

Credit Risk Modeling: Operational Recommendation

1 Operational Recommendation

1.1 Final Model Selection

The recommended production model is the **Calibrated Logistic Regression with Isotonic Calibration**, due to its balance between:

- Predictive accuracy,
- Explainability and interpretability, and
- Fairness stability across key demographics.

Component	Specification	Justification
Algorithm	Logistic Regression (Calibrated)	Transparent coefficients and monotonic calibration improve interpretability and reduce risk of hidden bias.
Calibration Method	Isotonic Calibration	Ensures probability outputs are well-calibrated across all risk levels.
Operational Threshold	0.40	Optimizes balance between sensitivity (detecting risky clients) and selectivity (reducing false rejections).

Table 1: Final Model Selection Summary

1.2 Operational Implementation Plan

Step 1 – Model Deployment

- Integrate calibrated probabilities into the credit decision system.
- Apply the 0.40 threshold to flag or reject applicants exceeding the predicted default probability boundary.

Step 2 – Governance and Documentation

- Register model version, deployment date, and key metrics in a Model Card.
- Include fairness documentation (EOD results) and calibration plots in the model package.

Step 3 – Performance Monitoring

- **Frequency:** Quarterly.
- **Scope:** Track AUC, KS, accuracy, and calibration stability (Brier score).
- **Drift Monitoring:** Assess population stability index (PSI) and feature drift over time.

Step 4 – Fairness Monitoring

- **Metric:** Equal Opportunity Difference (EOD) per attribute.
- **Threshold:** $|EOD| \leq 0.05$ considered acceptable; deviations trigger investigation.
- **Frequency:** Semi-annually or after major portfolio changes.
- **Action:** If EOD drift exceeds tolerance, perform recalibration or threshold adjustment.

Step 5 – Model Recalibration and Maintenance

- Annual model recalibration using updated data.
- Reassess both performance and equity metrics post-recalibration.
- Document all updates in the Model Governance Log.

1.3 Risk Management Considerations

- **Bias Reinforcement Risk:** Periodic re-training required to avoid bias reintroduction as population shifts.
- **Regulatory Audit Readiness:** Maintain evidence of fairness testing for internal and external reviews.
- **Transparency:** Publish summarized fairness results in compliance documentation to promote trust and accountability.

1.4 Long-Term Recommendations

- Expand fairness evaluation to additional attributes (e.g., geographic region, income level).
- Integrate fairness dashboards for real-time EOD tracking.
- Incorporate SHAP-based drift analysis to detect emerging bias in model explanations.
- Establish a Fairness Review Committee to oversee periodic audits and respond to stakeholder concerns.
- Enhance client communication by implementing an appeal mechanism for declined applications.

1.5 Conclusion

The Calibrated Logistic Regression model is suitable for operational deployment in a regulated credit environment due to its strong predictive performance, interpretability, and fairness consistency.

The defined monitoring and governance framework ensures that both model quality and ethical standards are maintained throughout its lifecycle.

In summary: The organization will operate a credit decision model that is accurate, explainable, and equitable—meeting both business goals and responsible AI standards.