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APPENDIX A
BASIC TABLES

TABLE A-1

Indexes of Firm Concentration, Selected Canadian Manufacturing Industries, 1948

<i>Group and Industry</i>	<i>Index 1: Percentage of Employ- ment Accounted for by Three Leading Firms</i>	<i>Index 2: Number of Firms Required to Account for 80 Per Cent of Employment</i>	<i>Index 3: Herfindahl's Index, Mini- mum Estimate,^h Employment</i>	<i>Index 4: Herfindahl's Index, Mini- mum Esti- mate,^h Output</i>
<i>Foods, beverages, tobacco</i>				
Cigarettes, cigars, tobacco	84.5	2.1	0.1797	0.1938
Distilleries ^a	84.2	2.5	0.2400	0.2487
Sugar refineries	68.3	4.1	0.1805	0.1957
Malt and malt products	66.2	3.6	0.1111	0.1111
Starch and glucose	64.6	4.0	0.1000	0.1000
Macaroni ^a	59.9	5.6	0.0714	0.0714
Tobacco processing and packing	58.6	5.6	0.1392	0.1496
Wine	57.5	9.1	0.1215	0.1173
Slaughtering and meat packing ^a	55.3	11.2	0.1052	0.1000
Processed cheese	49.2	7.4	0.1053	0.1337
Breweries ^b	48.6	8.6	0.0988	0.1111
Biscuits and crackers	41.7	11.1	0.0723	0.0852
Condensed milk ^a	35.6	12.0	0.0377	0.0394
Flour mills ^a	34.9	22.0	0.0604	0.0641
Cocoa, confectionery, etc.	33.4	23.4	0.0519	0.0607
Fruit and vegetable preparations	32.4	72.3	0.0398	0.0593
Soft drinks ^b	30.9	149.2	0.0345	0.0582
Bread and other bakery products ^b	20.9	732.5	0.0194	0.0257
Butter and cheese factories	19.2	369.9	0.0172	0.0161
Prepared stock and poultry feeds ^b	15.5	92.4	0.0167	0.0208
Fish curing and packing ^a	14.9	132.5	0.0175	0.0266
Feed mills ^b	3.4	469.8	0.0022	0.0017
<i>Textiles, leather, fur</i>				
Cotton thread	94.3	1.8	0.2975	0.2963
Cordage, rope, twine ^a	65.9	3.8	0.1463	0.1476
Carpets, mats, rugs ^c	64.0	4.8	0.1551	0.1807
Belting, leather	62.2	6.5	0.1435	0.1112

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TABLE A-1 (cont.)

<i>Group and Industry</i>	<i>Index 1: Percentage of Employ- ment Accounted for by Three Leading Firms</i>	<i>Index 2: Number of Firms Required to Account for 80 Per Cent of Employment</i>	<i>Index 3: Herfindahl's Index, Mini- mum Estimate,^h</i>	<i>Index 4: Herfindahl's Index, Mini- mum Esti- mate,^h Output</i>
<i>Textiles, leather, fur (cont.)</i>				
Cotton yarn and cloth ^c	59.8	5.1	0.1317	0.1307
Narrow fabrics, laces, etc.	53.8	10.3	0.1085	0.0931
Synthetic textiles and silk	48.7	11.3	0.0945	0.0917
Fur dressing and dyeing	41.1	9.1	0.0852	0.0913
Woolen yarn ^c	38.5	14.1	0.0659	0.0737
Corsets and girdles	37.1	13.9	0.0654	0.0640
Cotton and jute bags ^c	36.7	12.8	0.0685	0.0734
Dyeing and finishing of textiles	34.3	12.9	0.0635	0.0595
Woolen cloth ^c	28.3	25.2	0.0412	0.0357
Leather tanneries	26.5	19.3	0.0438	0.0501
Contractors, women's clothing	23.4	42.4	0.0279	0.0169
Leather gloves and mittens	20.9	30.5	0.0311	0.0293
Canvas products	19.9	39.1	0.0257	0.0264
Hosiery and knit goods	15.7	55.8	0.0205	0.0191
Miscellaneous leather products	13.8	80.2	0.0145	0.0160
Contractors, men's clothing	10.8	78.2	0.0126	0.0101
Boots and shoes, leather	8.5	109.6	0.0087	0.0089
Clothing, men's factory	8.2	154.4	0.0078	0.0067
Fur goods	5.6	282.1	0.0040	0.0046
Clothing, women's factory	4.0	517.0	0.0023	0.0022
<i>Wood products</i>				
Excelsior	62.8	4.0	0.1000	0.1000
Coffins and caskets	43.4	14.5	0.0759	0.0713
Plywood and veneer ^a	33.8	13.3	0.0526	0.0561
Flooring, hard wood	32.0	12.8	0.0641	0.0638
Boat building	17.0	92.7	0.0117	0.0136
Furniture	7.4	277.1	0.0047	0.0055
Sawmills ^a	7.0	1,843.4	0.0036	0.0069
Planing mills, sash and door factories ^b	4.6	377.0	0.0035	0.0041
<i>Paper products</i>				
Roofing paper	60.5	6.3	0.1406	0.1225
Pulp and paper mills ^a	27.8	22.5	0.0448	0.0484
Paper boxes and bags	16.8	57.6	0.0196	0.0259
<i>Iron and steel products</i>				
Pig iron	91.9 ^d	2.6 ^d	n.a.	0.2955 ^d
Automobiles	87.5	1.7	0.2181	0.2126
Railway rolling stock	79.2	3.1	0.2159	0.1659
Aircraft and parts ^a	78.2	3.1	0.2012	0.2030
Steel ingots and castings	76.3 ^e	3.4 ^e	n.a.	0.2053 ^e
Agricultural implements ^{a,c}	63.4	4.4	0.1377	0.1560
Bicycles ^c	80.6	2.9	0.1546	0.1526
Shipbuilding ^a	32.3	13.1	0.0626	0.0699
Iron castings ^b	19.8	45.9	0.0267	0.0314
Machine shops ^b	6.2	229.6	0.0046	0.0049

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TABLE A-1 (cont.)

<i>Group and Industry</i>	<i>Index 1: Percentage of Employ- ment Accounted for by Three Leading Firms</i>	<i>Index 2: Number of Firms Required to Account for 80 Per Cent of Employment</i>	<i>Index 3: Herfindahl's Index, Mini- mum Estimate,^h</i>	<i>Index 4: Herfindahl's Index, Mini- mum Esti- mate,^h Output</i>
<i>Nonferrous metals</i>				
Aluminum ^a	100 (1 firm)	0.8	1.0000	1.0000
Nickel ^a	100 (2 firms)	0.9 ^g	n.a.	0.8957 ^g
<i>Nonmetallic minerals</i>				
Cement	100.0	1.2	0.3333	0.3333
Gypsum products	91.7	1.6	0.2500	0.2500
Glass ^c	91.7	1.6	0.2500	0.2500
Artificial abrasives ^a	86.7	2.0	0.2000	0.2000
Abrasives products	81.9	2.7	0.1850	0.1923
Petroleum products ^c	80.1	2.99	0.2195	0.2052
Asbestos products ^c	64.0	4.8	0.1591	0.1349
Coke products ^c	52.7	5.7	0.1204	0.1307
Plate, cut and ornamental glass ^c	40.4	24.6	0.0634	0.0871
Cement products ^b	11.7	119.2	0.0118	0.0143
<i>Chemicals</i>				
Hardwood distillation	100 (2 firms)	1.0	0.5000	0.5000
Matches	97.9 ^t	0.9 ^f	n.a.	0.8030 ^f
Coal tar distillation ^c	91.7	1.6	0.2500	0.2500
Compressed gases	81.4	2.9	0.2272	0.2513
Soaps	74.6	4.1	0.1886	0.2414
Boiler compounds	66.7	3.7	0.1562	0.1819
Writing inks	66.3	3.8	0.1629	0.1850
Washing compounds	56.3	8.2	0.1116	0.1547
Printing inks	56.7	6.3	0.1121	0.1273
Vegetable oils ^a	53.7	7.0	0.1206	0.0902
Polishes and dressings	36.0	12.1	0.0677	0.0864
Paints and varnishes	31.5	22.2	0.0478	0.0436
Medicinal and pharma- ceutical preparations	19.7	49.4	0.0238	0.0263
<i>Miscellaneous</i>				
Pipes and smokers' supplies	85.3	2.3	0.2451	0.3081
Umbrellas	83.5	2.7	0.2416	0.2283
Fountain pens and pencils	67.3	4.4	0.1692	0.1248
Buttons	48.9	8.8	0.0942	0.0962

^a Industries classified as having high exports (see Chap. I).

^b Industry classified as having regionally separated markets (see Chap. I).

^c Industry classified as having high imports (see Chap. I).

^d Concentration measured in terms of blast furnace capacity. *The Primary Iron and Steel Industry, 1948*, Ottawa, Dominion Bureau of Statistics, 1949, p. 8.

^e Concentration measured in terms of steel furnace capacity. *The Primary Iron and Steel Industry, 1948*, p. 13.

^f Concentration measured in terms of number of matches produced. *Matches*, Report of Commissioner, Combines Investigation Act, Dec. 27, 1949, Ottawa, King's Printer, 1950.

^g Concentration measured in terms of value of sales of nickel producers. *Moody's Industrials, 1949*.

^h See Chap. I, sec. 2, and Appendix B.

n.a. = not available.

Source: Estimated from unpublished data by firm-size groups, from returns of the Census of Manufactures, 1948, compiled by the Dominion Bureau of Statistics, Ottawa, in 1950. Method of computing indexes described in Appendix B.

APPENDIX A

TABLE A-2

Indexes of Plant Concentration and Inequality, Total Canadian Manufacturing, 1922-1948

YEAR	NUMBER OF PLANTS REQUIRED TO ACCOUNT FOR 80 PER CENT OF				PERCENTAGE OF PLANTS REQUIRED TO ACCOUNT FOR 80 PER CENT OF			
	<i>Employment</i>		<i>Output</i>		<i>Employment</i>		<i>Output</i>	
	<i>Maximum</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Minimum</i>
1922	3,085	2,680	2,183	2,134	13.7	11.9	9.7	9.5
1923	3,319	2,879	2,228	2,198	14.7	12.7	9.8	9.7
1924	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1925	3,461	3,000	2,237	2,235	15.5	13.4	10.0	10.0
1926	3,244	2,899	2,177	2,054	14.3	12.8	9.6	9.1
1927	3,611	3,189	2,221	2,026	15.7	13.9	9.7	8.8
1928	3,507	3,160	2,302	2,041	15.0	13.5	9.8	8.7
1929	3,738	3,347	2,233	1,938	15.8	14.2	9.5	8.2
1930	3,757	3,315	2,251	2,042	15.6	13.8	9.4	8.5
1931	3,469	3,017	2,361	2,299	14.2	12.3	9.6	9.4
1932	3,411	3,142	2,348	2,179	14.5	13.4	10.0	9.3
1933	3,473	3,263	2,282	2,102	14.4	13.5	9.4	8.7
1934	3,569	3,262	2,211	2,132	14.5	13.3	9.0	8.7
1935	3,510	3,070	2,132	2,123	14.4	12.5	8.7	8.7
1936	3,476	3,039	2,137	2,058	14.4	12.5	8.8	8.5
1937	3,529	3,152	2,148	1,927	14.2	12.7	8.6	7.8
1938	3,698	3,240	2,247	2,135	14.7	12.9	8.9	8.5
1939	3,718	3,281	2,271	2,113	15.0	13.2	9.2	8.5
1940	3,823	3,333	2,173	1,917	15.0	13.1	8.5	7.5
1941	3,162	3,141	2,082	2,014	12.0	11.9	7.9	7.7
1942	2,976	2,809	1,960	1,901	10.7	10.1	7.0	6.8
1943	2,818	2,570	1,848	1,700	10.2	9.3	6.7	6.1
1944	3,096	2,913	1,994	1,863	10.9	10.2	7.0	6.5
1945	3,710	3,677	2,453	2,433	12.8	12.7	8.4	8.4
1946	5,091	4,488	3,354	3,078	16.3	14.4	10.7	9.9
1947	5,079	4,528	2,942	2,916	15.5	13.8	9.0	8.9
1948	5,152	4,607	2,883	2,723	15.4	13.8	8.6	8.1

Source: Computed from *The Manufacturing Industries of Canada*, Ottawa, Dominion Bureau of Statistics, various years. For method of computation see Appendix B.

TABLE A-3

Number of Plants per Firm, Selected Canadian Manufacturing Industries, 1948

<i>Group and Industry</i>	<i>Average Number of Plants per Firm^b</i>	<i>Weighted Average Number of Plants per Firm^c</i>
<i>Foods, beverages, tobacco</i>		
Fruit and vegetable preparations	1.32	8.08
Bread and other bakery products	1.04	5.02
Slaughtering and meat packing	1.18	3.89
Breweries	1.61	3.70
Soft drinks	1.12	3.64
Butter and cheese factories	1.06	3.61
Fish curing and packing	1.14	2.74
Distilleries	1.50	2.68
Cigarettes, cigars, etc.	1.15	2.52
Prepared feeds	1.22	2.13
Flour mills	1.07	1.97
Biscuits, crackers	1.20	1.78
Sugar refineries	1.57	1.78
Condensed milk	1.23	1.62
Wine	1.22	1.62
Cocoa, confectionery, etc.	1.04	1.55
Tobacco processing and packing	1.31	1.54
Malt and malt products	1.44	1.44
Macaroni	1.21	1.21
Processed cheese	1.11	1.17
Feed mills	1.01	1.03
Starch and glucose	1.00	1.00
<i>Textiles, leather, fur</i>		
Cotton yarn and cloth	1.81	3.93
Hosiery and knit goods	1.14	1.74
Cotton and jute bags	1.21	1.66
Synthetic textiles and silk	1.15	1.41
Woolen yarn	1.07	1.37
Narrow fabrics, laces, etc.	1.08	1.25
Woolen cloth	1.03	1.22
Dyeing and finishing of textiles	1.05	1.11
Clothing, men's factory	1.02	1.10
Contractors, men's clothing	1.02	1.09
Clothing, women's factory	1.01	1.07
Leather gloves and mittens	1.01	1.06
Fur goods	1.01	1.05
Corsets and girdles	1.03	1.04
Leather boots and shoes	1.00	1.01
Canvas products	1.00	1.00
Belting, leather	1.00	1.00
Carpets, mats, and rugs	1.00	1.00
Contractors, women's clothing	1.00	1.00
Cordage, rope, and twine	1.00	1.00
Cotton thread	1.00	1.00
Fur dressing and dyeing	1.00	1.00
Leather tanneries	1.00	1.00
Miscellaneous leather products	1.00	1.00

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APPENDIX A

TABLE A-3 (cont.)

<i>Group and Industry</i>	<i>Average Number of Plants per Firm^b</i>	<i>Weighted Average Number of Plants per Firm^c</i>
<i>Wood products</i>		
Coffins and caskets	1.12	1.67
Sawmills	1.03	1.39
Plywood and veneer	1.05	1.13
Planing mills, sash and door factories	1.01	1.12
Furniture	1.01	1.11
Boat building	1.00	1.00
Flooring, hardwood	1.00	1.00
Excelsior	1.00	1.00
<i>Paper products</i>		
Pulp and paper mills	1.65	3.40
Roofing paper	1.53	2.16
Paper boxes and bags	1.08	1.38
<i>Iron and steel products</i>		
Railway rolling stock	2.11	5.27
Agricultural implements	1.03	1.33
Steel ingots and castings	1.03	1.17 ^d
Iron castings	1.03	1.21
Aircraft and parts	1.00	1.00
Automobiles	1.00	1.00
Bicycles	1.00	1.00
Machine shop	1.00	1.00
Pig iron	1.00	1.00
Shipbuilding	1.00	1.00
<i>Nonferrous metals</i>		
Aluminum ^a	5.00	5.00
Nickel	2.00	2.89 ^e
<i>Nonmetallic minerals</i>		
Petroleum products	1.83	4.26
Cement	2.67	2.67
Gypsum products	2.5	2.5
Plate, cut, and ornamental glass	1.10	1.88
Glass	1.75	1.75
Artificial abrasives	1.20	1.20
Coke products	1.09	1.13
Cement products	1.02	1.12
Abrasive products	1.00	1.00
Asbestos products	1.00	1.00
<i>Chemicals</i>		
Compressed gases	3.21	8.50
Matches	2.50	6.36 ^e
Coal tar distillation	2.75	2.75
Vegetable oils	1.33	1.65
Hardwood distillation	1.50	1.50

(cont. on next page)

APPENDIX A

TABLE A-3 (cont.)

<i>Group and Industry</i>	<i>Average Number of Plants per Firm^b</i>	<i>Weighted Average Number of Plants per Firm^c</i>
<i>Chemicals (cont.)</i>		
Washing compounds	1.06	1.45
Paints and varnishes	1.05	1.41
Medicinal and pharmaceutical preparations	1.02	1.28
Printing inks	1.05	1.14
Soaps	1.02	1.02
Boiler compounds	1.00	1.00
Polishes and dressings	1.00	1.00
Writing inks	1.00	1.00
<i>Miscellaneous</i>		
Umbrellas	1.17	1.28
Fountain pens and pencils	1.09	1.22
Buttons	1.00	1.00
Pipes and smokers' supplies	1.00	1.00

^a One company in the industry. This company has 5 reduction plants and also one alumina plant which was not included here.

^b Number of plants divided by number of firms.

^c Number of plants per firm in each firm-size class weighted by percentage of industry's employment in that size class.

^d Percentage of total capacity used as weights.

^e Sales volume used as weights.

Source: Unpublished special compilation of data by firm-size classes, Ottawa, Dominion Bureau of Statistics.

TABLE A-4

Number of Firms and Plants Required to Account for 80 Per Cent of Employment, 96 Canadian Manufacturing Industries,^a 1948

INDUSTRY	NUMBER REQUIRED TO ACCOUNT FOR 80 PER CENT OF EMPLOYMENT		TOTAL EMPLOYMENT (3)
	<i>Firms</i> (1)	<i>Plants</i> (2)	
A. Industries in which 3 firms or less are required to account for 80 per cent of employment			
Hardwood distillation	1.0	1.2	167
Aluminum	0.8	2.0	10,000 ^b
Nickel	0.9	1.6	
Automobiles	1.7	1.7	24,703
Cotton thread	1.8	1.8	1,036
Pipes and smokers' supplies	2.3	2.3	333
Pig iron	2.6	2.6	3,837 ^c
Abrasive products	2.7	2.7	822
Glass	1.6	2.8	4,002
Bicycles	2.9	2.9	795
Cement	1.2	3.2	1,723

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APPENDIX A

TABLE A-4 (cont.)

INDUSTRY	NUMBER REQUIRED TO ACCOUNT FOR 80 PER CENT OF EMPLOYMENT		TOTAL EMPLOYMENT (3)
	<i>Firms</i>	<i>Plants</i>	
	(1)	(2)	
Artificial abrasives	2.0	3.4	1,835
Matches	0.9	3.5	738
Umbrellas	2.7	3.7	188
Gypsum products	1.6	4.0	951
Coal tar distillation	1.6	4.4	380
Cigarettes, cigars, etc.	2.1	7.1	8,959
Distilleries	2.5	7.3	4,213
Petroleum products	3.0	11.0	8,245
Compressed gases	2.9	21.2	1,156

B. Industries in which more than 3 firms but not more than 6 are required to account for 80 per cent of employment

Aircraft and parts	3.1	3.1	8,049
Steel ingots and castings	3.4	3.5	6,630 ^c
Boiler compounds	3.7	3.7	140
Writing inks	3.8	3.8	95
Cordage, rope, twine	3.8	3.8	1,470
Starch and glucose	4.0	4.0	964
Excelsior	4.0	4.0	161
Soaps	4.1	4.2	2,589
Asbestos products	4.8	4.8	1,020
Carpets, mats, rugs	4.8	4.8	1,541
Malt and malt products	3.6	5.2	676
Pens and pencils	4.4	5.5	1,248
Agricultural implements	4.4	5.7	19,111
Sugar refineries	4.1	5.8	3,267
Coke products	5.7	6.6	3,241
Macaroni	5.6	6.8	676
Tobacco processing and packing	5.6	8.6	1,500
Railway rolling stock	3.1	13.2	31,371
Cotton yarn and cloth	5.1	16.3	24,813

C. Industries in which more than 6 firms but not over 12 are required to account for 80 per cent of employment

Printing inks	6.3	6.5	547
Leather belting	6.5	6.5	214
Processed cheese	7.4	7.8	813
Buttons	8.8	8.8	1,844
Roofing paper	6.3	8.9	2,562
Vegetable oils	7.0	9.0	819
Fur dressing and dyeing	9.1	9.1	1,602
Washing compounds	8.2	10.6	485
Narrow fabrics, laces, etc.	10.3	11.8	2,081
Wine	9.1	12.8	664
Synthetic textiles and silk	11.3	13.9	16,097
Condensed milk	12.0	17.1	1,883

(cont. on next page)

APPENDIX A

TABLE A-4 (cont.)

INDUSTRY	NUMBER REQUIRED TO ACCOUNT FOR 80 PER CENT OF EMPLOYMENT		TOTAL EMPLOYMENT (3)
	<i>Firms</i> (1)	<i>Plants</i> (2)	
Biscuits and crackers	11.1	18.2	5,671
Breweries	8.6	26.9	8,407
Slaughtering and meat packing	11.2	29.5	21,879

D. Industries in which more than 12 firms
but not more than 24 are required to
account for 80 per cent of employment

Polishes and dressings	12.1	12.1	723
Hardwood flooring	12.8	12.8	1,536
Shipbuilding	13.1	13.1	18,399
Corsets	13.9	14.4	3,154
Dyeing and finishing of textiles	12.9	14.7	2,713
Plywood and veneer	13.3	15.2	6,335
Woolen yarn	14.1	17.2	4,840
Cotton and jute bags	12.8	17.9	1,360
Leather tanning	19.3	19.3	4,848
Coffins and caskets	14.5	19.7	1,322
Paints and varnishes	22.2	26.6	5,558
Cocoa, confectionery, etc.	23.4	29.1	10,076
Flour mills	22.0	32.9	5,325
Pulp and paper mills	22.5	50.3	51,924

E. Industries in which more than 24 firms
but not over 100 are required to account
for 80 per cent of employment

Woolen cloth	25.2	28.2	9,895
Plate, cut, and ornamental glass	24.6	31.2	1,916
Leather gloves and mittens	30.5	31.5	2,415
Canvas products	39.1	39.1	1,365
Contractors, women's clothing	42.4	42.4	1,572
Iron castings	45.9	49.5	19,354
Medicinal and pharmaceutical preparations	49.4	53.0	7,641
Paper boxes and bags	57.6	67.4	12,357
Hosiery and knit goods	55.8	75.6	27,634
Miscellaneous leather products	80.2	80.2	4,936
Men's clothing contractors	78.2	81.2	4,345
Boat building	92.7	92.7	1,569
Prepared stock and poultry feeds	92.4	134.1	4,324
Fruit and vegetable preparations	72.3	155.0	16,644

F. Industries in which over 100 firms are
required to account for 80 per cent of
employment

Cement products	119.2	125.6	3,760
Boots and shoes, leather	109.6	110.7	21,265
Clothing, men's factory	154.4	161.0	31,092

(cont. on next page)

APPENDIX A

TABLE A-4 (cont.)

INDUSTRY	NUMBER REQUIRED TO ACCOUNT FOR 80 PER CENT OF EMPLOYMENT		TOTAL EMPLOYMENT
	<i>Firms</i>	<i>Plants</i>	
	(1)	(2)	(3)
Fish curing and packing	132.5	173.9	12,243
Soft drinks	149.2	191.8	6,683
Machine shops	229.6	229.6	5,739
Fur goods	282.1	286.2	6,443
Furniture	277.1	287.2	25,893
Planing mills, etc.	377.0	391.5	17,794
Butter and cheese factories	369.9	442.0	21,824
Feed mills	469.8	478.6	1,799
Clothing, women's factory	517.0	529.0	33,416
Bread and other bakery products	732.5	836.7	31,543
Sawmills	1,843.4	1,993.7	56,756

^a This table includes all the industries in Table A-1.

^b Rough estimate based on output. Total employment in Nonferrous Metal Smelting and Refining is 19,701.

^c Estimated by dividing total employment for Primary Iron and Steel among its component groups in proportion to value added, which was computed from data in *The Primary Iron and Steel Industry, 1948*, Ottawa, Dominion Bureau of Statistics, December 1949.

Column	Source
1	Table A-1, Index 2.
2	Plant-size distributions, supplied by Dominion Bureau of Statistics. Method of computing as for col. 1 (see Appendix B).
3	Same source as col. 2.

TABLE A-5

Basic Series, Canadian Manufacturing Industries, 1917-1948

Year	Number of Establishments (1)	Total Power Equipment (h.p.) (2)	Em- ployees (thousands) (3)	Gross Value of Products (\$ millions) (4)	Number of Employees per Estab- lishment (3) ÷ (1) (5)	Horsepower per Estab- lishment (2) ÷ (1) (6)	Horsepower per Employee (2) ÷ (3) (7)
1917	21,845	1,658	606.5	2,821	27.76	75.92	2.73
1918	21,777		602.2	3,227	27.65		
1919	22,083		594.1	3,221	26.90		
1920	22,532	2,069	598.9	3,707	26.58	91.82	3.45
1921	20,848		438.6	2,489	21.04		
1922	21,016		456.3	2,375	21.71		
1923	21,080	2,147	506.2	2,663	24.01	101.85	4.24
1924	20,709	2,527	487.6	2,571	23.55	122.04	5.18
1925	20,981	2,877	522.9	2,817	24.92	137.14	5.50
1926	21,301	3,122	559.2	3,101	26.25	146.58	5.58

(cont. on next page)

APPENDIX A

TABLE A-5 (cont.)

Year	Number of Establishments (1)	Total Power Equipment (h.p.) (2)	Employees (thousands) (3)	Gross Value of Products (\$ millions) (4)	Number of Employees per Establishment (3) ÷ (1) (5)	Horsepower per Establishment (2) ÷ (1) (6)	Horsepower per Employee (2) ÷ (3) (7)
1927	21,501	3,277	595.1	3,257	27.68	152.43	5.51
1928	21,973	3,580	631.4	3,582	28.74	162.95	5.67
1929	22,216	3,856	666.5	3,883	30.00	173.55	5.78
1930	22,618	4,039	614.7	3,280	27.18	178.57	6.57
1931	23,083	4,100	528.6	2,555	22.90	177.62	7.76
1932	23,102	4,143	468.8	1,980	20.29	179.32	8.84
1933	23,780	4,135	468.7	1,954	19.71	173.89	8.82
1934	24,209	4,229	519.8	2,394	21.47	174.71	8.14
1935	24,034	4,331	556.7	2,654	23.16	180.22	7.78
1936	24,202	4,462	594.4	3,002	24.56	184.36	7.51
1937	24,834	4,712	660.5	3,625	26.59	189.75	7.13
1938	25,200	4,970	642.0	3,338	25.48	197.21	7.74
1939	24,805	5,045	658.1	3,475	26.53	203.40	7.67
1940	25,513	5,291	762.2	4,529	29.88	207.38	6.94
1941	26,293	5,850	961.2	6,076	36.56	222.50	6.09
1942	27,862	6,062	1,152.1	7,554	41.35	217.57	5.26
1943	27,652	6,416	1,241.1	8,733	44.88	232.02	5.17
1944	28,483	6,468	1,222.9	9,074	42.93	227.10	5.29
1945	29,050	6,607	1,119.4	8,250	38.53	227.42	5.90
1946	31,249	6,784	1,053.2	8,036	33.86	217.09	6.41
1947	32,734	7,399	1,131.8	10,081	34.57	226.04	6.54
1948	33,447	8,159	1,156.0	11,877	34.56	243.95	7.06

Source: Cols. 1, 3, 4: *The Manufacturing Industries of Canada, 1948*, Ottawa, Dominion Bureau of Statistics, p. 7. Col. 2: *Ibid.*, pp. 12, 83 and *The Manufacturing Industries of Canada, 1939*, p. 56.

TABLE A-6

Concentration and Related Time Series, 16 Canadian Manufacturing Industries, 1932-1948

YEAR	INDUSTRY'S EMPLOYMENT	CONCENTRATION INDEX ^a		INEQUALITY INDEX ^b		NUMBER OF PLANTS
		Output	Employment	Output	Employment	
Slaughtering and Meat Packing						
1933	9,289	19.5	22.0	14.4	16.3	135
1934	10,119	20.7	23.0	14.1	15.6	147
1935	10,674	22.6	22.4	16.3	16.1	139
1936	11,776	23.4	23.3	16.5	16.4	142
1937	13,070	22.9		16.6		138
1938	12,503	24.9		17.1		145
1939	12,765	28.6		19.0		150

(cont. on next page)

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TABLE A-6 (cont.)

YEAR	INDUSTRY'S EMPLOYMENT	CONCENTRATION INDEX ^a		INEQUALITY INDEX ^b		NUMBER OF PLANTS
		Output	Employment	Output	Employment	
Slaughtering and Meat Packing (cont.)						
1940	14,301					
1941	16,260		25.4		17.4	146
1942	17,397		25.0		16.9	148
1943	18,775		25.2		16.5	153
1944	23,867		24.0		15.7	153
1945	23,215		25.9		17.1	152
1946	22,536		26.9		18.3	147
1947	21,726		30.2		20.0	151
1948	21,879		31.2		22.0	142
Cotton Yarn and Cloth						
1932	15,092	15.5	15.7	44.2	44.9	35
1933	16,095	17.2	13.6	46.4	36.9	37
1934	18,106	16.8	16.4	46.7	45.6	36
1935	18,121					35
1936	17,910	15.7	15.4	45.0	43.9	35
1937	19,160	17.2		47.9		36
1938	18,049	15.8		42.6		37
1939	19,723	15.2		42.2		36
1940	23,616					37
1941	26,375		15.9		40.9	39
1942	25,796		15.7		39.2	40
1943	23,526		14.9		37.3	40
1944	21,900		15.8		38.4	41
1945	21,646		15.8		38.6	41
1946	20,662		16.4		39.9	41
1947	24,089		15.6		34.6	45
1948	24,813		16.3		34.8	47
Silk and Rayon (Synthetic Textiles and Silk)						
1932	7,036	6.9		28.8		24
1937	10,246	7.9		27.2		29
1938	8,922	7.9		28.2		28
1939	8,221					26
1940	8,512	6.8		25.3		27
1941	10,140	7.6		25.3		30
1942	11,088	9.4		28.4		33
1943	10,920	9.2	10.1	27.7	30.7	33
1944	11,315		10.1		31.6	32
1945	11,950		10.3		31.3	33
1946	13,100		11.3		31.4	36
1947	14,728		11.7		29.3	40
1948	16,097		13.8		30.8	45

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APPENDIX A

TABLE A-6 (cont.)

YEAR	INDUSTRY'S EMPLOYMENT	CONCENTRATION INDEX ^a		INEQUALITY INDEX ^b		NUMBER OF PLANTS
		Output	Employment	Output	Employment	
Women's Factory Clothing ^c						
1932	14,276	171	183	37.0	39.8	461
1933	15,264	190	220	35.2	40.6	540
1934	17,000	211	231	36.6	40.0	577
1935	17,894					591
1936	18,924					583
1937	19,981	226		38.1		593
1938	19,909	223		36.8		605
1939	20,270	228		37.1		615
1940	20,549					604
1941	24,545		276		41.1	671
1942	26,328		326		42.0	775
1943	25,752		346		44.3	781
1944	25,810		373		44.7	835
1945	27,975		446		45.1	989
1946	29,963		493		44.5	1,108
1947	30,969		532		45.5	1,169
1948	33,416		529		45.6	1,160
Leather Tanning						
1937	4,382	16.9		20.3		83
1938	3,940	17.0		19.3		88
1939	4,312					84
1940	4,166	14.5		18.6		78
1941	4,640	15.9		20.5		78
1942	4,770	15.0		18.8		80
1943	4,596	15.1	18.4	19.4	23.5	78
1944	4,472		18.9		25.2	75
1945	4,834		19.3		26.1	74
1946	5,400		19.4		24.9	78
1947	5,574		19.6		24.3	81
1948	4,848		19.3		26.5	73
Leather Boots and Shoes						
1937	16,773	77.7		35.2		221
1938	15,932	78.1		36.7		213
1939	16,957					222
1940	17,149	74.8		34.5		217
1941	18,841	79.5		37.9		210
1942	19,113	80.0		36.2		221
1943	18,665	84.6	92.5	38.1	41.7	222
1944	18,638		94.5		41.5	228

(cont. on next page)

APPENDIX A

TABLE A-6 (cont.)

YEAR	INDUSTRY'S EMPLOYMENT	CONCENTRATION INDEX ^a		INEQUALITY INDEX ^b		NUMBER OF PLANTS
		Output	Employment	Output	Employment	
Leather Boots and Shoes (cont.)						
1945	20,096		103.0		39.2	263
1946	22,334		113.2		38.5	294
1947	21,433		98.0		33.2	295
1948	21,265		110.7		37.9	292
Furniture						
1937	10,804	92.7		21.2		434
1938	10,284	98.6		25.1		392
1939	10,572					378
1940	11,541	96.8		25.6		378
1941	13,355	98.2		23.9		411
1942	13,223	104.2		23.7		440
1943	13,440	114.1	120.6	25.4	26.9	449
1944	14,046		130.6		27.7	472
1945	15,729		157.7		25.3	623
1946	19,217		212.7		25.8	824
1947	24,781 ^d		259.3		24.8	1,046 ^e
1948	25,893 ^d		287.2		25.5	1,128 ^e
Automobiles						
1935	13,095	1.8	1.8	8.9	9.2	20
1936	12,933	1.9	1.8	12.1	11.5	16
1937	14,946	1.5		9.8		15
1938	14,872	2.1		17.6		12
1939	14,427	1.7		14.5		12
1940	16,798	1.9		19.0		10
1941	22,401		1.3		12.8	10
1942	24,403		1.3		21.3	6
1943	24,265		1.5		29.1	5
1944	22,499		1.2		24.8	5
1945	17,915		1.4		23.9	6
1946	21,647		1.9		21.2	9
1947	23,837		2.1		23.6	9
1948	24,703		1.7		15.6	11
Petroleum Products						
1933	4,628	9.3	7.7	19.7	16.4	47
1934	4,957	10.7	7.9	21.0	15.5	51
1935	4,856	10.3	9.4	17.8	16.2	58
1936	5,019	10.2	10.8	16.1	17.1	63
1937	5,137	9.1		16.0		57
1938	4,675	9.4		16.0		59
1939	4,766	10.4		19.8		53

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APPENDIX A

TABLE A-6 (cont.)

YEAR	INDUSTRY'S EMPLOYMENT	CONCENTRATION INDEX ^a		INEQUALITY INDEX ^b		NUMBER OF PLANTS
		Output	Employment	Output	Employment	
Petroleum Products (cont.)						
1940	5,156					49
1941	5,406		10.8		22.1	49
1942	5,920		11.9		22.8	52
1943	6,085		11.3		21.7	52
1944	6,809		11.2		23.4	48
1945	6,775		10.9		23.7	46
1946	7,145		10.8		25.2	43
1947	7,760		10.9		23.6	46
1948	8,495		11.8		26.9	44
Paints and Varnishes						
1937	3,324	20.0		24.4		82
1938	3,412	20.7		23.8		87
1939	3,540					93
1940	3,750	22.6		24.3		93
1941	4,225	21.7		23.1		94
1942	4,507	21.3		22.2		96
1943	4,589	22.4	24.7	23.3	25.7	96
1944	4,821		25.1		25.9	97
1945	4,979		24.0		26.7	90
1946	5,006		25.2		28.6	88
1947	5,428		26.1		23.9	109
1948	5,558		26.6		23.4	114
Nonferrous Metals Smelting and Refining						
1934	8,298	6.1	8.0	40.7	53.3	15
1935	8,944	6.3	6.8	42.0	45.3	15
1936	10,015	3.7	4.1	24.7	27.2	15
1937	11,570	3.7		26.4		14
1938	12,788	4.5		32.1		14
1939	12,449	5.5		39.3		14
1940	13,466					14
1941	16,014		5.8		41.4	14
1942	21,162		5.2		32.5	16
1943	26,749		6.1		38.4	16
1944	23,927		6.3		39.4	16
1945	16,771		7.0		41.2	17
1946	14,546		6.0		40.0	15
1947	17,449		5.5		34.4	16
1948	19,701		5.4		32.0	17
Butter and Cheese						
1934	14,389	684.2	918.4	26.0	34.9	2,632
1935	14,786	713.7	940.7	27.6	36.3	2,589

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TABLE A-6 (cont.)

YEAR	INDUSTRY'S EMPLOYMENT	CONCENTRATION INDEX ^a		INEQUALITY INDEX ^b		NUMBER OF PLANTS
		Output	Employment	Output	Employment	
Butter and Cheese (cont.)						
1936	15,545	800.3	894.5	31.1	34.8	2,573
1937	16,583	842.6		32.8		2,568
1938	17,336	794.4		31.4		2,528
1939	17,448	728.9		28.8		2,528
1940	18,039					2,484
1941	18,922		796.7		32.8	2,427
1942	19,465		765.5		32.2	2,378
1943	19,181		645.2		27.9	2,314
1944	18,622		628.5		27.5	2,282
1945	19,435		611.9		30.0	2,241
1946	19,659		539.7		25.0	2,161
1947	20,757		536.2		26.3	2,037
1948	21,824		442.0		22.7	1,951
Pulp and Paper						
1934	26,993	36.6	39.0	38.6	41.1	95
1935	27,836	37.7	39.8	39.7	41.9	95
1936	30,054	37.5	40.1	41.5	43.1	93
1937	33,205	39.0		39.8		98
1938	30,943	40.6		41.0		99
1939	31,016	39.3		39.3		100
1940	34,719					103
1941	37,154		43.5		41.0	106
1942	38,007		43.6		41.5	105
1943	37,020		44.8		42.2	106
1944	37,896		44.6		42.9	104
1945	39,996		46.5		42.7	109
1946	44,967		47.1		41.7	113
1947	49,946		48.7		42.3	115
1948	51,924		49.1		42.0	117
Electrical Apparatus						
1935	15,549	34.8	31.4	19.1	17.3	182
1936	17,037	34.8	31.9	18.7	17.1	186
1937	21,706	31.6		16.5		191
1938	20,353	32.1		17.1		188
1939	20,261	33.0		17.4		190
1940	25,120					194
1941	33,086		32.1		15.2	211
1942	39,676		34.4		15.3	225
1943	46,928		34.0		15.2	223
1944	48,834		35.2		12.0	234
1945	44,129		38.5		15.6	247
1946	43,998		32.0		12.0	266

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TABLE A-6 (cont.)

YEAR	INDUSTRY'S EMPLOYMENT	CONCENTRATION INDEX ^a		INEQUALITY INDEX ^b		NUMBER OF PLANTS
		Output	Employment	Output	Employment	
1947	52,736		45.3		15.3	296
1948	53,873		47.3		15.1	314
Sawmills						
1935	25,727	257.8	645.2	7.0	17.4	3,698
1936	28,786	219.8	553.9	6.0	15.2	3,638
1937	33,917	287.7		7.5		3,836
1938	31,182	317.0		8.2		3,873
1939	32,399	307.4		7.8		3,941
1940	39,501					4,675
1941	45,104		1,085.6		23.3	4,655
1942	47,765		1,360.3		25.8	5,277
1943	43,954		1,418.1		27.6	5,140
1944	43,516		1,821.6		33.1	5,506
1945	44,040		1,660.5		31.4	5,295
1946	49,352		2,001.0		33.3	6,001
1947	55,425		2,059.0		31.8	6,481
1948	56,756		1,993.7		28.3	7,035
Flour and Feed Mills						
1934	5,633	108.8	396.3	8.3	30.3	1,310
1935	5,454	91.7	312.2	8.1	27.7	1,127
1936	5,685	104.2	283.9	9.3	25.4	1,118
1937	5,803	65.5		6.0		1,086
1938	5,778	52.3		4.8		1,080
1939	5,898	118.0		11.2		1,050
1940	6,215					1,027
1941	6,528		266.7		23.6	1,129
1942	6,720		290.4		24.8	1,171
1943	7,163		226.5		20.0	1,131
1944	7,289		206.5		19.0	1,087
1945	7,511		174.6		17.1	1,023
1946	8,036		176.9		18.2	974
1947	8,285		181.6		19.0	961
1948	7,124		184.4		20.0	924

^a Number of largest plants accounting for 80 per cent of employment.

^b Percentage of plants accounting for 80 per cent of employment.

^c Includes laces, tapes, and bindings up to 1938.

^d Figures include employment of the Mattresses and Springs industry which had 3,485 employees in 1946.

^e Figures include plants of the Mattresses and Springs industry which had 77 establishments in 1946.

Source: Employment and number of plants: *The Manufacturing Industries of Canada*, Ottawa, Dominion Bureau of Statistics, various years. Concentration and inequality indexes computed from plant-size distributions, some published in *Manufacturing Industries of Canada*, and some unpublished, obtained from Dominion Bureau of Statistics. Size distributions for Cotton Yarn and Cloth, Silk and Rayon, Women's Clothing, 1932, from *Textile Industries of Canada, 1931-32*.

TABLE A-7
Miscellaneous Basic Data, Selected Canadian Manufacturing Industries, 1948

Industry and Group	Number of Firms (1)	Number of Plants (2)	Employment per Firm (3)	Employment per Plant (4)	Horsepower of Equipment in Use per Wage Earner (h.p.) (5)	Adjusted Index of Mechanization (k.w.h.) (6)	Percentage of Firms Required to Account for 80 Per Cent of Employment in the Industry (7)
<i>Food, beverages, tobacco</i>							
Cigarettes, cigars, tobacco	54	62	166.9	144.5	.7	1,291.1	3.9
Distilleries	12	18	351.1	234.1	3.7	6,338.4	20.7
Sugar refining	7	11	466.7	297.0	11.2	13,751.6	58.9
Malt and malt products	9	13	75.1	52.0	24.9	46,748.7	40.0
Starch and glucose	10	10	96.4	96.4	9.3	6,395.9	40.0
Macaroni	14	17	48.3	39.8	3.9	9,293.0	40.0
Tobacco processing and packing	13	17	115.4	88.2	1.4	1,306.9	42.9
Wine	23	28	28.9	23.7	3.7	4,584.8	39.5
<i>Slaughtering and meat packing</i>							
Processed cheese	19	21	42.8	38.7	2.7	3,731.4	9.4
Breweries	38	61	221.2	137.8	4.9	12,180.6	38.9
Biscuits and crackers	41	49	138.3	115.7	1.6	1,653.0	22.7
Condensed milk	30	37	62.8	50.9	6.7	8,866.1	27.0
Flour mills	156	167	34.1	31.9	19.2	42,408.9	40.1
Cocoa, confectionery, etc.	188	196	53.6	51.4	2.4	1,966.4	14.1
<i>Fruit and vegetable preparations</i>							
Soft drinks	378	499	44.0	33.4	3.3	2,545.8	19.1
	408	458	16.4	14.6	1.6	2,629.9	36.6

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APPENDIX A

TABLE A-7 (cont.)

Industry and Group	Number of Firms (1)	Number of Plants (2)	Employment per Firm (3)	Employment per Plant (4)	Horsepower of Equipment in Use per Wage Earner (h.p.) (5)	Adjusted Index of Mechanization (k.w.h.) (6)	Percentage of Firms Required to Account for 80 Per Cent of Employment in the Industry (7)
<i>Foods, beverages, tobacco (cont.)</i>							
Bread and other bakery products	2,748	2,859	11.5	11.0	.8	1,851.2	26.7
Butter and cheese factories	1,848	1,951	11.8	11.2	3.7	4,553.4	20.0
Prepared stock and poultry feeds	260	318	16.6	13.6	14.0	15,262.8	35.5
Fish curing and packing	527	600	23.2	20.4	2.8	4,054.3	25.1
Feed mills	748	757	2.4	2.4	44.8	28,502.2	62.8
<i>Textiles, leather, fur</i>							
Cotton thread	6	6	172.7	172.7	2.5	4,717.8	29.9
Cordage, rope, twine	10	10	147.0	147.0	6.1	8,587.4	38.0
Carpets, mats, rugs	18	18	85.6	85.6	2.7	3,258.4	26.8
Belting, leather	14	14	15.3	15.3	1.8	3,310.2	46.4
Cotton yarn and cloth	26	47	954.3	527.9	5.1	12,592.7	19.5
Narrow fabrics, laces, etc.	38	41	54.8	50.8	1.6	2,017.3	27.2
Synthetic textiles and silk	39	45	412.7	357.7	4.0	15,160.4	28.9
Fur dressing and dyeing	21	21	76.3	76.3	2.5	2,762.8	43.3
Woolen yarn	54	58	89.6	83.4	2.9	4,509.0	26.0
Corsets and girdles	36	37	87.6	85.2	.3	527.7	38.7
Cotton and jute bags	29	35	46.9	38.9	1.7	1,340.7	44.2
Dyeing and finishing of textiles	43	45	63.1	60.3	3.5	4,705.5	30.0

(cont. on next page)

APPENDIX A

TABLE A-7 (cont.)

Industry and Group	Number of Firms (1)	Number of Plants (2)	Employment per Firm (3)	Employment per Plant (4)	Horsepower of Equipment in Use per Wage Earner (h.p.) (5)	Adjusted Index of Mechanization (k.w.h.) (6)	Percentage of Firms Required to Account for 80 Per Cent of Employment in the Industry (7)
<i>Textiles, leather, fur (cont.)</i>							
Woolen cloth	87	90	113.7	109.9	3.0	5,888.6	28.9
Leather tanneries	73	73	66.4	66.4	5.6	5,511.8	26.5
Contractors, women's clothing-	85	85	18.5	18.5	.2	577.4	49.9
Leather gloves and mittens	80	81	30.2	29.8	.4	507.1	38.2
Canvas products	101	101	13.5	13.5	.6	1,540.8	38.7
Hosiery and knit goods	237	271	116.6	102.0	1.0	1,868.4	23.6
Miscellaneous leather products	273	273	18.1	18.1	.7	849.6	29.4
Contractors, men's clothing	154	157	28.2	27.7	.2	312.6	50.7
Leather boots and shoes	291	292	73.1	72.8	.6	842.5	37.7
Clothing, men's factory	553	563	56.2	55.2	.2	475.8	27.9
Fur goods	611	615	10.5	10.5	.2	988.5	46.2
Clothing, women's factory	1,148	1,160	29.1	28.8	.2	520.4	45.0
<i>Wood products</i>							
Excelsior	10	10	16.1	16.1	...	...	40.0
Coffins and caskets	49	55	27.0	24.0	3.9	2,061.3	29.6
Plywood and veneer	42	44	150.8	144.0	4.5	6,286.5	31.6
Flooring, hardwood	25	25	61.4	61.4	5.5	7,131.8	51.2
Boat building	238	238	6.6	6.6	4.7	2,487.1	39.0
Furniture	1,117	1,128	23.2	23.0	2.7	2,109.8	24.8
Sawmills	6,843	7,035	8.3	8.1	14.9	14,324.6	26.9
Planing mills, sash and door factories	1,372	1,391	13.0	12.8	6.7	4,616.9	27.5

(cont. on next page)

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TABLE A-7 (cont.)

Industry and Group	Number of Firms (1)	Number of Plants (2)	Employment per Firm (3)	Employment per Plant (4)	Horsepower of Equipment in Use per Wage Earner (h.p.) (5)	Adjusted Index of Mechanization (k.w.h.) (6)	Percentage of Firms Required to Account for 80 Per Cent of Employment in the Industry (7)
<i>Paper products</i>							
Roofing paper	15	23	170.8	111.4	3.4	6,370.0	41.9
Pulp and paper industry	71	117	731.3	443.8	57.3 ^b	242,092.7 ^b	31.7
Pulp mills ^a				282.6	29.2	98,844.0	...
Paper mills ^a				146.3	19.3	57,113.2	...
Pulp and paper mills ^a				640.8	66.4	286,357.9	...
Paper boxes and bags	159	172	77.7	71.8	1.7	2,337.9	36.2
<i>Iron and steel products</i>							
Pig iron	4	4	959.3	959.3	13.7 ^c	23,215.9 ^c	63.8 ^e
Automobiles	11	11	2,245.7	2,245.7	3.5	4,734.7	15.6
Railway rolling stock	18	38	1,742.8	825.6	4.8	4,579.8	17.5
Aircraft	11	11	731.7	731.7	2.3	2,503.5	27.9
Steel ingots and castings	32	33	207.2	200.9	13.7 ^c	23,215.9 ^c	10.5 ^e
Agricultural implements	67	69	285.2	277.0	2.9	3,774.1	6.6
Bicycles	12	12	66.2	66.2	4.2	4,478.6	24.1
Shipbuilding	76	76	242.1	242.1	5.3	4,081.5	17.3
Iron castings	219	225	88.4	86.0	3.8	4,848.0	21.0
Machine shops	514	514	11.2	11.2	3.6	3,092.8	44.7
<i>Nonferrous metals</i>							
Aluminum ^b	1	5	80.0 ^f
Nickel ^b	2	4	42.5 ^f

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TABLE A-7 (cont.)

Industry and Group	Number of Firms (1)	Number of Plants (2)	Employment per Firm (3)	Employment per Plant (4)	Horsepower of Equipment in Use per Wage Earner (h.p.) (5)	Adjusted Index of Mechanization (k.w.h.) (6)	Percentage of Firms Required to Account for 80 Per Cent of Employment in the Industry (7)
<i>Nonmetallic minerals</i>							
Cement	3	8	574.3	215.4	54.7	167,353.2	40.0
Gypsum products	4	10	237.8	95.1	8.5	11,944.0	40.0
Glass	4	7	1,000.5	571.7	3.6	15,859.7	40.0
Artificial abrasives	5	6	367.0	305.8	8.9	12,235.5	40.0
Abrasive products	10	10	82.2	82.2	4.7	4,474.7	27.4
Petroleum products	18	33	458.1	249.8	12.3	38,760.4	16.6
Asbestos products	15	15	68.0	68.0	9.8	9,383.9	31.7
Coke products	11	12	294.6	270.1	...	...	51.7
Plate, cut, and ornamental glass	80	88	24.0	21.8	2.2	5,698.2	30.8
Cement products	361	369	10.4	10.2	3.8	2,497.5	33.0
<i>Chemicals</i>							
Hardwood distillation	2	3	83.5	55.7	1.7	4,272.3	50.
Matches	4	10	184.5	73.8	2.2	2,981.2	22.4 ^g
Coal tar distillation	4	11	95.0	34.5	6.3	15,596.4	40.0
Compressed gases	14	45	82.6	25.7	15.8	60,137.9	20.7
Soaps	48	49	53.9	52.8	6.6 ^d	8,725.6 ^d	8.5
Boiler compounds	13	13	10.8	10.8	6.9	2,071.0	28.3
Writing inks	9	9	10.6	10.6	1.1	1,306.7	42.2
Washing compounds	51	54	9.5	9.0	2.2 ^d	3,011.4 ^d	16.0
Printing inks	22	23	24.9	23.8	7.6	6,467.5	28.7
Vegetable oils	12	16	68.2	51.2	20.4	34,387.0	58.3
Polishes and dressings	53	53	13.6	13.6	1.8	2,702.8	22.7
Paints and varnishes	109	114	51.0	48.8	4.4	4,436.9	20.4

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TABLE A-7 (cont.)

Industry and Group	Number of Firms (1)	Number of Plants (2)	Employment per Firm (3)	Employment per Plant (4)	Horsepower of Equipment in Use per Wage Earner (h.p.) (5)	Adjusted Index of Mechanization (k.w.h.) (6)	Percentage of Firms Required to Account for 80 Per Cent of Employment in the Industry (7)
<i>Chemicals (cont.)</i>							
Medicinal and pharmaceutical preparations	211	215	36.2	35.5	1.8	2,925.5	23.4
<i>Miscellaneous</i>							
Pipes and smokers' supplies	12	12	27.7	27.7	1.1	789.8	19.3
Fountain pens and pencils	11	12	113.5	104.0	1.4	2,072.0	39.7
Buttons	31	31	59.5	59.5	1.2	1,731.5	28.4
Umbrellas	6	7	31.3	26.9	.1	555.5	45.3

^a These industries are either combinations or components of industries included in Table A-1. Basic data for cols. 5 and 6 are for these industries.

^b Weighted average of corresponding figure for pulp mills, paper mills, and pulp and paper mills.

^c Assumed equal to corresponding figure for Primary Iron and Steel.

^d Horsepower for combined industry, "soaps, washing compounds and cleaning preparations" allocated to components in proportion to cost of fuel and electricity. Adjustment factor (for col. 6) assumed the same for component industries as for combined industry.

^e Based on capacity of equipment. *Primary Iron and Steel Industry, 1948*, Ottawa, Dominion Bureau of Statistics, 1949.

^f Based on value of sales. *Moody's Industrials, 1949*.

^g Based on number of matches produced. *Matches*, Report of Commissioner, Combines Investigation Commission, Dec. 27, 1949, Ottawa, King's Printer, 1950.

^h No data on employment or horsepower available. Average

firm size estimated roughly at 3,333 employees for summary tables in Chapter II. See Table A-4, note b.

Column 1-4,7

Source

Computed from special tabulation of data by firm-size groups, compiled by Dominion Bureau of Statistics, 1950.

7 For method of computation see Appendix B.

5,6 Computed from tabulations of horsepower in use and electricity purchased for power and lighting, obtained from Dominion Bureau of Statistics. The index used in col. 6 is discussed in Chap. II, sec. 6. It is obtained by multiplying col. 5 by the amount of electricity purchased for power and lighting (in kilowatt-hours) and dividing by the horsepower capacity of electric motors operated by purchased power. The result is a figure representing kilowatt-hours per wage earner which can be regarded as an estimate of energy used per wage earner.

TABLE A-8

Value of Capital Employed, Selected Canadian Manufacturing Industries,
1943 and 1938

<i>Industry and Group</i>	<i>Fixed Capital per Wage Earner</i>		<i>Fixed Capital per Plant</i>		<i>Total Capital per Wage Earner 1943 (dollars)</i>
	<i>1943</i>	<i>1938</i>	<i>1943 (thousands of dollars)</i>	<i>1938 (thousands of dollars)</i>	
<i>Foods</i>					
Cigarettes, cigars, tobacco	1,480	2,156	179.3	146.5	9,238
Sugar refineries	11,744	9,221	2,172.7	1,745.6	23,862
Malt and malt products	19,676	14,450	608.2	276.8	32,918
Starch and glucose	2,998	4,358	306.5	299.6	8,356
Macaroni	4,317	5,652	134.6	96.4	5,924
Tobacco processing and packing	1,983	1,085	195.1	136.1	9,412
Wine	5,329	6,876	82.1	66.1	19,476
Distilleries	5,111	7,222	666.3	669.7	22,294
Slaughtering and meat packing	2,333	3,140	226.2	203.3	6,939
Condensed milk	3,948	4,953	157.0	139.7	6,899
Processed cheese	1,782	2,007	56.9	25.6	7,141
Fish curing and packing	1,811	2,284	26.2	18.5	4,071
<i>Textiles</i>					
Cotton thread	1,378	2,161	134.3	241.6	5,466
Cordage, rope, twine	3,264	6,060	409.8	466.6	9,814
Carpets, mats, rugs	3,138	3,280	177.4	192.2	7,809
Belting, leather	2,152	4,226	30.9	32.8	6,303
Cotton yarn and cloth	2,204	2,290	1,231.6	1,075.4	3,806
Synthetic textiles and silk	2,720	2,575	809.8	744.5	5,127
Fur dressing and dyeing	1,221	984	75.0	45.4	2,081
Wool yarn	2,235	2,063	158.6	159.6	4,705
Corsets	823	1,178	52.9	63.7	2,754
Cotton and jute bags	2,093	3,145	87.0	85.0	7,939
Textile dyeing and finishing	3,049	5,348	101.3	176.9	5,942
Wool cloth	1,487	2,268	161.1	195.4	3,741
Leather tanneries	2,069	2,180	108.9	87.5	6,358
Clothing, women's factory	639	637	17.6	17.7	2,064
Gloves, leather	424	638	15.7	17.7	1,478
Canvas products	788	2,176	16.3	13.3	2,579
Hosiery and knit goods	1,296	2,534	136.6	162.0	2,883
Miscellaneous leather products	833	1,286	13.5	13.0	2,383
Clothing, men's factory	558	631	36.5	29.2	2,270
Boots and shoes, leather	816	824	60.5	55.0	2,119
Fur goods	1,620	1,787	11.5	12.5	6,180
<i>Wood products</i>					
Excelsior	1,687	3,181	21.6	23.0	2,635
Coffins and caskets	2,347	2,640	37.8	41.7	4,794
Flooring, hardwood	1,568	2,346	93.2	96.1	3,828
Boat building	1,746	2,924	12.1	9.9	3,383
Furniture	1,331	1,632	34.5	36.4	2,760

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TABLE A-8 (cont.)

<i>Industry and Group</i>	<i>Fixed Capital per Wage Earner</i>		<i>Fixed Capital per Plant</i>		<i>Total Capital per Wage Earner</i>
	<i>1943</i>	<i>1938</i>	<i>1943</i>	<i>1938</i>	
	<i>(dollars)</i>		<i>(thousands of dollars)</i>		<i>(dollars)</i>
<i>Paper products</i>					
Roofing paper	2,298	4,061	101.6	152.9	7,305
Pulp and paper industry	14,881	18,696	4,441.4	5,038.4	21,098
Paper boxes and bags	1,606	2,736	88.9	96.8	3,288
<i>Metals</i>					
Automobiles	1,151	1,896	4,809.6	2,008.3	6,680
Railway rolling stock	2,602	3,937	2,160.5	1,905.4	4,434
Aircraft and parts	684	3,573	906.3	372.2	3,836
Primary iron and steel	4,735	5,499	2,369.7	1,199.7	7,465
Agricultural implements	1,714	3,172	463.2	447.3	5,090
Bicycles	3,444	3,371	266.5	340.5	6,567
Shipbuilding	931	7,544	754.7	574.8	3,432
Electrical apparatus and supplies	1,102	2,805	186.9	218.8	4,264
Nonferrous metals smelting and refining	11,176	26,106	16,326.4	8,811.0	16,780
<i>Nonmetallic minerals</i>					
Cement	35,547	49,467	4,967.7	5,775.2	45,115
Gypsum products	3,849	8,236	164.7	194.0	10,629
Abrasives and abrasive products	1,827	3,877	347.2	210.6	4,622
Petroleum products	9,147	8,965	833.3	570.4	19,041
Asbestos products	1,083	4,734	68.1	115.1	7,097
Cement products	2,985	3,480	20.0	18.9	4,747
<i>Chemicals</i>					
Hardwood distillation	5,971	8,662	277.7	272.0	6,943
Coal tar distillation	10,364	11,307	335.8	243.1	15,704
Compressed gases	6,325	9,973	105.5	98.7	11,860
Soap and washing compounds	4,213	4,603	62.6	59.2	11,434
Printing and writing inks	3,274	4,717	35.8	48.8	8,689
Vegetable oils	6,965	8,975	200.1	131.4	13,449
Polishes and dressings	2,507	3,868	20.8	17.0	8,782
Paints and varnishes	4,240	5,903	118.7	128.4	12,405
Medicinal and pharmaceutical preparations	2,656	3,324	50.8	46.5	10,664
<i>Miscellaneous</i>					
Pipes and smokers' supplies	838	368	6.2	3.5	2,027
Umbrellas	1,256	697	18.8	8.6	3,667
Pens and pencils	1,395	1,565	66.7	75.1	6,521
Buttons	1,219	1,229	42.4	35.8	2,709

Source: Computed from statistics of fixed capital made available by Dominion Bureau of Statistics, and from other data in *The Manufacturing Industries of Canada, 1943 and 1938*, Ottawa, Dominion Bureau of Statistics.

APPENDIX A

TABLE A-9
Industry Size, Number of Firms, and Firm Size, United States and Canada, 1947

Industry	Employment, ^b	Number of	(1) ÷ (2)	Employment, ^b	Number of	(4) ÷ (5)
	Canada, 1947 (1)	Firms, Canada, 1948 (2)	(3)	U.S., 1947 (4)	Firms, U.S., 1947 (5)	(6)
<i>Foods, beverages, tobacco</i>						
Malt and malt products	599	9	66.56	2,534	41	61.80
Distilleries	4,088	12	340.67	30,471	144	211.60
Macaroni	703	14	50.21	8,260	219	37.72
<i>Sugar refining</i>						
Cane	...	...	...	17,376	17	1,022.12
Beet	...	...	...	13,412	17	788.94
Total	3,003	7	429.00	30,788	...	...
<i>Meat packing, wholesale</i>						
Poultry dressing	...	...	...	210,427	1,999	105.27
Total, slaughtering and meat packing	21,726	120	181.05	22,049	330	66.82
<i>Breweries (malt liquors)</i>						
Wine	9,378	38	246.79	82,571	404	204.38
	722	23	31.39	8,034	379	21.20
<i>Canning and preserving fruit and vegetables</i>						
Dehydrated fruits and vegetables	...	...	...	137,519	1,856	74.09
Pickles and sauces	...	...	...	4,112	120	34.27
Total, fruit and vegetable preparations	17,036	378	45.07	22,340	637	35.07
<i>Soft drinks</i>						
Bread and other bakery products	5,827	408	14.28	84,569	5,169	16.36
Condensed milk	31,501	2,748	11.46	240,173	5,985	40.13
Biscuits and crackers	1,569	30	52.30	16,713	182	91.83
Tobacco processing	4,932	41	120.29	46,249	249	310.40
Starch and glucose (corn products)	1,509	13	116.08	25,954	93	279.08
Prepared animal feeds	1,082	10	108.20	12,341	47	262.57
	4,436	260	17.06	57,710	2,372	24.33

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APPENDIX A

TABLE A-9 (cont.)

Industry	Employment, ^b		Number of		Employment, ^b U.S., 1947 (4)	Number of Firms, U.S., 1947 (5)	(4) ÷ (5) (6)
	Canada, 1947 (1)	Canada, 1948 (2)	(1) ÷ (2) (3)	U.S., 1947 (4)			
<i>Textiles and leather</i>							
Cordage, rope, and twine	1,607	10	160.70	16,002	132	121.23	
Cotton yarn	...	...	...	92,368	317	291.38
Cotton cloth	...	...	...	357,411	422	846.95
Total	24,089	26	926.50	449,779	...	...
Carpets and rugs, wool	...	...	...	40,147	85	472.32
Carpets and rugs, other	...	...	...	7,203	182	39.58
Total	1,347	18	74.83	47,350	...	...
Leather belting	248	14	17.71	5,129	178	28.81	
Narrow fabrics	2,164	38	56.95	27,939	445	62.78	
Woolen fabrics	10,189	87	117.11	132,482	427	310.26	
Woolen yarn	4,816	54	89.19	33,257	181	183.74	
Corsets	3,259	36	90.53	37,588	493	76.24	
Fur dressing and dyeing	1,359	21	64.71	6,974	171	40.78	
Canvas products	1,392	101	13.78	11,426	889	12.85	
Leather tanneries	5,574	73	76.36	53,435	500	106.87	
Fur goods	6,094	611	9.97	18,813	2,227	8.45	
Textile bags	1,571	29	54.17	14,024	198	70.83	
Boots and shoes, leather	...	...	...	229,652	1,077	213.23
House slippers	...	...	...	11,129	207	53.76
Total	21,433	291	73.65	240,781	...	...
<i>Wood and paper</i>							
Veneer mills	10,546	136	77.54	
Plywood plants	26,570	142	187.11	
Total	5,990	42	142.62	37,116	

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APPENDIX A

TABLE A-9 (cont.)

Industry	Employment, ^b Canada, 1947	Number of Firms, Canada, 1948	(1) ÷ (2)	Employment, ^b U.S., 1947	Number of Firms, U.S., 1947	(4) ÷ (5)
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Wood and paper (cont.)</i>						
Roofing paper	2,183	15	145.53	16,615	104	159.76
Excelsior	172	10	17.20	1,218	48	25.37
Boat building	1,807	238	7.59	20,232	798	25.35
<i>Metals</i>						
Pig iron ^a	3,837	4	959.25	36,937	33	1,119.30
Aluminum	n.a.	1	n.a.	8,919	3	2,973.00
Railroad and street cars	...	...	...	60,788	68	893.94
Locomotives	...	...	...	30,348	33	919.64
Total, railway rolling stock	28,526	18	1,584.78	91,136	...	...
Agricultural machinery	...	...	...	94,848	955	99.32
Tractors	...	...	...	77,361	86	899.54
Total, agricultural implements	16,013	67	239.00	172,209	...	...
Shipbuilding	21,119	76	277.88	130,307	272	479.07
<i>Minerals</i>						
Gypsum products	905	4	226.25	7,479	33	226.64
Flat glass	...	...	...	27,241	15	1,816.07
Glass containers	...	...	...	47,140	41	1,149.76
Pressed and blown glassware, n.e.c.	...	...	...	42,224	107	394.62
Total, glass	4,002	4	1,000.50	116,605	...	...
Abrasive products	722	10	72.20	20,881	236	88.48
Petroleum refining	7,760	18	431.11	145,909	277	526.75

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APPENDIX A

TABLE A-9 (cont.)

Industry	Employment, ^b	Number of	(1) ÷ (2)	Employment, ^b	Number of	(4) ÷ (5)
	Canada, 1947	Firms, Canada, 1948		U.S., 1947	Firms, U.S., 1947	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Minerals (cont.)</i>						
Coke by-product ovens	...	...	...	35,898	49	731.99
Beehive ovens	...	...	...	8,162	53	59.66
Total	3,116	11	283.27	39,000	...	...
Asbestos products	966	15	64.40	21,487	85	252.79
<i>Chemicals</i>						
Matches	906	4	226.50	7,351	18	408.39
Printing inks	614	22	27.91	6,078	151	40.25
Paints and varnishes	5,428	109	49.80	53,907	1,154	46.71
Soaps	2,472	48	51.50	27,766	223	124.51
Compressed gases	1,089	14	77.79	9,000	69	130.43
Hardwood distillation	171	2	85.50	1,885	22	85.68
<i>Miscellaneous</i>						
Pens and mechanical pencils	...	...	...	15,666	180	87.03
Lead pencils	...	...	...	6,301	46	136.98
Total	1,426	11	129.64	21,967	...	...
Buttons	1,966	31	63.42	10,875	412	26.40
Umbrellas	188	6	31.33	3,764	162	23.23

^a See Table A-4, note c.

^b Includes proprietors and firm members.

n.a. = not available.

n.e.c. = not elsewhere classified.

Column

2

Source
 Dominion Bureau of Statistics, Ottawa, unpublished special compilation of data by firm size from returns of the Census of Manufactures, 1948.

4
 Source
Census of Manufactures, 1947, Bureau of the Census, Vol. I, Table 2.

5
 Source
Concentration of Industry Report, Dept. of Commerce, December 1949.

Column
 1
 Source
The Manufacturing Industries of Canada, 1947, Ottawa, Dominion Bureau of Statistics, 1950.

APPENDIX B

THE ESTIMATION OF CONCENTRATION INDEXES FROM GROUPED DATA

Our statistical data are grouped in size classes, since information on individual firms cannot be divulged. For this reason, concentration indexes must be estimated. To ensure that the results would not be significantly influenced by errors of estimation, we computed upper and lower limits for each type of index, as well as an interpolated average. The derivation of the formulas for these computations is outlined below.

The Percentage Controlled by the x Largest Firms

For each size class, the upper and lower limits of the class interval are given, as well as the number of firms and the sum of their sizes. We first locate the size class which includes the x th firm. The problem is then to estimate the sum of sizes of this firm and those larger than it in the same size class. This sum, added to the sum of sizes in the larger size classes (if any), and expressed as a percentage of total industry size, will be the required index.

Let U and L be the upper and lower limits respectively of the size class which includes the x th firm; let A be the sum of sizes of the x th firm and those larger in the same size class, and S the sum of sizes of all firms in that size class. U , L , A , and S are expressed as percentages of total industry size. The problem is to estimate A . Let n be the number of firms in that size class and r the rank, in that size class, of the x th firm, so that there are $(n - r)$ firms smaller than the x th firm in the size class (r is, of course, obtained simply by subtracting the number of firms in larger size classes from x . If there are no larger size classes, $r = x$).

The minimum possible value of A is obtained when the average size of the r leading firms in our size class is as small as possible. This average, cannot, however, be less than the average size of the remaining $(n - r)$ firms in the class since firms are arranged in decreasing order of size. Hence, A reaches its minimum when these two averages are equal, and in that case both must be equal to the average size of

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all firms in the class, that is, S/n . Hence, the minimum value of A is rS/n .

Derivation of the maximum value of A is more complicated and involves the use of the limits of the class interval. Clearly, A will reach a maximum if the r leading firms are all crowded at the upper class limit, so that rU is a possible maximum value. This situation may not, however, be consistent with the other conditions given by the data. If the r leading firms are all at the upper limit, the remaining $(n - r)$ firms may have to be smaller than the lower limit (in fact they may have to be negative) in order to satisfy the condition that the sum of all firm sizes should not exceed S . Hence, A cannot exceed the value it would have if the remaining $(n - r)$ firms were crowded at the lower limit of the class intervals; this value is $S - (n - r)L$. There are thus two maxima, neither of which can be exceeded by A . Hence, the maximum value of A is the *lower* of:

$$rU \quad \text{or} \quad S - (n - r)L$$

In most cases the class interval concerned is the leading class interval of the whole distribution, and its upper limit is often not given. In such a case the expression: $S - (n - r)L$ must be used.

The Number of Firms Required to Account for y Per Cent of an Industry

The problem of finding maximum and minimum limits for this index is essentially the same as the previous one, with the roles of maxima and minima reversed.

We first locate the class interval in which the smallest of the firms required to account for the y per cent is located. The problem then is to estimate the rank of this firm in the class interval. This figure, added to the number of firms in the larger classes (if any), is the required index.

Let the symbols U , L , S , n have the same meaning as in the previous example. A is now the part of S that is required to complete the y per cent which is the base of the index. In other words, A is the difference between y and the sum of firm sizes (expressed as percentages of industry size) in the larger size groups; r is the rank, within its size class, of the last firm required to complete A . The problem is to find upper and lower limits for r .

The solution is along the same lines as that given above. The maximum value of r is obtained, given A , when the average size of the r firms is as small as possible, that is, when it is equal to the average

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size of all firms in the interval (see above). In that case $A = rS/n$, therefore $r = An/S$. A minimum value of r is obtained when the r firms are as large as possible. There are, for the reasons explained above, two alternative conditions for this:

$$A = rU$$

$$A = S - (n - r)L$$

The minimum value of r , therefore, is the *higher* of:

$$A/U, \text{ or } \frac{A + nL - S}{L}$$

The Index Employed by Herfindahl

This index is the sum of squares of sizes of the individual firms expressed as a percentage of industry size. For any given class interval this sum is a minimum if the firms are all of the same size, and a maximum when the firm sizes are dispersed as widely as possible, that is, when each firm is either at the upper or the lower class limit. The index as a whole, therefore, is at its maximum or minimum value according as one or the other condition is satisfied in all the class intervals.¹

¹ In each class interval let X_i represent the size of the i th firm, other symbols having the same meaning as in the text, so that

$$\sum X_i = S, \quad L \leq X_i \leq U.$$

It is evident that the variance of the X_i attains its minimum value when $X_i = S/n$ for all i . Since S and n are fixed by the conditions of our problem, the sum of squares of the X_i is simply a linear increasing function of the variance, so that it, too, is minimized by the condition that minimizes the variance (I am indebted to Mr. Hastay for this proof).

The condition that maximizes the sum of squares of the X_i is more difficult to demonstrate. It is shown in the text (below) that, given the conditions of our problem, the X_i can be distributed to the class limits, L and U , in only one way. We will now show that any deviation from this distribution will lower the sum of squares of the X_i .

Suppose that firm i decreases in size from $X_i = U$ to X_i' , and there is a compensating change in firm j from $X_j = L$ to X_j' . It follows that

$$|X_i' - X_j'| < |X_i - X_j|$$

while $X_i' + X_j' = X_i + X_j$

Squaring of both the inequality and the equation yields

$$X_i'^2 + X_j'^2 - 2X_i'X_j' < X_i^2 + X_j^2 - 2X_iX_j$$

$$X_i'^2 + X_j'^2 + 2X_i'X_j' = X_i^2 + X_j^2 + 2X_iX_j$$

Adding the resulting inequality and equation we have $X_i'^2 + X_j'^2 < X_i^2 + X_j^2$, so that the change has reduced the contribution of firm i and firm j to the sum of squares and has thus reduced the sum of squares.

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For the minimum value, therefore, we assume that the contribution from each class interval is $n.S^2/n^2 = S^2/n$. For a maximum we must assume that for each class interval there are r firms at the upper limit and $(n - r)$ firms at the lower limit, r being determined by the equation

$$rU + (n - r)L = S$$

Hence

$$r = \frac{S - nL}{U - L}$$

The contribution from each class interval is

$$rU^2 + (n - r)L^2$$

substituting for r and simplifying, this becomes:

$$S(U + L) - nLU$$

For a leading class interval with no upper limit the maximum contribution to the index is obtained if we assume that all firms but one are concentrated at the lower class limit so that a single firm attains the maximum size consistent with the data. The size of this firm is then:

$$S - (N - 1)L$$

and the contribution of this interval to the index is

$$[S - (N - 1)L]^2 + (N - 1)L^2$$

In the actual computation of the maximum limit it was found that the contribution of the leading class interval is so great that the contributions of the other class intervals can safely be left at their minimum value, which is very much simpler to compute.

Interpolation

If we wish to compare different concentration indexes and to relate them to other factors, it is convenient to have a single estimate instead of the range between upper and lower limits, which in some cases is quite wide. We used for this purpose a simple average of the upper and the lower limits.

This is a fairly rough procedure. The justification for it is that we

It can be shown that *any* change from the situation in which the firms are distributed to the class limits can be decomposed into a series of changes of the type analyzed above, in which only two firms are involved and the sum of squares is reduced. This proves that the sum of squares is maximized when the firms are distributed to the class limits.

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know so little about the distribution of firms within the size class that there is no assurance that a more refined method of interpolation would produce a more correct result.²

Correlation Between Maximum and Minimum Limits of the Indexes

In order to judge whether the estimates of concentration obtained as described above are sufficiently accurate to permit their use in analysis, we studied the correlation between the rankings based on the upper and lower limit, using the firm size distributions for 1948. This correlation was examined for the following indexes:

1. The percentage of employment accounted for by the leading three firms
2. The number of firms required to account for 80 per cent of employment
3. Herfindahl's index

² For each class interval we are given the upper and lower limit as well as the total of firm sizes.

Very little, however, can be guessed as to the actual distribution of firms in this interval, particularly as, in most cases, their number is small.

The general shape of the size distribution suggests that in the class intervals with which we are mostly concerned—the leading or second largest size group—the distribution of firms will involve decreasing frequency with increasing size, or, in other words, when firms are ranked in order of increasing size their sizes, as a function of rank, will form a curve of increasing slope. There is no reason to believe, however, that the smallest firm will be near the lower limit of the class interval or the largest firm near the upper limit.

Linear interpolation cannot take into account all three of the given conditions (upper and lower limits and sum of sizes) but only two of them. It does not, moreover, conform to even the little we can guess about the size distribution.

To take all three data into account we would have to interpolate on a quadratic curve, which would involve a considerable amount of calculation. In view of the uncertainty as to the true range of the distribution of firms in the interval, this is hardly worth while.

A straight average of the limits is therefore adopted as the simplest method that involves no known bias.

In a few industries with very high concentration, however, a different procedure was employed for the index measuring the percentage of employment concentrated in the leading three firms. A straight average of the limits would have yielded an estimate so low as to be inconsistent with that for the index measuring the number of firms required to account for 80 per cent of employment; for example, in the cigarette and tobacco industry the latter is 2.11 while the former would have been 73 per cent on the basis of a straight average of the limits. In these industries, therefore, the estimate for the percentage accounted for by the three leading firms was the lowest figure consistent with the estimate of the number of firms required to account for 80 per cent and the other known facts about the size distribution. The industries involved are: cigarettes and tobacco, automobiles, glass, gypsum products, aircraft, coal-tar distillation, abrasives, abrasive products, bicycles.

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1. The correlation between the upper and lower limit of the percentage of employment concentrated in the three leading firms was computed for 59 industries, omitting those having exactly three firms in the leading size class and those with less than three firms altogether. The value of Spearman's coefficient of rank correlation was 0.872.³

The array of all 59 industries indicates that the difference in rankings based on upper and lower limits is considerably greater for the industries with high concentration than for those with low concentration. This suggests that the reliability of our estimates of concentration tends to increase as concentration decreases.

The reason for this relationship is that the gap between the upper and lower limits of the concentration index depends on the difference between the upper and lower class limits (or, if the upper class limit is not used in the computation, on the difference between the mean size in the class interval and the lower class limit) as well as on the number of firms in the class. Since, for this calculation, all sizes and class limits must be expressed as percentages of total industry size (see above), the difference between upper and lower class limits (or mean size and lower class limit) tends to be smaller where a larger part of total employment in the industry is in the other (smaller) size group, i.e. where concentration is lower.

2. Upper and lower limits for the number of firms required to account for 80 per cent of employment were computed for a sample of 45 industries, selected by systematic sampling from the larger group of 96 industries included in the study.⁴

The Spearman coefficient for this group was 0.988. For the 22 industries with highest concentration the coefficient was 0.902 and for the 23 industries with lower concentration it was 0.995.

The high values of these coefficients, as against those for the index of concentration in three leading firms, are due partly to the fact

³ The industries included in this correlation are those shown in Appendix A, Table A-1, with the exception of distilleries, sugar refining, ornamental and cut glass, wine, flour mills, fruit and vegetable canning, butter and cheese, cotton thread, belting, narrow fabrics, synthetic textiles, carpets, corsets, cotton and jute bags, dyeing and finishing of textiles, woolen cloth, contractors of women's clothing, miscellaneous leather products, shoes, fur goods, roofing paper, paper boxes, aluminum, nickel, cement, pig iron, petroleum products, railway rolling stocks, steel ingots, asbestos products, hardwood distillation, compressed gases, soap, pipes, umbrellas, pens and pencils.

⁴ The selected sample from Table A-1 by picking, with a random start, every 3rd industry in the foods group, every 2nd industry in textiles, wood products, nonmetallic minerals, and chemicals, 2 of the 3 industries in the paper group, and all the industries in the metals and miscellaneous groups.

This process of selection resulted in a sample of 52 industries. In 5 of these, information on individual firms was available, so that no estimation was necessary, and in 2 industries no positive minimum estimate could be computed. The remaining 45 industries were used in the correlation.

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that only one of the three industries that contributed most to the deviations in the previous experiment was included in this group.⁵ There is, however, the further significant difference that in many cases the size class in which the last of the firms required to account for 80 per cent of employment is located is not the leading size class, so that the difference between upper and lower class limit is less than in the leading size class. Hence, in general, the reliability of estimates of concentration based on the number of firms required to account for 80 per cent of employment is greater than for those based on the percentage controlled by the three leading firms.

3. Upper and lower limits for the index used by Herfindahl were computed for 17 industries in the food group.⁶ The correlation coefficient for these 17 industries was 0.907. The correlation coefficient for the index of concentration in three leading firms, for 13 of these industries (excluding 4 in which the leading size group contained exactly three firms) was 0.956. The poorer correlation for the Herfindahl index reflects the more extreme variation in the upper limit of this index. In some cases no upper limit is available for the leading class interval, and the extreme assumption is made that all firms but one are crowded at the lower class limit. In general, the gap between upper and lower limit of this index appears to be greater than for the index measuring concentration in three leading firms.

This survey indicates that the ranking of industries based on concentration indexes, estimated as described here, is probably quite close to that based on the correct values, particularly when the index measuring the number of firms required to account for 80 per cent of employment is used.

⁵ The three industries are malt, starch, and macaroni. The industry included in the second correlation is macaroni.

⁶ The industries omitted are malt, starch, macaroni, flour mills, and fruit and vegetable canning.

APPENDIX C

QUALITY OF THE SAMPLE

The sample of 96 industries used for the cross-section studies accounts for 52 per cent of all manufacturing industries and for 72 per cent of the value of output of manufactures. Its coverage in each industry group is shown in the following tabulation:

INDUSTRY GROUP	PERCENTAGE OF TOTAL MANUFACTURING INCLUDED IN SAMPLE, 1948	
	<i>Value of Output</i>	<i>Number of Industries</i>
Food, beverages, tobacco	95%	79%
Textiles and leather	82	63
Wood products	88	44
Paper products	71	30
Metal products	47	38
Nonmetallic minerals	86	67
Chemical products	56	54
Miscellaneous industries	15	20
Total	72	52

In Chapter II, section I, it was shown that the sample reveals significant differences in concentration level among the industry groups. This Appendix will investigate whether, in this respect, the sample is representative of manufacturing as a whole.

The industries omitted from the sample are those which do not coincide with a homogeneous product group (Chapter I). It is therefore necessary to investigate whether the differences in concentration observed among *industry groups* in the sample are applicable to *product groups* in the omitted sector.

The coverage of the sample is poorest in the *metals*, *chemicals*, and "*miscellaneous*" groups. In the *metals* group the leading omitted industries are the following (the percentage of the group's total output represented by each industry is given):

	<i>Per Cent</i>
Electrical apparatus and supplies	12.1
Nonferrous metals smelting and refining (other than aluminum and nickel)	8.0
Machinery	6.6

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These industries have been excluded because of the heterogeneity of their output. In *electrical apparatus and supplies*, four firms account for 50 per cent of employment. There are 301 firms in the industry but the number producing a particular article is generally much smaller. For example, there are only seven manufacturers of vacuum cleaners. There is little doubt, therefore, that the general level of product concentration is high.

In the smelting and refining of *nonferrous metals* the largest three firms account for 90 per cent of employment of the industry as a whole, and the total number of firms is only ten. Hence, in the sector excluded from the sample, concentration is sure to be high.

In the *household, office, and store machinery* branch of the machinery industry, the largest five firms account for 66 per cent of employment, but in the *industrial machinery* branch, the largest four firms account for only 19 per cent of employment.

In both branches there is a great deal of specialization of firms by products, but there is also a considerable output of machinery in other industries. The published statistics therefore do not permit a judgment as to the average level of product concentration. The same problem is encountered in many of the other metal fabricating industries excluded from the sample.

It can be concluded that while there is no doubt about the high level of concentration in primary iron and steel and transportation equipment (included in the sample) and in primary nonferrous metals and electrical apparatus (reviewed above), the statistics do not provide reliable information on concentration in the output of many of the fabricated metal products.

The leading *chemical* industries omitted from the sample are:

	<i>Per Cent</i>
Acids, alkalis, and salts	12
Fertilizer	11
Miscellaneous chemicals	12

In the first of these, three firms account for 65 per cent of employment. Concentration in the production of particular chemicals is even higher, as indicated by the following note in the statistical bulletin on this industry: "Except for sulphuric acid, separate figures for the production of chemicals in this group are not published, as many of the individual items were made by only one or two concerns."¹

In the *fertilizer* industry as a whole, the leading three firms account for 76 per cent of employment. Fertilizer materials are produced by

¹ *The Acids, Alkalis and Salts Industry in Canada, 1948*, Ottawa, Dominion Bureau of Statistics, December 1949, p. 1.

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only three companies in Canada (except for about 17 per cent of the output of ammonium sulphate produced as a by-product by five coke producers). Many small firms are engaged in the production of mixed fertilizer from these materials, but even in this branch of the industry the leading three producers account for 75 per cent of sales (year ended June 1947). The leading firms are integrated, each producing both certain materials and mixed fertilizer.²

The *miscellaneous chemical products* group produces synthetic rubber, explosives, oils, dyes, and many other products. The largest seven firms account for 71 per cent of employment, but concentration of output of many individual products is higher, as is indicated by the fact that nearly half the value of output is not itemized in the published statistics. Synthetic rubber, which accounts for nearly 25 per cent of the industry's output, is produced by only one firm.³ This survey leaves little doubt that the chemicals field as a whole is one of high concentration, as the sample indicated.

The group of "*miscellaneous*" industries accounts for only 1 per cent of total manufacturing output and between 2 and 3 per cent of the number of plants, but has 11 per cent of the industries. This group is therefore extremely small in relation to total manufacturing, and its industries are on the average much smaller than the others. These figures suggest that high concentration based on small industry size is likely to be as characteristic of the omitted sector as it is of the four industries included in the sample.

In the *wood* and *paper* groups the coverage of the sample is high in terms of output but low in terms of the number of industries. Most of the omitted industries classified under *paper* are in the printing and publishing field; there is no doubt that these are predominantly areas of low concentration on a national basis, although concentration in separate regional markets is high for newspaper publishing and probably some branches of commercial printing. While industries in this group have a variety of products, there is also a great deal of overlapping, and each major product is produced by a large number of firms. In the printing and publishing of newspapers and periodicals the eleven largest firms account for only 37 per cent of employment.

Some of the omitted *wood* products industries are small and each puts out a variety of products.⁴ Others, however, have a large number

² For above facts on the structure of the industry see *Report of the Royal Commission on Prices*, Ottawa, King's Printer, 1949, Vol. III, pp. 161-164.

³ *The Miscellaneous Chemical Products Industry, 1948*, Ottawa, Dominion Bureau of Statistics, 1950.

⁴ E.g. "beekeepers . . ." and "poultrymen's supplies," "lasts, trees and wooden shoe findings," "wooden ware."

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of firms ⁵ and most overlap considerably in the major products. It is probable therefore that most major products in the group as a whole are produced under conditions of low concentration.

In the remaining sectors the sample is large enough to make it fairly certain that the results are applicable to the whole group. The differences in concentration among product groups found in the sample therefore most probably apply to manufacturing as a whole, with the possible exception of fabricated metal products.

⁵ E.g., cooperage, wooden boxes.

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