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CANADA

DEPARTMENT OF TRADE AND COMMERCE

DOMINION BUREAU OF STATISTICS

INTERNAL TRADE BRANCH

INAUGURATING A SERIES OF

CANADIAN INDEX NUMBERS

OF

INDUSTRIAL MATERIAL PRICES

OTTAWA
1939

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OF

INDUSTRIAL MATERIAL PRICES

PREFACE

Increasing attention has been paid in recent years to the behaviour of particular price groups in contrast to emphasis placed earlier upon the broad movements in the general field of commodity prices. Although valuable as an indicator of underlying trends, the general wholesale price index may tend to obscure significant divergent movements in constituent commodity groups. This fact has led the Bureau to experiment with supplementary price index number series in order to provide a better basis of appraising changes in the general wholesale price level. As a result of experiments to date, a new series of index numbers of industrial material prices is presented in this bulletin, together with a description of tests which led to the choice of commodities and index formula selected. This work has been done by Douglas L. Ralston, B.A., under the direction of E. F. Greenway, M.A. It was conducted in the Bureau's Internal Trade Branch of which Herbert Marshall, B.A., F.S.S., is chief.

R. H. Coats.

R. H. Coats,
DOMINION STATISTICIAN.

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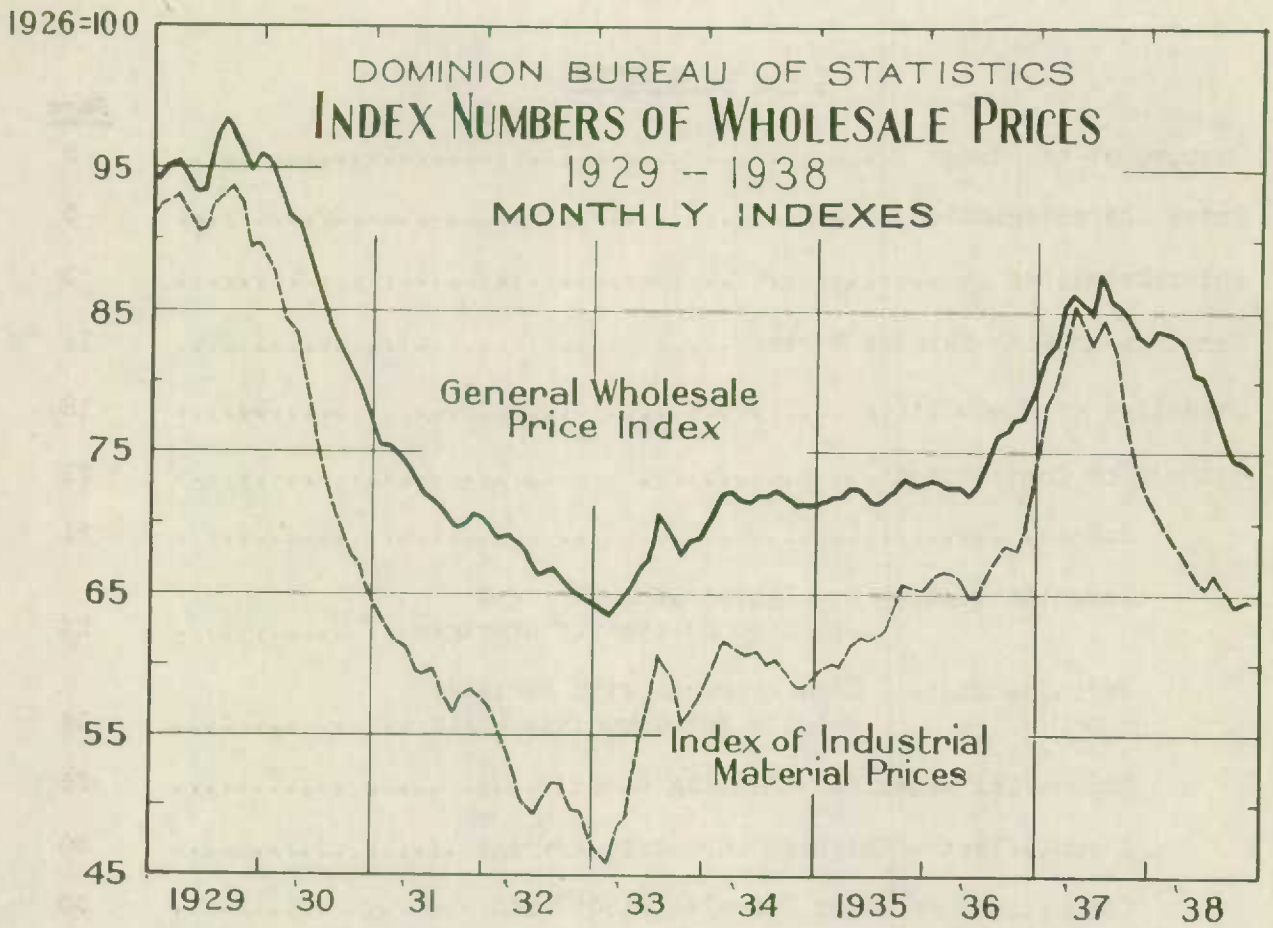
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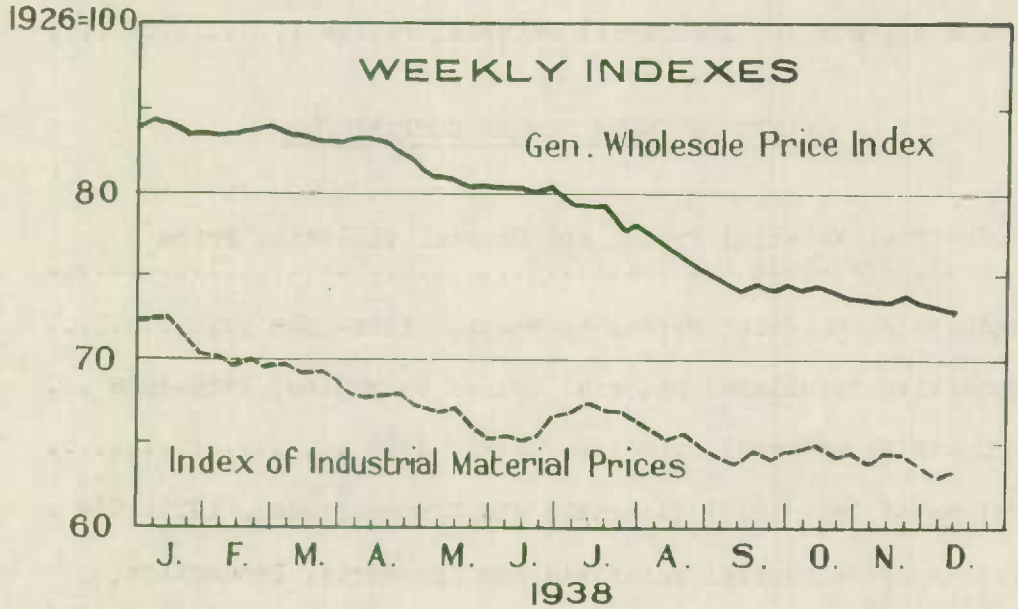
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70
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1938

A PRICE INDEX NUMBER OF INDUSTRIAL MATERIALS

PURPOSE OF THE INDEX

The primary aim in constructing an index of industrial material prices has been to provide a statistical measurement specially suited to a week-by-week examination of price behaviour in the markets which provide the basic materials required by industry. This index of 30 industrial materials is sufficiently inclusive to represent the general movement of prices for the industrial material group. More than 50 per cent of the annual value of such materials is directly represented, and a much higher percentage receives indirect representation. The index reflects, therefore, the composite of demand and supply forces which find expression in market price movements. However, the reaction of supply to demand is by no means uniform for all industrial materials, and likewise demand does not always show the same reaction to changes in supply. Therefore it is not sufficient to treat industrial material prices as a homogeneous unit, and to point out that industrial demand is the best available gauge of prospective business activity. It is necessary to recognize basic differences in demand and supply behaviour, and to search for a classification of industrial material prices which will throw these differences into clear relief.

INDEX CHARACTERISTICS

Casual inspection of industrial material price movements reveals two broad types of behaviour. There is an important group of materials for which the price structure is highly stable, yielding very slowly to forces of change. The supply of such materials can be, and usually is, adjusted quickly to variations in demand. This group includes the ferrous metals, coal, crude oil, etc. There is another larger group of industrial materials whose price structure is quite sensitive to market influences. In many cases, markets for this group are highly organized and transactions are conducted in future as well as in spot positions. For some of these, supply also can be adjusted fairly readily to demand, in view of the nature of production and a relatively small number of producers, e.g., non-ferrous metals. For others, supply adjustments are slow and in some instances falling prices may lead even to a temporary increase in production, when large numbers of producers increase output in an effort to offset the influence of price upon income, e.g., wheat. The character of demand for these commodities, which are mostly food products, also differs from that of other industrial materials. Requirements for most basic food materials are relatively constant, responding but slowly to changes in price. Purchases of other industrial materials are much more variable, depending upon changes in business prospects.

Possibilities of differences in price behaviour related to these considerations have led to a division of industrial material prices as follows:

1. Stable prices
2. Sensitive prices (a) manufacturing materials
   (b) food products

This classification, although empirical in character, makes possible the observation of divergent price movements which have had an important bearing upon economic developments during the past ten years.

In applying this classification to industrial material prices, an unweighted geometric average with the year 1926 as base, has been employed. The choice of this method was determined by extensive experiments with different types of index formulae.

From the various tests made it was found that for the particular purpose which the index was intended to serve, the unweighted geometric average possessed definite superiority to other types examined. Weighted indexes, constructed from a relatively small number of commodity price series, were influenced strongly by a few important products whose individual price fluctuations were in a position to overbalance the general movement through their extremely large weights. Especially was this noted in the case of wheat. On the other hand, the unweighted geometric average in which each item possessed equal weight was less liable to erratic behaviour. Such significant commodities for measuring price changes as non-ferrous metals and vegetable oils, which were relatively unimportant in the weighted indexes exerted a pronounced influence upon the unweighted geometric series.

Further, the unweighted geometric average proved as sensitive to basic price changes as other types of averages. At several points it was shown to be more sensitive than the other formulae considered. It should be noted also that the index levels using the unweighted geometric average were not substantially different from those of the weighted average. This was chiefly due to the inclusion of a representative group of stable price series which offset the lower price levels of the more sensitive commodities.

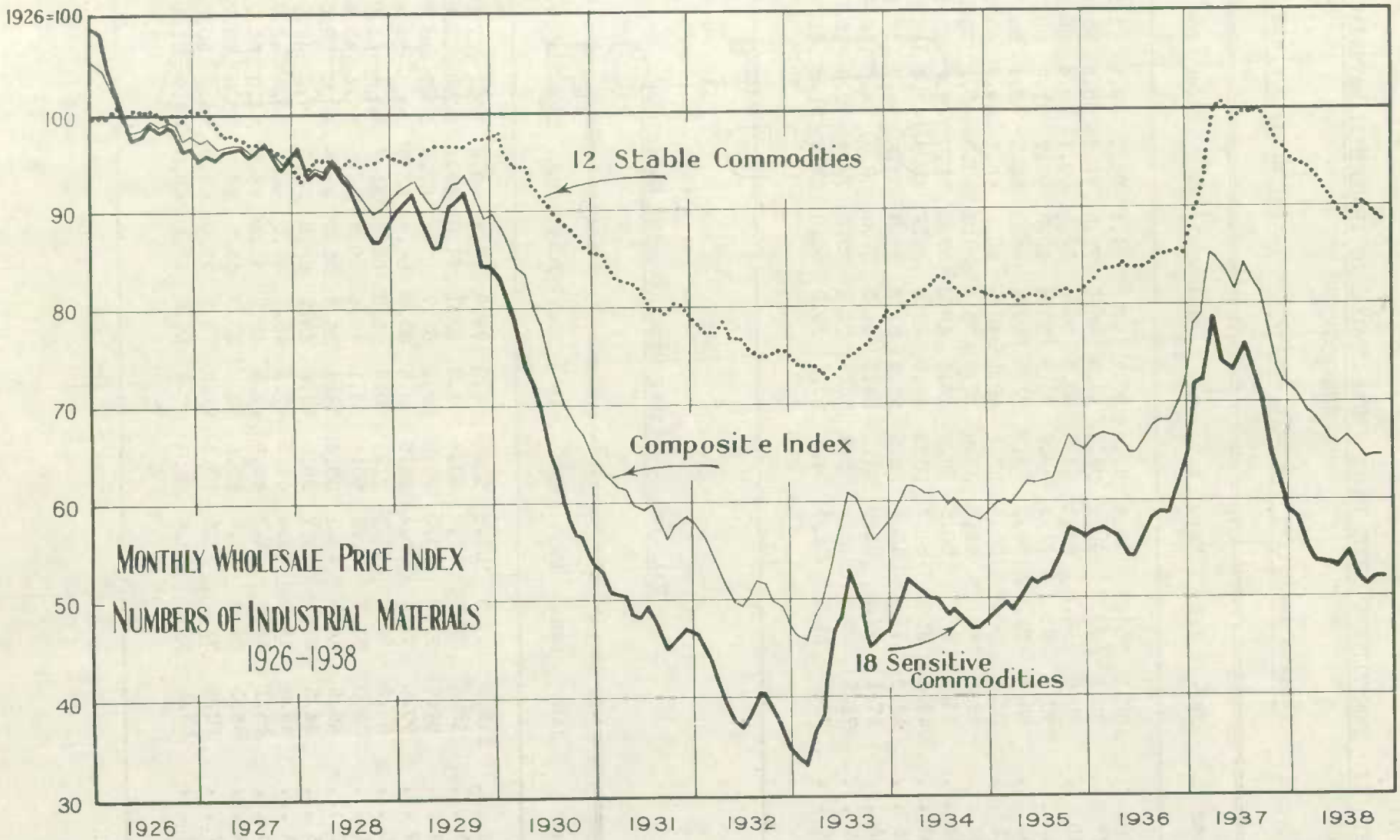
A detailed description of preliminary investigations leading up to the final choice of index formula and commodity price series is given at a later stage. The complete index of industrial material prices in both tabular and graphical form is presented immediately following. It will be noted that the index has been computed from 1926 to 1938 on a monthly basis, while a weekly index for the year 1938 to date also is included. It is planned to compute indexes weekly hereafter, to be released along with the Bureau's general index of wholesale prices.

TABLE I. MONTHLY PRICE INDEX NUMBERS OF INDUSTRIAL MATERIALS, 1926-1938

(1926=100)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1926 ...	104.7	102.6	100.7	99.4	98.3	98.4	99.5	98.9	99.2	99.1	97.4	98.0
1927 ...	97.2	97.5	96.4	96.7	96.8	96.9	96.0	96.6	96.7	96.0	94.8	96.1
1928 ...	95.4	93.7	94.5	94.1	95.2	93.8	93.4	92.1	90.9	89.9	90.2	91.1
1929 ...	92.2	92.7	93.2	91.8	90.3	90.4	92.9	93.0	93.7	92.4	89.4	89.5
1930 ...	88.3	86.8	84.0	83.4	79.8	77.4	74.0	71.9	69.3	67.7	66.6	64.9
1931 ...	63.9	62.1	61.5	61.2	59.5	59.3	59.6	57.9	56.1	57.7	58.1	57.7
1932 ...	56.8	55.2	53.4	51.5	49.7	49.2	50.3	51.6	51.5	49.9	49.1	47.4
1933 ...	46.0	45.8	48.4	49.3	54.0	56.7	60.8	59.4	58.6	55.7	57.0	57.6
1934 ...	59.4	61.7	61.5	60.9	60.7	60.9	59.8	60.1	59.1	58.4	58.3	58.9
1935 ...	59.8	60.0	59.7	61.1	62.0	61.7	62.0	62.1	64.1	65.9	65.5	65.3
1936 ...	66.1	66.5	66.3	66.0	64.6	64.6	66.4	67.7	68.2	68.0	69.9	73.1
1937 ...	78.1	79.3	85.2	84.7	83.4	82.3	84.5	82.9	81.2	76.8	73.4	71.5
1938 ...	70.6	69.2	68.8	67.4	65.9	65.5	66.3	65.1	64.1	64.2	64.2	

Chart 2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60
50
40
30
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
12 Stable Commodities
Composite Index
18 Sensitive Commodities
MONTHLY WHOLESALE PRICE INDEX
NUMBERS OF INDUSTRIAL MATERIALS
1926-1938

TABLE II. CONSTITUENT GROUP PRICE INDEX NUMBERS OF INDUSTRIAL MATERIALS, 1926-1938
(1926=100)

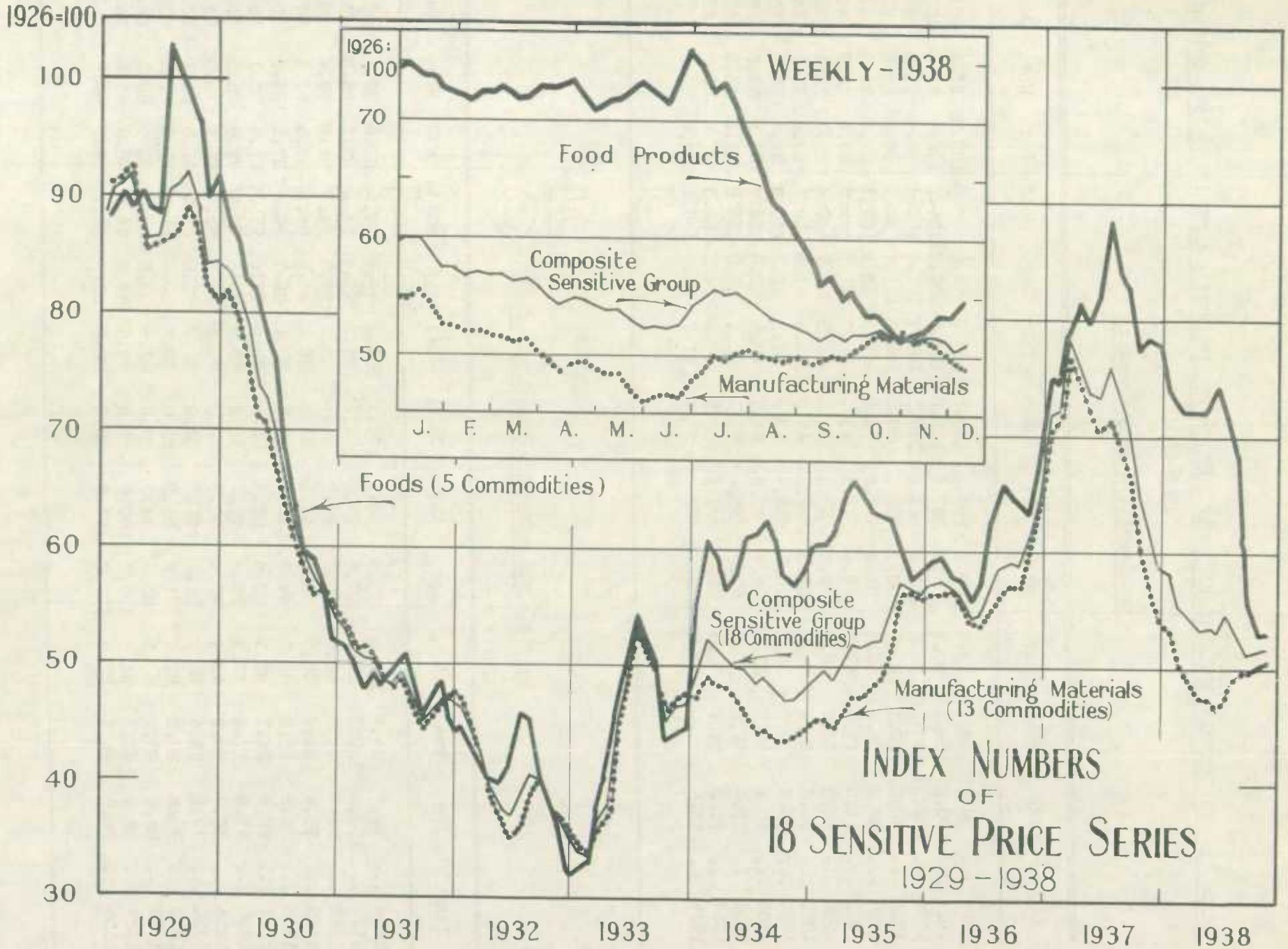
1. Eighteen Sensitive Commodities (Manufacturing Materials and Foods)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1926 ...	108.1	104.6	100.7	99.4	97.1	97.8	99.1	98.3	99.1	98.5	96.3	96.4
1927 ...	95.2	95.7	95.1	96.2	96.3	96.5	95.5	96.6	96.8	95.9	94.1	96.3
1928 ...	96.8	93.3	94.1	93.5	95.3	93.4	92.5	90.4	88.4	86.8	87.0	88.5
1929 ...	90.1	91.0	91.6	88.9	86.3	86.4	90.5	90.7	91.8	89.1	84.4	84.4
1930 ...	83.4	81.4	78.0	73.9	72.4	69.3	64.9	62.3	58.9	56.7	56.0	53.9
1931 ...	52.7	50.9	50.4	50.1	48.1	48.0	49.2	46.9	44.6	45.9	46.9	46.8
1932 ...	46.2	44.1	41.8	39.0	37.3	36.6	38.3	40.3	40.2	38.0	36.8	34.7
1933 ...	33.5	33.3	36.5	37.0	44.5	48.0	53.2	51.0	49.5	45.1	46.2	46.5
1934 ...	49.1	52.0	51.3	50.3	49.9	49.6	48.2	48.9	47.8	46.8	46.9	47.8
1935 ...	48.9	49.6	48.5	50.5	51.9	51.5	52.0	52.2	54.7	57.1	56.7	56.3
1936 ...	57.1	57.2	56.9	56.3	54.2	54.3	57.0	58.6	58.9	58.6	61.3	65.1
1937 ...	71.6	72.3	78.2	75.7	73.7	73.2	75.8	73.4	70.8	65.0	61.3	58.8
1938 ...	58.2	56.3	56.0	54.4	53.3	53.0	54.8	52.8	51.2	51.7	51.8	-

2. Thirteen Sensitive Manufacturing Materials

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1926 ...	112.1	107.2	102.6	98.9	95.9	95.9	97.9	98.6	99.1	97.8	95.8	94.6
1927 ...	93.4	93.5	93.7	93.6	92.2	93.1	91.9	93.4	93.9	93.6	92.2	94.3
1928 ...	94.7	90.7	90.0	88.0	89.1	87.7	87.3	85.5	83.7	83.7	85.3	86.5
1929 ...	90.8	91.2	92.6	88.5	85.4	85.6	86.0	86.9	89.3	86.4	82.4	81.5
1930 ...	81.8	79.6	76.3	71.1	70.4	66.9	63.8	61.7	58.8	55.9	56.1	54.8
1931 ...	53.3	51.3	51.5	50.4	48.1	47.6	48.7	46.5	44.4	45.4	46.3	47.7
1932 ...	46.8	44.3	42.1	38.6	36.4	34.9	35.8	38.6	40.0	38.0	37.1	35.8
1933 ...	34.2	33.6	35.7	36.5	43.8	48.2	52.8	50.7	49.2	45.9	47.1	47.4
1934 ...	46.8	49.1	48.4	48.3	47.2	45.9	44.0	44.5	43.6	43.2	43.6	44.2
1935 ...	45.1	45.4	44.3	45.9	47.4	47.2	48.3	48.6	51.9	56.0	56.6	55.6
1936 ...	56.3	56.2	56.6	55.9	53.7	53.3	54.9	56.0	56.8	56.7	60.5	64.0
1937 ...	70.4	71.5	77.9	73.6	71.7	70.0	71.4	69.6	66.7	60.8	57.2	54.4
1938 ...	53.1	51.1	50.7	48.8	47.4	46.5	49.4	49.6	49.6	51.4	51.5	-

Chart 3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90
80
70
60
50
40
30
1929
1930
1931
1932
1933
1934
1935
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Composite Sensitive Group (18 Commodities)
Manufacturing Materials (13 Commodities)
INDEX NUMBERS OF 18 SENSITIVE PRICE SERIES
1929 - 1938
1926=100
70
60
50
WEEKLY-1938
Food Products
Composite Sensitive Group
Manufacturing Materials
J. F. M. A. M. J. J. A. S. O. N. D.

TABLE II. CONSTITUENT GROUP PRICE INDEX NUMBERS OF INDUSTRIAL MATERIALS, 1926-38(Con.)

(1926=100)

3. Five Sensitive Food Products

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1926 ...	98.4	98.1	95.7	100.7	100.3	103.2	102.3	97.8	99.0	100.2	97.7	101.3
1927 ...	100.2	101.5	99.1	103.3	107.6	106.3	105.9	105.4	104.8	102.0	99.3	102.1
1928 ...	102.3	100.5	105.8	109.4	113.6	110.1	107.4	104.7	102.1	95.4	91.6	93.9
1929 ...	88.2	90.4	89.0	90.1	88.9	88.5	103.3	101.6	98.6	96.6	89.8	92.4
1930 ...	87.7	86.4	82.6	81.9	77.8	76.0	67.8	63.9	59.1	58.8	55.8	51.8
1931 ...	51.3	49.9	47.8	49.4	48.1	49.2	50.7	47.9	45.0	47.4	48.5	44.5
1932 ...	44.6	43.7	40.9	39.8	39.6	41.2	45.8	45.1	40.6	38.1	36.1	32.0
1933 ...	32.0	32.6	38.4	41.3	46.3	47.3	54.4	51.9	50.2	43.3	43.9	44.3
1934 ...	56.3	60.7	59.7	56.0	57.6	60.6	61.1	62.3	60.8	57.6	56.7	58.3
1935 ...	60.1	60.1	61.4	64.7	65.8	64.7	63.2	62.8	62.7	59.9	57.0	58.1
1936 ...	59.4	59.5	57.7	57.5	55.4	57.1	62.9	66.0	64.8	63.9	63.3	67.8
1937 ...	75.0	74.4	78.9	81.5	79.1	82.1	88.6	84.1	82.5	77.2	73.5	73.3
1938 ...	73.6	72.4	72.2	72.2	72.3	74.4	71.7	63.3	55.6	52.6	52.8	-

4. Twelve Stable Commodities

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1926 ...	99.7	99.8	100.6	99.4	100.2	100.1	100.1	99.9	99.5	100.0	99.1	100.5
1927 ...	100.3	100.3	98.5	97.6	97.6	97.3	96.6	96.6	96.6	96.2	95.8	95.8
1928 ...	93.3	94.3	95.3	95.2	95.1	94.4	95.2	94.8	94.8	94.8	95.4	95.7
1929 ...	95.4	95.4	95.7	96.3	96.6	96.6	96.6	96.6	96.6	97.5	97.5	97.6
1930 ...	98.2	95.5	94.3	94.5	92.3	91.3	90.1	89.1	88.6	87.9	86.2	85.6
1931 ...	85.4	84.0	82.9	82.6	82.4	81.5	79.6	79.6	79.3	81.2	80.1	79.0
1932 ...	77.8	77.4	77.1	78.4	76.7	76.6	75.5	75.0	74.9	75.0	75.5	75.3
1933 ...	74.0	73.9	73.9	73.4	72.5	73.0	74.6	74.7	75.6	76.4	78.0	79.4
1934 ...	79.1	79.6	80.7	81.1	81.7	82.9	82.7	82.0	81.2	81.5	81.1	80.7
1935 ...	80.8	80.8	81.4	81.2	81.0	81.0	80.7	80.5	81.2	81.6	81.3	81.6
1936 ...	82.4	83.5	83.5	83.5	84.3	83.6	83.6	83.9	85.0	85.0	85.1	85.0
1937 ...	88.9	91.3	96.9	100.2	100.6	98.8	99.5	99.5	99.8	98.6	96.3	96.0
1938 ...	94.5	94.3	93.8	92.8	90.6	90.0	88.5	89.3	90.1	89.0	88.5	-

Chart 4

WEEKLY WHOLESALE PRICE INDEX NUMBERS OF INDUSTRIAL MATERIALS 1938

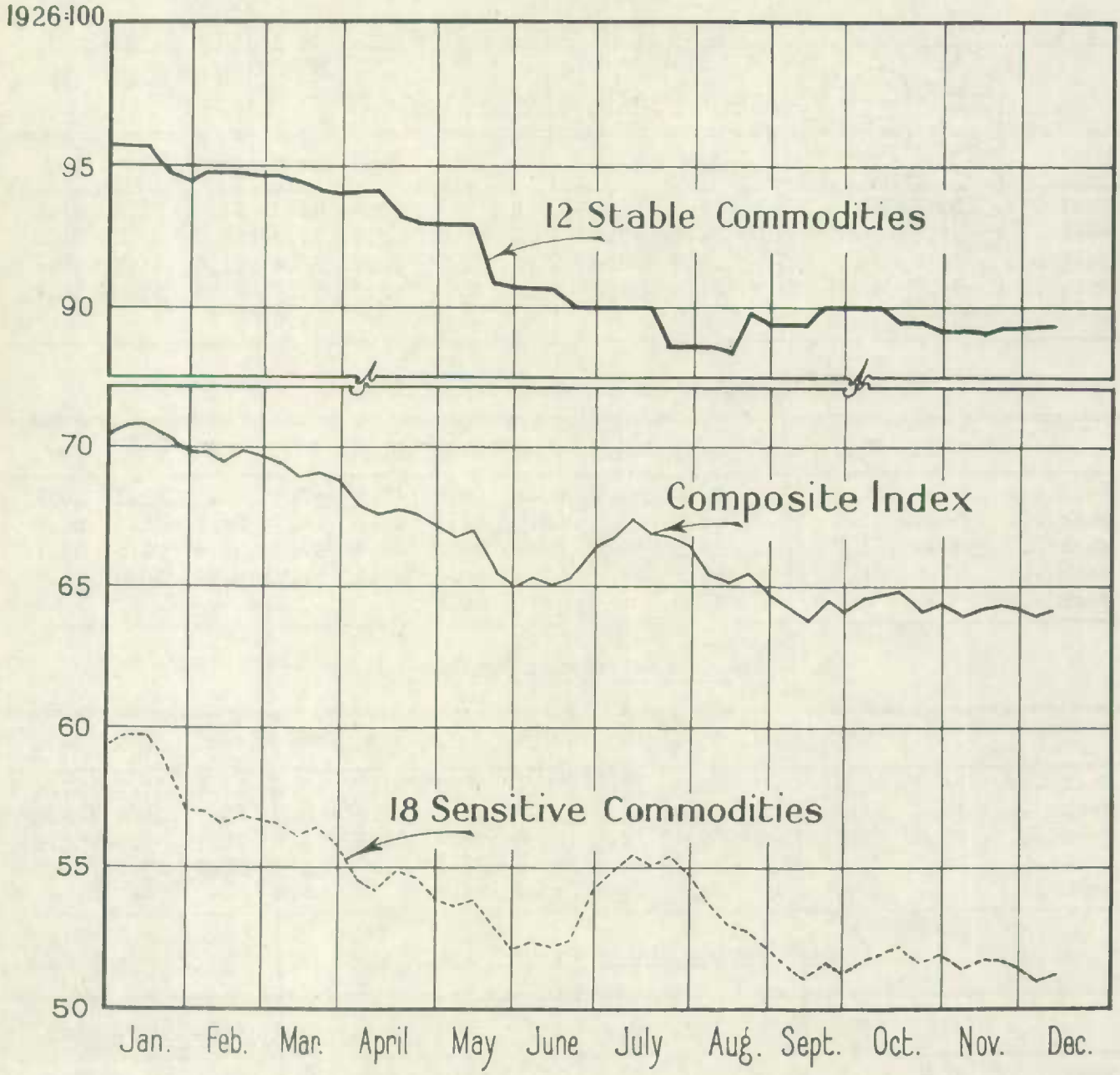


TABLE III. WEEKLY PRICE INDEX NUMBERS OF 30 INDUSTRIAL MATERIALS, 1938
(1926=100)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1st Week ...	71.4	69.3	69.0	67.7	66.8	65.0	66.7	65.4	64.2	64.5	63.8	63.5
2nd Week ...	71.4	69.0	68.9	67.4	66.9	64.9	67.1	64.8	63.8	64.7	64.0	63.8
3rd Week ...	70.5	69.2	68.8	67.5	65.5	65.0	66.4	65.1	64.4	64.0	64.1	63.8
4th Week ...	69.5	69.1	68.6	67.5	64.9	66.4	66.6	64.7	63.9	64.1	63.8	63.9
5th Week ...	-	-	-	67.0	-	-	66.2	-	64.4	-	-	-

TABLE IV. CONSTITUENT GROUP PRICE INDEX NUMBERS OF INDUSTRIAL MATERIALS, 1938
(1926=100)

1. Eighteen Sensitive Commodities

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1st Week ...	59.3	56.5	56.1	54.6	53.6	52.2	54.6	53.6	51.5	51.7	51.2	51.0
2nd Week ...	59.3	56.0	56.0	54.1	53.7	52.1	55.3	52.9	51.0	52.2	51.5	51.3
3rd Week ...	58.0	56.3	56.1	54.7	52.8	52.3	54.9	52.6	51.6	51.4	51.5	51.4
4th Week ...	56.7	56.2	55.7	54.6	52.0	54.2	55.1	52.2	51.0	51.5	51.3	51.7
5th Week ...	-	-	-	53.9	-	-	54.7	-	51.5	-	-	-

2. Thirteen Sensitive Manufacturing Materials

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1st Week ...	54.2	51.4	50.8	48.9	48.0	46.1	48.5	49.9	49.2	51.2	51.1	50.1
2nd Week ...	54.4	51.0	50.3	48.3	48.1	46.2	49.7	49.6	49.4	51.7	51.4	50.0
3rd Week ...	53.0	51.2	50.4	48.9	46.7	46.0	49.2	49.4	49.9	51.4	50.9	50.1
4th Week ...	51.6	51.0	49.6	49.1	45.6	47.6	50.0	49.6	49.7	51.9	50.5	50.3
5th Week ...	-	-	-	48.5	-	-	50.3	-	50.2	-	-	-

3. Five Sensitive Food Products

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1st Week ...	74.9	72.3	72.7	72.7	71.6	72.4	75.0	64.7	58.4	53.4	51.5	53.4
2nd Week ...	73.8	71.7	71.6	73.0	71.9	71.4	72.5	62.9	55.8	53.7	51.6	55.0
3rd Week ...	73.6	72.4	71.9	73.4	72.6	73.8	73.2	62.3	56.7	51.7	53.4	54.9
4th Week ...	72.6	72.4	72.8	72.0	73.3	76.3	71.4	60.0	54.9	51.0	53.4	55.3
5th Week ...	-	-	-	70.9	-	-	68.6	-	55.6	-	-	-

4. Twelve Stable Commodities

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1st Week ...	96.1	94.5	94.4	93.8	92.7	90.6	90.0	88.5	89.3	90.0	89.1	88.5
2nd Week ...	96.1	94.5	94.3	93.8	92.7	90.6	90.0	88.5	89.3	89.4	88.9	88.5
3rd Week ...	94.7	94.4	93.8	92.9	90.6	90.0	88.5	89.7	90.0	89.0	88.5	88.3
4th Week ...	94.4	94.4	93.8	92.7	90.6	90.0	88.5	89.3	90.0	89.0	88.5	88.1
5th Week ...	-	-	-	92.7	-	-	88.5	-	90.0	-	-	-

INDEX BEHAVIOUR, 1926-1938

The major trends outlined by the index of industrial material prices since 1926 can be summarized briefly as follows: From 1926 to 1929 underlying instability was apparent and the general index moved lower at a gradual pace throughout the period. From the base average, the index fell to 93.7 in September 1929. Then followed a severe decline which depressed industrial material prices along with other principal commodity groups until the beginning of 1933. Temporary improvement occurred in 1932 during the summer months, but markets weakened again towards the close and dropped to new low levels in February 1933. At this point the index stood at 45.8. A gradual rise punctuated by intermittent short-period declines ensued. In March 1937 industrial material prices attained their highest point since 1929, the index for the month reaching 85.2. A slightly lower peak was shown in July, after a minor reaction, when the index rose from 82.3 in June to 84.5. From this period to November 1938 the index of industrial material prices receded to levels on a par with those of 1936 and the latter part of 1935, with the November index recorded as 64.2. From Chart 1 it may be observed that the course of the industrial material price index since 1929 was generally similar to that of the Bureau's wholesale price index of 567 commodities.

The behaviour of constituent price groups which make up the composite index is also worthy of note. From Chart 2, Page 7, showing the averages for the past thirteen years of the 18 sensitive commodities, the 12 stable commodities, and the composite index of these separate groups, the effects of the constituent series upon the composite can be appreciated. It is apparent at the outset that the composite index follows closely the price level of the sensitive commodity series, the effect of the 12 stable items being mainly to moderate the amplitude of fluctuations. It can be observed also that in the combination of the two series the average lies at all times below the level of the 12 rigid products and above that for the sensitive group. Prices for the items comprising the former series have remained relatively high in comparison with 1926 averages, while the average for the sensitive group since 1929 has been usually at much lower levels.

When considering the price movements of the sensitive commodity series, it should be noted that the behaviour of constituents in this group is by no means homogeneous. The classification of sensitive commodity prices into manufacturing materials and food products serves to illustrate the divergent characteristics of some significance. The year 1929, particularly the latter months, presents an example of this variance in price behaviour. From June to July the index of the food products group advanced from 88.5 to 103.3, as compared to a fractional increase in manufacturing materials from 85.6 to 86.0 (cf. Chart 3, Page 9). The extreme rise in the food products index was due to a sharp advance in grain prices caused by threatened drought. It was reflected in the sensitive group average and influenced its movement to a greater extent than the larger sub-group composed of manufacturing materials. However, in general, the composite average followed the trends of this latter group. This is shown clearly from an observance of the separate movements during the period 1934-35, and again in 1937-38. A sharp advance chiefly in steers and hogs during the opening month of 1934 carried the index for foods far above that of manufacturing materials. Strengthened by upward revisions in grain prices, this level was sustained throughout 1934 and 1935. In contrast, manufacturing materials, particularly non-ferrous metals, wool, hemp, and cottonseed oil, showed a decline for the greater part of 1934, with a subsequent strengthening in the following year. The average of the sensitive series for this period remained very closely in line with that of the manufacturing materials sub-group, particularly in reference to the timing of the turning points. Another outstanding difference was found in the behaviour of the sub-groups during the latter half of 1938.

From June to July an upward swing occurred in the prices of manufacturing materials. This continued to a lesser degree until November. However, the composite average of sensitive industrial materials still continued to decline, because of heavy losses in grain prices. It is of interest that only fractional differences separated the two sensitive sub-groups in November, and that the food products section commenced to stiffen at that time.

Changes in the stable price series characteristically lag behind those of the sensitive series, sometimes by as much as several months. For example, the general decline which began in September 1929 did not find reflection in the price level of the 12 stable items until the beginning of 1930. Similarly the upswing in 1933 was delayed as far as May, the composite index and the sensitive group both having turned upward in March. However, this lagging tendency of the stable commodity series produced no marked effect upon the total index in so far as the timing of the changes at the important turning points were concerned.

Industrial Material Price Index and Other Related Series

A few comparisons between the industrial material price series and indexes in related fields will serve to indicate its position with reference to other industrial measurements. The various indexes employed in these comparisons, although differing widely in the amounts of change, displayed broad similarities in direction and timing. Especially was this noted in indexes most closely related to the price index of industrial materials, namely, common stock prices, purely sensitive prices, and the general wholesale price level. In regard to the amplitude of price changes, it was clear that the fluctuations occurring in the industrial material price index were greater than those shown by wholesale prices in general. This also was true to a lesser degree in the case of the Bureau's seasonally adjusted index of employment. The situation was reversed when the index of industrial material prices was compared with indexes of industrial production, common stock prices, and a purely sensitive price index. These latter revealed wider variations than the corresponding changes in industrial material prices.

The foregoing facts may be clearly observed from a brief comparison of the different indexes at three major turning points which record respectively a peak in 1929, the depression lows of 1932 and 1933, and a subsequent peak following recovery culminating in 1937. From Table V showing the relative averages and the computed percentage changes of the separate indexes for each of these periods, the individual differences in amplitude are apparent. The greatest fluctuations occurred in the movements of common stock prices. This index declined 80 p.c. from 1929 to 1932, and then increased 241 p.c. by 1937 over the depression low. The Wood-Gundy sensitive price index showed similar large variations with a 70 p.c. drop to 1932, followed by a rise of 224 p.c. from that period to 1937. Industrial material prices stood approximately half way between the indexes showing the greatest and least amounts of fluctuation. The general wholesale price index displayed the least variation, declining 36 p.c. in the period of falling prices and recovering by a similar amount of 37 p.c. by 1937.

Of the six indexes under consideration, no two were exactly alike in recording all three of the principal directional changes mentioned. In 1929, the index of industrial production reached its peak in January and was the first of the group to indicate a decline. The Wood-Gundy sensitive price index followed in March, while employment and the general wholesale price level advanced until August. The index of industrial material prices and common stocks continued to rise until the following month

Chart 5

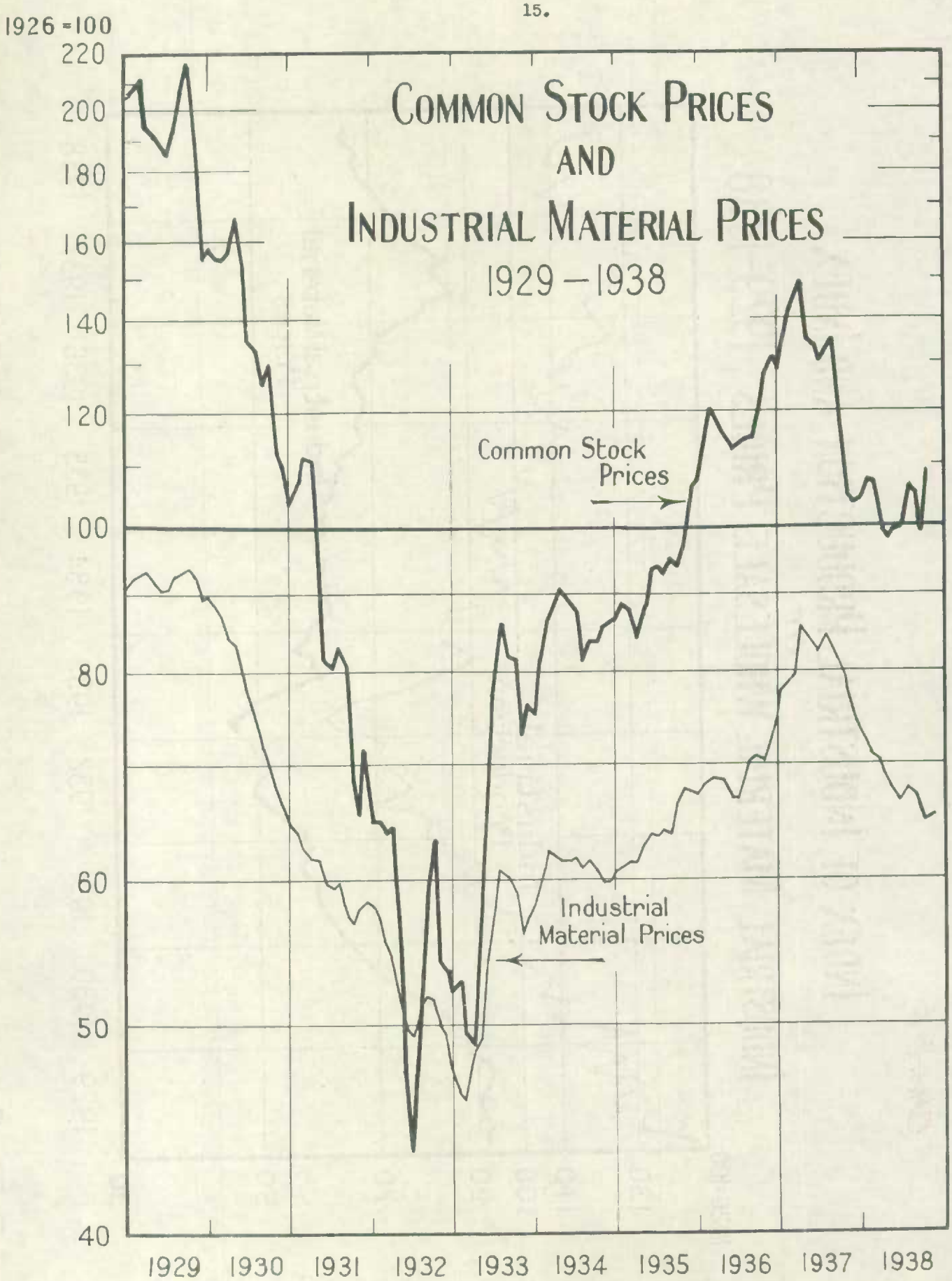

1926 = 100
220
200
180
160
140
120
100
80
60
50
40
COMMON STOCK PRICES
AND
INDUSTRIAL MATERIAL PRICES
1929 – 1938
Common Stock Prices
Industrial Material Prices
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938

Chart 6

INDEX OF INDUSTRIAL PRODUCTION AND INDEX OF INDUSTRIAL MATERIAL WHOLESALE PRICES, 1929-1938

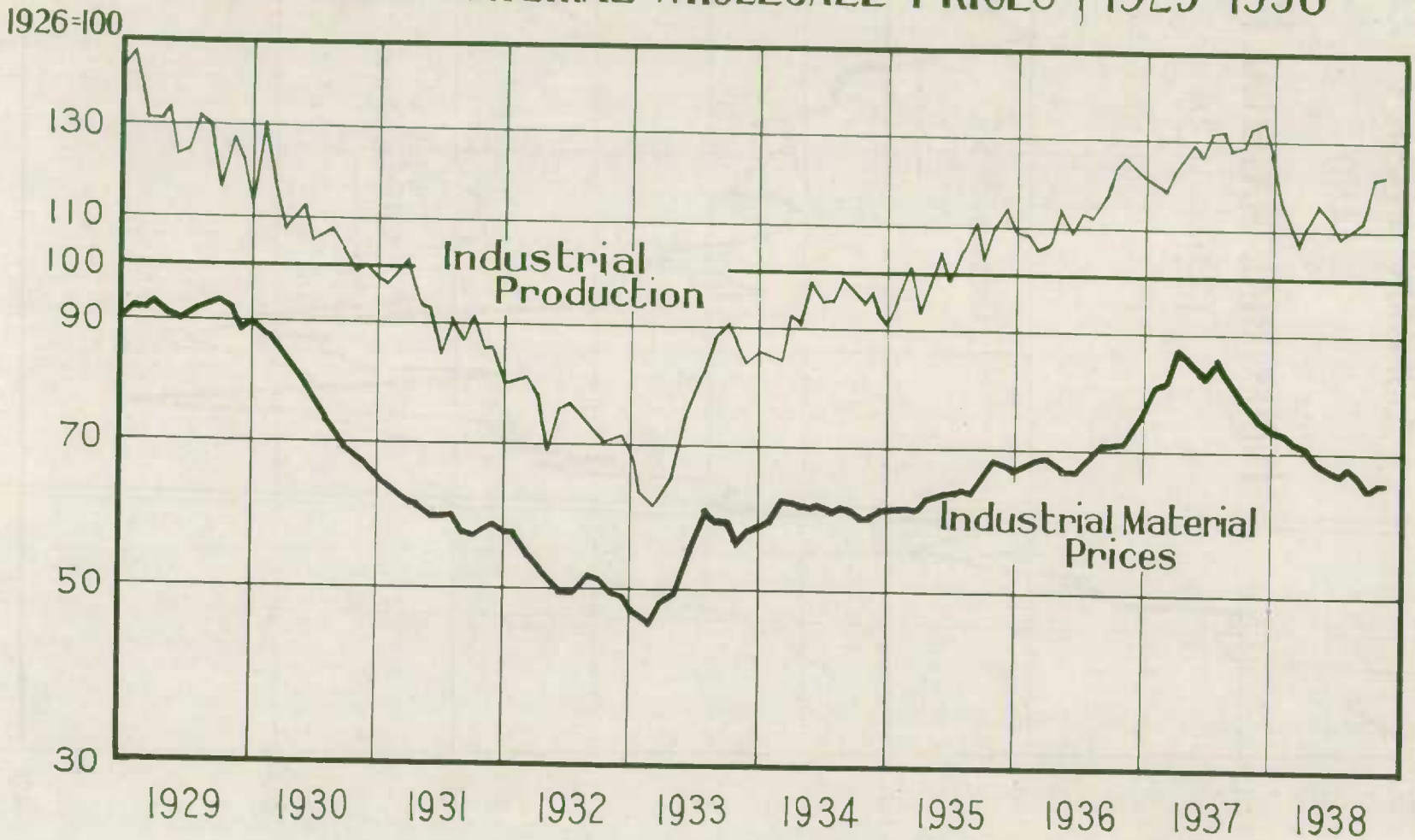
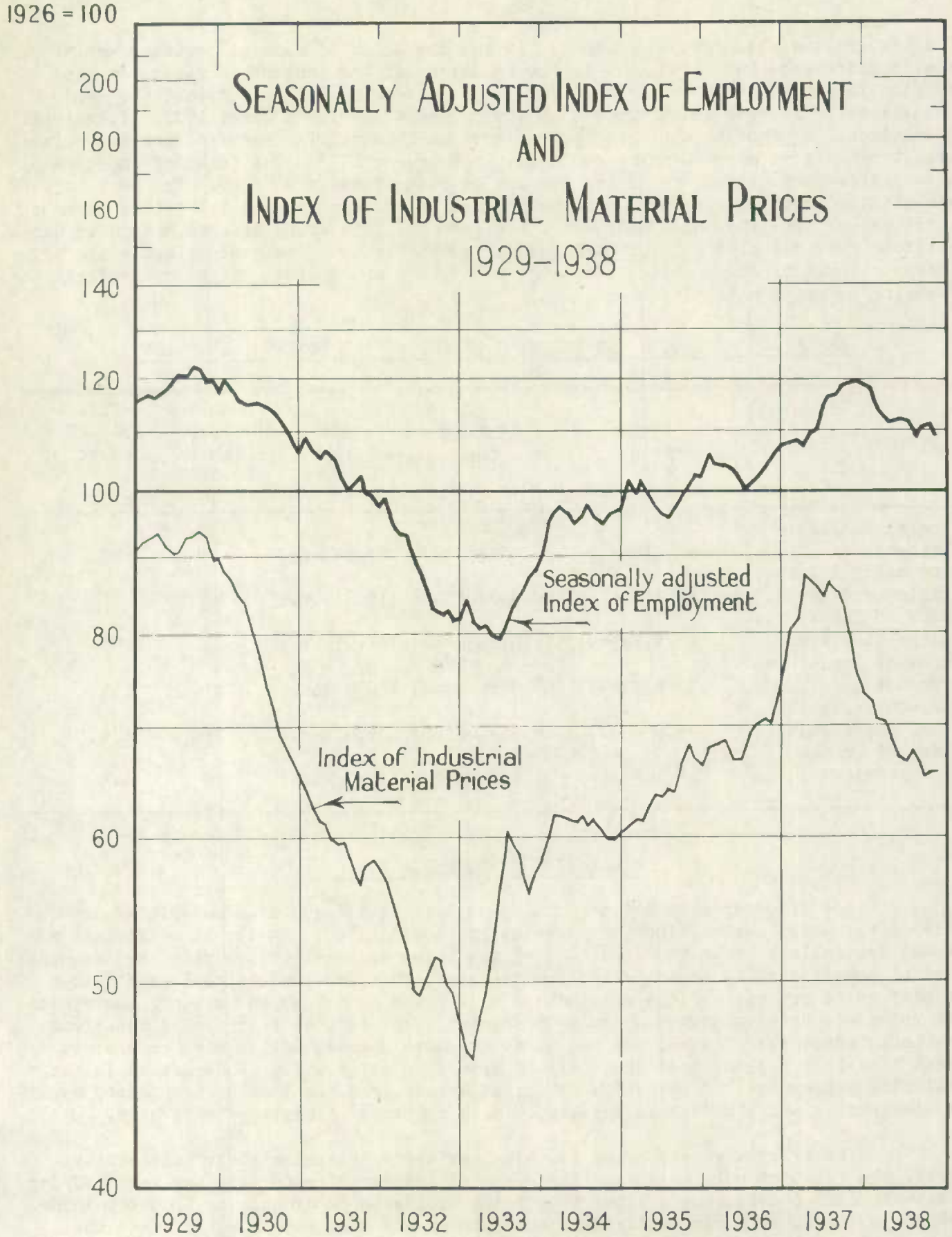


Chart 7


1926 = 100
SEASONALLY ADJUSTED INDEX OF EMPLOYMENT
AND
INDEX OF INDUSTRIAL MATERIAL PRICES
1929–1938
200
180
160
140
120
100
80
60
50
40
Seasonally adjusted Index of Employment
Index of Industrial Material Prices
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938

(September) and then dropped sharply. At the low point of general business activity, a wide difference was noted also in the behaviour of the indexes in recording the termination of the downward trend. The index of common stock prices and the Wood-Gundy sensitive price index dropped to their lowest levels in June, 1932. Industrial production, the general wholesale price index, and industrial material prices arrived simultaneously at corresponding positions in February 1933. The index of employment was considerably behind, recording its low in June of the same year. The peak in 1937 was attained early in the year for the indexes of industrial material prices, common stock prices, and the Wood-Gundy sensitive series. This group reached a high in March, although each revealed a lower peak several months later. The general wholesale price index followed in July, while industrial production and employment did not reflect the changing movement until November.

TABLE V. RECESSION AND RECOVERY OF INDUSTRIAL INDEXES, 1929-1937

Description	1929 High	1932-33 Low	1937 High	%Decline 1929 High to 1932-33 Low	%Rise 1932-33 Low to 1937 High
General Wholesale Price Index	98.4(Aug.)	63.5(Feb.'33)	87.6(July)	36	37
Seasonally Adjusted Employment Index..	122.4(Aug.)	79.5(June'33)	119.8(Nov.)	35	51
Index of Industrial Material Prices...	93.7(Sept.)	45.8(Feb.'33)	87.5(Mar.)	51	86
Index of Industrial Production	147.5(Jan.)	60.9(Feb.'33)	133.5(Nov.)	59	119
Wood-Gundy Sensitive Price Index..	91.6(Mar.)	27.6(June'32)	89.3(Mar.)	70	224
Index of Common Stock Prices	217.1(Sept.)	43.2(June'32)	147.2(Mar.)	80	241

SELECTION OF COMMODITIES

Adequate representation of the most important industrial materials was considered to be the basic criterion in selecting commodities. At the same time, it was deemed desirable to keep the structure of the index comparatively simple, and as sensitive as possible to important market influences. This required careful examination of many price series, and the elimination of a great number on the grounds that their inclusion was unnecessary to adequate representation, or that their price behaviour was unsatisfactory. The reconciliation of adequate representation with consistent price behaviour necessitated considerable experimentation which is described in the following paragraphs. Many series exhibited erratic fluctuations or pronounced cyclical tendencies which made them unreliable as indicators of basic price trends.

Three tests were applied to price series to determine their suitability. First, the value of related commodities used as industrial materials was recorded for the years 1925-6-7 to show whether they rated inclusion on grounds of industrial use. Second, price behaviour of individual commodities was examined in relation to the general wholesale index from 1926 to 1937 to decide whether erratic or cyclical tendencies made them unsuitable. And third, the dispersion of individual commodity indexes

on the base 1926=100 was examined at eight significant turning points of the general wholesale index to evaluate the importance of this factor as a source of possible distortion in final index computations.

The first two tests narrowed the basis of selection to 45 commodities and need not be commented upon in detail. The dispersion test data, however, contribute materially to an evaluation of the index and merit a descriptive note. Differences in price behaviour revealed by this test have been considered sufficient to justify sub-group indexes for stable and sensitive price series. In fact, it might be argued that the sub-group indexes were more significant than any composite based upon a small number of price series revealing a marked degree of dispersion. In answer to this, it may be pointed out that the selection of commodities has been purposive, and as already noted, it represents well over one-half the value of all industrial materials. Under such circumstances, resultant averages may be considered as definitely significant, particularly in view of the close correspondence of results from different index formulae and the careful testing of individual price series over a 12-year period to rule out those showing erratic behaviour. The principal effect of the stable group upon the composite index, it has been pointed out, is to raise its level and modify fluctuations shown by the sensitive group, but the pattern shown is essentially that of the latter.

As already noted, eight important turning points of the general wholesale price index were selected in order to judge the extent of price dispersion since 1926. The relative prices of 45 individual commodities were obtained for these periods which were chosen as follows: August 1929, February 1933, July 1933, May 1934, May 1936, March 1937, July 1937, March 1938. The central point in the range of fluctuations of the commodities was established for each of the turning points. As the number of items was odd, the median value was that of the 23rd relative price. Thus twenty-two items stood above this mark, while an equal number were below it. The results showed a marked consistency, with the majority of products fluctuating within a range from 10 to 15 points from the median. The table of results from this test shows that the number of prices with relatively slight variations from the central point exceeded those displaying a wider divergence at all periods considered.

TABLE VI. NUMBER OF COMMODITY RELATIVE PRICES WITHIN 30 POINTS OF THE MEDIAN VALUE
(out of a possible total of 45)

Period	Total Within 15 Points Above Median	Total Within 15 Points Below Median	Total Within 30 Point Range
August, 1929	13	18	32
February, 1933	8	18	27
July, 1933	15	14	30
May, 1934	15	10	26
May, 1936	14	12	27
March, 1937	10	14	25
July, 1937	12	12	25
March, 1938	14	6*	21*

* Within a range of 18 points below the median the number increased from 6 to 10, making a total of 25 in a range of 33 points.

This method of observing the price characteristics of specified commodities showed clearly the extremely irregular pattern followed by some items. Further it revealed those products possessing fairly regular price behaviour. Rubber and silk were always to be found far below the median and generally close to the bottom of the list, but they paralleled closely the general movement in sensitive commodity markets. Hides were seldom within the 30-point range, and were either far above the central point or at levels well below it. Many commodities, especially in the sensitive group, appeared consistently within the defined range for the eight periods, notable among which were cottonseed oil, hogs, lambs, cotton, wheat, lead, crude oil, pulp, scrap iron, wool and linseed oil. Commodities in the stable price group were generally far above the median. This discrepancy decreased during those periods in which the general level of wholesale prices was relatively high. Table VII shows the number of times each commodity appeared within 15 points of the median out of a total of eight opportunities.

TABLE VII. NUMBER OF TIMES SPECIFIED PRICE SERIES FELL WITHIN 30 POINTS OF THE MEDIAN VALUE
(out of a possible total of 8 times)

Commodity	No. Times in Range of 30 Points	Commodity	No. Times in Range of 30 Points
Cottonseed Oil	8	Cotton Thread	5
Hogs	8	Oranges	5
Tea	8	Coffee	5
Lambs	8	Oats	4
Linseed Oil	7	Spruce Lumber	4
Pulp, unbleached	7	Zinc	4
Pulp, bleached	7	Beef Hides	4
Cotton	7	Hessian	4
Scrap Iron	7	Steel Sheets	4
Crude Oil	7	Coal	3
Wool	7	Shellac	3
Paint Materials	7	Rosin	3
Steers	6	Potatoes	3
Wheat	6	Structural Shapes	2
Copper	6	Tobacco	2
Peanut Oil	6	Merchant Bars	2
Cocoa	6	Sheep Skins	2
Calves	6	Fir Lumber	1
Sugar	5	Iron Ore	1
Manila Hemp	5	Silk	1
Lead, Domestic	5	Calf Skins	1
White Lead	5	Rubber	0
Tin Ingots	5		

A number of price series used in the test were discarded mainly on account of their irregular behaviour when compared with the general price movement. Commodities such as cocoa, oranges, tea, lambs, sheep skins, calf skins, shellac, and potatoes, were found to possess highly irregular fluctuations. These were necessarily omitted even though several showed a high degree of consistency in the foregoing dispersion tests.

FINAL SELECTION OF PRICE SERIES

After completing the described tests, the following thirty individual commodity price series were selected for the industrial material price index.

Sensitive Price Series

(a) Manufacturing Materials

Rubber,	Raw, Plantation, first latex crepe
Linseed Oil,	Raw
Cottonseed Oil,	Refined
Rosin	Water white
Beef Hides,	Country cured
Cotton,	Raw, middling 1"-1 1/16"
Wool,	Raw, Eastern bright 1/4 blood
Silk,	Raw, (composite of 9 items)
Manila Hemp	12 1/2 p.c. fair current
Lead,	Domestic
Zinc,	Spelter
Copper,	Electrolytic domestic
Tin Ingots,	Straits

(b) Food Products

Wheat,	No.3 Manitoba Northern
Oats,	No.3 Canada Western
Sugar,	Raw, British West Indies, Preferential
Steers,	Good quality
Hogs,	Good bacon

Stable Price Series

Spruce Lumber,	Quebec
Fir Lumber,	No.1 Common
Pulp,	Unbleached Sulphite
Pulp,	Bleached Sulphite
Iron Ore,	Mesabi Bessamer
Scrap Iron,	Heavy Melting, charging box size
Structural Shapes,	Open Hearth
Merchant Bars,	Mild Steel
Steel Sheets,	No.24 U.S.G. Galvanized
Crude Oil,	Mid-Continent
Coal,	American Bituminous, run-of-mine
White Lead,	Basic Carbonate in Oil

METHODS OF COMPUTATION

Summary of Formulae Tests at Significant Periods

Geometric and arithmetic averages, in both weighted and unweighted form were employed in experimental construction tests to determine the most satisfactory formula for an index of industrial material prices. In the case of the weighted indexes, the quantities were based on the industrial consumption of commodities selected. Experimental indexes were constructed for significant periods as indicated by the general wholesale price index. The periods were those employed in the preceding discussion on price behaviour, namely, August 1929, February 1933, July 1933,

May 1934, May 1936, March 1937, July 1937, and March 1938. In addition, indexes for the months immediately preceding and following were also computed. This procedure enabled observation of absolute levels recorded as well as something of the manner in which the indexes behaved.

The foregoing tests were supplemented by construction of weighted arithmetic and weighted geometric indexes for the 30 commodities finally selected, for the years 1936, 1937, and 1938. This made possible a comparison of the behaviour of the final index number (simple geometric average of industrial material prices) with corresponding weighted arithmetic and geometric computations, as well as with the Bureau's general index of commodity wholesale prices. Graphic comparisons of these indexes may be found on Page 32.

In the first test a comparison of an unweighted geometric average and a weighted arithmetic series emphasized the fact that a few important products in a weighted average of a relatively small number of commodities were in a position to overbalance a movement which embraced a large majority of less heavily weighted constituents. For example, wheat, the most important item by far on a consumption weighting basis, was clearly responsible on different occasions for changing the direction of the weighted arithmetic average while many products were displaying opposite tendencies. The barometric significance of the non-ferrous group was curtailed especially by this type of index. Possessing very small weights in relation to commodities such as wheat, steers, and hogs, the non-ferrous group exerted a comparatively slight influence. In this respect the unweighted geometric series appeared superior to the weighted arithmetic average, since it gives equal value to all commodities.

In an attempt to prevent erratic behaviour caused by a relatively few important commodities, changes in weighting and constituents were introduced. As a result of these changes the influence of heavily weighted products was modified to a certain degree. However, the same commodities, with weights distributed a little more evenly, continued to be important factors in the measurements recorded by the weighted series, and it appeared impossible to devise any reasonable weighting system for this type of index in which a few commodities did not exercise a dominant influence. An indication of the influence exerted by this class of commodity was ascertained by the construction of indexes excluding the important item of wheat. When turning points were compared with the previous results, it was clearly apparent that the exclusion of wheat produced marked differences both in the levels of the index and the timing of changes. It is worthy of note that the effect upon the unweighted geometric average was relatively slight in comparison.

A weighted geometric average was found to record changes similar to the weighted arithmetic series, although retaining certain characteristics of the geometric form of average. Nevertheless the predominance of a few commodities observed in the weighted arithmetic series remained prevalent in this type also. This pointed to the unweighted geometric average as the most desirable type for the particular purpose in view.

Test of Indexes Based on Unweighted Geometric and Weighted Arithmetic Averages

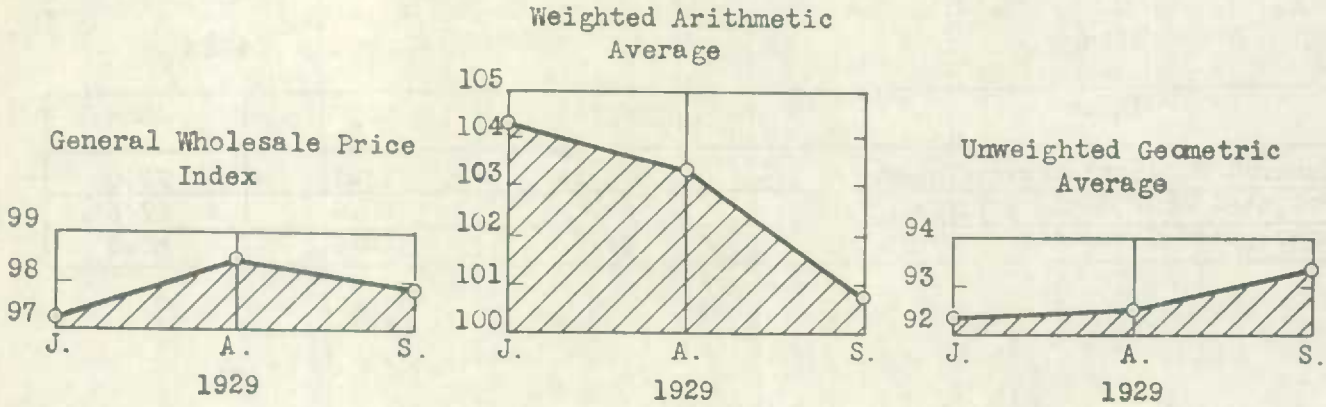
In the first tests a total of twenty-six commodities was included. These are shown on Page 33 with ratio weights based upon the value of quantities used in domestic industrial production in the years centring around 1926. At this stage it will be noted that the ferrous metal group was represented solely by scrap iron, the consumption of which is equivalent to only a small fraction of ferrous metals used by industry. The prices used to obtain weights were those of the base year 1926. Hence the formulae

employed to compute weighted arithmetic averages conformed to the Laspeyres type, with quantities and prices at the base period used in the determination of the weights.

Analysis of unweighted geometric and weighted arithmetic indexes revealed several clear-cut differences. First there were the inherent characteristics peculiar to each as a form of average. The weighted arithmetic series fluctuated over a wider range, and displayed greater degrees of change at the turning points. It followed more closely the exact turning points of the general wholesale price index. However, as this latter index is computed from the same form of arithmetic average, this similarity was to be anticipated. The geometric average displayed variances which appear worthy of a close examination. These were quite pronounced in August 1929, May 1934, March 1937, and March 1938, and a description of index behaviour for these periods is given immediately following.

August, 1929

It may be observed from the accompanying chart, that both the unweighted geometric and the weighted arithmetic indexes differed from the general wholesale index in recording turning points during the latter half of 1929. The early decline in the weighted arithmetic average was caused by a very few commodities. Steers recorded a drop from July to August of 152.1 to 137.9, while rubber and sugar also experienced a lesser reduction at this time. Wheat showed only a slight fractional change, together with most other commodities with large weights. Thus the severe cut in the price of steers was the principal factor in starting the index downward during July and August. This decline continued into the following month, leading to a general recession accelerated by heavy losses in the prices of wheat and hogs.

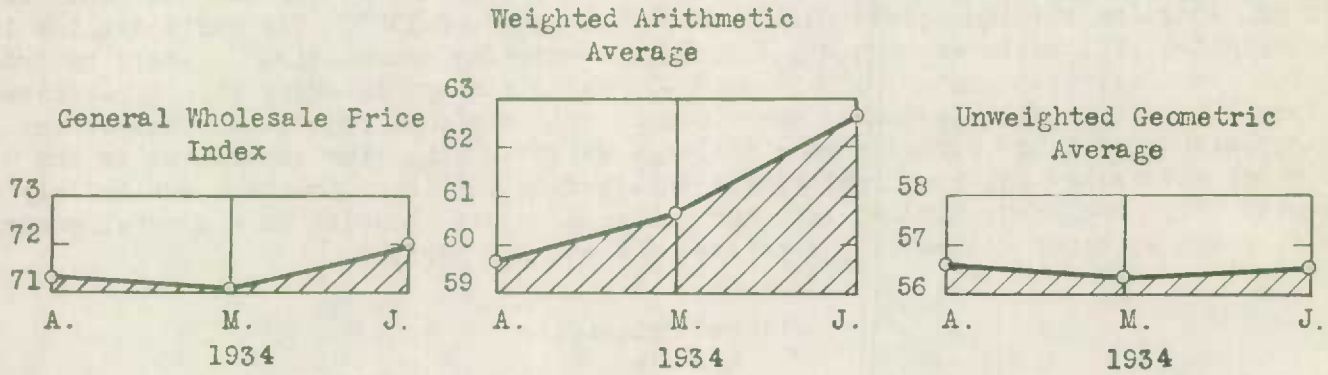


Index	July	August	September
General Wholesale Price Index	97.2	98.4	97.8
Weighted Arithmetic Average	104.3	103.3	100.7
Unweighted Geometric Average	92.3	92.5	93.3

Since all commodities in the geometric average possessed equal weight, the behaviour of the geometric index differed from the weighted arithmetic counterpart. The drop in the price of steers, rubber, and sugar, during July and August was offset by a sharp rise in oats from 126.6 to 136.6 and in linseed oil from 84.4 to 105.8. Minor gains also appeared in raw silk and lead. However, the majority of the commodities showed very little change during these two months, and the increase in the commodities mentioned was sufficient to keep the geometric index advancing. From August to September, further strength in these same commodities, especially linseed oil, along with marked increases in the prices of raw cotton, beef hides and sugar, caused the geometric average to rise again in September.

May, 1934

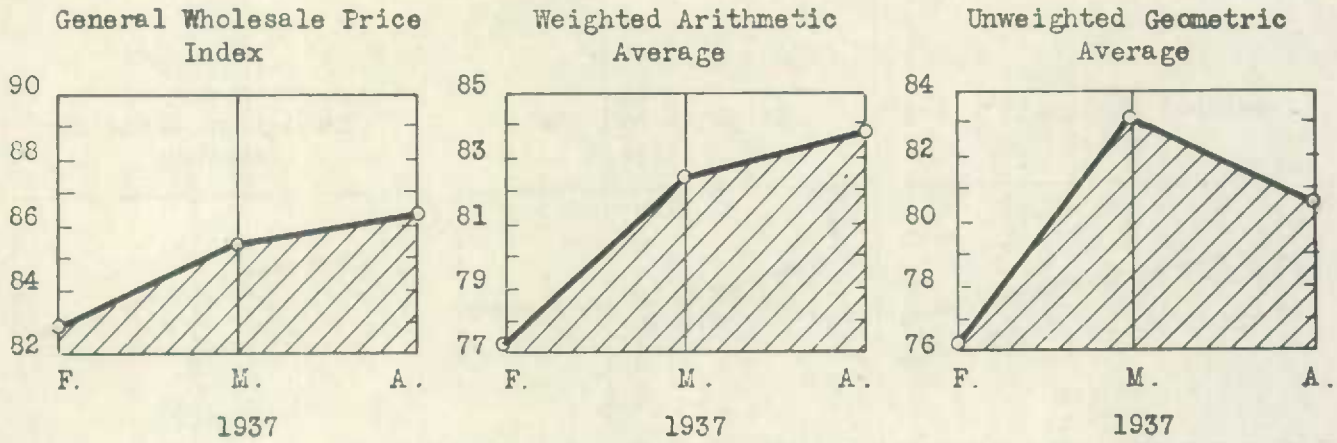
During the period centring around May, 1934, similar differences occurred in directional changes of the indexes, with the geometric average moving more closely in line with the general wholesale price index.



Index	April	May	June
General Wholesale Price Index	71.3	71.1	72.0
Weighted Arithmetic Average	59.7	60.6	62.6
Unweighted Geometric Average	56.6	56.3	56.5

A sharp advance occurred in the weighted industrial material index during April and May due to wheat, oats, and hogs, all heavily weighted products. They overbalanced other commodities such as the non-ferrous metals, beef hides, steers, cotton, wool, silk, and several others. It is significant that during these two months there were twice as many price reductions as there were increases, yet the arithmetic average rose due to the weights of wheat and hogs. The unweighted geometric index revealed a drop for the same period since the majority of commodities decreased in price.

March, 1937



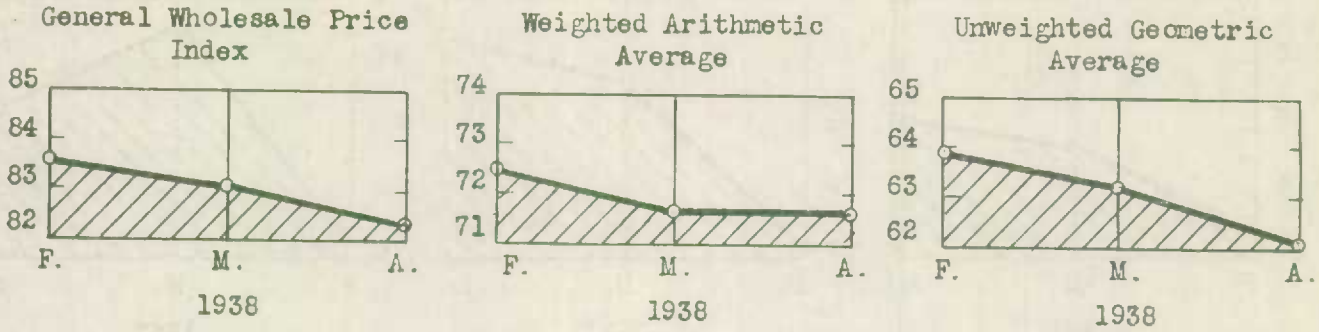
Index	February	March	April
General Wholesale Price Index	82.9	85.4	86.2
Weighted Arithmetic Average	77.2	82.4	83.6
Unweighted Geometric Average	76.2	83.1	80.6

The two arithmetic indexes recorded almost parallel advances during March and April, 1937, while the unweighted geometric average indicated a rise in March, but a decline for April. In this instance the simple geometric index led the weighted arithmetic series by one month in reflecting the beginning of a major recession (See Chart 8). The chief factors in the early decline of the geometric index were sharp drops from March to April for non-ferrous metals. Minor declines were also noted in the prices of beef hides, cotton, rosin, white lead, wool, and silk. However, the main downward impetus came from the non-ferrous metals, with copper, lead , zinc, and tin ingots all moving lower.

March, 1938

The experimental arithmetic index remained constant throughout March and April, 1938, while the simple geometric showed a definite decline in accordance with the general wholesale price index.

An examination of the prices in March and April, revealed that the divergence noted can be attributed to the sharp April rise in the prices of wheat and steers which offset with their large weights the downward tendency of the majority of the products in the index. Hogs also recorded a minor gain at th's period.



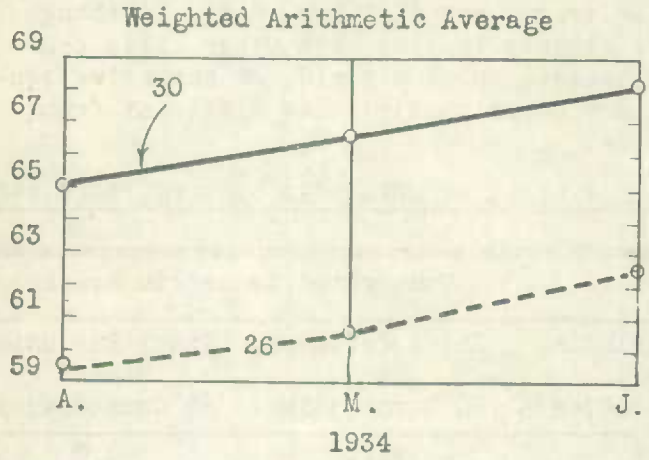
Index	February	March	April
General Wholesale Price Index	83.6	83.1	82.3
Weighted Arithmetic Average	72.4	71.6	71.6
Unweighted Geometric Average	63.9	63.2	62.1

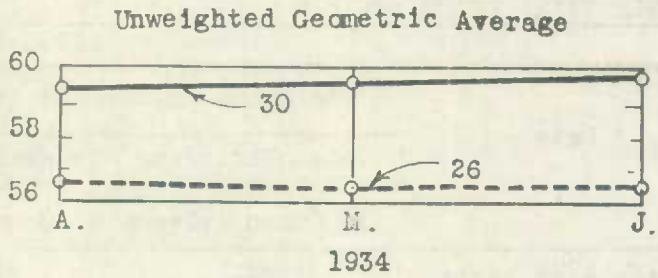
Additional Tests with Revised Weights and Commodity Lists

It was clear from the foregoing comparisons that a dominant influence was exerted upon the weighted arithmetic average by certain heavily weighted commodities, notably wheat, steers and hogs. The fact that a slight change in the price of wheat was able to alter the direction of the index through its weight of 22 per cent, produced an erratic tendency in the weighted series.

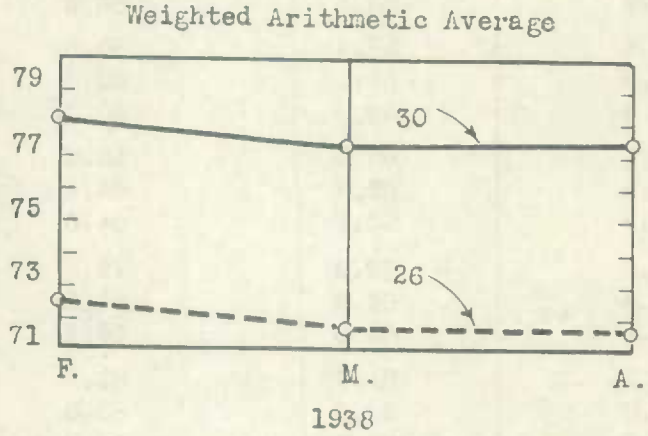
An arbitrary change of method was introduced at this point in an effort to give a more even distribution to the experimental index weighting system. Weights were computed from 1936 prices in place of those for 1926, since agricultural prices for the later year were considerably lower relative to the general wholesale average. To curb further the influence of certain products, total amounts of wheat and oats were reduced to the quantity used in the flour milling industry, while steers and hogs now represented the quantities taken by packing plants. To give the index a more representative aspect, four important commodities were introduced, namely, structural shapes, merchant bars, galvanized steel sheets, and bituminous coal. These additional products gave to the iron and steel group a weight which their industrial use warranted. The use of processed iron and steel items appeared logical in view of the volume of such materials imported for use by Canadian manufacturers. Care was taken to prevent weight duplication between scrap and other iron and steel items. The addition of coal was also consistent with the purpose in view, for it introduced an important industrial material into the index. The weight for coal was obtained from the quantity used for industrial purposes only. The commodities now included 30 products which are listed on Page 33 with their revised weights shown in the second column.

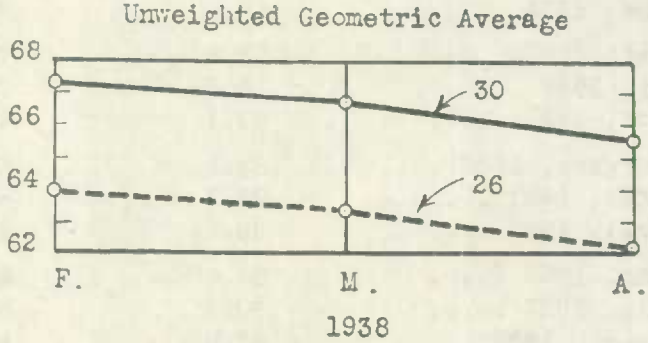
The two periods where the divergent characteristics noted in the previous comparisons had been most pronounced, namely, May 1934 and March 1938, were selected to examine the changes which the new weights and additional commodities would exert on the two types of indexes. For the weighted arithmetic series, the directional impulses were not greatly altered. Since the weight of wheat was reduced only from 22 to 19 per cent by the revision, the influence of this commodity was still an important factor in determining the turning points at these periods. However, the level of the indexes was altered materially due to the added products whose price levels were relatively high. The weighted arithmetic average was raised from four to seven points, while the geometric index underwent an increase of from three to five points.





Index	April	May	June
Weighted Arithmetic Average (30 Commodities)	65.0	66.5	68.1
Weighted Arithmetic Average (26 ")	59.7	60.6	62.6
Unweighted Geometric Average (30 Commodities)	59.4	59.5	59.6
Unweighted Geometric Average (26 ")	56.6	56.3	56.5





Index	February	March	April
Weighted Arithmetic Average (30 Commodities)	78.2	77.3	77.4
Weighted Arithmetic Average (26 ")	72.4	71.6	71.6
Unweighted Geometric Average (30 Commodities)	67.3	66.6	65.5
Unweighted Geometric Average (26 ")	63.9	63.2	62.1

The new unweighted geometric average recorded one change in the position of a turning point. From April to May 1934, it had formerly declined, but in the present case it showed a slight rise. Since it had not been affected by the changed weighting system, the movement was necessarily due to the action of prices for the additional commodities. The cause was found to be a rise in the relative price of bituminous coal from 88.8 to 94.4. The behaviour of both indexes now varied from that of the general price index which did not move upward until June; experimental indexes now increased from April to May.

Industrial Material Price Index Omitting Wheat

It has been shown that in a weighted average of a small group of commodities, a few large weights may influence to a considerable degree the results attained. The most notable commodity weight influencing price trends was that for wheat. Although the price of wheat generally records movements closely in line with other basic commodities, it has been demonstrated above that changes in crop yield, or marketing conditions, may produce variations in price that are occasionally quite different from the general movement of prices for short periods.

TABLE VIII. PRICE INDEX NUMBERS OF INDUSTRIAL MATERIALS AT SPECIFIED PERIODS, 1929-1938
(1926=100)

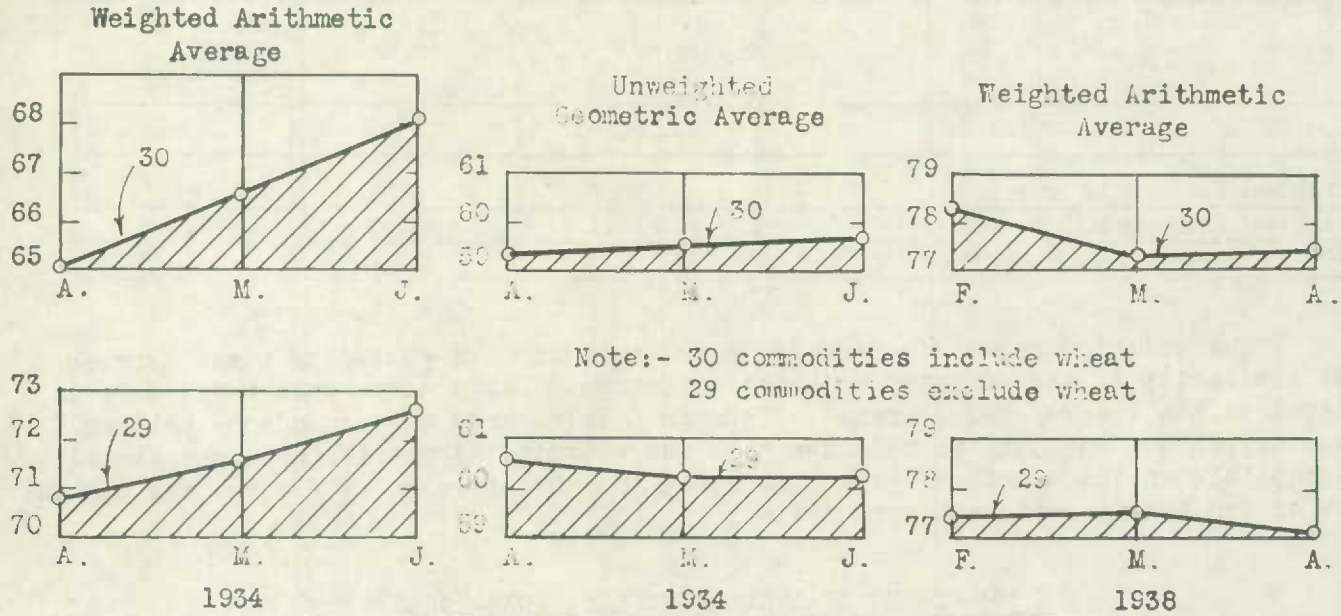
Date	Weighted Arithmetic Average		Unweighted Geometric Average	
	Index Including Wheat 30 Commodities	Index Excluding Wheat 29 Commodities	Index Including Wheat 30 Commodities	Index Excluding Wheat 29 Commodities
July, 1929	99.1	96.8	92.5	92.0
August, 1929 ...	98.3	95.8	92.6	92.1
September, 1929.	96.7	95.0	93.4	93.0
January, 1933 ..	53.2	59.2	45.4	46.1
February, 1933 .	51.0	56.1	45.0	45.6
March, 1933	54.0	59.2	47.5	48.1
June, 1933	59.0	62.3	55.7	56.2
July, 1933	64.2	66.1	60.0	60.1
August, 1933 ...	61.9	64.8	58.5	58.8
April, 1934	65.0	70.8	59.4	60.6
May, 1934	66.5	71.5	59.5	60.3
June, 1934	68.1	72.6	59.6	60.3
April, 1936	69.8	73.8	65.0	65.4
May, 1936	68.6	73.0	63.7	64.2
June, 1936	69.4	73.5	63.6	64.0
February, 1937 .	82.1	80.9	78.8	78.7
March, 1937	87.3	85.8	84.8	84.5
April, 1937	88.2	86.5	83.8	83.4
June, 1937	86.4	86.6	81.9	81.7
July, 1937	90.3	88.0	83.9	83.3
August, 1937 ...	87.5	87.5	82.2	80.0
February, 1938 .	78.2	77.4	68.3	67.7
March, 1938	77.3	77.5	67.6	67.4
April, 1938	77.4	77.1	66.5	66.0

In order to observe the influence of wheat, it was considered worthwhile to compute for the eight periods employed in the preceding comparisons, the identical indexes as before, using the second set of weights and the list of commodities as given on Page 33 with the exception of wheat. With wheat omitted, the commodities totalled twenty-nine, and the item with the largest weight was crude oil, followed by coal.

The results of this investigation showed clearly that wheat exercised an important influence upon the experimental indexes. Even in the geometric average, the omission of wheat caused definite changes, although the geometric average naturally was not influenced to the same extent as the weighted arithmetic series by this omission.

To illustrate the foregoing remarks, the changes at the periods May, 1934 and March, 1938 were graphed for comparison with the previous calculations based upon thirty commodities. For these two periods, computations without wheat showed differences in (a) index levels, (b) rates of change, and (c) direction.

From the graph showing the two arithmetic averages for May 1934, there is noted a wide difference in index levels. With wheat included, the index increased from 65.0 to 68.1 over the three-month period. Excluding wheat, the level of the index was raised more than five points when it changed from 70.8 to 72.6. Wheat during this period had very low relative prices of 43.8 in April, 46.8 in May, and 51.0 in June. Thus, wheat changed the level of the index to a considerable degree. When the sharp increase in wheat from May to June was excluded, the rise during the latter two months was also materially lessened. In April the level of the 29-commodity index was 5.8 points above the wheat-included index, while in June that increase diminished to 4.5.



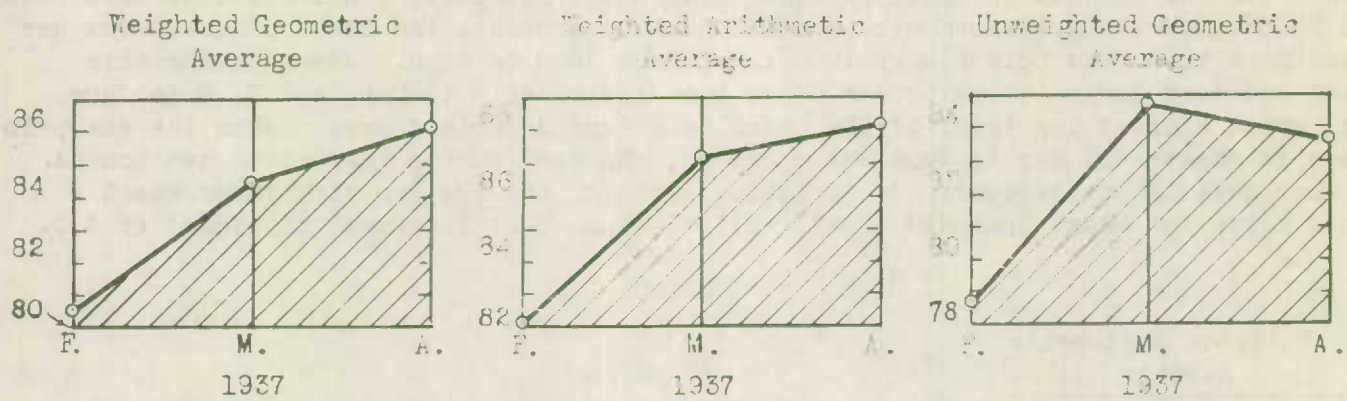
March 1938 affords an example of wheat during the direction of a turning point in the weighted arithmetic average. When wheat was included, the index dropped from February to March and remained constant for the following month. The omission of wheat prices which declined between February and March from 87.1 to 82.1 caused the experimental arithmetic index to advance instead of decline. A sharp rise in the prices of steers and hogs was responsible for this slight increase from February to March, which wheat had been able to overbalance.

May 1934 provided the only instance found among the eight periods considered where the exclusion of wheat affected the direction of an index based upon the unweighted geometric average. Wheat, as stated in the first illustration, rose from April to May. With this sharp advance excluded the index changed its direction to decline in May, and then remained constant for June.

Test of the Weighted Geometric Average

Since it was shown that a relatively few commodities were in a position to overbalance the majority of the constituents in a weighted arithmetic index, it seemed advisable to test a weighted series employing the geometric average which is less susceptible to the influence of a few commodities than the corresponding arithmetic type.

Using identical consumption weights (based on 1936 price levels), the behaviour of weighted geometric and arithmetic indexes was compared for the months centring around March 1937. This period was chosen because the weighted arithmetic and unweighted geometric averages moved in different directions from March to April.



Index	February	March	April
Weighted Geometric Average	80.6	84.5	86.1
Weighted Arithmetic Average	82.1	87.3	88.2
Unweighted Geometric Average	78.8	84.8	83.8

The weighted geometric average, both including and excluding wheat, showed marked similarity to the weighted arithmetic average. Differences were noted only in the level of the indexes and in rates of change. This close correspondence between the two series was accepted as evidence that the weighted geometric index was almost as susceptible as the weighted arithmetic index to short-term erratic movements induced by one or two heavily weighted commodities.

COMPARISONS OF INDEX FORMULAE, 1936-1938

The final test of index formulae was based on data for the three-year period 1936-1938. Monthly indexes were computed for these years to provide a continuous comparison over a considerable period of time. Four indexes were used in this comparison, namely:

(1) The general wholesale price index of the Dominion Bureau of Statistics (a weighted arithmetic series of 567 commodities).

(2) Index of industrial material prices (unweighted geometric average of 30 commodities).

(3) Index of industrial material prices (weighted arithmetic average of 30 commodities).

(4) Index of industrial material prices (weighted geometric average of 30 commodities).

Casual inspection revealed similarity of behaviour for all four series and close agreement between the weighted arithmetic and weighted geometric averages of industrial material prices. At every turning point during the three-year period, the two averages recorded the same directional changes. The levels of all four indexes were generally similar also, with the two computed as geometric averages being most closely aligned. The accompanying table showing annual indexes gives an indication of differences in the index levels.

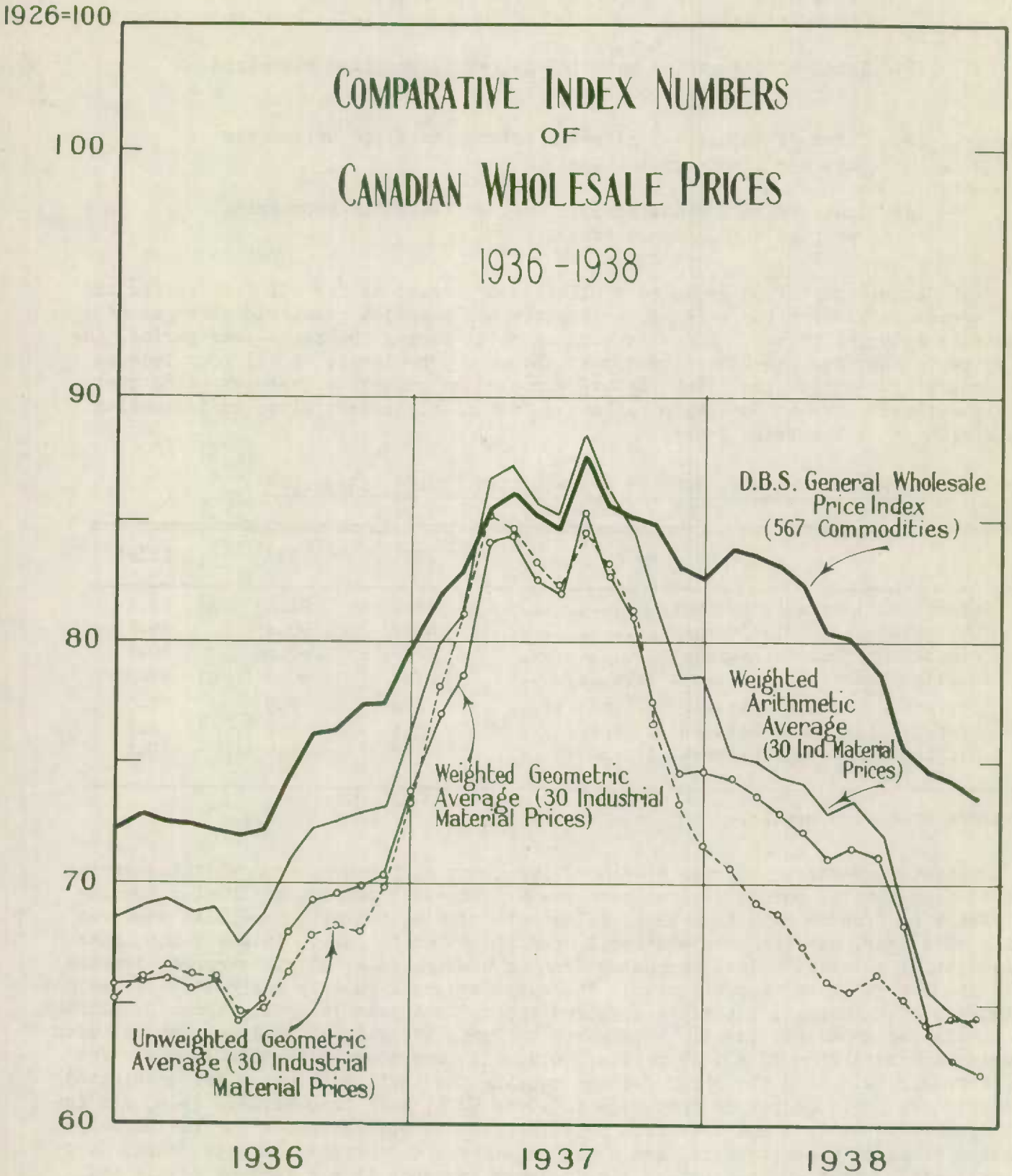
TABLE IX. COMPARISON OF ANNUAL INDEX LEVELS, 1936-1938
(1926=100)

	1936	1937	1938*
(1) General Wholesale Price Index	74.6	84.6	79.1
(2) Unweighted Geometric Average	67.2	80.4	66.5
(3) Weighted Arithmetic Average	70.9	83.6	70.9
(4) Weighted Geometric Average	67.3	80.3	69.4
Average Difference Between (3) and (4)..	3.6	3.3	1.5
Average Difference Between (2) and (4)..	0.1	0.1	2.9
Average Difference Between (1) and (3)..	3.7	1.0	8.2

* Average of eleven months.

The unweighted geometric average disclosed important differences from weighted series in recording turning points during these years. The peak periods of 1937, climaxing the almost continuous rise from 1933, illustrate this statement. Two peaks occurred during this year, one in March and April, and the other in July. In March the index of industrial material prices, computed from an unweighted geometric average, reached 85.2, its highest level for the year. The secondary peak in July was 84.5. The weighted indexes of industrial materials attained their first peak in April, a month behind the unweighted geometric index. From March to April the general wholesale price index likewise advanced from 85.4 to a peak of 86.2, and then receded to 85.2 in May. The non-ferrous metals were the chief factors causing the April decline of the unweighted geometric average. Copper dropped from 110.0 to 98.5, lead from 94.3 to 76.6, tin ingots from 103.9 to 91.6 and zinc from 88.1 to 71.7. Price increases for the heavily weighted items of wheat, steers, and hogs, together with advances in oats, scrap iron, and galvanized steel sheets, offset the downward tendency in non-ferrous metals and accounted for the continued rise in the weighted averages of industrial materials. It is interesting to note that four of the five items in the food sub-group classification of the index were mainly responsible for this rise of the weighted indexes. It should be noted also that the averages of the weighted series experienced a greater increase

Chart 8


1926=100
COMPARATIVE INDEX NUMBERS
OF
CANADIAN WHOLESALE PRICES
1936 - 1938
100
90
80
70
60
D.B.S. General Wholesale Price Index (567 Commodities)
Weighted Arithmetic Average (30 Ind. Material Prices)
Weighted Geometric Average (30 Industrial Material Prices)
Unweighted Geometric Average (30 Industrial Material Prices)
1936
1937
1938

in July, which carried all three to higher levels than those reached at the April peak. Thus the unweighted geometric average was several months in advance of the weighted indexes in reflecting the broad decline which commenced at this time.

The Bureau's general wholesale index resisted decline in the opening months of 1938 due mainly to increases for grains, meats, and newsprint. The two last-mentioned items are not included in the industrial materials price index.

A later comparison in the second half of 1938 served to indicate further the strength of wheat in influencing the course of Canadian weighted wholesale price indexes. The sharp decline in these series from July to November was caused chiefly by falling prices of wheat; the index for wheat declined from 75.2 in June to 37.4 in November. The unweighted geometric average showed only a moderate decline over these months which was modified by a slight increase from June to July. This marked the beginning of a definite upturn in sensitive manufacturing material prices which persisted throughout the next three months.

In closing it may be observed that the 1937-1938 decline in industrial material prices is probably depicted better by the steady recession of the unweighted geometric index than by the erratic movement of the weighted index series. The jerky changes in these latter tend to becloud the continuous nature of the movement. The evidence of this final test, therefore, coincided with that provided by preceding tests which favoured the selection of the unweighted geometric form of index for industrial material prices.

TABLE X. WEIGHTS USED IN TESTING ARITHMETIC AND GEOMETRIC INDEX FORMULAE

Commodities	Weights		
	First Set (1) 1926 Quantities 1926 Prices	Second Set (2) 1926 Quantities 1936 Prices	Final Set (3) 1926 Quantities 1926 Prices
Wheat, No.3 Manitoba Northern	222	190	181
Oats, No.3 Canada Western	61	9	8
Rubber, Raw Plantation, First Latex Crepe	47	25	45
Linseed Oil, Raw	7	9	6
Cottonseed oil, Refined	9	10	9
Sugar, Raw, B.W.I. Preferential	83	49	78
Rosin, Water White	3	3	3
Beef Hides, Country Cured	17	15	16
Steers, Good Quality	70	48	39
Hogs, Good Bacon	153	84	80
Cotton, Raw Middling, 1" - 1 1/16"	42	47	40
Wool, Raw, Eastern Bright 1/4 Blood ...	16	17	15
Silk, Raw, Composite 9 Items	7	3	6
Manila Hemp, 12 1/2 p.c. Fair Current..	5	5	5
Spruce Lumber, Quebec	34	48	32
Fir Lumber, No.1 Common	20	30	19
Pulp, Unbleached Sulphite	4	5	4
Pulp, Bleached Sulphite	3	3	3
Iron Ore, Mesabi Bessemer	-	-	80
Scrap Iron, Heavy Melting, C.B.S.	10	18	14
Structural Shapes, Open Hearth	-	18	18
Merchant Bars, Mild Steel	-	25	20
Steel Sheets, Galvanized No.24 U.S.G...	-	38	37
Lead, Domestic	34	30	32
Zinc Spelter, Domestic	10	7	9
Copper, Electrolytic Domestic	18	18	17
Tin Ingots, Straits	5	7	5
Crude Oil, Mid-Continent	116	132	110
Coal, American Bituminous, Run-of-Mine.	-	103	66
White Lead, Basic Carbonate in Oil	3	3	3
Red Lead, Genuine	1	1	-
TOTAL	1000	1000	1000

(1) Weights based on 1926 prices and quantities consumed by industry. These were applied to a preliminary list of 26 price series to test index behaviour at eight turning points in the general wholesale index between 1928 and 1938. These tests are described on Pages 22 to 26.

(2) Weights for 30 commodities based on 1936 prices and 1926 quantities consumed by industry. In the case of wheat and livestock, quantity figures were limited to amounts used in milling and meat packing establishments respectively. This experiment was made to test the effect of the radical change in the relative position of farm product prices and other industrial material prices between 1926 and 1936. Tests were carried out using these weights at certain periods where divergent characteristics in the preceding tests were most noted. In addition, tests were made in which wheat was both included and excluded. These are described on Pages 26 to 30.

(3) Weights for the 30 commodities finally selected. These were based on 1926 prices and quantities consumed by industry, and were applied to indexes computed from arithmetic and geometric averages during the years 1936, 1937, and 1938. The expedient of utilizing 1936 prices for weight construction failed to make any substantial change in the preponderant influence of wheat and livestock, leading to the re-adoption of 1926 (base year) price data for this purpose. The final comparisons of index formulae based on this third set of weights will be found on Pages 30 to 33.