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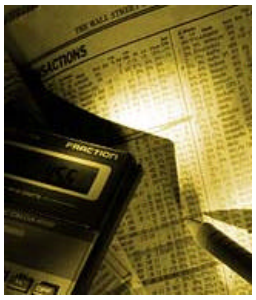
Investment Principles

Portfolio Construction and Analysis

Objective: The purpose of this project is to reinforce the portfolio concepts that you were exposed to in your Foundations of Finance class and this class through actual implementation of these concepts. At the end of this case, you should be able to construct your own portfolio and have the ability to analyze how it performs relative to some performance benchmark. In addition to this, you will learn how to decompose the return on a portfolio into its fundamental attributes via attribution analysis. The data for this project can be downloaded from my website. The file is called ip_mpt03.xls. The data is current as of September 2002.

The Investment Decision: You are working with high net worth clients and are deciding whether to have them invest in individual stocks, mutual funds, or both. Your clients have given to you two articles that they have read on great investment opportunities and want you to investigate these and let them know how they should invest their wealth. Their only requirement is that your choice should outperform the both the returns on the S&P500 and the 3-month Treasury bill on average.

Synopsis of Article 1: Jeffrey R. Kosnett and Brian P. Knestout, “Great Stocks You'll Want to Keep”, Kiplinger magazine [1]



In this article, Ben Pace, a portfolio manager at Deutsche Bank Private Banking in New York City, recommends investing in "ease-of-read" companies. These are companies with easy-to-understand business models and financial reports where an investor "seldom (has to) worry about getting hit with off-balance-sheet financing or those types of issues." Stocks that fit this profile are typically found in retailing, consumer-products, food and drug companies. He particularly likes six companies which have enjoyed rising profits for at least ten years in a row without the aid of "extraordinary items" (adjustments for reasons other than regular operations). These 6 companies include:

- Alberto-Culver (symbol ACV), the beauty-products company.
- Anheuser-Busch (BUD) the king of beers.
- Bed Bath & Beyond (BBBY) sells high quality household items and home furnishings
- Florida Rock Industries (FRK) makes cement, gravel, and other building materials
- Johnson & Johnson (JNJ) the world's most diversified health care company
- Sysco (SYY) the nation's largest distributor of food and related products

[1] http://www.kiplinger.com/magazine/archives/2002/July/investing/grtstock.html

Synopsis of Article 2: "10 Best Mutual Funds for 2001", Money magazine[2],

Money magazine profiles the ten best mutual funds for 2001. These mutual funds include Artisan Mid Cap, Bogle Small Cap Growth, Fidelity Dividend Growth, Longleaf Partners International, Tweedy Browne Global Value, UAM Clipper, Vanguard Total Bond Fund, Vanguard Windsor II, Wasatch Core Growth, and White Oak Growth Stock. Out of these funds, you focus on two for your client, the Clipper Fund (CFIMX) and White Oak Growth Stock (WOGSX) given their focus on large cap stocks.

- Clipper Fund[3] (CFIMX): A large-cap value investment vehicle, Clipper Fund often stockpiles cash of up to 30 percent which tends to dampen its volatility but results in even better long-term returns for buy-and-hold investors. Co-manager Peter Quinn says that the fund makes concentrated bets with only 35 or so stocks to limit risk. Managers adhere to a strict valuation discipline, buying only when a stock is selling for 70 percent or less of what they calculate the business is worth and always selling when a stock hits 100 percent of that figure. They also select from a list of just 250 companies, all leaders in growing markets, with healthy cash flow and shareholder-friendly management.

- White Oak Growth Stock[4] (WOGSX): A large-cap growth investment fund, this fund has typically topped the charts since its 1992 inception. The fund has 23 stocks (most large-cap growth funds have around 100), and its annual portfolio turnover was just 13 percent at last count (compared with a norm of 135 percent). Jim Oelschlager, the manager and founder finds stocks he can stick with by zeroing in on the sectors most likely to succeed in the long term. That's meant financials, health-care and technology picks.

Assignment/Tasks: Download the file ip_mpt03.xls and perform the following tasks using this spreadsheet. Please turn in a hard copy of your solutions together with your disk showing all your spreadsheet calculations. This is an *individual* project. As such, anyone caught cheating will be given an F on this assignment.

1. Expected Risk and Return on the Market (5 points): Using the data provided in the "S&P Historical Returns" worksheet, calculate the mean, variance, and standard deviation of the S&P. You will use the S&P are the market proxy. As such, we assume that the average return on the S&P is equal to the expected return on the market portfolio. Please use the template labeled "1. Single Indx Model (Template)" in your workbook to input your answers.

[2]http://money.cnn.com/best/funds
[3]http://www.uamfunds.com
[4]http:// www.oakassociates.com

2. Estimating the Parameters on the Market Model (5 points): Using the returns located in the "Returns" worksheet, estimate the intercept, the slope, and the standard error of the estimate associated with the single index model (a.k.a. market model) for Alberto-Culver (symbol ACV), Anheuser-Busch (BUD), Bed Bath & Beyond (BBBY), Florida Rock Industries (FRK), Johnson & Johnson (JNJ), and Sysco (SYY). You can use either the Regression[5] option in Tools ➜ Data Analysis ➜ Regression or you can use the INTERCEPT, SLOPE, and STEYX functions in Excel. Please put your answers in the template labeled "1. Single Indx Model (Template)" in your workbook.

3. Estimate the Expected Returns and Partition the Return (10 points): Calculate the expected return for each of your 6 stocks using the market model that you estimated in question 2 and the expected return on the market that you calculated in question 1. Next, partition the expected return for each stock into that portion of the return due to the market (systematic) and that percentage that is attributable to industry and company specific factors (unsystematic). Please put your answers in the template labeled "1. Single Indx Model (Template)" in your workbook.

4. Estimate the Expected Variance and Partition the Variance (10 points): Calculate the expected variance for each of your 6 stocks using the market model that you estimated in question 2 and the expected variance on the market that you calculated in question 1. Next, partition the expected variance for each stock into the portion of the variance due to systematic risk and the percentage that is attributable to unsystematic risk. Please put your answers in the template labeled "1. Single Indx Model (Template)" in your workbook.

5. Estimate the Expected Variance-Covariance Matrix (10 points): Calculate the expected covariances between your 6 stocks using the market model parameters that you estimated in question 2 and the expected variance on the market that you calculated in question 1. Please put your answers in the template labeled "1. Single Indx Model (Template)" in your workbook.

6. Optimizing Your Portfolio of 6 Stocks (20 points): Calculate the portfolio weights for each of your six stocks assuming a monthly risk free rate of .00136 (this is the return on the 3 month Treasury bill as of September 28, 2002) and also assuming that short sales are allowed. The decision problem is

$$\text{Max Slope} = \boldsymbol{\theta} = \frac{E(R_P) - r_F}{\boldsymbol{\sigma}_P}$$ maximize the excess return per unit of risk

subject to

$$x_1 + x_2 + \ldots + x_N = 1$$ sum of % invested in each stock equals 100%

Using the template "2. MPT (Template)" in conjunction with the Solver subroutine, find the optimal weights for your portfolio of 6 stocks. Do you have to short sell any of your 6

[5]If you do not see the Data Analysis option under Tools, go to Tools ➜ Add Ins ➜ Analysis Toolpak.

stocks? Which stocks constitute your largest holdings? Recognize that all of your stocks are growth stocks with all but one (FRK, a small cap stock) being a member of the S&P500. Consequently, your portfolio is primarily a large-cap growth portfolio.

7. Calculating Returns for Your Large Cap Growth Portfolio (5 points): Assume that your optimal portfolio weights obtained in question 6 remain constant over time. Calculate the monthly return on your portfolio of 6 stocks from October 1998 through September 2002. Please use the worksheet labeled "3. Portfolio Construc(Template)" for your calculations.

8. Calculating and Comparing Jensen Alphas: 6 Stock Portfolio vs. CFIMX and WOGSX (10 points): Calculate Jensen's alpha for your 6 stock portfolio, the Clipper mutual fund (CFIMX) and the White Oak Growth fund (WOGSX) using the S&P500 as the return on the market. The S&P500 is the correct benchmark to use since all of the funds analyzed are primarily large cap funds. Please use the Regression option in Excel located in the Data Analysis section under Tools in calculating Jensen's alpha. Do any of your portfolios outperform the S&P500 on a risk-adjusted basis? If so, which ones exhibit superior performance? Note: For superior performance to exist, the fund must not only have a positive alpha but also the T-statistic associated with the positive alpha must be statistically significant at either the 5% or 10% level. How did your portfolio do relative to two of the "best" mutual funds of 2001?

9. Cumulative Wealth (5 points): Calculate the cumulative wealth of your investment if you had invested $1,000 in either your 6 stock portfolio, the Clipper mutual fund (CFIMX) the White Oak Growth fund (WOGSX), the S&P500, or 3 month T-bills. Recall from your Foundations of Finance class that cumulative wealth involves compounding in each period using the formula:

$$Wealth_T = Wealth_0(1+r_1)*(1+r_2)*\ldots.*(1+r_{T-1})*(1+r_T)$$

> ***Example***: The returns on the S&P500 for October 1997 was $r_{97.10}$ = -.03448 and for November 1997 was $r_{97.11}$ = .04459. Thus, adding one to each return results in $(1+r_{97.10})$ = .96552 and $(1+r_{97.11})$ = 1.04459 respectively. Consequently, $1000 invested at the beginning of October 1997 would be worth $\$1{,}000*(1+r_{97.10})$ =$1,000*.96552 = $966 at the end of October 1997. At the end of November 1997, the initial investment of $1,000 would be worth $\$1{,}000*(1+r_{97.10})*(1+r_{97.11})$ =$1,000*.96552*1.04459 = $966*1.04459 = $1,009. Continuing with this logic process, the $1,000 invested in the S&P500 would have grown to $1,024 at the end of December 1997 and increased to $1,035 by the end of January 1998.

After you have finished calculating the cumulative wealth for each your investment on a monthly basis, plot the cumulative wealth for your 5 choices on the same chart using a Line Chart option in Excel. Which investment results in the largest wealth gain? Do all of the risky investments result in a higher level of wealth relative to investing in T-bills?

10. Attribution Analysis (20 points): Perform an attribution analysis of the Clipper mutual fund (CFIMX) using the data provided in the "Returns" worksheet. Appendix A provides the details of how to use the Solver subroutine in Excel to implement attribution analysis. The attributes or stock sectors that you will use to partition the return on CFIMX are

Variable	Proxy For
3 month T-bill	Cash
Rus1000G (Russell 1000 Growth)	Large Cap Growth
Rus1000V (Russell 1000 Value)	Large Cap Value
Rus2000G(Russell 2000 Growth)	Small Cap Growth
Rus2000V (Russell 2000 Value)	Small Cap Value

To obtain the initial set of weights, use the data from October 1997 through May 1999 (T=1,….,20). To calculate the next set of weights, use data from November 1997 through June 1999 (T=1,….,20) e.g., drop one month at the beginning and add one month at the end of the data series. Continue this logic process until you have obtained the final set of weights using data from February 2001 through September 2002. Provide a graph and discuss how CFIMX has changed their portfolio over time. For example, has their exposure to each stock sector remained constant over time? What have they increased or decreased their exposure in? Have they avoided any stock sectors? Is their claim that they are primarily a large cap value fund valid? Why or why not? Please explain.

Note: I have included the data in the Appendix in the worksheet labeled "Data from Attribution Appendix". If you are unsure of how to do attribution analysis, I would strongly suggest that you first replicate the example given in this Appendix prior to performing an attribution analysis on CSRSX.

Appendix A: Performance Attribution Analysis[6]

Objective of analysis: make inferences about a fund's exposures to variations in the returns of the asset classes.. the estimated style of the fund. To examine the behavior of a manager's average exposures to asset classes over time, one can perform a series of style analyses, using a fixed number of months for each analysis to determine if the fund's style is constant over time.

Measurement of Performance: For each month t

1. The fund's style is estimated, using returns from months t-60 through t-1
2. The return on the resulting style is calculated for month t
3. The difference between the fund's return in month t and that of the style benchmark determined in 1. and 2. is computed. This difference is the fund's *Selection Return* for month t.

Example: Using Excel to Calculate Sharpe Quadratic Programming Asset Class Exposures

Vanguard U.S. Growth Portfolio is an open-end mutual fund that seeks long-term capital appreciation through investing in stocks of established U.S. companies with above-average growth prospects.

We wish to determine the extent to which this mutual fund's actual performance is consistent with its primary objective using the Solver subroutine in Microsoft's Excel software in conjunction with the following return data:

Date	Vanguard US Grwth	Wilshire Large Growth	Wilshire Large Value	Wilshire Small Growth	Wilshire Small Value	Wilshire Midcap Growth	Wilshire Midcap Value
9209	.0150	0.0169	0.0099	0.0277	0.0076	0.0175	0.008
9210	-.0007	0.02	-0.0017	0.0489	0.0088	0.0408	0.0107
9211	.0476	0.0442	0.0203	0.0885	0.0463	0.0766	0.0416
9212	-.0006	0.006	0.0377	0.0382	0.0488	0.0306	0.0512
9301	-.0052	-0.0106	0.017	0.024	0.0337	0.0226	0.0311
9302	-.0366	-0.0149	0.0471	-0.0482	0.0228	-0.0337	0.0256
9303	.0122	0.0128	0.0252	0.0351	0.0341	0.0307	0.0451
9304	-.0443	-0.0559	-0.0195	-0.0327	-0.027	-0.0418	-0.026
9305	.0176	0.0366	0.0044	0.0592	0.007	0.057	0.0045
9306	.0048	-0.0129	0.0359	0.0112	0.013	0.0066	0.0229
9307	-.0103	-0.0274	0.014	0.0021	0.0202	-0.0089	0.0144
9308	.0208	0.0364	0.0334	0.0513	0.0256	0.0507	0.0218
9309	-.0041	-0.0065	0.0051	0.0422	0.0214	0.0251	0.0092
9310	.0225	0.0275	-0.0177	0.0032	-0.0023	0.0053	-0.01
9311	-.0007	0.0033	-0.0346	-0.0232	-0.0342	-0.0156	-0.039
9312	.0114	0.0103	0.0199	0.0491	0.0212	0.0553	0.0249
9401	.0308	0.02	0.0169	0.0284	0.009	0.0353	0.0167
9402	-.0123	-0.0104	-0.0358	0.0118	-0.0166	0.0053	-0.025
9403	-.0454	-0.0472	-0.0299	-0.07	-0.0317	-0.0595	-0.017

[6]From Craig Wainscott, "Attribution Analysis for Equities" in AIMR, *Performance Evaluation, Benchmarks, and Attribution Analysis*, 1995, no. 2

9404	.0152	0.0077	0.0283	0.005	0.013	0.004	0.0172
9405	.0197	0.0127	0.002	-0.0278	-0.0059	-0.0153	-0.011
9406	-.0293	-0.0322	-0.0313	-0.0583	0.0003	-0.0504	-0.009
9407	.0226	0.0289	0.0364	0.0316	0.0287	0.0244	0.0359
9408	.0409	0.0559	0.0164	0.0862	0.0237	0.0856	0.0237
9409	-.0174	-0.0179	-0.0392	-0.0005	-0.02	-0.0079	-0.028
9410	.0249	0.0282	0.0292	0.0263	-0.0167	0.0244	-0.009
9411	-.0211	-0.0246	-0.0333	-0.0474	-0.0269	-0.0443	-0.034
9412	.0137	0.0131	0.0006	0.0313	0.0258	0.0166	0.0134
9501	.0280	0.0284	0.0427	-0.0185	0.0205	0.0001	0.0371
9502	.0381	0.0363	0.0447	0.06	0.035	0.06	0.0417
9503	.0238	0.0292	0.013	0.0395	-0.0053	0.0369	-0.001
9504	.0370	0.0225	0.0272	0.015	0.028	0.0149	0.0259
9505	.0351	0.0387	0.0576	0.0242	0.0229	0.0164	0.0379
9506	.0295	0.0393	0.0033	0.0706	0.0268	0.0629	0.0267
9507	.0211	0.0307	0.0323	0.0856	0.0343	0.084	0.0413
9508	-.0037	0.0024	0.0243	0.0053	0.024	0.0153	0.0296
9509	.0563	0.0554	0.0521	0.0246	0.0316	0.0279	0.0286
9510	.0236	0.0065	-0.001	-0.0531	-0.0057	-0.0352	-8E-04
9511	.0393	0.0386	0.042	0.0476	0.0366	0.0525	0.0457
9512	.0024	-0.0009	0.0301	0.0125	0.0157	0.0036	0.0089
9601	.0403	0.0382	0.0318	-0.0165	0.0079	0.0173	0.0101
9602	.0312	0.0165	0.0065	0.0503	0.0082	0.0374	0.0119
9603	-.0037	0.0033	0.0095	0.0247	0.0157	0.0121	0.0131
9604	.0184	0.0238	0.001	0.0753	-0.0031	0.0593	-0.017

Sources: Bloomberg and Ibbotson and Associates, IDEAs database.

Step1: Open the Excel Spreadsheet and using the information given above, perform the following operations (an example of what your spreadsheet should resemble follows)

- Enter your returns in columns as shown above with Vanguard Returns in Column B

- Put the initial weights above each growth or value return column. Set each weight equal to 1/n where n = 6 asset classes or 1/6

- In column I, subtract the sum of the weights multiplied by the returns on each factor/asset class from the Vanguard returns in Column B. Square this difference.

	A	B	C	D	E	F	G	H	I
1									
2		*Weights*	.1667	.1667	.1667	.1667	.1667	.1667	
3	Date	Vanguard	LgGwth	LgVal	SmGwth	SmVal	MidGwth	MidVal	SqResiduals
4									
5	9209	.0150	.0169	.0099	.0277	.0076	.0175	.0080	.00000013
6	9210	-.0007	.0200	-.0017	.0489	.0088	.0408	.0107	.00048048
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
46	9602	.0312	.0165	.0065	.0503	.0082	.0374	.0119	.00008791
47	9603	-.0037	.0033	.0095	.0247	.0157	.0121	.0131	.00027994
48	9604	.0184	.0238	.0010	.0753	-.0031	.0593	-.0171	.00002313
49								SumWts	SumSq Resid
50								1.0000	.01269055

where
Col **I,** Row 5 = (B5-($C$2*C5+$D$2*D5+$E$2*E5+$F$2*F5+$G$2*G5+$H$2*H5))^2

..... (Use the copy command and paste this formula in rest of rows in Column I) .....

Col **I,** Row 48 = (B48-($C$2*C48+$D$2*D48+$E$2*E48+$F$2*F48+$G$2*G48+$H$2*H48))^2

- In column I, row 50, sum column I from row 5 through row 48. This represents the sum of squared residuals

- Sum the initial weights in columns C2 through H2 and put the result in H50 e.g. H50 = sum(C2:H2)

Intuition: Recall that the sum of the % invested in each stock must equal 100% e.g. b1 + b2 + b3 + b4 + b5 + b6 =1. Thus, this is one of our ***constraint cells***.

Step 2: Pull Down the **Tools** submenu and chose the ***Solver*** subroutine. Fill in the boxes as follows:

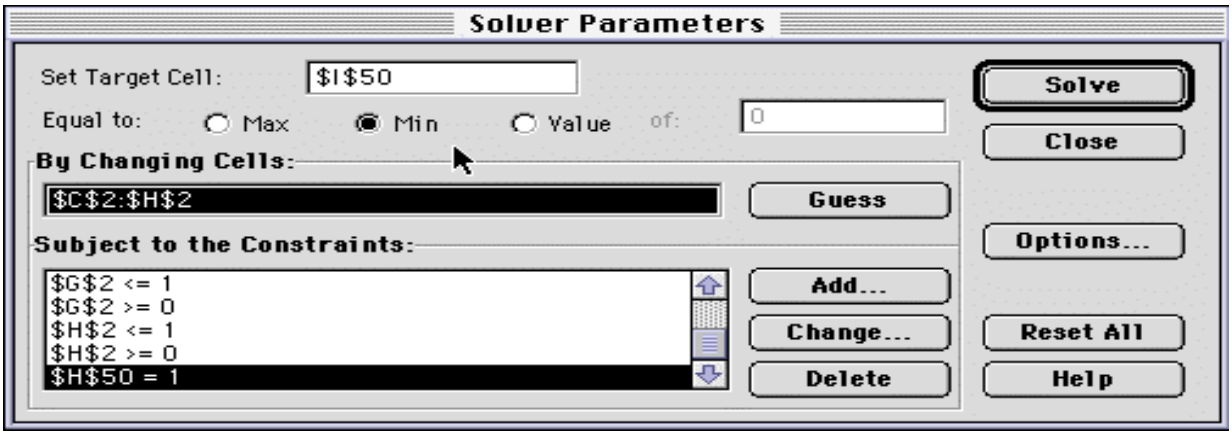
Set Target Cell: $I$50 The target cell is the cell you're minimizing

Equal to: ⊙ Min (You're minimizing the sum of the squared residuals)

By Changing Cells: $C$2:$H$2

Subject to the Constraints: $H$50 = 1 Note: you need to click on the **Add** button to add this constraint. The cell reference is $H$50, pull down the arrow and choose =, then type 1 in the constraint: box. Click on the **OK** button.

$C$2 => 0	The % invested in Large Growth is ≥ 0
$D$2 => 0	The % invested in Large Value is ≥ 0
$E$2 => 0	The % invested in Small Growth is ≥ 0
$F$2 => 0	The % invested in Small Value is ≥ 0
$G$2 => 0	The % invested in Midcap Growth is ≥ 0
$H$2 => 0	The % invested in Midcap Value is ≥ 0
$C$2 <= 1	The % invested in Large Growth is ≤ 1
$D$2 <= 1	The % invested in Large Value is ≤ 1
$E$2 <= 1	The % invested in Small Growth is ≤ 1
$F$2 <= 1	The % invested in Small Value is ≤ 1
$G$2 <= 1	The % invested in Midcap Growth is ≤ 1
$H$2 <= 1	The % invested in Midcap Value is ≤ 1



Step 3: Click on the **Solve** button. Your optimal weights should be as follows

Actual Exposure	.8735	.0747	.0000	.0517	.0000	.0000
Asset Class/ Factor	LgGwth	LgVal	SmGwth	SmVal	MidGwth	MidVal

Note that the actual exposure sums to 100%. Based on this actual exposure, it appears that the fund's major exposure ***is*** in large cap growth stocks although there appears to be a small exposure in both large cap and small cap value stocks.