**Module 6 Project 6**

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**By**

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**Title: Project 6 Report**

**ALY 6050 – Introduction to Enterprise Analytics**

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**Introduction**

In this assignment, I am using MS Excel to work on 2 different problems as given. It helps us to identify and develop a model with the total profit and maximization of it. This gives an idea about the profit optimization models, excel solver, data table, non-linear programming, binary programming, Hodrick-Prescott filter, decomposition method, time-series analysis and implementation of the model. Non-Linear Programming is a technique used in solving the problems and has become a usual tool for businesses and organizations.

In Problem 1 & 2 I have used optimization techniques to maximize the efficiency of the model. In Excel, we can simply access it by clicking on Solver in Analyze tab under the Data tab. I will also tend to determine the type of evaluations for each problem and showcase the results, and findings. In this report, I have implemented 2 Problems and their related questions.

**Analysis**

**Problem 1(A):**

In this Problem our goal is to generate as much local recognition as possible to the advertisement campaign of Josh Steele. We can clearly state the objective function as 110 X1 + 55 X2 + 80 X3 + 65 X4 + 400 X5 + 220 X6 + 35 X7 + 10 X8 + 20 X9

We have to consider couple of constraints on order to work on this problem. There are $80 X1 + $65 X2 + $250 X3 + $225 X4 + $500 X5 + $300 X6 +$55 X7 + $350 X8 + $300 X9 <= $20000 and 40 X1 + 20 X2 + 5 X3 + 8 X4 + 70 X5 + 40 X6 + 0 X7 + 75 X8 + 65 X9 <= 4000. Also, we have X1 <= 30, X2 <= 30, X3 <= 24, X4 <= 24, X5 <= 10, X6 <= 10, X7 <= 15, X8 <= 12, X9 <= 12

Now, we perform SUMPRODUCT() on the Price, Local Exposure, and National Exposure columns. In this way, let’s setup the Excel Sheet and click on the Solver to give the objective function, to define constraints, and solving model to derive the results.

After this step, I have observed that Josh Steele can give 30 FM radio spot ads, 23 AM radio spots, 10 city scape ads, 10 hometown ads, 10 neighborhood paper ads, 9 choir journal ads, and 8 professional organization magazine ads to maximize the local exposure of his campaign.

**Problem 1(B):**

In this problem, if Josh Steele, decides to use no more than 6 various types of ads, the model to solve this problem follows the same approach but here we add binary variables to make sure that there are no more than the 6 different types of ads.

If Josh Steele decides to use no more than 6 different types of ads, then he has to give 30 FM radio spot ads, 10 Hometown paper ads, 7 city scape ads, 10 neighborhood paper ads, 12 choir journal ads, and 12 professional organization magazine ads to maximize the local exposure.

**Problem 2(A, B):**

Hodrick – Prescott Filter has been the favorite empirical technique among researchers studying cycles. Software facilities and optimality criterion, from which the filter can be derived and explained with its wide range of use cases. However, various shortcomings and drawbacks have been observed and an alteration of variability and persistence and decreasing spurious cycles and correlations.

Almost, 20 years after its name as HP Filter in the literature is still favorite empirical technique used to separate cyclical behavior from the long run of the economic series. Applied to both true and artificial data. Filtered series have been studied mainly to discover and compare the univariate and cross moments like Variability, Auto Correlation, Bivariate, Correlation, etc.

The conceptual framework provided by Hodrick and Prescott can be summarized as follows: Yt = Ct + Tt

A useful insight of the HP filter can be derived from its representation on time domain. Researchers should be aware of the decomposition of the series that the filter assumes. Then a less mechanical use is proposed by testing how the estimated cyclical component bhaves using the auto correlation adjusted standard errors to evaluate cross correlation to differentiate the genuine from spurious case.

Although, the role of the filter as part of a descriptive analysis can’t be denied. Econometric modelling of filtered series is more problematic if the data generating process involves unfiltered series.

**Problem 2(C):**

In this problem, I have considered the quarterly time series of Hon stock from the Yahoo Finance site and applied the Hodrick-Prescott optimization method to decompose the logarithm of the given time series into its cyclic and trend components. Used the Excel Solver to solve this and obtained the results accordingly.

**Problem 2(D):**

As given, the Hodrick-Prescott decomposition of the logarithm of a time series is an additive decomposition; thus, this decomposition becomes a multiplicative type of decomposition for the original time series. In other words, if 𝒚 is the original time series and if 𝒙 = 𝒍𝒐𝒈(𝒚), then the decomposition 𝒙 = 𝒄 + 𝒕 for 𝒙 implies that 𝒚 = 𝟏𝟎 𝒄+𝒕 = (𝟏𝟎𝒄) (𝟏𝟎𝒕).

I have obtained the Cyclical and Trend components for all the 124 decision variables. And, calculated the z value based on this formula **𝑍=Σ𝐶𝑡2+𝜔Σ(𝑇𝑡+1−2𝑇𝑡+ 𝑇𝑡−1)^2,** where **𝜔** is 1600 for the quarterly time series.

**Problem 2(E, F):**

I have also plotted the line plots of the original time series along with its trend component on the same chart as shown below.

The above chart depicts the Trend component of the HON stock over the dates provided for the analysis.

The below chart shows the cyclical component of the given data over the dates provided for the analysis.

We can also observe from the calculations that, the summation of Cyclical and Trend components also produce the same plot.

**Conclusion**

From this project, I have gained a lot of knowledge and got familiar with the optimization techniques, MS Excel Solver, Non-Linear Programming, Optimization Models, Binary Programming, Hodrick-Prescott filter, decomposition method, time-series analysis, and decision modeling. I used Solver to predict the best for the decision to take and showcase the optimal solutions. The solver function is very much useful and I found it a good resource to play on and experiment with. Now, I am clear and will work on these concepts very well with deep understanding. Also, I have worked on the calculations to find the best solutions. So, I used these analyses and models to define and predict the prices and forecasted them. Also, working on MS Excel allowed me to work on these techniques. I previously did not work on these aspects, but from this Assignment, I had a great time learning them. In the coming days and assignments, I will make sure to use this knowledge and apply it to the problems.