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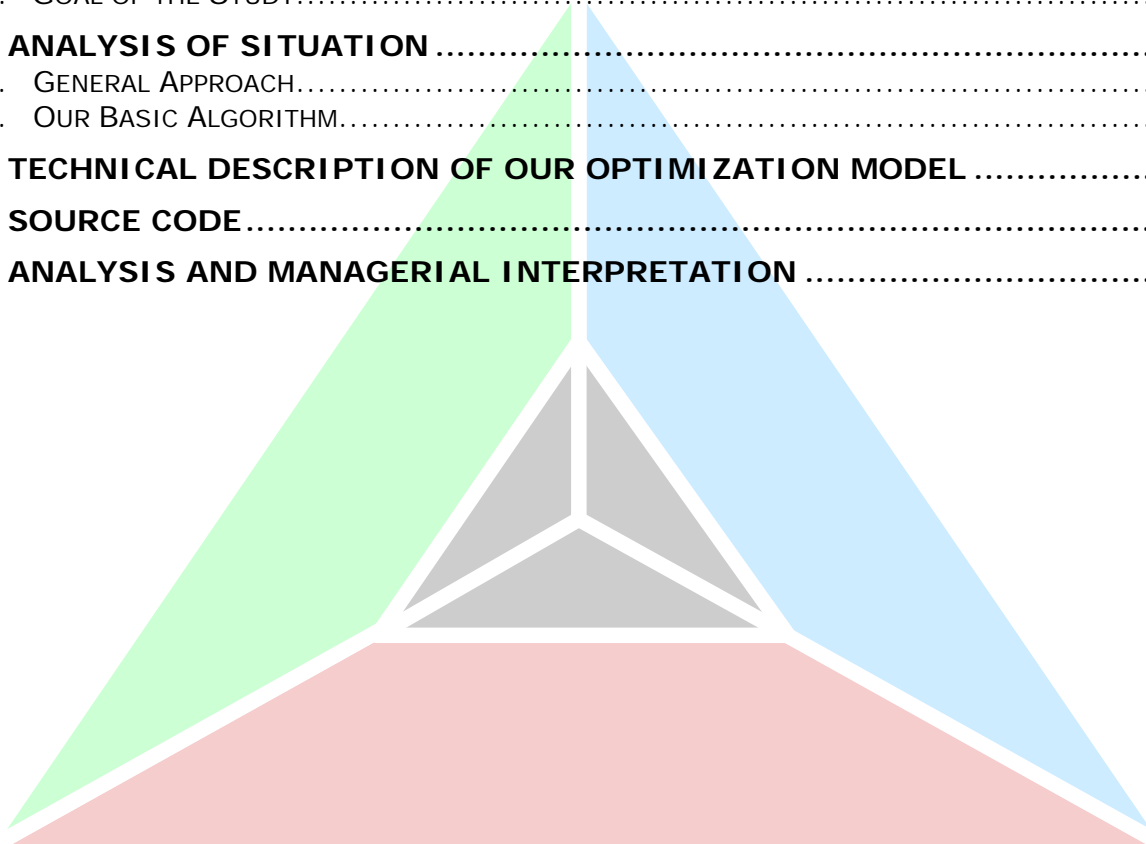
SENIOR
DESIGN
2010

CAPSTONE FINANCIAL

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1. Management Summary

The main goal of this project was to build a Financial Model that will assist Capstone Financial in their selection of where to distribute energy in selling one product over another. They need a new way to analyze their product sales and profitability levels. In order to fulfill our clients' needs we are developing a program to determine the optimal profitability levels.

The financial model uses an OPL based program to find solutions that are unique to Capstone's assets. To make the model more user-friendly, the program connects to an excel spreadsheet. This will also allow Capstone to reuse the model as they expand in the future. By developing this program the user only needs to input the data into the Excel file, open the program, run the program and the final data will automatically be put back into the original excel file in an easy to read format.

Essentially, the program we have developed extracts data from the spreadsheet provided by Capstone, analyzes the data, and recommends solutions. The analysis of the data is based on 13 constraints and 12 decision variables. The objective function is the net income equation, and the program determines the final solution by maximizing the objective function.

The program we have developed has given us an innovative approach to analyzing financial data from many different angles.

2. Background Information

a. Company Information

Capstone is a privately owned investment advisory firm in Houston, TX that offers privately managed accounts to achieve client's financial objectives. They currently have over \$3.8 billion in assets for about 3,000 different clients. Clients include individuals, endowments, trusts, corporations, public funds, healthcare and religious organizations. They provide products and services through three distribution channels: 1. Brokers/advisors 2. Institutions/corporations 3. High net-worth individuals. Revenues are generated by marginal product fees associated with assets under management allocated by product.

b. Purpose of Study

Capstone has in place a detailed budgeting process but desires to expand the process to include financial modeling that would enable the firm to measure profitability by product. Our goal for this project is to develop a model that would calculate existing profitability on assets under management by product. Our second goal is to develop an optimization model that takes into account the revenues and expenses associated with sales of existing products versus the revenues and expenses associated with the development of new products. The final output of the optimization model is to identify the most profitable mix for new product sales.

c. Goal of the Study

The main goal of our project is to develop a financial management tool, which would enable us to allocate expenses by product and in



turn measure product profitability. We plan on doing this by using the user-friendly Excel interface along with an ILOG OPL Development Studio 5.5 platform that generates our final solution and rewrites it back into the original Excel data file.

3. Analysis of Situation

a. General Approach

Originally we had separate budgets per department and product, which we combined into a master corporate budget. With a master corporate budget, we were then able to define the objective function, variables, costs and constraints for our model. We used the budget data not only to develop our optimization model, but also to conduct the final product analysis.

The data found in the corporate budget provided us with fixed and variable costs as well as constraints. Some of the data that we pulled from the spreadsheet and incorporated into our program includes the fee factor for each product, the average new account size, current number of assets, variable expense costs per product, as well as upper sales limits. Sales assumptions, averages and probabilities were also established in order to produce our model.

The first step in the approach of generating the model was to familiarize ourselves with the new Optimization Programming Language, or OPL. By reading parts of the OPL Language User Manual and looking at a number of various example problems we developed an understanding of the programming language.

Using OPL we found a feasible solution to determine which products were profitable as well as an estimated value on the future sales of the company.



The real problems we encountered were first sifting through the mass amounts of information to find relevant costs as well as analyzing this information and making it useable. Deciding what information was relevant to our model was the most important step. By developing a basic algorithm we gained a greater understanding of the scope of our project. This algorithm also helped us narrow down the information. Another problem we had was deciding which constraints were relevant to the solution we were seeking, and in what order we wanted the program to evaluate the constraints in order to maximize income.

b. Our Basic Algorithm

1. Initialize the decision variables and the other variables of float type
2. Read necessary information from excel and into the data file.
3. Set up main objective function to maximize net income
4. Develop constraints:
forall(e in Products)
 - a. Minimum number of new assets under each product
 - b. Maximum number of new assets under each product
(Maximum Asset Capacity)
 - c. New number of accounts should be initialized
 - d. The estimated new assets
 - e. The new revenue for the period
 - f. The total revenue for the period



- g. New Commission Expense
- h. IT Account Expense
- i. New Account Fee Expense
- j. Ending Assets
- k. Ending Accounts
- l. Net Income

5. Write Relevant Data back out to excel sheet

4. Technical Description of our Optimization Model

The Objective Function of our optimization model is to maximize the net income. The equation for net income is revenues less expenses. The revenues are determined by multiplying the amount of assets per product by the unique fee factor for the product. The expenses vary according to the number of the new accounts created.

We used 17 variables that held strings of float-type numbers, and these numbers were pulled from the Excel Sheet. Our 12 decision variables also held strings of float-type numbers, but the OPL program determined these numbers. By basing our program on strings we are able to easily add new products in the future by just adding a column in the Excel spreadsheet. The 13 constraints we developed were based on the relationships between all 29 variables.

The data we used was a combination of theoretical values as well as specific values and historical data. Theoretical values included the probability levels and percentages as well as the average new account size since new accounts can come in at various sizes. These numbers, although theoretical are as realistic as possible in the hypothetical model



we developed. Specific & historical values included the current assets under management, fee factors, current number of accounts and expense factors (i.e commission, IT and new account).

After the program runs, the relevant data held in the variables is written back out into a sheet in Excel named Results. The results sheet contains a detailed profile of the financial information, providing the user with a clear understanding of the recommendations.

5. Source Code

```
/******  
* OPL 5.5.1 Model  
* Author: Mallory Harrison & Natalie Jaroski  
* Made for Capstone Financial  
* Senior Design 2010  
*****/  
  
//Defining Products  
//Products is our main string making it easy to add a new product in the future  
{string} Products=...;  
  
//Defining Other Variables Needed - All of these variables are read in from Excel  
with specific data values  
  
float Average_New_Account[Products]=...;  
//Variable describing the Average New Account  
float Beginning_Assets[Products]=...;  
//Variable describing the assets currently under management
```




```
float Expected_Account_Sales[Products]=...;
//Variable describing the middle level of sales in the estimated value probability
float Expected_Probability_Success[Products]=...;
//Variable describing the probability percent of receiving the expected Sales
float ExistingRevenues[Products]=...;
//Variable describing existing revenues from current assets under management
float Fee_factor[Products]=...;
//Variable describing the factor used to multiply the new assets by to determine
revenue
float IT_Account_Fee_Factor[Products]=...;
//Variable describing the expense for IT for each new account
float Max_Number_Accounts[Products]=...;
//Variable describing the max capacity of number of accounts
float Maximum_Account_Capacity[Products]=...;
//Variable describing the max capacity of assets
float Minimum_Account_Sales[Products]=...;
//Variable describing the low level of sales in the estimated value probability
float Minimum_Probability_Success[Products]=...;
//Variable describing the low level of sales in the estimated value probability
float Minimum_Sales_Required[Products]=...;
//Variable describing the minimum amount of sales required
float New_Account_Fee_Factor[Products]=...;
//Variable describing the expense to Capstone for every new account
float New_Commission_Factor[Products]=...;
//Variable describing the percentage an employee makes for selling a new account
(commission expense)
float Number_of_Accounts[Products]=...;
//Variable describing the current number of accounts held under each product
float Target_Account_Sales[Products]=...;
//Variable describing the target level of sales in the estimated value probability
float Target_Probability_Success[Products]=...;
//Variable describing the probability percent of receiving the target sales
```



//Defining Decision Variables- These are the variables that our program will assign values to

```
dvar float+ Ending_Accounts[Products];  
//How many accounts will we end up with for each product?  
dvar float+ Ending_Assets[Products];  
//How much money will we have in assets for each product in the end?  
dvar float+ EV[Products];  
//What is the estimated value of the sales for next year with the probabilities given?  
dvar float+ IT_Account_Fee[Products];  
//What is the total IT fee for each product (expenses)?  
dvar float+ Net_Income[Products];  
//What is the net income?  
dvar float+ New_Account_Fee[Products];  
//What is the total new account fee (expenses)?  
dvar float+ New_Assets_Period[Products];  
//How many new assets should they have in the new period?  
dvar float+ New_Commission[Products];  
//What is the new commission (expenses)?  
dvar float+ NewRevenues[Products];  
//What is the revenue off of the new accounts if they are aquired?  
dvar float+ Total_Expenses[Products];  
//What is the total expense amount? This includes the IT fee, New Account fee and commission.  
dvar float+ TotalRevenues[Products];  
//What is the total amount made off of the new assets?  
dvar float+ New_Number_of_Accounts[Products];  
//How many new accounts should be assigned?
```

//Start of Model



//Objective function to maximize Net Income

maximize

sum(f in Products)

(Ending_Assets[f]*Fee_factor[f] - Total_Expenses[f]);

//Constraints

subject to {

forall(e in Products)

{

//This constraint sets the maximum amount of assets possible

Max: New_Assets_Period[e] <= Maximum_Account_Capacity[e];

//This constraint sets the minimum amount of sales required

Min: New_Assets_Period[e] >= Minimum_Sales_Required[e];

//This constraint sets the new number of accounts to the right number in relation to the new assets

NewAcct: New_Number_of_Accounts[e] ==
New_Assets_Period[e] / Average_New_Account[e];

//This constraint calculates the estimated value of next years sales according to the probabilities given

EstValue: EV[e] == (
(Minimum_Account_Sales[e]*Minimum_Probability_Success[e])
+ (Expected_Account_Sales[e]*Expected_Probability_Success[e])
+ (Target_Account_Sales[e]*Target_Probability_Success[e]));

//This constraint calculates the new revenues according to the amount of new assets

NewRev: NewRevenues[e] == New_Assets_Period[e] * Fee_factor[e];

//This constraint calculates the sum of the new account revenues as well as the existing revenues

TotalRev: TotalRevenues[e] == ExistingRevenues[e] + NewRevenues[e]

//The following 4 constraints calculate the expenses for each product

```
Expenses: New_Commission[e] == New_Commission_Factor[e] *
          NewRevenues[e];
          IT_Account_Fee[e] == IT_Account_Fee_Factor[e] *
          New_Number_of_Accounts[e];
          New_Account_Fee[e] == New_Account_Fee_Factor[e] *
          New_Number_of_Accounts[e];
          Total_Expenses[e] == New_Commission[e] +
          IT_Account_Fee[e] + New_Account_Fee[e];
```

//The Ending assets and ending accounts are calculated by adding the original number of assets/accounts with the recommended new ones

```
EndAsset:   Ending_Assets[e] == (Beginning_Assets[e] +
                                New_Assets_Period[e]) ;
EndAcct:    Ending_Accounts[e] == Number_of_Accounts[e] +
                                New_Number_of_Accounts[e];
```

//Net Income is calculated

```
Income:    Net_Income[e] == TotalRevenues[e] -
            Total_Expenses[e]; }
```

/******

* OPL 5.5.1 Data

* Author: Mallory Harrison & Natalie Jaroski

* Made for Capstone Financial

* Senior Design 2010

*****/

//This line is used to know which Excel spreadsheet OPL should read from
SheetConnection sheet("CapstoneData.xlsx");

//Each of the following lines of code is used to read the data from the excel spreadsheet

//the names inside of quotation marks are the names we assigned to the cells we wanted data to be read from in the spreadsheet

```
Products from SheetRead (sheet, "Products");
Average_New_Account from SheetRead (sheet, "Average_New_Account");
Beginning_Assets from SheetRead (sheet, "Beginning_Assets");
Expected_Account_Sales from SheetRead (sheet, "Expected_Account_Sales");
Expected_Probability_Success from SheetRead (sheet,
"Expected_Probability_Success");
ExistingRevenues from SheetRead (sheet, "Revenues");
Fee_factor from SheetRead (sheet, "Fee_factor");
IT_Account_Fee_Factor from SheetRead (sheet, "IT_Account_Fee_Factor");
Max_Number_Accounts from SheetRead (sheet, "Max_Number_Accounts");
Maximum_Account_Capacity from SheetRead (sheet,
"Maximum_Account_Capacity");
Minimum_Account_Sales from SheetRead (sheet, "Minimum_Account_Sales");
Minimum_Probability_Success from SheetRead (sheet,
"Minimum_Probability_Success");
Minimum_Sales_Required from SheetRead (sheet, "Minimum_Sales_Required");
New_Account_Fee_Factor from SheetRead (sheet, "New_Account_Fee_Factor");
New_Commission_Factor from SheetRead (sheet, "New_Commission_Factor");
Number_of_Accounts from SheetRead (sheet, "Number_of_Accounts");
Target_Account_Sales from SheetRead (sheet, "Target_Account_Sales");
Target_Probability_Success from SheetRead (sheet, "Target_Probability_Success");
```

//The following code writes the information back into the original excel spreadsheet for easy viewing of our findings

```
New_Assets_Period to SheetWrite (sheet, "Net_New_Sales");
Ending_Assets to SheetWrite (sheet, "Ending_Assets");
Ending_Accounts to SheetWrite (sheet, "Total_Accounts");
Fee_factor to SheetWrite (sheet, "FeeFactor");
Beginning_Assets to SheetWrite (sheet, "BeginningAssets");
EV to SheetWrite (sheet, "TargetSales");
```

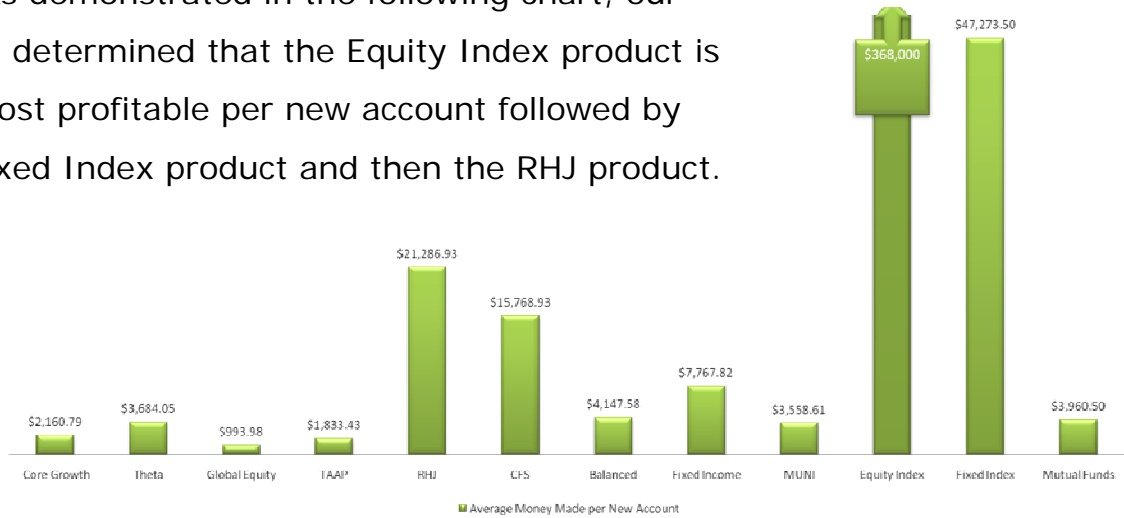
New_Assets_Period to SheetWrite (sheet, "NetNewSales");
Ending_Assets to SheetWrite (sheet, "EndingAssets");
Number_of_Accounts to SheetWrite (sheet, "BeginningAccounts");
New_Number_of_Accounts to SheetWrite (sheet, "NetNewAccounts");
Ending_Accounts to SheetWrite (sheet, "EndingAccounts");
TotalRevenues to SheetWrite (sheet, "TotalRevenue");
New_Commission to SheetWrite (sheet, "NewCommission");
New_Account_Fee to SheetWrite (sheet, "NewAccountFee");
IT_Account_Fee to SheetWrite (sheet, "ITAccountFee");
Total_Expenses to SheetWrite (sheet, "TotalExpenses");
Net_Income to SheetWrite (sheet, "NetIncome");

6. Analysis and Managerial Interpretation

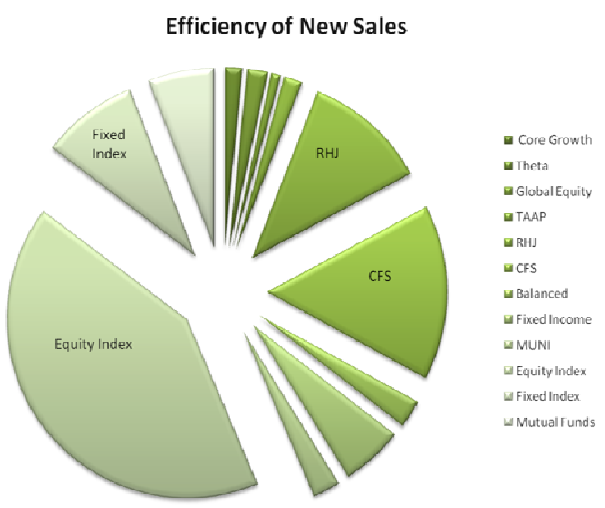
Prior to this project Capstone looked at their budgeting process as an accounting debit/credit process but as a result of our work done they are now focusing on the marginal cost of an additional new account. This helps them concentrate their efforts in the future. In early conversations with Capstone they indicated that their focus and belief was that the Mutual Funds product were most likely the most profitable. But as a result of our work Mutual Funds are profitable but in the middle of the road with the other products.

We found that every product under Capstone's Management is essentially profitable. Our model proves this by telling us to max out each of the products. In order to really understand how well each of the products were really performing we developed profitability ratios for the sets of data: the average amount of money made per new account and the efficiency ratio.

The average amount of money made per new account helps Capstone by telling them how much their efforts to get one account is really paying off. As demonstrated in the following chart, our model determined that the Equity Index product is the most profitable per new account followed by the Fixed Index product and then the RHJ product.



The efficiency ratio essentially tells us how much Capstone spends in order to make a dollar. The products which had the highest rankings in efficiency were RHJ, CFS, Equity Index and Fixed Index.



The pie chart on the left represents the future effort that will be put into creating new accounts for all of their products. It is recommended that Capstone allocates its energies towards the future sales of their products as

demonstrated in this pie chart; the products with the greater efficiency ratings will most likely be more profitable in the future.

We also provided Capstone with a estimated value probability computation that they requested. They will be able to adjust these values

each year to determine the possible new sales. This will help them estimate how much is probable to sell next year.

Furthermore, to make this model more realistic a few more constraints should be discussed and developed. We think that developing an estimated max capacity of sales of assets covering all products would help give a more reasonable goal than maxing out the possible sales. A possible way of obtaining this max capacity value could be to do a forecast of the next years values by using the past 5 years actual sales.

In the future Capstone wants us to continue development of this model. They want to add new constraints and new forecasting methods to make it even more helpful in the decision making process. Things such as the maximum employee capacity to sell, market forecasting and estimated returns over a multi-year period are being discussed to be added into the model.

