

EVALUATION OF INVESTMENT PERFORMANCE IN
INTERNATIONAL EQUITY MARKETS

Project Guidelines

You will assume that you have invested in two portfolios: a domestic U.S portfolio comprised of all the stocks in the Standard & Poors (500) Composite Index; and a foreign portfolio comprised of all the stocks in an index that tracks the foreign market. To measure the performance of these two portfolios, you need to collect values of the two indexes for ten weeks. Since stock markets are tracked by more than one index, make sure that once you choose the index of your foreign stock market, you follow only that index.

Sources: For the foreign market you need to follow a stock index of this market as published in such sources as: *The Wall Street Journal*, *The New York Times*, *The Financial Times* or the INTERNET. (You can go to yahoo and click on “finance.”) **Once you have chosen a source, you must use it through out the term. Different sources often track different indexes and mixing them will distort your evaluations.** The S&P Composite (500) Index can be found in the same sources mentioned above.

Data to collect: For each of the two indexes (the foreign market index and the US S&P index), you should record the **closing** value of the index on **Friday** of each week in the period given below. If the Friday value is missing because of a holiday or market closure, then record the closing value of the immediately preceding available day: i.e., Thursday, Wednesday and so on.

You also need to collect the value of the foreign exchange (FX) of the dollar, that is, the units of the foreign currency (of the country whose stock market you follow) per \$, on two dates: on the first Friday and the last Friday of the period indicated below.

Period: Collect weekly index values each Friday, from Friday, February 11, 2005 to Friday, April 15, 2005 (10 weeks). In this period, you must have ten index values for each stock market.

Performance evaluation measures: You will estimate the following measures: (a) the average or mean rate of return and (b) the standard deviation of the weekly rates of return for both the foreign and the S&P index; (c) the correlation coefficient of the weekly returns of the two indexes; (d) the holding period return for the foreign market index as well as the S&P 500 index between Friday, Feb. 11 and Friday, April 15, 2004; and (e) the holding period return over the same period for the foreign market adjusted for the dollar exchange value of the foreign currency (this is the return you made over the ten-week period in dollars).

Calculations

Calculation of weekly returns: You will use the collected index values to calculate the weekly rates of return of your foreign market and the US market, respectively. A weekly return is calculated

as follows:

Rate of return = [Index value of this week minus index value of previous week] divided by index value of previous week.

Therefore, you will start calculating returns after the second Friday.

Calculation of the mean, the standard deviation and the correlation coefficient: To measure the performance of a stock market you need to calculate such statistics as the **mean or average return** (which measures your % gain) and the **standard deviation of returns** (which measures your risk). In addition, to understand how two markets move in relation to each other, you need to calculate the **correlation coefficient** of the returns of the two markets.

Please refer to the attachment for the method of calculating these statistics. (We will also cover these statistics in Chapter 4 (BB).) Calculation of these statistics will be possible only after you finish collecting data, i.e., after April 15.

Calculation of the holding period return (HPR). This type of return shows the percentage change in the value of your portfolio (either from the foreign market or the S&P 500) for the whole period, i.e., from Friday, Feb. 11 to Friday, April 15. You will estimate a HPR for the foreign stock index and the S&P 500.

HPR = (Index value of 10th week minus index value of first week) divided by index value of first week

Calculation of the holding period return of the foreign market in dollar terms. Because the dollar may buy more or less units of another currency over time, U.S. investors need to adjust their return in a foreign market by the change in the value of the dollar. In other words, you need to estimate your holding period return on the foreign stock market but adjusted for changes in the foreign exchange rate of the dollar. To do this, **please follow the instructions below.**

Final form of project: Based on your work, you will submit a paper which includes the following:

- (1) Page 1: A title page with your name, the foreign market and the name of the index.
- (2) Page 2: Tables 1 and 2. In Table 1 show clearly and neatly the index values and the calculated returns for each market, respectively, on a week-by-week basis; show also the two currency values. In Table 2 present the statistics you estimated, i.e., mean or average return, standard deviation, correlation coefficient, holding period returns for both indexes and the dollar adjusted holding period return for the foreign index.
- (3) A brief commentary of no more than two pages which will explain:
 - (i) the meaning of the actual numerical values of the mean, standard deviation and correlation coefficient and what they imply for your investments in the two markets. For example, which market was more profitable or riskier; in which market you would prefer to invest; what the correlation coefficient means for the relationship of the two markets and whether it makes sense to invest in both or not (i.e., whether it pays to diversify).
 - (ii) The meaning and implication of the actual values of the holding period returns and the dollar-adjusted return on the foreign market; in which market you would prefer to invest.
- (5) The formulas you used to calculate every measure and the printouts of your computer spreadsheets. This should be in an appendix.

Requirement: You must use some computer spreadsheet to make your calculations and print your paper.

NOTES: (a) Papers which look unreasonably alike and hence may be the product of plagiarism will receive **zero** grade regardless who copies whom. (b) Late papers (but submitted by day of final exam) without permission will lose **one third of the grade that is allocated to this project.** Submissions without permission after the final exam will receive ZERO credit.

Table Format: The tables should look like this:

Table 1

Week	Foreign Index	For. Index Return	S&P 500	S&P 500 Return	Currency Rates
#1	value	% return	value	% return	units of foreign currency per 1\$
#2.....	value	% return	value	% return	nothing
#10	value	% return	value	% return	units of foreign currency per 1\$

Table 2

Variable	Foreign Market Portfolio	S&P Portfolio
Average Rate of Return	value	value
Standard Deviation	value	value
Correlation Coefficient	value	-
HPR of Portfolio	value	value
\$-Adjusted HPR - foreign	value	value

DEADLINE: Tuesday, May 10, 2005.

HOW TO CALCULATE THE CORRELATION COEFFICIENT

I will use two assets with four rates of return per period (say weeks) as given below. Let's assume asset A stands for the US index and asset B for the foreign market index.

A. First I need to calculate the expected return and st. deviation of the returns of each asset.

R_a	$R_a - E(R_a)$	$[R_a - E(R_a)]^2$	R_b	$R_b - E(R_b)$	$[R_b - E(R_b)]^2$
.10	.1 - .1	0	.14	.14-.05	.0081
-.05	-.05-.1	.0255	.10	.10-.05	.0025
.15	.15 -.1	.0025	-.08	-.08-.05	.0169
.20	.20- .1	.01	.04	.04-.05	.0001
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$\Sigma = .40$		$\Sigma = .038$	$\Sigma = .20$		$\Sigma = .0276$
$E(R_a) = .4/4$		$VAR = .038/4$	$E(R_b) = .2/4$		$VAR = .0276/4$
$= .10$		$= .0095$	$= .05$		$= .0069$
		St. Dev. = .0974			St.Dev. = .0831

B. I can now calculate the covariance and correlation coefficient of the returns.

$R_a - E(R_a)$	$R_b - E(R_b)$	$[R_a - E(R_a)] \times [R_b - E(R_b)]$
0	.09	0
-.15	.05	-.0075
.05	-.13	-.0065
.10	-.01	-.001
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		$\Sigma = -.015$
		$COV = -.015/4 = -.00375$

$$\begin{aligned} \text{CORRE}(R_a, R_b) &= \text{Covariance of the returns of assets A and B} \mathbf{divided} \text{ by the product of the} \\ &\text{standard deviations of the returns of A and B} = \text{COV} / [\text{St. Dev}(A) \times \text{St. Dev}(B)] \\ &= (-.00375) / (.0974 \times .0831) = -.4633 \end{aligned}$$

Notes:

1. For the Expected Return, I added the returns and then divided by their number, 4.
2. For the Variance, I summed the squared values of the deviations and then divided by the number of the deviations, 4.
3. For the Covariance, I first calculated the product of the deviations and then added these products. I divided the sum by the number of the products, 4.
4. For the Correlation Coefficient, I divided the covariance by the product of the st. deviations.

Notice that when we have a series of numbers, we apply formulas for mean, st. dev. and correlation that do not use probabilities.

HOW TO ADJUST RETURNS FOR CHANGES IN THE FOREIGN EXCHANGE RATE OF THE DOLLAR

This note shows how to adjust a rate of return realized in a market with a currency other than the dollar. This adjustment is necessary because a U.S. investor needs to know what dollar-equivalent return made on an investment denominated in a foreign currency. This allows to compare returns on domestic (and hence dollar-based) investments to returns on foreign-currency-based investments.

By foreign exchange rate we mean the value of one dollar in units of another currency. For example if the dollar buys .90 Euros, then the foreign exchange rate of the \$ in Euros is EU0.90.

Note: The instructions how to calculate the \$-adjusted rate of return are given in steps 1 to 4 at the end of this note. Below, we first explain why these steps are necessary.

Background information

Let's assume we have 1 \$ to invest in a French stock portfolio on January 1, 2002.

We need first to convert the dollar into Euros. Assume an exchange rate of EU1.15 (1\$ can buy 1.15 Euros). This means our 1 \$ buys a French stock portfolio worth EU1.15.

That is, the beginning value of the portfolio in Euros is: $\$1 \times \text{EU}1.15 = \text{EU}1.15$.

During the course of 2002, this portfolio will produce a return, dividends plus capital gains.

Now assume we are at the end of 2002, on December 31 and we wish to estimate our return in dollars. We are told that our French stock portfolio realized a rate of return equal to 10% or 0.10. We also observe that the foreign exchange rate of the \$ is EU0.90. We need first to know how much the Euro is worth in dollars, since we need to convert our investment in our home currency. A dollar exchange rate of EU0.90 translates into an exchange rate of the Euro in dollars equal to \$1.1111, that is a Euro can buy 1.1111 dollars.

Based on this information we have:

- a. Value of the portfolio in Euros on December 31, 2002: $\text{EU}1.10 \times (1 + 0.15) = \text{EU}1.265$. That is, our portfolio is worth EU1.265 one year later.
- b. Value of the portfolio in dollars, i.e., convert the Euro-based value of the portfolio into dollars:
 $\text{EU}1.265 \times \$1.1111 = \1.4055 . That is 1.265 Euros are worth 1.4041 dollars at the end of 2002. Alternatively, the dollar value can be found by dividing EU1.265 by the exchange rate of the dollar in Euros which, as we said above, is \$0.90.
That is, ending value in dollars: $\text{EU}1.265 / \text{EU}0.90 = \1.4055 .
- c. We are now ready to calculate the dollar-equivalent or dollar-adjusted rate of return on our initial 1 \$ investment.
Dollar-adjusted rate of return of foreign investment = $(\$1.4055 - \$1) / \$1 = 40.55\%$.

Notice that from the point we converted the 1 \$ into Euros to invest in France to the point we converted the Euros back to dollars we performed the following operations:

$\$1 \times \text{EU}1.15 = \text{EU}1.15$ >>> this converts \$ into Euros

multiply by $(1 + 1.10) = \text{EU}1.265$ >>> it calculates ending portfolio value in Euros

divide by $\text{EU}0.90 = \$ 1.4055$ >>> it converts Euro value into dollar value

Minus $\$1 = \0.4055 >>> it calculates dollar return

divide by $\$1 = 40.55\%$ >>> it calculates rate of return in dollars.

Notice that because the Euro gained vs the dollar during 2002, our investment in Euros is more valuable at the end of 2002. This means that in addition to making a 10% return in the French stock market, we also made a positive return in the foreign exchange market. Of course, the effect of the exchange rate would be the opposite if the dollar had gained vs the Euro. This is so, because the Euro would be translated into fewer dollar at the end of 2002. This is what we call **foreign currency risk** in investments.

Therefore, to estimate a dollar-adjusted rate of return for the project, we must follow the four steps below:

- Step 1:** Calculate the holding period return from week 1 to week 10 (see formula in guidelines). This is how we would estimate the 10% we assumed above. **Then add 1.**
- Step 2:** Divide the dollar foreign exchange rate in the units of the foreign currency in week #1 by the dollar foreign exchange rate in week #10. This is the equivalent of dividing $\text{EU}1.15$ by $\text{EU}0.90$
- Step 3:** Multiply the numbers in steps 1 and 2.
- Step 4:** Subtract 1 from the product found in Step 3. This is the dollar-adjusted rate of return.