Volume Title: Electronic Computers and Business Indicators

Volume Author/Editor: Julius Shiskin

Volume Publisher: UMI

Volume ISBN: 0-87014-371-9

Volume URL: http://www.nber.org/books/juli57-1

Publication Date: 1957

Chapter Title: APPENDIX A COMPUTATIONAL STEPS AND SAMPLE TABLES

Chapter Author: Julius Shiskin

Chapter URL: http://www.nber.org/chapters/c2730

Chapter pages in book: (p. 30 - 39)

APPENDIX A

COMPUTATIONAL STEPS AND SAMPLE TABLES

I. Computation of Preliminary Seasonally Adjusted Series

1. Original observations. Where an adjustment for the number of working or trading days is made, these figures are shown after adjustment and all subsequent computations are based on these adjusted figures (Table 1 of sample "print-out" shown below).
2. Ratios of the original observations for each month to the average of the original observations for the preceding and following months are computed. Arithmetic means of these ratios for each month are given at the bottom of the table (Table 2).
3. A twelve-month moving average of the original series is computed. This curve provides a measure of the trend-cycle component of the series. It also provides annual averages of the original series (Table 3).
4. The twelve-month moving average is centered—that is, a two-month moving average of the twelve-month moving average is computed. This operation places the moving average values at mid-months. The first value of the centered moving average is placed at the seventh month of the original series. Thus six moving average values will be missing at the beginning and at the end of the series (Table 4).
5. Ratios of the original observations to the centered twelve-month moving average are computed. This computation results in a series which shows primarily the seasonal and irregular components of the original series (Table 5).
6. This step will provide a method for identifying extreme items among the ratios computed by step 5, substituting more representative ratios for these extreme ratios and fitting smooth curves to all ratios for each month.
   a) Fit a five-term moving average to the ratios for each month. This results in the loss of moving average values for the first two and the last two years for which ratios are available. To obtain moving averages for the first two years, use the average of the first two ratios as the estimated value of the ratio for each of the two years preceding the first year available. This is equivalent to weighting the first three years' ratios by $\frac{2}{5}$, $\frac{2}{5}$, and $\frac{1}{5}$, respectively, to obtain the first year's moving average value, and to weighting the first four years' ratios by $\frac{3}{10}$, $\frac{3}{10}$, $\frac{2}{10}$, and $\frac{2}{10}$, respectively, to obtain the second year's moving average value. Moving average values for the last two years are obtained in a similar manner.
   b) For each month, compute two-sigma control limits about the five-term moving average line. All ratios falling outside these limits are designated as extreme.
   c) Replace extreme ratios as follows: For an extreme ratio falling at the first point in the series, substitute the average of the first three ratios of the series; for an extreme ratio falling in the middle of the series, substitute the average of the extreme ratio and the preceding and following ratios; for an extreme ratio falling at the end of the series, substitute the average of the extreme ratio and the two preceding ratios.
   d) The six missing ratios at the beginning of the series are supplied by extending the first available ratios for the corresponding months back to the initial month of the series. The six missing ratios at the end are supplied similarly.
   e) For each year, center the twelve ratios (i.e., adjust the twelve ratios so that their sum will be 1,200) by division of the twelve items by their arithmetic mean. If the initial year is incomplete, use as the ratio for any missing month the value of the average ratio for the same month in the next two years in centering the initial year's ratios. Treat the terminal year's ratios in a similar manner.
   f) For each month, compute a three-term moving average of a three-term moving average of the centered ratios yielded by step 6*e*, above. This will result in the loss of two moving average values at the beginning and two at the end. To obtain the values missing at the beginning, use the average of the first two centered ratios as the estimated value of the cen-

tered ratio for each of the two years preceding the first year available. This is equivalent to weighting the first three years' centered ratios by $\frac{9}{18}$, $\frac{7}{18}$, and $\frac{2}{18}$, respectively, to obtain the first year's moving average value, and to weighting the first four years' centered ratios by $\frac{5}{18}$, $\frac{7}{18}$, $\frac{4}{18}$, and $\frac{2}{18}$, respectively, to obtain the second year's moving average value. The missing values at the end are obtained in a similar way. The values of these twelve curves constitute the preliminary seasonal adjustment factors (Table 6).

7. These seasonal factors are divided into the corresponding figures of the original series, month by month; i.e., the seasonal factor for January, 1947, is divided into the original observation for January, 1947; the factor for January, 1948, is divided into the original observation for January, 1948. Similarly, the factor for February, 1947, is divided into the original observation for February, 1947; the factor for February, 1948, into the original observation for February, 1948; and so on. This yields the preliminary seasonally adjusted series (Table 7).

II. Computation of Final Seasonally Adjusted Series

8. Compute a weighted fifteen-month moving average (Spencer's fifteen-term formula) of the preliminary seasonally adjusted series. The weights are as follows: $-3/320$, $-6/320$, $-5/320$, $3/320$, $21/320$, $46/320$, $67/320$, $74/320$, $67/320$, $46/320$, $21/320$, $3/320$, $-5/320$, $-6/320$, $-3/320$. This is equivalent to a weighted five-month moving average (weights are $-\frac{3}{4}$, $\frac{3}{4}$, 1, $\frac{3}{4}$, $-\frac{3}{4}$) of a five-month moving average, of a four-month moving average, of a four-month moving average of the data.

   To obtain values for the beginning points of this curve, use the average of the first four values of the preliminary seasonally adjusted series as the estimated value of this series for each of the seven months preceding the first month available. The values for the end are supplied similarly.

   The preliminary seasonally adjusted series contains the cyclical, trend, and irregular components of the series with only a trace of the seasonal component. The weighted fifteen-month moving average can be used in place of a twelve-month moving average because there is no significant seasonal factor to suppress. The weighted fifteen-month moving average is much more flexible than a twelve-month moving average and will therefore provide a better measure of the trend-cycle component; it is also much smoother than a simple five-month moving average, and it fits the data about as closely as does the five-month moving average (Table 8).

9. Ratios of the original observations to the weighted fifteen-month moving average are computed (Table 9).

10. Compute the ratios of the preliminary seasonally adjusted series (step 7) to its weighted fifteen-month moving average (step 8). Month-to-month changes in these ratios are computed and averaged without regard to sign. This yields a preliminary measure of the average amplitude of the irregular component.

11. This step will provide a method for identifying extreme items among the ratios computed by step 9, substituting more representative ratios for these extreme ratios, and fitting smooth curves to all ratios for each month.

    a) Fit a five-term moving average to the ratios for each month. This results in the loss of moving average values for the first two and the last two years. To obtain moving averages for the first two years, use the average of the first two ratios as the estimated value of the ratio for each of the two years preceding the first year available. This is equivalent to weighting the first three years' ratios by $\frac{2}{5}$, $\frac{2}{5}$, and $\frac{1}{5}$, respectively, to obtain the first year's moving average value, and to weighting the first four years' ratios by $\frac{3}{10}$, $\frac{3}{10}$, $\frac{2}{10}$, and $\frac{2}{10}$, respectively, to obtain the second year's moving average value. The moving average values for the last two years are obtained in a similar manner.

    b) For each month, compute two-sigma control limits about the five-term moving average line. All ratios falling outside these limits are designated as "extreme."

    c) Replace extreme ratios as follows: For an extreme ratio falling at the first point in the series, substitute the average of

the first three ratios of the series; for an extreme ratio falling in the middle of the series, substitute the average of the extreme ratio and the preceding and following ratios; for an extreme ratio falling at the end of the series, substitute the average of the extreme ratio and the two preceding ratios (Table 10).

d) For each year center the twelve ratios (i.e., adjust the twelve ratios so that their sum will be 1,200) by division of the twelve items by their arithmetic mean. If the initial year is incomplete, use as the ratio for any missing month the value of the average ratio for the same month in the next two years in centering the initial year's ratios. Treat the terminal year's ratios in a similar manner (Table 11).

e) If the average irregular amplitude, computed in step 10 above, is under 2, use step 11*f*; if it is 2 or more, use step 11*g*.

f) For each month compute a three-term moving average of a three-term moving average of the centered ratios yielded by step 11*d*, above. This will result in the loss of two moving average values at the beginning and two at the end. To obtain the values missing at the beginning, use the average of the first two centered ratios as the estimated value of the centered ratio for each of the two years preceding the first year available. This is equivalent to weighting the first three years' centered ratios by $\frac{9}{18}$, $\frac{7}{18}$, and $\frac{2}{18}$, respectively, to obtain the first year's moving average value, and to weighting the first four years' centered ratios by $\frac{5}{18}$, $\frac{7}{18}$, $\frac{4}{18}$, and $\frac{2}{18}$, respectively, to obtain the second year's moving average value. The missing values at the end are obtained in a similar way. These smoothed ratios constitute the final seasonal adjustment factors. This series is identified later by the symbol *S* (Table 12).

g) For each month compute a three-term moving average of a five-term moving average of the centered ratios yielded by step 11*d*, above. This will result in the loss of three moving average values at the beginning and three at the end. To obtain the values missing at the beginning, use the average of the first two centered ratios as the estimated value of the centered ratio for each of the three years preceding the first year available. This is equivalent to weighting the first four years' centered ratios by $\frac{6}{15}$, $\frac{6}{15}$, $\frac{2}{15}$, and $\frac{1}{15}$, respectively, to obtain the first year's moving average value; to weighting the first five years' centered ratios by $\frac{9}{30}$, $\frac{9}{30}$, $\frac{6}{30}$, $\frac{4}{30}$, and $\frac{2}{30}$, respectively, to obtain the second year's moving average value; and to weighting the first six years' centered ratios by $\frac{5}{30}$, $\frac{7}{30}$, $\frac{6}{30}$, $\frac{6}{30}$, $\frac{4}{30}$, and $\frac{2}{30}$, respectively, to obtain the third year's moving average value. The missing values at the end are obtained in a similar way. These smoothed ratios constitute the final seasonal adjustment factors. This series is later identified by the symbol *S* (Table 12).

h) Estimates of the seasonal factors one year ahead are given at the bottom of Table 12. These estimates are made by adding to the seasonal factor for the end year, one-half the trend between the factor for that year and the preceding year. If X = seasonal adjustment factor for year N, then X_{N+1} is estimated by the equation

$$X_{N+1} = \frac{3X_N - X_{N-1}}{2}.$$

12. These seasonal factors are divided into the corresponding figures of the original series, month by month; i.e., the seasonal factor for January, 1947, is divided into the original observation for January, 1947; the factor for January, 1948, is divided into the original observation for January, 1948. Similarly, the factor for February, 1947, is divided into the original observation for February, 1947; the factor for February, 1948, into the original observation for February, 1948; and so on. This yields the final seasonally adjusted series. This series is later identified by the symbol *CI* (Table 13).
13. The ratios of the final seasonally adjusted series to the averages of the final seasonally adjusted series for the preceding and the following months are computed. This is a rough test for residual seasonality, similar to that made on the original observations described in step 2, above. Arithmetic means of these ratios for each month are given at the bottom of the table (Table 14).
14. Compute an uncentered twelve-month moving average of the final seasonally adjusted series. This step is required to carry

out the test described in step 15. It also provides annual averages of the seasonally adjusted series (Table 15).

15. Compute ratios of the uncentered twelve-month moving average of the standard seasonally adjusted series to the uncentered twelve-month moving average of the original series. This is a test of the effect of the seasonal adjustment on the level of the series, showing whether the adjustment has resulted in significant differences between the level of the adjusted and the unadjusted series for any twelve-month period (Table 16).
16. Using the final seasonally adjusted series, compute the ratio of the value of each month, from February through the following January, to that of the preceding January. Such a table of ratios will disclose repetitive patterns in successive years of more than one month's duration (Table 17).

III. Measures of the Irregular, Cyclical, and Seasonal Components

17. Compute a weighted fifteen-month moving average (Spencer's fifteen-term formula) of the final seasonally adjusted series. The weights are as follows: $-3/320$, $-6/320$, $-5/320$, $3/320$, $21/320$, $46/320$, $67/320$, $74/320$, $67/320$, $46/320$, $21/320$, $3/320$, $-5/320$, $-6/320$, $-3/320$. This is equivalent to a weighted five-month moving average (weights are $-\frac{3}{4}$, $\frac{3}{4}$, 1, $\frac{3}{4}$, $-\frac{3}{4}$), of a five-month moving average, of a four-month moving average, of a four-month moving average of the data.

    To obtain values for the beginning points of this curve, use the average of the first four values of the final seasonally adjusted series as the estimated value of this series for each of the seven months preceding the first month available. The values for the end are supplied similarly.

    The final seasonally adjusted series contains the cyclical, trend, and irregular components of the series. The weighted fifteen-month moving average can be used in place of a twelve-month moving average because there is no seasonal factor to suppress. The weighted fifteen-month moving average is much more flexible than a twelve-month moving average and will therefore provide a better measure of the trend-cycle component; it is also much smoother than a simple five-month moving average, and it fits the data about as closely as does the five-month moving average. This series is identified by the symbol C (Table 18)
18. Compute the month-to-month percentage changes in the original series (Table 19).
19. Compute the month-to-month percentage changes in the final seasonal adjustment factors (Table 20).
20. Compute the month-to-month percentage changes in the final seasonally adjusted series (Table 21).
21. Compute the month-to-month percentage changes in the ratios (step 9) of the original observations to the weighted fifteen-month moving average (Table 22).
22. Compute the ratios of the final seasonally adjusted series (step 12) to its weighted fifteen-month moving average (step 17). This provides a measure of the irregular component of the series. This series is identified by the symbol I (Table 23).
23. Compute the month-to-month percentage changes in the irregular component (Table 24).
24. Compute the month-to-month percentage changes in the weighted fifteen-month moving average of the final seasonally adjusted series (Table 25).
25. Compute the average, without regard to sign, of the percentage changes in steps 18, 19, 20, 23, and 24. This operation yields measures of the average monthly amplitude of the original series, the seasonal component, the seasonally adjusted series, the irregular component, and the cyclical component, respectively. The symbols used to represent these averages are original, $\bar{O}$; irregular, $\bar{I}$; cyclical, $\bar{C}$; seasonal, $\bar{S}$; and seasonally adjusted, $\overline{CI}$ (Table 27).
26. Compute the following ratios of the average monthly amplitudes of step 25:
    a) Irregular component to cyclical component ($\bar{I}/\bar{C}$)
    b) Irregular component to seasonal component ($\bar{I}/\bar{S}$)
    c) Seasonal component to cyclical component ($\bar{S}/\bar{C}$)
    d) Irregular component to original series ($\bar{I}/\bar{O}$)
    e) Cyclical component to original series ($\bar{C}/\bar{O}$)
    f) Seasonal component to original series ($\bar{S}/\bar{O}$)
    See Table 27.
27. Compute the ratio of the average monthly

amplitude of the irregular to the cyclical components when percentage changes are taken between entries two, three, four, and five months apart (Table 27).

The interval corresponding to the last $\bar{I}/\bar{C}$ ratio that is less than 1.00 is designated as "Number of Months for Cyclical Dominance," and a moving average of the seasonally adjusted data is computed, using this interval as its period (Table 26).

28. The average duration of run, that is, the average number of months the series moves before changing direction, is computed for the following:
   a) Seasonally adjusted series
   b) Irregular component
   c) Cyclical component
   d) Seasonally adjusted series smoothed by moving average with period as given by number of months for cyclical dominance
   See Table 27.
29. Compute the ratios of (*a*) the twelve-month moving average of the month-to-month percentage changes in the irregular component (step 23) to (*b*) the twelve-month moving average of the month-to-month percentage changes in the cyclical component (step 24). In the computation of these moving averages the signs of the percentage changes are disregarded (Table 28).

IV. Notes

30. Where the average monthly amplitude of the irregular component is 4.0 or larger (on the basis of the preliminary seasonally adjusted series) and for special purposes, two additional tables are computed and inserted between Tables 10 and 11. In the first one, the stable adjustment factors are computed by averaging the modified ratios of step 11*c* for each month and then centering the average so that their sum will be 1,200. In the second table, these stable factors are divided into the corresponding values of the original data, yielding a seasonally adjusted series based on a constant seasonal pattern. These two additional tables (identified by double asterisks in the sample given) do not affect the computations in any other tables.
31. After the tables, four Univac point charts are printed: (1) original and seasonally adjusted series, (2) seasonally adjusted and smoothed series, (3) seasonal-irregular ratios and seasonal adjustment factors, in chronological order, and (4) seasonal-irregular ratios and seasonal adjustment factors, month-by-month.

The following points will be helpful in interpreting such charts:

a) The scales for the first two charts are identical and are limited to one of five standard scales: 1″ = 10, 100, 1,000, 10,000, 100,000, depending upon the amplitude of the series.
b) The scale for the third chart ranges from 60 to 170 per cent. Ratios or factors that do not fall in this range are not charted but are shown numerically in the margin next to the time scale.
c) The last chart is printed in twelve sections, one for each month. The scale is limited to one of four standard scales: 1″ = 1 per cent, 2 per cent, 4 per cent, or 8 per cent. The scale used is printed below the title of each section of the chart, that is, scale 1, 2, 4, or 8. If scale 8 is too small for the amplitude of the data, this chart is not printed.
d) Throughout all the charts, only one symbol, *X*, is printed whenever both points for one month are identical.

For the method of preparing such charts, which are not shown in Part V of this appendix, see Harry Eisenpress, James L. McPherson, and Julius Shiskin, "Charting on Automatic Data Processing Systems," *Computers and Automation*, August, 1955.

32. It is not necessary to make the full run. The following alternative sets of tables can be prepared, when specified:
   a) Complete run (approximately 6 minutes per ten-year series)
   b) Seasonal adjustment only (Tables 1–17; approximately 2.3 minutes per ten-year series)
   c) Seasonal adjustment and auxiliary measures (all tables, 1–28; approximately 4 minutes per ten-year series)
   d) Seasonal adjustment, auxiliary measures, and first two charts (approximately 4.8 minutes per ten-year series)

The stable seasonal adjustment factors and seasonally adjusted series can also be obtained with each run, without appreciably affecting the time required.

V. A Sample Run

This sample "print-out" shows only the last few years of a much longer run. The averages therefore include more figures than are shown. Tables 6, 7, and 8 are omitted from this sample.

Actual Sample Univac Print-out for Private Non-Farm Dwelling Units Started, 1951–56, Reduced Approximately 60 Per Cent

(Original Series—Annual Rate in Thousands—from the Bureau of Labor Statistics)

1 ORIGINAL SERIES — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	986	918	1082	1108	1171	1084	1042	1060	1144	1067	866	714
1952	737	892	1093	1164	1212	1163	1213	1169	1190	1190	988	811
1953	818	886	1153	1289	1267	1224	1157	1106	1105	1081	959	774
1954	781	887	1118	1278	1289	1351	1355	1356	1361	1326	1240	1079
1955	1048	1055	1354	1566	1621	1577	1463	1468	1363	1258	1061	882
1956	884	924	1127	1319	1330	1255	1188	1238	1088	1094	924	755
1957	721	750	906	1074								

2 RATIOS OF ORIGINAL TO PRECEDING AND FOLLOWING — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	106.0	88.8	106.8	98.4	106.8	98.0	97.2	97.0	107.6	106.2	97.2	89.1
1952	91.8	97.5	106.3	101.0	104.2	95.9	104.0	97.3	100.9	109.3	98.8	89.8
1953	96.4	89.9	106.0	106.5	100.8	101.0	99.3	97.8	101.1	104.7	103.4	89.0
1954	94.0	93.4	103.3	106.2	98.1	102.2	100.1	99.9	101.5	102.0	103.1	94.3
1955	98.2	87.8	103.3	105.3	103.1	102.3	96.1	103.9	100.0	103.8	99.2	90.7
1956	97.9	91.9	100.5	107.4	103.3	99.7	95.3	108.8	93.3	108.7	99.9	91.8
1957	95.8	92.2	99.3									

AVERAGES OF RATIOS — SERIES #5503

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
95.2	87.9	107.2	103.8	101.7	100.2	98.7	102.2	98.6	106.4	100.1	92.1

3 UNCENTRD 12-MONTH MOVING AVERAGE OF ORIGINAL — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1132	1082	1062	1050	1039	1020	999	997	998	1003	1006	1013
1952	1027	1036	1040	1050	1060	1068	1075	1075	1080	1090	1095	1100
1953	1095	1090	1083	1074	1071	1068	1065	1065	1062	1061	1063	1074
1954	1090	1111	1132	1153	1176	1202	1224	1238	1258	1282	1309	1328
1955	1337	1346	1347	1341	1326	1310	1296	1285	1266	1246	1221	1194
1956	1172	1152	1129	1116	1104	1094	1080	1066	1047	1027	-	-
1957	-	-	-	-								

4 CENTERED 12-MONTH MOVING AVERAGE OF ORIGINAL — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1158	1107	1072	1056	1045	1030	1010	998	998	1001	1005	1010
1952	1020	1032	1038	1045	1055	1064	1072	1075	1077	1085	1092	1097
1953	1098	1093	1086	1078	1073	1070	1067	1065	1064	1062	1062	1069
1954	1082	1101	1122	1143	1165	1189	1213	1231	1248	1270	1296	1319
1955	1333	1342	1347	1344	1334	1318	1303	1291	1276	1256	1233	1208
1956	1183	1162	1141	1123	1110	1099	1087	1073	1057	1037		

5 RATIOS OF ORIGINAL TO 12-MONTH MOVING AVERAGE — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	85.1	82.9	100.9	104.9	112.1	105.2	103.2	106.2	114.6	106.6	86.2	70.7
1952	72.3	86.4	105.3	111.4	114.9	109.3	113.2	108.7	110.5	109.7	90.5	73.9
1953	74.5	81.1	106.2	119.6	118.1	114.4	108.4	103.8	103.9	101.8	90.3	72.4
1954	72.2	80.6	99.6	111.8	110.6	113.6	111.7	110.2	109.1	104.4	95.7	81.8
1955	78.6	78.6	100.5	116.5	121.5	119.7	112.3	113.7	106.8	100.2	86.1	73.0
1956	74.7	79.5	98.8	117.5	119.8	114.2	109.3	115.4	102.9	105.5		

9 RATIOS OF ORIGINAL TO WEIGHTED 15-MO MOV AV — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	83.5	80.5	99.5	107.4	118.5	112.3	108.3	109.3	116.5	107.7	86.8	71.0
1952	72.7	87.1	105.6	111.4	115.2	109.6	113.2	107.7	108.5	107.9	89.5	73.5
1953	74.2	80.3	104.4	117.1	116.0	113.8	109.4	106.1	107.0	104.8	92.4	73.9
1954	73.5	82.4	102.2	114.6	113.1	115.6	112.6	109.3	106.2	100.5	91.9	78.9
1955	76.3	76.8	99.0	115.1	119.6	117.2	110.1	112.6	107.2	101.5	87.6	74.3
1956	75.6	80.1	98.9	117.1	119.8	114.5	109.7	115.5	102.5	104.4	89.9	75.3
1957	73.9	78.9	97.3	116.5								

10 MODIFIED RATIOS:ORIGINAL/WTD 15-MO MOV AV — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	83.5	80.5	99.5	107.4	118.5	112.3	108.3	109.3	116.5	107.7	86.8	71.0
1952	72.7	87.1	105.6	111.4	115.2	109.6	113.2	107.7	108.5	107.9	89.5	73.5
1953	74.2	80.3	104.4	117.1	116.0	113.8	109.4	106.1	107.0	104.8	92.4	73.9
1954	73.5	82.4	102.2	114.6	113.1	115.6	112.6	109.3	106.2	100.5	91.9	78.9
1955	76.3	76.8	99.0	115.1	119.6	117.2	110.1	112.6	107.2	101.5	87.6	74.3
1956	75.6	80.1	98.9	117.1	119.8	114.5	109.7	115.5	102.5	104.4	89.9	75.3
1957	73.9	78.9	97.3	116.5								

** STABLE-SEASONAL ADJUSTMENT FACTORS — SERIES #5503

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
719	763	1013	1139	1187	1163	1122	1129	1066	1054	897	748

** STABLE-SEASONAL ADJUSTED SERIES — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1371	1203	1068	973	987	932	929	939	1073	1012	965	955
1952	1025	1169	1079	1022	1021	1000	1081	1035	1116	1129	1101	1084
1953	1138	1161	1138	1132	1067	1052	1031	980	1037	1026	1069	1035
1954	1086	1163	1104	1122	1086	1162	1208	1201	1277	1258	1382	1443
1955	1458	1383	1337	1375	1366	1356	1304	1300	1279	1194	1183	1179
1956	1229	1211	1113	1158	1120	1079	1059	1097	1021	1038	1030	1009
1957	1003	983	894	943								

11 CENTERED RATIOS:ORIGINAL/WTD 15-MO MOV AV — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	834	804	994	1073	1184	1122	1082	1092	1164	1076	867	709
1952	726	870	1054	1112	1150	1094	1130	1075	1083	1077	894	734
1953	742	803	1045	1172	1161	1139	1095	1062	1071	1049	924	739
1954	735	823	1021	1145	1130	1155	1125	1092	1061	1004	918	788
1955	765	770	992	1154	1199	1175	1103	1129	1074	1017	878	745
1956	754	799	986	1168	1195	1142	1094	1152	1022	1041	897	751
1957	740	790	974	1167								

12 FINAL SEASONAL ADJ FACTORS: 3*5 MO MOV AVS — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	73.8	78.2	100.6	113.0	118.4	114.7	113.1	111.3	109.5	105.2	88.0	74.1
1952	75.0	80.1	101.7	112.8	117.3	114.0	111.8	110.2	109.1	105.0	88.6	74.4
1953	75.2	81.1	102.1	113.4	116.6	113.9	111.3	109.9	108.0	104.3	89.3	74.8
1954	75.1	80.8	101.5	114.8	117.0	114.3	110.7	110.3	106.8	103.8	90.1	75.0
1955	74.7	80.2	100.5	115.7	117.6	114.8	110.5	111.9	105.2	103.3	90.1	75.5
1956	74.9	79.4	99.2	116.2	118.6	115.2	110.1	113.5	104.2	103.3	89.9	75.5
1957	74.9	79.3	98.4	116.4								

ESTIMATED SEASONAL FACTORS ONE YEAR AHEAD — SERIES #5503

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1957					119.1	115.4	109.9	114.3	103.7	103.3	89.8	75.5
1958	74.9	79.3	98.0	116.5								

13 FINAL SEASONALLY ADJUSTED SERIES — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1336	1174	1076	981	989	945	921	952	1045	1014	984	964
1952	983	1114	1075	1032	1033	1020	1085	1061	1091	1133	1115	1090
1953	1088	1092	1129	1137	1087	1075	1040	1006	1023	1036	1074	1035
1954	1040	1098	1101	1113	1102	1182	1224	1229	1274	1277	1376	1439
1955	1403	1315	1347	1354	1378	1374	1324	1312	1296	1218	1178	1168
1956	1180	1164	1136	1135	1121	1089	1079	1091	1044	1059	1028	1000
1957	963	946	921	923								

14 RATIOS, FINAL ADJ TO PRECEDING AND FOLLOWING — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	108.8	97.3	99.9	95.0	102.7	99.0	97.1	96.8	106.3	100.0	99.5	98.0
1952	94.6	108.3	100.2	97.9	100.7	96.3	104.3	97.5	99.5	102.7	100.3	99.0
1953	99.7	98.5	101.3	102.6	98.3	101.1	100.0	97.5	100.2	98.8	103.7	97.9
1954	97.5	102.6	99.6	101.0	96.0	101.6	101.5	98.4	101.7	96.4	101.3	103.6
1955	101.9	95.6	100.9	99.4	101.0	101.7	98.6	100.2	102.5	98.5	98.7	99.1
1956	101.2	100.5	98.8	100.6	100.8	99.0	99.0	102.8	97.1	102.2	99.9	100.5
1957	99.0	100.4	98.6									

AVERAGES

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
99.9	99.8	100.5	100.3	98.5	99.5	100.8	98.9	101.0	99.0	100.5	99.6

15 UNCENTERED 12-MO MOVING AVERAGE FINAL ADJ — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1142	1099	1081	1070	1058	1032	1002	997	997	1001	1005	1011
1952	1025	1034	1038	1048	1059	1069	1078	1076	1081	1089	1094	1099
1953	1095	1090	1085	1076	1073	1068	1064	1065	1063	1061	1062	1071
1954	1086	1105	1126	1146	1171	1205	1235	1253	1273	1293	1316	1332
1955	1341	1348	1350	1345	1328	1306	1287	1274	1257	1239	1217	1193
1956	1173	1155	1134	1120	1108	1094	1076	1058	1040	1022		

16 RATIOS, 12-MO MOV AVS, FINAL ADJ TO ORIGINAL — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	100.9	101.6	101.8	101.9	101.8	101.2	100.3	100.0	99.9	99.8	99.9	99.8
1952	99.8	99.8	99.8	99.8	99.9	100.1	100.3	100.1	100.1	99.9	99.9	99.9
1953	100.0	100.0	100.2	100.2	100.2	100.0	99.9	100.0	100.1	100.0	99.9	99.7
1954	99.6	99.5	99.5	99.4	99.6	100.2	100.9	101.2	101.2	100.9	100.5	100.3
1955	100.3	100.1	100.2	100.3	100.2	99.7	99.3	99.1	99.3	99.4	99.7	99.9
1956	100.1	100.3	100.4	100.4	100.4	100.0	99.6	99.2	99.3	99.5	-	-
1957	-	-	-	-								

17 RATIOS, EACH MO TO PRECEDING JAN, FINAL ADJ — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1040	879	805	734	740	707	689	713	782	759	737	722
1952	736	1133	1094	1050	1051	1038	1104	1079	1110	1153	1134	1109
1953	1107	1004	1038	1045	999	988	956	925	940	952	987	951
1954	956	1056	1059	1070	1060	1137	1177	1182	1225	1228	1323	1384
1955	1349	937	960	965	982	979	944	935	924	868	840	833
1956	841	986	963	962	950	923	914	925	885	897	871	847
1957	816	982	956	958								

18 WEIGHTED 15-MO MOVING AVERAGE OF FINAL ADJ — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1194	1157	1100	1037	986	958	953	963	977	989	1000	1012
1952	1025	1037	1045	1049	1049	1053	1062	1076	1091	1101	1105	1107
1953	1108	1110	1110	1103	1089	1069	1049	1035	1029	1032	1040	1051
1954	1062	1076	1093	1114	1139	1168	1202	1241	1282	1322	1353	1372
1955	1378	1375	1368	1363	1359	1351	1334	1306	1271	1235	1204	1181
1956	1165	1153	1142	1129	1115	1101	1088	1075	1060	1042	1020	995
1957	970	949	936	930								

19 PERCENT CHANGE FROM PRECEDING MO. ORIGINAL — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	4.6	- 6.9	17.9	2.4	5.7	- 7.4	- 3.9	1.7	7.9	- 6.7	- 18.8	- 17.6
1952	3.2	21.0	22.5	6.5	4.1	- 4.0	4.3	- 3.6	1.8	.0	- 17.0	- 17.9
1953	.9	8.3	30.1	11.8	- 1.7	- 3.4	- 5.5	- 4.4	- .1	- 2.2	- 11.3	- 19.3
1954	.9	13.6	26.0	14.3	.9	4.8	.3	.1	.4	- 2.6	- 6.5	- 13.0
1955	- 2.9	.7	28.3	15.7	3.5	- 2.7	- 7.2	.3	- 7.2	- 7.7	- 15.7	- 16.9
1956	.2	4.5	22.0	17.0	.8	- 5.6	- 5.3	4.2	- 12.1	.6	- 15.5	- 18.3
1957	- 4.5	4.0	20.8	18.5								

20 PERCENT CHANGE FROM PRECEDING MO. SEASONAL — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	.3	6.0	28.6	12.3	4.8	- 3.1	- 1.4	- 1.6	- 1.6	- 3.9	- 16.3	- 15.8
1952	1.2	6.8	27.0	10.9	4.0	- 2.8	- 1.9	- 1.4	- 1.0	- 3.8	- 15.6	- 16.0
1953	1.1	7.8	25.9	11.1	2.8	- 2.3	- 2.3	- 1.3	- 1.7	- 3.4	- 14.4	- 16.2
1954	.4	7.6	25.6	13.1	1.9	- 2.3	- 3.1	- .4	- 3.2	- 2.8	- 13.2	- 16.8
1955	- .4	7.4	25.3	15.1	1.6	- 2.4	- 3.7	1.3	- 6.0	- 1.8	- 12.8	- 16.2
1956	- .8	6.0	24.9	17.1	2.1	- 2.9	- 4.4	3.1	- 8.2	- .9	- 13.0	- 16.0
1957	- .8	5.9	24.1	18.3								

21 PERCENT CHANGE FROM PRECEDING MO. FINAL ADJ — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	4.3	- 12.1	- 8.3	- 8.8	.8	- 4.4	- 2.5	3.4	9.8	- 3.0	- 3.0	- 2.0
1952	2.0	13.3	- 3.5	- 4.0	.1	- 1.3	6.4	- 2.2	2.8	3.8	- 1.6	- 2.2
1953	- .2	.4	3.4	.7	- 4.4	- 1.1	- 3.3	- 3.3	1.7	1.3	3.7	- 3.6
1954	.5	5.6	.3	1.1	- 1.0	7.3	3.6	.4	3.7	.2	7.8	4.6
1955	- 2.5	- 6.3	2.4	.5	1.8	- .3	- 3.6	- .9	- 1.2	- 6.0	- 3.3	- .8
1956	1.0	- 1.4	- 2.4	- .1	- 1.2	- 2.9	- .9	1.1	- 4.3	1.4	- 2.9	- 2.7
1957	- 3.7	- 1.8	- 2.6	.2								

22 PERCENT CHANGE FROM PRECEDING MO. S-I RATIOS — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	7.1	- 3.6	23.6	7.9	10.3	- 5.2	- 3.6	.9	6.6	- 7.6	- 19.4	- 18.2
1952	2.4	19.8	21.2	5.5	3.4	- 4.9	3.3	- 4.9	.7	- .6	- 17.1	- 17.9
1953	1.0	8.2	30.0	12.2	- .9	- 1.9	- 3.9	- 3.0	.8	- 2.1	- 11.8	- 20.0
1954	- .5	12.1	24.0	12.1	- 1.3	2.2	- 2.6	- 2.9	- 2.8	- 5.4	- 8.6	- 14.1
1955	- 3.3	.7	28.9	16.3	3.9	- 2.0	- 6.1	2.3	- 4.8	- 5.3	- 13.7	- 15.2
1956	1.7	6.0	23.5	18.4	2.3	- 4.4	- 4.2	5.3	- 11.3	1.9	- 13.9	- 16.2
1957	- 1.9	6.8	23.3	19.7								

23 IRREGULAR COMPONENT — SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	111.9	101.5	97.8	94.6	100.3	98.6	96.6	98.9	107.0	102.5	98.4	95.3
1952	95.9	107.4	102.9	98.4	98.5	96.9	102.2	98.6	100.0	102.9	100.9	98.5
1953	98.2	98.4	101.7	103.1	99.8	100.6	99.1	97.2	99.4	100.4	103.3	98.5
1954	97.9	102.0	100.7	99.9	96.8	101.2	101.8	99.0	99.4	96.6	101.7	104.9
1955	101.8	95.6	98.5	99.3	101.4	101.7	99.3	100.5	102.0	98.6	97.8	98.9
1956	101.3	101.0	99.5	100.5	100.5	98.9	99.2	101.5	98.5	101.6	100.8	100.5
1957	99.3	99.7	98.4	99.2								

24 PERCENT CHANGE FROM PRECEDING MO. IRREGULAR SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	6.2	- 9.3	- 3.6	- 3.3	6.0	- 1.7	- 2.0	2.4	8.2	- 4.2	- 4.0	- 3.2
1952	.6	12.0	- 4.2	- 4.4	.1	- 1.6	5.5	- 3.5	1.4	2.9	- 1.9	- 2.4
1953	- .3	.2	3.4	1.4	- 3.2	.8	- 1.5	- 1.9	2.3	1.0	2.9	- 4.6
1954	- .6	4.2	- 1.3	- .8	- 3.1	4.5	.6	- 2.8	.4	- 2.8	5.3	3.1
1955	- 3.0	- 6.1	3.0	.8	2.1	.3	- 2.4	1.2	1.5	- 3.3	- .8	1.1
1956	2.4	- .3	- 1.5	1.0	.0	- 1.6	.3	2.3	- 3.0	3.1	- .8	- .3
1957	- 1.2	.4	- 1.3	.8								

25 PERCENT CHANGE FROM PRECEDING MO. CYCLICAL SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	- 1.7	- 3.1	- 4.9	- 5.7	- 4.9	- 2.8	- .5	1.0	1.5	1.2	1.1	1.2
1952	1.3	1.2	.8	.4	.0	.4	.9	1.3	1.4	.9	.4	.2
1953	.1	.2	.0	- .6	- 1.3	- 1.8	- 1.9	- 1.3	- .6	.3	.8	1.1
1954	1.0	1.3	1.6	1.9	2.2	2.5	2.9	3.2	3.3	3.1	2.3	1.4
1955	.4	- .2	- .5	- .4	- .3	- .6	- 1.3	- 2.1	- 2.7	- 2.8	- 2.5	- 1.9
1956	- 1.4	- 1.0	- 1.0	- 1.1	- 1.2	- 1.3	- 1.2	- 1.2	- 1.4	- 1.7	- 2.1	- 2.5
1957	- 2.5	- 2.2	- 1.4	- .6								

26 2-MO MOVING AVERAGE. FINAL ADJUSTED SERIES SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1255	1125	1029	985	967	933	937	999	1030	999	974	974
1952	1049	1095	1054	1033	1027	1053	1073	1076	1112	1124	1103	1089
1953	1090	1111	1133	1112	1081	1058	1023	1015	1030	1055	1055	1038
1954	1069	1100	1107	1108	1142	1203	1227	1252	1276	1327	1408	1421
1955	1359	1331	1351	1366	1376	1349	1318	1304	1257	1198	1173	1174
1956	1172	1150	1136	1128	1105	1084	1085	1068	1052	1044	1014	982
1957	955	934	922									

27 I. C. & S COMPONENTS. THEIR RELATIONS. & AVERAGE DURATION OF RUN SERIES #5503

O	I	C	S	CI
11.53	4.85	3.43	9.14	6.01

I/C	I/S	S/C	I/O	C/O	S/O
1.41	.53	2.66	.42	.30	.79

AVERAGE DURATION OF RUN

CI	I	C	2-MO M.A.
2.38	1.74	12.88	3.83

MONTHS SPAN

	1	2	3	4	5
I/C	1.41	.88	.61	.44	.29

MONTHS FOR CYCLICAL DOMINANCE 2

28 RATIOS. 12-MO MOV AVS OF IRREG & CYCLE AMPS SERIES #5503

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951	1727	1810	1905	2022	2224	1828	1661	1875	2233	2955	3615	4425
1952	4582	4558	3991	3982	4049	4402	5025	4057	4452	3844	3597	2956
1953	2267	2109	2387	2333	2341	2350	2183	2317	1890	1685	1582	1739
1954	1589	1479	1213	1149	1174	1105	1222	1352	1485	1585	1683	1629
1955	1888	1918	2065	2140	1816	1631	1497	1097	983	957	806	842
1956	743	834	978	1030	1055	971	846	799	773	782		