**Portfolio Performance Evaluation– Chapt. 24 in BKM**

Simple Return = Amount you made = Future Value - 1

Amount you invested Present Value

Example: Buy a stock for $100 and at end of the time period it is worth $106, plus you received a $2 dividend.

Rate of Return = (106 – 100) + 2 = 108 - 1 = 8%

100 100

Note that this assumes no compounding within the time period you are looking at – meaning that if the time period is a year, this is an annual return; if it is a month, it is a monthly return, etc.

Annualizing is just like calculating EAR. Add one to the return, raise it to the number of compounding periods in a year, and subtract one.

For example, if this occurred over a one-month period,

(1 + .08)12 – 1 = 151.82%

If it occurred over 82 days,

(1 + .08)365/82 – 1 = 40.86%

For continuous compounding, Rate of Return =  =  = 7.7%

To annualize, simply multiply by the number of time periods in a year.

If this was a month, 7.7% is the monthly continuously compounded return. To annualize it: (7.7%) (12) = 92.35%

If it occurred over 82 days, (7.7%) (365/82) = 34.26%

**Arithmetic Averages vs. Geometric Averages**

Geometric Average Return – The compounded annual return earned by an investor who bought the security and held it for ‘T’ years. This is equivalent to earning this return each year and reinvesting the earnings at the end of each year.

Geometric Average Return = [Π (1+Rt)]1/T – 1

Note that [Π (1+Rt)] is often referred to as the buy-and-hold return.

Example: Let’s take the hypothetical returns for Freeman Corp.

2001 .05

2002 .09

2003 -.12

2004 .20

‾= .05 + .09 - .12 + .20 = .22 = .055 = 5.5% = Arithmetic Average Return

1. 4

Geometric Mean = [(1.05) (1.09) (0.88) (1.20)]1/4 – 1 = 4.85%

Note that the geometric average is always less than or equal to the arithmetic average.

The difference between the two is greater when there is more variance in the returns.

Geometric means give you an accurate buy-and-hold return and are better measures of past performance.

Another Example: You invest $100 and your investment grows by 50% the first year to $150. The second year, your investment declines by 50%, so it is now at $75. You started with $100 but ended up with $75, yet your average return was zero. The buy-and-hold return was [(1.5) (.5)]1/2 – 1 = -13.4%

Buy-and-Hold returns give the best indication of past performance. However, arithmetic means need to be used when determining expected returns (future) and when calculating standard deviations.

**Dollar-Weighted Returns**

Suppose you purchase one share for $100 and at the end of a year receive a $2 dividend. Also at the end of the first year, you buy another share for $106. At the end of the second year, you receive another $2 dividend (per share) and the share price is $110.

-100\_\_\_\_\_\_\_\_\_\_\_\_-106; +2\_\_\_\_\_\_\_\_\_+4; +220

0 1 2

Find the Internal Rate of Return (IRR) to get the dollar-weighted rate of return

0 = -100 – 106 + 2 + 4 + 220 = -100 – 104 + 224

1+r 1+r (1+r)2 (1+r)2 1+r (1+r)2

r = 6.442%

It is dollar-weighted because the second year (when more dollars are invested) gets more weighting than the first year.

**Time-weighted Returns**

In the example above, the return in the first year was 8%. Find the return in the second year in the same manner.

224 – 1 = 5.66%

212

Now, average together the two returns using either an arithmetic mean or a geometric mean

8% + 5.66% = 6.83% or [(1.08) (1.0566)]1/2 – 1 = 6.82%

2

In this example, since the second year did worse than the first year, and there were more dollars invested in the second year, the dollar-weighted average is lower than the time-weighted average. If you did better in the time period when you had more money invested, the dollar-weighted average would be higher.

Most money managers are evaluated using time-weighted averages rather than dollar-weighted averages, because the amount of money they manage is generally not under their control.

**Risk-Adjusted Performance Measures**

There are many different ways to adjust for portfolio risk. Some of the most well-known are:

1. Sharpe Ratio
2. Treynor’s Measure
3. Jenson’s Alpha
4. Information Ratio
5. M2

The Sharpe Ratio is simply the excess return (above the risk-free rate) divided by the standard deviation of returns. If the risk-free rate is annualized, so too must be the return on the portfolio and the standard deviation of returns.

Sharpe Ratio = RP – Rf

σ

Treynor’s measure uses the same idea as the Sharpe Ratio, but it uses Beta as the measurement of risk

Treynor’s Measure = RP – Rf

βP

Jenson’s Alpha is the excess return on the portfolio above the expected return that was predicted by the CAPM

Jenson’s Alpha = αP = RP – [Rf + βP (Rm – Rf)]

The Information Ratio takes Jenson’s Alpha and divides it by the standard deviation of the error term (this is the level of unique risk – the risk that could be diversified away).

Information Ratio = αP

σ(eP)

M2 = Modigliani Squared which creates a hypothetical managed portfolio which we will call P\*. P\* is found comparing the standard deviation of the actual managed portfolio with the standard deviation of the market. P\* is structured to have the same standard deviation as the market.

**Example**:

You manage a portfolio (p) for which RP = 10% and σp = 20%

During the same time, the market’s (or whatever index you want to compare yourself to) return was 8% and its standard deviation was 10% (σm = 10%)

Since your portfolio’s standard deviation was twice that of the market’s, P\* will be comprised of your portfolio mixed with an equal amount of Treasury Bills.

If T-Bills yielded an average of 4% over the time period we are looking at, RP\* = (.5)(4%) + (.5)(10%) = 7%

Since T-Bills have σ = 0 (in theory, they are risk-free), σP\* = (.5)(20%) = 10% = σm.

Since P\* and the market have the same standard deviation, it is fair to compare their returns. That is what M2 does. M2 = RP\* - Rm = 7% - 8% = -1%.

If your adjusted portfolio (P\*) has a higher return than the market (with the same standard deviation), you must be doing something right as a money manager. You have beat your index. In our example, you beat the index before the adjustment, but after the adjustment, you fell short. The idea is to create an apples-to-apples comparison of returns, where both the adjusted portfolio and the index have the same risk (as measured by standard deviation).

If your portfolio has a lower standard deviation than the market, P\* will involve a leveraged position in T-Bills (borrowing at the risk-free rate and investing the proceeds into your portfolio to create P\*).

**Measuring Performance with a Market-Timing Strategy**

Many investors do not select individual securities, but simply try to time the market by shifting funds between a market-index portfolio and a risk-free portfolio. They put the money in the market when they believe the market will be going up and in a money market fund when they believe the market will be going down.

The typical way we calculate the alpha of a portfolio is by doing an OLS regression with excess portfolio returns (above the risk-free rate) on the left and excess market returns on the right. However, this method assumes a constant Beta (slope) when, in fact, we have a low beta when funds are in the money market fund and a high beta when funds are in the market-index portfolio (see the illustrations in BKM).

We can work around this by allowing beta to take on two separate values. We use the following equation:

Rp – R­f = α + β1 (Rm – Rf) + β2 (Rm – Rf) D + e

where D is a dummy variable that equals 1 when Rm > Rf and zero otherwise.

This means that when the market return is below the risk-free rate, β1 is the estimate of beta, but when the market return is above the risk-free rate, β1 + β2 is the estimate of beta.

Most importantly, If β2 > 0 , we are observing positive market-timing ability.

Note that the researcher who first developed this methodology empirically tested it against 116 mutual funds between 1968 and 1980 and found that the average fund had a negative value for β2.

**Additional Issues**

Skill vs. Luck

Because of the typically high variances of portfolio returns, if you want to use standard statistical techniques to determine if a portfolio manager’s returns are above the market index (t-stat > 1.96 that α > 0), it will take too many data points (too many years of portfolio returns) to be practical. By the time you determine that an investor’s abnormal positive returns are statistically significant, he/she is ready to retire!

Survivorship Bias

If a mutual fund or an individual investor is not performing well, they will often go out of business or be replaced after a while. This is definitely a survival of the fittest business. Thus, if you are comparing yourself or your fund over a long period of time, with other funds or investors, remember that only the best have lasted long enough to enter your comparison universe. So, if a fund performs in the 50th percentile over a 20-year period, it did better than half of the funds that were around for 20 years – but only the best funds lasted 20 years!

Window Dressing

Since mutual funds only need to report the exact composition of their funds quarterly, many fund managers apply the practice of “window dressing” at the end of each quarter. Window dressing is the practice of selling your losing stocks and purchasing those that have done well over the last quarter (note – you didn’t own them when they did well), so that your quarterly report looks like you have owned the best-performing stocks over the quarter. Note that this doesn’t increase your returns, just the snapshot composition of the portfolio.