EQUITY RISK PREMIA AND CORPORATE PROFIT FORECASTS AROUND THE STOCK CRASH OF OCTOBER 1987

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ABSTRACT

This research examines a detailed time series of future aggregate profit forecasts. It seeks to determine whether the path of equity prices in the twelve month period surrounding the October 1987 crash could be justified by changes in the fundamental determinants of stock prices, i.e., the present value of expected future corporate profits. It does not address what caused the shifts in expectations of future corporate profits, but whether there was a sufficiently large change in these forecasts to justify the movement of stock prices.

The paper concludes that the rise and subsequent fall of stock prices in 1987 cannot be explained by discounting the mean or "consensus" level of future profit forecasts with a constant equity risk premium. It is determined that the required equity risk premium must have changed over three percentage points over the period to reconcile the consensus valuations with the actual time series of stock prices.

Two explanations are offered to explain the deviation of actual stock prices from the consensus valuation. The first analyzes whether changes in the required equity risk premium was correlated with the cross-sectional dispersion of the forecasts of future corporate profits. The second explanation, using a Lintner model of heterogeneously informed investors with a constant equity risk premium, examines whether changes in an index of investor "sentiment" could explain stock prices in 1987.

The study finds that both the one-year ahead dispersion of profit forecasts and the indicators of investor sentiment are independently significant in explaining the deviation between the S&P 500 Index and the consensus valuations of corporate equity during this period. Therefore one cannot reject the hypothesis that the stock market behavior during 1987 was accompanied by changes in the perceived risk of the future stream of corporate profits or shifting sentiment between those investors adhering to the optimistic and pessimistic profit forecasts. Changes in consensus valuations alone cannot explain the movements in the market.

I. Introduction

The stock market crash of October 19, 1987 was one of the most dramatic financial events in recent history. In six and one-half hours of trading, the S&P 500 Index fell by more than 20%, the greatest single-day decline in the history of the New York Stock Exchange. Despite the magnitude of this decline, economists have failed to find any events that could justify such a sudden fall in the valuation of corporate equity.[1]

This paper examines a detailed time series of future aggregate profit forecasts. It seeks to determine whether the path of equity prices in the twelve month period surrounding the October 1987 crash could be justified by changes in the fundamental determinants of stock prices, i.e., the present value of expected future corporate profits. The research does not address what caused the shifts in expectations of future corporate profits. Rather it examines whether there was a sufficiently large change in corporate profit forecasts to justify the movement of stock prices in 1987.

The research concludes that the rise and subsequent fall of stock prices in 1987 cannot be explained by discounting, with a constant equity risk premium, the mean, or "consensus" level of future profit forecasts. Two explanations are offered to explain this finding. The first derives the required equity risk premium needed to track the actual path of stock prices given the mean level of corporate profit forecasts. This premium, which fluctuates by more than three percentage points during the period, is then compared to the cross-section dispersion of the forecast data on future

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[1]For an analysis of triggering events for large stock market moves see Cutler, Poterba, and Summers (1989). An investor survey by Shiller (1987) also failed to uncover any fundamental causes of the crash. For a discussion of the proximate macroeconomic forces influencing the market around the crash see Brady (1988), Siegel (1988), and Meltzer (1988).

corporate profits. The second explanation examines a time series of an index of investor "sentiment" obtained from institutional investors and market newsletters. In the context of a Lintner (1969) model of heterogeneously informed investors, the paper examines whether shifts in investor sentiment between optimistic and pessimistic corporate profit forecasters can explain the movement of stock prices.

The one-year ahead dispersion of profit forecasts fell throughout early 1987 to its low point at the peak of the market in September, rose dramatically after the market crash, and then fell, irregularly, in the following months. An index of this dispersion is very significant in explaining the deviation between the S&P 500 Index and the consensus valuations during this period. Shifting investor sentiment is also shown to be significant during this period, but not as significant as the short-term dispersion of profits. Both the risk and sentiment indices are highly correlated during this period so that the individual contributions of each factor is not well-defined.

The plan of this paper is as follows. Section II computes the theoretical valuation of the S&P 500 Index based on survey data and analyzes the change in risk premia of stocks necessary for the actual path of stock prices to generate the consensus forecasts of future profits. Section III shows how the dispersion of forecasts of profit growth is correlated with movements of stock prices over this period. Section IV analyzes a theoretical valuation model of risky assets in the context of heterogeneously informed traders and computes an expectation variable used to capture changing numbers of "optimistic" and "pessimistic" investors. Section V offers some concluding comments.

II. Valuation of Stocks from Future Profit Forecasts

A. Sources and Description of Data

A time series forecast of corporate profits is taken from the Blue Chip Economic Indicators (BCEI). BCEI compiles monthly forecasts of macroeconomic variables from about 50 major financial, corporate, and forecasting firms. At the beginning of every month, each forecaster is asked to provide an estimate of the percentage change of a particularly macroeconomic variable over the next two calendar years. Twice each year, the forecasters are requested to provide percentage change forecasts for each of the next five years, and then an average annual rate of change for six to ten years ahead. The long-range forecasts are reported twice a year in the March and October Bulletins.[2]

In the Survey, corporate profits are defined as nominal pretax profits, including inventory valuation and capital consumption adjustments, as compiled by the Bureau of Economic Analysis (BEA).[3] The Consensus forecasts are the average of all forecasters. The High forecast is the average of the top ten forecasts and the Low forecast is the average of the bottom ten forecasts. The High and Low forecasts are therefore about the 90th and 10th percentile of ranked forecasts, respectively. Table 1 displays the Consensus, the High and Low estimates, and the standard deviation of the estimates of the growth rate for corporate profits, from April, 1987 through March, 1988. Table 1A displays the Consensus and High and Low estimates for the long-range forecasts surveyed in March and October of 1987, and March of 1988.

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[2]The Bulletins are dated on or about the tenth of each month. BCEI states that the survey is taken in the first few days of each month, so that the October, 1987 survey was taken well before the stock crash.

[3]Since the analysis in this section is based on the expected percentage change in future profits, there will be a difference in equity valuation based on before- and after-tax profits only if tax rates are expected to change.

Table 1 shows that prior to the crash, from March to October 1987, there was a small deterioration in the consensus outlook for the 1988 over 1987 estimate of the growth of corporate profits. However, Table 1A shows that over the same time period there was some increase in the longer-range forecast of profit growth. As will be shown below, the net effect of falling short-term profits growth and rising longer-term growth approximately cancelled out when determining the present value of these expected profits. These tables also demonstrate that over the same time period there was an increasingly optimistic forecast of corporate profits offered by the optimistic forecasters and an increasingly pessimistic forecast given by the pessimistic forecasters.

The crash, which first impacts in the November data, clearly influenced profit expectations. Since 1987 was nearly over, the 1987 profit forecasts changed very little, but, "pessimists," or the mean of the bottom 10 forecasters, dropped their forecasts of profit growth in 1988 from -0.3% in October to -10.1% in November. The consensus forecasters reduced their forecasts from 8.3% to 3% over the same period. "Optimists," on the mean of the top 10 forecasters, seemed to be least affected by the crash, lowering their 1988 over 1987 estimate of corporate profit growth by only three percentage points.[4]

Unfortunately, immediately after the crash there was no survey on the change in long-range profit forecasts. The next long-term forecast was conducted in March, 1988. It is apparent from Table 1, however, that the forecasts of profit growth in 1988 remained about the same level in March 1988 as they were in November, 1987, and far below the October level. The longer-range forecasts, however, changed little from just prior to the crash until

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[4]BCEI indicates that the change in most forecast variables was the largest in the 11-year history of the survey.

March 1988. In fact, the long-range consensus forecast after 1992 improved slightly from the previous October and the spread between the optimistic and pessimistic forecast shrunk from 5.3 to 3.8 percentage points.[5]

B. Valuation of Corporate Profit Forecasts

These profit forecasts permit the derivation of an index of stock prices based on the future expected corporate profits and the discount rate for equity. Specifically, the theoretical index of stock prices, P_t^* can be written as

$$(1) \qquad P_t^* = \sum_{i=1}^{\infty} \frac{k_t CP^e_{t+i} | I_t}{(1 + d_t)^i}$$

where CP^e_{t+i} is an index of expected corporate profits taken at time t for period t + i, based on the t-period information set, I_t; k_t is the percent of corporate profits remitted to the shareholders, and d_t is the discount rate on equity. The index CP^e_{t+i} is taken from the monthly BCEI surveys from April 1987 through March 1988. The expected growth of corporate profits after 1997 is taken to be identical to the average growth rate from 1992 through 1997.[6] The discount rate on equity, d_t can be expressed as

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[5]The record shows that corporate profits increased 10.0% from 1987 to 1988. This was slightly above the consensus forecast throughout most of the period (the January 1987 consensus was exactly on target) and vastly above the consensus levels after the crash. Ex Post the fact that the crash had negligible effect on the economy surprised most forecasters.

[6]Since the long-range forecasts are taken only twice per year, expected growth rates in intermediate months are calculated by straight line interporation, with one exception. After the crash, if the March 1988 forecast was below that in the previous October, the lower figure was used in the intermediate months. The rationale for this is that the stock crash immediately lowered profit estimates, and it was unlikely that the March 1988 figure would be below that of the previous November. Approximately the same empirical results were obtained if the interpolation was done by using the 1988 profit forecast as an instrument for estimating the intermediate months.

(2) $$d_t = i_t + ep_t ,$$

where i_t is the nominal interest rate and ep_t is the equity risk premium. Since the expectations for future corporate profit growth are reported in nominal terms, a nominal discount rate is appropriate for discounting these cash flows.

Equation (1) indicates that for a constant dividend remission rate, the theoretical valuation of stocks P_t^* will change when either (1) corporate profits change or (2) the discount rate changes. The discount rate will change when either interest rates or the equity risk premium changes.

The theoretical price indices for the S&P 500 Index are computed for three series of expected future profits: the consensus level, representing the mean expectation, and the "optimistic" and "pessimistic" level representing the mean of the ten highest and ten lowest forecasts.[7] The theoretical price based on the consensus forecast is normalized so that its mean equals actual mean of the S&P 500 index from April 1987 through March 1988.

For the purpose of computing these theoretical indices, the equity risk premium, ep_t, is set at a constant six percentage points above the nominal interest rate. This value approximates the long-run premium that equity holders have received over treasury bonds over the last sixty years. The results are not sensitive to the premium used. Section III.C analyzes the case of a variable risk premium, ep_t.

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[7]It is assumed that the optimistic (and pessimistic) forecasters for each period remained optimistic in the subsequent periods. To the extent this was not the case, the high and low valuations may represent higher than the 90th% percentile and lower than the 10th percentile, respectively.

The contribution of changing profitability forecasts and changing discount rates are displayed in Graphs 1-3. Chart 1 depicts the theoretical valuation of stocks, P_t^*, from April 1987 through March 1988 calculated for a constant discount rate viz. setting d_t = 14.3%, or 6% above mean long-term rates. This graph reflects only the changing expectations of future corporate profitability. Graph 2 displays the theoretical valuation of the S&P 500 Index by computing the equity discount rate where i_t equals the actual monthly series of 10-year constant maturity government bonds yields. Graph 3 sets i_t equal to the rate of interest on 90-day Treasury bills. All these valuations assume that the equity risk premium, ep_t, is constant.

Examination of Graph 1 reveals how little the theoretical price of stocks changed before and after the stock crash based on the consensus expectations of future corporate profits. The consensus estimate dropped by about 7% from October to November, and both the optimistic and pessimistic valuation by 11%. In contrast, the S&P 500 Index fell by about 28% over that month. It is clearly seen that the actual movements of the S&P 500 Index around the crash far exceeded the changes in the valuations of either the high, low, or consensus forecasters. The divergence between the optimistic and pessimistic valuation of stock is readily apparent before the crash. Furthermore, by March 1988, the optimistic forecasters valued stocks above their August, 1987 high, while the consensus forecast was only 4% lower. The S&P 500 Index, in contrast, was still more than 16% below its August peak.

The observation that neither the consensus, nor the pessimistic or optimistic forecasters of profit fundamentals justified the movement of the S&P 500 Index is strengthened by using a variable interest rate, i_t in Eq. (1). Because of the upward increase in interest rates before the crash, the theoretical valuation of equity prices based on the consensus profit forecast

fell sharply from 292 in April to 246 by October. In contrast, the optimistic forecasters continued to raise their profit forecasts to just about offset the increase in the discount rate prior to the crash. However, because interest rates dropped sharply right after the crash, the consensus valuation of stock prices in November despite the drop in forecasted profits, was actually above (by about 1/2 percent) that in October. This means that the decline in profit forecasts after the crash was matched almost exactly by the drop in interest rates.[8] By March, 1988, both the consensus, and particularly the optimistic forecasters, already valued equities at a level which exceeded the August, 1987 peak. Graph 3 displays the theoretical valuation of equity prices based on a constant equity premium above the 90-day treasury bill rate instead of the 10-year constant maturity government bond. The pattern of valuations is similar to those using the long-term government bond.

C. Changes in Risk Premium and Consensus" Stock Valuations

Another way of interpreting these forecasts is to derive the equity premium, ep_t, which, given the interest rate, i_t, will value the consensus forecast of profits to the actual level of the S&P 500 Index. This is given in Table 3. The equity premium (above the long-term government rate) falls from about 6%, the long-run average, in April, 1987, to about 4.5% in October, just prior to the crash. It then rises sharply to over 7.0% before decreasing to 6.58% in March, 1988. The same pattern is found by computing the equity premium off the short-term treasury bill rate.

It is open to question whether there could be a change in the risk premium on equity of almost 3 percentage points during this period. Some

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[8] A real business cycle model might suggest that the drop in interest rates was caused by the drop in the expected profitability of capital used by firms.

researchers, like Black (1988) claim the equity risk premium is indeed volatile.[9] It is conceivable that the nature of the 1982-87 bull market also contributed to the decline in perceived risk to equity. From August, 1982 through August 1987 the maximum decline in the S&P 500 Index was 13.2% (between October 1983 and June 1984). Data available on broad based stock indices from 1885 show that there is no other comparable five year period, even during the great bull market from 1924-29, where such a small correction in stock prices occurred. It is conceivable that investors significantly lowered their estimates of riskiness of stocks during 1987.[10] The sharp increase in the risk premium in November could be associated with the volatility which followed the stock market crash and is explored below.

Table 3 also shows the yield on Baa long-term corporate securities and the spread between the Baa bonds and long-term government bonds during the period. From October to November, the Baa-government bond spread increased by .59 percentage points while the derived equity risk premium increased by over 2.5 percentage points, over a four to one differential. It is yet to be determined whether this ratio is consistent with equilibrium models of security pricing.[11]

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[9]Also see Gennotte and Marsh (1988) on this subject.

[10]Mandelbrot (1966) had specified how "runs" in the market could change expectations.

[11]For some literature on the risk premia of corporate securities see Jones, Mason and Rosenfeld (1984) and Kim, Ramaswamy, and Sundaresan (1989).

III. Stock Valuation and the Dispersion of Profit Forecasts

A. Development of Risk Measures

In standard valuation models an increase in the uncertainty of the return of the risky asset will lower its price.[12] The degree to which the price of the risky asset falls depends on the aggregate risk aversion of investors.

This section develops two indices of changing fundamental risk and relaxes the assumption made in the above section that the variance of the return to the risky asset is invariant over time. The first index is the variance of the approximately 50 forecasts of the growth of corporate profits from 1987 to 1988. This index is derived from the standard deviation of corporate profits listed in Table 1.[13] The index, normalized so that the mean is set equal to 1 is shown in Table 6.

The second index is derived from the estimated standard deviation of the estimate of the valuation of equities. Unfortunately, individual data on the long-range forecasts given in Table 1A are not available, so that this index is estimated from data of the high, consensus, and low levels of the valuation of stocks. The standard deviation, and the standard deviation normalized by the level of the S&P 500 Index, are shown in Table 2. The normalized standard deviation, called Risk 2, is shown in Table 7.

Table 1 shows that the standard deviation of the forecasts of the growth of 1988 corporate profits decreased from April 1987 through October. In November, the standard deviation increased by 1.5 percentage points, or nearly

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[12]There are some models (see Abel ( )), where the risk-free rate is endogenous, where under certain conditions an increase in uncertainty can raise equity prices. We shall assume that those conditions do not apply.

[13]This assumes that the dispersion of the average investor's forecast is related to the dispersion across forecasters. See Zarnowitz and Lambros (1987).

30% from the October figures, taken just prior to the crash. From November 1987 through March 1988, the standard deviation dropped from 7.0% to 6.7%.

Table 2 reports the standard deviation of the valuation forecasts, based on the present value of future corporate profits estimates. In contrast to the one-year ahead standard deviation, the dispersion of the valuation of corporate profits increased markedly from April through October 1987, particularly when future profits are discounted at a constant rate. This corroborates the figures which indicated that the "optimistic" forecasters were becoming increasingly more optimistic, while the "pessimistic" forecasters were becoming increasingly more pessimistic about long-term future corporate profits through the market rise of 1987. The October crash increased the standard deviation of the valuation of profits relative to the S&P 500 Index in all cases, particularly when future profits are discounted at variable interest rates. As in the case of the standard deviation of year-ahead forecasts, this risk measure drops somewhat from November 1987 through March 1988.

B. Empirical Significance of Risk Measures

In order to test the significance of these risk measures in explaining the difference between the actual value of the S&P 500 Index (SP_t), and the Consensus valuation C_t, the following regressions are estimated:

$$(6) \qquad SP_t - C_t = \gamma_i R_t^i + \varepsilon_t \ , \quad i = 1, 2 \ .$$

R_t^1 represents that 1 year ahead risk measure, and R_t^2 represents the risk measure based on present value of the entire profile of future corporate profit estimates. The regressions were run for three cases: (1) d_t = constant, (2) d_t = 6% above long-term government rate, and (3) d_t = 6% above short-term government rate.

It can be seen from Table 5 that the first risk measure, based on year-ahead forecasts, is extremely significant (at the one-percent level) in all the equations. The second risk measure, based on long-term valuation is also significant at the 5% level but these regressions display far greater autocorrelation than those involving the other risk measure. As noted earlier the second risk variable is measured with much less precision than the first measure due to the lack of detailed data on long-range forecasts.

IV. Heterogeneous Expectations and Stock Valuations

A. Sentiment of Investors

Expectations about future returns on financial assets are marked by considerable heterogeneity. In this section it is assumed that those individuals who invest in the stock market may differ from those forecasters who estimate future corporate profits. Some, who include "uninformed" investors, are assumed to follow the "consensus" valuation of future corporate profits. But others, who believe themselves to be "informed," obtain information which causes them to identify with either the "optimistic" or "pessimistic" valuation of stocks. Over time, there may be shifts in the numbers in these groups which may account for some of the movement of security prices around the consensus valuation. Sharp shifts in investor sentiment around the 1987 crash are confirmed by survey evidence. Table 4 combines the results of two surveys. The first is institutional stock market sentiment from Decision-Makers Poll taken by Drexel Burnham Lambert. The second records the prevailing sentiment of investor newsletter collected by Chartcraft, Inc. Both of these surveys record the percentage of those investors surveyed which are either "bullish" or "bearish" about the equity market. The percentage that is neutral (neither bullish or bearish) are grouped as

consensus investors. The figures presented in Table 4 represent the average in each survey.[14]

It can be seen that bullish sentiment peaked and bearish sentiment bottomed at the market top in August, 1987. Bearish sentiment increased through October 1987 and the change in sentiment between October and November was one of the sharpest shifts noted in any of the surveys.

B. Valuation of Risky Assets under Heterogeneous Expectations

The valuation of risky assets under differential information was first analytically derived by Lintner (1967), and later extended by Grossman (1976) and Huang and Litzenberger (1988). The analytical details of the model analyzed in this manuscript are derived in the appendix. The basic structure of the model follows.

The economy consists of two periods, a risky and a riskless asset, and three groups of investors. The risky asset, x, has a return of mean m_x and variance σ_x^2. Two of the groups believe they have special information about the distribution of the risky asset and condition their estimate on this information. Group 1 has a "high" valuation of the mean return on the risky asset, m_1, and I term this group the "optimists." The other group has a "low" valuation of the mean return, m_2, and I term this group the "pessimists." Optimists and pessimists number n_1, and n_2, respectively. The third group is comprised of the rest of the investors, or "consensus," whose forecasts are uninformed.[15] Consensus investors base their estimate on the unconditional mean and variance of the distribution.[16]

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[14]The Drexel survey was taken approximately every two months, so that intermediate months were interpolated. Both surveys are highly correlated.

[15]For a rigorous analysis of the opinion groups, see Verrecchia (1979) and Varian (1987).

(continued)

Under these circumstances, the equilibrium price of the risky asset at time t, $P_{x,t}$ is derived in the Appendix (Eq. (A11)).

$$(3) \qquad P_{x,t} = m_{x,t} + \beta \left[\frac{n_{1,t}a_2(x_{1,t} - m_{x,t}) + n_{2,t}a_1(x_{2,t} - m_{x,t})}{n_{1,t}a_2 + n_{2,t}a_1}\right]$$

$$- \sigma^2_{x,t}(1 - \beta)\left(\frac{n_{1,t}}{a_1} + \frac{n_{2,t}}{a_2}\right)^{-1} .$$

The coefficients a_1 and a_2 are the constant absolute risk aversion of groups 1 and 2 respectively, and $0 < \beta < 1$, is the common degree of certainty by which each group holds it expectations of the return on the risky asset (defined in Eq. A7).

The above equation indicates that the equilibrium price of the risky asset is equal to the sum of (1) the unconditional mean of the price distribution of the risky asset, m_x, plus (2) a weighted average of the signals of each group multiplied by β, minus (3) a risk premium equal to the conditional variance of the distribution of the risky asset times the harmonic mean of the risk aversion of each group.

Several factors can cause the market valuation of the risky asset to differ from the consensus valuation, m_x. One factor is changes over time in the dispersion of fundamental uncertainty, σ^2_x, which has been examined in the previous section. Another involves shifting weights between "optimistic" and "pessimistic" valuations of the future stream of corporate profits which can be estimated by the changing number of investors who identify with each forecast. This method of determining the valuation of stock prices from profit forecasts is treated in the following section.

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[16] It is possible to assume the "consensus" group is a third informed group but this complicates the analysis and would not change the empirical results of the model.

C. Formation of Expectational Variable

In order to incorporate changing investor sentiment into the model, it is necessary to assume that the distribution of profit forecasts of investors may differ from that of the forecasters reported in Tables 1 and 1a. Under this assumption, the average equity valuation of investors at any given period of time may differ from the consensus valuation shown in Table 2. This clearly would not be a "rational expectation" equilibrium where the price of securities "homogenizes" the individual expectations of all investors.[17] However such an equilibria may be possible in a model where the large money managers may be subject to prevailing investor sentiment or psychology in their market which can only be justified on fundamental grounds by latching onto non-consensus fundamental forecasts.[18]

In order to implement changes in investor sentiment into Eq. (3), the variable $x_{1,t}$ is identified as the "optimistic" or "high" estimate of the valuation of the S&P 500 Index, and $x_{2,t}$ is identified with the low, or "pessimistic" valuation. Hence $x_{1,t} - m_{x,t}$ is interpreted as the difference between the high and consensus valuations and $x_{2,t} - m_{x,t}$ the difference between the low and consensus valuations. These valuations are taken from Table 2. $n_{1,t}$ and $n_{2,t}$ refer to the fraction of "bullish" and "bearish" investors at time t, taken from Table 4. In order to derive the second term on the right-hand-side of Eq. (3) it is assumed that the coefficient of risk aversion of Group 1 and Group 2 are set equal ($a_1 = a_2$) so that these coefficients drop out of the expression.

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[17]See Grossman (1976), Diamond and Verrecchia (1981) and Huang and Litzenberger (1988) on the subject of informationally efficient markets.

[18]These fundamental profit forecasters may not have sufficient wealth (or borrowing capability) to offset equity price movements which differ from the consensus.

uninformed.[15] Consensus investors base their estimate on the unconditional mean and variance of the distribution.[16]

Under these circumstances, the equilibrium price of the risky asset at time t, $P_{x,t}$ is derived in the Appendix (Eq. (A11)).

$$(3) \qquad P_{x,t} = m_{x,t} + \beta \left[\frac{n_{1,t}a_2(x_{1,t} - m_{x,t}) + n_{2,t}a_1(x_{2,t} - m_{x,t})}{n_{1,t}a_2 + n_{2,t}a_1}\right] - \sigma^2_{x,t}(1 - \beta)\left(\frac{n_{1,t}}{a_1} + \frac{n_{2,t}}{a_2}\right)^{-1} .$$

The coefficients a_1 and a_2 are the constant absolute risk aversion of groups 1 and 2 respectively, and $0 < \beta < 1$, is the common degree of certainty by which each group holds it expectations of the return on the risky asset (defined in Eq. A7).

The above equation indicates that the equilibrium price of the risky asset is equal to the sum of (1) the unconditional mean of the price distribution of the risky asset, m_x, plus (2) a weighted average of the signals of each group multiplied by β, minus (3) a risk premium equal to the conditional variance of the distribution of the risky asset times the harmonic mean of the risk aversion of each group.

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"pessimistic" valuations of the future stream of corporate profits which can be estimated by the changing number of investors who identify with each forecast. This method of determining the valuation of stock prices from profit forecasts is treated in the following section.

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[17]See Grossman (1976), Diamond and Verrecchia (1981) and Huang and Litzenberger (1988) on the subject of informationally efficient markets.

[18]These fundamental profit forecasters may not have sufficient wealth (or borrowing capability) to offset equity price movements which differ from the consensus.

The dependent variable estimated over the period from April 1987 through March 1988 is the difference between the actual S&P 500 Index, SP_t, and the consensus valuations, taken from Table 2. The independent expectational variable is a weighted average of the derivations of optimistic and pessimistic forecasts from the consensus forecasts. This expectational variable, denoted as E_t, is defined as

$$E_t \equiv \frac{n_{1,t}(H_t - C_t) + n_{2,t}(L_t - C_t)}{n_{1,t} + n_{2,t}} \tag{4}$$

where H_t is the High or "optimistic" valuation, L_t is the Low or "pessimistic" valuation, and C_t is the consensus valuation, as shown in Table 2. The first set of regression equations estimated are

$$SP_t - C_t = \beta E_t + \varepsilon_t \text{ .}^{19} \tag{5}$$

The regression results are shown in Table 5. The coefficient β is significant at the 1% level in all the regressions where it appears as a single regressor. The coefficient is estimated to be .437 in the case of a constant discount rate, .675 with a variable long-rate, and .575 with a variable short rate.

Graphs 4-5 display the fitted valuations of the S&P 500 Index, $\hat{SP}_t = C_t + \hat{\beta}E_t$, E_t, and the actual value of the S&P 500 Index. The fit is clearly best in the case where the discount rate is constant ($\bar{R}^2$ exceeds .75), but E_t clearly improves the fit even in the case where the discount rate is changing (and the $\bar{R}^2$ exceeds .50). The regressions tend to confirm that the sharp

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[19]The mean of the expectational variable, E_t, is set equal to zero to avoid any systematic biases in measuring "bullish" and "bearish" sentiment. Since the mean of the consensus valuation, C_t has by design been set equal to that of the S&P 500 Index, Eq. (5) is estimated without a constant term.

shift in sentiment from the optimistic to the pessimistic forecasters corresponded closely with the changing levels of stock prices.

D. Significance of both Risk and Expectations

In order to test the significance of both the expectational and risk measures, the following equations were estimated:

$$(6) \qquad SP_t - C_t = \beta E_t + \gamma_i R_t^i + \epsilon_t , \quad i = 1, 2 .$$

where R_t^i represents the risk measures defined in Section IV above. When either the risk measure and the expectational variable are included, each is significant only in the case of a constant discount rate. In the case of discounting at the long rate, neither variable is independently significant, only marginal significance is attained with the variable when discounted at the short rate.

Taken together, the risk and expectational variable have strong explanatory power in the regressions, particularly in the case of one-year ahead risk variable. The improvement in the fit is when the risk measure is added to the expectational variable is shown in Graphs 4 through 5.

The strong significance of the one-year ahead risk variable in explaining the movement of the S&P 500 Index can be seen by referring to Table 6. The first risk measure moved down as the stock market was rising from April 1987 through October, which coincided with the decline in the equity risk premium over the long-term treasury rate calculate in Table 3. When the market broke in October, the risk measure jumped, as did the computed equity risk premium. The subsequent recovery in the market was also accompanied by a reduction in year-ahead risk and the equity risk premium.

V. Summary

Examination of a disaggregated time series of corporate profit forecasts shows that the rise and subsequent fall of stock prices in 1987 cannot be explained by changes in a "consensus" forecast of future corporate profits. Two other fundamental factors are constructed: one, a measure of the riskiness of future corporate profits, and the second a measure of the shift of sentiment between "bullish" and "bearish" investors. Both measures independently significantly explain the stock market movements, with the risk measure being the most significant. When taken together, the correlation between these variables during the time period examined does not allow us to distinguish which is most significant in explaining the market movements.

The strong significance of the risk factor supports the hypothesis that changes in the equity risk premium can explain the movement of stock prices in 1987 and early 1988. However, the risk factor most strongly correlated is one that measures the dispersion of one-year ahead corporate profits. Measures, albeit based on less complete data, of the dispersion of long-range corporate profit growth does not explain the market as well as changes in the sentiment, or expectational variable.

It should be noted that neither of the factors developed can be construed as "casual" in explaining the stock market movements. The shift to a pessimistic profit outlook and the increase in the dispersion of short-term profit forecasts could be said to be a result of the market break that was precipitated by other factors. The decreased dispersion of short-term profit forecasts from April to October 1987 may have contributed to the market's upward movement by decreasing the equity risk premium. At the same time, the increase in the long-range dispersion of corporate profit growth have made the

market more vulnerable to any negative shocks. Until more data is analyzed, it is still impossible to explain on fundamental grounds why the market broke downward so suddenly in October, 1987.

APPENDIX

Consider a 2 period financial market containing one risky and one riskless asset. In the first period individuals trade assets and in period two they consume the assets and the economy ends. One share of the risky assets pays $\tilde{X}$ units of the consumption good in the final period, where $\tilde{X}$ is a normal random variable with mean m_x and variance σ_x^2. The riskless asset is in zero net supply and pays one unit of the single consumption good for sure at time 1, while the risky asset has a total supply of 1.

Assume there are two groups of investors, with n_1 investors in group 1 and n_2 investors in group 2. Every individual in each group has a utility function of consumption C displaying constant absolute risk aversion, a_i, of the form

$$U_i(C) = -\exp\{-a_i C\} \quad . \tag{A1}$$

The structure of individual information is as follows. All individuals agree on the mean and variance of the unconditional distribution of $\tilde{X}$. However, each group, through examining its own unique information, indicators, and models, forms an estimate x_i of $\tilde{X}$. The relation between the distribution of the underlying uncertainty of $\tilde{X}$ and that formed by group i can be expressed

$$\tilde{X}_i = \tilde{X} + \tilde{\varepsilon}_i \quad , \tag{A2}$$

where $\tilde{X}$ and $\tilde{\varepsilon}_i$ are mutually independent and normally distributed random variables with $E(\tilde{\varepsilon}_i) = 0$ and $\text{var}(\tilde{\varepsilon}_i) = \sigma_i^2$.

If x_i is the realization of $\tilde{X}_i$, and $\tilde{C}_i$ is random second period consumption (which equals wealth) then an individual in group i will perform the following maximization,

$$\max_{\theta_i} E\left[-\exp\{a_i \tilde{C}_i\} \middle| \tilde{X}_i = x_i\right] \tag{A3}$$

such that

$$\tilde{C}_i = (\bar{\theta}_i - \theta_i)P_x + \theta_i\tilde{X} \quad , \tag{A4}$$

where P_x is the price of the risky asset in the first period, $\bar{\theta}_i$ and θ_i are the endowment of, and desired number of individual i's risky shares, respectively. The price of the riskless asset in the first period is normalized to be unity.

The formation of individual signals of $\tilde{X}$, x_i, will in general change the mean and improve the estimate of the underlying distribution of $\tilde{X}$. The conditional estimate of the mean and variance of the distribution can be written

$$E(\tilde{X}|\tilde{X}_i = x_i) = m_x + \beta_{xy_i}(x_i - m_x) \quad , \tag{A5}$$

$$Var(\tilde{X}|\tilde{Y}_i = x_i) = \sigma_x^2(1 - \beta_{xy_i}) \tag{A6}$$

where

$$\beta_{xy_i} = \frac{\sigma_x^2}{\sigma_x^2 + \sigma_{\varepsilon_i}^2} \quad . \tag{A7}$$

To evaluate the equilibrium price of the risky asset, substitute (4) into (3) and take the expectation through the exponential to yield

$$E[-\exp\{a_i(\bar{\theta}_i - \theta_i)P_x + \theta_i\tilde{X}\}] = \tag{A8}$$

$$-\exp\{a_i(\bar{\theta}_i - \theta_i)P_x + \theta_i\, E(\tilde{X}|x_i) + \tfrac{1}{2}\, a_i^2\, \theta_i^2\, var(\tilde{X}|x_i)\} \quad .$$

Taking the derivative of (A8) with respect to θ_i and solving yields

$$\theta_i = \frac{E(\tilde{X}|x_i) - P_x}{a_i var(\tilde{X}|x_i)} \quad . \tag{A9}$$

By Walras Law, when the market for the risky asset clears, the market for the riskless asset also clears, we must have

$$\text{(A10)} \qquad \sum_i \theta_i = 1 \ .$$

If we assume that $\sigma^2_{\varepsilon_i}$ is equal across the two groups, and set β equal to the common β_{xy_i}, then the equilibrium price of the risky asset, S_x can be derived by substituting (A5) and (A6) into (A10) to equal

$$\text{(A11)} \quad P_x = m_x + \beta \left[\frac{n_1 a_2 (x_1 - m_x) + n_2 a_1 (x_2 - m_x)}{n_1 a_2 + n_2 a_1}\right] - \sigma_x^2 (1 - \beta)\left(\frac{n_1}{a_1} + \frac{n_2}{a_2}\right)^{-1} \ .$$

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Table 1

Expected Yearly Percentage Increase in Corporate Profits[1]

	Month of Survey											
	Apr 87	May 87	Jun 87	July 87	Aug 87	Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88
1987 over 1986												
High	19.1	18.8	18.5	18.1	17.5	16.5	17.7	16.5	16.4	--	--	--
Low	0.8	1.8	3.8	3.9	3.8	3.7	4.2	3.8	4.1	--	--	--
Consensus	9.3	10.5	11.0	11.6	10.4	9.6	10.0	9.2	9.7	--	--	--
High minus Low	18.3	17.0	14.7	14.2	13.7	13.0	13.5	12.7	12.3	--	--	--
Std. Dev.	6.6	6.2	5.4	5.1	5.1	5.0	5.2	4.9	4.6	--	--	--
1988 over 1987												
High	18.3	17.3	16.5	15.7	15.6	15.7	16.0	13.0	12.7	13.5	12.0	12.3
Low	2.5	0.8	0.0	-0.8	0.1	1.1	-0.3	-10.1	-9.0	-10.9	-9.4	-9.0
Consensus	10.0	8.9	8.1	7.2	8.2	8.5	8.3	3.0	3.4	2.9	2.9	2.9
High minus Low	15.8	16.5	16.5	16.5	15.5	14.6	16.3	23.1	21.7	24.4	21.4	21.3
Std. Dev.	5.8	6.1	6.0	6.0	5.6	5.3	5.5	7.0	6.9	7.1	6.7	6.7
1989 over 1988												
High	--	--	--	--	--	--	--	--	--	16.1	18.1	16.9
Low	--	--	--	--	--	--	--	--	--	-3.0	-1.3	-2.5
Consensus	--	--	--	--	--	--	--	--	--	5.6	6.4	5.9
High minus Low	--	--	--	--	--	--	--	--	--	19.1	19.4	19.4
Std. Dev.	--	--	--	--	--	--	--	--	--	7.4	7.3	6.8

[1]Current Dollar, Pretax Corporate Profits with Inventory Valuation Adjustment and Capital Consumption Allowance. Source: Blue Chip Economic Indicators.

Table 1A

Long-Range Expected Increase in Corporate Profits

	March 1987	October 1987	March 1988
1989 over 1988			
High	9.7	11.1	16.9
Low	2.6	-6.0	-2.5
Consensus	6.4	3.5	5.9
High minus Low	7.1	17.1	19.4
1990 over 1989			
High	9.3	13.5	11.9
Low	-1.3	-3.7	-7.9
Consensus	5.1	5.3	3.4
High minus Low	10.6	17.2	19.8
1991 over 1990			
High	8.7	17.6	13.8
Low	1.4	3.1	0.8
Consensus	5.7	10.2	7.8
High minus Low	7.3	14.5	13.0
1992 over 1991			
High	10.8	12.7	14.7
Low	5.4	4.3	3.0
Consensus	7.7	8.3	9.0
High minus Low	5.4	8.4	11.7
Annual 1992-97			
High	8.0	9.9	9.7
Low	5.9	4.6	5.9
Consensus	7.0	7.3	7.5
High minus Low	3.1	5.3	3.8

Table 2

Valuation of S&P 500 based on Corporate Profit Forecasts

	Month of Survey											
	Apr 87	May 87	Jun 87	July 87	Aug 87	Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88
Actual S&P Index	292.4	284.6	288.7	306.8	315.6	334.6	321.8	233.3	244.1	247.9	249.4	264.4
Discounted at Constant Rate												
High	444.9	470.1	503.8	531.8	571.6	617.4	682.7	609.1	617.4	598.7	602.6	613.8
Low	182.3	176.0	171.0	167.2	163.7	160.6	155.1	136.8	142.7	141.2	149.5	146.8
Consensus	281.9	284.5	286.6	287.3	289.0	289.8	292.6	271.3	276.9	272.1	275.9	275.8
Std. Dev.	102.5	114.7	129.8	142.3	159.1	178.2	205.8	184.3	185.2	178.5	176.7	182.2
Std. Dev./S&P	.350	.403	.450	.464	.504	.532	.640	.790	.759	.720	.709	.689
Discounted at 6% above Long Rate												
High	473.3	446.4	488.9	503.2	400.0	466.1	489.1	507.0	500.8	518.2	575.3	564.9
Low	206.3	187.2	186.7	182.2	173.6	160.7	154.7	144.8	148.5	149.8	165.9	159.7
Consensus	310.6	288.6	298.7	297.1	286.0	263.2	261.9	264.2	264.6	270.6	292.6	285.5
Std. Dev.	104.2	101.1	117.9	125.2	127.3	119.1	130.5	141.3	137.4	143.7	159.7	158.1
Std. Dev./S&P	.356	.355	.408	.408	.403	.356	.405	.606	.563	.580	.640	.598
Discounted at 6% above Short Rate												
High	448.9	454.8	493.1	528.8	528.3	511.5	518.7	540.2	531.8	522.0	569.0	586.0
Low	194.6	184.6	182.3	181.2	172.6	162.5	153.2	143.6	147.3	145.3	159.4	157.1
Consensus	293.7	288.6	295.5	301.7	290.9	274.3	265.8	269.0	269.0	265.8	283.6	285.5
Std. Dev.	99.2	105.4	121.3	135.6	138.8	136.1	142.6	154.7	150.0	147.0	159.8	107.3
Std. Dev./S&P	.339	.370	.420	.442	.440	.407	.443	.663	.614	.593	.641	.633

Table 3

Interest Rates
Equity Risk Premium

Month	Interest Rate[1] (%)			Equity Risk Premium[2] (%)		BAA — Long Government
	Short	Long	BAA	Short	Long	
April 1987	7.93	8.02	9.62	6.04	6.43	1.60
May 1987	8.11	8.61	10.37	6.09	6.10	1.76
June 1987	7.99	8.40	10.58	6.16	6.00	2.18
July 1987	7.86	8.45	10.43	5.89	5.81	1.98
August 1987	8.14	8.76	10.74	5.46	5.29	1.98
September 1987	8.57	9.42	10.82	4.68	4.28	1.40
October 1987	8.86	9.52	11.42	4.69	4.48	1.90
November 1987	8.23	8.86	11.35	7.07	7.04	2.49
December 1987	8.36	8.99	11.22	6.74	6.61	2.23
January 1988	8.31	8.67	11.24	6.52	6.68	2.57
February 1988	7.96	8.21	10.85	6.89	7.14	2.64
March 1988	7.91	8.37	10.56	6.48	6.58	2.19

[1]Long = 10 yr. constant Maturity Government Securities.

Short = 90 day Treasury Bills

BAA = BAA Corporate Securities

[2]Equity Risk Premium = Premium above government security rate so as to discount consensus valuation of future corporate profits to actual value of S&P 500 Index.

Table 4

Institutional and Investor Newsletter Sentiment in Stock Market (in percent)

Month	Bullish	Bearish	Neutral (Consensus)
April 1987	42.6	26.7	30.7
May 1987	40.2	27.1	32.7
June 1987	46.8	19.9	33.3
July 1987	51.5	19.8	28.7
August 1987	59.6	19.6	20.8
September 1987	49.3	24.5	26.2
October 1987	52.8	33.5	13.7
November 1987	25.7	42.4	31.9
December 1987	25.6	45.3	29.1
January 1988	27.6	48.2	24.2
February 1988	30.3	40.5	29.2
March 1988	39.7	32.8	27.5

Source: Average of Drexel Burnham Lambert Poll of Institutional Investors and Chartcraft Incorp. poll of Investment Newsletters.

Table 5
Regression Equations

$$SP_t - C_t = \beta E_t + \gamma_i R_t^i + \varepsilon_t \ , \quad i = 1, 2 \ .$$

Discounting Assumptions	*Independent Variables (Standard Error)* E_t	R_t^1	R_t^2	$\bar{R}^2$	*SEE*	*DW*
Discounted at Constant Rate $d_t = 14.3\%$	.437** (.075)			.754	13.31**	1.19
		-134.2** (11.65)		.923	7.46**	2.08
			-116.8** (40.81)	.427	20.41*	.809
	.138 (.059)	-103.5** (16.50)		.945	6.31**	3.05
	.370** (.050)		-74.8** (17.8)	.902	8.42**	2.14
Discounted at 6% Above Long Rate $d_t = 6\% + i_t$ i_t = *Long–Term Government Rate*	.675** (.195)			.521	24.95**	1.18
		-150.5** (33.4)		.649	21.36**	.968
			-215.1* (71.3)	.453	26.69*	.571
	.167 (.306)	-123.0 (61.1)		.625	22.08**	1.02
	.464 (.235)		117.8 (80.3)	.567	23.75**	.842
Discounted at 6% Above Short Rate $d_t = 6\% + i_t$, i_t = *Short–Term Government Rate*	.575** (.148)			.577	20.85**	1.24
		-143.9** (25.0)		.751	16.02**	1.14
			-117.3* (61.9)	.427	24.27*	.701
	.119 (.203)	-122.5* (44.6)		.735	16.52**	1.22
	.435* (.165)		-93.8 (59.0)	.629	19.54**	.99

** = significant at 1% level, * = significant at 5% level.

Table 6

Equity Premia and Risk Measures

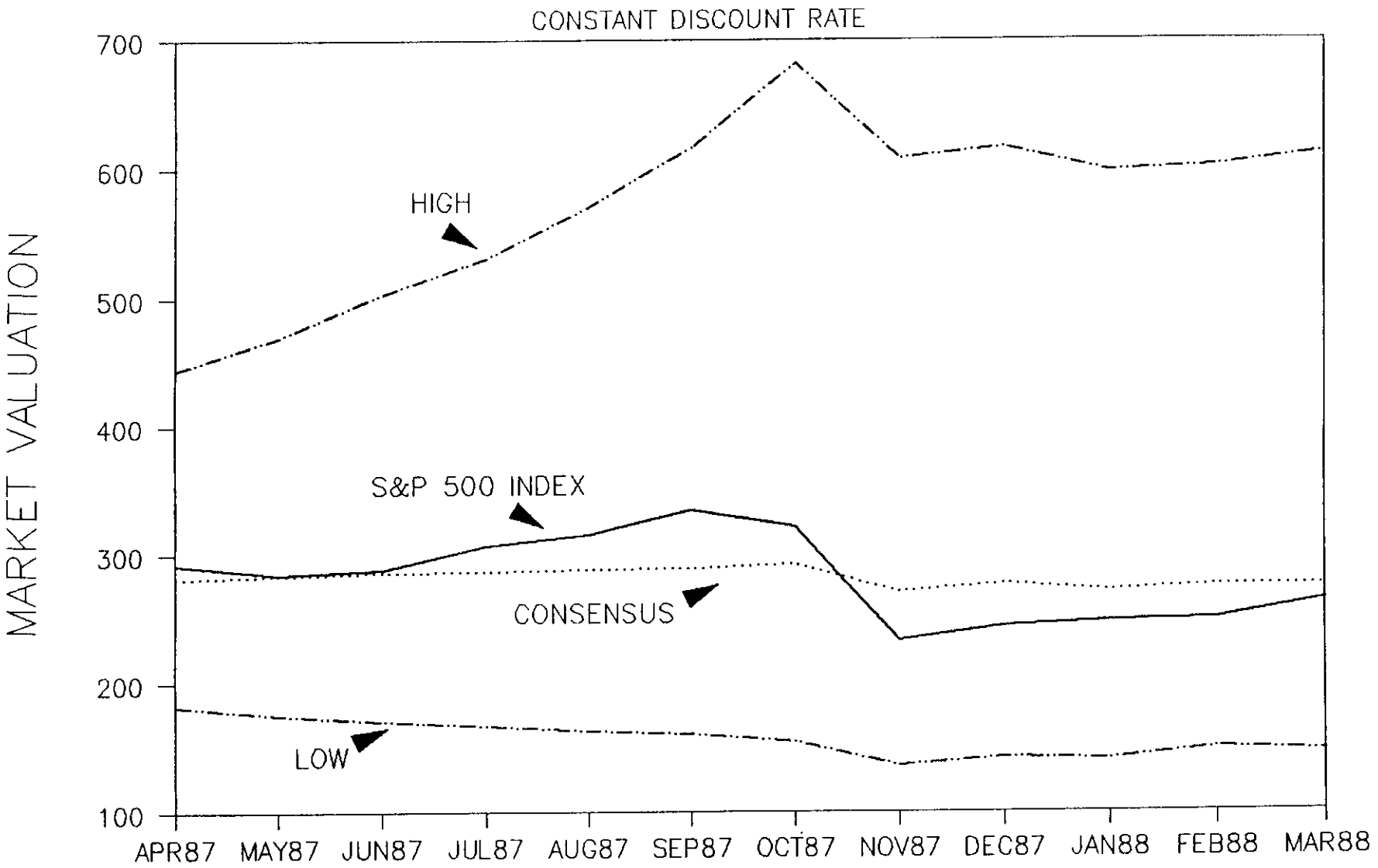
Date	S&P Index	Risk 1[1]	Risk 2[2]	Equity Premium[3]
April 1987	292.4	.851	.753	6.43%
May 1987	284.6	.953	.751	6.10%
June 1987	288.7	.932	.863	6.00%
July 1987	306.8	.911	.862	5.81%
August 1987	315.6	.809	.852	5.29%
September 1987	334.6	.736	.752	4.28%
October 1987	321.8	.789	.857	4.48%
November 1987	233.3	1.247	1.280	7.04%
December 1987	244.1	1.224	1.190	6.61%
January 1988	247.9	1.269	1.225	6.68%
February 1988	249.4	1.139	1.353	7.14%
March 1988	264.4	1.140	1.263	6.58%

[1]Index of Standard Deviation of one year ahead forecast (Mean Set = 1).

[2]Index of Standard Deviation/S&P Index for Long-Rate Valuation (Mean Set = 1).

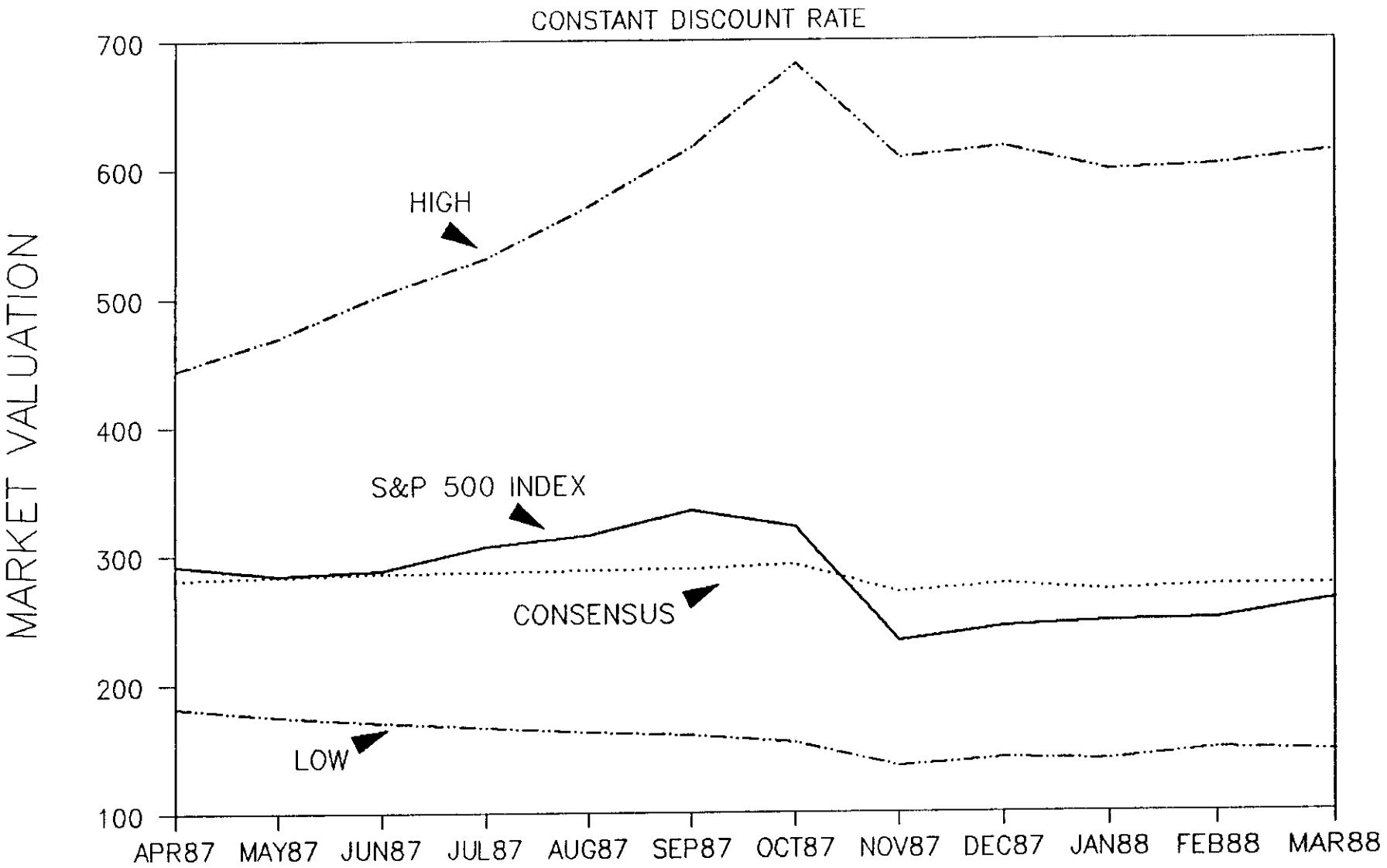
[3]Equity Risk Preimium from Long-Rate (from Table 3).

VALUATION OF CORPORATE PROFIT FORECASTS



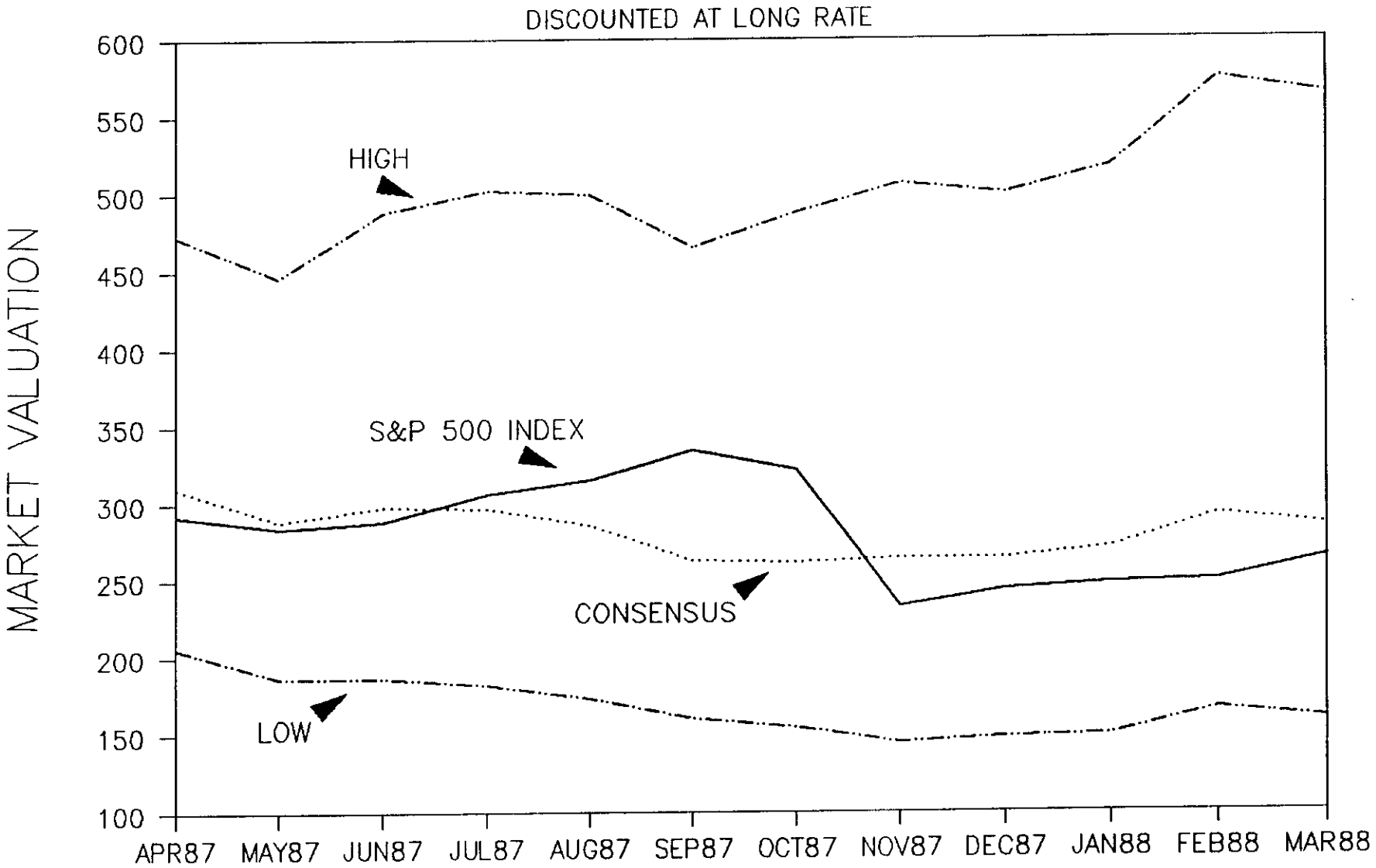
Graph 1

VALUATION OF CORPORATE PROFIT FORECASTS



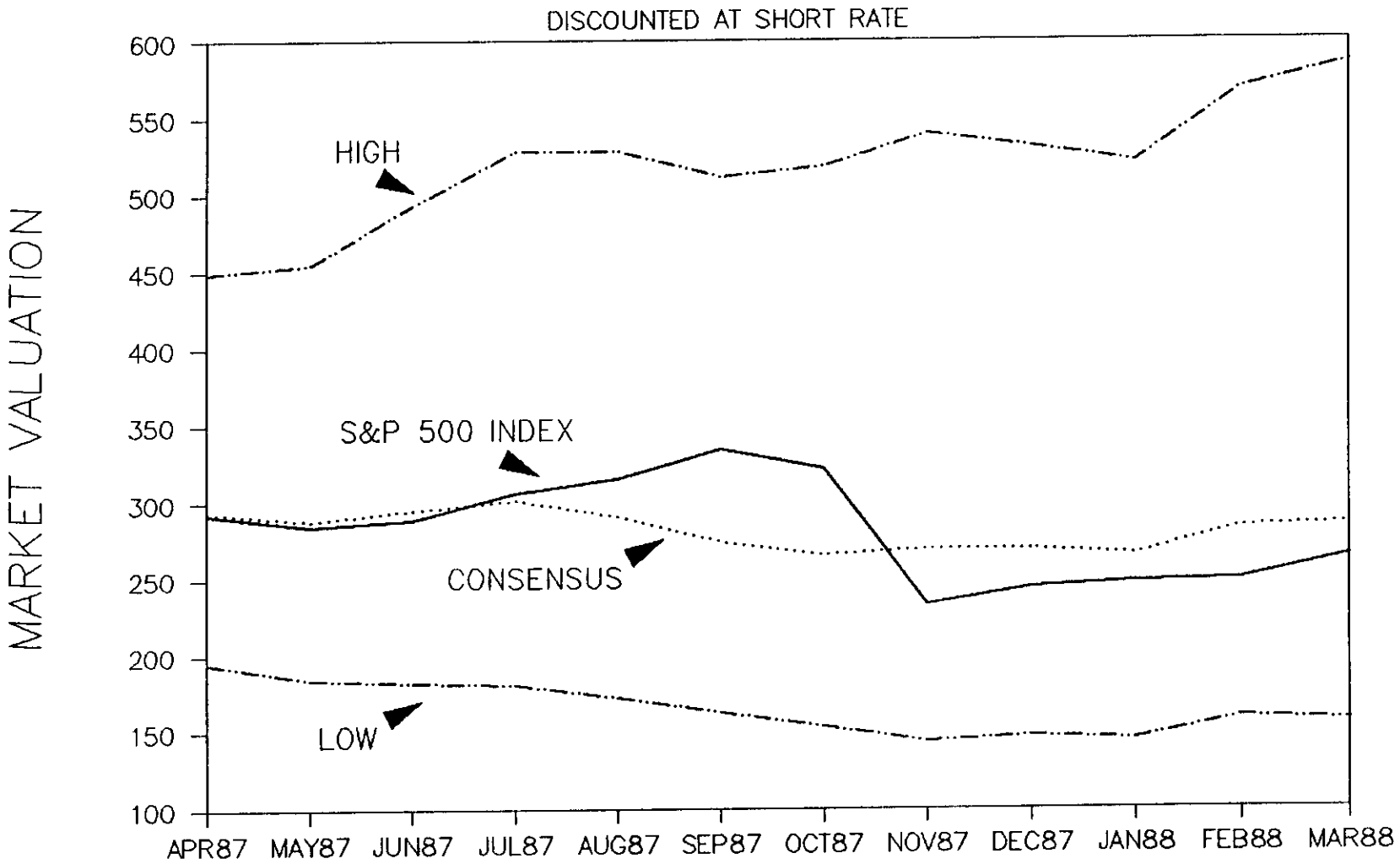
Graph 1

VALUATION OF CORPORATE PROFIT FORECASTS



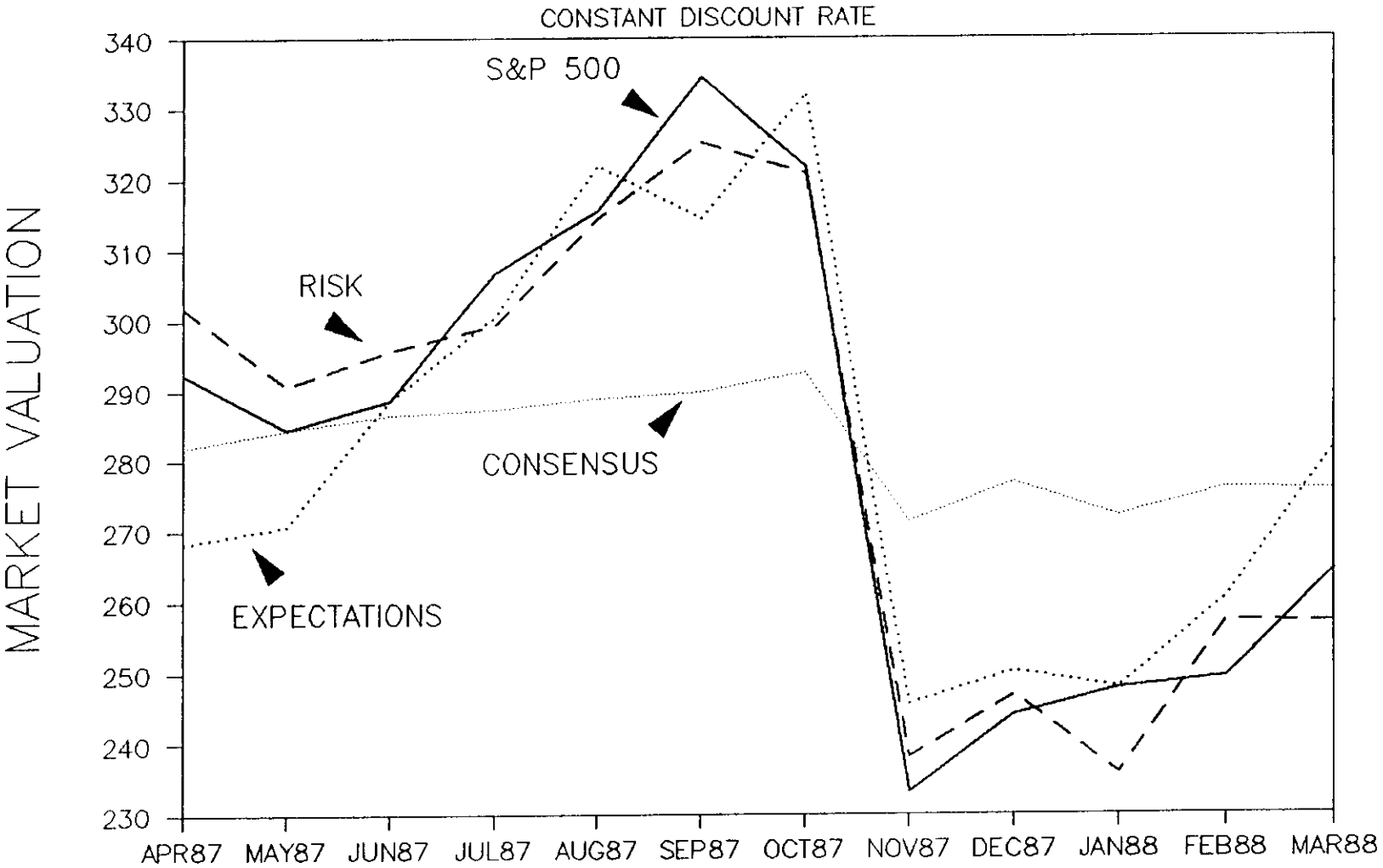
Graph 2

VALUATION OF CORPORATE PROFIT FORECASTS



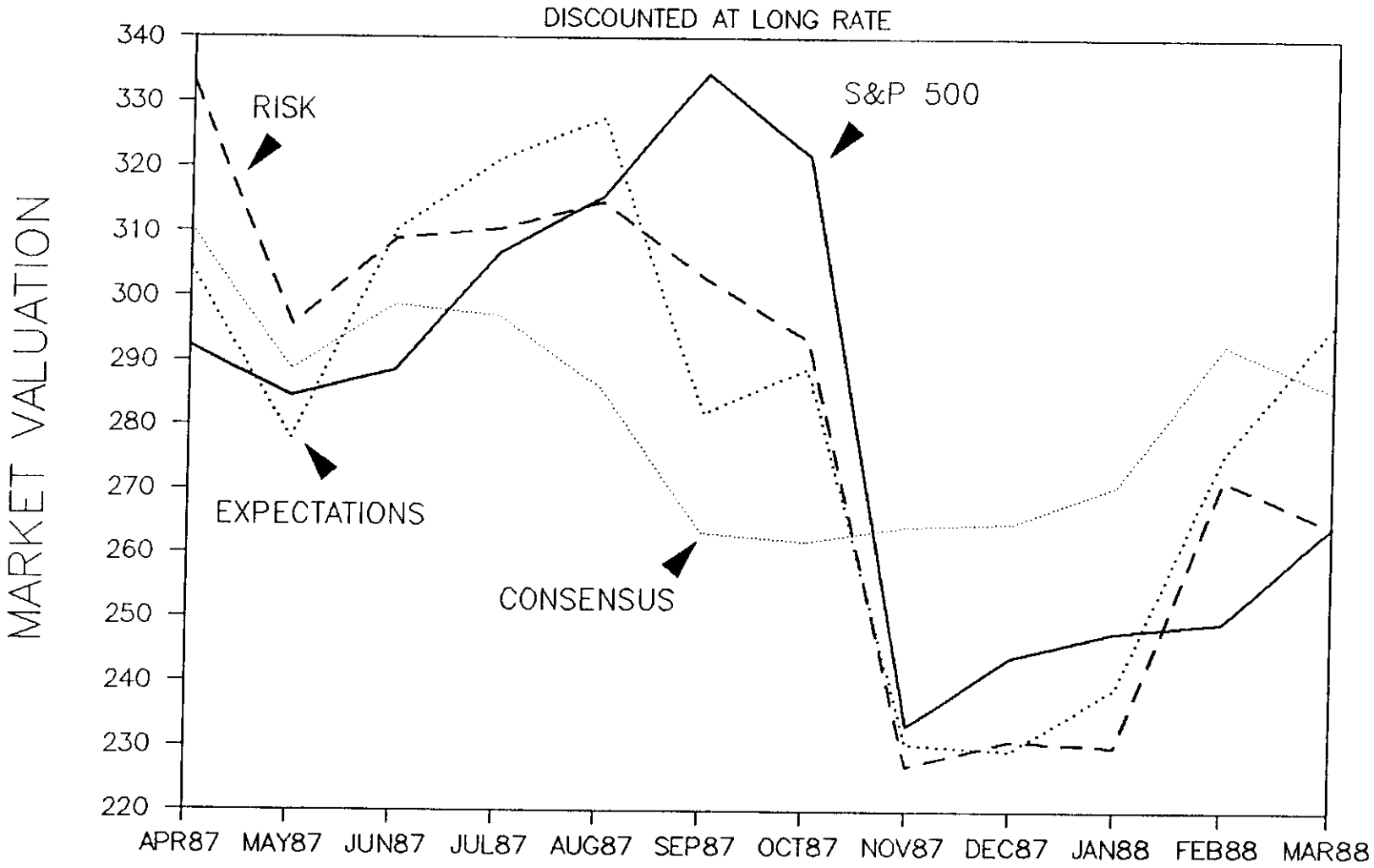
Graph 3

FITTED VALUATION OF PROFIT FORECASTS



Graph 4

FITTED VALUATION OF PROFIT FORECASTS



Graph 5