The Biggest Mistakes We Teach

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I. Introduction

When I started to teach at the University of Pennsylvania's Wharton School over twenty years ago, I used the very first edition of the Brealey and Myers' textbook. The book had some mistakes in it, as almost all books do. For example, the first two editions had an incorrect formula for the valuation of warrants. I taught the incorrect formula for several years before a perceptive student asked a question that exposed the mistake. But I don't want to dwell on technical errors. Instead, I want to focus on some of the conceptual mistakes that dominate the received body of wisdom in the academic finance profession.

II. The Relative Risk of Stocks and Bonds

Almost all finance textbooks prominently feature the historical returns provided by Ibbotson Associates. These numbers show that since 1926, stocks have produced higher average annual returns than bonds, and that stocks are riskier than bonds. This is consistent with equilibrium risk-return models. There are three problems with this evidence that stocks are riskier than bonds, however.

First, the use of annual holding periods. There is no theoretical reason why one year is the appropriate holding period. People are used to thinking of interest rates as a rate per year, so reporting annualized numbers makes it easy for people to focus on the numbers. But I can think of no reason other than convenience for the use of annual returns. If returns follow a random walk, then whether a one year holding period is used, or a shorter or longer period is used, makes no difference. But if there is mean reversion or mean aversion in the data, then the risk of one class of securities relative to another depends on the holding period.

Second, the use of arithmetic, rather than geometric returns. The relation between the arithmetic (simple) average and the geometric (compounded) average is given by the formula

$$r_{arith} = r_{geo} + 1/2\sigma^2$$

The higher is the variance rate, the larger will be the difference between the arithmetic and geometric returns. For stocks, the difference between the arithmetic and geometric averages is about 2% per year. For bonds, the difference is much smaller. As a result, the performance of stocks relative to bonds looks better when arithmetic averages are compared than when geometric averages are compared. Now, if stock and bond returns follow a random walk, the use of annual arithmetic returns is appropriate. But if there is mean reversion or mean aversion, then the use of arithmetic returns over longer time periods is not appropriate. With mean reversion, the multi-period arithmetic return will be closer to the geometric return.

Third, the use of nominal, rather than real returns. People are concerned about the consumption bundle that they can consume. The only reason that nominal returns, rather than real returns, should be reported in textbooks is simplicity. But this simplicity comes at a cost. If stocks are good short-term hedges against inflation, they could have a higher variance of nominal returns and yet offer a lower variance of real returns. In fact, stocks are bad short-term hedges against inflation. On theoretical grounds, it is the standard deviation of real returns that is relevant.

Figure 1 provides an updated version of Figure 2-4 in Jeremy Siegel's *Stocks for the Long Run*, showing the standard deviation of real returns for different holding periods, using data starting in 1802. For a one-year holding period, stocks are twice as risky as bonds. For holding periods of twenty or more years, however, stocks are less risky than bonds.

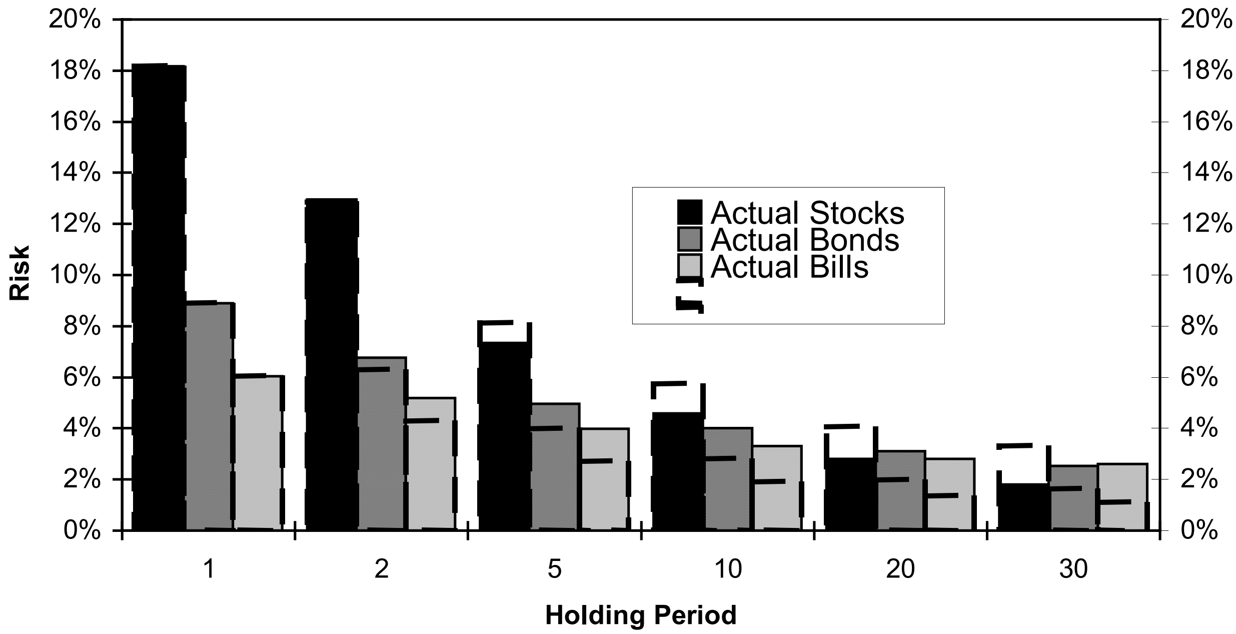

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Figure 1: The annualized standard deviation of compounded real holding-period returns from Janaury 1802 to September 2001. For example, a two-year buy-and-hold real return of 21% would have an annualized compounded real return of 10%. For the sample period, there are 199 overlapping two-year returns, from which 199 annualized numbers are calculated. The bars represent these actual standard deviations. The dashed bars represent what the standard deviations would be if the one-year standard deviations are divided by the square root of the holding period, which is the random walk assumption. This is an updated version of Figure 2-4 from Siegel (1998), supplied by Jeremy Siegel.

Why is this so? Well, although stocks are a bad hedge against inflation in the short-run, they are a good hedge against inflation over a longer period of time, such as five years. This pattern is a major contributor to the negative autocorrelation of real stock returns that exists over a five-year horizon. In other words, real stock returns show a tendency towards mean-reversion. This makes stocks less risky over a T-year holding period than would be suggested by multiplying the annual variance by T. If there is no mean reversion, the T-period variance of returns, σ^2_T, is equal to T times the variance of single-period returns, σ^2. If one uses monthly returns data, however, researchers generally find that $\sigma^2_T < T\sigma^2$ when using a market index when T is greater than 24 months.

I can think of another reason why real stock returns are negatively autocorrelated at three-to-five year horizons. If individuals put too much weight on recent evidence, then they will put more money into stocks after stocks have done well, pushing up the prices even further. Similarly, after stocks have done poorly, they will pull money out of stocks, depressing prices further. This is an example of the representativeness heuristic. People put too much weight on recent evidence. This is also known as the fallacy of small numbers.

In contrast to stocks, the real returns on nominal bonds show no tendency towards mean reversion. In fact, there is a slight tendency towards mean-aversion, making them more risky the longer the holding period. But the big risk with nominal bonds comes from a hyper-inflation. Fortunately, the U.S. has never had a hyper-inflation, but other countries have. In a hyper-inflation, stocks typically have negative real returns, but then recover, at least partially. Bonds get wiped out in real terms, and once this occurs, you can never recover.

Stocks are riskier than bonds for short holding periods. But it is not at all obvious that this is true for long holding periods, either historically or in the future.

III. Estimating the Future Equity Risk Premium

The equity risk premium is the difference in returns between stocks and safe assets, such as Treasury bills. There are three approaches to estimating the equity risk premium on a point-forward basis. The first approach is to extrapolate historical returns. The second approach is to use a theoretical model of what the equity premium should be, given plausible assumptions about risk aversion. The third approach is to use forward-looking information such as the current dividend yield and interest rates.

Many textbooks encourage students to use the historical arithmetic equity risk premium of 9% for computing the cost of equity capital. Ivo Welch's recent survey of financial economists indicates that most finance professors extrapolate the historical average, too, although many shade it down to about 7%, perhaps due to concerns about survivorship bias. The numbers that I am about to compute using forward-looking information suggest that 1% is a more defensible number.

Before doing so, let me point out how extrapolating historical numbers can result in numbers that are nonsensical. If one were estimating the equity risk premium for Japan at the end of 1989, using the historical data starting when the Japanese stock market reopened after World War II, one would produce an equity risk premium of more than 10%. But at the end of 1989, the Japanese economy was booming, corporate profits were high, and the market's price-earnings ratio was over 60. At the time, it was the conventional wisdom that the cost of equity capital for Japanese corporations was low. It *cannot* be the case that the cost of equity capital is low *and* the equity risk premium is high. But it *can* be the case that the historical equity premium is high, and the expected equity risk premium for the future is low.

If a theoretical model is used for what the equity risk premium should be, one comes up with a number in the vicinity of 2% if geometric returns are used, or 4% if arithmetic returns are used. This is the approach used by Mehra and Prescott (1985) in their famous paper.

The first forward-looking approach to estimate the future real return on equities is to look at the market's earnings yield. The earnings yield is just the reciprocal of the P/E ratio. Now, one must normalize earnings because earnings may be temporarily high or low due to business cycle effects. Historically, the earnings yield has averaged 7%. Not coincidentally, the average compounded real return on equities has averaged 7%. This historical average of 7% is composed of a dividend yield of 4.5% and a real capital gain of 2.5%.

Today, the earnings yield is in the vicinity of 4%, once one smoothes out business cycle effects. This generates a real return on equities, on a point-forward basis, of about 4%, which is below the historical average. The lower forecast today is because the P/E ratio is higher than the historical average of about 14. The higher P/E ratio today also results in a lower dividend yield. Today, the dividend yield is about 1.5%. The dividend yield is low both because the P/E ratio is high, and the payout ratio of dividends to earnings is relatively low. The dividend payout ratio is low partly because of the increase in share repurchases. Because of share repurchases, expected real capital gains have increased. But employee stock options have also become more popular, and this dilution partly offsets the effect of share repurchases. A 2.5% real capital gain per share plus a 1.5% dividend yield produces a 4% per year real return on equities.

The second forward-looking approach is to use the Gordon dividend growth model. Using this model, which is a rearrangement of the growing perpetuity formula $P_0 = Div_1/(r - g)$, one gets that

$$r = \text{the dividend yield} + g$$

where g is the growth rate of dividends per share. If the dividend yield stays constant over time, then the growth rate of dividends per share will be the same as the growth rate of the stock price.

What is a plausible estimate of g? If aggregate dividends grow at 2.5%, and the aggregate dividend/labor income ratio for the economy stays constant, this would imply that real labor income grows at 2.5%. If the population grows at 1%, this would imply that per capita income grows at 1.5% per year. This is equal to the historical average long-term growth rate of about 1.5% in developed countries, according to Prichett (1997). A 1.5% per year growth rate means that real per capita income will double every 47 years. If the net effect of share repurchases and option dilution adds 1% to per share growth, then a growth rate of real dividends per share of 2.5% can be justified. Adding a 1.5% dividend yield to this gives a 4% real return on equities in the future.

Since 1997, the U.S. Treasury has issued inflation-indexed bonds, commonly known as TIPS, for Treasury Inflation-Protected Securities. These bonds do offer protection against inflation risk. Many textbooks do not even acknowledge the existence of this important asset class.

The Ibbotson numbers show that the historical real return on bonds has been about 1%. But today, TIPs are yielding real returns of about 3.3%. If the expected real return on equities is 4% and the real return on inflation-indexed bonds is 3.3%, the equity risk premium is only 0.7%. In round numbers, 1%. The equity premium has gotten squeezed from the top (low future real returns on stocks) and the bottom (a higher real return on bonds).

I think that textbooks should present historical returns, but should focus on the Gordon dividend growth model for estimating the future equity risk premium. For predicting future dividend growth rates, all one has to do is assume an economy-wide growth rate and then assume that the ratio of labor income to capital income is a constant. Fama and French (2002) and Jagannathan, McGratton, and Scherbina (2000), among others, also adopt the Gordon dividend growth model framework and conclude that the equity risk premium is now in the vicinity of 1%, far below the historical average.

IV. The Fed Model

The so-called Fed Model states that the stock market is fairly valued when the earnings yield on stocks is equal to the interest rate on bonds. This model for valuing stocks is based on the empirical regularity that is illustrated in Figure 2.

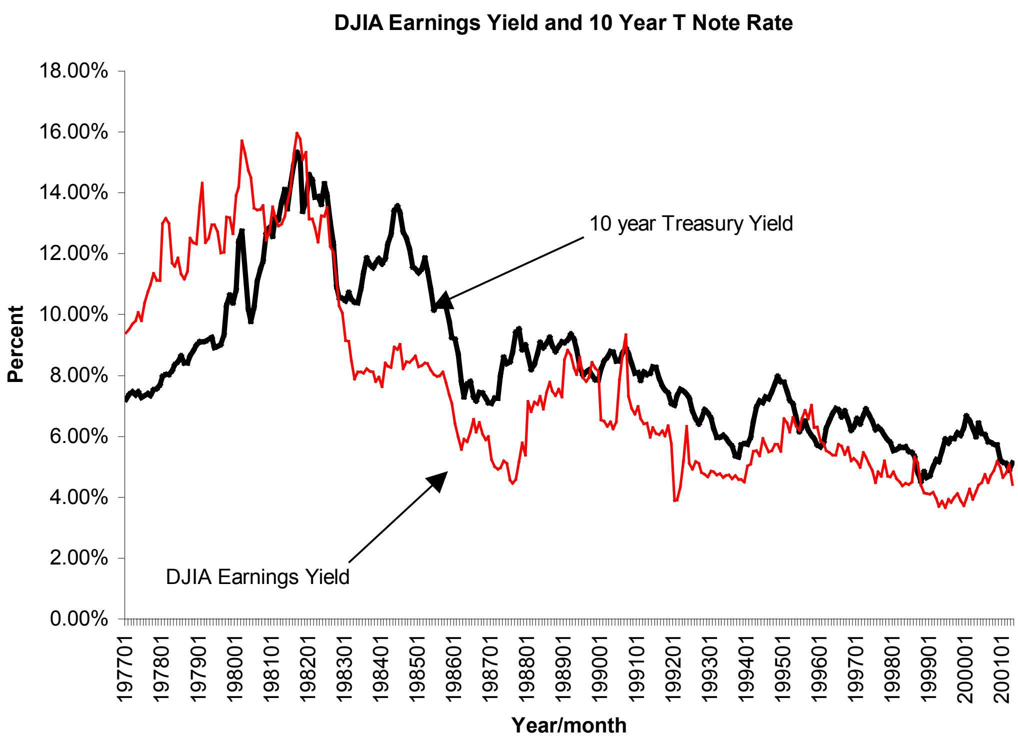

Figure 2: Monthly values of the earnings yield (last fiscal year's earnings) on the Dow Jones Industrial Average and the nominal yield on 10-year Treasury securities.

Empirically, this is a model that works very well. But on theoretical grounds, if most of the variation in nominal interest rates comes from changes in expected inflation rather than changes in real rates, the model should not work well. In fact, the strong positive correlation should theoretically be negative, in an efficient market. The logic was first pointed out by Modigliani and Cohn in their 1979 *FAJ* article, and is reiterated in my paper with Richard Warr in the March 2002 *JFQA*. The logic is that, for firms with debt in their capital structure, earnings are depressed by high nominal interest payments. The part of the nominal interest payment that goes to compensate bondholders for inflation reflects the decline in the real value of the liabilities of the firm. Accountants measure the cost to equityholders from the interest payments, but they don't measure the benefit to equityholders from the decline in the value of the firm's real liabilities. Thus, in an inflationary environment, accounting earnings underestimate the true economic earnings of a firm. Since accounting earnings are used to calculate the price-earning (P/E) ratio, the more economic earnings are understated, the higher should be the P/E ratio.

Now, inflation distorts accounting earnings in other ways, and the tax system is not inflation-neutral. But when Richard Warr and I adjust for these other effects, we conclude that the net impact is that P/E ratios should be higher, not lower, in periods of high inflation. This is exactly the opposite of the empirical evidence.

I think that there is a complacency in the profession. If we have an empirical pattern that is difficult to reconcile with theory, we shy away from saying that the market gets it wrong. Instead, we search for other explanations or just ignore the inconvenient facts.

The Fed model is typically not discussed in textbooks. But it is frequently discussed in the financial press, and there is never any discussion of why the empirical relation is inconsistent with rational valuation. Adjusted for business cycle effects, the earnings yield on stocks is an estimate of the expected real return on stocks.[1] The earnings yield is *not* an estimate of the expected *nominal* return on stocks. For the earnings yield to move one-for-one with the nominal bond yield, as the Fed model would have it, one has to assume that the nominal yield on bonds equals the real return on stocks. This is why the empirical success of the Fed model is inconsistent with rational valuation.

V. The Limits to Arbitrage and Market Efficiency

Securities markets in the United States are very good at getting the little things right. It is incredibly difficult to find high-frequency arbitrage opportunities that persist. But in my opinion, the profession has made a serious error in jumping to the conclusion that if the market gets the little things right, it must get the big things right. Low-frequency events are not amenable to formal statistical tests. By definition, they don't repeat themselves frequently. What makes it difficult to separate out overreactions that slowly correct themselves from rational time-variation in equilibrium expected returns is that the market gets overvalued when there are legitimate grounds for optimism, and undervalued when there are legitimate grounds for pessimism.

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[1] Note that every textbook points out that the earnings yield on a stock is not the cost of equity capital for the firm, because earnings growth rates for firms vary all over the map. But the economy's growth rate of earnings does not vary much over time, once one accounts for business cycle effects. So the "normalized" earnings yield on the market is a good estimate of the cost of equity capital, in real terms, for the market as a whole.

By low-frequency events, I am referring to things like the October 1987 stock market crash, the Japanese bubble of the 1980s, and the TMT (technology, media, and telecom) bubble of the late 1990s.

Market efficiency does not just mean the lack of arbitrage profits. Just because it is difficult to design and implement strategies that will reliably make positive risk-adjusted profits does not mean that large misvaluations are not common. As Shleifer and Vishny (1997) have pointed out, taking positions in misvalued securities is extremely risky. For instance, if one shorted overvalued Japanese stocks at the beginning of 1988, one would have lost substantial money over the next two years. An investor who did this might not have had any capital left when the bubble finally burst starting in January of 1990.

Similarly, money managers that bet against overvalued internet stocks in early 1999 suffered huge losses before the TMT bubble burst starting in March 2000. Few of these investors had any capital left in March 2000. As with the Japanese bubble, unless one had the foresight to avoid taking a position when the misvaluations were large, and wait until the misvaluations became very large, you would have been wiped out. Being right in the long run is no consolation if you have lost everything in the short run.

But I am hard-pressed to find a discussion along these lines in most textbooks. Instead, the evidence on high-frequency efficiency is typically fallaciously applied to assert that low-frequency inefficiencies won't exist.

VI. Dividend Policy

The chapter on dividend policy should be called payout policy. There are two distinct issues-- the form of payout, and the level of payout. In the days of M&M, these were pretty much one and the same. But since 1984, they have been very different. The typical textbook covers the Modigliani and Miller theorem, taxes, and signaling, and then at the end of the chapter adds a few paragraphs on share repurchases. Instead, I would suggest that the first half of the chapter should be devoted to what determines the level of cash payouts, and the second half should be devoted to the choice between share repurchases and dividends. The empirical evidence is that taxes are at best a second-order consideration in determining the form of payout. In particular, any tax-based model would predict that there should have been much more share repurchases prior to the 1986 tax reform act, because capital gains had been given preferential tax status. Shefrin and Statman's 1984 *Journal of Financial Economics* article giving behavioral reasons for cash dividends is barely mentioned, if it is mentioned at all, in most textbooks.

I suspect that if most of us were writing a textbook from scratch today, the chapter on payout policy would look very different than the one that appears in textbooks. There is a strong path-dependency involved. Even if a textbook author wants to make a major change, most professors don't want to have to revise their lecture notes.

VII. Lease Finance

Most textbooks cover leasing before they cover options. Many leases give the lessee the right to buy the item that they have leased at the end of the lease, at a fixed exercise price. This option is valuable. But most textbooks ignore it, because they haven't covered option pricing theory yet.

Similarly, most textbooks cover issuing equity before options are covered. Many of these textbooks cover rights offerings in their chapter on issuing equity or raising capital. But because they haven't covered options yet, they don't note that a right is just a warrant. So they don't give the correct formula for valuing a right that is not deep in the money.

The deferral of the options chapter until late in the book has other costs. In one prominent textbook (I won't mention names, to protect the guilty), convertible bonds are covered before option pricing is covered. The gyrations that the textbook has to go through are funny, except that students don't get the humor.

VIII. Conclusions

I've taken issue with the way we as a profession teach certain things, and the way that textbooks present them. These are some of my pet peeves. I'm sure that each of us could make up a list. But I have to concede that I find it a lot easier to criticize others than to do it right myself. I have no intention of writing a textbook. And even if I did, and got a lot of things right that other textbooks get wrong, I'm sure that I would introduce different mistakes.

About seven years ago I attended an NBER meeting where Michael Jensen was one of the speakers. Jensen received his Ph.D. from Chicago in 1968. I received my Ph.D. from Chicago in 1981, and by that time a number of Jensen's articles were on the reading lists. At the NBER meeting, Jensen said that he had come to realize that most of what he learned in graduate school was wrong. Well, I feel that way, too. Twenty years from now, I expect that my former doctoral students will be saying that a lot of what they learned in graduate school was wrong. I just wish that I knew now which things that I'm teaching are wrong, rather than having to wait twenty years to find out.

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