Appendix C. Result Details

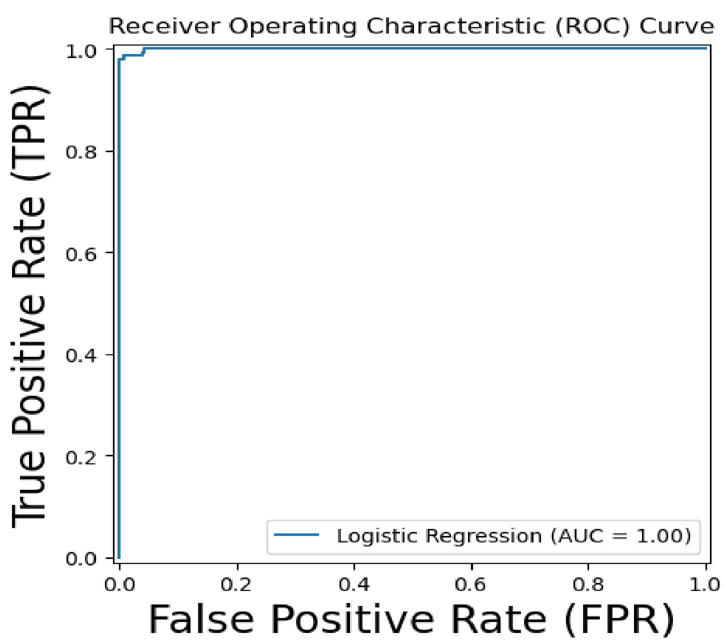
C1. Model Performance Summary

Model	TN	FP	FN	TP	Accuracy
Logistic (0.5)	232	2	2	150	98.97%
Logistic (0.6)	235	0	3	150	99.23%
KNN (Unscaled)	231	4	15	138	95.10%
KNN (Scaled)	230	5	9	144	96.39%

C2. ROC and Discrimination

The logistic regression model achieved an **AUC ≈ 0.999**, indicating near-perfect discrimination within the audited sample.

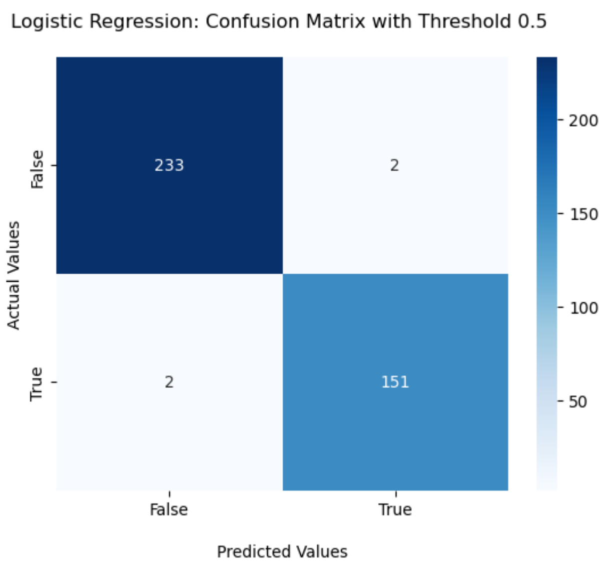
The ROC curve demonstrates high true positive rates while maintaining low false positive rates across decision thresholds.

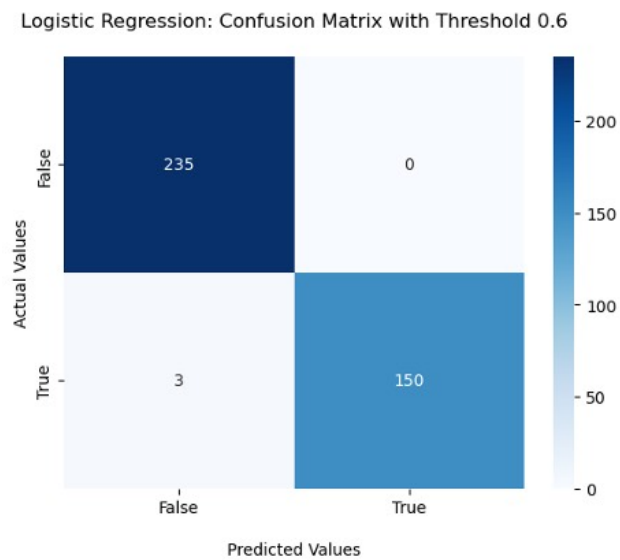


C3. Threshold Sensitivity

Performance was stable across thresholds of 0.5 and 0.6.
Increasing the threshold reduced false positives without materially increasing false negatives.

This suggests the model is robust to moderate changes in decision rules.





C4. Error Trade-Off Analysis

From a policy perspective:

- **False negatives (FN)** represent missed evaders and lost enforcement revenue.
- **False positives (FP)** represent unnecessary audits and administrative costs.

Because enforcement prioritizes minimizing missed evaders, logistic regression is preferable due to its substantially lower false negative rate.

C5. Limitations

Several limitations should be noted:

- The dataset includes only firms selected for audit based on prior suspicion. As a result, it does not represent the full population of firms. This selection process may make prediction easier and inflate measured performance.

- The dataset has been modified for instructional purposes, with simplified variable definitions. Real-world enforcement environments may involve noisier or less structured data.

- Model evaluation is based on a single dataset. External validation on independent data would be necessary to assess generalizability.

C6. Future Work

Future extensions could include:

- Testing tree-based models (e.g., random forests, gradient boosting)
- Evaluating cost-sensitive learning approaches
- Incorporating temporal dynamics in firm behavior
- Validating the model on a broader, more representative sample