HHH Bank Personal Loan Program Analysis Report

DBA5107: Data Analytics in Banking

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Contents

Key Insights

- HHH bank's loan program has made smooth progress, expanding rapidly from 2017 to 2018.
- The interest rate for the program has been on the rise while the loan default rate has been declining over the years
- HHH bank's current credit rating system has some deficiencies, and there is room for improvement in both the bank's data and credit models.

Loan Program Overview

The loan program at HHH bank has been rapidly expanding over the years, figure 1 illustrated the limit granted each year from 2007 to 2018. The total loan amount for the year 2017 was 4,640,900 dollars, while the total amount for the year 2018 increased steeply to 7,539,581,400 dollars. The graph is also indicating an exponential pattern. The growth in the loan program has brought a number of challenges for the bank to manage, such as controlling interest rates and bad loan rates.

To address these issues, this report aims to provide a comprehensive analysis of the program based on nine years of data. The analysis will cover several aspects of the loan program, including its overall marketing performance, loan default rate, credit model evaluation, and how to maximize the expected return if the existing total program limit is controlled to 60%.

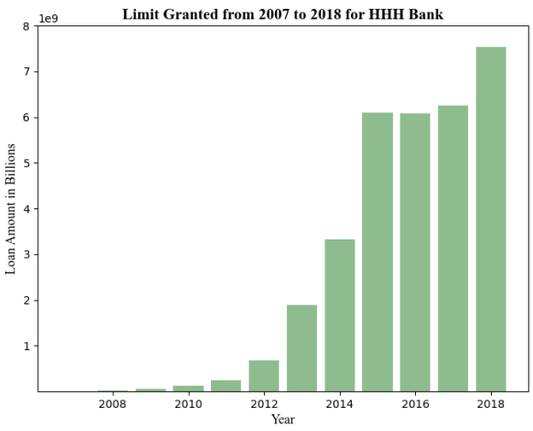

Figure 1: limit granted each year

Program Performance

The pie charts on the right show a significant purpose shift in loan programs offered by banks, with debt consolidation loans accounting for more than 50% of all loans in 2018, as compared to 33.5% in 2007. This indicates a growing demand for debt consolidation, which can be attributed to the rising debt burden on individuals and businesses. The trend also suggests that banks are responding to this demand by adjusting their lending practices.

The increase in lending activities can provide businesses and individuals with greater financial resources, which can be beneficial for their operations and in- vestments. Moreover, HHH bank can earn higher revenues by charging interest on these loans. This can lead to improved profitability, which can positively impact the program's shareholders. However, HHH bank must also consider the risks associated with increased lending. A higher volume of loans means that there is a greater chance of borrowers defaulting on their loans, leading to potential cash flow shortages and significant losses for the bank. It is crucial for HHH bank to balance the potential benefits of offering more loans with the associated risks and adopt appropriate risk management practices.

The trend toward debt consolidation loans highlights the need for HHH bank to adjust its lending practices to meet changing customer demands. While increased lending activities can generate greater revenues, HHH bank must also consider the risks associated with such practices. Effective risk management practices can help banks strike a balance between providing financial resources to customers and maintaining financial stability.

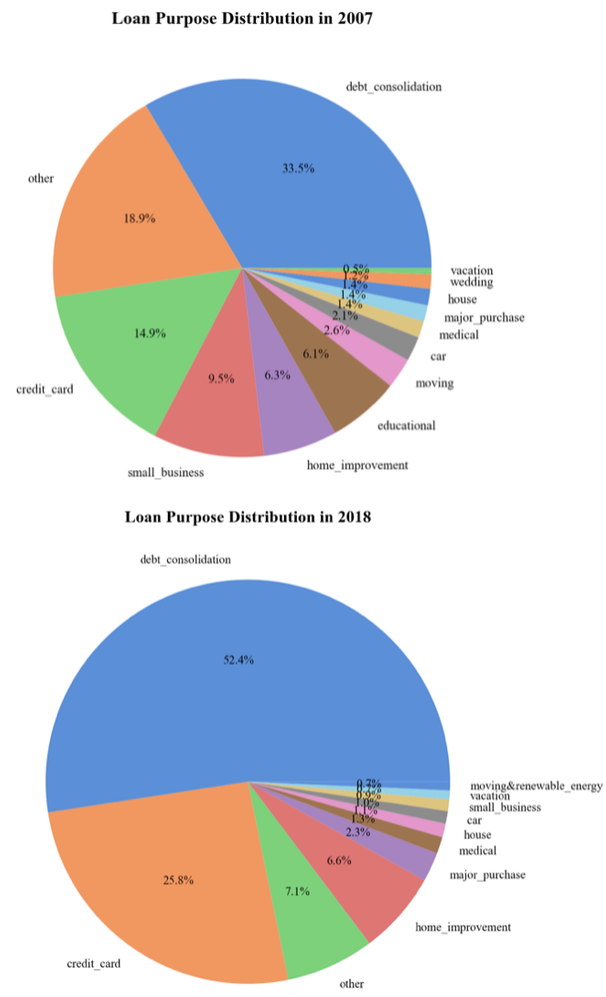

Figure 2: Loan purpose distributions

Pricing Strategy

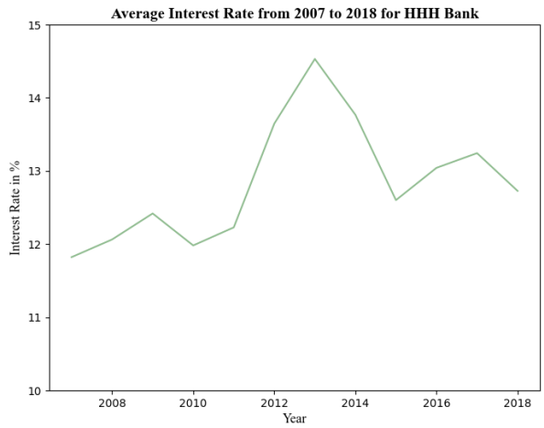

Figure 3: Average interest rates across years

As shown in figure 3, the average interest rate has been on an increasing trend over the years, with a sharp increase to 14.53 in 2013. The significant increase in 2013 can be attributed to various factors, including changes in Federal Reserve policy, economic conditions, and inflation.

Combined with the analysis of the program's overall performance, the rate hike in 2013 did not affect the program's performance much. Therefore, the program has some room for interest rate adjustments in the future, depending on market conditions and customer demand. Nevertheless, it is crucial to adopt a cautious approach while considering interest rate adjustments to ensure that the program remains competitive in the market, meets customer expectations, and controls default risk.

Portfolio Default

As shown in the plot on right, the default rate has an overall decreasing trend. Compared with the interest rate plot in figure 3, it is important to note that the interest rate adjustment did not have a negative impact on loan default rates. However, this does not mean that rates can be constantly adjusted upwards. As mentioned in the pricing strategy section, price adjusting should be done conservatively, taking into account market conditions and the bank's overall financial health.

Meanwhile, there are possibilities that the decrease in default rate is because of the increasing program size rather than effective credit assessment. Hence, it is important to examine the effectiveness of the existing credit assessment model to ensure that it can differentiate credit risks effectively.

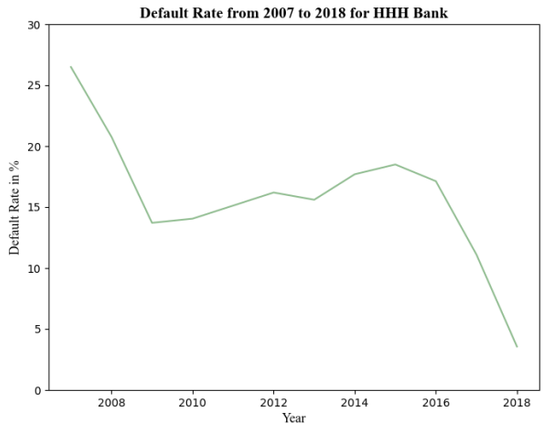

Figure 4: Default across years

Credit Assessment

The graph below illustrates the percentage of Bad loans for each credit grade group. It shows a clear trend indicating that the percentage of Bad Loans decreases as the credit rating goes up. This suggests that the bank has an effective credit assessment method to grade its customers.

However, it is worth noting that the Bad Loan Cases in Grades G and F do not exceed 50%, indicating that a significant proportion of Grade G and F customers have good credit standing. Therefore, HHH bank could further improve its credit evaluation model to better differentiate credit risks among lower-grade customers.

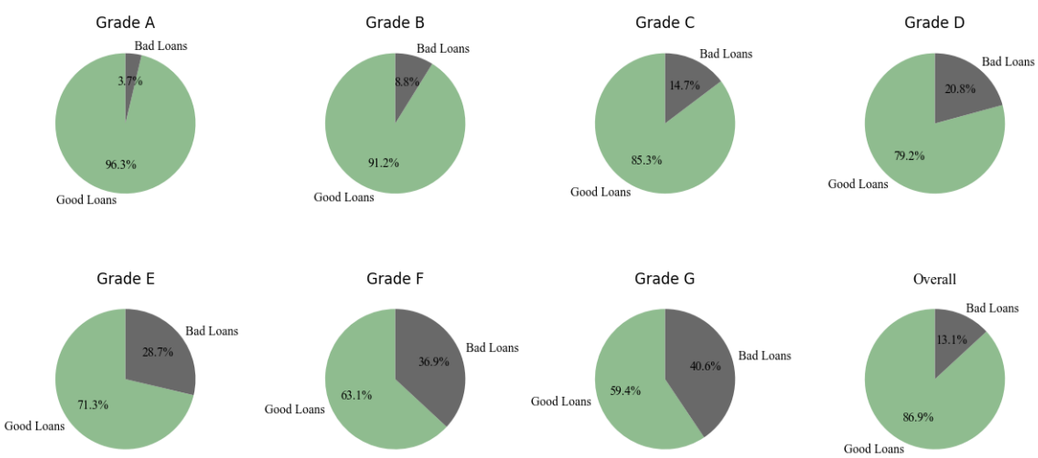

Figure 5: Bad loan% for each credit grade

Credit Model

To enhance the credit model, a random forest model is built using parameters below.

Parameter	Description
annual income	Customer's annual income.
loan amount	The loan amount.
purpose	Loan purpose.
average current balance	Average current balance of the customer.
interest rate	Interest rate to the loan.
verification status	If the customer information is verified.
home ownership	Type of house ownership.
issue year	Year which the loan was issued.

Table 1: Description of Parameters

During the data cleaning process, quality issues are found in the data provided by the bank. For instance, annual income information was missing for many customers, which was imputed using the median in the modeling process. However, this approach also introduced potential errors in the model. Furthermore, there were some variables that were duplicated, such as purpose and title, and the vast majority of customers had the same information in these two variables. While the purpose was a choice provided by the bank, the title could be filled in by the customer. Therefore, to process and model the data more efficiently, the title variable was deleted, reducing the size of the data set.

The original dataset is split into training and testing groups with a ratio of 8:2. The final accuracy is around 0.97037.

The percentage of default rate among customers with a G credit rating has increased from 40.6 to 42, and the percentage of default rate for customers with grade A is decreased by 0.2%. Based on the new model, it is evident that the random forest model has resulted in improvements to the original credit model.

Grade	Old Credit Assessment Bad Loan%	Random Forest Model Bad Loan%
A	3.7	3.5
B	8.8	8.9
C	14.7	14.6
D	20.8	21.0
E	28.7	29.1
F	36.9	28.3
G	40.6	42.0

Table 2: Comparison of Two models effectiveness

While the model enhances some of the overdue customer identification effects, the results are not as satisfactory as desired. Further improvements may be necessary to achieve the desired level of accuracy in identifying overdue customers.

To optimize the model further, it is recommended to implement the following suggestions:

- Bank should strengthen its data quality control process to ensure the accuracy and completeness of the data used for modeling. This can minimize the risk of errors and enhance the effectiveness of the models.
- Bank could merge internal databases to obtain more variables that can help leverage additional information and incorporate it into the model. This can improve the accuracy and precision of the model and better predict credit risks.
- Bank could try other machine learning methods, such as XGBOOST, which can provide additional insights and features that could complement the random forest model.

Program Limit Adjustment

Considering the potential restructuring of HHH bank's business, it is important to maintain a profitable loan program while managing risks effectively. If the existing total program limit is only allowed to keep 60%, the bank should implement a series of measures to maximize the expected return:

- Adjusting interest rates: set competitive interest rates that are profitable but also attractive to customers. Based on market conditions, HHH bank can consider adjusting interest rates for different loan products to balance profitability and risk.
- Optimizing credit models: credit models should be continuously improved to minimize the risk of default to ensure that loans are granted to customers with a high likelihood of repayment.
- Controlling costs: manage operating expenses effectively to minimize loan losses and improve profitability. This can be achieved through a combination of strategies, such as reducing overhead costs, streamlining processes, and using advanced technologies to automate certain tasks.

If the portfolio begins to attrition, it is important to analyze the lost customers to identify the underlying causes. For example, the bank could analyze the credit ratings and loan purposes of the lost customers to determine if there are specific trends or issues that need to be addressed. Based on this analysis, bank could develop a targeted plan to mitigate attrition.

To reduce future customer churn, HHH bank also should focus on improving customer service and satisfaction. This can be achieved by offering a better customer experience, increasing engagement through targeted marketing and communication, or providing customized products and services that meet the unique needs of each customer.

In conclusion, loan programs should be prepared in advance for future limit expansions and reductions to ensure profitability through the above suggestions.