Portfolio Optimization

Team 3

Wilhelm Kamptner
Will Jackson
Samuel Thomas

OnTime Analytics

100 Darden Blvd
Charlottesville, VA 22903

Contracting@OnTime.com

678-456-7890

Our Solutions

Predictive Analytics

Analyze and mine structured and unstructured data

Data Visualizations

Develop datasets and data visualization from compiled data

Statistical Modeling

Create predictive models to forecast future probabilities and statistical analysis

Business Intelligence

Develop a range of tools and big data solutions from a suite predictive analytical software platforms and programming languages for process automation

Problem

Wells Fargo CFO Mike Santomassimo: “Home lending revenue declined 8 percent from a year ago, primarily due to lower mortgage banking income driven by lower gain and sale margins and origination volumes...”

“We increased our non-conforming originations in the fourth quarter and have grown our non-conforming portfolio for seven consecutive months, reflecting the improvements in our capabilities as well as the reintroduction of cash out refinancing late in the first quarter of 2021”

Source:https://www.inman.com/2022/01/17/wells-fargo-mortgage-production-fades-as-it-closes-branches/

Problem 1

Mortgage loan production fell by 8 percent with 27 percent fewer homebuyers in 2021.

Problem 2

Closure of 270 branch locations and lay offs of 16,000 employees adds pressure on remaining retail branches.

Problem 3

Process automation to include mortgage and auto underwriting presents digitization challenges of mortgage servicing and card activities.

Conforming Loans

- Loans may be sold to Fannie Mae or Freddie Mac
- More likely to be cheaper
- More common
- Limited to $548,250 in most areas (up to $822,375 in some high-cost-of-living areas)
- Minimum credit score: 620
- Maximum DTI ratio: 43%
- Minimum down payment required: At least 3%

Non-Conforming Loans

- Loans may be held by lender, or sold to another lender
- More likely to be expensive
- Less common
- Potentially no limits on loan size
- Minimum credit score: 580
- Maximum loan limit varies by program and lender
- Maximum DTI ratio: varies
- Minimum down payment required: varies, but more likely with 20%

Market Conditions

Wells Fargo Bank Key Facts
Customers: 69M
Mobile Banking: 26.8M
Market Value of Stock:$186.1B
Total Assets in US: $1.75T
No. 1 Home Loan Servicer
No. 2 Auto Lender of EVs
No. 2 Debit Card Issuer
No. 4 Overall Auto Lender

Trend 1

Housing supply rate falls from 12 months in 2011 to less than 2 months.

Trend 2

Fed has signaled increases to prime interest rates with potential increases in residential cash-out refinancing.

Trend 3

Rocket Mortgage is positioning to overtake Wells Fargo as number one mortgage lender.

Trend 4

Greater market pressures to cut costs and use of process automation to increase loan production efficiency.

Source:https://www08.wellsfargomedia.com/assets/pdf/about/corporate/wells-fargo-today.pdf
Source:https://www.insiderintelligence.com/insights/largest-banks-us-list/

Project Goals and Objectives

	PROBLEMS WE ARE SOLVING OR OPPORTUNITIES WE ARE GOING AFTER	SUPPORT WE NEED TO ACHIEVE THIS GOAL	HOW WILL ACHIEVING THIS GOAL HAVE A GREAT IMPACT?	KEY METRICS. HOW WILL WE KNOW WE HAVE ACHIEVED THIS GOAL? HOW DO WE KNOW IF WE ARE SUCCESSFUL?
BUILD A TOOL TO ENHANCE WELLS FARGO PORTFOLIOS	In order to maintain a competitive advantage, Wells Fargo needs a automated solution to analyze and predict portfolio performance.	Strong support from the client including access to Wells Fargo internal data and business environment knowledge from experts.	By building and implementing a data science solution, Wells Fargo can reasonably predict portfolio performance and utilize new technology.	Decrease in Net Losses year over year as well as reduction in loan defaults.
PROVIDE INSIGHT ON INTERNAL DATA METRICS	Giving clear visualizations on data elements to assist in business decision making and understanding of the business at large.	Access to Wells Fargo internal data as well as internal knowledge of business objectives and mission goals.	By making data understanding simple, more of the business can align on their awareness. Build a stronger Wells Fargo.	Increase business understanding from all partners across the company.
ENHANCE SPECIFIC LINES OF BUSINESS	As Wells Fargo enters 2022, the need to increase automation tools is critical. Fine tuned tools in specific LOBs provides a higher degree of accuracy across the board.	Allow our data scientists in to each LOBs specific data as well as experts in the business who can provide insight.	As X business increases in 2022, implementing automation tools from the start will help push to reach client business goals.	Aligning with Wells Fargo, we hope to reach about 70% automated decision making across the company, focusing in key LOBs such as Auto Loans.

Solutions

Wells Fargo Proposed Predictive Analytical Solutions

Solution 1

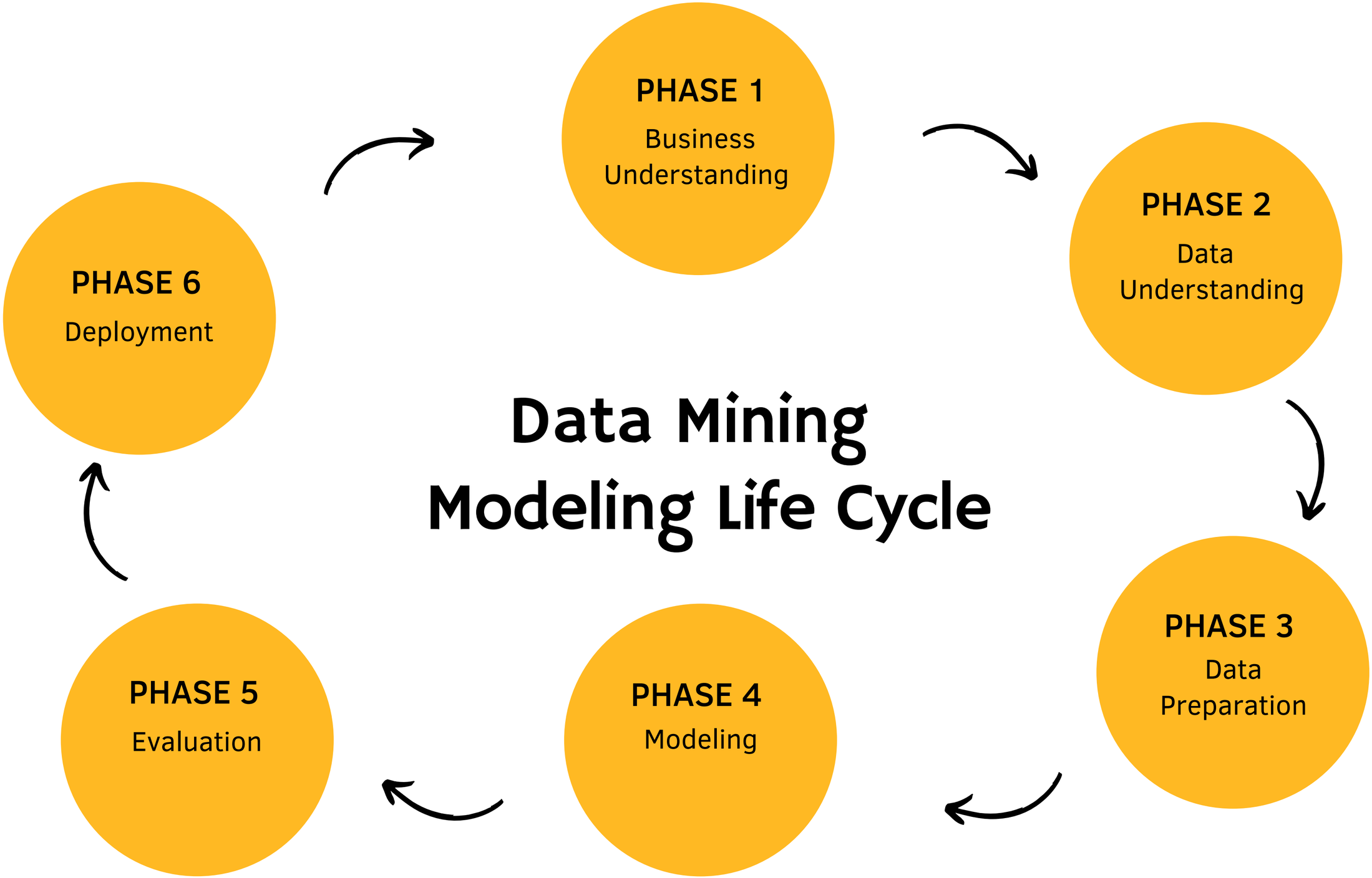
Portfolio optimization of existing loans to reduce overall net losses in a tighter housing market.

Solution 2

Results from data discovery and modeling approach may be used as preliminary screening of loan applicants.

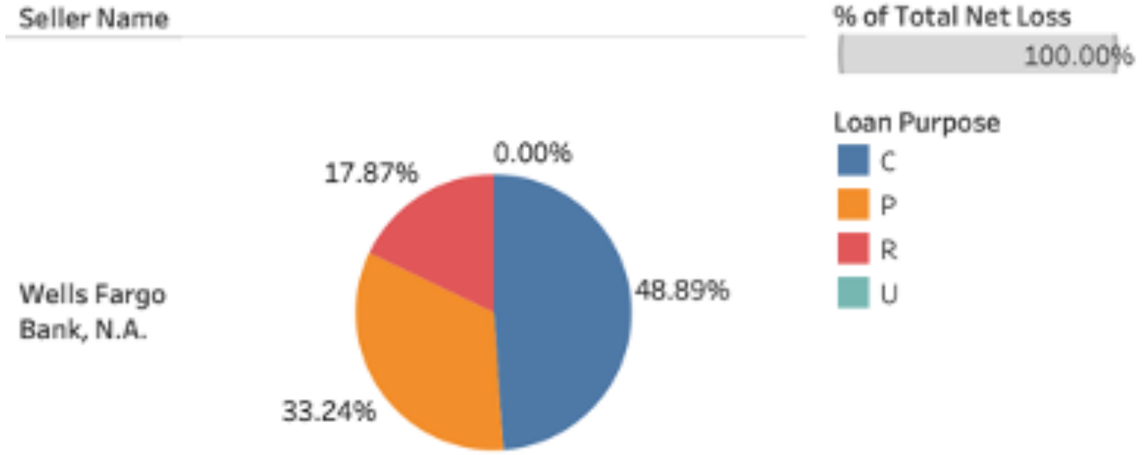
Solution 3

Forecasting models could support underwriting for mortgage and auto lending loans.


PHASE 1
Business Understanding
PHASE 2
Data Understanding
PHASE 3
Data Preparation
PHASE 4
Modeling
PHASE 5
Evaluation
PHASE 6
Deployment
Data Mining
Modeling Life Cycle

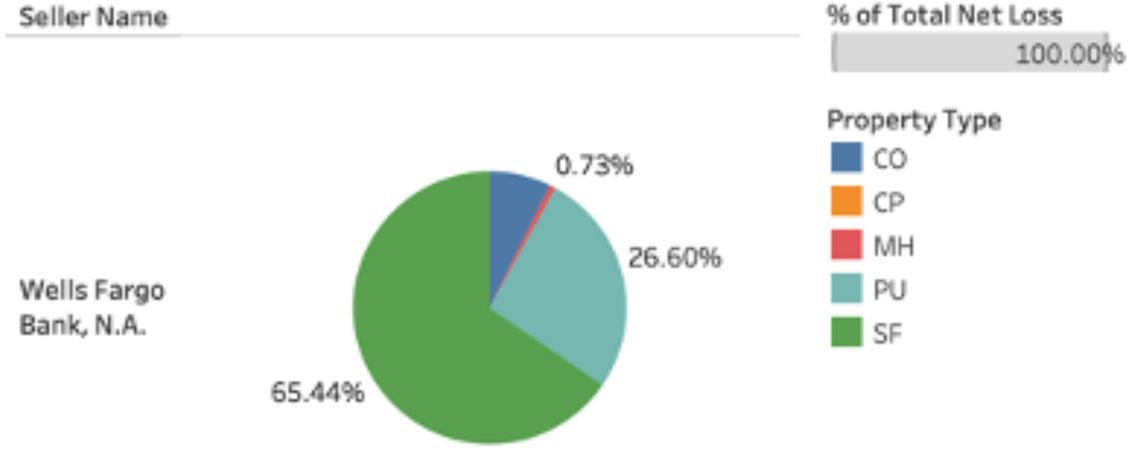
Wells Fargo Portfolio Analysis

Wells Fargo Loan Purpose Pie Chart



Loan Purpose (color) and % of Total Net Loss (size) broken down by Seller Name. The view is filtered on Seller Name, which keeps Wells Fargo Bank, N.A.. Percents are based on the whole table.

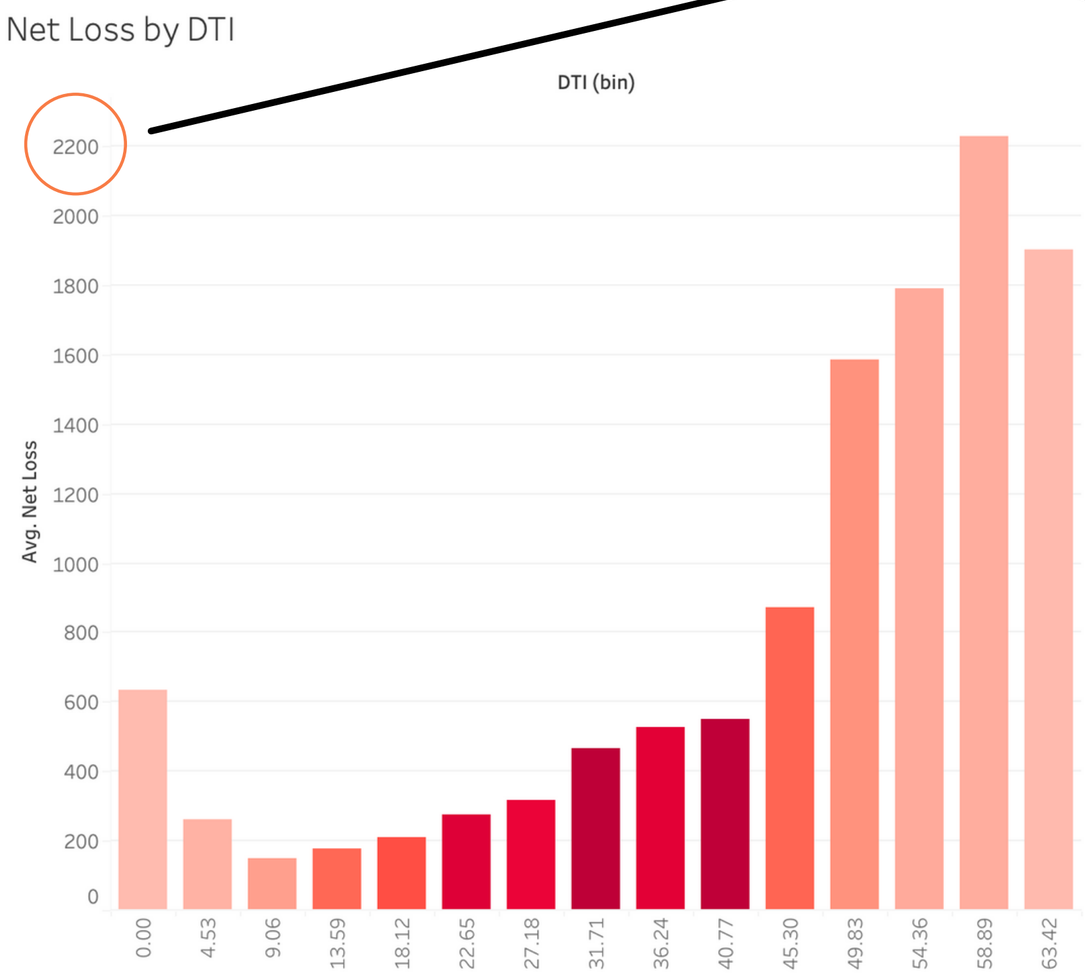
Wells Fargo Property Type Pie Chart

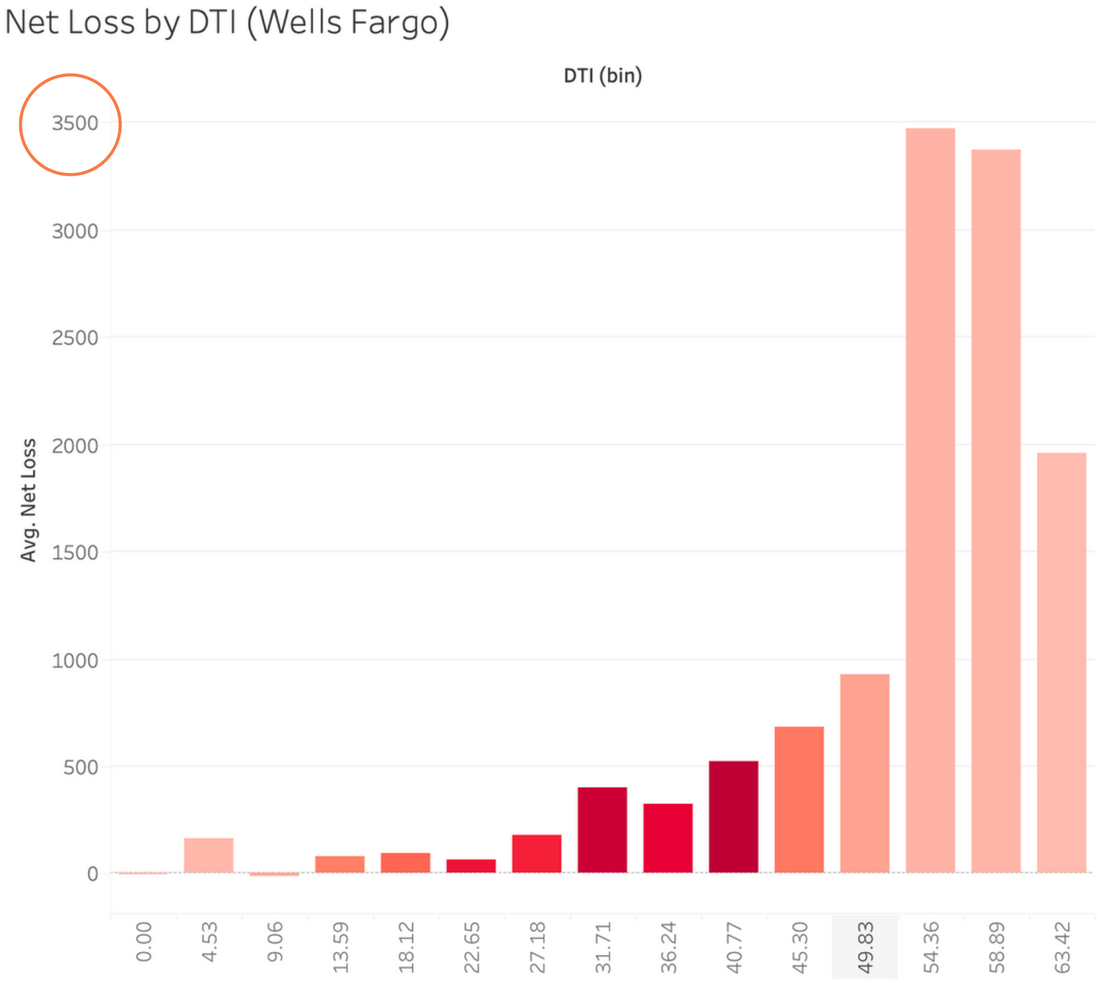


Property Type (color) and % of Total Net Loss (size) broken down by Seller Name. The view is filtered on Seller Name, which keeps Wells Fargo Bank, N.A.. Percents are based on the whole table.

Wells Fargo Debt to Income Net Loss

$220K versus $350K
(AVG/Loan)





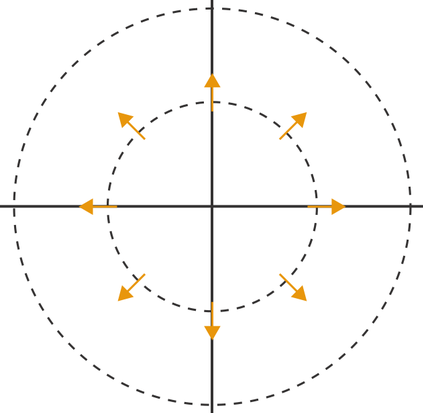
Predictive Analytics Steps

- Variable Selection: We analyzed several data elements and how they interacted with each other, and how those loans performed. From there, we selectively chose variables we thought were crucial in predicting loan performance
- Decision Trees provide step-through analysis of individual loans and creates buckets, which each loan is categorized into.
- Evaluating our model performance on historical data provides confidence in our ability to predict loan performance at scale.

Modeling Approach

STEP 1

A decision tree has the benefit of being more easily interpretable. However, as complexity rises, we have to resort to more complex models, hence the introduction of the Boosted Tree model and Random Forest approach.



STEP 2

During and after evaluation of data elements through our discovery process, we created a formula of key elements and started modeling them. Our approach uses a combination of Random Forest as well as a Gradient Boosted Tree model.

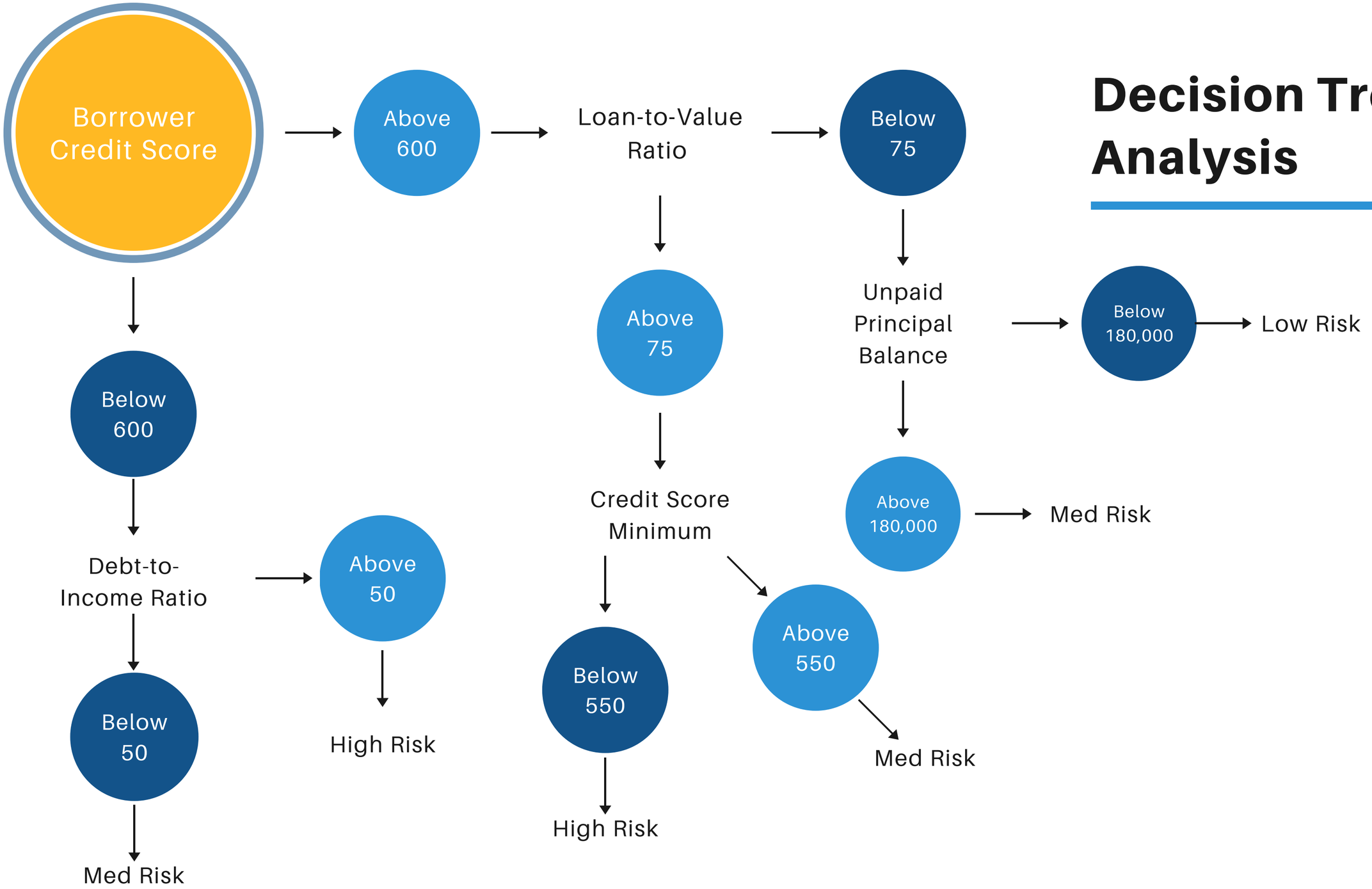
STEP 3

We tune the parameters of our models to find a good fit for the data at hand.

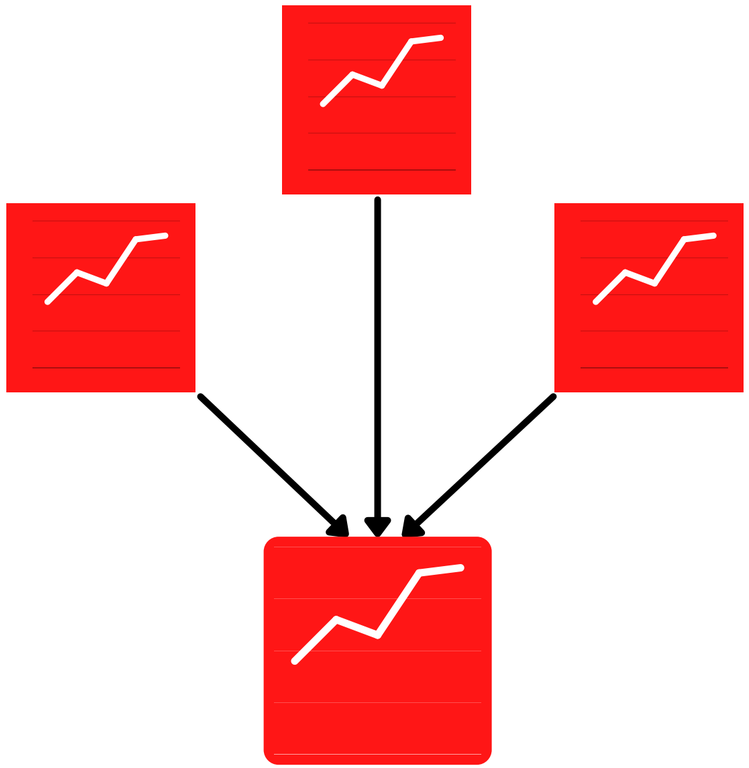
STEP 4

Assemble, analyze, test results, and go back to step 1 if necessary.

Decision Tree Analysis

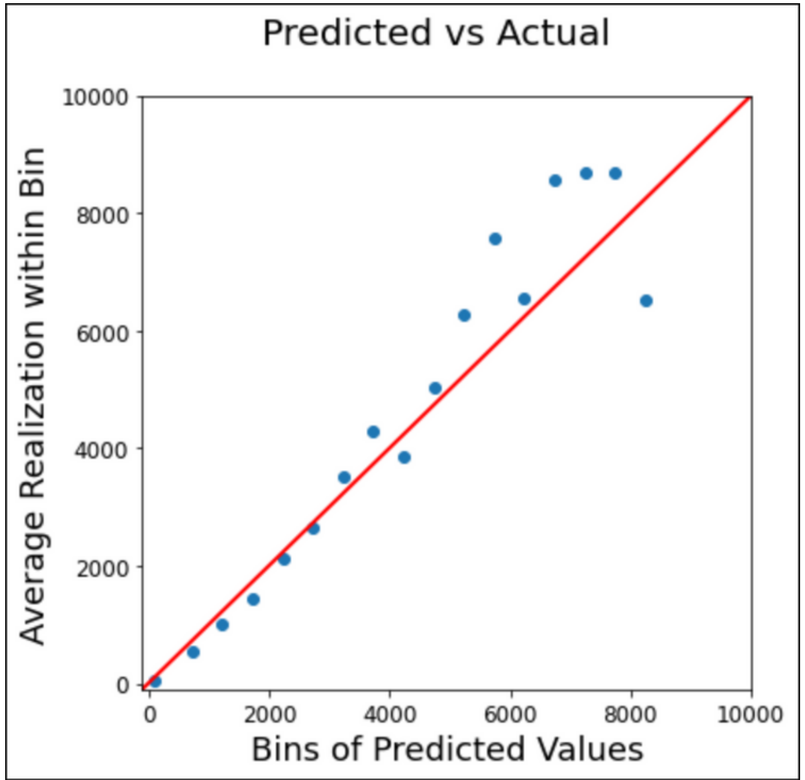


Predictive Model Results



Our model is a combination of other models. By aggregating models together, we find an average which helps eliminate biases and weaknesses in individual models

With our combined models, we can start comparing our predicted losses vs the historical losses and see how strong our predictions are



Confidence in Different Data

We run and test our model multiple times, on different data pulls, to build confidence in our predictive capabilities. The more we know about the data, the stronger we can predict.

RMSE	Naive - RMSE
6947.961538	177.647847

RMSE	Naive - RMSE
7190.282860	174.222957

RMSE	Naive - RMSE
7093.012042	153.736767

RMSE	Naive - RMSE
6967.965199	157.644186

Summary/Key Takeaways

Our plan for supporting Wells Fargo's goals for loan portfolio optimization and process automation.

PROBLEMS WE ARE SOLVING OR OPPORTUNITIES WE ARE GOING AFTER

Loan Portfolio Optimization - Purchase, Cash Out Refinance, Purchase, and Refinance.

To maintain a competitive edge, fine-tuned tools in specific LOB will enhance business understanding and decision making.

SUPPORT WE NEED TO ACHIEVE THIS GOAL

Predictive Forecasting- Support process automation for mortgage and auto lending underwriting.

Having top down, bottom up support from Wells Fargo through individual LOB data and professional knowledge ensures mission success.

HOW WILL ACHIEVING THIS GOAL HAVE A GREAT IMPACT?

Risk Management and Net Loss Reductions- Development of Data Analytics for Better Decision Making.

Through the use of new technology and implementation of a data science solution, Wells Fargo will continue to achieve high internal performance metrics and customer satisfaction.

KEY METRICS. HOW WILL WE KNOW WE HAVE ACHIEVED THIS GOAL? HOW DO WE KNOW IF WE ARE SUCCESSFUL?

Financial Results, Credit Quality of Loan Portfolios, Reduced Credit Losses for Loans and Model Repurposing

Through a reduction of net losses in specific LOB and a reduction in loan defaults, as well as 70% automation of decision making across the company.

CHALLENGES WE'RE ANTICIPATING

Potential Increases in Residential Cash Out Refinancing-Interest Rates

Lending practices for VA and FHA Loans along with FICO Scores and DTIs are key considerations in future positive modeling results.

Objective

Increase portfolio performance in an automated fashion that allows the business to spend less time on assessing borrowers and more time on future growth and business solutions to more complex problems in alignment with the Q4-21 Wells Fargo Financial Report

Data about Data

We are utilizing Fannie Mae data as part of a proof of concept. Evaluation of the market and data elements provide guidance on key variables important to good investments.

Solution

A combination of various decision tree models provides a level of predictability on loans based on values in the borrowers profile.

Key Elements

As part of our discovery, both in the data and in the market, key variables are big indicators of a loans performance.
Debt-to-Income Ratio, Borrower Credit Score, Loan to Value Ratio, Loan Term, and more end up being important metrics critical to understanding good loan issuance.

Unique Value Proposition

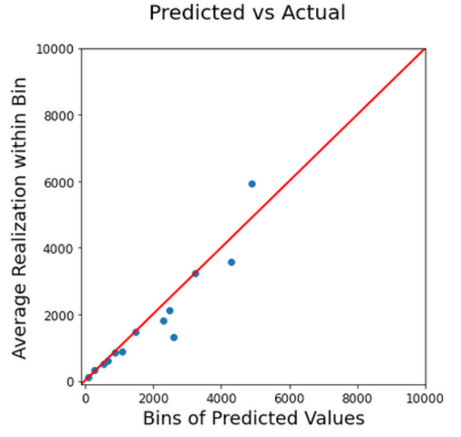
Setting Wells Fargo up for a stronger automated future with greater efficiency in their non-conforming loan portfolios, auto lending, and residential underwriting.

High Level Concept

With Wells Fargo support, setting up automated models accross all Lines of Business, and creating standards that are consistent across the business

Predictability Provides Confidence

By proving model effectiveness, and by proving predictability, this allows our client to rely on automation tools and focus efforts towards future development and planning.



Customer Segments

Residential Loans
Auto Loans
Single Family home buyers
Cash-Out Refinancing

Competitive Advantage

An automated approach gives us consistency which we can rely and plan on, as well as being faster than any human could.

Cost Structure

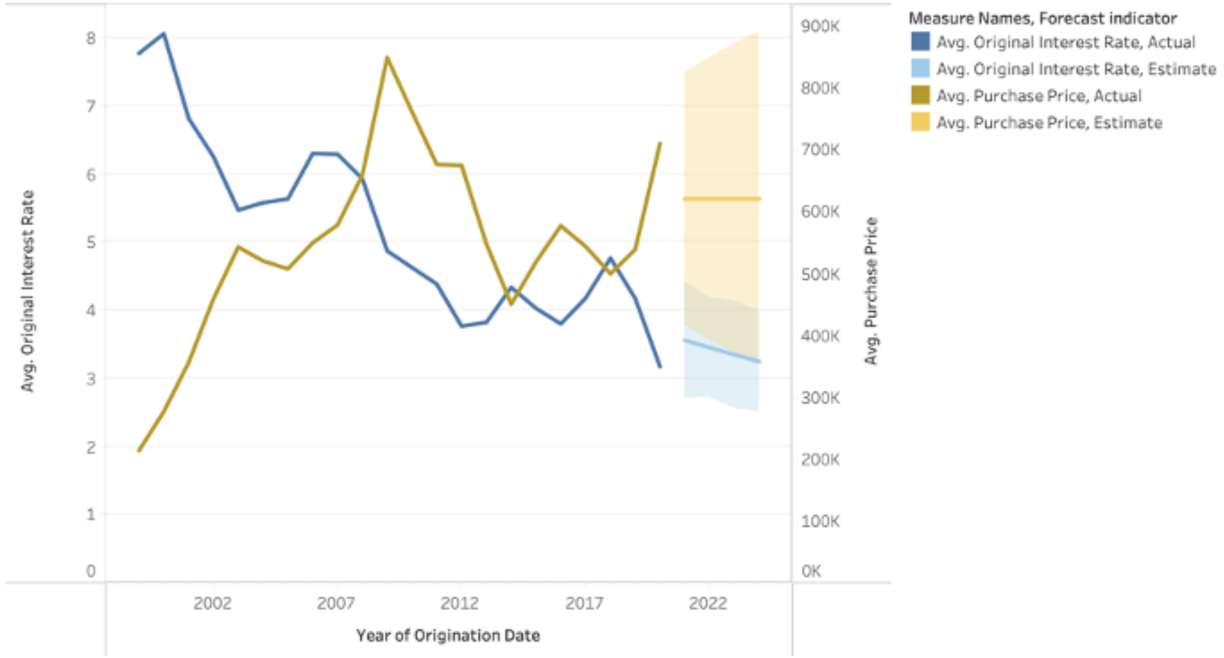
Our consulting team and strong data scientists will efficiently build models that can work and operate effectively well after our team has seperated. Our goal is to build a lasting automated process that Wells Fargo can rely on.

Revenue Streams

Predictability in our models allows Wells Fargo to project out their revenue streams and growth with confidence

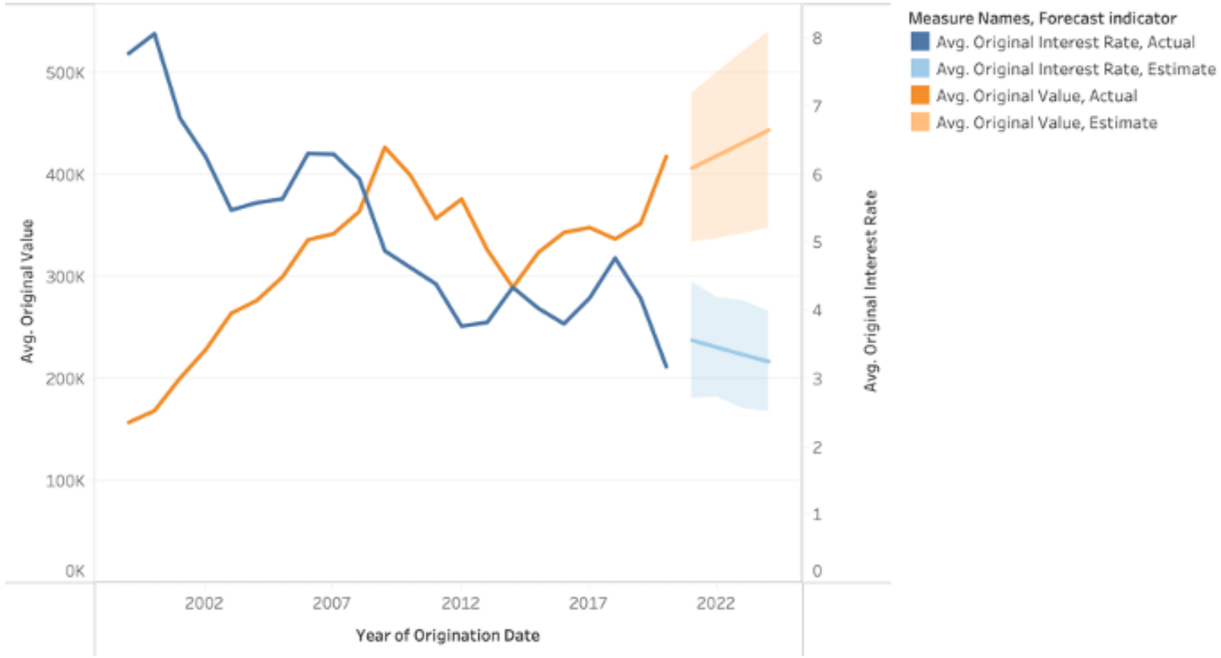
Wells Fargo Portfolio Analysis- Interest Rates

Wells Fargo Interest Rate Purchase Price



The trends of Avg. Original Interest Rate and Avg. Purchase Price for Origination Date Year. Color shows details about Avg. Original Interest Rate, Avg. Purchase Price and Forecast indicator. The data is filtered on Seller Name, which keeps Wells Fargo Bank, N.A..

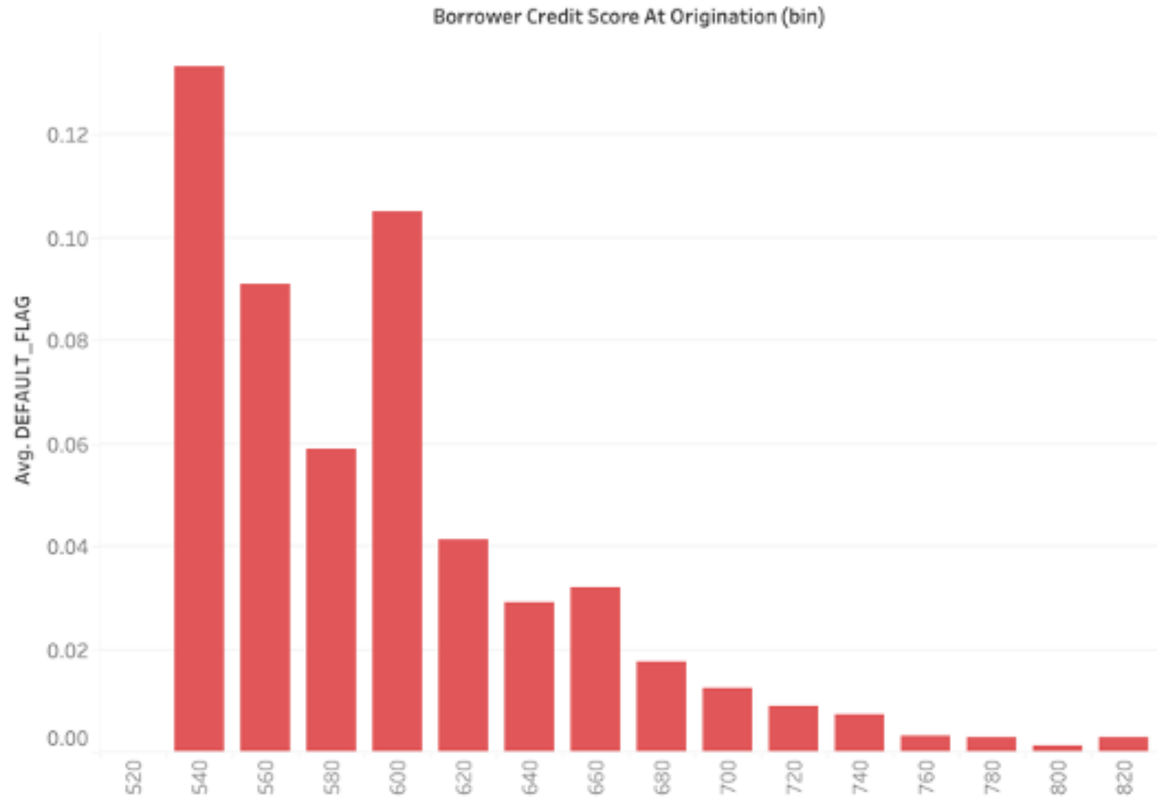
Wells Fargo Original Value Interest Rate



The trends of Avg. Original Value and Avg. Original Interest Rate for Origination Date Year. Color shows details about Avg. Original Value, Avg. Original Interest Rate and Forecast indicator. The data is filtered on Seller Name, which keeps Wells Fargo Bank, N.A..

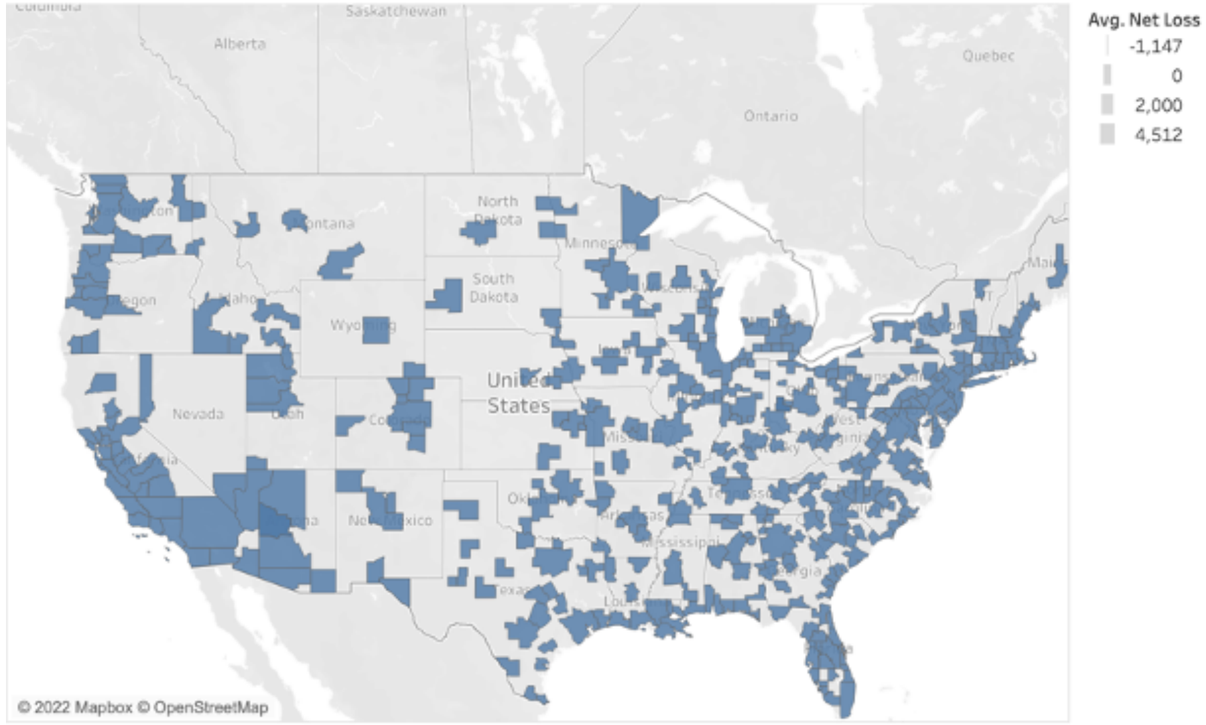
Wells Fargo Default and Net Loss

Wells Fargo Default Credit Score



Average of DEFAULT_FLAG for each Borrower Credit Score At Origination (bin). The data is filtered on Seller Name, which keeps Wells Fargo Bank, N.A.. The view is filtered on Borrower Credit Score At Origination (bin), which excludes Null.

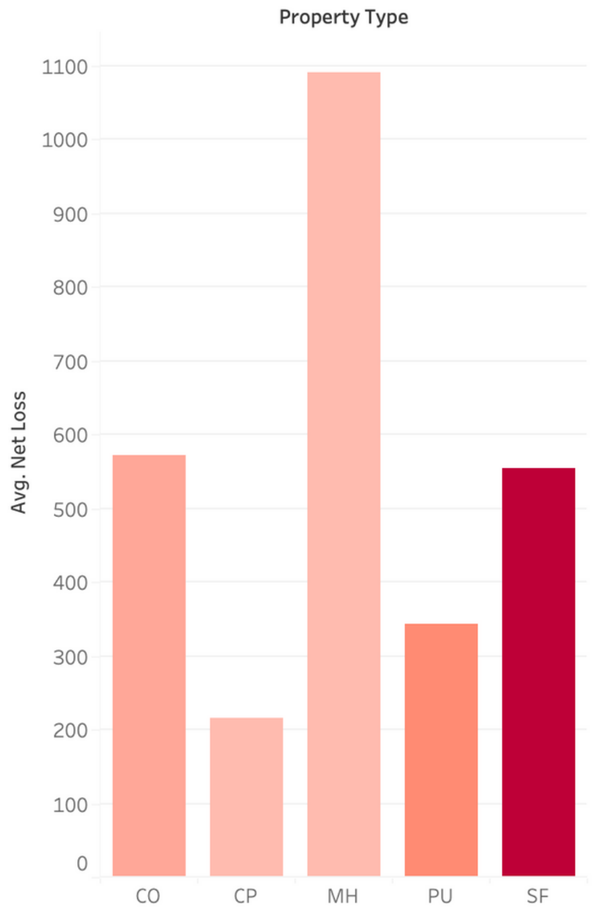
Wells Fargo Net Loss Map



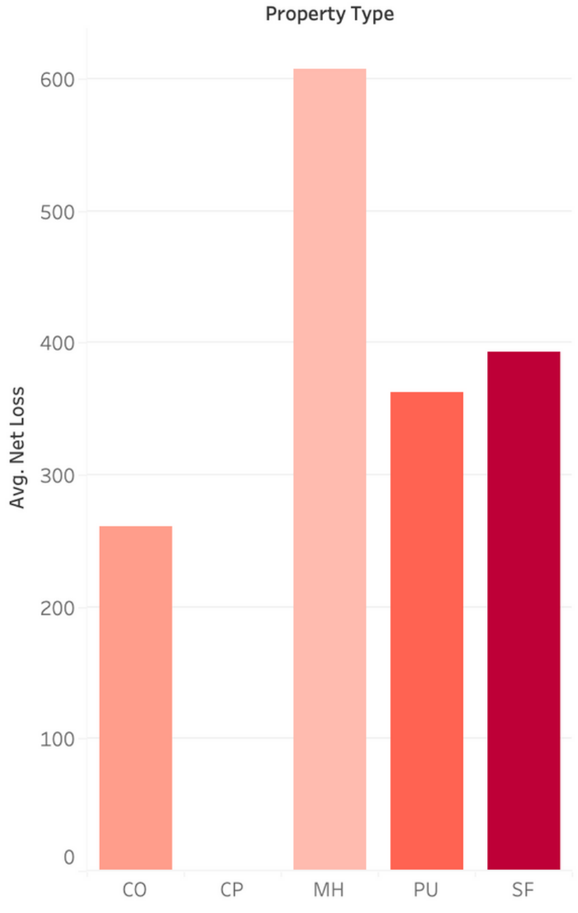
Map based on Longitude (generated) and Latitude (generated). Size shows average of Net Loss. Details are shown for MSA and Msa Name. The data is filtered on Seller Name, which keeps Wells Fargo Bank, N.A..

Wells Fargo Portfolio Analysis

Net Loss By Property Type



Net Loss By Property Type (Wells Fargo)



Net Loss By Credit Score

Net Loss By Credit Score (Wells Fargo)