DOCUMENT RESUME

ED 180 443 IR 007 917

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TITLE The Financial Analysis System: An Integrated Software System for Financial Analysis and Modeling.
PUB DATE 6 Apr 79
NOTE 19p.; Paper presented at the Annual Conference on Academic Computing Applications (Gary, IN, April 6, 1979); For a related document, see IR 007 915; Best copy available

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Programs; *Data Analysis; Economic Education; Instructional Aids; *Mathematical Models
IDENTIFIERS *Financial Data

ABSTRACT

This paper discusses the Financial Analysis System (FAS), a software system for financial analysis, display, and modeling of the data found in the COMPUSTAT Annual Industrial, Over-the-Counter and Canadian Company files. The educational utility of FAS is also discussed briefly. (Author)

# THE FINANCIAL ANALYSIS SYSTEM: AN INTEGRATED SOFTWARE SYSTEM FOR FINANCIAL ANALYSIS AND MODELING

by

S. Michael Groomer

# THE FINANCIAL ANALYSIS SYSTEM: AN INTEGRATED SOFTWARE SYSTEM FOR FINANCIAL ANALYSIS AND MODELING

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During the past fifteen years there has been an emergence of many large machine readable data bases. These data bases have been complemented by the tremendous advancements in computer technology and the utilization of automated procedures for financial analysis and display. Moreover, there is an ever increasing trend toward the utilization of computer-based financial data analysis in the educational curriculum, as well as for financial and industrial concerns.

There are, however, several factors which limit the role of the computer in concert with these data bases as a standard part of the curriculum. While there is a widespread utilization of computer based analyses and modeling in academic research, the same is not true for general classroom instruction and teaching methods. This is due, in part, to inadequate resources such as computer hardware, software and technical support. In addition, students enrolled in courses which treat the fundamentals are seldom able to make use of computer based methods due to their limited or non-existent background in computer programming, computer applications and statistical methods.

A number of generalized statistical packages, such as the Statistical Analysis System (SAS) or the Statistical Package for the Social Sciences (SPSS) have removed some of the barriers associated with student utilization of large data bases. In nearly all cases, however, the desirable display, analysis and modeling capabilities are not directly available. Examples of these deficiencies would include financial statements and comparative analyses. Moreover, there are significant staff requirements necessary to develop, operate and maintain associated data, particularly in the situation where multiple large data bases are utilized. Certainly, there is a need to implement generalized software specifically directed toward the larger and more significant financial data bases.

One such software package recently available for use with the COMPUSTAT[1] financial data is the Financial Analysis System. Thus, the purpose of this paper is to describe the Financial Analysis System (FAS)[2] in facilitating effective utilization of the COMPUSTAT data base in the classroom environment.

## FAS AND ITS ORIGINS

FAS is a batch-oriented, modular software package of analytical modeling and display routines designed to facilitate the effective utilization of the COMPUSTAT data files. Although relatively new, FAS is being implemented at both academic and commercial installations. The COMPUSTAT data service consists of a number of machine readable libraries of financial, market and statistical information covering several thousand industrial and non-industrial companies. The data is available via lease agreement from Standard and Poor's Compustat Services, Inc. on an annual, quarterly or monthly update basis. Data on the largest and most significant companies listed on the New York, American and Regional Stock Exchanges as well as Canadian companies are available. In addition to broad company coverage, the annual industrial files contain detailed key balance sheet, income statement and market items by individual companies. FAS may be used to access annual data found on the Primary, Supplementary, Tertiary, Over-the-Counter and Canadian Files.

FAS is a software product of the Public Affairs Information Service (School of Business and Public Administration) of the University of Missouri-Columbia and is currently under exclusive license to Management System Developments, Inc. FAS was developed at Missouri after three years of experience and support of several programs developed for use with the COMPUSTAT data which had specific and limited capabilities and required a reasonable amount of computer expertise to use. Thus, FAS arose out of a need to have a broadly based piece of software for display and analysis of COMPUSTAT data which could be more easily utilized, maintained and enhanced.

## OPERATIONAL CHARACTERISTICS

FAS is written in a highly portable set of FORTRAN IV consisting of approximately 11,500 lines of code and has been successfully executed on IBM, CDC, UNIVAC and BURROUGHS mainframes. Because of its size, FAS has been overlayed at a majority of the installation sites. Moreover, most implementers have found catalog procedures very helpful in facilitating user access to this software.

Communicating with FAS is easily accomplished via two types of user control cards: procedure cards and request cards. Key word procedures are used to tell FAS which display or analytical routines are to be used. The request cards indicate which companies in the data file are to be selected for processing. Procedure cards and related request cards comprise a request set. One or more request sets may be processed in a given job. The procedures currently available through FAS are summarized on the next page.[3]

COMPUTE: The COMPUTE procedure enables the user to create user defined variables. These can be single variables (scalars) or time-series variables (vectors). Using built-in functions, the user can compute the mean, standard deviation, geometric growth rate, and arithmetic growth rate for time-series variables.

AVG: The AVG procedure computes and displays average industry ratios from a set of 30 predefined ratios.

GROUP: The GROUP procedure instructs FAS to aggregate all of the COMPUSTAT data items for the requested companies. This allows the user to create industry or composite type data.

INPUT: The INPUT procedure enables the user to merge non-COMPUSTAT data with data from the COMPUSTAT files. For example, economic data such as GNP, or additional company data can be read in and used in subsequent computations.

LIST: The LIST procedure instructs FAS to print all or part of the data for the requested companies in a tabular form. Through the use of the ITEMS and YEARS parameters, the user can select specific items or years. If neither ITEMS nor YEARS is specified, all items for the last ten years are printed in an organized data list format--all items grouped by type; i.e., income statement, balance sheet, etc.

OUTPUT: The OUTPUT procedure enables the user to write out, to any peripheral device, user specified data in a user specified format. For example, computed variables such as ratios along with COMPUSTAT data items could be written onto another file to be processed by other user software.

PLOT: The PLOT procedure produces a two-dimensional plot of two user specified variables. The number of rows can be controlled with a ROWS parameter up to a maximum of fifty rows.

PUNCH: The PUNCH procedure enables the user to write to an auxiliary device, an eighty column character record,--normally directed to a card punch. This procedure does not require a user specified format and is provided as a convenience to the non-programming user.

RATIOS: The RATIOS procedure is used to request the default set of 30 predefined financial ratios or a user specified subset. Liquidity ratios, asset ratios, efficiency-ratios, profitability ratios, and leverage ratios comprise the 30 predefined ratios.

RECORD: The RECORD procedure is similar to the PUNCH procedure; however, the data record is written in binary (via an unformatted FORTRAN WRITE).

REGR: The REGR procedure allows the user to estimate multiple regression models using ordinary least squares. The correlation matrix and related descriptive statistics can optionally be printed.

REPORT: The REPORT procedure is used to generate any one of three standard reports to display user specified data. Report layouts provide flexibility for the display of data for multiple years, data items, and companies.

SCREEN: The SCREEN procedure enables the user to select companies based upon user specified criteria. Examples would be selecting only those companies from an industry that had sales in specified years greater than a given amount, selecting companies that had a P/E ratio in the latest year greater than a user specified value.

STATEMENTS: The STATEMENTS procedure is used to generate income statements, balance sheets, and/or source and use of funds statements for specified years for the requested companies.

TITLE: The TITLE procedure permits the user to print an 80 character title at the top of each page of the FAS output.

TREND: The TREND procedure instructs FAS to prepare a trend analysis on a predefined set of variables or a user specified set of variables. The trend is estimated using ordinary least squares. Both a linear trend and compound growth rate model are estimated for the requested variables.

These procedures can be qualified for greater flexibility, through the use of keyword parameters. For example, YEARS is used to specify a specific year or years for time series variables.

In order to make effective use of FAS, the user must be familiar with the annual data record found on the industrial file(s). An individual company record contains the following information.

1. Industry Number
2. CUSIP Company Number (Issuer Code)
3. CUSIP Issue Number and Check Digit
4. File Identification Code
5. Exchange Listing and S&P Index Code
6. Industry Name (Alphabetic Field)
7. Company Name (Alphabetic Field)
8. Stock Ticker Symbol (Alphabetic Field)
9. Fiscal Year End Month of Data for Each of 20 Years
10. Data Year
11. Special Treatment Footnote Code for Each of 20 Years
12. Update Code (0,1,2 or 3)
13. Annual Footnotes. Data Array of 35 Footnotes for 20 Years
14. Data Array of 135 Items for 20 Years

FAS reads the entire record for each company requested. The user can address selected parts of this record through the use of reserved words. For example, the data matrix is accessed with the reserved word D. Thus, a specific item for a specific year would be D(2,75), indicating that the second data item for 1975 is desired for utilization in any of the respective procedures.

The ability of the user to display a significant portion of the data as well as many related relationships is best exemplified in the "default output." This output is a thirteen page listing, part of which is presented in Figure 1, and consists of the following:

A. Organized Data List. The organized data list contains all 135 data items plus 13 derived items for the last ten years.

B. Ratio Analysis. Here FAS computes 30 predefined ratios.

C. Trend Analysis. FAS computes least squares trend for a selected set of items and ratios.

Moreover, the user need provide only a request card (no procedure cards) to secure this default output.

The ability to organize this data via financial statements is an important part of any financial analysis. The user may easily generate financials with the (STATEMENTS) procedure. Industry composites, which would take days to collect and compute, are easily provided by AVG or user supplied COMPUTEs, GROUPs and SCREENs. This is a further indication of the flexibility of FAS.

For the user who wishes to undertake modeling applications, REGRESSION and TREND are available. REGRESSION, for instance, provides extensive distributional analysis for each parameter. In addition, the I/O capabilities afforded by RECORD, INPUT, and OUTPUT provide very easy access by FAS to foreign data or to make available COMPUSTAT data for processing by other software systems.

## EDUCATIONAL UTILITY OF FAS

In the academic community, the display, analytical modeling and I/O capabilities of FAS seem generally sufficient to make frequent and effective use of the COMPUSTAT data base. Although there is an increasing trend toward more available and up-to-date computer resources at the larger colleges and universities, this is not true in all instances. However, users of FAS would find it very desirable to have additional capabilities which include a prompting, conversational form for interactive use and extend FAS so that it could address the quarterly data files as well.

The increased availability and usability of software systems like FAS in concert with large data bases suggests that students with potential careers in business, particularly in accounting and finance, should indeed be exposed to this type of software and data. Recall that FAS is being utilized in commercial as well as academic circles. It is unlikely that any interest in the utilization of computer based methods will follow students into their careers unless they have been academically exposed. Moreover, the ever increasing utilization of both time-sharing and computer service vendors for data analysis, modeling and evaluation suggests a corresponding activity in the educational curriculum.

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INDUSTRY NAME: LUMBER & WOOD PRODUCTS  COMPANY NAME: BOISE CASCADE CORP  TICKER SYMBOL: BCC
INDUSTRY NUMBER: 2400  COMPANY NUMBER: 97383  CUSIP ISSUE NUMBER: 103
FILE CODE: PRIMARY INDUSTRIAL FILE AND S&P 425 INDEX
EXCHANGE LISTING AND S&P INDEX CODE: NYSE AND IN THE S&P 425 INDEX
*** FOOTNOTES ***  THERE ARE SPECIAL TREATMENT FOOTNOTES FOR THIS COMPANY
YEAR: 57
FOOTNOTE NUMBER: 3

# O R G A N I Z E D  D A T A  L I S T

*** BALANCE SHEET ITEMS - ASSETS ***

| YEAR | END OF FISCAL YEAR | 1 CASH MM$ | 2 RECEIVABLES MM$ | 67 RECEIVABLES (ESTIMATED DOUBTFUL) MM$ | 3 INVENTORIES MM$ | 76 RAW MATERIALS MM$ | 77 WORK IN PROCESS MM$ | 78 FINISHED GOODS MM$ |
|---|---|---|---|---|---|---|---|---|
| 67 | DECEMBER | 18.1000 | 88.0000 | .0001 | 97.9000 | .0001 | .0001 | .0001 |
| 68 | DECEMBER | 10.5000 | 95.7000 | .0001 | 112.2000 | .0001 | .0001 | .0001 |
| 69 | DECEMBER | 90.5430 | 228.4330 | 2.4720 | 161.3650 | 85.9370 | .0001 | .0001 |
| 70 | DECEMBER | 97.7530 | 219.9580 | 2.5660 | 167.3180 | 86.4990 | .0001 | .0001 |
| 71 | DECEMBER | 78.9410 | 214.8380 | 5.0300 | 194.9280 | 102.3640 | .0001 | .0001 |
| 72 | DECEMBER | 71.2670 | 170.1960 | 2.8750 | 180.4100 | 95.9560 | .0001 | .0001 |
| 73 | DECEMBER | 186.7510 | 141.4060 | 2.8000 | 195.7250 | 103.1230 | .0001 | .0001 |
| 74 | DECEMBER | 92.6720 | 129.7350 | 2.7810 | 248.6220 | 145.9480 | .0001 | .0001 |
| 75 | DECEMBER | 34.0710 | 140.0770 | 2.6090 | 261.8520 | 151.4610 | .0001 | .0001 |
| 76 | DECEMBER | 105.2860 | 204.6750 | 2.2330 | 313.3260 | 174.8370 | .0001 | .0001 |

| YEAR | 68 CURRENT ASSETS (OTHER) MM$ | 4 CURRENT ASSETS (TOTAL) MM$ | 7 PLANT-GROSS MM$ | 8 PLANT-NET MM$ | 73 CONSTRUCTION IN PROGRESS(NET) MM$ | 31 INVESTMENTS IN AND ADVANCES TO SUBS. MM$ | 32 INVESTMENTS IN AND ADVANCES TO OTHERS MM$ | 33 INTANGIBLES MM$ |
|---|---|---|---|---|---|---|---|---|
| 67 | .0000 | 204.0000 | 563.9000 | 403.3000 | .0001 | 11.2320 | 31.5730 | .0000 |
| 68 | .0000 | 218.4000 | 554.4000 | 363.4000 | .0001 | 48.8920 | 26.6970 | .0000 |
| 69 | .0000 | 480.3410 | 844.2820 | 560.7310 | .0000 | 81.2790 | 265.2600 | .0000 |
| 70 | .0000 | 485.0290 | 948.0570 | 641.4470 | .0000 | .0000 | 300.6570 | .0000 |
| 71 | .0000 | 488.7070 | 1040.7260 | 702.9410 | .0000 | .0000 | 271.2920 | .0000 |
| 72 | 83.4290 | 505.3020 | 907.4320 | 585.1830 | .0000 | 59.9660 | 159.1920 | .0000 |
| 73 | .0000 | 523.8820 | 891.2700 | 560.8240 | .0000 | 67.7850 | 84.3640 | .0000 |
| 74 | .0000 | 471.0290 | 1016.9840 | 655.5680 | .0000 | 76.8400 | 70.0050 | .0000 |
| 75 | .0000 | 436.0000 | 1169.1870 | 765.4240 | .0000 | 81.1290 | 58.0740 | .0000 |

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O R G A N I Z E D  R A T I O S  L I S T

LIQUIDITY RATIOS

| YEAR | FISCAL YEAR MONTH | 1 CURRENT RATIO | 2 ACID TEST RATIO | 3 CASH TURNOVER | 4 RECEIVABLE TURNOVER | 5 INVENTORY TURNOVER | 6 SALES-PER $ WORKING CAPITAL |
|---|---|---|---|---|---|---|---|
| 67 | DECEMBER | 1.6361 | .8509 | 42.4972 | 8.7409 | 7.8570 | 9.6980 |
| 68 | DECEMBER | 1.6012 | .7786 | 97.7619 | 10.7262 | 9.1488 | 12.5177 |
| 69 | DECEMBER | 1.5021 | .9975 | 19.0606 | 7.5550 | 10.6950 | 10.7480 |
| 70 | DECEMBER | 1.9295 | 1.2639 | 17.5632 | 7.8054 | 10.2611 | 7.3479 |
| 71 | DECEMBER | 1.6179 | .9726 | 22.6228 | 8.3126 | 9.1617 | 9.5681 |
| 72 | DECEMBER | 1.2754 | .6094 | 16.1491 | 6.7622 | 6.3794 | 10.5491 |
| 73 | DECEMBER | 1.6971 | 1.0630 | 7.0919 | 9.3661 | 6.7667 | 6.1548 |
| 74 | DECEMBER | 1.6533 | .7806 | 15.6849 | 11.2040 | 5.8464 | 7.8096 |
| 75 | DECEMBER | 1.4336 | .5726 | 42.7945 | 10.4089 | 5.5682 | 11.0570 |
| 76 | DECEMBER | 2.0917 | 1.0402 | 18.3456 | 9.4371 | 6.1646 | 5.9377 |

ASSET RATIOS

| YEAR | 7 CASH/ TOTAL ASSETS | 8 RECEIVABLES/ TOTAL ASSETS | 9 INVENTORY/ TOTAL ASSETS | 10 INTANGIBLES/ TOTAL ASSETS |
|---|---|---|---|---|
| 67 | .0209 | .1017 | .1132 | .0000 |
| 68 | .0102 | .0931 | .1092 | .0000 |
| 69 | .0456 | .1151 | .0813 | .0000 |
| 70 | .0431 | .0970 | .0738 | .0000 |
| 71 | .0360 | .0979 | .0888 | .0000 |
| 72 | .0400 | .0955 | .1012 | .0000 |
| 73 | .1178 | .0892 | .1235 | .0000 |
| 74 | .0588 | .0823 | .1578 | .0000 |
| 75 | .0217 | .0892 | .1668 | .0000 |
| 76 | .0608 | .1182 | .1810 | .0000 |

EFFICIENCY RATIOS

| YEAR | 11 EARNING POWER | 12 PROFIT MARGIN | 13 SALES TURNOVER |
|---|---|---|---|
| 67 | 5.7854 | 10.8450 | 1.5938 |
| 68 | 3.5224 | 12.3186 | 2.3046 |
| 69 | 4.2986 | 9.7230 | 2.3926 |
| 70 | 9.0431 | 5.6365 | 1.9619 |
| 71 | 154.4425 | .3225 | 2.0075 |
| 72 | 5.0584 | 11.9258 | 1.6577 |
| 73 | 3.7314 | 16.7025 | 1.7067 |
| 74 | 3.9143 | 14.7934 | 1.7269 |
| 75 | 5.9161 | 10.4022 | 1.6249 |
| 76 | 5.4249 | 11.7094 | 1.5743 |

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INDUSTRY NUMBER: 2400
COMPANY NAME: BOISE CASCADE CORP
COMPANY NUMBER: 97383
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CUSIP ISSUE NUMBER: 103

## PER SHARE DATA RATIOS

| YEAR | 25 PRICE/ EARNINGS | 26 DIVIDEND YIELD | 27 DIVIDEND PAYOUT | 28 CASH FLOW PER SHARE | 29 PRICE/ CASH FLOW | 30 COMMON STOCK HOLDER EQUITY |
|---|---|---|---|---|---|---|
| 67 | 20.6250 | .6109 | 10.4512 | 3.8056 | 10.0139 | 8.5828 |
| 68 | 27.2584 | .3823 | 7.7745 | 4.0041 | 15.2678 | 15.6083 |
| 69 | 29.5543 | .3226 | 19.4870 | 3.9126 | 18.7315 | 26.8567 |
| 70 | 39.8707 | .5405 | 21.1084 | 2.6756 | 16.9471 | 27.9915 |
| 71 | -15.6250 | 1.3333 | -20.5021 | .4305 | 43.5491 | 25.2637 |
| 72 | 8.6240 | 1.1236 | 9.7072 | 2.6574 | 4.1864 | 19.6538 |
| 73 | 4.7578 | .9164 | 4.3247 | 4.5345 | 3.0323 | 24.5731 |
| 74 | 2.9915 | 4.1619 | 12.4903 | 5.1615 | 2.0343 | 27.6864 |
| 75 | 10.9375 | 2.5905 | 28.3606 | 4.0708 | 5.8036 | 29.2575 |
| 76 | 10.1894 | 2.2662 | 23.1267 | 5.7536 | 5.8442 | 31.9029 |

## TREND ANALYSIS

THE DEPENDENT VARIABLES ARE REGRESSED OVER THE FOLLOWING YEARS: 67 68 69 70 71 72 73 74 75 76

### ESTIMATE OF LINEAR TREND MODEL Y=A+BT

| DEPENDENT VARIABLE (Y) | SLOPE (B) | Y INTERCEPT (A) | CORRELATION COEFFICIENT (R) |
|---|---|---|---|
| EARNINGS PER SHARE | .1539 | 1.1194 | .3433 |
| NET PROFIT TO COMMON | 7.0747 | 14.7961 | .5070 |
| NET SALES | 62.4744 | 1090.6586 | .5101 |
| DIVIDEND PER SHARE | .0481 | .0616 | .6885 |
| AVERAGE MARKET PRICE | -4.3592 | 56.9004 | -.6081 |
| BOOK VALUE PER SHARE | 1.6579 | 14.9501 | .7242 |
| CASH FLOW PER SHARE | .1610 | 2.8924 | .3232 |
| PE RATIO | -2.5580 | 27.9874 | -.4879 |

### ESTIMATE OF THE ANNUAL COMPOUND GROWTH MODEL $E_T = E_0(1+G)^T$

| GROWTH FACTOR (G) | Y INTERCEPT (A) | CORRELATION COEFFICIENT (R) | FIRST YEAR VALUE | LAST YEAR VALUE |
|---|---|---|---|---|
| .0001 | .0001 | .0001 | .0001 | .0001 |
| .0001 | .0001 | .0001 | .0001 | .0001 |
| .0539 | 6.9449 | .5521 | 1093.8603 | 1754.9557 |
| .1139 | -1.8818 | .5455 | .1697 | .4478 |
| -.1227 | 4.0052 | -.5679 | 48.1495 | 14.8233 |
| -.0908 | 2.6507 | .7057 | 15.4506 | 33.7766 |
| .0448 | .9299 | .1775 | 2.6479 | 3.9296 |
| .0001 | .0001 | .0001 | .0001 | .0001 |

## PROFITABILITY RATIOS

| YEAR | 14 RETURN ON COMMON EQUITY | 15 EARNINGS/ ASSETS | 16 EARNINGS/ SALES | 17 NET INCOME/ TOTAL ASSETS | 18 NET INCOME/ TOTAL INVESTED CAPITAL |
|---|---|---|---|---|---|
| 67 | 20.5938 | .0850 | .0956 | .0328 | .0490 |
| 68 | 15.2488 | .1152 | .1154 | .0442 | .0740 |
| 69 | 8.8631 | .0803 | .0923 | .0383 | .0605 |
| 70 | 3.9806 | .0453 | .0598 | .0156 | .0257 |
| 71 | -4.7531 | .0087 | .0107 | -.0169 | -.0286 |
| 72 | 6.5494 | .0734 | .1137 | .0226 | .0354 |
| 73 | 12.4200 | .1181 | .1413 | .0569 | .0828 |
| 74 | 12.6636 | .1190 | .1290 | .0658 | .0908 |
| 75 | 7.3933 | .0751 | .0808 | .0407 | .0538 |
| 76 | 10.3289 | .1073 | .0961 | .0562 | .0708 |

## LEVERAGE RATIOS

| YEAR | 19 LONG TERM DEBT/ TOTAL ASSETS | 20 LONG TERM DEBT/ INV. CAPITAL | 21 FIXED CHARGE COVERAGE | 22 CASH FLOW/ TOTAL DEBT | 23 WORKING CAPITAL/ TOTAL ASSETS | MKT. VALUE OF EQUITY/ TOTAL DEBT |
|---|---|---|---|---|---|---|
| 67 | .3620 | 54.0939 | 3.7673 | .1476 | .0917 | 1.4784 |
| 68 | .2459 | 41.1890 | 4.5827 | .2810 | .0798 | 4.2905 |
| 69 | .2000 | 31.2674 | 4.0494 | .2788 | .0809 | 5.2214 |
| 70 | .2152 | 35.0361 | 1.9206 | .1547 | .1030 | 2.6215 |
| 71 | .2310 | 38.5316 | .0304 | .0225 | .0851 | .9800 |
| 72 | .2936 | 45.5896 | 3.0583 | .1256 | .0612 | .5258 |
| 73 | .2268 | 32.7412 | 8.1275 | .3323 | .1357 | 1.0076 |
| 74 | .2028 | 27.8740 | 9.2500 | .4054 | .1181 | .8246 |
| 75 | .2043 | 26.9497 | 5.4526 | .3047 | .0840 | 1.7683 |
| 76 | .2475 | 31.1216 | 5.7599 | .3569 | .1879 | 2.0860 |

## FOOTNOTES

1. COMPUSTAT is a registered trademark of Standard and Poor's Compustat Services, Inc. and is used to represent a set of proprietary data products, produced and marketed by Standard and Poor's Compustat Services, Inc.

2. For a more extensive description, see Carl E. Ferguson and Warren G. Glimpse, Financial Analysis System - User's Guide, Management System Developments, Inc., 1978.

3. Reproduced from the FAS manual with permission.

## REFERENCES

Ferguson, Carl E. and Warren G. Glimpse. Financial Analysis System - A User's Guide. Management System Developments, Inc., 1978.