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Assignment 5

Yuqi Zheng

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Executive Summary

This report uses the R language and Excel Solver to perform a deep optimization model of my neighbor, Sunnyside. We will outline assumptions about market penetration, costs associated with opening and staffing an office, and the impact of the percent commission of Sunnyside.

Firstly, we build an optimization model with parameters, variables, objective function, and constraints in Excel and run the GRG non-linear model to analyze Sunnyside's performance. Market penetration could be found by calculating starting market penetration+(0.05-commission)*change in market penetration per commission+change in market penetration per employee*number of employees to hire. But the market penetration is decreased by 1.4843% comparing the starting market penetration. Besides, we found Sunnyside's budget only can hire 1.9372 employees, which is impossible. Moreover, the commission is also decreased by 0.3438% compared to the previous status. According to the above findings, we suggest the Sunnyside manager should change marketing strategies to develop their brand and to maximize the profit in the future.

Develop an optimization model

To develop an optimization model in Excel, we need to define the objective function, parameters, variables, and constraints. Firstly, we need to collect the eight forecasts total sale data from previous assignment 4, as shown in Appendix 1.

According to the realistic scenario, the parameters for this question are the starting market penetration, change in the market penetration per commission, minimum commission, maximum commission, the change in market penetration per employee, the monthly budget, the Number of highest hired employees, IRR per quarter, percentage of rent and utilities price, base office space required, cost per square feet. The data are 5.5, 150%, 4%, 5%, 0.5%, 15000, 3, 1.5%, 1.5%, 250, 610.490266 respectively. It is easy to calculate the monthly rent per square feet, which is equal to 610.490266*0.015.

The variables of this problem should be the commission, office space, and the Number of employees to hire. We could regard those variables as x, y, and z. The last step is to build constraints. According to the information, the office space should large and equal to office space required; the Number of employees to hire should small and equal to 3 and large and equal to 1; the total cost per month should small and equal to the budget 15000.

Moreover, the commission should not only large and equal to 4%, but also small and equal to 5%. The objective function represents NPV profit, which equals to NPV costs subtract NPV income, and we need to maximize it. Future costs of this problem by using formula (Number of employees to hired*65000/12+office space*monthly rent per square feet)*3 and the future income should calculate by every quarter forecast*commission*market penetration.

We also could write this problem in the mathematical way as follow:

Max NPV(1.5%, Future costs) – NPV(1.5%, Future Income)

s.t y >= 125z + 250

z >= 1

z <= 3

9.16y +(65000/12)*z <= 15000

x <= 5%

x >= 4%

Market Penetration

After using Excel solver, we could get the value of the commission is 4.6562%, office space is 492.1580, and the Number of employees is 1.9372. Here, it is better to choose two instead of 1.9372. After getting the value of variables, we could easily calculate the market penetration, costs associated with opening and staffing an office, and the impact of the percent commission in Sunnyside.

Since market penetration is a measure of how much customers are using a product or service compared to the total estimated market for that product or service, we calculate the market penetration by starting market penetration+(0.05-commission)*change in market penetration per commission+change in market penetration per employee*number of employees to hire, which equals to 6.9843%. Thus, we could conclude there is customers are using 6.9843% of Sunnyside's apartments compared to the total estimated market for the apartments. In other words, Sunnyside's apartments not occupied well in this industry, which means the market share performance is not good enough. A low market share means Sunnyside will lose more potential customers due to their not well-established products and brand. But Comparing to the starting

marketing penetration, 5.5%, Sunnyside increased 1.4843% for their market penetration, which means Sunnyside made a successful marketing strategy even though its progress is minus.

Costs Associated with Employees

The Number of employees that Sunnyside needs to hire is 1.9372. The monthly cost per employee is $10493.2, so the payroll budget should be $20327.5. There also have a charge from office space rent, and the rental fee is $4506.8. Therefore, the total cost of 1.9372 people per month is around $15000.

As we see, our monthly budget is $15000 with no surplus and no deficit. However, although it seems that the money is in line with our budget, in fact, it is only enough to hire 1.9372 people. In actual circumstances, we can't only hire 1.9372 people. If we need to hire two people, then this cost will bigger than our budget. Therefore, to ensure the best performance of the company, we suggest that Sunnyside allocate more budget to hire employees. Otherwise, Sunnyside might need to consider only hire one employee and change the marketing strategy in the future.

Impact of Commission

In Assignment 1, we know the starting commission for Sunnyside is 5%, but right now, it decreased to 4.6562%. It means, on average, Sunnyside earns a commission of 4.6562 cents per dollar on residential sales. Thus, Sunnyside decreased 0.3438% profit from charging commissions on client transactions, and their profit will fall too. Intuitively, the decline in commission means that the earnings of Sunnyside are not as good as before, so we still recommend that Sunnyside change the new market strategy, because our goal is to maximize the NPV profits.

Appendix

Starting Market Penetration	5.5000%								
Change in market penetration/commission	150.0000%								
Minimum Commission	4.0000%								
Maximum Commission	5.0000%								
Change in market penetration/employee	0.5000%								
Market Penetration	6.9843%								
IRR/QTR	1.5000%								
				Future Income					Future Costs
Forecasts(Total Sale)	1	82454736	1	268145.38				Q1	45000.00
	2	78137596	2	254105.90				Q2	45000.00
	3	81607008	3	265388.54				Q3	45000.00
	4	104107016	4	338559.27				Q4	45000.00
	5	90187551	5	293292.73				Q1	45000.00
	6	85870411	6	279253.26				Q2	45000.00
	7	89339824	7	290535.90				Q3	45000.00
	8	111839832	8	363706.63				Q4	45000.00
Cost/Sqft Office Space	610.490266								
Rent and Utilities as % of price	1.50%								
Monthly rent/SqFt	9.16	Last year(2016)							
Total Rent	4506.80								
Monthly Cost/ Employee	10493.20								
Payroll Budget	20327.50								
Office Space/ Employee	242.1507919								
Base office space required	250								
Office Space Required	492.1507919								
Total Cost/Month	15000.00								
Monthly Budget	15000								
NPV Costs	$336,866.63								
NPV Income	$2,195,902.24								
Variables									
Commission	4.6562%								
Office Space	492.1507919								
Number of employees to Hire	1.937206335								
Objective Function									
NPV Profit	$1,859,035.61								

Appendix 1