PROJECT REPORT

PROJECT NAME: Application of Data Envelopment Analysis on Banking

INTRODUCTION

DEA is used to develop the excel model for this project

- The data envelopment analysis (DEA) method can be used to determine whether an organization/business is operating efficiently. Specifically, DEA can be used by inefficient organizations to benchmark efficient and best-practice organizations.
- DEA provides an objective way to identify best practices in these service organizations and has consistently generated new insights that lead to substantial productivity gains that were not otherwise identifiable.
- DEA is a linear programming-based tool for evaluating the performance of homogeneous organizational units that is becoming more popular in banking. The bank branch is usually the assessment unit. Most studies focus on determining a summary assessment of each unit's efficiency, estimating performance targets for the unit, and finding role-model units with good operational practice. Additional applications for DEA in banking include calculating efficiency based on resource and output prices, estimating efficient operational budgets, assessing financial risk at the branch level, and calculating the impact of managerial change initiatives on productivity.
- In DEA, a unit's efficiency is often tested against a subset of the DEA efficient units. Only basic examples with no more than three input and output variables can be used to measure efficiency and identify peers using graphical means. In general, a linear-programming model can be used to determine whether a unit is DEA efficient, identify

its efficient peers and determine the input and output levels that would make the unit DEA efficient.

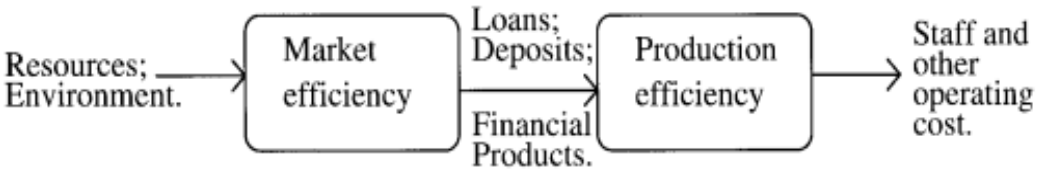
- The efficiency of a unit is frequently checked in DEA against a subset of DEA efficient units. To test efficiency and identify peers via graphical techniques, only basic examples with no more than three input and output variables can be employed. A linear-programming model can be used to establish whether a unit is DEA efficient, identify its efficient peers, and predict the input and output levels that would make the unit DEA efficient in general.

- The bank unit, in terms of intermediation, is an intermediary that collects funds in the form of deposits and "intermediates" them to loans and other revenue-generating operations. Liquidity and market efficiency are two types of intermediation efficiency that can be quantified.

- The bank level, not the branch level, is where liquidity efficiency is measured. It reflects the bank's risk of financial failure. The efficacy of a unit's labor, capital, space, market potential, and other resources in converting them into product sales is referred to as market efficiency.

- The efficiency of production and intermediation are not mutually exclusive, but rather complimentary. The market and production efficiencies can be thought of as a reflection of the unit's performance during the two stages of profit generating. The greater a branch's market efficiency is in converting its resources and the potential in its environment into loans, deposits, and other revenue-generating financial products, the better. The cheaper the branch's staffing and other costs are to support its revenue-generating financial products, the more efficient it is. The branch's profitability is determined by the combined effect of the two efficiencies.

- One of the most useful consequences of a DEA evaluation is the identification of efficient peers for each inefficient unit. Because of the structure of the DEA model, an inefficient unit and its efficient peers would typically manage a comparable mix of goods with a similar mix of resources in similar conditions. As a result, efficient peers are frequently used as role models by inefficient units looking to enhance their performance.



- The more market efficiency a branch has, the better it is at converting its resources and the potential in its environment into loans, deposits, and other revenue-generating financial products. The lesser the staffing and other expenditures a branch incurs to support its revenue-generating financial products, the more efficient it is. The branch's profitability is determined by the combined effect of the two efficiencies.

BUSINESS PROBLEM:

The following are a few banking-related issues that we attempted to address with this model, both directly and indirectly.

A) Surviving a fiercely competitive environment

It's vital to stay afloat in the face of strong competition to avoid losing customers.

B) Low Margins

It is critical for businesses to maximize profits and margins.

C) Non–performing assets

It's Important to distinguish between performing and non-performing assets to avoid squandering money, time, and resources.

D) Gap between promise and performance

E) Customer wealth advice

No one wants their money to be sitting in a bank. Banks should demonstrate a path for their clients to progress.

F) **Customer Retention**

A bank should engage in a number of initiatives in order to enhance the number of repeat clients and the profitability of each existing customer. Customer retention methods allow to deliver and extract additional value from current customers.

G) **Cross border transaction**

Issues with cross-border transactions, such as the time it takes for money to move into an international account and hefty transaction costs, must be addressed.

H) **Operation and security costs**

CLIENTS:

The potential client of our project are as follows:

- **Department of Banking Operations and Development**
- **Department of Economic Analysis**
- **Department of Statistical Analysis and Computer Services**

BUSINESS QUESTION:

To evaluate which JP Morgan Chase branches in New York are delivering excellent service to clients, effectively utilizing their resources, and working efficiently, as well as which ones are inefficient and should be improved.

DATA & SCOPE FOR THE PROBLEM

- **JPMorgan Chase Bank Dataset**
- **Data Source: Kaggle**
- **Number of Branches: 312**
- **Location: New York**
- *Data contains Institution name, branch name, branch number, Established Data, Address, City, county, state, zip code, inputs, and outputs.*

  For simplicity, the data has been downsized significantly (Only last 6 years data has been taken).

Inputs & Outputs of the DEA model

Inputs

- *Direct staff cost*
- *Number of facilities*
- *Number of salespersons*
- *Existing customer base*

Outputs

- *Mortgage application secured*
- *Insurance sales*
- *Saving account sales*
- *Number of new saving accounts opened*

MODEL APPROACH:

The following would be the anticipated result.

the efficiency of a bank branch is defined as

Efficiency of the bank branch = Value of branch's outputs / Value of branch's inputs

Objective:

To develop an LP spreadsheet model, using the DEA methodology, to determine whether each bank branch of the JP Morgan chase organization is efficient in terms of using its inputs to produce its outputs.

Decision variables (changing cells): *Unit inputs values, unit output values for selected branch*

Objective (target cell): *Total output value of selected bank* branch

Other calculated variables: *Total input cost, total output value (for each branch)*

CONSTRAINTS:

- ***Selected branch input cost must be equal to nominal value.***
- ***For branch number, input values must be greater than or equal to output values.***

- *Input cost of the selected branch = 1.* **This constraint sets the total value of each branch's inputs to 1**.
- ***Efficiency constraint***: **Input values >= Output values**. *This ensures that no branch is more than 100% efficient.*
- *The solver replaces the values of* ***Unit cost of inputs*** *and* ***Unit prices of outputs*** *with optimal values.*

Result:

To maximize selected branch output value and check whether the selected branch is efficient or not.

BUSINESS IMPACT OF THIS EXCEL MODEL(RECOMMENDATIONS/OBSERVATIONS):

Opportunities for Improvement and Further Research

While our model does an adequate job at comparing the performances of many branches of JPMorgan banks in New York City, there are numerous ways that we can improve on this project and several other opportunities for further research. First, in our model, we decided to calculate efficiency for local branches of a bank. We focused only on branches that are located within one single city, New York. We did this for several reasons. The first reason is that it made it easier to demonstrate how our model worked with only a small number of branches rather than a very large number. The second reason is that there are advantages to a model that only focuses on branches that are in the same area. If JPMorgan is looking only to adjust strategy or close branches in New York City, it makes the most sense to calculate branch efficiency by comparing the performances of only New York City branches. This is because the company would have similar expectations for branches that are in the same area. There are several reasons for this, including population size and demographics. Since New York is a very densely populated and diverse location, we may expect it to have different performance than branches in a more rural and homogenous location. However, there is opportunity for further research to

calculate efficiency based on the performance of every branch in the country. This would allow JPMorgan to be able to find efficiency relative to every branch, solving a slightly different problem. This would be more useful likely for finding what area of the country performs the best and discovering why they perform the best. It could be either based on business strategy and decisions, or simply demographics, but this model would aid in solving the problem.

Next, our model could potentially be improved by using more or different inputs and outputs with the help of a larger dataset. If we could utilize a larger dataset with more diverse data, it could help our efficiency model to be more accurate because we would be able to narrow down all of our candidate inputs and outputs to be able to find the ones that are the most important. It is possible that we have used the best possible inputs and outputs for the data that we have available to us, so we may need to find a way to collect more data in the future. The best way for this to be able to occur is to recommend to JPMorgan to start collecting more data that they think may be useful in calculating efficiency over the next several months or years. We can then test our model against this new data periodically to try to determine the optimal inputs and outputs and come to a conclusion and an optimized version of the model for use in several years.

A final way that we can improve our model is to compare JPMorgan's branches performances to those of branches of other banks. When using our model, we can only calculate the

efficiency of the branches based on how well all of JPMorgan's branches perform, but this could have two different negative effects on the way the efficiency is calculated. For one, if JPMorgan's branches are performing exceptionally well in comparison to every other bank, then this will not be reflected in our model. All efficient branches are only considered efficient in the context of JPMorgan branches. Conversely, if JPMorgan generally performs worse than other banks, then the branches we find efficiency for may overestimate our branches' efficiencies. These two possibilities can have different negative effects. If we are using this model to decide branches to close, then we may decide to close many branches that are performing poorly by JPMorgan standards but well compares to every other bank. In fact, out of 321 branches that we measured

in this model, only 196 were found to be efficient. So, if we used the result of the model to close 125 branches, it may have a severe negative effect on the company, as we may close branches that are running efficiently. It would likely be a good idea to also supplement our model with analysis on how JPMorgan compares in performance to other banks in order to determine what course of actions needs to be taken based on the results of this model. If JPMorgan performs well, then look to improve to model the efficient branches. But, if JPMorgan performs poorly, then look for how the less efficient branches are held back, and potentially consider closing especially inefficient branches.

Conclusion

Ultimately, we found the model that we created to have several very useful applications for JPMorgan or any other large bank. It can accurately help to determine what branches of a bank are efficient, which can help the company make important decisions about these branches. One important way that this model can be useful is to help minimize risk by determining if some branches are so inefficient that they may need to be put out of operation. Furthermore, this model can help greatly improve a bank's profits by allowing the company to determine which branches perform better. This way, these branches can be further analyzed to understand how and why they perform better, which can be applied in the future to improve efficiency in all branches and increase profits. Overall, the DEA model is very useful and can help a bank learn important information about its branches that are vital to the future success of the company.

Data Source:

https://www.kaggle.com/

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