EFFICIENT FRONTIER

Jacksonville University

Finance 534

Summer 1st Term

By

**Annualized returns and standard deviation of returns for our eight securities**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | WMT | HD | C | LUV | TXN | JNJ | IBM | BA |
| **Annual std deviation** | 0.170073274 | 0.256 | 0.70289336 | 0.33947062 | 0.2829175 | 0.151421 | 0.192617 | 0.3098372 |
| **Annual Return** | 0.115246719 | 0.2575 | -0.1177338 | 0.02522875 | 0.0449745 | 0.0564385 | 0.162961 | 0.0469389 |

**Correlation Matrices**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | WMT | HD | C | LUV | TXN | JNJ | IBM | BA |
| WMT | 1 | 0.371639987 | 0.322228529 | 0.31769286 | 0.14162193 | 0.35423 | 0.1871011 | 0.183629191 |
| HD | 0.371639987 | 1 | 0.439196512 | 0.38994383 | 0.46325023 | 0.336342 | 0.3267911 | 0.421735254 |
| C | 0.322228529 | 0.439196512 | 1 | 0.45823707 | 0.48233729 | 0.478776 | 0.3310887 | 0.659796696 |
| LUV | 0.317692864 | 0.389943832 | 0.458237067 | 1 | 0.46214205 | 0.493098 | 0.4172458 | 0.499953357 |
| TXN | 0.141621927 | 0.46325023 | 0.482337291 | 0.46214205 | 1 | 0.409466 | 0.571813 | -0.00862002 |
| JNJ | 0.354229995 | 0.336342002 | 0.478776313 | 0.49309759 | 0.4094657 | 1 | 0.4484206 | 0.554390153 |
| IBM | 0.187101093 | 0.326791131 | 0.33108866 | 0.4172458 | 0.57181299 | 0.448421 | 1 | 0.394416304 |
| BA | 0.183629191 | 0.421735254 | 0.659796696 | 0.49995336 | -0.00862 | 0.55439 | 0.3944163 | 1 |

**Variance Covariance Matrices**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **wmt** | **hd** | **c** | **luv** | **txn** | **jnj** | **ibm** | **ba** |
| **wmt** | 0.02892 | 0.016179 | 0.03852 | 0.018342 | 0.00681 | 0.009122 | 0.006129 | 0.009676 |
| **hd** | 0.01618 | 0.065518 | 0.07902 | 0.033883 | 0.03355 | 0.013036 | 0.010705 | 0.033447 |
| **c** | 0.03852 | 0.079019 | 0.49406 | 0.109341 | 0.09592 | 0.050958 | 0.044826 | 0.143692 |
| **luv** | 0.01834 | 0.033883 | 0.10934 | 0.11524 | 0.04439 | 0.025347 | 0.027283 | 0.052585 |
| **txn** | 0.00681 | 0.033547 | 0.09592 | 0.044385 | 0.08004 | 0.017541 | 0.031161 | -0.00076 |
| **jnj** | 0.00912 | 0.013036 | 0.05096 | 0.025347 | 0.01754 | 0.022928 | 0.013079 | 0.02601 |
| **ibm** | 0.00613 | 0.010705 | 0.04483 | 0.027283 | 0.03116 | 0.013079 | 0.037101 | 0.023539 |
| **ba** | 0.00968 | 0.033447 | 0.14369 | 0.052585 | -0.00076 | 0.02601 | 0.023539 | 0.095999 |

**Expected return, standard deviation and bordered covariance matrix for the equally weighted portfolio**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | WMT | HD | C | LUV | TXN | JNJ | IBM | BA | **Sum of weight** |
| **Weight** | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 1 |
| **Variance** | 0.04635111 |  |  |  |  |  |  |  |  |
| **Standard Deviation** | 0.21529307 |  |  |  |  |  |  |  |  |
| **E(Rp)** | 0.07394383 |  |  |  |  |  |  |  |  |

**Bordered covariance matrix**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | WMT | HD | C | LUV | TXN | JNJ | IBM | BA |
| WEIGHT | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 |
| WMT | 0.000451952 | 0.00025279 | 0.000601879 | 0.00028659 | 0.00010647 | 0.000143 | 9.577E-05 | 0.000151193 |
| HD | 0.00025279 | 0.001023726 | 0.001234668 | 0.00052943 | 0.00052418 | 0.000204 | 0.0001673 | 0.000522607 |
| C | 0.000601879 | 0.001234668 | 0.007719673 | 0.00170845 | 0.00149872 | 0.000796 | 0.0007004 | 0.002245191 |
| LUV | 0.000286593 | 0.000529427 | 0.001708448 | 0.00180063 | 0.00069352 | 0.000396 | 0.0004263 | 0.000821647 |
| TXN | 0.000106475 | 0.000524176 | 0.001498719 | 0.00069352 | 0.00125066 | 0.000274 | 0.0004869 | -1.1807E-05 |
| JNJ | 0.000142537 | 0.00020369 | 0.000796211 | 0.00039604 | 0.00027408 | 0.000358 | 0.0002044 | 0.000406401 |
| IBM | 9.57693E-05 | 0.000167271 | 0.000700402 | 0.00042629 | 0.00048689 | 0.000204 | 0.0005797 | 0.000367792 |
| BA | 0.000151193 | 0.000522607 | 0.002245191 | 0.00082165 | -1.181E-05 | 0.000406 | 0.0003678 | 0.001499986 |

**Weights of securities in each portfolio you created to obtain the efficient frontier**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Return | Std Deviation | WMT | HD | C | LUV | TXN | JNJ | IBM | BA | Sum of weight |
| 1% | 0.25822964 | 0 | 0 | 0.25 | 0.093 | 0 | 0.657 | 0 | 0 | 1 |
| 2% | 0.22866448 | 0 | 0 | 0.1944 | 0.0762 | 0.018 | 0.7112 | 0 | 0 | 1 |
| 3% | 0.20130854 | 0 | 0 | 0.1385 | 0.0578 | 0.044 | 0.7596 | 0 | 0 | 1 |
| 4% | 0.17717829 | 0 | 0 | 0.0827 | 0.0394 | 0.07 | 0.808 | 0 | 0 | 1 |
| 5% | 0.15776087 | 0 | 0 | 0.0269 | 0.021 | 0.096 | 0.8564 | 0 | 0 | 1 |
| 6% | 0.14338716 | 0.0854 | 0 | 0 | 0 | 0.112 | 0.7841 | 0 | 0.0186 | 1 |
| 7% | 0.13364155 | 0.2474 | 0 | 0 | 0 | 0.084 | 0.6657 | 0 | 0.0028 | 1 |
| 8% | 0.12922548 | 0.3189 | 0 | 0 | 0 | 0.055 | 0.5754 | 0.051 | 0 | 1 |
| 9% | 0.12657224 | 0.3398 | 0 | 0 | 0 | 0.023 | 0.5071 | 0.1299 | 0 | 1 |
| 10% | 0.12536194 | 0.3505 | 0.0133 | 0 | 0 | 0 | 0.4458 | 0.1904 | 0 | 1 |
| 11% | 0.1251562 | 0.3473 | 0.0482 | 0 | 0 | 0 | 0.3844 | 0.2201 | 0 | 1 |
| 12% | 0.12588197 | 0.3441 | 0.0832 | 0 | 0 | 0 | 0.323 | 0.2497 | 0 | 1 |
| 13% | 0.12752336 | 0.3408 | 0.1182 | 0 | 0 | 0 | 0.2617 | 0.2793 | 0 | 1 |
| 14% | 0.13004569 | 0.3376 | 0.1532 | 0 | 0 | 0 | 0.2003 | 0.309 | 0 | 1 |
| 15% | 0.133399 | 0.3343 | 0.1881 | 0 | 0 | 0 | 0.1389 | 0.3386 | 0 | 1 |
| 16% | 0.13752253 | 0.3311 | 0.2231 | 0 | 0 | 0 | 0.0775 | 0.3683 | 0 | 1 |
| 17% | 0.14234934 | 0.3279 | 0.2581 | 0 | 0 | 0 | 0.0161 | 0.3979 | 0 | 1 |
| 18% | 0.14815741 | 0.2727 | 0.3179 | 0 | 0 | 0 | 0 | 0.4094 | 0 | 1 |
| 19% | 0.15567943 | 0.1991 | 0.3865 | 0 | 0 | 0 | 0 | 0.4144 | 0 | 1 |
| 20% | 0.16472018 | 0.1255 | 0.4551 | 0 | 0 | 0 | 0 | 0.4194 | 0 | 1 |

**Expected return and standard deviation of efficient portfolios and graph them along with the expected return and standard deviation of 8 securities that I worked with in this exercise**.

|  |  |
| --- | --- |
| Return | Std Deviation |
| 1% | 0.25822964 |
| 2% | 0.22866448 |
| 3% | 0.20130854 |
| 4% | 0.17717829 |
| 5% | 0.15776087 |
| 6% | 0.14338716 |
| 7% | 0.13364155 |
| 8% | 0.12922548 |
| 9% | 0.12657224 |
| 10% | 0.12536194 |
| 11% | 0.1251562 |
| 12% | 0.12588197 |
| 13% | 0.12752336 |
| 14% | 0.13004569 |
| 15% | 0.133399 |
| 16% | 0.13752253 |
| 17% | 0.14234934 |
| 18% | 0.14815741 |
| 19% | 0.15567943 |
| 20% | 0.16472018 |

**Observations you can make regarding the position of individual securities, equally weighted portfolio relative to the efficient frontier**

The Efficient frontier indicates that at the 7.4% return which is the return for equally weighted portfolio, risk is around 12.5%. While it shows 21.5 % risk for the equally weighted portfolio. Solver technique is used to find out the standard deviation of 1% up to 20% return. Graph shows that, from 1% to 11% the risk is gradually decreases while from 11% it strats to increase slowly. For any given value of standard deviation, we prefer a portfolio that gives us the greatest possible rate of return; so we always want a portfolio that lies up along the efficient frontier, rather than lower down, in the interior of the region. This is the first important property of the efficient frontier. The second important property of the efficient frontier is that it's *curved*, not straight. This is actually significant -- in fact, it's the key to how diversification lets us improve our reward-to-risk ratio.