DATA ENVELOMENT ANALYSIS ON RESTAURANT CHAIN TEAM 1

PROJECT REPORT - BIA 650

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Abstract

The purpose of this report is to build a Data Envelopment Analysis (DEA) model using linear programming to gauge the efficiency of business operating units effectively and objectively. DEA is one of the more advanced applications of linear programming in which the objective, as thought by our book, is to maximize the efficiency. Through our secondary research, we figured out to project DEA as a minimization problem to minimize the efficiency index of the business operating unit in question while comparing it to a composite unit. Composite unit is projected as an ideal, imaginary unit that takes the least amount of input and gives maximum amount of output based on the weights assigned from each of the business operating units. This report highlights both approaches, minimization and maximization, and analyzes a restaurant chain in question. There are 5 restaurants being analyzed, geographically in different locations, and all of them consume the same type of inputs and produce the same type of outputs, which is one of the critical assumptions of DEA. There is slight variation in the absolute efficiency metric number for both the approaches highlighted in this article, but the answer in terms of which restaurant is consistent. Attached with this report are two excel files, each having the calculations to support the premises and approaches presented in this report. We have also included answer reports, and sensitivity reports and their interpretation in this article. This study aims to provide a benchmark to the management in evaluating the relative performance of business operating units.

Project Proposal

Component	Description
Business Problem	Evaluate the performance of the restaurants in terms of efficiency.
Client(s)	Restaurant chain owners looking evaluate the performance of their restaurants in different locations and maximize the output of their restaurants.
Business Question	Which one of the 5 restaurants in the study are inefficient and can be improved upon.
Data & Scope	Five operating units, which are R1, R2, R3, R4 and R5. Three input measures, which are Hours of operation, FTE Staff, and the dollar amount spent on weekly supplies. Three output measures, which are an average weekly profit contribution, weekly market share, and annual growth rate.
Model(s)	We plan to DEA under linear programming and one/two tables to find the inefficient restaurants and the measure to make them efficient.
Anticipated Results	Discovery of inefficient restaurants and comparable results of efficiency across all the restaurants in the study
Business Impact	Better allocation of resources to inefficient restaurants to increase their efficiency

Data Envelopment Analysis (DEA)

DEA method is best suited to determine if any business is operating efficiently. More importantly, inefficient corporations use DEA to benchmark or pit themselves against the efficient or best-practice corporations. According to (Sherman & Ladino, 1995):

> DEA gives us an objective measure to recognize best practices in the service organizations and it has consistently led to newer insights that provide substantial productivity increases that were not easily identifiable.

Explanation of DEA with an example

To explain DEA with the help of an example, let's assume a set of operating units that consume same type of inputs and produce the same type of outputs. These operating units can be any entities ranging from schools, hospitals corporations, etc.

Here we assume these to be three schools that are completely independent providing knowledge to its students. Each school provides its students with on-campus classes, pre-decided hours of live speaker sessions given by famous industry experts, and a certain number of practical assignments on marketing and supply chain. Let us say that these three are the inputs given to students in these three schools.

Talking about outputs, research papers or articles written by students on their projects, on campus job placement recruiters, and number of internships offered to the students can be the three outputs given to the students of these three schools.

Where do these numbers come from

Before we proceed further, we have studied in this course that we should always declare what can be the source of the data for inputs and outputs. For a DEA analysis to be performed, we must first define the corporations' inputs and outputs. Next, we should select a unit of measurement for input and output. Both of these are difficult tasks considering the fact that corporations take in a vast variety of inputs and give out a vast variety of outputs, all of which can be measured in a number of different ways. All you have to take care of is that each unit of measurement for inputs and outputs should be consistent across the operating units to compare. For example, if one is comparing the efficiency of two cars, the output measure of distance travelled has to be same i.e. both the cars' output should be either measured in miles or kilometers. It can't be that the output of one car is measured in miles and is compared with a car which output is measured in kilometers. Then, a company's accounting department should be able to provide the figures for inputs and outputs for that company.

The traditional approach to measuring efficiency would be to determine mean and variance, commonly referred to as measures of centrality, of these three schools and compare their relative performance. Based on how the outputs are structured, the performance of the students in each academic year would determine the efficiency of the institution in question.

An alternative, more sophisticated way could be to construct a linear programming model to measure weights belonging to every school that would constraint the resource availability and estimate the relative efficiency given by the outputs. Here the two approaches, maximization and minimization, come into play. Either we can optimize the efficiency with a maximization objective or optimize the efficiency index with a minimization objective.

Efficiency Vs Efficiency Index

The underlying principle of both concepts is that each operating unit, or schools for our example, should be shown as its best version. Which is to say that the inputs and outputs should be measured in such a way that a given school looks as good as it can be relative to other schools. In order to determine if a school is efficient, the model estimates a price per unit of each output produced and a cost per unit of each input consumed. Then the efficiency of a school is:

$$\text{Efficiency of School} = \frac{\text{Value of school's outputs}}{\text{Value of school's inputs}}$$

Whereas efficiency index is determined by:

$$\text{Efficiency Index} = \frac{\text{Weighted sum of outputs of all schools}}{\text{Weighted sum of Inputs of all schools}}$$

We will elaborate on the concept of efficiency index in the later sections as well as solve our business problem using both approaches. For now, we lay down the four ideas used by DEA to determine whether a given school is efficient.

1- Efficiency of each school is limited to be equal to or less than 1. Therefore, no school can be more than 100% efficient. To put this as a linear constraint, we show:

$$\text{Value of school's inputs} >= \text{Value of school's outputs}$$

2- To check if a school is efficient, it helps to scale prices of inputs in such a way that the value of school's inputs become 1. Be mindful that this idea is only applicable to the maximization problem of DEA, and in theory, any other value would also work, but making input values equal to 1, enforces the school's output values to be interpreted as efficiency of the school.

$$\text{Efficiency of school} = \text{Value of school's output}/1$$

3- To present a given school as its best version, the output prices and input costs should be selected to maximize that school's efficiency. So if the school's efficiency is equal to 1 after running the model, the school is said to be efficient. Subsequently, the said school will be inefficient if efficiency is less than 1.

4- Output prices and input costs of all the schools must be positive.

Data

The data for our model has been collected from Ranch House Inc, which is a fast-food restaurant chain with several branches across the country. We will be examining five of their branches located at Clarksville, Bardstown, Jeffersonville, St. Matthews and New Albany. As our goal is to Evaluate the performance of each branch and present our findings to the higher management at ranch house Inc, it is important that we decide on the right parameters i.e., input and output measures That best reflect the performance of each branch and allow for A comparative study.

Input measures

The following input measures have been taken into consideration thought our model:

- **Weekly hours of operation** - this value describes the total number of hours per week during which majority of the restaurant staff members will be present.

- **Full-time equivalent staff** - FTE is used to measure the number of full-time and part-time staff members that are working in each branch. It is calculated by taking the ratio of the number of hours That should be worked in a full-time weekly schedule do the actual number of hours worked by the staff members.

- **Weekly supply expenses** - this measure details the amount (in dollars) spent per week on various restaurant supplies.

Restaurant	Hours of operation	FTE Staff	Supplies ($)
Bardstown	96	16	850
Clarksville	110	22	1400
Jefforsonville	100	18	1200
New Albany	125	25	1500
St. Matthews	120	24	1600

Output measures

The following output measures have been taken into consideration thought our model:

- **Average weekly contribution to profit** – this measure is used to determine a branch's profitability. it can be defined as the average profit (in dollars) generated per week by each branch. profit is basically the revenue minus the variable costs.

- **Market share** - this measure reflects the percentage of the market i.e., fast food restaurants, that is controlled by each branch in each city. it is calculated by dividing the restaurant's sales by the total sales generated from fast food restaurants during a stipulated time.

- **Annual growth rate** - this measure reflects the average increase or decrease in the revenue generated by each branch in a given year.

Restaurant	Weekly Profit ($)	Market Share (%)	Growth Rate (%)
Bardstown	3800	25	8.0
Clarksville	4600	32	8.5
Jefforsonville	4400	35	8.0
New Albany	6500	30	10.0
St. Matthews	6000	28	9.0

Composite Unit

In a general DEA analysis, the organization's inputs and outputs must first be defined. Then for each input or output, a unit of measurement must be selected. Neither of these is necessarily an easy task, because organizations such as hospitals, banks, and schools consume a variety of inputs and produce a variety of outputs that can be measured in alternative ways. However, after the list of inputs and outputs has been chosen and units of measurement have been selected, accounting data can be used to find the required data for the model.

As we are calculating the relative efficiency of the restaurants, it is necessary that a separate model is run for each of the branches or operating units. Therefore, we will be devising an Imaginary composite unit that results in a weighted average of the five branches under consideration.

Consider the following weights assigned to the given operating units:

- Bardstown - w_b
- Clarksville - w_c
- Jeffersonville - w_j
- New Albany - w_n
- St. Matthews - w_m

The sum of the weights must be equal to 1:

$$w_b + w_c + w_j + w_n + w_m = 1$$

The composite units for each of the input measures are as follows:

1. $Hours\ of\ operation_{composite\ unit} = 96w_b + 110w_c + 100w_j + 125w_n + 120w_m$
2. $FTE\ Staff_{composite\ unit} = 16w_b + 22w_c + 18tw_j + 25w_n + 24w_m$
3. $Weekly\ supply_{\ composite\ unit} = 850w_b + 1400w_c + 1200w_j + 1500w_n + 1600w_m$

The composite unit of each input measures must be less than or equal to that of the individual operating unit under consideration (*i*). Therefore, we derive the following constraints pertaining to the availability of resources:

- $Hours\ of\ operation_{composite\ unit} \leq Hours\ of\ operation_{\ i}$
- $FTE\ Staff_{composite\ unit}, \leq FTE\ Staff_i$
- $Weekly\ supply_{\ composite\ unit} \leq Weekly\ supply_{\ i}$

The composite units for each of the output measures are as follows:

1. $Weekly\ profit_{composite\ unit} = 96w_b\ 3800w_b + 4600w_c + 4400w_j + 6500w_n + 6000w_m$
2. $Market\ share_{composite\ unit} = 96w_b 25w_b + 32w_c + 35w_j + 30w_n + 28w_m$
3. $Annual\ growth\ rate_{composite\ unit} = 96w_b : 8w_b + 8.5w_c + 8w_j + 10w_n + 9w_m$

Likewise, the composite unit of the output measures must be greater than or equal to that of the individual operating unit under consideration (*i*). we derive the following constraints pertaining to the performance of the branch.

- $Weekly\ profit_{composite\ unit} \geq Weekly\ profit_i$
- $Market\ share_{composite\ unit} \geq Market\ share_i$
- $Annual\ growth\ rate_{composite\ unit} \geq Annual\ growth\ rate_i$

Constraints

Here, we will demonstrate formulating the constraints while determining the relative efficiency of the Bardstown branch. As stated earlier the composite unit for each measure will result in an output That will be compared against the measures of the Bardstown branch. For the composite unit to be regarded as relatively efficient, it must be taking in comparatively lesser inputs and in turn producing the same or higher value of outputs as that of umm the Bardstown branch.

Essentially, what we're measuring here is how much of Bardstown’s input resources is available for the composite unit to generate the same amount of output as Bardstown. Now this is what we call the efficiency index (E), and it is chosen as the objective function of our model. Since we are trying to reduce the input resources available for the composite unit, our main objective is to minimize the efficiency index.

To summarize our goal is to minimize E, subject to the following constraints:

1. $Individual\ weights\ must\ add\ upto\ one: w_b + w_c + w_j + w_n + w_m = 1$
2. $Minimum\ weekly\ profit: 3800w_b + 4600w_c + 4400w_j + 6500w_n + 6000w_m \geq 4600$
3. $Minimum\ market\ share: 25w_b + 32w_c + 35w_j + 30w_n + 28w_m \geq 32$
4. $Minimum\ annual\ growth\ rate: 8w_b + 8.5w_c + 8w_j + 10w_n + 9w_m \geq 8.5$
5. $Hours\ available\ to\ composite\ uint: 96w_b + 110w_c + 100w_j + 125w_n + 120w_m - 110E \leq 0$

6. $FTE\ Staff\ available\ to\ composite\ uint: 16w_b\ + 22w_c\ +\ 18tw_j\ +\ 25w_n\ + 24w_m\ -\ 22E \leq\ 0$
7. $Weekly\ supply\ expenses\ available: 850w_b\ + 1400w_c\ +\ 1200w_j\ +\ 1500w_n\ + 1600w_m\ -\ 1400E\ \leq\ 0$
8. $Inequality\ contraint: E \geq 0, w_b \geq 0,\ w_c \geq 0,\ w_j\ \geq 0,\ w_n \geq 0,\ w_m \geq 0$

Maximization Problem:

Here we will briefly discuss how to solve this particular business problem with the objective of maximizing the efficiency, in contrast to minimizing the efficiency index using a composite restaurant which is the main focus of this report.

Model

Input Cost: Same costs given in the previous section.

Output Prices: Same costs given in the previous section.

Decision Variables: Unit costs of each input and unit price of each output

Constraints:

- The restaurant for which the efficiency is being measured should have input cost equal to 1.
- The input costs of all the restaurants should be greater than equal to output prices.

Objective Function:

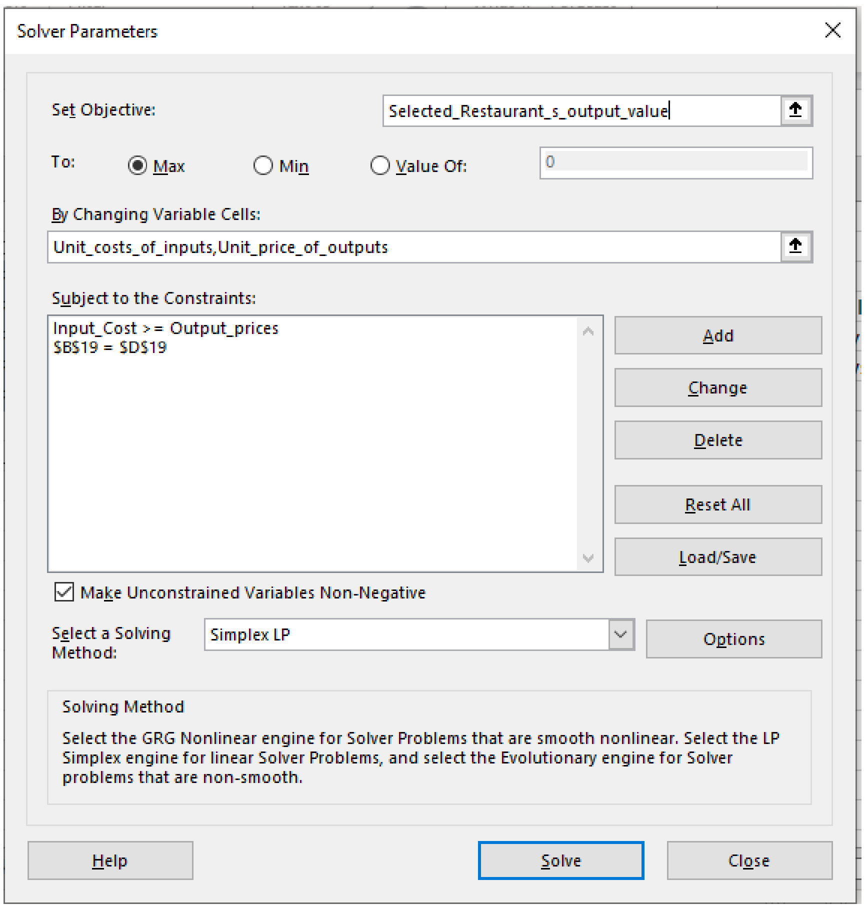
Since the input costs of the selected restaurant is equal to 1, this makes the efficiency of the selected restaurant equal to its value of the outputs. Hence, our objective is to maximize the output value of the selected restaurant.

Restaurant for the analysis	**1**							Index	
Inputs	Hours of operations	FTE Staff	Supplies	**Outputs**	Weekly Profit	Market Share	Growth rate	Bardstown	1
Restaurant 1 Inputs	96	16	850	Restaurant 1 Outputs	$ 3,800	25	8	Clarksville	2
Restaurant 2 Inputs	110	22	1400	Restaurant 2 Outputs	$ 4,600	32	8.5	Jeffersonville	3
Restaurant 3 Inputs	100	18	1200	Restaurant 3 Outputs	$ 4,400	35	8	New Albany	4
Restaurant 4 Inputs	125	25	1500	Restaurant 4 Outputs	$ 6,500	30	10	St. Matthews	5
Restaurant 5 Inputs	120	24	1600	Restaurant 5 Outputs	$ 6,000	28	9		
Decision Variables									
Unit costs of inputs	0	0	0.001176471	Unit price of outputs	0.000263158	0	0		
Constraints					Range Names				
Restaurant	Input Cost		Output prices		FTE_Staff	='Bardstown Model'!$C$3:$C$7			
1	1	>=	1		Growth_rate	='Bardstown Model'!$I$3:$I$7			
2	1.647058824	>=	1.210526316		Hours_of_operations	='Bardstown Model'!$B$3:$B$7			
3	1.411764706	>=	1.157894737		Input_Cost	='Bardstown Model'!$B$13:$B$17			
4	1.764705882	>=	1.710526316		Market_Share	='Bardstown Model'!$H$3:$H$7			
5	1.882352941	>=	1.578947368		Output_prices	='Bardstown Model'!$D$13:$D$17			
					Restaurant_for_the_ana	='Bardstown Model'!$B$1			
Selected Restaurant's input cost	1	=	1		Selected_Restaurant_s_	='Bardstown Model'!$B$21			
					Supplies	='Bardstown Model'!$D$3:$D$7			
Selected Restaurant's output value	1				Unit_costs_of_inputs	='Bardstown Model'!$B$9:$D$9			
					Unit_price_of_outputs	='Bardstown Model'!$G$9:$I$9			

Please refer to the attached excel sheet named, "DEA Maximization Problem - Final Project" for maximization problem models.

Solution:

Running the solver with the below mentioned configurations for each restaurant individually, tells us if the selected restaurant is operating inefficiently or not. We setup 5 models for 5 restaurants and estimate the efficiency of each restaurant separately.



By this approach we get to know that Clarksville and St. Mathews are two restaurants operating inefficiently with output values of 0.95 and 0.96 respectively. You will see later in the next sections that minimization problem also produces the same result. However, it reports the efficiency of Clarksville to be 0.95 (same as maximization problem) and efficiency of St. Mathews to be 0.992 which is different from the maximization problem. Although both approaches conclude that these two restaurants are inefficient, the absolute efficiency does not seem to be consistent in both the approaches and makes sense because it is possible that one of the approaches might get stuck at local minimum/local maximum in their effort to reach global minimum/global maximum.

Solution (Minimization Problem):

Let's consider the key questions which we intend to answer using Development Envelopment Analysis:

Is the restaurant at the Clarksville Ranch House one of the less efficient ones in the area?

A score of around 0.96 on the efficiency measure is the optimal level of performance for the Clarksville operating unit. The composite restaurant is capable of producing at least each output measure at a level comparable to that of Clarksville by employing no more than approximately 96% of the input measures required by Clarksville. This allows the composite restaurant to produce output measures at a level comparable to that of Clarksville. The ideal form of the composite unit is achieved by taking the weighted average of the three cities of Bardstown, Jeffersonville, and New Albany. When compared to Clarksville, the composite unit exhibits higher levels of efficiency.

					Objective Coeficients	1					
	wb	**wc**	wj	wn	wm	E		**Constraints**			
Decision Variable	0.175	0	0.575	0.25	0	0.959545					
Constraint-1	1	1	1	1	1		=	1	1		
Weekly Profit	3800	4600	4400	6500	6000		>=	4600	4820	Weekly Profit	Output
Market Share	25	32	35	30	28		>=	32	32	Market Share	Output
Growth Rate	8	8.5	8	10	9		>=	8.5	8.5	Growth Rate	Output
Hours of Operation	96	110	100	125	120	-110	<=	0	-2.8E-14	Hours Ops	Input
FTE Staff	16	22	18	25	24	-22	<=	0	-1.71	FTE	Input
Supplies	850	1400	1200	1500	1600	-1400	<=	0	-129.614	Supplies	Input
								Objective Function	0.959545		

Where does the composite restaurant have a higher production than the restaurant in Clarksville? In comparison to the restaurant in Clarksville, how much less of each input resource is used by the composite restaurant?

Given that the primal is a problem of minimization, the slack column can be understood to represent surplus. The requirement that the business makes a weekly profit must not be met, and there must be an excess of $220. This indicates that the composite unit generates a weekly profit of $4,820 ($4,600 plus $220), which is comparatively $220 higher than the operating unit that is being questioned (i.e. Clarksville). Nevertheless, the market share and annual growth limits are obligatory, which means that both the composite unit and the Clarksville unit can create no more than 32% of the market share and 8.5% of the annual growth respectively.

Because there is no room for a surplus in the operating hours constraint, it can be deduced that the composite unit makes use of approximately 96% of the operation hours that are made available to the Clarksville unit. On the other hand, the constraints on the FTE staff and weekly supply expenses are not binding and there is some excess. This suggests that the composite unit utilizes fewer than approximately 96% of the full-time equivalent (FTE) employees and weekly supply expenses that are available to the Clarksville unit.

Therefore, the composite unit is comparatively more efficient than the Clarksville unit since it employs a relatively smaller FTE workforce, has relatively lower weekly supply expenses, and delivers the same amount of market share and annual growth with an additional $220 of weekly profit contribution.

Which other restaurants in the area ought to be researched in order to compile a list of potential methods in which the Clarksville restaurant might become more productive.

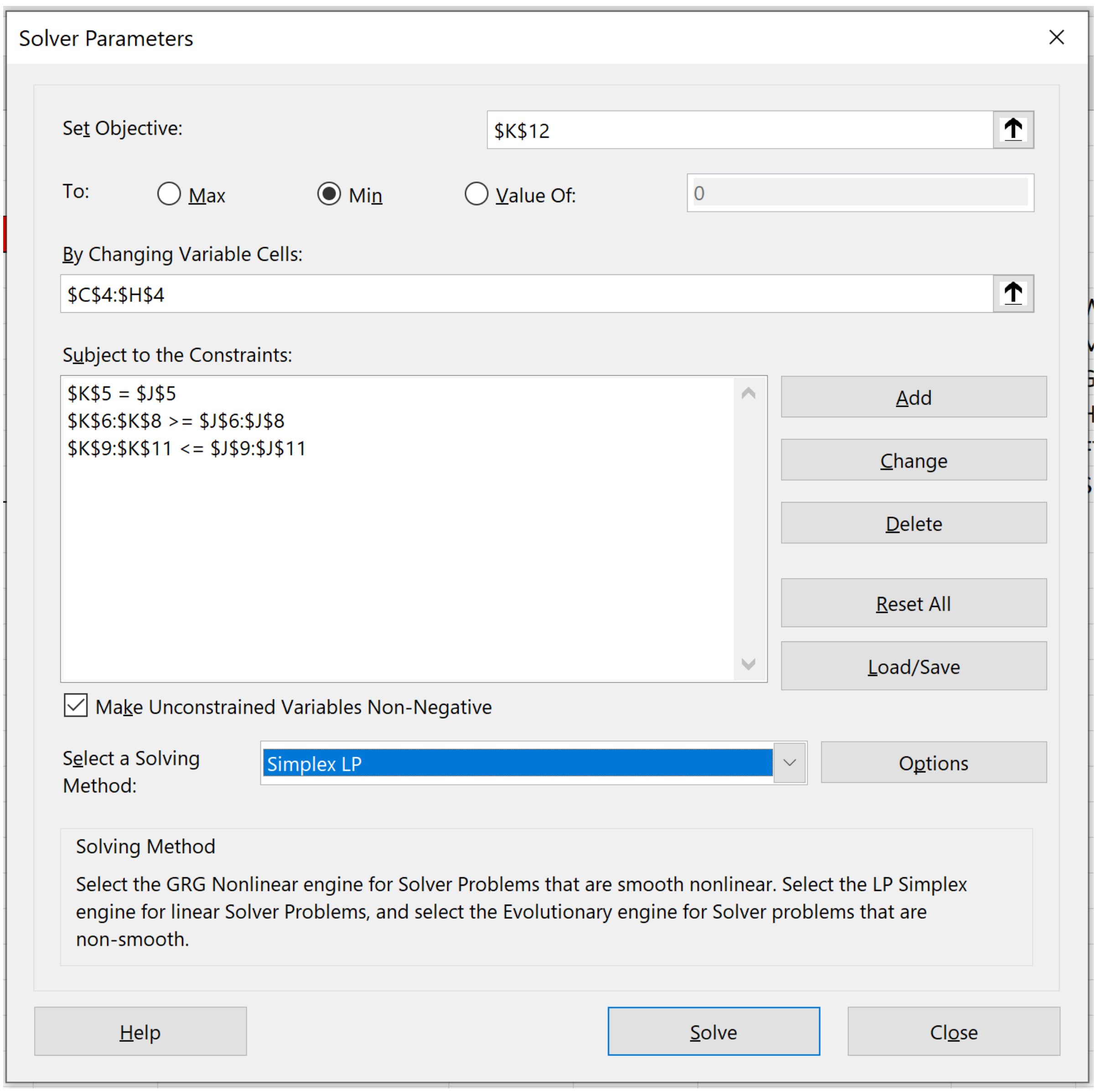
We have found that the weights that produce the best results are those that are derived from a weighted average of the units for Bardstown, Jeffersonville, and New Albany. NOT in Clarksville and NOT in St. Matthews In an ideal world, these units should offer suggestions about ways in which the Clarksville unit may improve. On the other hand, we can solve LPP models that are analogous to those of the other four units and then compare the optimal efficiency index scores.

					Objective Coeficients	1					
	wb	wc	wj	**wn**	wm	E		**Constraints**			
Decision Variable	0	0	0	1	0	1					
Constraint-1	1	1	1	1	1		=	1	1		
Weekly Profit	3800	4600	4400	6500	6000		>=	6500	6500	Weekly Profit	Output
Market Share	25	32	35	30	28		>=	30	30	Market Share	Output
Growth Rate	8	8.5	8	10	9		>=	10	10	Growth Rate	Output
Hours of Operation	96	110	100	125	120	-125	<=	0	0	Hours Ops	Input
FTE Staff	16	22	18	25	24	-25	<=	0	0	FTE	Input
Supplies	850	1400	1200	1500	1600	-1500	<=	0	0	Supplies	Input
								Objective Function	1		

The scores for Bardstown, Clarksville, Jeffersonville, New Albany, and St. Matthews on the efficiency index are 1, 0.96, 1, and 1, respectively, while New Albany's score is 0.99. A score of one indicates that there is insufficient evidence to determine whether the composite unit or the matching operational unit is more efficient overall. This might be interpreted as meaning that there is no clear winner. A score that is less than one indicates that the composite unit is relatively more efficient than the operating unit that is being compared to it.

					Objective Coeficients	1					
	wb	wc	wj	wn	**wm**	E		**Constraints**			
Decision Variable	0	0	0.238095	0.761905	0	0.992063492					
Constraint-1	1	1	1	1	1		=	1	1		
Weekly Profit	3800	4600	4400	6500	6000		>=	6000	6000	Weekly Profit	Output
Market Share	25	32	35	30	28		>=	28	31.19048	Market Share	Output
Growth Rate	8	8.5	8	10	9		>=	9	9.52381	Growth Rate	Output
Hours of Operation	96	110	100	125	120	-120	<=	0	-1.4E-14	Hours Ops	Input
FTE Staff	16	22	18	25	24	-24	<=	0	-0.47619	FTE	Input
Supplies	850	1400	1200	1500	1600	-1600	<=	0	-158.73	Supplies	Input
								Objective Function	0.992063		

It has come to our attention that, in comparison to the Clarksville unit, the composite unit generates an additional $220 in weekly profit while maintaining the same level of market share and annual growth as the Clarksville unit. Whereas, in comparison to the St. Matthews location, the composite restaurant generates an additional 3.19 percentage points of market share and 0.52 percentage points of annual growth while maintaining the same level of weekly profit contribution. In all scenarios, the composite unit consumes a relatively smaller number of operational hours, full-time equivalent staff members, and weekly supply expenses than the corresponding operating units. The composite unit utilizes 96% of Clarksville's available operational hours and 99% of St. Matthews' available operational hours. However, the composite unit utilizes less than 96% of the FTE staff and less than 99% of the weekly supply expenses that are available to Clarksville. This is in comparison to St. Matthews, which utilizes 100% of the FTE staff and 100% of the weekly supply expenses.



Therefore, it is possible for us to reach the conclusion that the restaurant in Clarksville and the restaurant in St. Matthews are not as efficient as the composite unit. Despite this, we cannot say for certain that Bardstown, Jeffersonville, or New Albany are effective places to live. They are somewhat in a position to provide suggestions for areas of improvement to the other two operating units.

Sensitivity Analysis

The following steps are involved in the Planning Process and Analyzing problem:

1. **Methodology**
2. **Efficiency Index Scores**
3. **Evidence**
4. **LPP Models**
5. **Conclusion**

Methodology

We have found that the weights that produce the best results are those that are derived from a weighted average of the units for Bardstown, Jeffersonville, and New Albany.

NOT in Clarksville, and,

NOT in St. Matthews

In an ideal world, these units should offer suggestions about ways in which the Clarksville unit may improve.

On the other hand, we can solve LPP models that are analogous to those of the other four units and then compare the optimal efficiency index scores.

Efficiency Index Scores

The scores for Bardstown, Clarksville, Jeffersonville, New Albany, and St. Matthews on the efficiency index are 1, 0.96, 1, and 1, respectively,

While New Albany's score is 0.99. A score of one indicates that there is insufficient evidence to determine whether the composite unit or the matching operational unit is more efficient overall.

Evidence

This might be interpreted as meaning that there is no clear winner. A score that is less than one indicates that the composite unit is relatively more efficient than the operating unit that is being compared to it.

LPP Models

Let's compare the results from the five basic LPP models.

Restaurant	Optimal Efficiency Score	Surplus Weekly Profit	Surplus Market Share	Surplus Market Growth
Bardstown	1	$0	0%	0%
Clarksville	0.96	$220	0%	0%
Jeffersonville	1	$0	0%	0%
New Albany	1	$0	0%	0%
St. Matthews	0.99	$0	3.19%	0.52%

It has come to our attention that, in comparison to the Clarksville unit, the composite unit generates an additional $220 in weekly profit while maintaining the same level of market share and annual growth as the Clarksville unit.

Whereas, in comparison to the St. Matthews location, the composite restaurant generates an additional 3.19 percentage points of market share and, 0.52 percentage points of annual growth while maintaining the same level of weekly profit contribution.

In all scenarios, the composite unit consumes a relatively smaller number of operational hours, full-time equivalent staff members, and weekly supply expenses than the corresponding operating units.

The composite unit utilizes 96% of Clarksville's available operational hours and, 99% of St. Matthews' available operational hours.

Restaurant	Optimal Efficiency Score	Surplus Operations Hours	Surplus FTE Staff	Surplus Expenses Supply
Bardstown	1	0 hours	0 staff	$0
Clarksville	0.96	0 hours	<96% staff	<96% supply $
Jeffersonville	1	0 hours	0 staff	$0
New Albany	1	0 hours	0 staff	$0
St. Matthews	0.99	0 hours	<99% staff	<99% supply$

However, the composite unit utilizes less than 96% of the FTE staff and,

Less than 99% of the weekly supply expenses that are available to Clarksville. This is in comparison to St. Matthews, which utilizes 100% of the FTE staff, 100% of the weekly supply expenses.

Conclusion

Therefore, it is possible for us to draw the conclusion that the restaurant in Clarksville and the restaurant in St. Matthews are not as efficient as the composite unit.

Despite this, we cannot say for certain that Bardstown, Jeffersonville, or New Albany are effective places to live.

They are somewhat in a position to provide suggestions for areas of improvement for the other two operating units.

Decision Support System:

We also aim to provide the management of these restaurants or for any company for that matter because it can be implemented on similar set of organizations, with a decision support system, in which they will only need to change a few inputs to reach the optimal output.

Our DSS spreadsheet will be divided in 2 parts:

1. Front-end part
2. Back-end part

The front end will allow the user to select the restaurant in question, assign the input and output values of the set of restaurants, run the program to get the efficiency of the selected restaurant, and to get answer and sensitivity reports.

Our front end will have a greeting screen with a description of what this DSS is about, which is to know the efficiency of the selected restaurant. Our front end will also display two buttons:

1. Set up problem
2. Solver

Once then user clicks on the set-up problem, he can change the inputs and outputs of the restaurants. Under this button, user will have the option to delete and add the value of inputs outputs, and constraints.

For example, let’s assume that instead of weekly profit of $3800, Bardstown earns $4000 in the next week. So, the user will have to enter the value of $4000 for the weekly profit output value for Bardstown restaurant. If they want to change the number of supplies, they can do that by clicking on “set up problem”, select the restaurant and change the input value of supplies.

After making these adjustments in inputs and outputs, the user will click on the Solver button, which will be pre-formulated as formulated in the excel to get the new profit margin. We will have to make use of “Vlookup” formulas in setting up this DSS. The excel sheet will be our back-end part of the DSS. In this way, just by making the needed adjustments the user can get an estimate for select restaurant’s efficiency.

References

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