment, assets, etc.) accounted for by a given fixed number of the largest firms. Thus the percentages of output accounted for by the largest four and eight firms have been used in the analysis of data from the United States Census of Manufactures.<sup>20</sup> Other indexes measure the number of the largest firms required to account for a substantial (given) proportion of output, or other measure of size. The index employed in most of this study is of this kind, and measures the number of the largest firms in an industry that account for 80 per cent of employment. This kind of index measures concentration inversely, decreasing in numerical value as concentration increases. More elaborate indexes have been proposed from time to time. An interesting example is the index used by O. C. Herfindahl in a study of concentration in the steel industry, which consists of the sum of squares of firm sizes, all measured as percentages of total industry size.<sup>21</sup>

The different indexes of concentration involve different scales of measurement, and even the ranking of industries by concentration level may vary with the index used. Hence the significance of results obtained by the use of any one index may be questioned. The particular index used for this study—the number of the largest firms account-

<sup>19</sup> For a more thorough discussion of various concentration indexes and their interrelations, see Gideon Rosenbluth, "Measures of Concentration," in *Business Concentration and Price Policy*, Princeton University Press for National Bureau of Economic Research, 1955, pp. 57-95.

<sup>20</sup> E.g. "Concentration of Industry Report," mimeographed, Dept. of Commerce, December 1949.

<sup>21</sup> Orris C. Herfindahl, "Concentration in the Steel Industry," unpublished Ph. D. dissertation, Columbia University, 1950. This index is equal to the reciprocal of the number of firms when all firms are of the same size, and reaches its maximum value of unity when there is only one firm in the industry.

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ing for 80 per cent of employment—was chosen primarily because of its direct significance for economic analysis. It measures the number of firms in substantial control of an industry, that is, the number of effective competitors and the number that must be studied for a reasonably complete picture of the industry. This index is also simple to compute and can be estimated with fair accuracy from grouped firm-size distributions.<sup>22</sup> The significance of our findings is, however, greatly enhanced by the fact that when concentration is measured in a cross section of industries by various methods, the index used here is highly correlated with others. The ordering of industries by concentration turns out to be very similar, no matter which of a number of indexes is used. Hence our findings are representative of those that would be obtained by means of other concentration indexes.

The high correlation between our measure of concentration and two others is illustrated by Table 4. For the group of industries on which this table is based (listed in Table A-1, Appendix A), comparison of

TABLE 4  
Comparison of Three Concentration Indexes, 96 Canadian  
Manufacturing Industries, 1948

UNWEIGHTED AVERAGES				
NUMBER OF LARGEST FIRMS REQUIRED TO ACCOUNT FOR 80% OF EMPL. <sup>a</sup>	NUMBER OF INDUSTRIES	<i>Number of Largest Firms Required to Account for 80% of Empl.</i>	<i>Percentage of Employment Accounted for by Leading 3 Firms</i>	<i>Herfindahl's Index of Concentration of Employment (minimum estimate)<sup>b</sup></i>
Less than 1.70	8	1.2	96.6	.05353
1.70 to 2.73	8	2.2	87.2	.2397
2.73 to 3.65	8	3.1	78.0	.1897
3.65 to 4.40	8	4.0	67.1	.1505
4.40 to 6.30	8	5.3	60.4	.1319
6.30 to 9.10	8	7.7	54.1	.1135
9.10 to 12.81	8	11.2	43.0	.0794
12.81 to 20	8	14.2	35.3	.0623
20 to 40	8	26.3	29.6	.0458
40 to 90	8	60.2	19.1	.0232
90 to 250	8	135.0	14.1	.0142
250 and over	8	608.6	9.0	.0071

<sup>a</sup> Class intervals include lower limits.

<sup>b</sup> Sum of squares of firm sizes divided by square of industry size (see Orris C. Herfindahl, "Concentration in the Steel Industry," unpublished Ph. D. dissertation, Columbia University, 1950, for a discussion of this index. See also my Appendix B for the method of computation of maximum and minimum estimates of the index).

Source: Appendix A, Table A-1.

<sup>22</sup> See Appendix B.

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our index with the percentage of employment accounted for by the leading three firms yields a Spearman rank correlation coefficient of 0.981. Comparison of our index with that used by Herfindahl yields a Spearman rank correlation coefficient of 0.979.<sup>23</sup>

Employment is used to measure concentration in this study since no other data were available on a comprehensive basis.<sup>24</sup> Investigations described elsewhere<sup>25</sup> indicate that concentration of employment and output are highly correlated, but that employment concentration tends to be slightly lower than concentration of output.

### 3. Sources of Data and Selection of Sample

The Canadian statistics used in this study are based on the *Census of Manufactures* taken annually by the Dominion Bureau of Statistics. The reporting unit is the establishment (i.e. in general, the plant) and the information obtained is similar to that collected in the United States. All establishments are enumerated, regardless of size.

The Dominion Bureau of Statistics made a special compilation of the data for 1948, in which those establishments in each industry that belonged to the same firm were grouped together, so that the principal statistics of each industry by size of *firm* (measured in terms of employment) could be given.<sup>26</sup> These size distributions are used for the cross-section studies. For years other than 1948, however, only *plant* size distributions are available, so that the study of changes in concentration over time is confined to concentration by plants.

The size distributions for both plants and firms involve grouping of data, since statistics relating to individual firms must be kept secret. This means that concentration indexes could not be computed exactly, but were estimated from accurately computed upper and lower limits. The resulting estimates are least reliable for industries with high

<sup>23</sup> This correlation is based on only 85 of the 96 industries shown in Appendix A, Table A-1. Eleven industries for which no size distributions of data are available, because the number of firms is small, have been omitted.

<sup>24</sup> In a few industries other measures—output and capacity—are used; see Table A-1.

<sup>25</sup> Rosenbluth, *op. cit.*, pp. 89–92.

<sup>26</sup> If a firm owns plants classified in different industries it will appear in the statistics as several firms. This concept of the firm is more appropriate to an investigation of the structure of product markets than one recording all activities of a multi-industry firm in a single industry.

The firm to which a plant belongs was found by inspection of mailing lists, supplemented for the leading companies by inspection of the financial manuals to determine subsidiaries and parent companies. It is assumed that in this way most fully owned subsidiaries and those controlled through ownership of a majority of voting stock were identified with the parent company.

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concentration, but their general accuracy is indicated by the fact that the upper and lower limits are highly correlated.<sup>27</sup>

The industrial classification used in Census statistics is not the best one for our purpose. To be ideally suited to the study of business policy, a concentration measure should be applied to a group of firms competing in the sale of a given product or homogeneous group of products, with no close substitutes outside the industry. But the facts of economic life make it difficult to establish neat groups of this sort. Products can be defined in various ways, a plant produces different products, and the "product mix" of one plant differs from that of others. Moreover, the group of firms producing a given commodity in a given area is not always the same as the group competing in its sale. When transport costs are high in relation to value of product, the market may be divided regionally. In other cases imports may compete with domestic products, or the latter may compete with others in the export market.

The Canadian Census of Manufactures uses principles of industrial classification much like those followed in the United States. Each industry corresponds to a group of products and each plant is assigned to the industry in which the greater part of the value of its output falls. In establishing these product groups the statisticians have been largely guided by business usage, subject to certain restrictions.

In Canada manufacturing plants have been grouped into broad classes based on the type of *raw material* used (animal products, vegetable products, wood products, etc.).<sup>28</sup> Within each group, however, industries have been distinguished mainly on the basis of *product* use, and sometimes on the basis of the process of production. If an "industry" is carried on by only a few firms it is merged with others, since the official policy is not to publish data pertaining to three firms or less. As an industry grows, it is likely to be subdivided into two or more new classifications, for two reasons. First, as the number of firms increases, it may be possible to separate activities previously merged with others because of the secrecy requirement. Second, as the market expands it becomes worthwhile for firms to specialize in operations previously combined with others in the same plant, and thus a "real" new industry may arise.

To be sure that our measures of concentration would be economically significant, we limited our cross-section study to those industries

<sup>27</sup> See Appendix B.

<sup>28</sup> These groupings are now being superseded by a new "Standard Industrial Classification" similar to the International Standard Classification published by the United Nations.

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in which the firms could reasonably be regarded as close competitors. These industries are, first, those producing roughly the same products (or closely substitutable products) and, second, those with heterogeneous products each of which can be produced by most of the firms. We examined the output of each industry, and rejected those in which a group of reasonably substitutable products did not constitute at least 80 per cent of output (by value). Exceptions were made where the information available indicated that manufacturing equipment was not specialized so that each manufacturer could produce any of the leading products. Of the remaining industries, we also excluded those having a leading product of which over 20 per cent was produced in other industries.

The 96 industries that survived both tests were used in the cross-section analysis, but were divided according to three criteria. Those in which imports or exports accounted for over 20 per cent of the output of the leading product were segregated, and those in which geographical regions constituted separate markets were identified. The largest group, to which none of these qualifications apply, can be regarded as selling in a national market. Concentration as a factor in business policy is, of course, most significant for this last group.<sup>29</sup>

### 4. Summary of Main Findings

The Canadian manufacturing industries show wide variation in the degree of concentration, but, on the average, concentration is quite high. In half the industries studied, 9 or less of the leading firms account for 80 per cent of employment, and in one-third of the industries less than 5 firms account for 80 per cent of employment. Examples of industries with very high concentration are the primary metals, automobiles, railway equipment, cotton textiles, cigarettes, distilleries, and many of the industries processing nonmetallic minerals and chemicals, such as glass and compressed gases.

<sup>29</sup> Decisions regarding the homogeneity of product groups, the specialization of firms, and the regional separation of markets were based on personal judgment, common knowledge, and consultation of officers of the Dominion Bureau of Statistics, and were confirmed by comparison of the resulting classification with a similar classification of United States manufacturing industries in *The Structure of the American Economy*, National Resources Committee, 1939, Part I, Appendix 8.

Two industries should not, strictly speaking, have been included in the sample. Just over 20 per cent of the leading product of *feed mills* is produced in another industry (flour mills), and *iron castings* contains a group of specialized pipe producers. Since these errors were found at a late stage of the work, it was not considered worthwhile to omit these industries.

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On the other hand, there are many industries in which concentration is low. In one-quarter of the industries studied over 40 firms are required to account for 80 per cent of employment. Low concentration is typical of the apparel industries and many other branches of the textiles group, and of bread, butter and cheese, and other food processing industries. Other examples of industries with low concentration are sawmills, planing mills, machine shops, cement products, pharmaceutical preparations. In some of these industries (e.g. bread), concentration measured on a national basis does not indicate the degree of market control, since different regions constitute substantially separate markets. Within each such region concentration is likely to be higher.

One of the striking features apparent even on a superficial examination of the data is that large industries tend to be less concentrated than small industries. For example, while the industries in which over 40 firms are required to account for 80 per cent of employment constitute one-quarter of the number of industries examined, they account for nearly one-half of the total employment in the sample. Thus the general level of concentration appears lower when the size of industries is taken into account than when each industry is given an equal weight. This inverse correlation between concentration and industry size has been reported also by students of concentration in the United States and the United Kingdom.<sup>30</sup>

In interpreting our findings regarding the level of concentration the reader will, of course, bear in mind that other aspects of an industry's structure also influence business policy. We do not measure the importance of collusion, public regulation, trade association activities, interlocking directorates, identity of creditors or stockholders of different firms, and other ways in which the policies of firms may be coordinated.

To permit investigation of the causes of variation in concentration, the concentration index was broken down into simpler component variables. We show that concentration is, mathematically, a function of the size of the industry, the average size of firms in the industry, and the degree of inequality of firm sizes within an industry. Some 29 per cent of the variation in concentration among our industries can be ascribed, directly and indirectly, to variation in the size of the industries; 64 per cent can be ascribed to independent variation in average firm size (i.e. variation in average firm size not connected with

<sup>30</sup> See, for example, P. Sargent Florence, *The Logic of British and American Industry*, University of North Carolina Press, 1953, pp. 130-131.

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the variation in industry size); and only 7 per cent to variation in the degree of inequality of firm sizes.

These findings have a number of important implications and determine the further direction of the inquiry. Inequality in the size of firms within industries is of very little importance as a cause of variation in concentration. This somewhat surprising result provides the justification for avoiding in the present study the very difficult question of the causes of inequality of firm size.

On the other hand, nearly two-thirds of the variation in concentration is due to variation in *average* firm size. Thus the common idea that large firms mean high concentration, while not, by any means, necessarily correct, is apparently often true in fact. These results also suggest that a promising attack on the causes of variation in concentration can be made by inquiring why average firm size varies among industries.

A number of writers on industrial organization have suggested that firms tend to be large where the technique of production requires a high proportion of capital to labor. Large firms can generally obtain capital on better terms than small ones, and this advantage is of greater competitive significance where capital is important among the factors of production. Moreover, the greater the variety of machinery used in the process of production, the higher the lowest common multiple of machine capacities is likely to be, and this determines the minimum scale of plant required for full capacity operation.

A second factor influencing firm size is the importance of transportation costs (for the product or the raw material) in relation to other costs. High transportation costs tend to diminish the economical scale of the plant, if they occur in conjunction with scattered location of the market or of raw material sources. In such a case, increasing the scale of operation at one place involves transportation of the raw materials or product over increasing distances, and thus raises costs. This limitation on plant size will in turn affect the average size of firms where, as appears to be the case in many industries, the competitive advantages of multi-plant operation are not very great.

Regression analysis reveals that the three variables—industry size, capital-labor ratio, and importance of transportation costs—together account for 62 per cent of the variation in concentration. Concentration is here again measured by the number of firms accounting for 80 per cent of employment, an index which, as mentioned above, decreases in numerical value with an increase in concentration. The

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individual influence on this index of each of the three factors is indicated by the following figures:

Other things equal, industries in which transportation costs are an important factor have, on the average, twelve times as high a concentration index as the rest (i.e. lower concentration). An industry that is 10 per cent larger than another, has, on the average and other things equal, a concentration index that is 3 per cent higher (i.e. lower concentration). Finally, an industry with a 10 per cent higher capital-labor ratio than another has, on the average, a concentration index that is 7 per cent lower (i.e. higher concentration).

How is the remaining 38 per cent of the variation in concentration to be explained? The time-honored classification of industries by degree of durability of the product and by type of purchaser (producer goods, consumer goods) reveals no significant differences in concentration when the influence of industry size, capital-labor ratio, and transportation costs has been eliminated. The small differences that are found are, however, suggestive and can be related to theories proposed by various writers. Further research into this question will probably have to be concerned with technical characteristics other than those summed up in the capital-labor ratio, with dynamic factors such as degree of cyclical fluctuation and rate of growth, and possibly with the characteristics of the purchasers of the industry's products.

The findings discussed so far relate to concentration by firms. They also serve to explain the variation in concentration by plants, however, since plant and firm concentration are highly correlated.

While highly correlated, plant and firm concentration are, of course, not the same. Concentration by firms is higher, in most cases, because some firms operate several plants. Moreover, our data reveal that the plants associated in multi-plant firms are generally the larger plants of an industry, while small plants are operated by single-plant firms. This correlation between plant size and number of plants per firm may perhaps occur because there is a balance between, on the one hand, the internal and external economies associated with the expansion of output in one location, and, on the other hand, the cost saving (not confined to transportation costs) associated with the geographical dispersal of a given output. As a firm's output grows, a point is reached where the economies of dispersal begin to outweigh the further economies of growth in a single location.

Differences of opinion regarding antitrust policy, particularly with regard to mergers and "trust-busting," often involve conflicting estimates of the significance of the difference between plant and firm concentration. This matter is investigated in some detail in Chapter

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III. It is found, for example, that while nearly half of total employment in the sample is in industries in which less than 24 *firms* account for 80 per cent of employment, the industries in which less than 24 *plants* account for 80 per cent of employment constitute only just over one-third of the sample's total employment.

The industries in which the difference between plant and firm concentration is particularly large are, of course, those in which multi-plant firms are particularly important. Most of these industries fall into one of two groups. First, there are those in which multi-plant operation reflects the high cost or difficulty of transporting the product or raw materials. It has already been shown how this factor limits plant size. It also limits the average size of firms, but in the industries concerned, most of which process foodstuffs, large multi-plant firms appear to have certain competitive advantages. These are probably not only in finance and management, but also in advertising and reputation as well as in buying and selling. Examples of these industries are bread, fruit and vegetable canning, butter and cheese factories, soft drinks; most of them have relatively low concentration.

The second group consists of industries in which multi-plant operation by the leading firms is the result of a large number of mergers in the course of their growth. In this group are such industries as nickel, matches, cement, distilleries, cigarettes, most of them characterized by very high firm concentration.

Among the industries in which multi-plant firms are of negligible importance there are also examples of both very high and very low concentration. Most of the industries in the textiles, apparel, and wood products groups have very low concentration while primary iron and steel, aircraft, automobiles, bicycles, have high concentration.<sup>31</sup> The reasons for this pattern are suggested in Chapter III. With respect to such industries as steel and automobiles the Canadian pattern differs from that of the United States, where multi-plant firms are significant. This difference is due to the greater density of the United States market, with eleven times the Canadian population, which has made the geographical dispersion of plants economical.

The difference in the size of the United States and Canadian economies is strikingly reflected in the levels of concentration in the two countries. With very few exceptions, comparable industries are

<sup>31</sup> It must be remembered that in this study a multi-plant firm is one that has several plants *in the same (narrowly defined) industry*. Thus the firms that have only one plant at each stage of steel production are single-plant firms, even though they have numerous plants in other industries.

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more highly concentrated in Canada. Further analysis of the data shows that this higher concentration in Canada cannot be attributed to greater inequality of firm sizes. In fact, inequality is usually greater in the United States. The difference in concentration must therefore be the result of a difference in the number of firms, which is in nearly all cases much smaller in Canada. Going further, it is found that Canadian industries have fewer firms because, while the average size of their firms is about the same as in the United States, the industries themselves are much smaller. This smaller industry size, finally, reflects the smaller size of the Canadian economy combined with an industrial pattern very similar to that of the United States.

In technology, business methods, and culture, Canada resembles the United States very closely. Physical proximity, common language and background, as well as United States control of many Canadian manufacturing industries have reinforced the diffusion of culture and technical practices. Thus it is not surprising that firm sizes and *relative* industry sizes are quite similar in the two countries. For the same reasons the ranking of industries by concentration level is much the same in Canada as in the United States.

This comparison of concentration between the two countries suggests that further growth of the Canadian economy will tend to reduce the level of concentration. The same conclusion is suggested by the study of trends in concentration.

Concentration by *plants* for *manufacturing as a whole* increased markedly between about 1890 and 1920, as the factory replaced the workshop in many industries. In the period between the wars, however, plant concentration for manufacturing as a whole did not change significantly. Since industries with high concentration, particularly automobiles and nonferrous metals, became increasingly important during this period, it may be assumed that plant concentration *within* industries, tended, on the average, to decrease. One cannot be sure about the trend of *firm* concentration, however, particularly in view of evidence of a substantial merger wave in the 1920's.

Between 1939 and 1943 there was a sharp increase in plant concentration for manufacturing as a whole, reflecting the increased importance of war production, particularly aircraft and shipbuilding. There is no evidence of a general increase in concentration by plants *within* industries. This upswing in concentration was followed by a reversal of even greater amplitude, so that by 1948 over-all plant concentration was well below the level of the period between the wars. The downswing in concentration was the result both of the

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declining importance of war industries and of a substantial decrease in concentration within many industries.

The decline in plant concentration between 1922 and 1948 took place in the face of increasing mechanization and of substantial growth in the average size of plants. Decreasing concentration must therefore be ascribed to the fact that total output and employment in the manufacturing industries grew even more rapidly than plant size. The growth of manufacturing employment reflects both population growth and the increasing importance of manufacturing in the Canadian economy. Thus the tendency toward increased concentration, which is frequently expected to follow from the progress of mechanization and increasing plant size, has been counteracted by growth of the market.