



**LEHIGH**  
University

*Pennsylvania*  
Lehigh Valley Workforce Investment Board, Inc.

## **WALL STREET WEST**<sup>®</sup>

### **Topic: Risk and Return Statistics**

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**Learning objective:** Collect data for use in calculating returns, risk measures, and distribution statistics.

#### **Description:**

This module is to provide students with an introduction to calculating returns, risk measures, and distribution statistics. Students will locate and download data on a company's stock price and use Excel for calculations.

#### **Data Collection**

- Use finance.yahoo.com for data collection for indices and companies
- Market Proxies (Symbol)
  - DJIA (^DJI)
  - Russell 3000 (^RUT)
  - S&P500 (^GSPC)
- For at least three companies, download price returns and look up the reported Beta (see the **Dividend Discount Model Module** for data collection information).
- Go to FRED (Federal Reserve Economic Data) provided from the St. Louis Federal Reserve Bank (<http://www.research.stlouisfed.org/fred/>). Download the 1-year Treasury Constant Maturity Rate to be used as a risk-free proxy from to an Excel file. These annual risk-free returns,  $r_{\text{annual}}$ , must be converted to weekly returns. First convert to decimals (i.e., use the percentage returns given and divide by 100) and then solve for the weekly return ( $r_{\text{weekly}} = (1 + r_{\text{annual}})^{(1/52)} - 1$ ).
- Calculate weekly returns for each of the companies and the indices [ $r_i = (\text{price}_t / \text{price}_{t-1}) - 1$ ].
- Combine the weekly **risk-free returns, the returns for the companies and the indices** into one file making sure that the dates match. If the company's returns file contains a return on a date, but the treasury file does not, then copy the return from the previous week for the treasury. If

the treasury's return file contains a return on a date, but the company file does not, then copy the return from the previous week for the company.

- Create a portfolio using equal weights for the 4 firms, the 3 indices, and the risk-free proxy to generate weekly portfolio returns (You can use the =average( ) function in Excel for each row of returns for your equally weighted portfolio).

Please example output report form at the end of the document for the following steps:

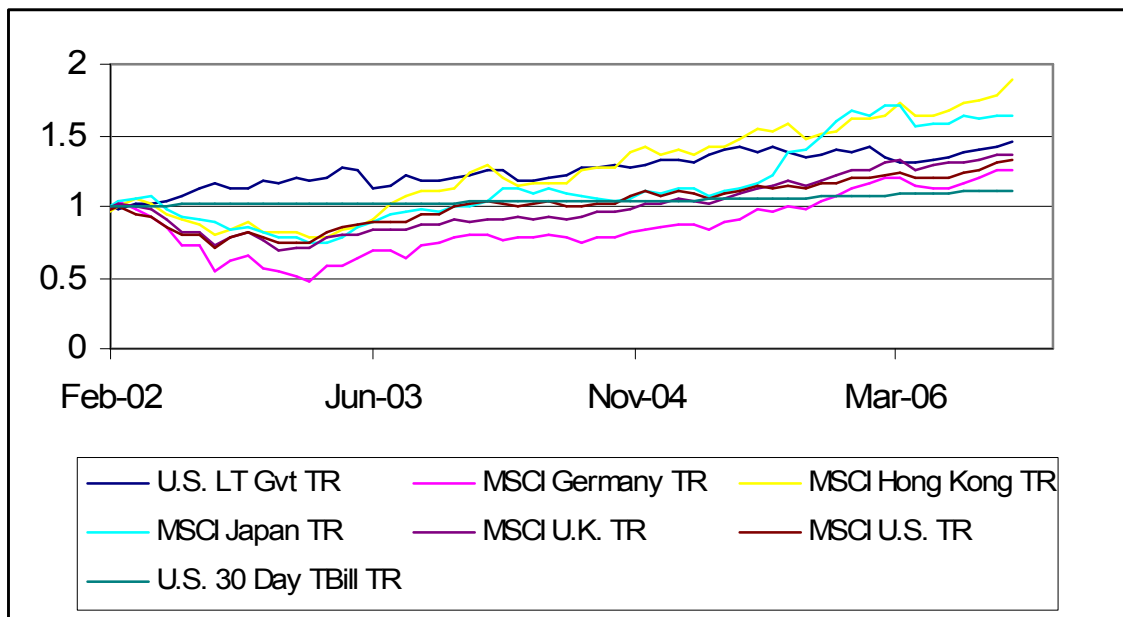
- Using this created return file, calculate a set of summary statistics for the 4 firms, the 3 indices, the risk-free proxy, and the portfolio using the built-in Excel functions for last 1 year (52 wks), last 2 years (104 wks), and last 5 years (260 wks). Calculate the correlation between each of the firms, the indices, the risk-free proxy, and the portfolio using the built in Excel functions for all three time period (1-year, 2-years, and 5-years). = CORREL(array1,array2)
- Calculate the covariance between each of the firms, the indices, the risk-free proxy, and the portfolio using the built in Excel functions for all three time period (1-year, 2-years, and 5-years). = COVAR(array1,array2)
- Calculate the excess returns for your companies, the 3 indexes, and the portfolio. (Excess Returns =  $r_i - r_f$ )
- Using these excess returns, estimate the beta for each of the four companies and the portfolio using each of the 3 market proxies over the 3 time periods.

Note: Excess returns on the Market index are your X-variables ( $r_m - r_f$ ) and the excess returns on the firm are your Y-variables ( $r_i - r_f$ ).

Note: Calculate the betas using the regression analysis function under the Tools menu within Excel to generate a Characteristic Line for your company versus the various indices, which are used as market proxies (Data/Data Analysis/Regression). Complete the analysis to fill in a beta table to summarize the results. If your computer does not have the Regression function, then under Add-Ins, check Analysis ToolPak to install it.

Statistic	Excel Function	Equation
Arithmetic Mean	= AVERAGE(array)	$\bar{R} = \frac{\sum R}{n}$
Standard Deviation	= STDEVP(array) for a pop. = STDEV(array) for a sample	$\sigma = \sqrt{\sigma^2}$
Variance	= VARP(array) for a pop. (n) = VAR(array) for a sample (n-1)	$\sigma^2 = \left\{ \frac{\sum [R_i - E(R)]^2}{n} \right\}$
Minimum	= MIN(array)	
Maximum	= MAX(array)	

Skewness	= SKEW(array)	$\frac{n}{(n-1)(n-2)} \sum \left( \frac{x_j - \bar{x}}{s} \right)^3$
Kurtosis	= KURT(array)	$\frac{n(n+1)}{(n-1)(n-2)(n-3)} \sum \left( \frac{x_j - \bar{x}}{s} \right)^4 - \frac{3(n-1)^2}{(n-2)(n-3)}$
Geometric Mean	= GEOMEAN(array) - 1	$G = \left( \prod (1+r_n) \right)^{\frac{1}{n}} - 1$
Correlation	= CORREL(array1,array2)	$\rho_{AB} = \frac{\sigma_{AB}}{\sigma_A \sigma_B}$
Covariance	= COVAR(array1,array2)	$\sigma_{AB} = \sum_{i=1}^m [R_{A,i} - E(R_A)][R_{B,i} - E(R_B)] p_i$
Return	=(B3+C3-B2)/B2 Column B is prices, C is dividends	$r_t = \frac{P_1 + C_1 - P_0}{P_0}$
Return Relative	=(A3+B3)/A2 Column B is prices, C is dividends	$(1+r_t) = \frac{P_1 + C_1}{P_0}$
Cumulative Wealth Index	=(E3)(D4) Column D is return relatives Column E is cumulative wealth	$W_{t+1} = (W_t)(1+R_{t+1})$



Risk Return Homework

Name \_\_\_\_\_

		Air Products	AirGas	Praxair	Valspar	DJIA	R3000	SP500
Returns	Weekly							
	Annualized							
Std. Dev. (sample)	Weekly							
	Annualized							
Std. Dev. (pop.)	Weekly							
	Annualized							
Variance (sample)	Weekly							
Variance (pop.)	Weekly							
Minimum								
Maximum								
Skewness								
Kurtosis								
GeoMean								

Covariance

	Air Products	AirGas	Praxair	Valspar	DJIA	R3000	SP500
Air Products							
AirGas							
Praxair							
Valspar							
DJIA							
R3000							
SP500							

Correlation

	Air Products	AirGas	Praxair	Valspar	DJIA	R3000	SP500
Air Products							
AirGas							
Praxair							
Valspar							
DJIA							
R3000							
SP500							