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THE MAGAZINE OF USENIX & SAGE

April 2003 • volume 28 • number 2

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### THE WORKPLACE

Swartz: Isn't That a Little Risky?

**USENIX & SAGE**

The Advanced Computing Systems Association &  
The System Administrators Guild

# isn't that a little risky?

In previous columns, I wrote that the best way to ensure that you retire in style is to create a financial plan that enables it. This means calculating your current income, taxes, expenses, and investments and estimating what these might be for the future you want to live. Since very few people can fund their retirement out of existing savings, almost all financial plans will rely on investments to grow over time to cover future requirements.

No matter what you do with the money you are saving for retirement, you are taking some risk. The risk may be due to corporate malfeasance, market fluctuation, inflation, interest rates, or world events. Whatever the risks, the key to good investing is to minimize the risks you take to get the return you need.

## Isn't Investing Just Like Gambling?

Given these risks, it is common to hear investing compared to gambling. While there are some striking similarities, such as making money and losing one's "investment," there are two important differences.

First, a gambling bet either pays off a specified amount or you forfeit your entire stake. If you win, you end up with a known amount more than you started with. If you lose, you're left with nothing.

An investment, on the other hand, is seldom an all-or-nothing affair. It is rare when an investment results in a total loss. Also, you don't know at the beginning how much you might get if you "win." What's more, there are lots of intermediate outcomes and you can cash in an investment, winner or loser, whenever you choose.

In addition, many stocks and bonds make periodic payments in the form of interest or dividends. Some investments are made primarily for these payouts. Dividends and interest also help cushion any downward movement in the value of these investments.

Second, the underlying probabilities of a specific bet can be calculated precisely. Because these probabilities identify *long-term* outcomes, a gambler relies on irregularities in the short-term distribution to achieve a "profit."

Investment prices, however, are based on market forces that can be estimated but not measured precisely. An investor relies on the belief that in the future the demand for a specific investment will outstrip its supply and the price will rise, be it a share of stock, the interest paid by a bond, or a piece of real estate. Unlike a dice game, where a die always has six sides, the marketplace is constantly undergoing change. It is not possible to say with any certainty what the price of an investment will be in the next few minutes, let alone months or years.

## Quantifying Risk

The probabilities associated with two six-sided dice are known, so a gambler is aware of the risks being taken when betting at a crap table. However, the risks of buying 100 shares of a company's stock or a \$1,000 bond are not quite so obvious. Since riskier investments, like chancier bets, carry a higher possibility of loss, it makes sense that they also should compensate by providing larger returns. But, without a way to quantify risk, it is impossible to know if an investment's risk justifies its return.

A great deal of theoretical work and data collection have been undertaken to define investment risk. For the most part, this effort has focused on defining equations that

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Ray Swartz ran his own computer training and consulting company for 20 years, until stepping away from gainful employment in 2000. Watching the stock market and his retirement portfolio move up and down like a yo-yo has given him a new appreciation of his tolerance for risk.

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statistically fit the data collected and assigning Greek letters to various coefficients in the results.

Since statistics are involved, some assumptions get made. This research assumes that the past accurately predicts the future and that variations in investment values are normally distributed. Data seem to support these.

In the end, two values have emerged to represent an investment. One is the investment's expected return, which is calculated as its average gain/loss over time. The second measurement is the investment's volatility: that is, how much its value varies, calculated by taking the standard deviation of the investment's gains/losses over time.

Simply knowing how much an investment's value varies is of limited use. More useful is comparing an investment's volatility with that of the overall market. This ratio is represented by the Greek letter beta ( $\beta$ ). A  $\beta$  of 1.0 means that a stock investment is as volatile as an underlying index (a 5% move in the index would mean a 5% move in this stock). A  $\beta$  of 2.0 means the stock's price moves twice as much as the index. An investment with a  $\beta$  of 0.5 would move half as much as the market. A company's  $\beta$  is considered a measure of its risk.

Two stocks offering the same expected return at the same  $\beta$  could be considered equivalent investments (though other factors would go into such a determination). Investments might offer the same expected return but have different betas, or the same  $\beta$ s but different returns. A higher  $\beta$  means that an investment's value will move around more than one with a lower  $\beta$ .

Suppose your financial plan calls for a return of 8.25% on your retirement assets. Knowing the return you need allows you to select how much risk you want to take in order to get it. Let's say that the market's 50-year average return is 9.5% (it isn't). Since you only need an 8.25% return, you could seek investments with  $\beta$ s of less than 1.0 and have a portfolio with less volatility than the overall market.

You might also devise a strategy that combines investments of different risk levels to further reduce the overall risk of your portfolio. For example, you might combine some government bonds with a return of, say, 6.0% with a market index fund to achieve your 8.25% return.  $\beta$ s for individual stocks and mutual funds are readily available from investment counselors (another source is <http://www.morningstar.com>).

### Different Kinds of Risk

Total investment risk is a combination of different risks all acting together to create volatility. There are many reasons why investment values go up and down: A company is going through good or bad times (company risk); a company's industry is having a hard time, and all companies in that industry are affected (industry risk); the entire stock market is moving up or down and stocks are doing the same regardless of their individual merits (market risk).

A similar kind of analysis applies to bonds. Bonds are a loan of money to a company or government in exchange for a preset rate of interest for a specified period of time. Bonds are bought and sold on the open market just like shares of stock, except they don't confer ownership in the underlying company (or government :-). Since bondholders have no ownership stake in the company, any factor that affects the payment of interest will move the price of the company's bonded debt. To help guide buyers of bonds, rating agencies such as Standard & Poor's and Moody's have devised scoring

systems that evaluate a company's ability to meet its bond obligations (default risk). These ratings are equivalent to a stock's  $\beta$ , and a bond's value is greatly affected by the company's debt rating.

While the market value of a bond varies, there is no volatility to the return of a bond if you hold it to maturity. As long as the company doesn't default, you will continue to get the same interest for the life of the bond. However, if you need to sell a bond before it is due, you have to find a buyer in the open market.

What a buyer is willing to pay for a bond depends on several factors, such as the interest the bond pays, the company's bond rating, and the overall sentiment about interest rates. In addition to these factors, the market price of a bond is greatly affected by the current rate of interest for this type (length and quality) of debt.

Let's suppose you own a \$1,000 bond paying 5% interest. If the going rate for bonds like yours is 6%, then a buyer will discount the value of your bond until it, too, is paying 6%. The discount is easy to calculate. Your bond pays \$50 per year and \$50 is 6% of \$833.33, which is what a buyer would be willing to pay for your bond. Because interest rates rose (interest rate risk), you've lost \$167.67 (assuming you bought the bond for \$1,000). Incidentally, this is why the value of a bond moves inversely to the interest rate. If the interest rate falls, a buyer will pay a premium for your bond, instead of demanding a discount!

Another problem that bondholders have to consider is inflation. As inflation rises (inflation risk), the interest a bond pays buys less. Also, the return of the principal will be in inflated dollars. Inflation risk is not such a problem with stocks, as companies can raise prices to offset the impact of higher costs.

It might seem like a no-brainer to fund one's retirement by buying bonds that yield the interest rate required by your financial plan. But there is a catch. Your financial plan assumes that you earn the specified return continuously. Thus, when you receive a bond's interest, you have to reinvest that interest in accordance with your plan. However, interest rates move every day (interest rate risk, again), and you might not be able to reinvest that interest at the necessary percentage rate without taking on more risk. An example may make this clearer. Your \$1,000 bond paying 5% gets you \$50 a year in interest. Today, getting 5% interest requires either very long-term or high-risk bonds. Interest rate and inflation risks make it hard for a portfolio 100% invested in bonds to maintain a high rate of return over the long term.

### Getting the Most for Your Risk

As I described above, not all risks are the same. Just because two investments have the same amount of volatility doesn't mean they have the same pattern of volatility.

Consider two stocks that are in the same industry – say, GM and Ford. Since they are both in the same business, their stocks will likely move together. When one is up or down, so is the other. If there is a slump in car buying (industry risk), both stocks will go down. Note that due to company risk, these two stocks will not move in lockstep.

Now, consider stocks in different businesses, say GM and Levi Strauss. Since these stocks are not in the same industry, there will be times when one is down but the other is up. The end result for us is less overall volatility!

If Ford, GM, and Levi Strauss all have the same expected return and  $\beta$ s, a portfolio containing both GM and Levi Strauss will have the same return but less overall volatil-

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ity than a similar one containing Ford and GM or 100% of just one of the companies. By buying two stocks instead of one, we lower company risk. By having stocks in different industries, we also lower industry risk.

By picking our investments wisely, we can reduce the overall risk of our retirement portfolios without having to accept lower returns! In investment lingo, this is called diversification. It is worth noting that the downside of diversification is that the combined portfolios have less range, both high-end and low-end, than undiversified investments. That is, the total upside and downside potential is less when you diversify your risk. If your plan is solid, losing this bit of unlikely upside will have no impact on your future.

### How Do I Use This Information?

While all this sounds good, how does it work in the real world? Calculating how two stocks vary means calculating the statistical covariance of their stock movements.<sup>1</sup> This can be done if you have all the data and a good statistical package. However, there are thousands of stocks, and building a complete covariance table for each one would be way too much work. What is more common is for an investment's covariance to be calculated to some standard index, like the S&P500. This information is available from financial advisors and from the Net (again, at <http://www.morningstar.com>, among other sites).

If you invest in individual stocks, you need to be careful to compare the companies you invest in by industry and covariance. Keep in mind, though, that buying shares in just a few companies still exposes you to significant company risk, since a meaningful percentage of your portfolio may be concentrated in a few stocks. To gain the benefit of diversification, many commentators suggest holding at least 10 different stocks. The most common way to minimize company risk is to invest in mutual funds. Since mutual funds buy into many companies, your exposure to any single company is greatly reduced.

There are other ways you might want to diversify. Common investment advice says to diversify geographically by investing in the companies of different countries. This not only allows you to lessen the impact of holding all your money in a single currency (currency risk) but also takes advantage of covariance between the economies of different global areas. However, international investing has its own unique risks, such as political instability, market manipulation, and outright fraud.

Another way to diversify is by the size of the companies you invest in. Typically, stocks are divided into three classes: large-cap, mid-cap, and small-cap. The word "cap" is short for "capitalization" and refers to the total value of a company, which is calculated by multiplying the number of shares outstanding by the share price. Large-cap companies tend to be established, well-financed industry leaders, whereas small-cap companies are lesser known and often more vulnerable to the vagaries of the marketplace. Stocks tend to be more highly correlated with others in their same class than with stocks in different classes. As such, different classes of stocks don't always move in the same direction, so they offer further diversification opportunities. Mutual funds usually clearly identify what class of stocks they buy, so it is easy to determine the capitalization mix of your portfolio.

1. Covariance is a statistical calculation that measures how two sets of values vary with one another. For investment purposes, covariance results range from +1 to -1, with +1 for two investments that move together 100% of the time and -1 representing two investments that move exactly opposite to one another.

Since stocks and bonds tend to move in opposite directions, another way to reduce your portfolio's volatility is to hold both stocks and bonds. In theory, in good times the stocks go up, in bad times the bonds go up (and still pay interest)!

As a counterpoint to all this talk about diversification, it is possible to over-diversify. In this case, your portfolio is spread around in so many different investments that you can't take advantage of a strong move in any one of them. Also, the more investments you have, the more incidental costs you pay, which further decreases your return.

How can you know if your portfolio is taking too much risk for the return it is generating? The best advice is to talk with your investment advisor. Financial planners often have software programs that can dissect your portfolio and compare its expected return to its estimated risk.

Lastly, there is some risk that can't be diversified away: market risk. Some events such as natural disasters, terrorist attacks, war outbreaks, or economic meltdowns move all markets down. However, the effect of such shocks is often short-lived, especially if the underlying economies remain well-ordered and responsive. The only way to avoid market risk is to hold cash or equivalents, such as bank CDs. But these investments have risks, too, such as interest rate fluctuations and inflation.

In the end, no matter what you do with your investment dollars, you take some risks. While risk can't be avoided, it can be minimized.