Money Matters: Exploring the State of Financial Well-Being in the U.S

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What is Financial Well-being?

Financial well-being can be defined as a state of being wherein a person can fully meet current and ongoing financial obligations, can feel secure in their financial future, and is able to make choices that allow enjoyment of life. (Consumer Financial Protection Bureau (CFPB)).

Through learning and effort, and given reasonable opportunity and support, people can move along the continuum to greater financial well-being.

Financial Well-Being in America (2017) - Catalog (data.gov)

Project Goals

Analyze influencing factors

Develop a predictive model

Provide insights and recommendations

Guiding Questions

I. How do demographic factors such as household income, education level, age, generation, and ethnicity affect an individual's financial well-being score?

II. How do individuals' beliefs and knowledge about financial concepts, such as investment risks, interest rates, and mortgage terms, impact their financial well being-scores?

III. How can we develop a machine learning model that integrates both demographic factors and individuals' beliefs and knowledge about financial concepts to accurately predict financial well-being scores?

Tools Used

Python

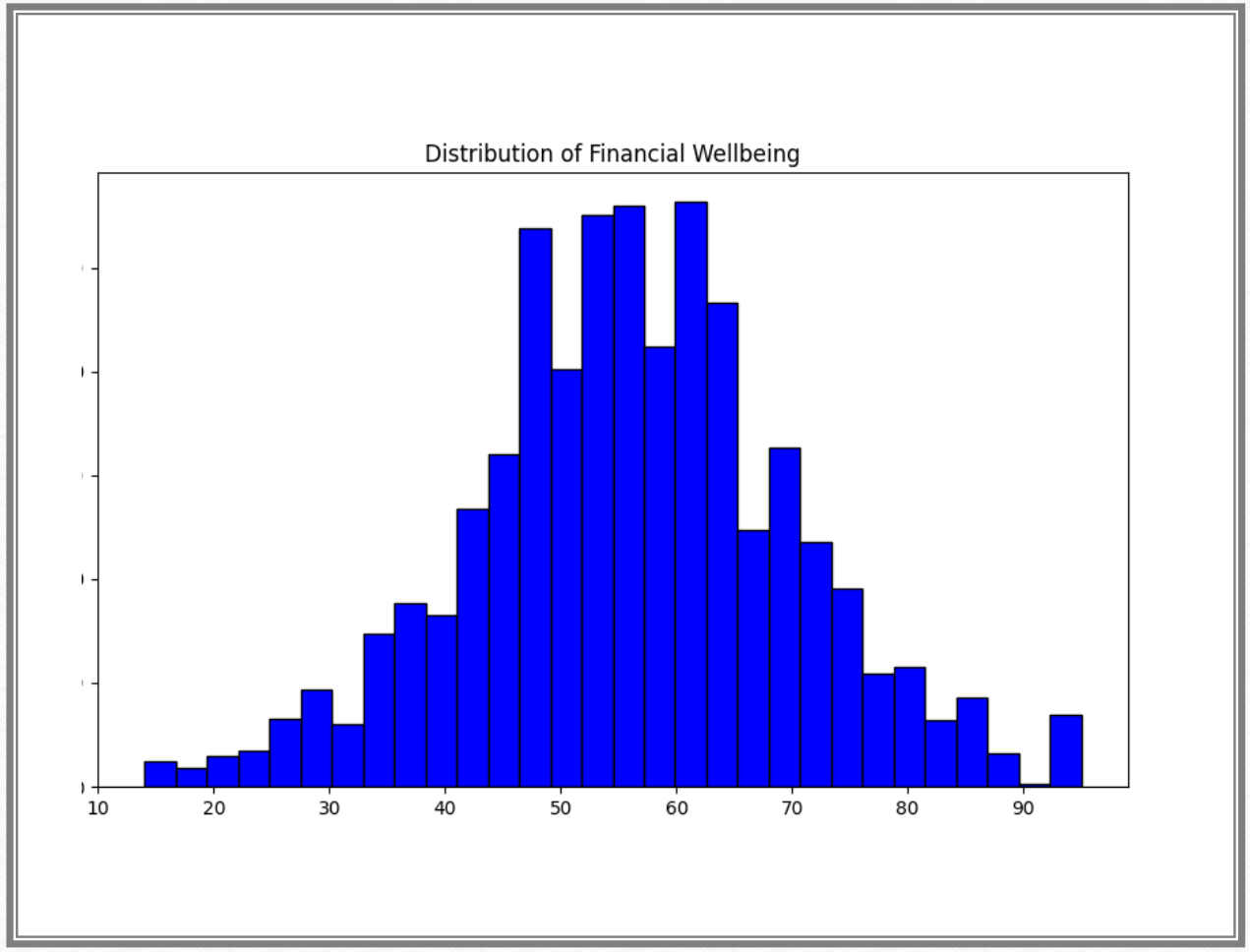
SQL

Excel

Power BI

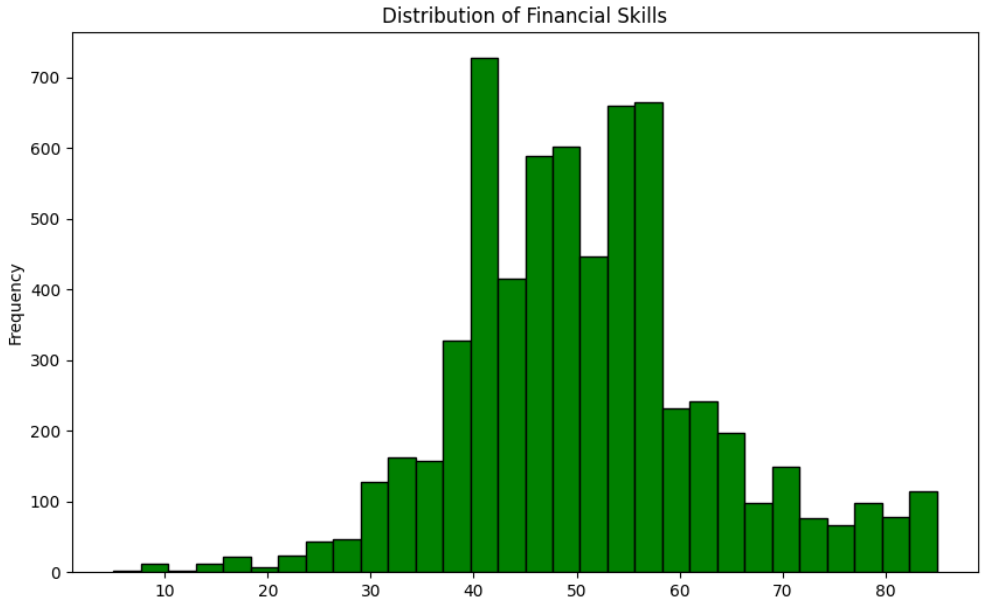
Libraries Used

- import pandas as pd
- import matplotlib.pyplot as plt
- import seaborn as sns
- from sklearn.model_selection import train_test_split, cross_val_score
- from sklearn.ensemble import RandomForestRegressor
- from sklearn.metrics import mean_squared_error, r2_score
- from sklearn.preprocessing import StandardScaler
- from sklearn.ensemble import GradientBoostingRegressor
- from sklearn.model_selection import GridSearchCV
- from scipy.stats import pearsonr



Distribution of financial well-being Scores

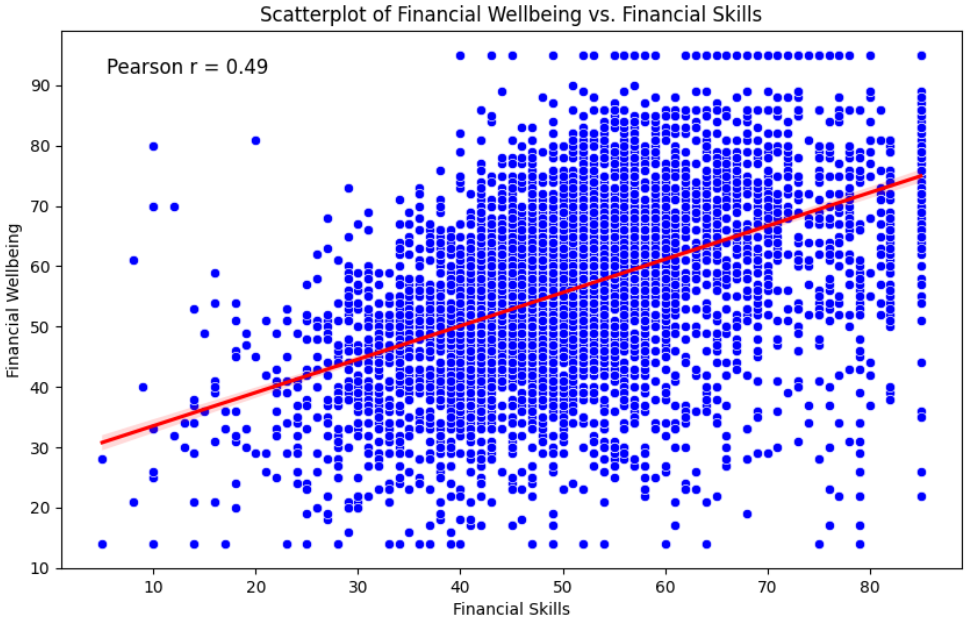
- **N** = 6394
- **Mean**: 56.08
- **Std Dev**: 14.06
- **Min**:14
- **Median**: 56
- **Max**: 95
- **Shape**: The histogram shows a normal distribution centered around the mean, with data spread around it.



Distribution of financial skills

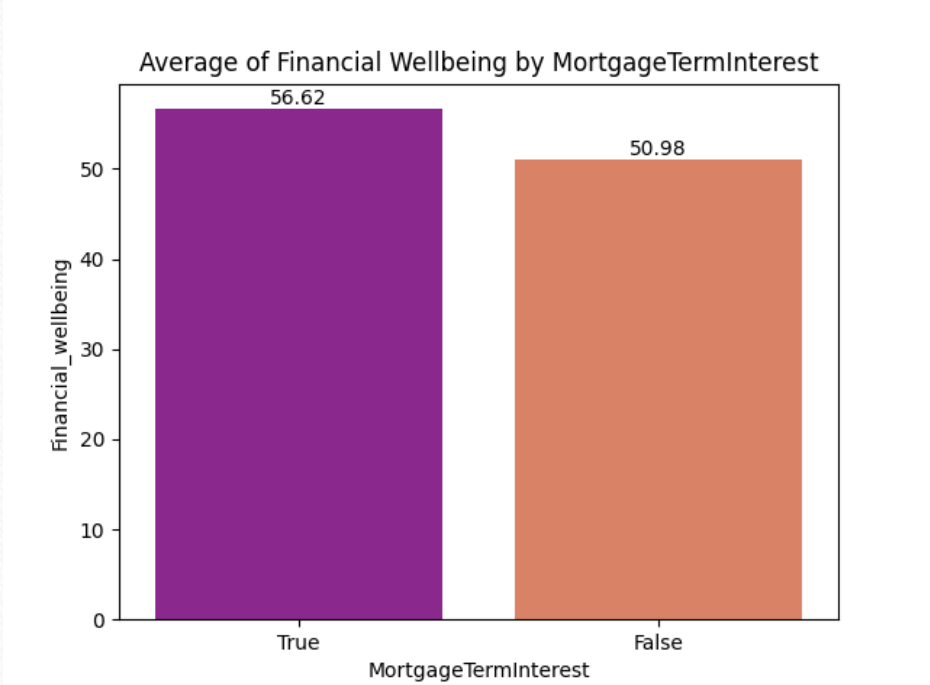
- **N** = 6394
- **Mean**: 50.78
- **Std Dev**: 12.52
- **Min**: 5
- **Median**: 50
- **Max**: 85
- **Shape**: The histogram shows a positive skew(0.287)(rightward tail) distribution.

Financial Well-being & Financial Skills Correlation



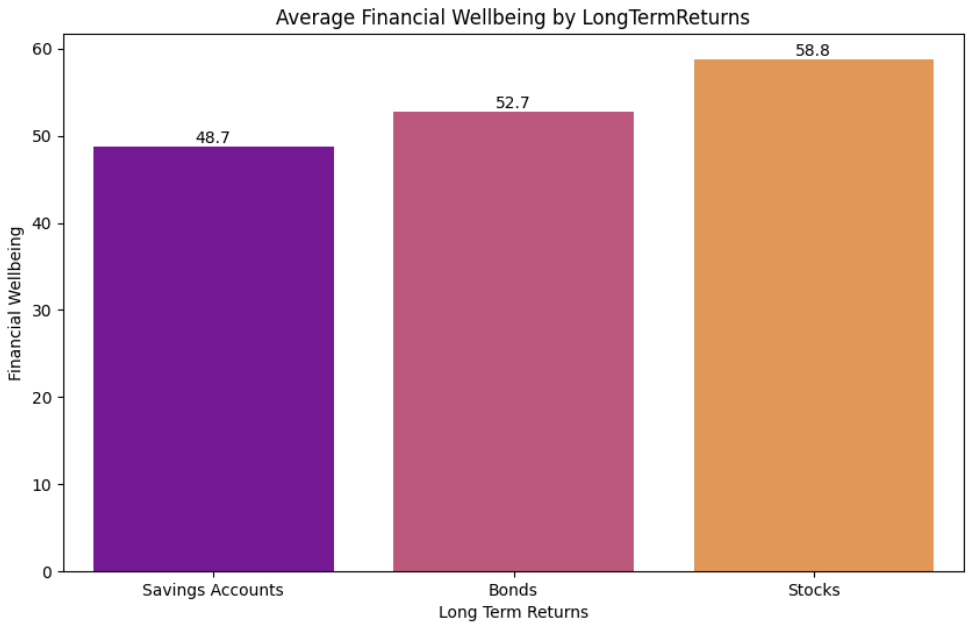
- Pearson r = 0.49 indicates a moderate correlation between financial skills and financial well-being.

Financial Well-being by Mortgage Term Interest



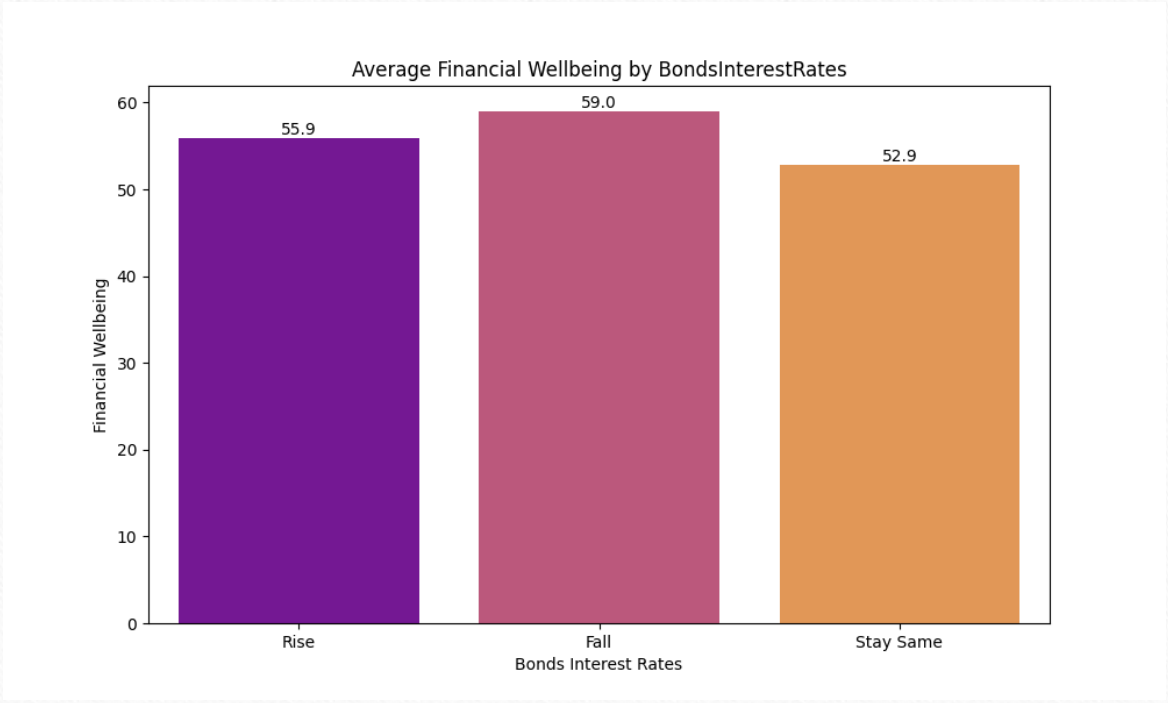
Regarding the statement that a 15-year mortgage requires higher monthly payments but results in less total interest paid compared to a 30-year mortgage, those who answered ‘True’ have a higher average financial well-being score (56.6) than those who answered ‘False’ (51.0).

Financial Well-being by Long-Term Returns



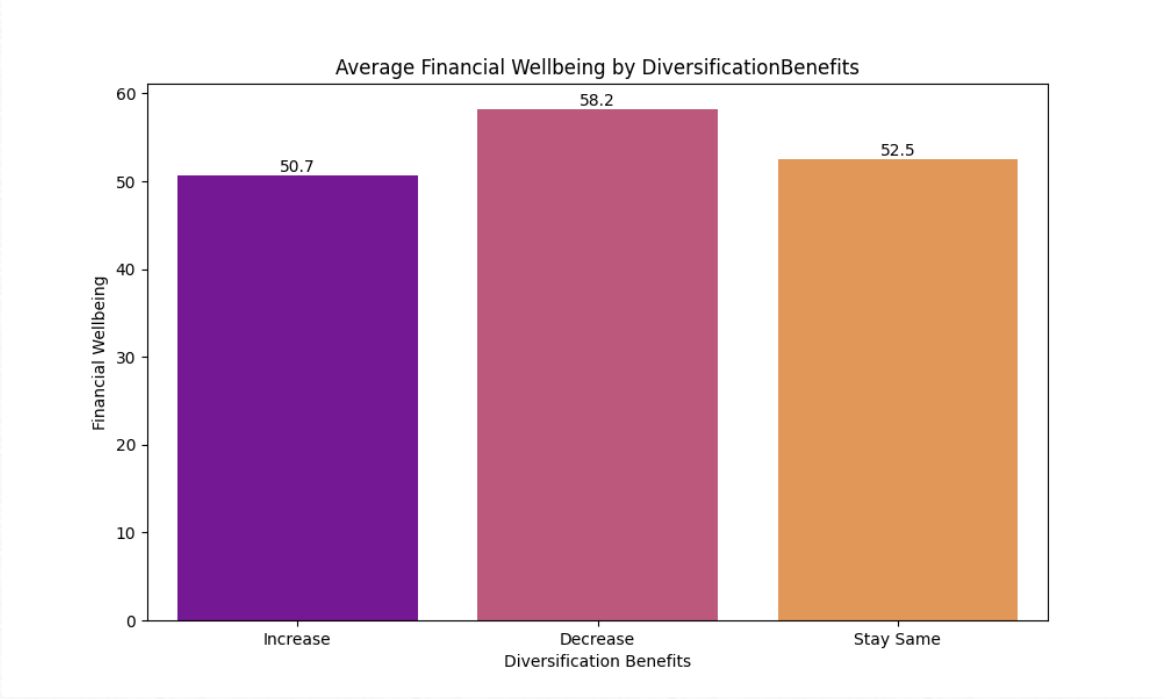
In terms of long-term investment(10-20 years), stocks have the highest average financial well-being score (58.8), compared to bonds(52.7) and savings accounts (48.7).

Financial Well-being by Bonds Interest Rates



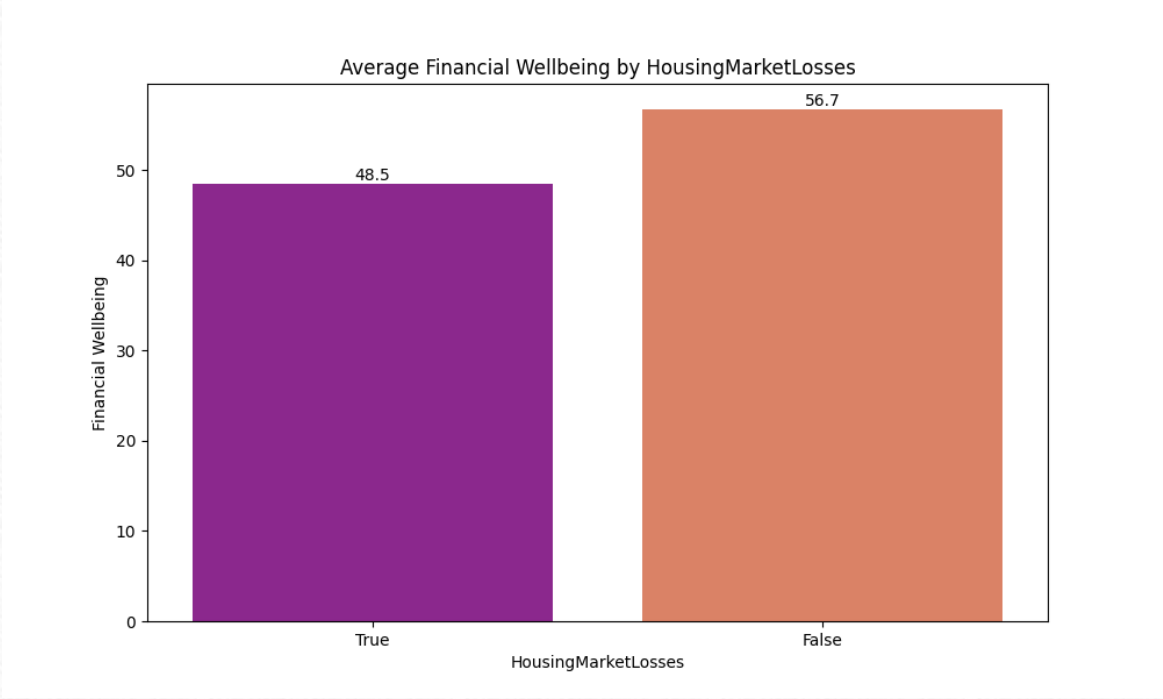
Regarding the impact of rising interest rates on bond prices: Those who expect bond prices to fall have the highest average financial well-being score (59.0), compared to those who expect bond prices to rise (55.9) and those who believe bond prices will stay the same (52.9).

Financial Well-being by Diversification Benefits



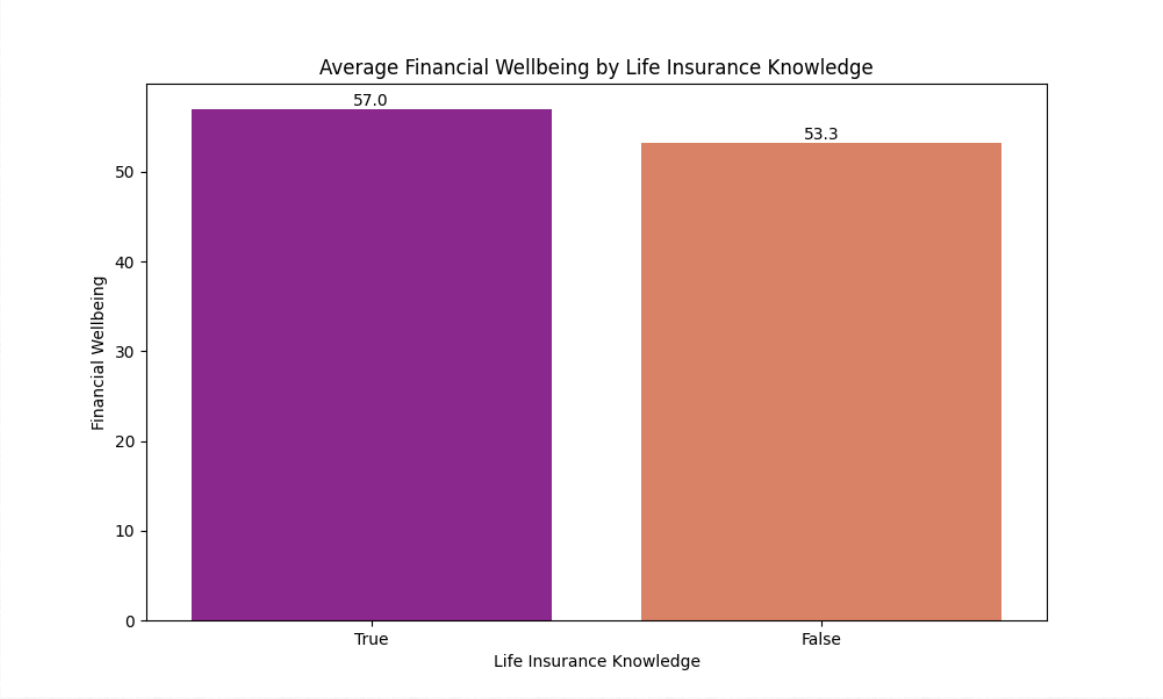
Concerning the impact of diversifying investments among different assets, those who believe spreading money among different assets decreases risk have the highest average financial well-being score(58.2), compared to those who think it increases risk(50.7) or that it stays the same (52.5).

Financial Well-being by Housing Market Losses



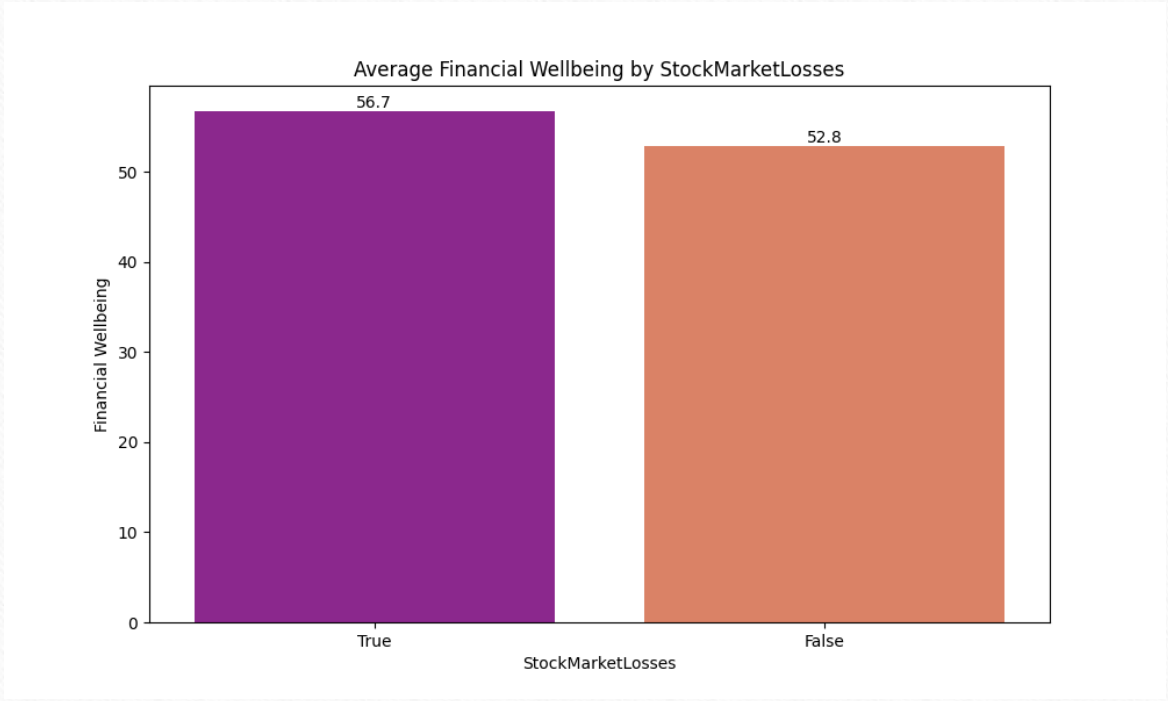
On the belief that housing prices in the US can never go down, those who believe the statement is false have a higher average financial well-being score (56.7) compared to those who believe the statement is true.

Financial Well-being by Life Insurance Knowledge



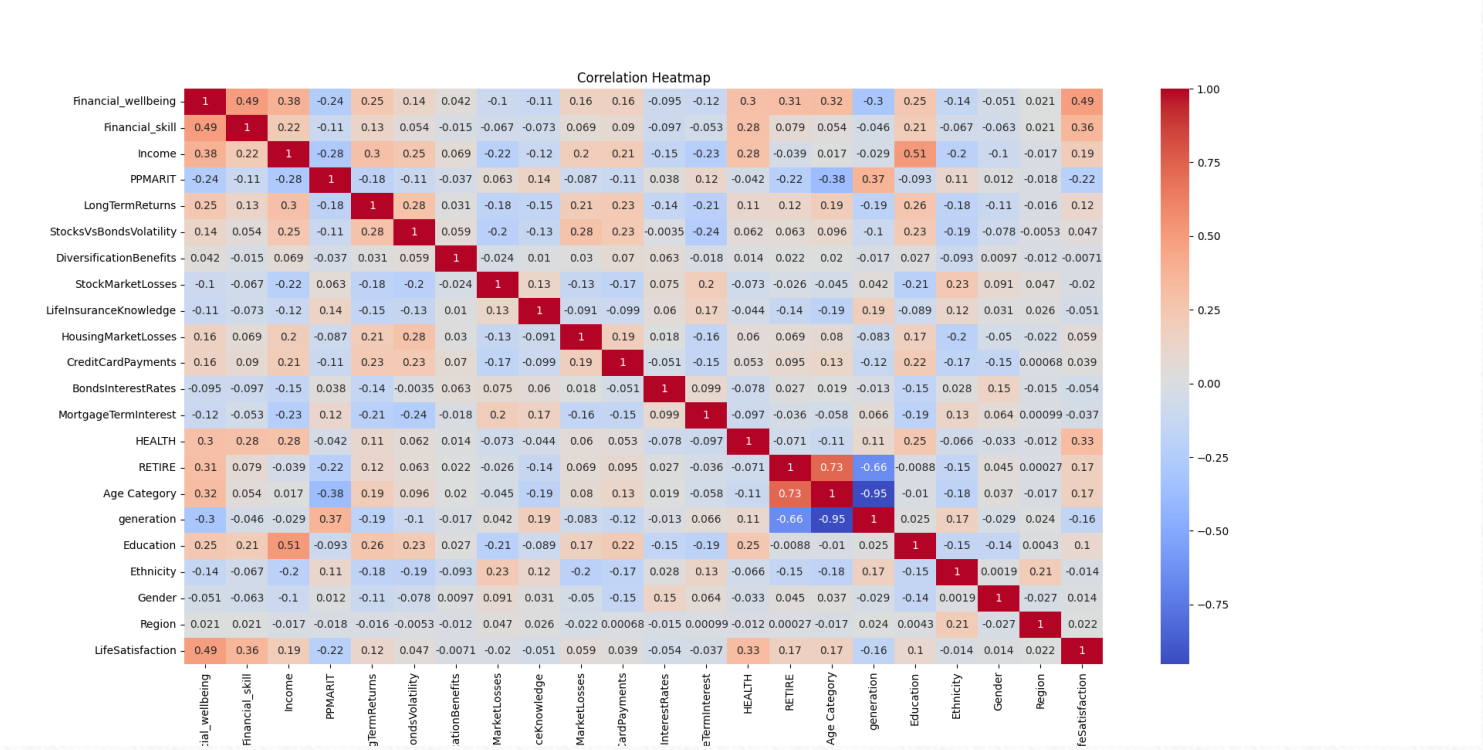
Concerning the statement that 'Whole life insurance has a savings feature while term life insurance does not', those who believe the statement is true have a higher average financial well-being score (57.0) compared to those who believe the statement is false(53.3).

Financial Well-being by Stock Market Losses



Those who believe it's possible to have less than $1,000 when withdrawing from a stock mutual fund have a higher average financial well-being score (56.7) compared to those who think it's not possible (52.8).

Correlation Heatmap



- Warm colors = High positive correlations
- Cooler colors = High negative correlations
- Neutral colors = No correlations

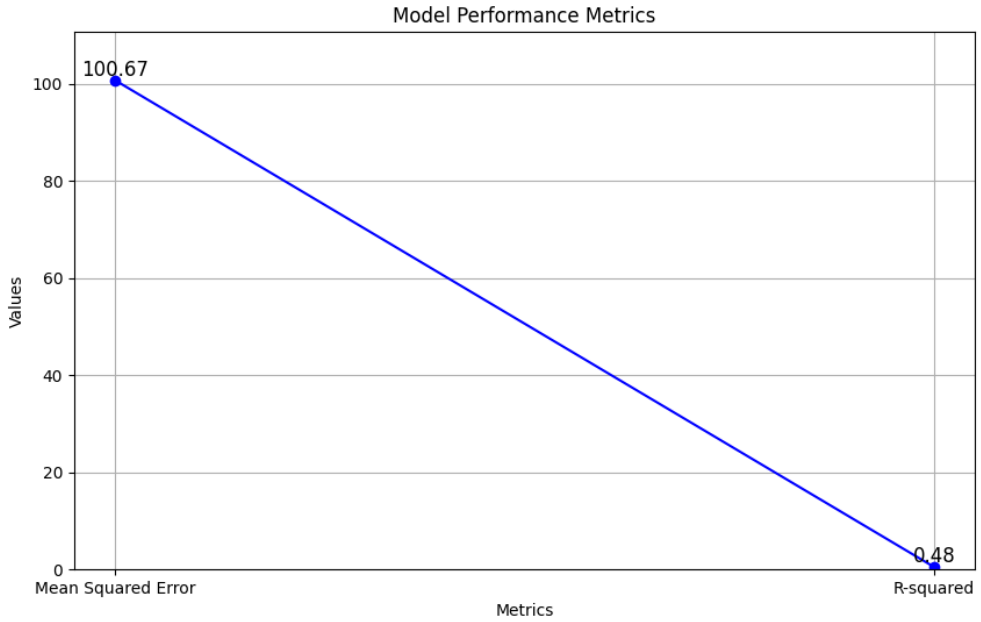
Machine Learning Model: Process

- Split the data: `X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=0)`
- Feature scaling: Normalize data
- Model selection and training: selected GradientBoostingRegressor(builds a series of models to make predictions) and fit the model to the training data to learn patterns and relationships.
- Tune the model: 1) Hyperparameter Tuning => Techniques like GridSearchCV were used to adjust the model's settings to improve its performance.
- 2) Cross-Validation: Assess the model's performance across different subsets of the training data to ensure it generalizes well.

Machine Learning Model: Process

- Evaluate the model: Calculate performance metrics using Mean Squared Error(MSE) and R-squared (R^2) to understand how effectively the model predicts financial well-being.
- Best settings for the tool: {‘Learning Rate': 0.1, ‘Max Depth': 3, ‘Number of Estimators': 100}
- Performance Scores: Test Mean squared error:100.67 {how much the tool’s predictions are off from the actual values}
- Test R-squared:0.48 { the tool is only able to explain 48% of the differences in the financial well-being of the test data}

Model Performance Metrics



- Negative correlation between MSE(measures prediction error) and R^2(accuracy)
- High MSE => Low R^2
- Low MSE => High R^2

Key Insights

- Education and income are strong predictors of financial well-being.
- Life satisfaction and health are positively correlated with financial well-being.
- Individual beliefs and knowledge of financial concepts greatly influence financial decisions and outcomes.
- Older generations and married individuals generally have higher financial well-being scores.

Recommendations

- Improve financial education
- Promote health and well-being initiatives {holistic well-being program, support for mental health}
- Provide customized financial advice
- Encourage long-term financial stability