Mortgage Market Power and Disparities

A Large-Scale Analysis Using HMDA Public Data

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MACS 30123 Final Project

Research Questions

- Are racial disparities in mortgage approval and pricing worse in concentrated local markets?
- Are non-white applicants disadvantaged even after controlling for income and geography?
- Does market concentration exacerbate or mitigate these disparities?

Data and Key Variables

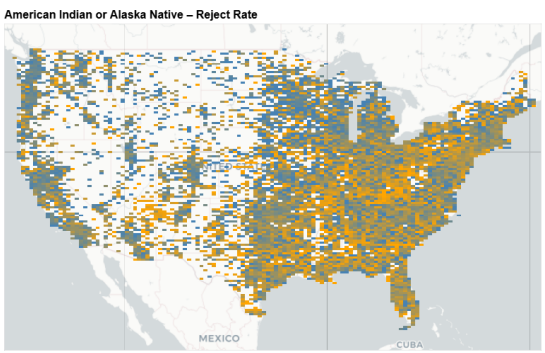
- **Source:** HMDA public data (2018–2023), ¿80M observations
- **Key variables:** race, income, loan amount, property value, rate spread, action taken
- **Market structure:** lender concentration at the census tract level

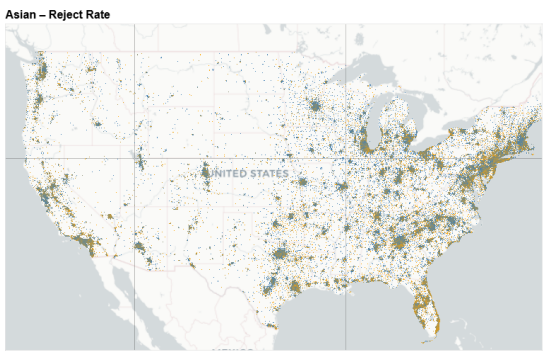
Social Science Importance

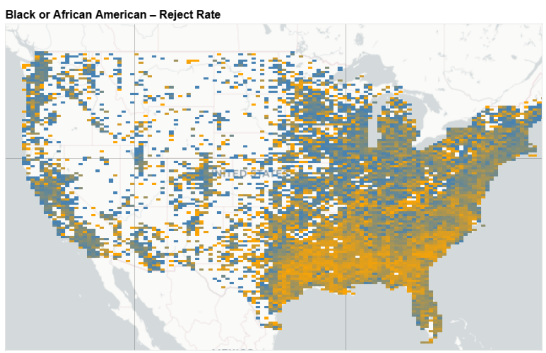
- Analyzes structural inequality in mortgage lending
- Implications for:
  - Fair lending enforcement
  - Mortgage policy and regulation
  - Financial inclusion and equity

Interactive Visualization: Rejection Rates by Tract

- Used Holoviews/Bokeh to visualize spatial rejection rates
- Interactive maps allow zooming into census tracts across the U.S.
- Orange: Top 20 MSAs (high loan volume)
- Green: Non-top 20 MSAs
- Helps explore geographic concentration of disparities

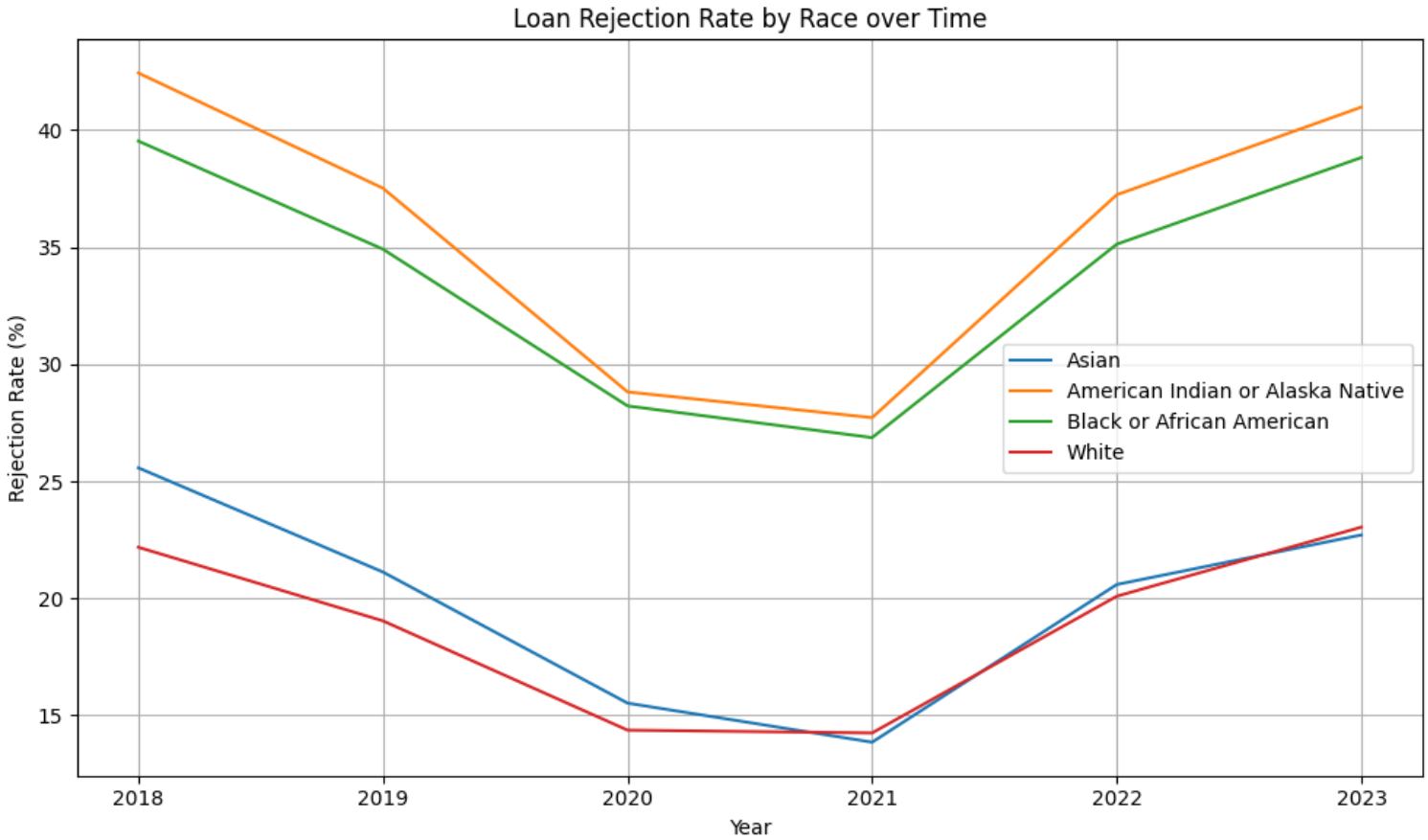




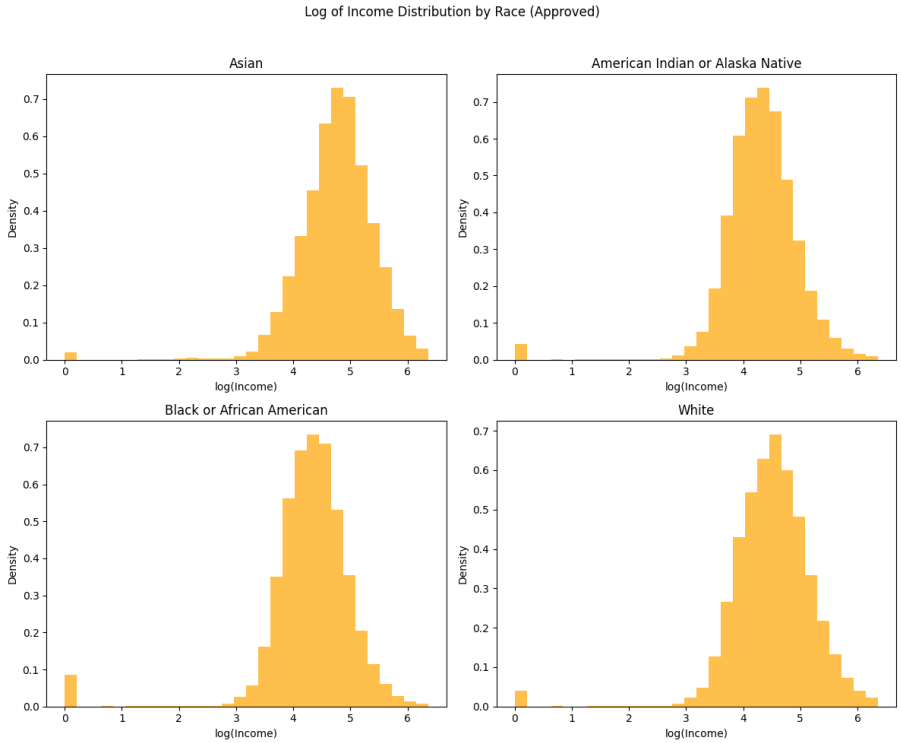


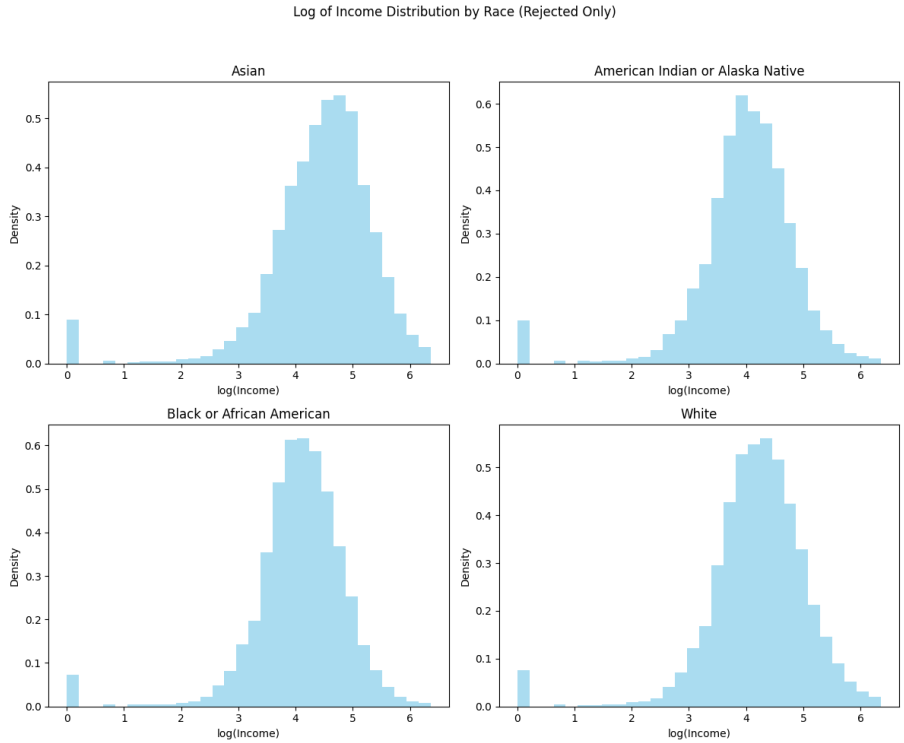
Exploratory Analysis

- Disparities by race in approval and pricing
- Visual evidence of persistent racial gaps

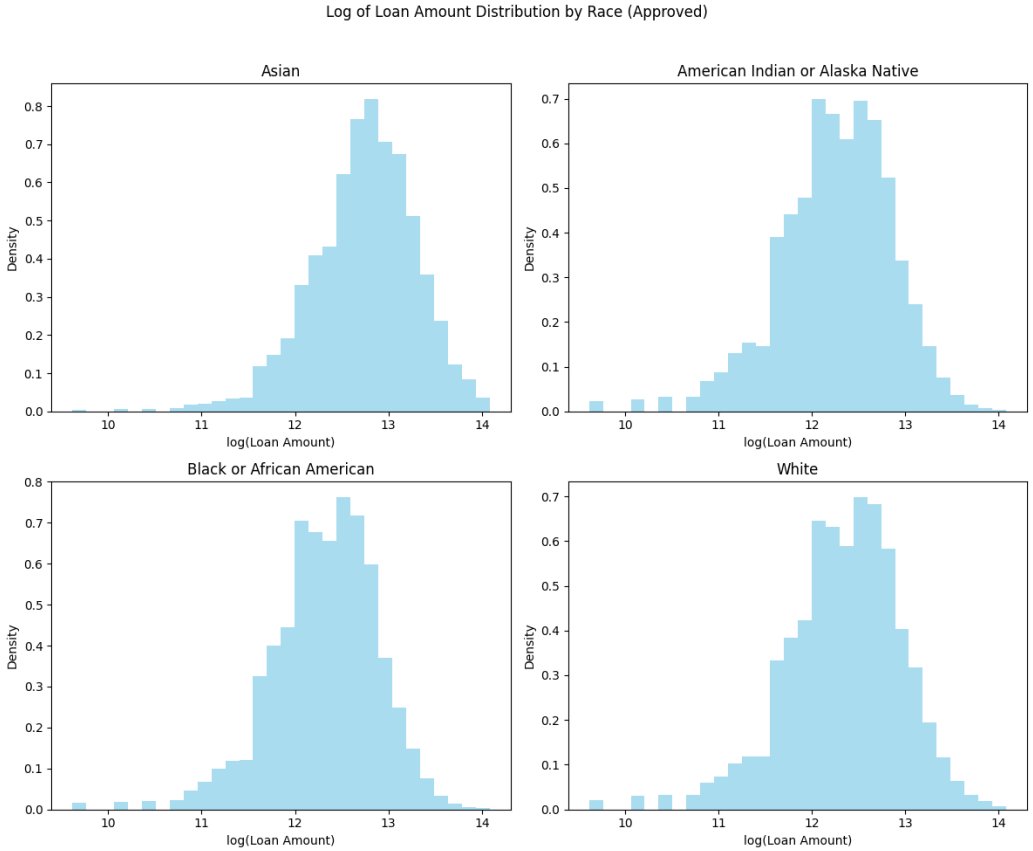


Income Distribution (Approved Rejected)

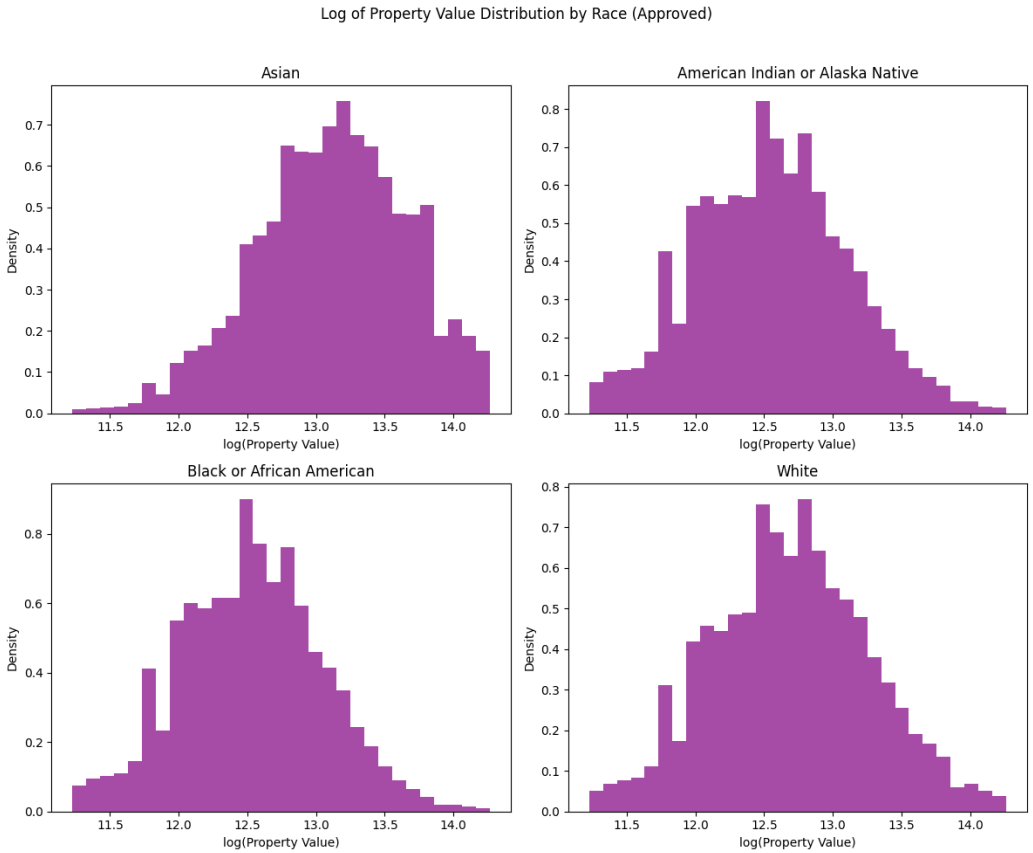




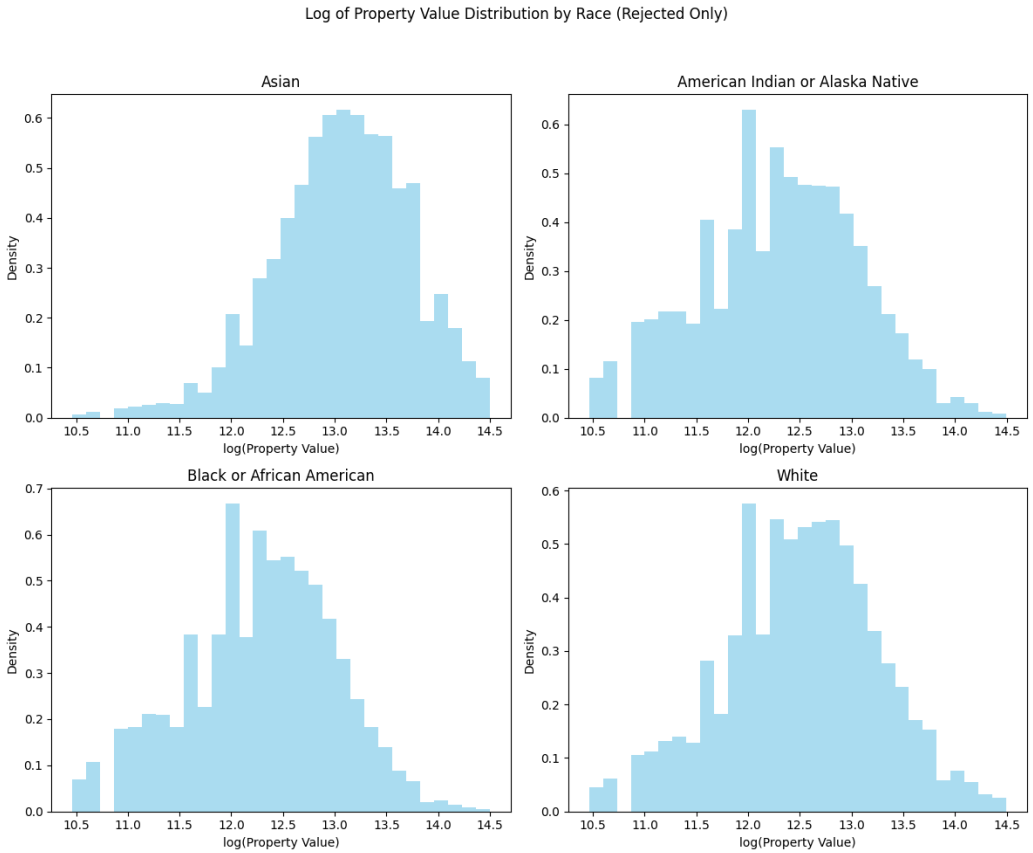
Loan Amount Distribution



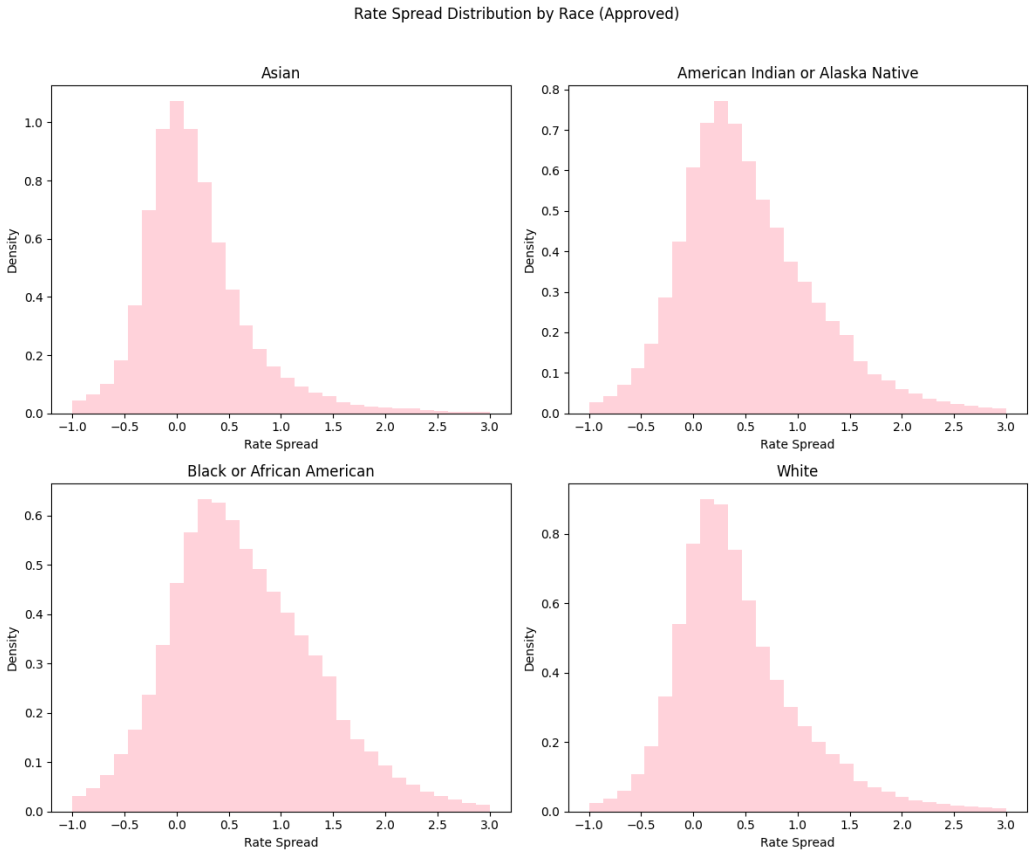
Property Value Distribution (Approved)



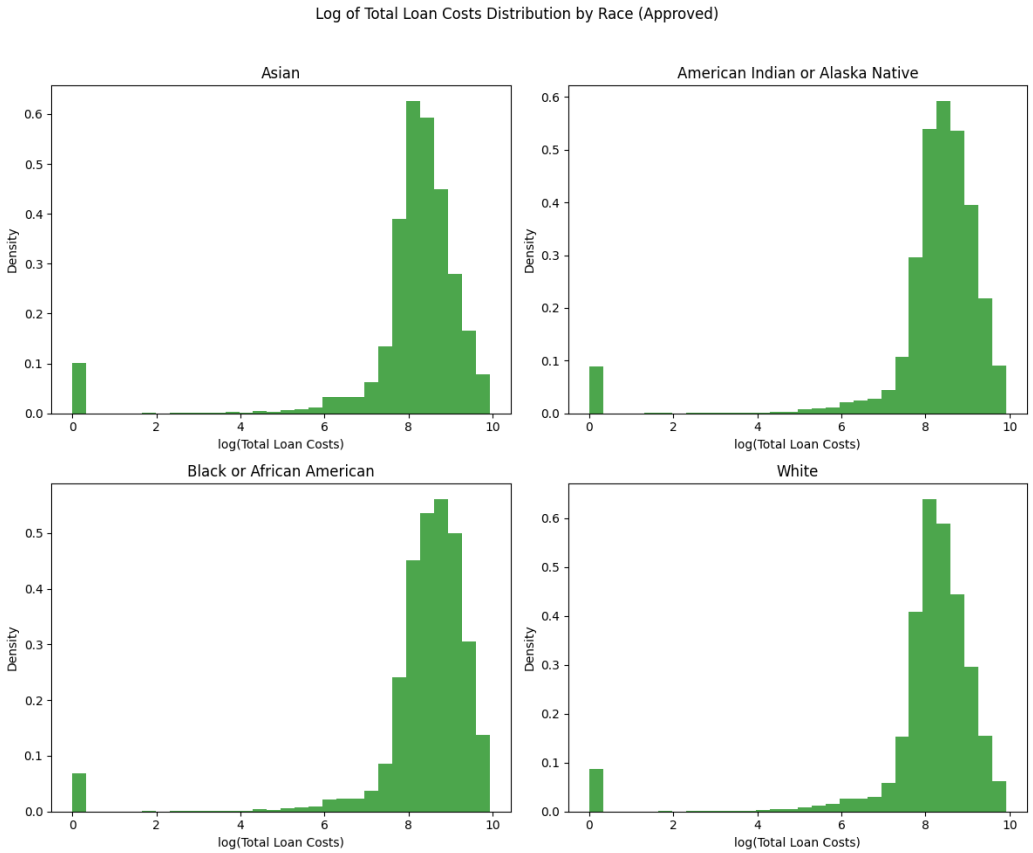
Property Value Distribution (Rejected)



Rate Spread Distribution



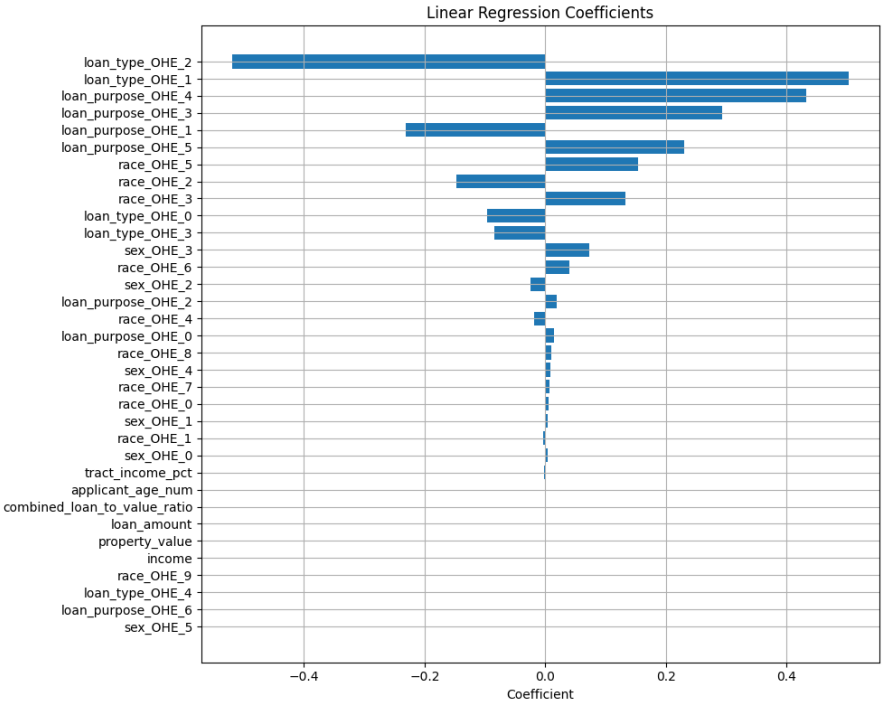
Total Loan Costs Distribution

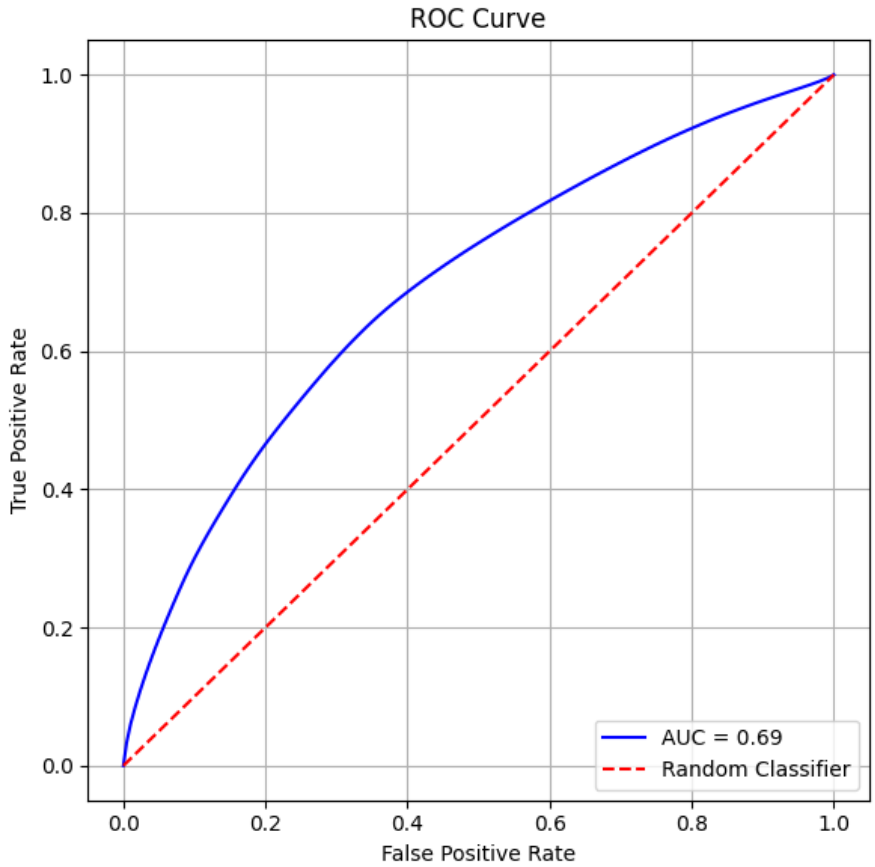


Machine Learning Models

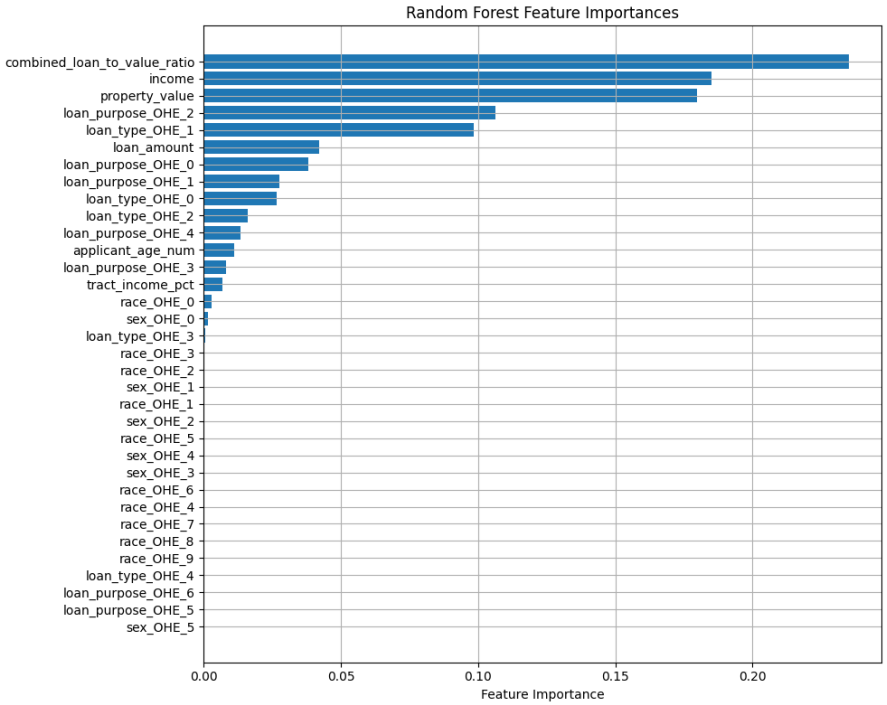
- **Logistic regression (rejection):** AUC ≈ 0.69
- **Linear regression (rate spread):** RMSE ≈ 3.58
- **Tree-based models:**
  - Random Forest RMSE: 3.52
  - GBT RMSE: 3.43
- Race remains a significant predictor *even after* full controls

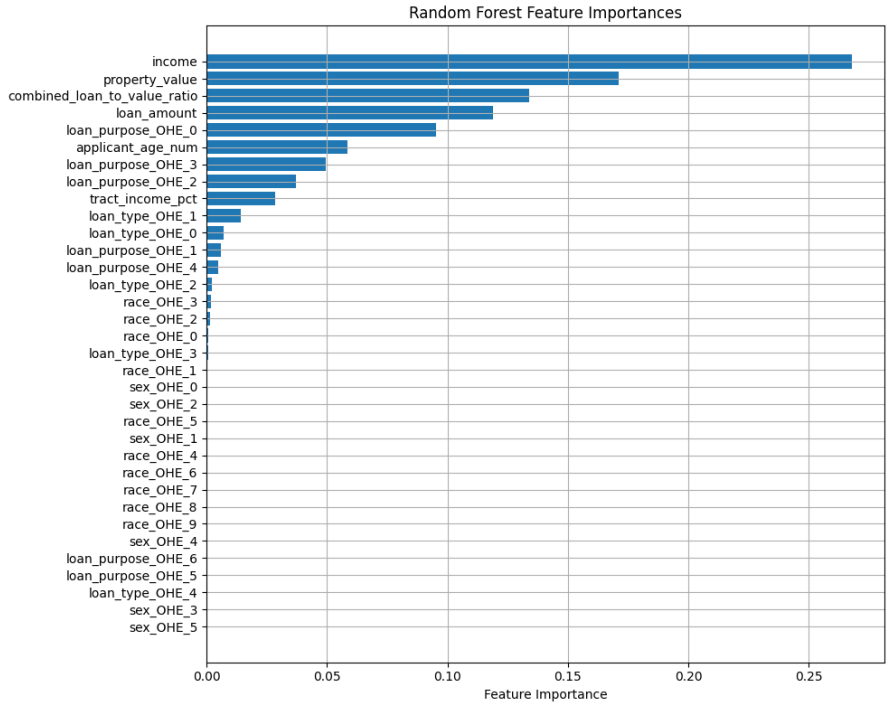
Model Outputs: Coefficients and ROC





Model Outputs: Feature Importances





Conclusion

- Market concentration is associated with greater racial disparities
- Implications for competition and credit access
- Future work: causal models, simulations, deeper policy analysis