Abstract

Financial and accounting data (stock prices, market information, balance sheets) are widely available for a fee on most commercial networks (Compuserve, America on-line). Recent regulations have made much of the above data freely available on the Internet as well as through the modem. The electronic dissemination of information is enabling the average user to analyze data independently and make more informed investment decisions.

This paper introduces some fundamental theories and concepts of modern financial analysis. Where appropriate, SAS procedures to accomplish these analyses will also be presented. The paper concludes with a discussion on SAS/EIS® and its use in financial analysis. Sample EIS building methodology will also be presented.

Introduction

Ten years ago there were around 800 stock and bond mutual funds. Today there are more than 4000 funds and the numbers are increasing daily. While the explosion in mutual funds can be largely attributed to the pension system, economic environment and consumer fiscal awareness are increasingly playing major roles. Additionally, investment companies are offering products and services that require less than $2000 contribution, spurring many to invest for retirement or for college tuition for their children.

The stock market crash of 1987 clearly illustrates that the investment field is fraught with risk. The myriad opportunities from stocks, bonds and mutual funds demand thorough and constant analysis. This paper will not enable you to find the next super-stock or select your investment strategy. Instead, you will be able to better understand some of the numerous theories and concepts surrounding financial and investment analysis. The theoretical and analytical methodologies offered are not guaranteed to produce a favorable return on any investment. Hopefully, this paper will enable you to extend your understanding of investing. The paper will begin with some fundamental information on mutual funds followed by a discussion of bonds and U.S. Treasury securities. We will then at look at some theory on the analysis of common stocks and portfolios. SAS procedures to quantify the theories along with SAS/EIS methodologies to analyze your financial investments on a continuous basis will be presented. Where appropriate sources of free data and additional information are discussed.

Mutual Funds

Mutual funds are a pooling of investments that are professionally managed and sold as shares to the general public. Mutual funds are ideal for those investors that would prefer their investment to be professionally managed. Since the funds trade in large volumes they benefit from favorable transaction costs. Naturally, for providing this service mutual funds charge a management fee. Mutual funds provide diversification by investing in different securities or in many securities of the same kind. Diversification helps in reducing risk [Sharpe, 1981].

Mutual funds can be readily bought or sold in the market. If the funds are open-ended they can also be purchased directly from the fund. Today you can buy almost every kind of fund that you desire - including funds that deal in global investments, growth funds, short-term bond funds, index funds, income funds, gold funds, taxable and non-taxable funds.

Mutual funds may have charges other than management fees. Most of the fees are expressed in percentages. A front-end load is an initial sales fee for the right to participate in the purchase of shares. A portion of this fee goes to managing the fund but most of it goes toward sales commissions. A back-end load is generally charged when you sell your shares, and generally the percentage decreases over time. Many mutual funds are now resorting to an exit-fee to reduce the loss to remaining subscribers of the fund. A re-load fee is charged for re-investing your gains. A 12b-1 fee is used to pay for advertising, commissions and other expenses.

While performance is the key to investing in mutual funds, a thorough examination of the various fees is critical. Empirical research has illustrated that in general, load funds do not do better than no-load funds. Arguably, some load funds do a lot better than no-load funds during a certain time frame. You must ensure that the returns, after all expenses, have been consistently better over at least a 5 year term. Check management fees carefully. In the 1960's the average expense ratio at U.S. equity funds was 0.79%; specifically, stock-picking fees, salaries, and administration overhead amounted to 79 cents for every $100 invested. Today, expense ratios are nearly twice that level. Financial magazines and
journals advise against paying exorbitant costs when choosing a mutual fund. Guidelines include using the 1.5% rule as normal management fees for stock funds and 1% for bond funds. Also, look at the expense ratio history of the fund.

Morningstar is an excellent source of information on the performance of mutual funds. Among the various measures is benchmarking a fund's return with an index representative of the fund's class and objectives. Comparison of the fund's return with that of its peers is also made. Tax-adjusted returns are also calculated, denoting the impact of taxes on the fund. Risk of a fund is measured relative to other funds in its investment class. The Sharpe ratio which measures historical risk-adjusted performance is also calculated. The higher the ratio the better the fund's performance.

Bonds

Bonds are issued by corporations or governments generally in $1000 denominations. After their original issue, bonds may be bought or sold in the secondary (commercial) market at prevailing prices. Bonds are not redeemable before maturity unless, by the terms of their issue, they are callable. Bond interest is paid semi-annually based on its coupon rate. For example, if a $1000 bond was selling at a coupon of 6%, it will pay interest of $60 every year - $30 semi-annually - until it matures. A bond's current yield is its coupon rate divided by the prevailing market price. A bond's yield to maturity is higher since you receive the full $1000 redemption upon maturity. Generally, the longer the maturity period the greater the risk. The bond issuer may go broke or the interest rates might rise thereby decreasing the value of your bonds. You will find it very difficult to dispose of your bond if a newly issued bond similar to yours (6% coupon) has a coupon of 8% - paying $20 more in interest annually. Both Standard and Poor's and Moody regularly rate the numerous corporate and municipal bonds. A bond with Moody's rating of Aaa or Standard and Poor's AAA are considered to be of the best quality and extremely likely to pay both the principal and interest. Corporate bonds are taxable while treasury bonds are subject to federal tax but not local tax. Municipal bonds are generally free of federal and local taxes.

U.S. Treasury Securities

In addition to bonds, the Treasury issues bills and notes. The primary distinction between a bill, note, and bond is the length of time to maturity. Bills are short term obligations of one year or less. Notes are issued with a term of at least one year, but not more than ten years. Bonds are issued with terms greater than ten years. Bonds and notes pay semi-annual interest while bills are sold at a discount from their redemption value or par. Original issue Treasury securities may be bought at no fee or commission directly from Federal Reserve banks and branches or the Bureau of the Public Debt. Investors should complete a TREASURY DIRECT tender form. Generally, most individual investors make a non-competitive tender. Non-competitive bidders agree to pay the price equivalent to the weighted discount rate of accepted competitive tenders. Competitive bidders may have their tenders rejected or may pay a higher price for the security. Once issued, Treasury securities may be traded on commercial markets.

Return

Return is the standard way of measuring performance. If your investment reports a total return of 10% for the year, then every $1.00 invested at the beginning of the year is worth $1.10 by year's-end. Return consists of interest, dividends or other earnings and any change in the price of the security. Money market funds generally consist of interest earnings. Return on bonds includes change in bond prices and interest earnings. Return on stocks includes dividends and changing stock prices. Tax effects, commissions (buying and selling), sales loads, redemption fees, and other fees that are paid to acquire or divest an investment should be included in the equation for calculating return.

Historically the stock market has provided the best return on financial investments. For the period 1973-1993 small-company stocks provided an annualized return of 18.8% while large-company stocks provided 12.8%. During the same period long-term corporate bonds had a return of 10.2% while the return on intermediate-term U.S. government bonds and Treasury bills was 9.8% and 7.5% respectively.

Risk

Varying amounts of risk accompany investments. One weighs the expected returns and risk when making investment decisions. Each type of investment may also have one or more type of risk. Inflation risk poses a great threat to your investment. During your working career, you may have seen your annual income keep pace with - or stay ahead of - the rise in cost of living, enabling you to maintain your standard of living. Similarly, if your investment does not better - or at least keep up with - inflation, you may be in danger of seriously eroding its purchasing power. For example, the purchasing power of your $1000 investment after five years at an average rate of inflation of four percent would amount to $819 if your capital did not appreciate. The prospect of accelerating inflation hurts stock prices because investors will not pay as high a price for shares of a company if there is a chance inflation will erode future earnings and dividends.
Investing in bonds exposes one to interest rate risk as bond prices fluctuate with interest rates. For example, 20-year Treasury bonds issued in 1970 provided yields around 8 percent with the prime rate around 7.9 percent and inflation around 5.5 percent. By 1980 the prime rate was averaging 15 percent reflecting sharply the inflation rate of 12 percent. Those who purchased the 20-year bonds in 1970 would have had to sell them at a substantial loss to take advantage of the double-digit yields of 1980.

Currency risk is determined by fluctuations in the exchange rates of currencies. Multi-national companies’ earnings can be eroded if there is a downward trend in the currency prices. Market risk is that portion of the stock price associated with the movement of the market (for example the Dow Jones Index) as a whole. Nonmarket risk is that portion of price change unique to that particular stock. For example, if the outlook of the domestic economy is expected to improve, the stock prices of companies doing business at home would be expected to rise. Most empirical research considers the return on a 30 day U.S. Treasury bill a risk-free asset. In reality, there is nothing like a risk-free investment.

Evaluating Risk of Historical Stock Returns

To simplify calculations the paper will assume no tax consequences and no payment of fees to acquire or divest an investment. Thus the single-period return of a security for the ith stock for the tth period (\( R_{it} \)) can be calculated as Purchase price (\( P_{it-1} \)) minus Selling Price (\( P_{it} \)) plus any dividend (\( D_{it} \)) issued for the security divided by the purchase price.

\[
R_{it} = \frac{P_{it} - P_{it-1} + D_{it}}{P_{it-1}}
\]

Table 1 illustrates the daily returns of IBM's stock for the week December 06, 1993 - December 10, 1993. There is no return for December 06, 1993 as it is the reference point. No dividends were paid during this period. The return for December 09, 1993 is calculated as follows:

\[
(53.6250 - 53.8750) / (53.8750) = -0.0046
\]

Returns for the other days are similarly calculated.

The single-period returns can be easily calculated in SAS using the LAG function in a DATA step.

<table>
<thead>
<tr>
<th>Date</th>
<th>Closing Price</th>
<th>Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-Dec</td>
<td>53.7500</td>
<td></td>
</tr>
<tr>
<td>7-Dec</td>
<td>53.7500</td>
<td>0.0000</td>
</tr>
<tr>
<td>8-Dec</td>
<td>53.8750</td>
<td>0.0023</td>
</tr>
<tr>
<td>9-Dec</td>
<td>55.6250</td>
<td>-0.0046</td>
</tr>
<tr>
<td>10-Dec</td>
<td>55.2500</td>
<td>0.0303</td>
</tr>
</tbody>
</table>

It is essential that some thought be given to time periods. The graphs below illustrate the monthly (Figure 1) and daily (Figure 2) returns (obtained from Center for Research in Security Prices database) for IBM from January 01, 1990 - December 31, 1993. Although, we are looking at the same stock the daily returns graph looks less volatile than the monthly returns. Looking at the standard deviation of the daily returns versus the standard deviation of the monthly returns one would confirm the volatility of the monthly returns. If one were presented with only one of the graphs one could easily conclude incorrect risk levels.

Comparisons of securities should be made over identical time periods. For example the S&P 500 Index rose an annual average of 15.9% over a five-year period ending December 31, 1992. However, moving the time period back by four months to the five years ending August 31, 1992, the average annual return reduces to 8.3%. This time period includes the 1987 market crash.

Risk is generally measured by the probability of an outcome and its magnitude. Probability is estimated by measuring the difference between the actual outcome and the expected value. To predict growth rates or future values of stocks various statistical measures such as the mean, variance and standard deviation are used. Other statistical measures that are used to measure risk are covariance and correlation coefficient. The descriptive statistics can be calculated by using the MEANS procedure while correlations and covariances can be obtain using the CORR procedure in SAS.

The mean is the average of all returns for a given period of time. The variance is the most common measure of dispersion around the mean. It is obtained by squaring all the differences between the individual values and the mean. The results are then summed and divided by the number of values. The standard deviation is the square root of the variance. The smaller the standard deviation the less each return varies from the mean. Thus, the standard deviation is an estimate of the likely divergence of an actual amount from an expected amount. In the earlier example of misleading time periods - IBM daily returns risk appears lower than the risk levels.
of the monthly returns with the standard deviation for the
daily return being 0.0161 versus 0.0812 for the monthly
return.

Figure 1

IBM Monthly Returns

January 1990 - December 1993

Figure 2

IBM Daily Returns

January 1990 - December 1993

The co-movement of two random variables can
be summarized by the covariance statistic. The
covariance can be negative, positive, or zero. A positive
covariance indicates that the variables tend to move
together while a negative covariance indicates that the
variables tend to move in opposite directions. A zero
covariance indicates the movement of the variables is
unrelated. The degree of co-movement cannot be inferred
from the magnitude of the covariance since the
covariance term is influenced by the unit of measurement
used. The degree of co-movement reported should be
independent of the units of measurement of the two
variables. This measure is known as the correlation
coefficient. The values can range from -1 to +1 inclusive.
A perfect positive correlation is denoted by +1 while a
perfect negative correlation is denoted by -1. Zero states
that the variables are not correlated.

If the distribution of returns is constant and
future returns are expected to be similar to past returns
then a mean of the returns can be used to predict the
future returns. Similarly, if past growth trends are stable
then a growth rate is calculated and the returns are
predicted by extrapolating into the future. If the returns
have seasonal patterns or identifiable trends over time
then fitting a time series model to forecast future values
would be appropriate.

Portfolio Analysis

Assessing risk, and its relation to future returns
in quantitative measures is a challenging task. Adding to
the confusion are expectations of investors and varying
levels of risk the investors are willing to tolerate to
achieve their returns. Different stages in your investment
life cycle command different risk levels. If you have many
years before the age of retirement you may choose to
invest in securities that involve a large amount of risk but
may offer better long-term return potential. On the other
hand, if you are retiring within a few years you may not
want to take the risk of incurring sizable short term losses
and thus choose safer investments.

A common method of reducing risk is to
assemble a portfolio with different assets or securities.
You could diversify by purchasing stock in several
industries, or you could mix your investments - stocks,
bonds and money market instruments.

As illustrated in Table 2 the risk of a security is
measured in terms of its contribution of risk to the whole
portfolio rather than the individual total risk of each
security. If Ford's stock does not do as well as expected
the return of the portfolio will be marginally decreased. If
Exxon's stock does badly then the portfolio return will be
significantly reduced. An investor who simply wants the
greatest return would go only with the Exxon stock.
However, this amounts to putting all your eggs in one
basket. Maintaining a portfolio of diverse securities
reduces risk.

The expected portfolio return is calculated as
follows:

\[ R_p = \sum_{i=1}^{N} X_i R_i \]

Where \( R_p \) is the return of the portfolio, and \( X_i \) is
the proportion of the portfolio's value invested in security \( i \)
and \( R_i \) is the return on security \( i \). \( N \) is the number
of securities and \( \sum \) denotes summation, meaning that all
securities must be included in the total.

The expected holding period return for the
portfolio is 10.56%, which is a summation of the expected
return of each security multiplied by the proportion of the
portfolio's value invested in each of the securities.
Table 2

<table>
<thead>
<tr>
<th>Security</th>
<th>Number of Share</th>
<th>Current Price</th>
<th>Current Value</th>
<th>Proportion of Portfolio</th>
<th>Expected Future Value per share</th>
<th>Expected Future Value</th>
<th>Expected Return (%)</th>
<th>Portfolio Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM</td>
<td>100</td>
<td>70</td>
<td>$7,000</td>
<td>0.3889</td>
<td>$7.500</td>
<td>7.1429</td>
<td>2.7778</td>
<td></td>
</tr>
<tr>
<td>FORD</td>
<td>200</td>
<td>25</td>
<td>5,000</td>
<td>0.2778</td>
<td>5.400</td>
<td>8.0000</td>
<td>2.2222</td>
<td></td>
</tr>
<tr>
<td>EXXON</td>
<td>100</td>
<td>60</td>
<td>6,000</td>
<td>0.3333</td>
<td>7.000</td>
<td>16.6667</td>
<td>5.3333</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$18,000</td>
<td></td>
<td>$19,900</td>
<td></td>
<td>10.5556</td>
<td></td>
</tr>
</tbody>
</table>

The expected relative value of each security is obtained by dividing the expected future value of each share with the current price of that share. The result is subtracted from 1 and multiplied by 100 to obtain the expected return of each security \(100\left(1 - \frac{1}{3}\right)\). The portfolio contribution of each security is obtained by multiplying each security's proportional value of the portfolio with its expected return.

Efficient Portfolios

Since the 1950's there has been considerable empirical research in portfolio theories from Capital Asset Pricing Model (CAPM) to the Efficient Frontier of Portfolios. Using CAPM you can predict returns on assets, if returns on the market portfolio are known. The asset may be any financial investment that offers returns. The efficient frontier of portfolios developed by Harry Markowitz [1959] to evaluate any asset returns, is the set of portfolios that offers the greatest return for each level of risk. Risk was defined by Markowitz as the standard deviation of expected returns. The return of a stock is the arithmetic mean return. As we have seen earlier the portfolio return is the weighted returns of the individual stocks. He pointed out that simply holding different issues would not significantly reduce the variability of a portfolio's expected rate of return if the prices and expected earnings of these securities contained a high degree of covariance - that is, if the direction of prices, timing and magnitude were similar. Effective diversification is possible only if the portfolio has securities that do not fluctuate in a similar manner, so that the variability of the portfolio's return is significantly less than the variability of the individual securities of the portfolio. The efficient frontier model can be used for hundreds and thousands of assets. Since the Markowitz model is nonlinear you might have trouble solving some cases.

The SAS documentation *Stock Market Analysis Using the SAS System: Portfolio Selection and Evaluation, Version 6, First Edition* explains the various portfolio methodologies in excellent detail. SAS program code to analyze the various theories are also presented.

Financial Statement Analysis

The financial statement can be likened to a numerical model of the firm. Analyzing the statement should enable you to better understand the management and predict future earnings and growth. All companies whose stock is publicly held have to annually submit a 10K report to the Securities and Exchange Commission (SEC). In addition to the financial reports (balance sheet, income statement etc.) the 10K details other accounting information.

The balance sheet contains three main sections: assets, liabilities and equity. Assets are the money and the properties of the company, while liabilities are the debt the company owes. Equity is the difference between the assets and the liabilities. The income statement also called the profit and loss statement deals with the sales and expenses of the company and the resulting profit or loss.

One can request a copy of the 10K report directly from the company. Compustat and other commercial organizations can provide the same information for a fee. Since January 1, 1994, the 10K reports and other financial reports of many companies have been available on the Internet at no charge. The EDGAR project as it is called disseminates the information in plain ASCII or text files. For more information send mail to edgar@town.hall.org with "SEND edgar/general.txt" in the body of the mail message. If you have access to world wide web the Wharton URL "//www.wharton.upenn.edu/infonet.html" will point you to various types of business and financial information.

Analyzing the statement in full, looking at the footnotes (which should always be done) and accompanying text can be time-consuming if not daunting. Professional analysts begin with simple measures to assess complex relationships. For example, the analyst might look at the firm's probability of paying its short-term creditors with the amount of cash on hand.
The resulting ratio may be compared to the firm's industry and warrant further analysis if there are significant differences.

Ratios have been used since 300 B.C. However, the use of financial ratios started in the 1850's with widespread use in the 1890's [Horrigan, 1976]. When incorporated into statistical models, financial ratios have had better results in determining corporate 'failure' than 'success' (relative earnings per share) [Houghton, 1987]. Ratios should be used to get a better understanding of the financial statement of a company and comparing the firm to its peers or its industry. The Almanac of Business and Industrial Financial Ratios published annually by Prentice-Hall contains selected ratios and other financial information.

Listed below are a summary of widely used ratios:

Current: Current Assets divided by Current Liabilities. Indication of a company's ability to meet its current obligations. The Current Ratio should be 2 to 1 or higher.

Quick: Cash + Accounts Receivable divided by Total Current Liabilities. Indicates a company's ability to discharge its obligations without the necessity of selling inventories. Should be 1 to 1 or higher.

Liquidity: Cash divided by Current Liabilities. Also called the cash ratio. Determines the amount of cash or cash equivalents available to pay current liabilities. Liquidity ratio should be 0.40 to 1.

Working Capital to Sales: Current Assets - Current Liabilities divided by Sales. Indicates the sales generated from each dollar of working capital.

Debt to Equity: Total Liabilities divided by Total Stockholders Equity. Some debt is good but too much is dangerous. Most businesses stay below a 1 to 1 debt ratio.

Return on Equity: Net Income divided by Total Stockholder's equity. Generally, 0.14 to 1 ratio is good. However, the return on equity ratio should be compared to industry averages.

Return on Assets: Earnings before Income and Taxes (EBIT) divided by Total Assets. A good barometer of management - measures the firm's ability to utilize its assets.

Price to Earnings: Price divided by Earnings Per Share. Earnings per share is derived by dividing Net Income by Number of common shares participating in net income. The price to earnings (P/E) ratio is one of the common measurements of the value of a stock. It is generally reported in most newspapers that list stock information. The stocks that make up the Standard & Poor's 500 stock index sell for an average of about 16.8 times their earnings. It is essential that a firm's current P/E ratio be compared to the previous years, and to the P/Es of other firms in the same business.

Object-Oriented Technology

Executive Information Systems (EIS) which were originally designed for quick retrieval of information for senior executives, is now frequently utilized by the rest of the organization. Today's computing environment presents information with more graphics and text as opposed to the traditional way of supplying endless tabulations of figures. We are increasingly using the mouse rather than the keyboard to access information. Similarly, the paradigm of developing applications has shifted from writing discrete programs that accomplish a specific data processing task or series of tasks to encapsulation of related data and procedures into a new unit of software - the object. An object is a package of data and routines that perform specific functions. You define the data that the object will use and provide instructions on how the object should execute. Kindel [1993] likens an object to a time-release capsule. Just as those tiny pills know when to release their medication, the code inside an object knows how to do its job. The following example of charting current ratio of various industries may further illustrate the principle of objects. Conventional programming would call for repeatedly modifying the data and chart programs to reflect the changes necessary to graph the various industries. Using object-oriented programming, you would divide your application into several standard, interchangeable parts. You can modify, enhance or add to any part without affecting any other part. Thus, you would define an object that would chart data and another object that would obtain the data. Even if the data changes, the chart object does not need further modifications because its function is to chart regardless of the data's characteristics.

Some advantages of object-oriented technology include the reuse of objects whenever possible, development in a fraction of the time and cost of conventional methods and yielding higher-quality systems that have fewer bugs while offering better solutions to the problems they address. Object-oriented software is generally easier to modify and maintain than conventional software.

Investment analysis requires dynamic applications that respond quickly to constantly changing market and economic conditions. The EIS paradigm of fast retrieval of information both text and graphics is similar to what is required in investment applications.
Object-oriented technology aids by rapidly developing investment applications that respond to the vagaries of the financial market. Objects reduce the need for a major rewrite every time there is a change in the environment or analytical methods.

SAS/EIS

SAS/EIS provides an interactive application development environment that is useful for rapidly building applications for financial and statistical analysis, reporting, data management and graphics. The SAS/EIS application framework allows you to create your application and execute your application within the same environment.

SAS/EIS comes with its own set of pre-written objects that are ready to be used without any modification. The objects include business graphs, graphical menu builders, critical success factors, and forecasting. SAS provides over 500 icons to enhance the aesthetics of your application. Although, the default objects provide extensive functionality, you can extend the capabilities of your application by providing access to other SAS application development tools or software products.

SAS/EIS provides a predictable and easily documented mechanism for your applications by providing you with the necessary databases - metabase system, object database, and the application database. SAS/EIS provides the capability of developing customized objects or even modifying SAS supplied objects.

SAS/EIS provides the capability of converting existing applications into objects. However, the functionality of the applications must be generic. Applications that cannot function correctly in a wide variety of situations may not be ideal for conversion to objects.

Creating a SAS/EIS Application

SAS/EIS can be invoked by selecting GLOBALS from the menu bar of any display window and then selecting SAS/EIS. SAS/EIS can also be accessed through the SAS/ASSIST menu. Figure 3 illustrates the SAS/EIS main menu.

Applications allows you to execute your application or default applications provided by SAS. A metabase contains information about the datasets you intend to use in your various applications. It does not contain the dataset themselves. In turn, each metabase can be listed in a metalist. A metalist is a master list of metabases and the SAS datasets registered in each metabase. The Build EIS window enables you to display, test, execute and maintain the applications that you are creating. In the Object Manager you can add new objects or edit existing user-written objects.

Figure 3

Creating an application in SAS/EIS involves four main steps.

1. Registering your datasets and variables in the metabase. This includes assigning attributes to your variables. Attributes define what your variable is going to be used as - charting, forecasting or analysis.

2. Building the necessary applications that make up your EIS. In this step you define the type of application - executing a program, forecasting, or displaying a variance report. You can test your applications at all stages.

3. The next step involves linking the various applications to a common menu. Various icons can be defined to enable an user to click on the icon and execute the desired application. SAS allows you to fully test all your applications within the context of the menu.

4. The final step involves coding to enable your users to access the EIS, by issuing a one-word command to execute it.

Sample EIS

In this section we will create an application that incorporates some of the financial and investment theories presented earlier. We will build a menu that comprises of three objects - forecast, chart and execute a SAS program.

If you were unable to attend the presentation at SUGI 20 and would like the data necessary to create the sample EIS application, please contact me. The address can be found under the Author heading.
SAS/EIS requires that all data should be SAS datasets prior to using it in an application. We will be using three SAS datasets for our sample EIS application. For simplicity, the datasets contain only the variables that are used in the applications. The datasets are stored in the SASUSER library.

**RETURNS** - contains monthly stock returns from January 1976 to December 1986 for Consolidated Edison, Mobil and Texaco which have been obtained from the Center for Research in Securities Prices database. The variables are *date*, *edison*, *mobil* and *texaco*. The variables *edison*, *mobil* and *texaco* contain the monthly returns of their respective companies.

**RATIO** - contains annual current ratio for IBM, Hewlett Packard, Digital, and Compaq which were calculated from data obtained from Compustat. The variables are *cratio*, *compname* and *date*. The time period for the computing companies is 1983 to 1993.

**FEDRECS** - contains monthly U.S. Federal Government Receipts (Pankratz, 1991) from January 1976 to December 1987. A log transformation was applied to the receipts to stabilize the variance. The variables are *logrecs* and *date*.

### Register Datasets and Variables

The first task after you execute SAS/EIS is to register the information in the Metabase. Select **Metabase** from the SAS/EIS main menu. Select **Metalist** from the Metabase System menu. The first time you invoke SAS/EIS, a metalist named SASUSER.MLUSER and a metabase named SASUSER.MBUSER are automatically created.

Select the SASUSER.MLUSER metalist. Select **Edit** from the resulting popmenu. Select the SASUSER.MBUSER metabase. Select **Edit** from the resulting popmenu. Select **Add to register your datasets**. Select the above datasets from the resulting Directory window. A message window appears to indicate that default attributes such as variables' name, type and length are being assigned.

Select the **RATIO** dataset. Select **Registered variables** from the resulting menu. You should see a list of your variables in the RATIO dataset. Select **compname** and assign the DRILL attribute to the variable. Selecting DRILL enables you to drill down during the execution of the EIS to see a different subset of the data. The attributes that you can assign to a variable depend on whether the variable is numeric or character. A variable can have more than one attribute.

On returning select the remaining variables and assign attributes as follows: *date* - assign the date attribute. For *cratio* assign the actual and analysis attributes.

Assign attributes to the **fedrecs** dataset. Assign date attribute for the date variable and forecast attribute for logrecs.

### Building Applications

The next step is build the applications that make up your EIS. Return to SAS/EIS main menu by selecting Bookmark → SAS/EIS. Select **Build EIS**.

The Build EIS window appears with the default application database SASUSER.SASAPPL. The first application is a vertical bar chart to display the ratios of the computer companies. Select **Add → Business graphs**. Fill in the appropriate information. In the **Name** field type **Chart**. In the **Description** field enter Current Ratio: 1983-1993. Select **Data set** and choose SASUSER.RATIO. Select **Analysis variable** to specify the first-level drill-down variable. Enter **compname**. Make sure **Vertical bar chart** is selected as the type of chart. Select **Customize → Statistical options** to specify the statistic you want the chart bars to represent. Select **Mean** as the statistic to chart. The Analysis variable should automatically be *cratio* since it is the only variable registered with the analysis attribute. Test your application. You should see a chart displaying the current ratio of each of the computer companies. Select **OK** to return to the application database window.

The second application will be a simple forecasting application that uses the past data in the FEDRECS dataset to predict future federal receipts. The forecast module provides a quick and automatic way to generate forecasts for many time series in one step. You can select data points on the graph to display the corresponding data values, including forecast values. Select **Add → Forecasting**. In the **Name** field enter **forecast**. In the **Description** field enter U.S. Federal Receipts. Enter SASUSER.FEDRECS as the **Forecast data set** and logrecs as the **Forecast Variable** and date as the **Date Variable**. Click on **Forecast options**. Since the data is seasonal (most tax receipts are in April while business tends to submit them every quarterly) activate the **Seasonal data** button. Test your application. You should see a plot of Federal Receipts over time. Return to the application database window.

The third application is to execute a SAS program. The program generates covariance, means and correlation coefficients for the RETURNS data. Select **Add → Execute a SAS program**. In the **Name** field enter **Covar**. In the **Description** field enter Covariance, Correlations and Means. Enter the appropriate storage area for the SAS program - whether it is an external file name or a file reference. In this.
instance the program cov.sas is an external file name. Issue the full path of the program. Upon testing the object you should see an output window illustrating the various statistics requested in the program. Return to the application database window.

Linking an EIS

You can link all your applications with a menu by defining a desktop application using the graphics menu builder and incorporating SAS supplied icons.

Select Add ➔ Graphics menu builder. Enter EISMENU in the Name field and SUGI 20 in the Description field. Select Build and from the resulting menu select Actions ➔ Make ➔ Graphic Text. An outline of a box will appear. Move the box to the center of the window. Click on the outline when you are satisfied with the location. The Graphic Text Attributes window appears. In the Text box enter SAS/EIS DEMO. Select OK and return to the Build window.

To create an icon for the forecasting application select Actions ➔ Make ➔ Icon and move the outline to the desired location. In the Label field enter Forecast. A default SAS icon is displayed under Current Icon. Click once on the Current Icon to select a SAS supplied icon. Scroll down to the desired icon and click on it. The number should be displayed in the number field. Select OK to return. Select Target Application from the Additional Attributes window. Select EIS application ➔ Edit Value. In the Library field enter SASUSER, in the database field enter SASAPPL and enter Forecast in the Name field. The type will automatically come up as forecast. Select OK three times to return to the BUILD window.

Repeat the steps for the two applications defined earlier, namely Chart and Covar, and for an additional Exit application. For the Chart application select Chart as the type of application and for Covar select Execute as the type of application. For the Exit application select Exit Menu from the Target Application window instead of EIS application as you did with the earlier applications. Select OK twice and return to the BUILD window.

Select File from the action bar, and then select End from the resulting pull-down menu to return to the Graphics Menu Builder window.

Select Test to test the menu you just created. Click on the various icons to make sure it is the desired output. Figure 4 illustrates the completed menu. Select OK ➔ Goback to return to the Application Database window.

SAS/EIS can be executed by users through the SAS/EIS application framework or by including the command below in autoexec.sas.

```
dm 'runeis appl=sasuser.sasappl.eismenu.desktop' continue;
```

Figure 4

![SAS/EIS DEMO](image)

Conclusion

This paper has presented a basic theoretical foundation of financial and investment analysis. Since investing requires statistical, reporting, and visual analysis on a continuum, a discussion of object-oriented technology and the use of SAS/EIS to execute these analyses was also presented. SAS/EIS is an excellent tool to complement the other capabilities of SAS, specifically data management, statistics and graphics.
References


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Author

Paul J. Ratnaraj
Wharton Computing and Information Technology
The Wharton School
3620 Locust Walk
Philadelphia, PA 19104-6301
(215) 898-7602
e-mail: ratnaraj@wharton.upenn.edu