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Measuring and Interpreting Time, Firm, and Ledger Effects

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Abstract

The main objectives of this paper are to show how to decompose quarterly income data into three components -- trend-cycle (C), seasonal (S), and irregular (I); to calculate the relative percentage contribution of each component to changes in the original series for time spans of one, two, three and four quarters; to show that the trend of the relative contribution of each component results in a time, firm, and ledger effect for each income statement variable; and finally, to draw forecasting implications for users of quarterly income statement data. Of greatest significance was the discovery that the decomposition of a time series of accounting data produced time, firm, and ledger effects on the S, C, and I components. The impact of these three effects is of greatest importance to management when preparing financial plans or forecasts.

During the past two decades economists have used a linear filter version of the X-11 program to adjust monthly and quarterly macro-economic data. The X-11 program was designed by the Bureau of the Census [10] to analyze historical time series and determine seasonal adjustments and growth trends. Seasonally adjusted and unadjusted economic data are reported on either a monthy or quarterly basis in the Federal Reserve Bulletin. To adjust the seasonal component of the data, the X-11 program first decomposes the time series data into trend (C), seasonal (S) and irregular (I) components. Subsequently, the trend and irregular components are used to construct a seasonally adjusted series.

A time series of quarterly income statement data for most large and medium sized companies are now available on the Compustat file. An analyses of the C, S and I components of income statement data can provide planning insights for financial managers and analysts. The two alternative methods used in decomposing a data time-series are Box-Jenkins [3] over-all autoregressive integrated moving average (ARIMA) seasonal model, and the X-11 model. Cleveland and Tiao [5] have found that the X-11 approximation decomposition model is generally a good proxy for the ARIMA seasonal model.

The main objectives of this paper are to show how to decompose quarterly income statement data into the three components; to calculate the relative percentage contribution of each component to changes in the original series for time spans of one, two, three and four quarters; to show that the trend of the relative contribution of each component results in a time, ledger and firm effect for each income statement variable; and finally, to draw forecasting implications for users of quarterly income statement data.

THE X-11 AND FINANCIAL ANALYSIS

Monthly and quarterly economic and business data are widely used in short-run financial planning. The quality of the information contained in a monthly or quarterly time series is unique when compared to a series of annual data. Extracting these unique properties of monthly or quarterly data can provide substantive insight to management.

Two major approaches to time series analysis are the component analysis and sample function analysis. The component analysis regards the time series as being composed of several influences or components which are generally taken to be trend-cycle (C), seasonal (S), and irregular (I), or random movements. In component analysis, C and S influences are modeled in a deterministic manner; C may be regarded as a polynomial of a given degree and the seasonal component may be modeled by a trigonometric function with a given period and amplitude. Random influences are usually assumed to have a sample probability structure and are treated as independent, identically distributed random variables having zero mean and finite variance.

The sample function analysis regards a time series as an observed sample function representing a realization of an underlying stochastic process. Complicated parametric statistical estimation procedures are used to determine the properties of time series data. Cleveland and Tiao [5] have shown that the X-11 component analysis is generally a good approximation for the ARIMA type of sample function analysis. Theoretically, the results obtained from sample function analysis are more precise than those obtained from component analysis. However, the empirical results obtained from the component analysis are easier to understand and interpret than those from sample function analysis. Therefore, the X-11 analysis technique has occupied an important place in applied time series analysis for over 20 years.

Dunn, Williams and Spivey [6] have used both component analysis and sample function analysis techniques to analyze and predict telephone demand in local geographical areas. Bonin and Moses [2] have used the component analysis methods to determine the evidence of seasonal variations in prices of individual Dow Jones Industrial stocks. Chambers, Mullick and Smith [4] have extensively discussed the possible usefulness of the X-11 decomposition technique for business analysis and forecasting. In summary the preceding discussion provides the justification for utilizing the X-11 method to analyze corporate quarterly accounting data.

THE MEASUREMENT TASK

Identifying the Components

The X-11 program is based on the premise that seasonal fluctuations can be measured in an original series of economic data and separated from trend, cyclical, trading-day and irregular fluctuations. The seasonal component (S) reflects an intrayear pattern of variation which is repeated constantly or in an evolving fashion from year to year. The trend-cycle component (C) includes the long-term trend and the business cycle. The trading day component (TD) consists of variations which are attributed to the composition of the calendar. The irregular component (I) is composed of residual variations that reflect the effect of random or unexplained events in the time series [10, p. 1].

Decomposing past time series and discovering the relative contribution of the C, S and I components to changes in the series provides invaluable insight to management and financial analysts. The trend-cycle (C) component reflects permanent information in both a short- and long-run economic time series. The seasonal component is considered to represent a permanent pattern underlying the short-run time series. Although the relative contribution of the seasonal component may be quite high in the short-run, it contains permanent type information that management can take into account for short and intermediate-run planning. The uncertainty arising from the seasonal component is relatively low.

The irregular (I) component contains the randomness that exists in the time series and for both short and long-run analysis. This I component can be interpreted as noise in the information system. The higher the relative contribution of the I component in a time series the greater the noise and/or uncertainty. Large forecasting errors can occur when the relative contribution of the I component is high. Additionally, the irregular component of accounting earnings can bias the cost of capital estimate which was of concern to Miller and Modigliani [8]. They used a cross sectional regression method to estimate the cost of capital for the utility industry. M & M have used the instrumental variable method to remove the random component in annual accounting earnings data.

Measuring Component Contribution

For quarterly forecasting the X-11 generates a seasonal forecast of the next four quarters and computes the relative contribution of the C, S and I components to the percentage change in the original data series. The relative contribution of the C, S and I components is calculated for a time span of one, two, three and four quarters. This calculation provides the statistical information utilized in this study. It is structured on the following realtionship [11, pp. 18-19].

$$\overline{O}_t^{\,2} = \overline{I}_t^{\,2} + \overline{C}_t^{\,2} + \overline{S}_t^{\,2} + \overline{P}_t^{\,2} + \overline{TD}_t^{\,2} \qquad (1)$$

where each symbol represents the mean of the absolute changes in a series:

$\overline{O}_t$ = original series;

$\overline{I}_t$ = final irregular series;

$\overline{C}_t$ = final trend cycle;

$\overline{S}_t$ = final seasonal factors

$\overline{P}_t$ = prior montly adjustment factors, (not applicable to the quarterly model);

$\overline{TD}_t^{\,2}$ = Final trading day adjustment factors (not applicable to the quarterly model).

Since the sum of squares of the percent changes does not exactly equal $\overline{O}_t^{\,2}$, $(\overline{O}_t')^2$ is substituted, where $(\overline{O}_t')^2 = \overline{I}_t^{\,2} + \overline{C}_t^{\,2} + \overline{S}_t^{\,2}$. The relative contribution of the changes in each component for each time span is the ratio $\overline{I}_t^{\,2}/(\overline{O}_t')^2$, $\overline{C}_t^{\,2}/(\overline{O}_t')^2$ or $\overline{S}_t^{\,2}/(\overline{O}_t')^2$, [11, p. 19].

<u>An Example</u>

An example will illustrate the statistical computation of the relative contribution of each C, S and I component to the percentage change in the original time series. The quarterly sales of Caterpillar Tractor Company from the IQ 1969 to the IVQ 1980 are the data used in the example. These original sales data are found in Exhibit 1 and are graphically presented in Exhibit 2.

The relative contribution of each component for a one-quarter time span is calculated in the following manner. The first step is to determine the absolute change in the original sales series (O_t) between each quarter, e.g., $|O_1 - O_2|$. Sales in the first and second quarters (O_1 and O_2) of 1969 were $500.4 million and $558.9 million, respectively. The absolute change in sales between the first and second quarters was $58.4 million. The absolute difference in sales between the third and fourth quarters $|O_3 - O_4|$, was $23.1 million, |$482.7 - $459.6|. Thus for the original sales series (O_t) the X-11 routine calculates the absolute change in sales between each of the 36 quarters, i.e., $|O_1 - O_2|$, $|O_2 - O_3|$, $|O_3 - O_4|$, ..., $|O_{34} - O_{35}|$, $|O_{35} - O_{36}|$. The mean of the changes in the original sales series ($\overline{O}_t$) was $1.091 billion, which is shown in Exhibit 3.

The X-11 routine also calculates the absolute change in the original sales for a time span of two, three and four quarters. Because the computation methodology is similar for each time span, the four quarter time span is used to illustrate the technique. The absolute change in sales every four quarters is calculated by the model. All possible four quarter time period combinations of changes in sales are computed, e.g., $|O_1 - O_5|$, $|O_5 - O_9|$, $|O_9 - O_{13}|$, ..., $|O_{29} - O_{33}|$, $|O_2 - O_6|$, $|O_6 - O_{10}|$, ..., $|O_{30} - O_{34}|$, $|O_3 - O_7|$, ..., $|O_{31} - O_{35}|$, $|O_4 - O_8|$, ..., $|O_{32} - O_{36}|$. The same procedure is utilized to calculate a two and a three quarter time span. The means of the changes in the original series (O_t) for a two, three and four quarter time span were $1.419 billion, $1.534 billion and $1.908 billion. These values are also presented in Exhibit 3.

The Final Measurement

The next step in the process is to calculate the mean absolute change in the final adjusted time series for the C, I and S components. The X-11 computes a final adjusted table for each component. A brief review of the process used to calculate the final estimated C, I and S components follows.

The moving average used to estimate the C component is selected on the basis of the amplitude of the irregular variations in the data relative to the amplitude of long-term systematic variations. The routine selects a moving-average that provides a suitable compromise between the need to smooth the irregular with a long-term inflexible moving average and the need to reproduce accurately the systematic element with a short-term flexible moving average [10, p. 3].

The selection of the appropriate moving average for estimating the trend cycle (C) component is made on the basis of a preliminary estimate of the $\overline{I}/\overline{C}$ rate (the ratio of the mean absolute quarter-to-quarter change in the irregular to the trend-cycle). A 13-term Henderson average of the preliminary seasonally adjusted series is used as the preliminary estimate of C and the ratio of the preliminary seasonally adjusted series to the 13-term average used as the estimate of the I component [11, p. 3]. The extreme value of the series are replaced with a smoothing routine. Finally a 5-term Henderson curve is used to modify the seasonally adjusted series to obtain the final trend cycle (C) and irregular (I) series [11, pp. 3-4]. A graphic presentation of the final trend-cycle, 5-term Henderson curve is presented in Exhibit 2. In general, Exhibit 2 shows the C component tracks the original time series reasonably close.

The S-I ratios for each quarter are smoothed by a 3x5-term moving average (a 3 term average of a 5-term average) to estimate final seasonal factors. Because the statistical calculations of the final C, S and I components are lengthy and complex, the numerous tables generated by the model are not presented. The final S and I series are graphically presented in Exhibit 2. The irregular component is substantially more volatile than the seasonal component for Caterpillar sales. A strike in the IVQ 1979 caused a substantial deviation from the original series and had a profound affect on the I component. A summary of the mean absolute changes in sales in the C, S and I series for one, two, three and four quarter time series are presented in Exhibit 3. The calculation of these mean absolute changes follows the same procedure used in computing the change in the original sales series. These mean values in Exhibit 3 provide the base for computing the relative contribution of each component to changes in the original series.

A revision to equation 1 presented earlier specifies the relationship involved in calculating the relative contribution of the C, S and I components. The calculations utilize the data in Exhibit 3. An example that computes the relative contribution of each component to changes in the original Caterpillar sales series for a one quarter time span follows. The revision to equation 1 is

$$(\overline{O'})^2 = \overline{I}^2 + \overline{C}^2 + \overline{S}^2. \qquad (1a)$$

Substituting the appropriate values from Exhibit 3 into (1a) produces

$$(995.08)^2 = (723.58)^2 + (420.51)^2 + (538.31)^2. \qquad (1b)$$

For a one quarter time span the relative contribution of each component is ...

$$\text{I component} = \frac{\bar{I}^2}{(\bar{O}')^2} = \frac{(723.58)^2}{(995.08)^2} = 52.88\%$$

$$\text{C component} = \frac{\bar{C}^2}{(\bar{O}')^2} = \frac{(420.51)^2}{(995.08)^2} = 17.86\%$$

$$\text{S component} = \frac{\bar{S}^2}{(\bar{O}')^2} = \frac{(538.31)^2}{(995.08)^2} = \underline{29.27\%}$$

$$100.00\%$$

Interpretation

The above data indicate that the irregular component accounted for 52.88% of the change in the original sales series of Caterpillar Tractor Company in a one quarter time span. Additionally 17.86% of the change in the original sales series were related to the trend-cycle component and 29.27% was represented by the seasonal component. Approximately 47% of the changes in past quarterly sales of Caterpillar are related to permanent information signals while 53% of the change can be attributed to random or unexplained events.

The relative contribution of each component to changes in Caterpillar's original sales series for one, two, three and four quarter time spans are presented in Exhibit 4. For the two, three and four quarter time spans the irregular component composes approximately 25%, 18% and 17%, respectively, of the change in sales. The trend-cycle component increased as the length of the time span increased. The seasonal component declined as the time span increased. It ended at almost zero for a four quarter time span. This change over time in the relative contribution of each S, C and I component is referred to as the time effect. In the following section we explore how the S, C and I components can be influenced by the time effect and show how two additional effects, firm and ledger, also make unique contributions.

ANALYSIS

In this section we shall accomplish several tasks. We explain the presence of time, ledger and firm effects in the original time series data and show how to measure these three effects. We discuss the affect the time, ledger and firm effects have on the S, C and I components. Finally, an empirical analysis of the presence of time, ledger and firm effects are presented.

The Three Effects

There are time, ledger and firm effects evident in the I, C and S components of the time series data. The time effect reflects the trend of the relative contribution of the I, C and S component as the time span is increased. For example, if using four quarters of information produces a smaller contribution of the I component than a one quarter time period, the decrease in the I component is related to the length of the time period, which is the time effect. The aggregation of data into time periods of one or four quarters can produce vastly different interpretations of financial outcomes. The presence of the time effect has profound implications to management when selecting the optimal time span for aggregating the data to be used in a forecast or in analysis.

The ledger effect represents the changes in the relative contribution of the I, C or S component at each stage in the income statement. For example, an increasing ledger effect occurs when the relative contribution of the I component is 10% for sales, 15% for operating income, and 20% for EBIT and 25% for net income. In this example the ledger effect increased as one moves down the income statement. Alternatively, the ledger effect could be decreasing or unchanged.

The firm effect reflects differences that exist among companies in the relative contribution of a component for a single variable. For example, the relative contribution of the I component for sales of companies A, B and C is 35%, 17% and 5%. The size of the relative contribution of the preceding I component reflects basic differences in the sales of the three companies. This difference represents the firm effect. One of the major factors affecting the magnitude of the firm effect is the size of the firm. Until recently size was not considered to be an important variable in the tests of the efficient market hypothesis, but Ball [1] has recently focused on size. Although asset size is important, our concern is that the more subtle issue is the size of the relative contribution of the random component to the original series.

Data

The analysis utilizes quarterly data for five income statement variables--sales, operating income, depreciation, earnings-before-interest-and-taxes (EBIT) and net income. The data were selected from the industrial Compustat files for 68 companies that had continuous data for all five variables for the period 1970-78.

The X-11 model was used to calculate the relative contribution of each S, C and I component for each income statement variable. These data were used to illustrate the presence of time, ledger and firm effects. Each effect will be analyzed separately.

Time Effect

The means and standard deviations (S.D.) of the relative contributions of the I, C and S components for the five income statement variables are presented in Exhibit 5. The mean and S.D of the relative contributions are reported according to time spans of one, two, three and four quarters. The trends in these data reflect the time effect for each varible.

A brief explanation will aid in the interpretation of the data reported in Exhibit 5. The average relative contributions of the I, C and S components for each time span equal 100 percent. For example, the mean relative contribution of the I, C and S components for sales in a one quarter time span are 17.71, 32.42 and 49.87 percent, respectively. The respective standard deviations are $\pm$ 11.82, $\pm$ 18.76 and $\pm$ 22.76 percent. For a time span of four quarters the means of the three components for sales are 4.71, 95.11 an .18 percent, and the S.D.'s are plus or minus 4.83, 4.99 and .33 percent respectively.

The clarity of the time effect observed in the data is captured in Exhibit 6. It contains the means of the relative contribution of the S, C and I components for the five income statement variables for a one-quarter and a four-quarter time span. A few observations will aid in the interpretation of the graphic presentation in Exhibit 6. The first circle on the left is carrying information on the contribution of each component to a percentage change in sales in a one-quarter time span. The I component is signaling random noise or transitory information, and it accounts for 18 percent of the series trend. The trend-cycle and seasonal components are carrying permanent information that contribute 82 percent of the change in the sales trend. The composition of the information in the one-quarter sales data is heavily loaded with permanent signals and modestly affected by random signals. These decomposition components provide valuable information to management for intermediate-term financial planning. In contrasts when annual data are decomposed a vastly different structure emerges. There is a telescopic expansion of the contribution of the C component, and the reverse of the seasonal contribution. The C component contributes 95 percent of the change in annual sales data and only 5 percent is related to the I component. There is no seasonal component in annual data. Exhibit 6 also shows the time effect is present in the other income statement variables.

In Exhibit 5 the means and standard deviations of the relative contributions of each component have unique and stable patterns for each time span. The relative contribution of the seasonal components decline as the time span increases which indicates a decreasing effect. The relative contribution of the trend-cycle component increases with the length of the time span, which reflects an increasing time effect. The pattern of the relative contribution of the irregular component oscillates over the length of the time spans. With the exception of the one quarter time span, the contribution of the I component is always smaller than the means of S and C. There is a significant drop in the relative information of the I component in one, two and three quarter time spans and a slight increase when all four quarters are included.

Ledger Effect

In observing the ledger effect in Exhibit 5, one finds each I, C and S component takes a unique path. In general the relative contribution of the I component increases in size as one moves from sales to net income. This portrays an increasing ledger effect. This finding indicates to management that the forecasting of net income is more complicated than sales. In Exhibit 5 there is no consistent linear ledger effect present in the relative contributions of seasonal components. The relative contributions of the trend-cycle component increases with each income statement variable signaling an increasing effect. These ledger effects are graphically presented in Exhibit 6 for the five income statement variables and for a one and four quarter time span.

Firm Effect

Porter [10] shows there is a substantial difference in the financial and production characteristics of industries and firms. We refer to these differences as firm effect's. The following ANOVA tests show the presence of firm effects in the I, C and S components for cash income statement variable.

ANOVA Tests

A two-way ANOVA model was used to test the impact of the time, ledger and firm effects on the S, C and I components. The two-way ANOVA test can be defined as

$$X_{ijk} = U + T_i + B_j + (TB)_{ij} + e_{ijk} \qquad (2)$$

where:

X_{ijk} = kth observation in a cell representing the intersection of the ith and jth factors;

U = overall mean;

T_i = sub-group mean associated with the first factor effect, which is time effect;

B_j = sub-group mean associated with second factor effect, which is either the firm effect or ledger effect;

TB_{ij} = interaction.

In this paper, the two factor pairwise combinations are (1) time and firm effects and (2) time and ledger effects.

There are three hypotheses to be tested with the analysis of variance as indicated in Equation 2. The hypotheses and their corresponding regions of rejection with α = .05 (or .01) are as follows:

H_{01}:	there are no time effects	H_a:	there are time effects
H_{02}:	there are no firm (or ledger) effects	H_a:	there are firm (or 1 ledger) effects
H_{03}:	there are no interaction effects	H_a:	there are interaction effects

These two-way ANOVA techniques are used to analyze

(1) the impacts of time and firm effect on the percentage contribution of S, C and I components;

(2) the impacts of time and ledger effect on the percentage change contribution of S, C and I components.

The ANOVA tests used 68 firms, five ledgers and four time horizons to analyze the fluctuation of the S, C and I components. The F values of these tests are listed in Exhibit 7. The method of calculating the degrees of freedom for F test in the two way analyses of variance with interaction can be found in Neter and Wasserman [9]. F values in Exhibit 7 show that time, firm and ledger effects are all important in determining the relative percentage change of the S, C and I components. The interaction between time and ledger effects are statisically different from zero except for the C component. In conclusion the empirical study supported the presence of a time, ledger and firm effect on the S, C and I components for all but one test.

In investigating the association between alternative profitability measures and security rates of return, Lee and Zumwalt [7] found security rates of return are affected by the level of the income statement variable as well as the industry. The empirical results on ledger and time effect have provided direct explanations to Lee and Zumwalt's findings. The time effect findings imply that Lee and Zumwalt's results may not be independent of the time unit used to measure the related data.

CONCLUSIONS

Financial planning and forecasting are dependent on past data as a first approximation of future performance. One way to improve the planning and forecasting process is to provide management a tool that will generate greater insight into the secrets contained within the data. The X-11 time series decomposition program is a tool well known to analysts of macro economic data, but it is not widely used in analyzing firm data. The X-11 program makes it possible to determine the seasonal (S), trend-cycle (C) and irregular (I) components in a data time series. Additionally the program calculates the relative percentage contribution of the S, C and I components to the original time series.

Our analysis of five income statement ledgers shows that S and C components provide permanent information trends to management; the irregular component contains temporary information. The larger the relative percentage contribution of the I component the greater the potential of forecasting or planning errors. Alternatively, the larger the permanent component the greater the potential of stable planning results.

The analysis found time, firm and ledger effects were present in the S, C and I components. The time effect showed the relative percentage contribution of the S, C and I components were directly affected by the length of the time period of the data. The shorter the time period of the data, the greater the relative percentage contribution of the irregular component. The longer the time period the greater the relative contribution of the C component and the smaller the S component. The analysis also discovered the relative percentage contribution of the S, C and I components varied widely among companies for all of the income statement variables tested. Finally, the study found the relative percentage contribution of the random component was markedly greater for net income than the variables that precede it in the income statement. That is the ledger effect.

The time, ledger and firm effects on the S, C and I components have profound affect on management's success in interpreting past results and in preparing plans and forecasts. When using past time series data for forecasting and planning, the data must be adjusted for time, ledger and firm effects on the S, C and I components in order to reduce forecasting errors and improve planning outcomes.

Exhibit 1. Original Quarterly Sales Data for Caterpillar Tractor, I 1969 to IV 1977
(in millions $)

Original Series	Quarterly Sales Data				
Year	1st Quar	2nd Quar	3rd Quar	4th Quar	Total
1969	500.4	558.9	482.7	459.6	3001.6
1970	524.6	537.0	579.1	487.1	2127.8
1971	564.4	585.1	522.3	503.4	2175.2
1972	620.8	653.6	678.5	649.3	2602.2
1973	751.8	800.2	823.4	807.0	3182.4
1974	822.4	956.8	1081.7	1221.2	4082.1
1975	1125.8	1328.7	1293.0	1216.2	4963.7
1976	1199.8	1266.6	1312.9	1263.0	5042.3
1977	1363.5	1454.6	1513.2	1517.6	5848.9
1978	1630.1	1843.7	1816.8	1928.6	7219.2
1979	1923.7	2136.7	2232.2	1320.6	7613.2
1980	2100.4	2316.3	2085.7	2095.4	8597.8

EXHIBIT 2. ORIGINAL SALES AND THE X-11 FINAL COMPONENT SERIES OF CATERPILLAR 1969-1980

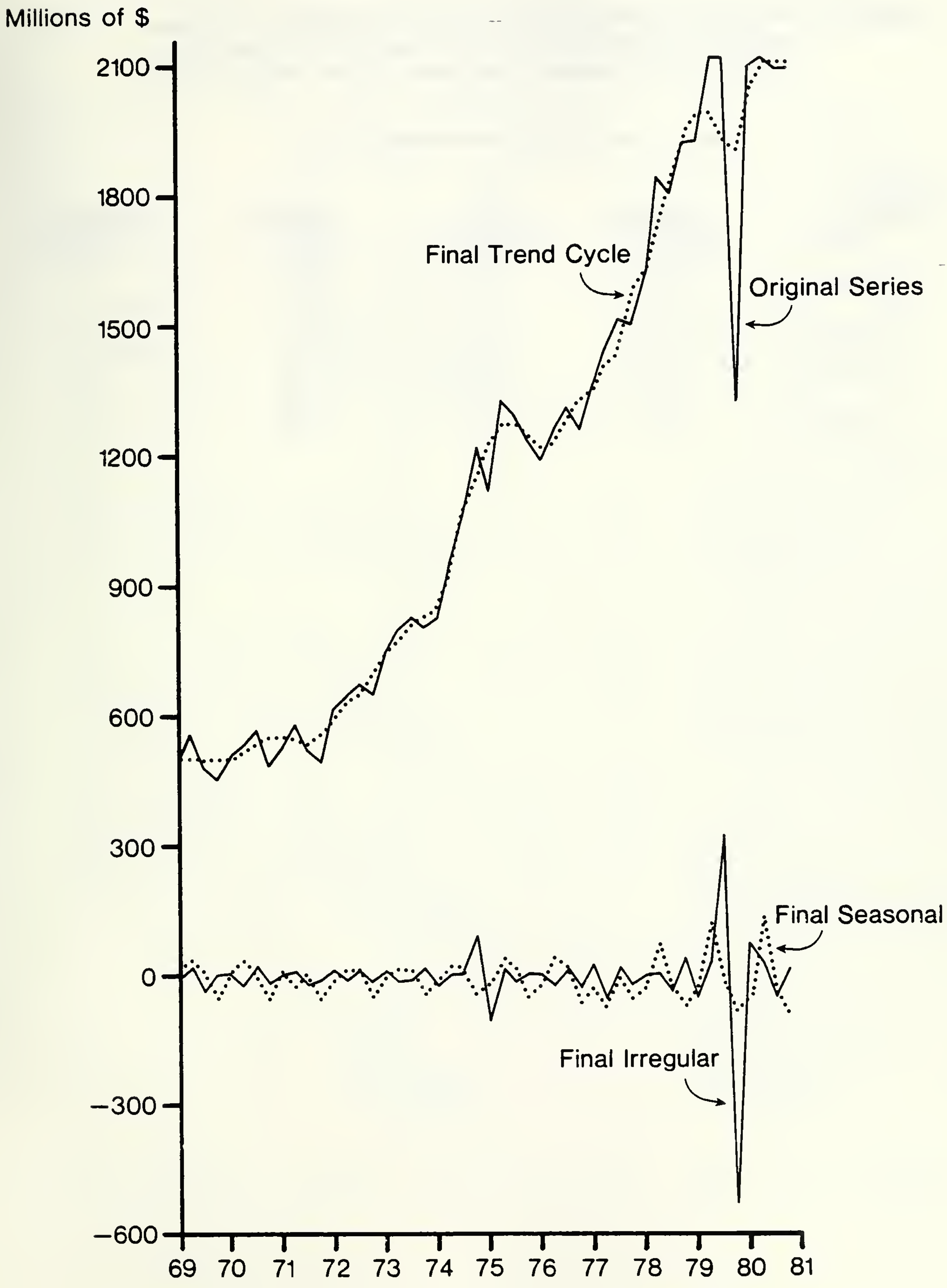

Exhibit 3. Mean of the Absolute Changes in Sales Related to Trend-Cycle, Seasonal and Irregular Components For One, Two, Three and Four Quarter Time Spans Without Regard to Sign

Mean Values (in millions of dollars)

Span in Quarters	Original	Trend Cycle	Seasonal	Irregular
1	1091.19	923.45	538.31	723.58
2	1419.30	1145.06	647.23	602.19
3	1533.78	1469.19	522.19	619.77
4	1908.36	1910.48	64.93	696.73

Exhibit 4. Relative Contributions of Components to Changes in Caterpillar Sales for One, Two, Three and Four Quarter Time Spans

Relative Contribution
(in percent)

Span in Quarters	Trend Cycle	Seasonal	Irregular	Total
1	17.86	29.27	52.88	100.00
2	46.94	28.44	24.62	100.00
3	68.50	13.08	18.42	100.00
4	82.58	0.15	17.27	100.00

Exhibit 5. Means and Standard Deviations of the Relative Contributions of the I, C and S Components of Five Income Statement Variables for 68 Companies, 1970-1978
(in percent)

Time Span in Quarters	Irregular Mean	Irregular S.D.	Trend-Cycle Mean	Trend-Cycle S.D.	Seasonal Mean	Seasonal S.D.
Sales						
1	17.71	11.82	32.42	18.76	49.87	22.76
2	6.59	5.80	60.15	23.52	33.26	23.69
3	4.35	3.94	72.65	20.09	23.00	19.58
4	4.71	4.83	95.11	4.99	.18	.33
Operating Income						
1	26.21	15.59	23.55	16.88	50.24	23.50
2	12.49	9.12	48.53	21.43	38.97	23.88
3	8.49	6.27	60.39	22.65	31.12	22.94
4	11.78	7.66	87.92	7.74	.30	.25
Depreciation						
1	36.13	18.35	25.59	15.09	36.80	23.58
2	15.66	10.97	51.10	22.31	31.77	23.32
3	11.77	9.30	65.92	21.69	20.84	19.06
4	13.46	11.47	84.87	15.48	.20	.27
EBIT						
1	27.04	15.59	21.95	15.50	51.01	23.09
2	12.70	8.62	46.95	20.98	40.34	23.90
3	9.08	5.99	58.30	21.77	32.62	22.76
4	13.11	7.28	86.54	7.35	.35	.31
Net Income						
1	30.63	19.09	21.41	14.64	47.96	25.27
2	15.17	11.23	47.10	21.50	37.73	24.02
3	11.33	10.19	57.35	22.88	31.33	24.04
4	15.80	12.49	83.83	12.55	.37	.49

EXHIBIT 6. CONTRIBUTIONS OF SEASONAL, TREND-CYCLE AND IRREGULAR COMPONENTS

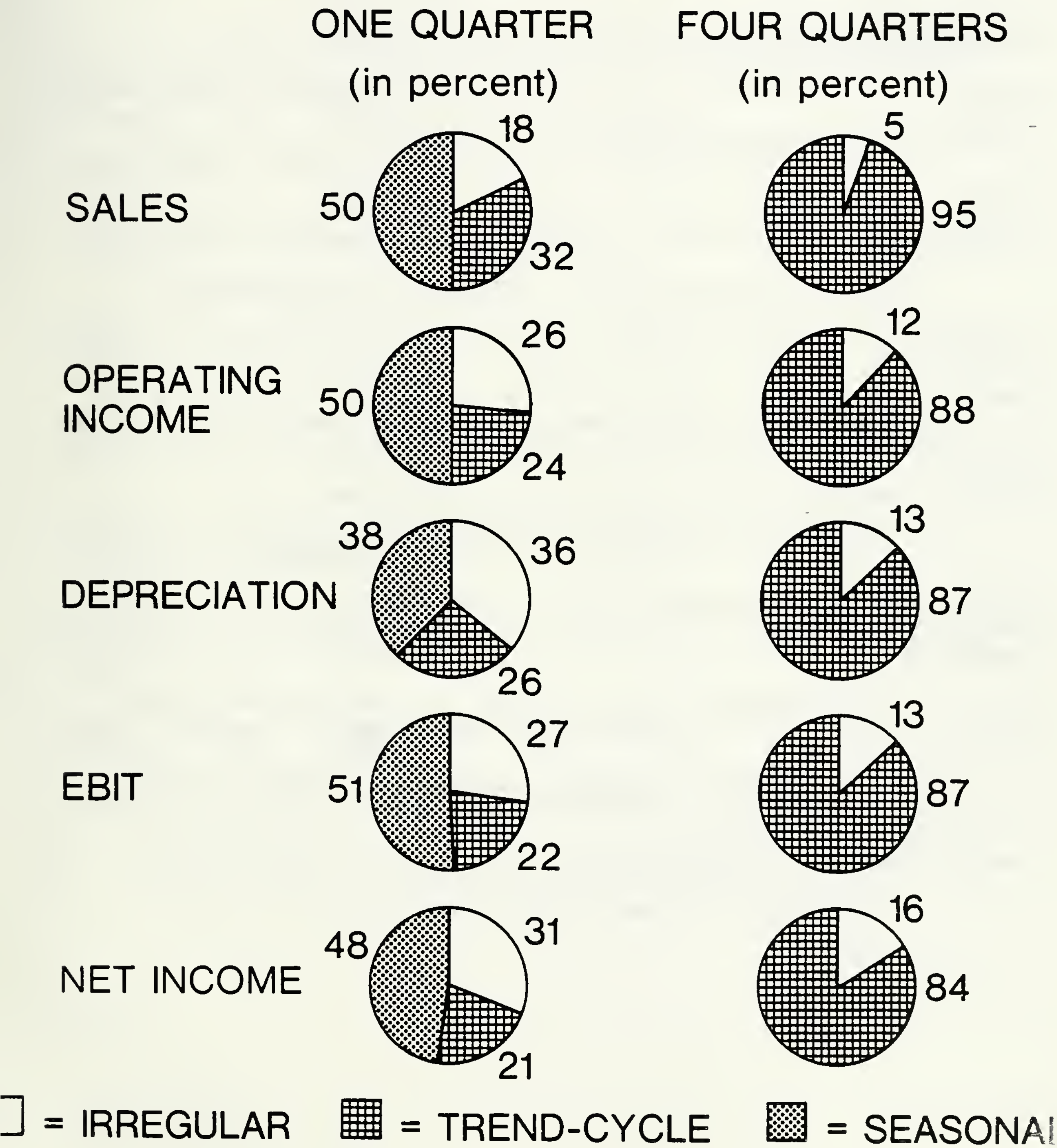

Exhibit 7. F Ratios for Analysis of Variance Tests Measuring the Significance of Time, Ledger and Firm Effects

Single Variable Effect and Interaction Effects	SEASONAL COMPONENTS 68 Company Sample
Ledger	3.17*
Time	725.92**
Ledger and Time	2.48**
Firm	6.83**
Time	1449.50**
Firm and Time	6.23**
	CYCLICAL TREND COMPONENTS
Ledger	7.15**
Time	1810.85**
Ledger and Time	1.58
Firm	4.52**
Time	3624.71**
Firm and Time	6.13**
	IRREGULAR COMPONENTS
Ledger	13.45**
Time	539.76**
Ledger and Time	6.15**
Firm	3.40**
Time	411.83**
Firm and Time	5.00**

*significant at .05 level.
**significant at .01 level.

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