ALY6050: Introduction to Enterprise Analytics

Module 6

Assignment 6

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## Introduction

Chimotoxic, a business that produces chemicals for industrial application, has contacted Rockhill Shipping & Transport Company (RSTC) to transfer waste products from its six plants to three waste disposal facilities. Because the chemical wastes could be dangerous to people or the environment if they leak during shipment, Allen, a manager of the South-Atlantic office of RSTC, is concerned about this idea. Also, certain localities in the areas where the factories are situated may forbid the shipping of hazardous chemicals via their municipal boundaries. The price of transporting a barrel of garbage from each of the six plants to each of the three disposal facilities has been calculated by Allen.

Allen is thinking of using each of the six facilities and the trash disposal sites as intermediary shipment locations in addition to shipping directly from each of the six plants to one of the three waste disposal sites. Allen wants to identify the shipping routes that will reduce RSTC's overall cost as a result, so that he may create a contract proposal to present to Chimotoxic for waste disposal.

## Analysis

This issue can be modeled as a transshipment issue. Transportation issues known as transshipment challenges allow for intermediate transshipment stations between the origin and the destination. Six sources, three destinations, and six intermediate transshipment sites are present in this challenge. In order to reduce the overall cost of transportation, we must identify the best shipping routes. We can utilize the linear programming method to resolve this issue. The quantity of waste carried in barrels from each source to each destination via each intermediate site might be considered a decision variable.

The following table displays Allen's anticipated costs for transporting a barrel of garbage from each of the six factories to each of the three disposal facilities.

|  |  |  |  |
| --- | --- | --- | --- |
| **Plant:** | ***Orangeburg*** | ***Florence*** | ***Macon*** |
| **Denver** | $10 | $8 | $9 |
| **Morganton** | 14 | 10 | 8 |
| **Morrisville** | 13 | 18 | 11 |
| **Pineville** | 15 | 11 | 12 |
| **Rockhill** | 9 | 12 | 9 |
| **Statesville** | 18 | 12 | 13 |

The following table shows optimal shipping costs for per barrel of waste from six plants to three waste disposal sites.

|  |  |  |  |
| --- | --- | --- | --- |
| **Plant** | **Orangeburg** | **Florence** | **Macon** |
| **Denver** | 45 | 0 | 0 |
| **Morganton** | 0 | 0 | 35 |
| **Morrisville** | 0 | 0 | 55 |
| **Pineville** | 0 | 50 | 0 |
| **Rockhill** | 30 | 0 | 0 |
| **Statesville** | 0 | 35 | 0 |

The total shipping cost comes up to $2575 for transporting waste from plants to the disposal site per week.

The following table shows shipping costs for per barrel of waste from each plant to another plant.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Plant** | | | | | |
| **Plant:** | **Denver** | **Morganton** | **Morrisville** | **Pineville** | **Rockhill** | **Statesville** |
| **Denver** | $--- | 3 | 4 | 3 | 3 | 4 |
| **Morganton** | 3 | $--- | 3 | 3 | 2 | 4 |
| **Morrisville** | 4 | 3 | $--- | 3 | 3 | 2 |
| **Pineville** | 3 | 3 | 3 | $--- | 4 | 2 |
| **Rockhill** | 3 | 2 | 3 | 4 | $--- | 2 |
| **Statesville** | 4 | 4 | 2 | 2 | 2 | $--- |

We are checking if he should drop and pick up some loads at the various plants and waste sites, or if it would be less expensive to ship directly from the plants to the waste sites.

The following table shows optimal shipping costs for per barrel of waste from six plants to three waste disposal sites.

|  |  |  |  |
| --- | --- | --- | --- |
| **Plant** | **Orangeburg** | **Florence** | **Macon** |
| **Denver** | 0 | 45 | 0 |
| **Morganton** | 0 | 0 | 45 |
| **Morrisville** | 0 | 0 | 45 |
| **Pineville** | 0 | 40 | 0 |
| **Rockhill** | 75 | 0 | 0 |
| **Statesville** | 0 | 0 | 0 |

The following table shows optimal shipping costs for per barrel of waste from each plant to another plant.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Plant:** | **Denver** | **Morganton** | **Morrisville** | **Pineville** | **Rockhill** | **Statesville** |
| **Denver** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Morganton** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Morrisville** | 0 | 0 | 0 | 0 | 10 | 0 |
| **Pineville** | 0 | 10 | 0 | 0 | 0 | 0 |
| **Rockhill** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Statesville** | 0 | 0 | 0 | 0 | 35 | 0 |

The total shipping cost that will occur in this transshipment is $ 2460 per week.

## Conclusion

In conclusion, linear programming techniques were used to successfully address the transshipment problem for Rockhill Shipping & Transport Company. Direct shipping and transshipment were the two scenarios that were taken into consideration, and the best routes and associated costs were found for each.

The best routes for the direct shipping scenario suggested that all trash from each plant be transported directly to the least expensive disposal facility. In this case, the weekly cost came to $2575.

The best routes for the transshipment scenario suggested that some plants' trash should be sent to intermediate locations, picked up by another vehicle, and then delivered to the final location. In comparison to the direct shipping option, this scenario's total cost per week was $2460.

A total of 205 barrels will be transported each week from a source to a destination in the transshipment case.

Finally, the effects of expanding each waste disposal site's capacity by 5 barrels per week were assessed for both scenarios. It was discovered that the cost for the direct shipping scenario decreased by $15 while the cost for the transshipment scenario decreased by $10 each week.

Part 2:

## Introduction

In order to reach at least a baseline expected return of 15% while reducing risk, we have examined a portfolio of assets and established the allocation of investment to each asset. To better comprehend the mathematical link between these two variables, we have also plotted the expected portfolio return vs the minimized risk for various baseline expected returns.

## Analysis

The Markowitz portfolio optimization approach, which considers the predicted returns and covariances of assets to minimize risk while attaining a target return, was used to establish the optimal allocation of investments. We determined the weights of each asset that would reduce risk while generating at least a 15% anticipated return using the provided expected return and covariance matrix data.

|  |  |  |
| --- | --- | --- |
| **Asset Type** | **Expected Return** | **Allocation Percentage** |
| CDs | 5% | 0.00 |
| High tech stocks | 28% | 0.11 |
| Foreign stocks | 22% | 0.18 |
| Energy stocks | 15% | 0.16 |
| Put options | 15% | 0.21 |
| Gold | 7% | 0.34 |

The optimal allocation suggests that the investor should invest the majority of their portfolio in gold, followed by put options, foreign stocks, energy stocks, and high tech stocks. Notably, there is no allocation suggested for CDs as they do not offer a sufficient expected return to meet the baseline.

It is important to remember that this allocation is based on previous data and could not be a reliable predictor of future results. Also, buying put options entails some risk, so before making any purchases, investors should carefully assess their risk tolerance and financial goals.

We examined a portfolio of assets and plotted the anticipated return of the portfolio against the risk that was reduced for various baseline anticipated returns of 11%, 14%, 17%, 20%, 23%, and 26%.

To examine the link between these two variables, we have plotted the predicted portfolio return on the y-axis and the minimized risk (variance) on the x-axis. As anticipated, we have seen that as the baseline expected return rises, so does the expected portfolio return. In addition, we have seen a concave relationship between predicted portfolio return and minimized risk, where the latter increases at a decreasing pace as the former rises.

The evidence also points to a relationship between projected portfolio return and variation that is favorable. This is due to the fact that higher predicted returns are frequently linked to increased risk (variance). Although there may be diminishing profits with increased risk, the concave relationship between the minimized risk and predicted portfolio return argues otherwise. So, when building their portfolio, investors should try to strike a balance between expected profits and risk.

## Conclusion

As a result of our analysis of a portfolio of assets, we have pinpointed the ideal investment mix that will yield at least a 15% projected return while lowering risk. We found a concave relationship between predicted portfolio return and decreased risk, which is consistent with the Markowitz portfolio optimization method. For investors looking to attain their desired returns while controlling risk in their investment portfolio, this research offers helpful insights.