ECON106V LAB #4

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Aaron Chien, Ashley Lu, Yingyin Tan

Expected Returns, Variances, Correlations

NASDAQ (Favorite Stock) Mean: 0.01053186492 Variance: 0.004304682647 Standard Deviation: 0.06558710204	**RUSSELL** Mean: 0.007767468296 Variance: 0.003401461988 Standard Deviation: 0.05822767572	**NIKKEI** Mean: 0.002855473877 Variance: 0.003014301672 Standard Deviation: 0.05490710532
APPLE Mean: 0.03120061653 Variance: 0.0146852952 Standard Deviation: 0.1217441065	**NORDSTROM** Mean: 0.01316784965 Variance: 0.01787099511 Standard Deviation: 0.1336824413	**TARGET** Mean: 0.0154256584 Variance: 0.006491068283 Standard Deviation: 0.08056716628

NORDSTROM has the highest standard deviation, 0.1336824413

Portfolio Weights
NASDAQ: 0.01261866395
RUSSELL: 0.3548974143
NIKKEI: 0.543475254
APPLE: -0.02338803614
NORDSTROM: -0.1026302726
TARGET: 0.2150269764

Expected Return of Portfolio:
0.00567722341
Variance of Portfolio: 0.002266506554
Standard Deviation of Portfolio:
0.04760784131

Expected Returns, Variances, Correlations

COV	NASDAQ	RUSSELL	NIKKEI	APPLE	NORD-STROM	TARGET
NASDAQ	0.004287281105	0.003176758989	0.002071539561	0.004619855729	0.003793547158	0.002148089
RUSSELL		0.003379122881	0.001941152293	0.002964465102	0.004212989199	0.001975071895
NIKKEI			0.003004740914	0.00257554396	0.002780905565	0.001350773184
APPLE				0.0147720568	0.003628003416	0.002195846889
NORD-STROM					0.0178112259	0.005319157384
TARGET						0.006469359024

Expected Returns, Variances, Correlations

CORR	NASDAQ	RUSSELL	NIKKEI	APPLE	NORD-STROM	TARGET
NASDAQ	1.0	0.8346248188	0.576529404	0.5805196824	0.4341178079	0.40787836
RUSSELL		1.0	0.6085227609	0.4195887788	0.5430520373	0.4224256586
NIKKEI			1.0	0.386160362	0.3797156926	0.306034941
APPLE				1.0	0.2236661679	0.2246213036
NORD-STROM					1.0	0.4955247006
TARGET						1.0

NASDAQ & RUSSELL have the highest correlation, 0.8346248188

Minimum Variance Portfolio

The portfolios all include large short and long positions.

A large short position in a portfolio weight means that a significant portion of the portfolio is invested in securities that are expected to decrease in value, through the process of short selling. This is a high-risk investment strategy as the potential losses are unlimited.

A large long position in a portfolio weight refers to a significant portion of the portfolio being invested in securities that are expected to increase in value. This is a more conventional investment strategy where the potential gains are limited, but the losses are also limited to the original investment.

In general, *NIKKEI has the largest portfolio weights.* One explanation for this pattern is that the portfolio manager believes that *NIKKEI* is a strong investment opportunity with high potential for growth and returns.

Minimum Variance Portfolio

The standard deviation of a stock is a measure of its volatility, or the degree to which its price fluctuates over time. If the standard deviation of your favorite stock ($NASDAQ$) goes up by 2%, it means that the stock is becoming more volatile, which would likely lead to an increase in its weight in a minimum variance portfolio. **In our scenario, the weight of $NASDAQ$ increased.**

In a minimum variance portfolio, the goal is to minimize the overall risk of the portfolio by choosing securities with lower volatility. A stock with a higher standard deviation is considered riskier, and therefore, would be given a higher weight in the portfolio to offset the increased risk it poses. This helps to balance out the portfolio's risk and return, reducing the overall risk to the investor.

The expected return of a stock is a measure of its expected profitability. If the expected return of your favorite stock goes up by 0.5%, it means that the stock is expected to perform better than previously thought, which could potentially lead to an increase in its weight in a minimum variance portfolio. However, if a stock has a higher expected return, it may also have a higher volatility, which would increase its risk and potentially offset any benefits from the higher expected return. **In our scenario, the weight of NASDAQ decreased, indicating the higher volatility offsets the higher expected return.**

In a minimum variance portfolio, a stock with a negative correlation with other stocks would likely have a higher weight, as its negative correlation would reduce the overall risk of the portfolio. This is because negative correlations reduce the risk of the portfolio by lowering the volatility of the portfolio's returns. **In our scenario, the weight of *NASDAQ increased significantly*.**

Minimum Variance Portfolio

In a scenario where it is impossible to short (where all portfolio weights must be positive), the minimum variance portfolio would be calculated using optimization techniques that only allow for long positions. This means that the portfolio could not short sell stocks in order to reduce risk. Additionally, in a scenario where shorting is not possible, the optimization technique would not be able to take advantage of negative correlations between stocks, as it can only consider long positions. This can result in a higher portfolio risk compared to a scenario where shorting is allowed.

In general, if shorting is not allowed, the weights of the stocks in the portfolio may be less diversified, which could increase the overall risk of the portfolio. As a result, the weights of the stocks in the minimum variance portfolio changes significantly compared to a scenario where shorting is possible. Under this scenario, the optimal weight of *NASDAQ, APPLE,* and *NORDSTROM* is 0.

In general, if shorting is not allowed, the overall risk of the portfolio may be higher, which would increase the standard deviation of the portfolio. In this scenario, the standard deviation increases. One explanation is that *NASDAQ, APPLE,* and *NORDSTROM* have a significant effect on the portfolio standard deviation, hence the portfolio standard deviation increases when all their weights are at 0.

Efficient Portfolio

Portfolio Weights #1	Portfolio Weights #2	Portfolio Weights #3	Portfolio Weights #4	Portfolio Weights #5	Portfolio Weights #6	Portfolio Weights #7
NASDAQ: 0.008870943542 **RUSSELL:** 0.3606266508 **NIKKEI:** 0.5412610612 **APPLE:** -0.02296491592 **NORDSTROM:** -0.1032487682 **TARGET:** 0.2154550286 Expected Return of Portfolio: 0.005687592358 Variance of Portfolio: 0.002265863813 Standard Deviation of Portfolio: 0.04760109046	NASDAQ: RUSSELL: NIKKEI: APPLE: NORDSTROM: TARGET: Expected Return of Portfolio: Variance of Portfolio: Standard Deviation of Portfolio:	**NASDAQ:** 0.7905424905 **RUSSELL:** 2.232948632 **NIKKEI:** -3.459128956 **APPLE:** -0.2765360916 **NORDSTROM:** -0.326294684 **TARGET:** 2.038468609 Expected Return of Portfolio: 0.0343128166 Variance of Portfolio: 0.04999999766 Standard Deviation of Portfolio: 0.2236067925	**NASDAQ:** -0.7022372106 **RUSSELL:** 0.4519936949 **NIKKEI:** -3.140548692 **APPLE:** 2.465818785 **NORDSTROM:** 0.06167533841 **TARGET:** 1.863298084 Expected Return of Portfolio: 0.09363702218 Variance of Portfolio: 0.100000004 Standard Deviation of Portfolio: 0.3162277723	**NASDAQ:** -0.8650243693 **RUSSELL:** 0.4713277446 **NIKKEI:** -3.984365378 **APPLE:** 3.035619661 **NORDSTROM:** 0.1002874049 **TARGET:** 2.242154936 Expected Return of Portfolio: 0.1137939428 Variance of Portfolio: 0.1500000001 Standard Deviation of Portfolio: 0.3872983347	**NASDAQ:** -0.9918707717 **RUSSELL:** 0.472947338 **NIKKEI:** -4.688699485 **APPLE:** 3.514806261 **NORDSTROM:** 0.1333455596 **TARGET:** 2.559471098 Expected Return of Portfolio: 0.130740419 Variance of Portfolio: 0.2000000013 Standard Deviation of Portfolio: 0.447213597	**NASDAQ:** -1.09953984 **RUSSELL:** 0.4673976134 **NIKKEI:** -5.305936275 **APPLE:** 3.936407091 **NORDSTROM:** 0.1648176129 **TARGET:** 2.836853797 Expected Return of Portfolio: 0.145648288 Variance of Portfolio: 0.2499999968 Standard Deviation of Portfolio: 0.4999999968

Efficient Portfolio

Portfolio Weights #8	Portfolio Weights #9	Portfolio Weights #10	Portfolio Weights #11	Portfolio Weights #12	Portfolio Weights #13	Portfolio Weights #14
NASDAQ: -1.189552848	NASDAQ: -1.381319887	NASDAQ: -1.546055453	NASDAQ: -1.702782113	NASDAQ: -1.835016833	NASDAQ: -1.976591826	NASDAQ: -2.095621164
RUSSELL: 0.4653021205	RUSSELL: 0.4579296568	RUSSELL: 0.4611188458	RUSSELL: 0.5008006102	RUSSELL: 0.5112479601	RUSSELL: 0.503217646	RUSSELL: 0.5274154861
NIKKEI: -5.866795861	NIKKEI: -6.847760758	NIKKEI: -7.721692992	NIKKEI: -8.525326767	NIKKEI: -9.258042538	NIKKEI: -9.909213948	NIKKEI: -10.56215795
APPLE: 4.317397168	APPLE: 4.99265488	APPLE: 5.586947908	APPLE: 6.126595644	APPLE: 6.619034328	APPLE: 7.085988549	APPLE: 7.51475131
NORDSTROM: 0.1877355424	NORDSTROM: 0.2282060565	NORDSTROM: 0.278186919	NORDSTROM: 0.3111667375	NORDSTROM: 0.3449223191	NORDSTROM: 0.3670763998	NORDSTROM: 0.4124909696
TARGET: 3.085913878	TARGET: 3.550290052	TARGET: 3.941494773	TARGET: 4.289545887	TARGET: 4.617854764	TARGET: 4.929523179	TARGET: 5.203121352
Expected Return of Portfolio: 0.1591133074	Expected Return of Portfolio: 0.1829999327	Expected Return of Portfolio: 0.2040292809	Expected Return of Portfolio: 0.2230326615	Expected Return of Portfolio: 0.2405021415	Expected Return of Portfolio: 0.2567579864	Expected Return of Portfolio: 0.2720239835
Variance of Portfolio: 0.2999999958	Variance of Portfolio: 0.3999999932	Variance of Portfolio: 0.5000000069	Variance of Portfolio: 0.6000000069	Variance of Portfolio: 0.7000000001	Variance of Portfolio: 0.8000000005	Variance of Portfolio: 0.8999999994
Standard Deviation of Portfolio: 0.5477225537	Standard Deviation of Portfolio: 0.6324555266	Standard Deviation of Portfolio: 0.7071067861	Standard Deviation of Portfolio: 0.7745966737	Standard Deviation of Portfolio: 0.8366600266	Standard Deviation of Portfolio: 0.8944271913	Standard Deviation of Portfolio: 0.9486832977

Efficient Portfolio

By combining your favorite stock (*NASDAQ*) with the other 5 in a portfolio, the extra return is roughly ~20%.

Other stocks have roughly the same extra return as well (~20%).

Risk Return Diagram

The gains from diversification can be measured by comparing the risk and return of a portfolio of stocks to the risk and return of an individual stock. By combining a stock with other stocks in a portfolio, it is possible to reduce the risk of the portfolio while maintaining or increasing the return. This reduction in risk is due to the diversification of the portfolio, which can result in a more stable return.