Volume Title: Seasonal Adjustments by Electronic Computer Methods

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Volume Publisher: UMI

Volume ISBN: 0-87014-418-9

Volume URL: http://www.nber.org/books/shis58-1

Publication Date: 1958

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Chapter URL: http://www.nber.org/chapters/c2603

Chapter pages in book: (p. 24 - 35)

velopment and testing of new theories of economic fluctuations. They constitute an unparalleled challenge to the ingenuity and imagination of economic statisticians.

(6) Modern data-processing systems record, store, calculate, compare, choose, and print numbers, letters, and other symbols. They perform these operations automatically, accurately, and at lightning speeds, but with abject devotion to very detailed instructions provided by human beings. While there is no doubt that this equipment will eventually be used to proliferate other more elaborate measures of economic activities, the mechanical production of such new measures is not enough to assure an improvement in our understanding of economic events. The fruitfulness of this work will ultimately depend, as do all other empirical studies, upon the quality of the theoretical concepts formulated by economic scientists to organize and analyze the data.

APPENDIX A

REVISIONS OF SEASONAL METHOD II NOW UNDER CONSIDERATION

Since the completion of the Univac program considerable experience has been gained with the results of Method II. On the basis of this experience, we are making tests with a view to revising the electronic computer program. A brief description of each of the contemplated tests is given below. The series to be used in testing has been selected with the following criteria in mind: (1) differing irregular, cyclical, and seasonal components so that the results for series with different types of economic fluctuations will be known; and (2) widely used series, so that the substantive meaning of the results can better be understood. The five series selected are: total unemployment; railroad freight ton miles; residential construction contracts; business failures, liabilities; and Federal Reserve index of mining production.

(a) *Variable method of adjusting ends of series:* The present method of obtaining seasonal-irregular ratios at the ends of series will not give good results when the last two ratios, whose average is used as the estimate for the years following the last one for which a figure is available, are both relatively extreme, and particularly when they fall on the same side of the seasonal adjustment factor curve (see, for example, Chart 2, Business Failures, December). Experiments are under way to determine an effective way of handling such situations.

These experiments will involve adjusting the test series for periods which both include and exclude data for terminal years; for example, a series for which data for the period 1940–1956 are available will be adjusted for the period 1940–1950 and 1946–1956. The effect of the method of adjusting ends can thus be determined by comparing the adjustments for the years 1946–1950 when data for 1940–1945 and 1951–1956 are and are not used.

Several different methods of estimating seasonal-irregular ratios for the years for which they are needed to bring the seasonal adjustment factor curves to the end years will be tested. For illustrative purposes these alternative methods along with the implicit weights given in each case to the seasonal-irregular ratios, when a three-term of a three-term moving average is fitted to them, are shown in Table A-1. Our present thought is that a variable method will prove the best; for example, to average no more than two ratios, as at present, when the irregular component is small, and four ratios when it is large.

(b) *Control limits:* The selection of two standard errors as the limits for separating normal from extreme ratios was arbitrary, in the sense that it was not based on any study of the distribution of seasonal-irregular ratios. Now evidence is mounting that these limits are too broad—too many extreme ratios appear to be included without modification in the averaging for the seasonal adjustment factors. We are planning studies of the distribution of seasonal-irregular ratios and tests to determine the comparative results with limits of 1 and 1½ standard errors.

TABLE A-1

METHODS OF ESTIMATING SEASONAL-IRREGULAR RATIOS AND IMPLICIT WEIGHTS GIVEN TO AVAILABLE RATIOS IN COMPUTING SEASONAL ADJUSTMENT FACTORS

(N is the last year for which a seasonal-irregular ratio, X_N, is available; the weights are adjusted so their sum equals 10)

Extrapolation Method	Factor for Year *N*-1: Implicit Weights Given to Ratio for Year							Factor for Year *N*: Implicit Weights Given to Ratio for Year						
	N-6	*N*-5	*N*-4	*N*-3	*N*-2	*N*-1	*N*	*N*-6	*N*-5	*N*-4	*N*-3	*N*-2	*N*-1	*N*
Three-Term Moving Average of Three-Term Moving Average														
I. $\frac{1}{2}(X_N+X_{N-1})=X_{N+1}=X_{N+2}$ (Method II)				1.1	2.2	3.9	2.8					1.1	3.9	5.0
II. $\frac{1}{3}(X_N+X_{N-1}+X_{N-2})=X_{N+1}=X_{N+2}$				1.1	2.6	3.7	2.6					2.2	3.3	4.4
III. $\frac{1}{4}(X_N+X_{N-1}+X_{N-2}+X_{N-3})=X_{N+1}=X_{N+2}$				1.4	2.5	3.6	2.5				0.8	1.9	3.1	4.2
IV. Straight line fitted to moving average values of X_{N-4}, X_{N-3}, X_{N-2}; fitted value for $X_N=X_{N+1}=X_{N+2}$	−0.1	−0.2	−0.1	1.4	2.8	3.8	2.4	−0.4	−0.7	−0.4	0.9	3.0	3.7	4.0
Simple Five-Term Moving Average														
V. $X_{N+1}=X_{N-4}$; $X_{N+2}=X_{N-3}$ (Method I)			2.0	2.0	2.0	2.0	2.0			2.0	2.0	2.0	2.0	2.0

(c) *Moving averages of seasonal-irregular ratios:* Where the average monthly irregular amplitude is less than 2, Method II now uses a three-term moving average of a three-term moving average, which is equivalent to a five-term moving average with weights 1, 2, 3, 2, 1; for series where the average irregular amplitude is 2 or more, it uses a three-term moving average of a five-term moving average, which is equivalent to a seven-term moving average with weights 1, 2, 3, 3, 3, 2, 1. This weighted seven-term moving average sometimes does not turn with the ratios, and, of course, requires more extrapolation for missing ratios than the weighted five-term moving average. We are now considering two changes: (i) the substitution for the three of a five-term moving average, of a five-term moving average with different weight patterns, for example 1, 3, 4, 3, 1—this curve, a member of a family of weighted moving averages suggested by Victor Zarnowitz, has the advantage of a shorter period involving less extrapolation at the ends and may also be expected to follow the seasonal-irregular ratios more closely, since the central points have relatively more weight; (ii) the use of less flexible curves, possibly straight lines, for measuring the seasonal adjustment factor for series in which the irregular factor is very pronounced.

(d) *Variable cycle-trend curves:* We are searching for a family of curves to use for series with different irregular components. We are considering (i) Robert Henderson's general formula which makes the sum of the squares of the third differences in the weights of the weight diagram a minimum for any number of terms desired; (ii) variants of the five-term moving average with weights 1, 3, 4, 3, 1: for example, a nine-term moving average with weights 1, 3, 6, 8, 9, 8, 6, 3, 1. For relatively smooth series, as indicated by the magnitude of the irregular component, these curves would be used in place of the weighted fifteen-term moving average (Spencer curve), now used to delineate the cycle-trend component. Such curves, being for a shorter period, would involve less extrapolation at the end and would perhaps also result in better estimates of the irregular component.

(e) *Correlation of I and S:* A common method of judging the validity of a seasonal adjustment is to compare the month-to-month movements in the seasonally adjusted series with the month-to-month movements in the seasonal adjustment factors. Following our usual thinking, the seasonally adjusted series is considered to be made up of trend-cycle and irregular factors. Since a smooth curve, usually the Spencer graduation, is used as the estimate of the trend-cycle factor, it may be disregarded for this purpose and the correlation coefficient between the month-to-month movements of the irregular and seasonal factors may provide a test of the validity of the seasonal adjustment. Since a residual seasonal will often appear in a positive pattern in some years and in an inverted pattern in others, separate correlation coefficients have to be computed for each year. The presence of significant correlation coefficients would be interpreted to mean that there is a seasonal component in the adjusted series; in this case a statement would automatically be printed after the computations indicating that a residual seasonal pattern remains and that further work is required.[1]

This test would also be applied to determine whether there is a seasonal pattern in the original observations. Here the cycle-trend curve would be divided into the original observations and the quotient correlated with the seasonal adjustment factors. The absence of significant correlation coefficients would be interpreted to mean that there is no seasonal pattern in the original observations. In such cases, the statement that the original observations have no seasonal pattern would be printed instead of the tables.

While these changes may appear to be large, we do not believe they would affect many series. The Univac programming and the experimental work involved is substantial, however, and changes cannot, therefore, be introduced in the method for some time. The user of Method II should expect further refinements with the accumulation of additional experience. Many of these improvements have been suggested by the experience of users and further suggestions would be most welcome.

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[1] See Arthur F. Burns and Wesley C. Mitchell, *op. cit.*, pp. 54–55.

APPENDIX B

OTHER ELECTRONIC COMPUTER METHODS FOR SEASONAL ADJUSTMENT

Two additional computer methods for seasonal analysis have been programmed recently and applied on a limited scale. A brief description of them follows:

1. *Regression Seasonal Adjustments*

The present writers have prepared and "proved-in" a program for the calculation of regression seasonal adjustments. In this method, the original observations and a Spencer fifteen-month weighted moving average of the standard seasonally adjusted data in Method II are used as the basis for the computations. Differences between the original observations and the Spencer graduation are computed to provide a measure of the seasonal-irregular component. Seasonal adjustment factors are then fitted to (a) the differences as the dependent variable, and (b) the corresponding values of the smooth curve of the seasonally adjusted series as the independent variable.

The logic of this approach is as follows: Consider a monthly time series for which a scatter diagram is drawn so that values for a given month are plotted as the ordinate and the corresponding values representing the trend and cyclical components as the abscissa. If the original values for the month include neither a random nor a seasonal component, all the points fall on a straight line that passes through the origin and has a slope of one because the trend-cycle component has merely been plotted against itself. If the assumptions are changed to allow a multiplicative seasonal component in the original values, all the points fall on a straight line that passes through the origin, but the slope deviates from one. If the original values include an additive seasonal component, the slope of the line remains one, but the line no longer passes through the origin. If the seasonal component is partly additive and partly multiplicative, the line does not pass through the origin and its slope differs from one. These relations tend to prevail if the series also includes a random component. However, the observations no longer fall on a straight line, but tend to be distributed at random around such a line. It can be concluded, therefore, that the seasonal component for a given month can be measured by the difference between the parameters of a fitted straight line and the parameters of a line passing through the origin and having a slope of one.

In order to allow for the possibility of a changing seasonal pattern, time is introduced as a third variable. The equation used to derive the seasonal adjustment factors for each month is $y-x=a+bx+ct+dxt$, where y represents the original observations, x represents the corresponding values of the trend-cycle curve, and t represents time. Other variables could, of course, be added to this program, for example, variations in the average temperature, the number of Saturdays and Sundays in each month, and so on.

The regression technique for measuring and adjusting seasonal fluctuations comprises an entirely different conceptual approach from that followed in Methods I and II. In making the adjustments it attempts to take into account certain causes of seasonal variations. This is intellectually preferable to the more mechanical approach of the earlier methods. On the other hand, the regression technique is very sensitive: The regression curves are fitted to approximate measures of the seasonal-irregular factors; minor defects of measurement can result in poor regression curves, as was demonstrated by earlier experiments with the use of deviations from the twelve-month moving average of original observations. Furthermore, a method of handling extremes must also be developed for this program. While this approach is promising, the writers do not feel that there is as yet enough experience with it to form a judgment of its usefulness.

2. *Moving Polynomial Graduations*

A seasonal program has been prepared for the IBM 701 electronic computer following a plan developed at the National Bureau by Millard Hastay. While this program, like Method II described above, is based on the standard ratio-to-moving-average method, it differs in a number of important respects. First, the smoothing of the seasonal-irregular ratios for each month is accomplished in the IBM program by moving polynomial graduations. More specifically, for each month a third-degree polynomial is fitted by least squares to overlapping eleven-term periods of seasonal-irregular ratios. The smoothed value for each point is the central fitted value of its associated third-degree polynomial. For the last five ratios for each month, the smoothing is accomplished by taking the last five fitted values of the same polynomial, that which is fitted to the last eleven ratios of the month. Similar smoothing is made in the first five ratios of the month. Certain constraints are also put on the smoothed curves used for the beginning and ending years; for example, the first derivative is required to equal zero at the terminal year. (The moving polynomial approach is like the use of short-term weighted moving averages in the Univac program. The ratios required to bring these short-term averages up to date are obtained in the Univac program by taking averages of the last two ratios available as the estimated values of each of the following two ratios.)

To minimize the effects of "extreme" ratios, the period used for the IBM program was taken as eleven years. For the test series studied, this sometimes did not give satisfactory results, with poor adjustments almost always traceable to extreme ratios. Moreover, the method cannot be applied without modification to periods shorter than eleven years. (The Univac program uses control limits to identify extreme ratios and then reduces the weights assigned to the extreme items.)

Other differences between the two electronic computer programs are the use in the Univac method of (1) an iterative procedure to obtain improved seasonal-irregular ratios —that is, a fifteen-term weighted moving average (approximately equivalent to a moving third-degree polynomial) of a preliminary seasonally adjusted series is used as the basis for obtaining the final seasonal-irregular ratios; and (2) different weighted moving average curves, which vary according to the magnitude of the irregular component of each series, to obtain the final seasonal adjustment factors from the seasonal-irregular ratios.

Thus far experience with the IBM 701 program has been quite limited. However, drawing on experience with the Univac program, Hastay has recommended the direct identification and replacement of extreme ratios, as in the Univac method, instead of the present indirect attack on this problem by long-period smoothing. With extreme ratios handled directly, polynomial smoothing over shorter periods would become feasible. This improvement, and the addition to the IBM program of the iterative technique, with a weighted moving average to measure the trend-cycle component, would bring the IBM and Univac programs closer together.

TABLE 1

SEASONAL COMPUTATIONS, METHOD II

TOTAL UNEMPLOYMENT, UNITED STATES, 1940–1957

Reproduction of Actual High-Speed Print-Out, Reduced 60 Per Cent
Original Observations derived from Census Bureau's Monthly Report on the Labor Force, Series P-57 (Thousand Persons)

1ORIGINAL SERIES — SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			836	823	799	831	915	874	685	724	726	691
1941	741	693	650	638	566	619	600	562	468	384	380	362
1942	432	404	358	305	259	289	283	219	168	161	163	152
1943	148	142	112	101	95	130	139	105	87	78	71	69
1944	61	69	69	63	73	88	89	68	60	44	50	50
1945	63	64	59	53	53	89	95	83	165	156	174	197
1946	230	265	270	233	231	257	227	206	207	196	193	212
1947	240	249	233	242	196	256	258	210	191	169	162	164
1948	206	264	244	219	176	218	223	194	190	164	183	194
1949	266	322	317	302	329	378	410	369	335	358	341	349
1950	448	468	412	352	306	338	321	250	234	194	224	223
1951	250	241	215	174	161	198	186	158	161	162	183	167
1952	205	209	180	161	160	182	194	160	144	128	142	141
1953	189	179	167	158	131	156	155	124	132	130	170	231
1954	309	367	372	346	330	335	335	324	310	274	289	284
1955	335	338	318	296	249	268	247	224	215	213	240	243
1956	288	291	283	256	261	293	283	220	200	191	246	248
1957	294	288	270	248								

2 RATIOS OF ORIGINAL TO PRECEDING AND FOLLOWING — SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			-	100.7	96.6	97.0	107.3	109.3	85.7	102.6	102.6	94.2
1941	107.1	99.6	97.7	104.9	90.1	106.2	101.6	105.2	98.9	90.6	101.9	89.2
1942	112.8	102.3	101.0	98.9	87.2	106.6	111.4	97.1	88.4	97.3	104.2	97.7
1943	100.7	109.2	92.2	97.6	82.3	111.1	118.3	92.9	95.1	98.7	96.6	90.8
1944	117.4	92.0	104.5	88.7	96.7	108.6	114.1	91.3	107.1	80.0	106.4	88.5
1945	110.5	104.9	100.9	94.6	74.6	120.3	110.5	63.8	138.1	92.0	98.6	97.5
1946	99.6	106.0	108.4	93.0	94.3	112.2	98.1	94.9	103.0	98.0	94.6	97.9
1947	104.1	105.3	94.9	112.8	78.7	112.8	110.7	93.5	100.8	95.8	97.3	89.1
1948	96.3	117.3	101.0	104.3	80.5	109.3	108.3	93.9	106.1	87.9	102.2	86.4
1949	103.1	110.5	101.6	93.5	96.8	102.3	109.8	99.1	92.2	105.9	96.5	88.5
1950	109.7	108.8	100.5	98.1	88.7	107.8	109.2	90.1	105.4	84.7	107.4	94.1
1951	107.8	103.7	103.6	92.6	86.6	114.1	104.5	91.1	100.6	94.2	111.2	86.1
1952	109.0	108.6	97.3	94.7	93.3	102.8	113.5	94.7	100.0	89.5	105.6	85.2
1953	118.1	100.6	99.1	106.0	83.4	109.1	110.7	86.4	103.9	86.1	94.2	96.5
1954	103.3	107.8	104.3	98.6	96.9	100.8	101.7	100.5	103.7	91.5	103.6	91.0
1955	107.7	103.5	100.3	104.4	88.3	108.1	100.4	97.0	98.4	93.6	105.3	92.0
1956	107.9	101.9	103.5	94.1	95.1	107.7	110.3	91.1	97.3	85.7	112.1	91.9
1957	109.7	102.1	100.7									

AVERAGES OF RATIOS — SERIES #4406

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
107.3	104.9	100.7	98.7	88.8	108.0	108.3	93.6	101.5	92.6	102.4	91.6

3 UNCENTERED 12-MONTH MOVING AVERAGE OF ORIGINAL — SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			-	-	-	-	-	778	763	747	728	710
1941	684	658	640	611	583	555	529	505	481	453	428	400
1942	374	345	320	302	284	266	242	221	200	183	169	156
1943	144	135	128	121	113	106	101	95	91	88	86	83
1944	78	75	73	70	69	67	65	65	64	63	62	62
1945	62	64	72	82	92	104	118	135	152	167	182	196
1946	207	218	221	224	226	227	228	227	224	224	221	221
1947	224	224	223	221	218	214	211	213	213	212	210	207
1948	204	202	202	202	204	206	211	216	222	229	242	255
1949	271	285	297	314	327	340	355	367	375	379	377	374
1950	366	356	348	334	325	314	298	279	262	247	235	224
1951	212	205	199	196	193	188	184	182	179	178	177	176
1952	177	177	176	173	169	167	166	163	162	162	160	157
1953	154	151	150	150	153	160	170	186	203	219	235	250
1954	265	282	297	309	318	323	325	323	318	314	307	302
1955	294	286	278	273	269	265	262	258	255	251	252	254
1956	257	257	256	254	255	255	255	255	254	253	-	-
1957	-	-	-	-								

4 CENTERED 12-MONTH MOVING AVERAGE OF ORIGINAL — SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			-	-	-	-	-	-	770	755	738	719
1941	697	671	649	626	597	569	542	517	493	467	441	414
1942	387	360	333	311	293	275	254	232	210	192	176	163
1943	150	139	131	124	117	110	104	98	93	90	87	84
1944	81	77	74	72	69	68	66	65	65	64	63	62
1945	62	63	68	77	87	98	111	127	144	160	175	189
1946	202	212	219	223	225	227	228	227	225	224	223	221
1947	223	224	224	222	219	216	213	212	213	213	211	208
1948	205	203	202	202	203	205	209	214	219	226	235	249
1949	263	278	291	306	320	333	347	361	371	377	378	376
1950	370	361	352	341	330	319	306	288	271	255	241	230
1951	218	209	202	197	194	190	186	183	180	178	178	177
1952	177	177	176	174	171	168	167	165	163	162	161	159
1953	156	153	151	150	152	156	165	178	194	211	227	243
1954	258	273	289	303	314	321	324	324	320	316	311	304
1955	298	290	282	276	271	267	264	260	256	253	252	253
1956	256	257	257	255	254	255	255	255	255	254		

5 RATIOS OF ORIGINAL TO 12-MONTH MOVING AVERAGE SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			-	-	-	-	-	-	89.0	95.9	98.4	96.1
1941	106.3	103.3	100.2	101.9	94.8	108.8	110.7	108.7	94.9	82.2	86.2	87.4
1942	111.6	112.2	107.5	98.1	88.4	105.1	111.4	94.4	80.0	83.9	92.6	93.3
1943	98.7	102.2	85.5	81.5	81.2	118.2	133.7	107.1	93.5	86.7	81.6	82.1
1944	100.0	89.6	93.2	87.5	105.8	129.4	134.8	104.6	92.3	68.8	79.4	80.6
1945	101.6	101.6	86.8	68.8	60.9	90.8	85.6	65.4	114.6	97.5	99.4	104.2
1946	113.9	125.0	123.3	104.5	102.7	113.2	99.6	90.7	92.0	87.5	86.5	95.9
1947	107.6	111.2	104.0	109.0	89.5	118.5	121.1	99.1	89.7	79.3	76.8	78.8
1948	100.5	130.0	120.8	108.4	86.7	106.3	106.7	90.7	86.8	72.6	77.9	77.9
1949	101.1	115.8	108.9	98.7	102.8	113.5	118.2	102.2	90.3	95.0	90.2	92.8
1950	121.1	129.6	117.0	103.2	92.7	106.0	104.9	86.8	86.3	76.1	92.9	97.0
1951	114.7	115.3	106.4	88.3	83.0	104.2	100.0	86.3	89.4	91.0	102.8	94.4
1952	115.8	118.1	102.3	92.5	93.6	108.3	116.2	97.0	88.3	79.0	88.2	88.7
1953	121.2	117.0	110.6	105.3	86.2	100.0	93.9	69.7	68.0	61.6	74.9	95.1
1954	119.8	134.4	128.7	114.2	105.1	104.4	103.4	100.0	96.9	86.7	92.9	93.4
1955	112.4	116.6	112.8	107.2	91.9	100.4	93.6	86.2	84.0	84.2	95.2	96.0
1956	112.5	113.2	110.1	100.4	102.8	114.9	111.0	86.3	78.4	75.2		

6 PRELIMINARY ADJUSTMENT FACTORS SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			101.1	101.6	94.2	108.5	110.9	107.2	90.4	89.2	93.1	92.5
1941	107.7	106.3	101.2	99.7	92.8	110.1	114.7	106.4	90.7	87.7	91.4	91.4
1942	107.8	107.6	100.6	96.4	92.7	112.4	121.3	105.3	90.6	85.5	89.7	90.2
1943	106.2	106.8	96.8	92.1	93.6	115.2	127.4	104.9	94.0	85.4	88.7	88.8
1944	106.0	107.3	95.7	91.7	97.3	115.0	125.7	101.6	95.7	85.4	89.2	89.5
1945	106.7	109.4	96.1	94.8	97.4	114.3	118.9	97.6	96.8	87.7	89.7	90.4
1946	108.2	115.7	102.4	101.4	96.7	113.4	112.4	94.6	94.0	85.3	86.7	89.1
1947	107.0	119.0	107.6	105.2	94.1	113.6	112.3	95.2	91.6	84.1	84.0	86.3
1948	106.4	122.7	112.8	105.9	93.7	111.8	112.0	95.1	89.1	81.3	83.3	85.8
1949	107.6	121.5	112.6	101.8	93.1	109.7	110.9	94.0	88.4	83.5	87.9	88.9
1950	112.4	122.1	111.6	98.2	92.1	107.5	108.2	91.6	88.1	83.5	92.3	92.4
1951	117.0	120.7	109.8	96.7	91.0	107.3	107.2	89.6	89.0	83.0	93.9	94.7
1952	119.7	122.0	111.2	99.5	92.0	106.4	106.5	88.8	89.7	79.3	90.7	94.3
1953	120.0	122.6	114.1	104.3	93.5	105.0	103.1	87.0	89.8	77.6	88.3	94.9
1954	117.2	122.1	115.8	106.6	96.1	104.1	101.2	87.8	88.0	78.0	88.9	94.2
1955	115.1	119.3	115.1	106.2	97.7	106.1	101.5	87.2	84.9	79.1	92.4	95.4
1956	113.1	116.1	112.6	103.3	100.4	110.4	106.2	87.6	81.5	78.4	94.9	95.6
1957	113.1	114.1	111.0	101.6								

7 PRELIMINARY ADJUSTED SERIES SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			827	810	848	766	825	815	758	812	780	747
1941	688	652	642	640	610	562	523	528	516	438	416	396
1942	401	375	356	316	279	257	233	208	185	188	182	169
1943	139	133	116	110	101	113	109	100	93	91	80	78
1944	76	64	72	69	75	77	71	67	63	52	56	56
1945	59	59	61	56	54	78	80	85	170	178	194	218
1946	213	229	264	230	239	227	202	218	220	230	223	238
1947	224	209	217	230	208	225	230	221	209	201	193	190
1948	194	215	216	207	188	195	199	204	213	202	220	226
1949	247	265	282	297	353	345	370	393	379	429	388	393
1950	399	383	369	358	332	314	297	273	266	232	243	241
1951	214	200	196	180	177	185	174	176	181	195	195	176
1952	171	171	162	162	174	171	182	180	161	161	157	150
1953	158	146	146	151	140	149	150	143	147	168	193	243
954	264	301	321	325	343	322	331	369	352	351	325	301
955	291	283	276	279	255	253	243	257	253	269	260	255
956	255	251	251	248	260	265	266	251	245	244	259	259
957	260	252	243	244								

8 WEIGHTED 15-MO MOVING AVERAGE OF PREL ADJ SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			819	818	815	812	808	803	796	783	763	736
1941	706	675	647	621	597	572	544	515	485	457	431	409
1942	388	368	344	316	287	258	232	212	197	184	172	159
1943	146	132	121	113	108	106	103	100	95	89	83	77
1944	73	71	71	72	72	72	70	66	62	59	57	56
1945	56	56	56	57	62	72	90	115	142	170	194	212
1946	226	235	239	238	233	226	221	219	220	223	226	225
1947	224	221	220	220	221	222	220	216	210	203	199	198
1948	200	203	204	203	201	199	199	201	205	211	219	230
1949	245	264	286	309	332	353	371	385	396	401	402	399
1950	393	383	369	353	335	315	295	277	262	249	238	227
1951	216	204	194	185	180	178	179	181	184	185	184	180
1952	175	170	168	168	170	173	174	172	168	163	158	154
1953	151	149	147	146	144	143	143	147	158	176	202	233
1954	265	292	312	326	335	342	347	349	347	339	327	312
1955	297	285	275	267	260	255	253	254	256	258	258	257
1956	255	253	253	255	257	258	257	255	253	253	253	254
1957	254	252	250	248								

9 RATIOS OF ORIGINAL TO WEIGHTED 15-MO MOV AV SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			102.1	100.6	98.0	102.3	113.2	108.8	86.1	92.5	95.2	93.9
1941	105.0	102.7	100.5	102.7	94.8	108.2	110.3	109.1	96.5	84.0	88.2	88.5
1942	111.3	109.8	104.1	96.5	90.2	112.0	122.0	103.3	85.3	87.5	94.8	95.6
1943	101.4	107.6	92.6	89.4	88.0	122.6	135.0	105.0	91.6	87.6	85.5	89.6
1944	111.0	97.2	97.2	87.5	101.4	122.2	127.1	103.0	96.8	74.6	87.7	89.3
1945	112.5	114.3	105.4	93.0	85.5	123.6	105.6	72.2	116.2	91.8	89.7	92.9
1946	101.8	112.8	113.0	97.9	99.1	113.7	102.7	94.1	94.1	87.9	85.4	94.2
1947	107.1	112.7	105.9	110.0	88.7	115.3	117.3	97.2	91.0	83.3	81.4	82.8
1948	103.0	130.0	119.6	107.9	87.6	109.5	112.1	96.5	92.7	77.7	83.6	84.3
1949	108.6	122.0	110.8	97.7	99.1	107.1	110.5	95.8	84.6	89.3	84.8	87.5
1950	114.0	122.2	111.7	99.7	91.3	107.3	108.8	90.3	89.3	77.9	94.1	98.2
1951	115.7	118.1	110.8	94.1	89.4	111.2	103.9	87.3	87.5	87.6	99.5	92.8
1952	117.1	122.9	107.1	95.8	94.1	105.2	111.5	93.0	85.7	78.5	89.9	91.6
1953	125.2	120.1	113.6	108.2	91.0	109.1	108.4	84.4	83.5	73.9	84.2	99.1
1954	116.6	125.7	119.2	106.1	98.5	98.0	96.5	92.8	89.3	80.8	88.4	91.0
1955	112.8	118.6	115.6	110.9	95.8	105.1	97.6	88.2	84.0	82.6	93.0	94.6
1956	112.9	115.0	111.9	100.4	101.6	113.6	110.1	86.3	79.1	75.5	97.2	97.6
1957	115.7	114.3	108.0	100.0								

10 MODIFIED RATIOS.ORIGINAL/WTD 15-MO MOV AV SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			102.1	100.6	98.0	102.3	113.2	108.8	86.1	92.5	95.2	93.9
1941	105.0	102.7	100.5	102.7	94.8	108.2	110.3	109.1	96.5	84.0	88.2	88.5
1942	111.3	109.8	104.1	96.5	90.2	112.0	122.0	103.3	85.3	87.5	94.8	95.6
1943	101.4	107.6	92.6	89.4	88.0	122.6	128.0	105.0	91.6	87.6	85.5	89.6
1944	111.0	106.4	97.2	87.5	101.4	122.2	127.1	103.0	96.8	84.7	87.7	89.3
1945	112.5	114.3	105.4	93.0	85.5	123.6	105.6	89.8	102.4	91.8	89.7	92.9
1946	101.8	112.8	113.0	97.9	99.1	113.7	102.7	94.1	94.1	87.9	85.4	94.2
1947	107.1	112.7	105.9	105.3	88.7	115.3	117.3	97.2	91.0	83.3	81.4	82.8
1948	103.0	121.6	119.6	107.9	87.6	109.5	112.1	96.5	92.7	77.7	83.6	84.3
1949	108.6	122.0	110.8	97.7	99.1	107.1	110.5	95.8	84.6	89.3	84.8	87.5
1950	114.0	122.2	111.7	99.7	91.3	107.3	108.8	90.3	89.3	77.9	94.1	98.2
1951	115.7	118.1	110.8	94.1	89.4	111.2	103.9	87.3	87.5	87.6	94.5	92.8
1952	117.1	122.9	107.1	95.8	94.1	105.2	111.5	93.0	85.7	78.5	89.9	91.6
1953	119.6	120.1	113.6	108.2	91.0	109.1	108.4	84.4	83.5	73.9	84.2	99.1
1954	116.6	125.7	119.2	106.1	98.5	104.1	96.5	92.8	89.3	80.8	88.4	91.0
1955	112.8	118.6	115.6	110.9	95.8	105.1	97.6	88.2	84.0	82.6	93.0	94.6
1956	112.9	115.0	111.9	100.4	101.6	113.6	110.1	86.3	79.1	75.5	97.2	97.6
1957	115.7	114.3	108.0	100.0								

** STABLE-SEASONAL ADJUSTMENT FACTORS SERIES #4406

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1109	1156	1082	996	937	1113	1109	955	893	837	892	919

** STABLE-SEASONAL ADJUSTED SERIES SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			773	826	853	747	825	915	767	865	814	752
1941	668	599	601	641	604	556	541	588	524	459	426	394
1942	390	349	331	306	276	260	255	229	188	192	183	165
1943	133	123	104	101	101	117	125	110	97	93	80	75
1944	73	60	64	63	78	79	80	71	67	53	56	54
1945	57	55	55	53	57	80	86	87	185	186	195	214
1946	207	229	250	234	247	231	205	216	232	234	216	231
1947	216	215	215	243	209	230	233	220	214	202	192	178
1948	166	228	226	220	188	196	201	203	213	196	205	211
1949	240	279	293	303	351	340	370	386	375	428	382	380
1950	404	405	381	353	327	304	289	262	262	232	251	243
1951	225	208	199	175	172	178	168	165	180	194	205	182
1952	185	181	166	162	171	164	175	168	161	153	159	153
1953	170	155	154	159	140	140	140	130	148	155	191	251
1954	279	317	344	347	352	301	302	339	347	327	324	309
1955	302	292	294	297	266	241	223	235	241	254	269	264
1956	260	252	262	257	279	263	255	230	224	228	276	270
1957	265	249	250	249								

11 CENTERED RATIOS,ORIGINAL/WTD 15-MO MOV AV SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			1021	1006	980	1023	1132	1088	861	925	952	939
1941	1058	1035	1013	1035	956	1091	1112	1100	973	847	889	892
1942	1102	1087	1030	955	893	1109	1208	1022	844	866	938	946
1943	1023	1086	935	902	888	1237	1292	1060	925	884	863	904
1944	1097	1051	961	865	1002	1208	1256	1018	957	837	867	882
1945	1119	1137	1048	925	850	1229	1050	893	1018	913	892	924
1946	1021	1131	1133	982	994	1140	1030	944	944	881	856	945
1947	1082	1138	1070	1064	896	1165	1185	982	919	841	822	836
1948	1033	1220	1200	1083	879	1099	1125	968	930	780	839	846
1949	1088	1222	1110	979	993	1073	1107	960	848	895	850	877
1950	1135	1217	1113	993	909	1069	1084	899	889	776	937	978
1951	1164	1188	1115	947	899	1119	1045	878	880	881	951	934
1952	1178	1237	1078	964	947	1059	1122	936	862	790	905	922
1953	1201	1206	1141	1086	914	1095	1088	847	838	742	845	995
1954	1157	1248	1183	1053	978	1033	958	921	886	802	877	903
1955	1129	1187	1157	1110	959	1052	977	883	841	827	931	947
1956	1128	1149	1118	1003	1015	1135	1100	862	790	754	971	975
1957	1158	1144	1081	1001								

12 FINAL SEASONAL ADJ FACTORS, 3*5 MO MOV AVS SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			101.3	100.4	95.3	107.6	114.5	108.2	90.8	88.3	91.9	91.9
1941	106.2	105.1	100.5	98.1	94.5	110.1	117.1	107.0	90.6	87.8	91.3	91.8
1942	106.8	106.3	99.8	95.8	93.3	113.7	118.6	105.0	92.0	87.4	90.1	91.4
1943	107.3	107.8	100.4	93.8	92.9	116.4	118.4	102.1	93.1	87.2	89.2	91.4
1944	107.4	109.5	101.6	93.7	92.3	118.5	117.1	99.5	94.5	87.2	87.8	90.9
1945	107.0	111.4	104.4	95.2	92.5	118.3	115.3	97.6	94.8	86.6	86.6	90.2
1946	106.9	113.8	107.5	97.9	92.4	116.8	113.0	96.3	94.6	86.1	85.6	89.0
1947	107.0	116.4	110.7	100.4	92.7	114.0	111.2	95.4	93.0	84.9	85.6	89.0
1948	108.0	118.4	112.0	101.3	92.4	111.8	110.5	94.6	91.0	84.4	86.4	89.2
1949	109.7	120.0	112.3	100.9	92.5	109.9	110.4	93.9	89.4	83.1	87.9	90.1
1950	112.4	120.9	111.9	100.0	92.4	109.1	109.8	92.3	87.9	82.5	89.1	91.6
1951	114.7	121.7	112.0	99.9	92.9	108.1	108.2	90.9	87.2	81.3	89.9	93.3
1952	116.2	121.5	112.4	101.1	93.4	107.7	106.2	89.8	86.5	80.8	90.1	94.3
1953	116.4	121.3	113.2	102.8	94.4	107.4	104.9	89.3	85.9	79.7	90.4	94.5
1954	116.0	120.2	113.5	104.2	96.0	107.9	104.4	88.6	84.5	78.9	90.9	94.9
1955	115.2	118.9	113.3	104.3	97.9	108.8	104.7	88.1	83.1	77.9	92.3	95.4
1956	114.6	117.2	112.5	103.6	99.3	110.3	105.6	87.4	81.7	77.5	94.3	96.2
1957	114.2	115.9	111.3	102.0								

13 FINAL SEASONALLY ADJUSTED SERIES SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			825	820	838	772	799	808	754	820	790	752
1941	698	659	647	650	599	562	512	525	517	437	416	394
1942	404	380	359	318	278	254	239	209	183	184	181	166
1943	138	132	112	108	102	112	117	103	93	89	80	75
1944	75	63	68	67	79	74	76	68	63	50	57	55
1945	59	57	57	56	57	75	82	85	174	180	201	218
1946	215	233	251	238	250	220	201	214	219	228	225	238
1947	224	214	210	241	211	225	232	220	205	199	189	184
1948	191	223	218	216	190	195	202	205	209	194	212	217
1949	242	268	282	299	356	344	371	393	375	431	388	387
1950	399	387	368	352	331	310	292	271	266	235	251	243
1951	218	198	192	174	173	183	172	174	185	199	204	179
1952	176	172	160	159	171	169	183	178	166	158	158	150
1953	162	148	148	154	139	145	148	139	154	163	188	244
1954	266	305	328	332	344	310	321	366	367	347	318	299
1955	291	284	281	284	254	246	236	254	259	273	260	255
1956	251	248	252	247	263	266	268	252	245	246	261	258
1957	257	248	243	243								

14 RATIOS, FINAL ADJ TO PRECEDING AND FOLLOWING — SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			-	98.6	105.3	94.3	101.1	104.1	92.6	106.2	100.5	101.1
1941	98.9	98.0	98.9	104.3	98.8	101.2	94.2	102.0	107.5	93.7	100.1	96.1
1942	104.4	99.6	102.9	99.8	97.2	98.3	103.2	99.1	93.1	101.1	103.4	104.1
1943	92.6	105.6	93.3	100.9	92.7	102.3	108.8	98.1	96.9	102.9	97.6	96.8
1944	108.7	88.1	104.6	91.2	112.1	95.5	107.0	97.8	106.8	83.3	108.6	94.8
1945	105.4	98.3	100.9	98.2	87.0	107.9	102.5	66.4	131.3	96.0	101.0	104.8
1946	95.3	100.0	106.6	95.0	109.2	97.6	92.6	101.9	99.1	102.7	96.6	106.0
1947	99.1	98.6	92.3	114.5	90.6	101.6	104.3	100.7	97.9	101.0	98.7	96.8
1948	93.9	109.0	99.3	105.9	92.5	99.5	101.0	99.8	104.8	92.2	103.2	95.6
1949	99.8	102.3	99.5	93.7	110.7	94.6	100.7	105.4	91.0	113.0	94.9	99.3
1950	103.1	100.9	99.6	100.7	100.0	99.5	100.5	97.1	105.1	90.9	105.0	103.6
1951	98.9	96.6	103.2	95.3	96.9	106.1	96.4	97.5	99.2	102.3	107.9	94.2
1952	100.3	102.4	96.7	96.1	104.3	95.5	105.5	102.0	98.8	97.5	102.6	93.8
1953	108.7	95.5	98.0	107.3	93.0	101.0	104.2	92.1	102.0	95.3	92.4	107.5
1954	96.9	102.7	103.0	98.8	107.2	93.2	95.0	106.4	102.9	101.3	98.5	98.2
1955	99.8	99.3	98.9	106.2	95.8	100.4	94.4	102.6	98.3	105.2	98.5	99.8
1956	99.8	98.6	101.8	95.9	102.5	100.2	103.5	98.2	98.4	97.2	103.6	99.6
1957	101.6	99.2	99.0									

AVERAGES

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
100.4	99.7	99.9	100.1	99.8	99.3	100.9	98.3	101.5	98.9	100.8	99.5

15 UNCENTERED 12-MO MOVING AVERAGE FINAL ADJ — SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			-	-	-	-	-	778	763	749	729	711
1941	688	664	644	612	581	551	527	504	480	452	425	399
1942	377	350	323	301	282	263	241	220	199	182	167	155
1943	145	136	129	121	113	105	100	94	90	87	85	82
1944	78	76	73	70	68	66	65	64	63	63	61	61
1945	61	63	72	83	95	108	121	136	152	167	183	196
1946	205	216	220	224	226	228	228	227	223	224	220	221
1947	223	224	223	220	217	213	210	211	211	209	208	205
1948	203	201	202	201	203	206	210	214	219	226	240	252
1949	267	282	296	316	330	345	358	368	375	379	377	374
1950	368	358	348	332	321	309	294	278	263	248	235	225
1951	215	207	200	197	193	188	184	182	179	178	178	177
1952	178	178	176	173	169	167	165	163	162	162	159	157
1953	154	151	150	151	153	161	170	183	198	213	230	243
1954	258	277	294	310	321	325	327	326	322	318	310	305
1955	298	288	279	273	268	265	261	258	256	253	254	255
1956	258	258	257	254	254	255	255	255	254	254		

16 RATIOS. 12-MO MOV AVS. FINAL ADJ TO ORIGINAL SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			-	-	-	-	-	100.0	100.0	100.3	100.1	100.1
1941	100.6	100.9	100.6	100.2	99.7	99.3	99.6	99.8	99.8	99.8	99.3	99.8
1942	100.8	101.4	100.9	99.7	99.3	98.9	99.6	99.5	99.5	99.5	98.8	99.4
1943	100.7	100.7	100.8	100.0	100.0	99.1	99.0	98.9	98.9	98.9	98.8	98.8
1944	100.0	101.3	100.0	100.0	98.6	98.5	100.0	98.5	98.4	100.0	98.4	98.4
1945	98.4	98.4	100.0	101.2	103.3	103.8	102.5	100.7	100.0	100.0	100.5	100.0
1946	99.0	99.1	99.5	100.0	100.0	100.4	100.0	100.0	99.6	100.0	99.5	100.0
1947	99.6	100.0	100.0	99.5	99.5	99.5	99.5	99.1	99.1	98.6	99.0	99.0
1948	99.5	99.5	100.0	99.5	99.5	100.0	99.5	99.1	98.6	98.7	99.2	98.8
1949	98.5	98.9	99.7	100.6	100.9	101.5	100.8	100.3	100.0	100.0	100.0	100.0
1950	100.5	100.6	100.0	99.4	98.8	98.4	98.7	99.6	100.4	100.4	100.0	100.4
1951	101.4	101.0	100.5	100.5	100.0	100.0	100.0	100.0	100.0	100.0	100.6	100.6
1952	100.6	100.6	100.0	100.0	100.0	100.0	99.4	100.0	100.0	100.0	99.4	100.0
1953	100.0	100.0	100.0	100.7	100.0	100.6	100.0	98.4	97.5	97.3	97.9	97.2
1954	97.4	98.2	99.0	100.3	100.9	100.6	100.6	100.9	101.3	101.3	101.0	101.0
1955	101.4	100.7	100.4	100.0	99.6	100.0	99.6	100.0	100.4	100.8	100.8	100.4
1956	100.4	100.4	100.4	100.0	99.6	100.0	100.0	100.0	100.0	100.4	-	-
1957	-	-	-	-								

17 RATIOS. EACH MO TO PRECEDING JAN. FINAL ADJ SERIES #4406

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1940			-	-	-	-	-	-	-	-	-	-
1941	-	944	927	931	858	805	734	752	741	626	596	564
1942	579	941	889	787	688	629	592	517	453	455	448	411
1943	342	957	812	783	739	812	848	746	674	645	580	543
1944	543	840	907	893	1053	987	1013	907	840	667	760	733
1945	787	966	966	949	966	1271	1390	1441	2949	3051	3407	3695
1946	3644	1084	1167	1107	1163	1023	935	995	1019	1060	1047	1107
1947	1042	955	938	1076	942	1004	1036	982	915	888	844	821
1948	853	1168	1141	1131	995	1021	1058	1073	1094	1016	1110	1136
1949	1267	1107	1165	1236	1471	1421	1533	1624	1550	1781	1603	1599
1950	1649	970	922	882	830	777	732	679	667	589	629	609
1951	546	908	881	798	794	839	789	798	849	913	936	821
1952	807	977	909	903	972	960	1040	1011	943	898	898	852
1953	920	914	914	951	858	895	914	858	951	1006	1160	1506
1954	1642	1147	1233	1248	1293	1165	1207	1376	1380	1305	1195	1124
1955	1094	976	966	976	873	845	811	873	890	938	893	976
1956	863	988	1004	984	1048	1060	1068	1004	976	980	1040	1028
1957	1024	965	946	946								