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DEPARTMENT OF STATISTICS
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MEANING, PURPOSE AND CONSTRUCTION OF INDEX NUMBERS

The following brief description of index numbers is given in response to a number of inquiries as to how the monthly indexes of retail sales as published by the Bureau may be used as a standard of comparison with individual results. The meaning of the term "Index Number" as it relates to the dollar value of retail sales may be best explained by means of a simple example.

Retail Trade in Canada, 1930 - 1936

<u>Year</u>	<u>Amount</u> \$	<u>Amount as a Percentage of 1930 "Indexes"</u>
1930 ...	2,755,569,900	100.0
1931 ...	2,320,963,000	84.2
1932 ...	1,922,066,000	69.8
1933 ...	1,705,768,000	64.8
1934 ...	1,958,754,000	71.1
1935 ...	2,053,699,000	74.5
1936 ...	2,202,202,000	79.9

The second column in the above table shows the total dollar value of retail trade in Canada for each of the years 1930 to 1936 as obtained from the results of the annual Census of Merchandising and Service Establishments. The third column shows the sales for each of the years 1931 to 1936 expressed as percentages of the 1930 figure. These percentages which express the sales for any period in terms of those for a given constant period are known as indexes of sales. The constant period (in this case the year 1930) is known as the base period.

For some purposes the actual sales figures are of prime importance. But the trend in sales during the period under review is more readily grasped from the percentages or indexes. The indexes point out the significant movements. Hence the name - index - pointing out.

It should be noted that an index number is meaningless unless the base period is stated. Thus, while the statement that retail sales in Canada totalled \$2,202,202,000 in 1936 is significant, no meaning attaches to the fact that the index of sales for that year stood at 79.9 until it is stated that sales for 1930 formed the base upon which the comparison is made. The choice of base period may vary. Preferably the base should be a period of normal conditions. Since 1930 is the first year for which complete data on retail sales are available, sales for that year are chosen as the basis for comparisons with later periods.

Not only do the index numbers provide a ready means of comparison between any period and that chosen as the base but they also permit of comparisons between any two periods in the series. For example, sales of \$2,202,202,000 for 1936 were \$416,434,000 greater than the \$1,785,768,000 shown for 1933. The increase expressed as a percentage of the 1933 figure amounts to 23.3 per cent. The index for 1936 on the 1930 base stands at 79.9, an increase of 15.1 points or also 23.3 per cent over the index of 64.8 for 1933.

Thus for observing the general trend or for obtaining year-to-year ratios the indexes of sales may be used in exactly the same way as though the actual dollar figures were given.

Monthly Indexes

Indexes already explained were computed on an annual basis. They were computed by expressing the sales for each year as a percentage of sales for the one year chosen as base (in the above case, 1930). Monthly indexes are similarly computed by expressing the sales for each month as a percentage of some fixed amount. The fixed amount might be taken as the sales of any given month - say January, 1930. But January sales are low in every year as are also those for February so that indexes for all months other than the Januarys and Februarys would appear very high. Since it is only the relative change from month to month that counts, perhaps this would not matter but

it is preferable to choose a base which is independent of these wide seasonal variations. This is achieved by using as base the average monthly sales over a year or even over a period of years. The base used in the construction of the Bureau's monthly indexes of retail sales is the average monthly sales for 1930 - that is, one-twelfth the aggregate annual sales for that year. The method of construction may be described by reference to the following table in which monthly indexes are computed for the monthly sales of a fictitious departmental firm. The figures were obtained by adding together the returns of a number of moderate-sized departmental stores.

The second column contains the total dollar sales for each month from January, 1930, to October, 1937. The base figure is first obtained by totalling the twelve amounts for 1930 or \$8,456,220 and dividing the sum by 12 giving \$704,685. Each amount in Column 2 is then expressed as a percentage of \$704,685 by dividing by that figure and multiplying by 100 to clear of fractions. The resulting percentages or indexes are shown in Column 3. The indexes thus computed may be compared with the "unadjusted" indexes of department store sales shown in the monthly reports on retail sales issued by the Bureau. The comparison may best be made by charting the two series, the published averages and the individual results, on one chart. Such a comparison for the fictitious department store in the above example is shown in the attached chart, each point on the chart representing the index for a certain month as shown across the bottom. The widely fluctuating lines represent the actual monthly movements, the full lines representing the averages and the dotted lines the results for the individual firm. A comparison of the two graphs shows that not only did sales of the individual firm keep at a higher level than the average but also that its seasonal movements were much more pronounced especially in the spring months. The Bureau's indexes of departmental store sales are computed from monthly data submitted by practically all the department stores in Canada and including both store and mail order business. The inclusion of mail order sales doubtless has a considerable effect in modifying the seasonal characteristics revealed in monthly indexes of sales for department stores.

Corrections for Seasonal Variations

A special bulletin was issued by the Bureau two years ago explaining in considerable detail the method of constructing indexes of sales and of correcting these in order to remove seasonal variations and reveal the underlying trend.⁽¹⁾ A first approach to the problem can be achieved by means of moving averages which may also be explained by reference to the indexes of our fictitious departmental firm. The twelve indexes for 1930 as given in Column 3 are totalled and the total placed in Column 4 opposite the month of June, 1930. The twelve indexes starting with February, 1930, and including January, 1931, are next totalled and the result placed opposite July, 1930. In the same way totals for every twelve-month period are found and placed opposite the mid point of that period. The total for any period may be readily found from the preceding one by deducting the figure for the first month in the earlier period and adding on one new amount in the series. The first total shown in Column 4, 1200.01, is the sum of the twelve indexes for 1930. The second total, 1188.41, equals 1200.01 minus 73.19 (the index for January, 1930) and increased by 61.59 (the index for January, 1931). The third total is obtained from the second by deducting 79.05 (the index for February, 1930) and adding 63.21 (the index for February, 1931). All the figures in Column 4 may thus be found by the simple process of subtraction and addition.

Each total in Column 4 is next divided by 12 and the resulting quotients are entered in Column 5. These averages are known as twelve-month moving averages and reflect the general underlying trend with the wide seasonal swings so apparent in the original indexes completely removed. Moving averages for the individual firm and for the department store group as a whole are also shown on the attached chart.

Moving averages are deficient in that they cannot be brought up to date. From the method of their construction they are necessarily six months behind. To overcome this difficulty it is customary to compute seasonal correction factors or factors which may be applied to the unadjusted indexes in order to remove the main seasonal effects. The method used in constructing these adjustment factors is fully described in the bulletin to which reference has already been made.

(1) Monthly Indexes of Retail Sales, 1929 - 1935.

This report, explaining the method of construction of the indexes of retail sales and their adjustment for seasonal variations and containing a summary of results with illustrative charts, may be obtained from the Dominion Bureau of Statistics, Ottawa, for 50 cents.

Leaving here CNR 8.45 Friday Arriving Montreal

Calculation of Monthly Indexes of Sales

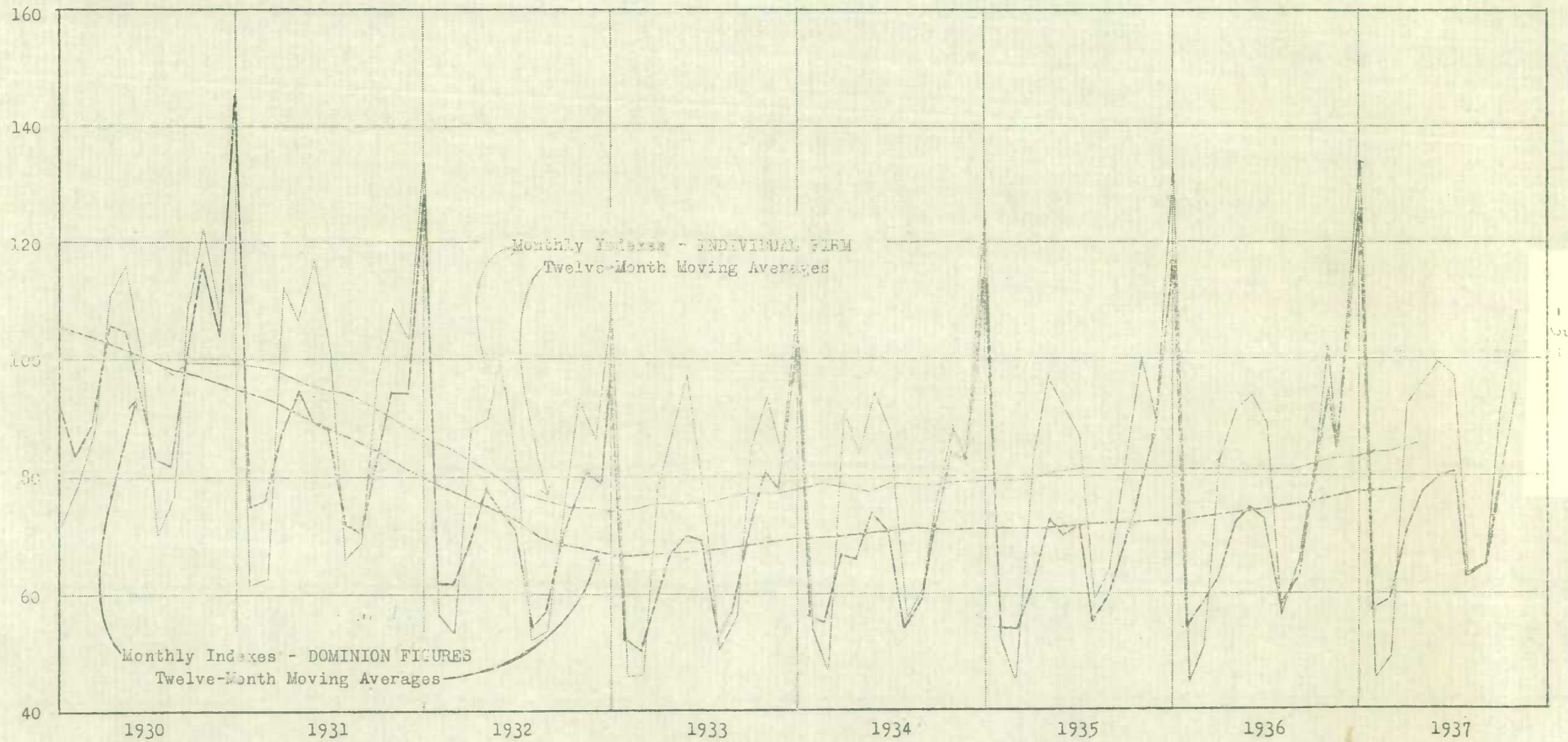
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Year and Month	Total Sales	Indexes of Sales, Average for 1930 = 100	Twelve-Month Moving Totals	Twelve-Month Moving Averages
<u>1930</u> - January	515,762	73.19		
February	557,030	79.05		
March	623,234	88.44		
April	785,397	111.45		
May	827,555	117.44		
June	705,163	100.07	1200.01	100.00
July	494,131	70.12	1188.41	99.03
August	540,517	76.70	1172.57	97.71
September	771,334	109.46	1197.44	99.79
October	865,845	122.87	1192.92	99.41
November	759,970	107.85	1193.46	99.46
December	1,010,282	143.37	1193.94	99.50
<u>1931</u> - January	434,041	61.59	1189.56	99.13
February	445,454	63.21	1181.45	98.45
March	798,511	113.31	1167.83	97.32
April	753,516	106.93	1153.60	96.14
May	831,407	117.98	1150.16	95.85
June	708,567	100.55	1140.47	95.04
July	463,255	65.74	1135.07	94.59
August	483,351	68.59	1124.82	93.74
September	675,339	95.84	1100.34	91.70
October	766,161	108.72	1083.19	90.27
November	735,219	104.33	1066.26	88.86
December	941,995	133.68	1046.31	87.19
<u>1932</u> - January	395,958	56.19	1032.81	86.07
February	373,192	52.96	1018.53	84.88
March	625,982	88.83	993.72	82.81
April	632,699	89.78	979.02	81.59
May	712,113	101.05	960.83	80.07
June	568,011	80.60	933.90	77.83
July	368,126	52.24	923.71	76.98
August	382,747	54.31	916.50	76.38
September	500,517	71.03	906.12	75.51
October	662,539	94.02	903.74	75.31
November	606,984	86.14	899.36	74.95
December	752,286	106.75	894.84	74.57
<u>1933</u> - January	324,175	46.00	892.77	74.40
February	322,411	45.75	894.42	74.53
March	552,849	78.45	908.42	75.70
April	615,900	87.40	908.39	75.70
May	681,229	96.67	906.00	75.50
June	536,091	76.08	906.78	75.56
July	353,514	50.17	914.56	76.21
August	394,325	55.96	914.39	76.20
September	599,221	85.03	926.80	77.23
October	662,302	93.99	923.01	76.92
November	590,154	83.75	921.70	76.81
December	757,761	107.53	932.37	77.70

Calculation of Monthly Indexes of Sales (Cont'd.) -

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Year and Month	Total Sales	Indexes of Sales, Average for 1930 = 100	Twelve-Month Moving Totals	Twelve-Month Moving Averages
<u>1934</u> - January	378,959	53.78	937.07	78.09
February	321,185	45.58	942.11	78.51
March	640,249	90.86	935.22	77.93
April	589,177	83.61	930.43	77.54
May	671,976	95.36	929.76	77.48
June	611,295	86.75	946.12	78.84
July	386,647	54.87	945.35	78.78
August	429,832	61.00	945.02	78.75
September	550,675	78.14	937.44	78.12
October	628,587	89.20	951.08	79.26
November	585,458	83.08	946.88	78.91
December	873,038	123.89	947.14	78.93
<u>1935</u> - January	373,561	53.01	951.70	79.31
February	318,840	45.25	956.03	79.67
March	586,839	83.28	956.84	79.74
April	685,320	97.25	967.81	80.65
May	642,425	91.16	973.25	81.10
June	613,165	87.01	981.16	81.76
July	418,759	59.43	972.21	81.02
August	460,381	65.33	978.42	81.53
September	556,361	78.95	978.41	81.53
October	705,892	100.17	972.07	81.01
November	623,760	88.52	975.26	81.27
December	928,741	131.80	977.23	81.44
<u>1936</u> - January	310,455	44.06	973.98	81.16
February	362,642	51.46	974.48	81.21
March	586,733	83.27	974.12	81.18
April	640,610	90.91	976.40	81.37
May	664,893	94.35	973.44	81.12
June	627,048	88.98	975.36	81.28
July	395,864	56.18	976.18	81.35
August	463,914	65.83	974.14	81.18
September	553,781	78.59	983.07	81.92
October	721,964	102.45	987.89	82.32
November	602,910	85.56	992.21	82.68
December	942,291	133.72	1000.49	83.37
<u>1937</u> - January	316,274	44.88	1007.20	83.93
February	348,248	49.42	1005.97	83.83
March	649,715	92.20	1018.80	84.90
April	674,624	95.73	1023.96	85.33
May	695,303	98.67		
June	685,363	97.26		
July	443,175	62.89		
August	455,233	64.60		
September	644,191	91.42		
October	758,337	107.61		

MONTHLY INDEXES OF RETAIL SALES

(Comparison of Results for an Individual Firm and Dominion Averages for Department Stores)



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