Portfolio Management & Risk Optimization (D64–D68)

Machine Learning for Credit Risk, Segmentation & Systemic Risk
Weekly Report Summary

Across Days 64–68, we explored how Machine Learning can help identify borrower risk, uncover hidden behaviors, and anticipate market-wide stress events. This presentation walks through the journey from micro-level credit scoring to macro-level systemic risk modeling, presenting insights that strengthen modern portfolio risk management.

Executive Summary

- ML applied across micro → macro risk layers

- Logistic Regression → best credit scoring model

- K-Means revealed meaningful high-risk borrower clusters

- Bayesian Network showed how equity shocks propagate

- Foundation set for deeper model tuning & systemic stress testing

ML Foundations in Risk (D64)

Key ML Applications:

- Risk Classification

- Risk Clustering

- Systemic Risk Modeling

Challenges:

- Data quality issues

- Interpretability requirements

- Dynamic market environments

Supervised Credit Risk Modeling (D65)

Dataset: **1000 borrowers; 70% good, 30% bad credit**

Model Performance

- Logistic Regression: *AUC 0.8011*

- Random Forest: *AUC 0.7932*

Insights:

- Logistic Regression = best + most interpretable

- Key predictors: savings status, checking account, loan purpose, duration

XGBoost Benchmarking (D66)

XGBoost Results:

- Accuracy: 0.7233

- AUC: 0.7558

Comparison:
 LR > RF > XGBoost (for this dataset)

Takeaway:
 Simple interpretable models outperform complex ones on small structured data.

Unsupervised Segmentation (D67)

K-Means Clusters:

- **Cluster 0 – High Risk:** 41.67% default

- **Cluster 1 – Moderate Risk:** 29.86% default

Characteristics:

- High-risk group → long duration, high loan amount, unstable employment

- Validates supervised model findings

Anomaly Detection (D67)

DBSCAN:

- Labeled 1000 anomalies, 0 clusters

- Indicates high feature heterogeneity

- Requires parameter tuning & scaling refinements

Systemic Risk Propagation (D68)

Bayesian Network Nodes:
Equity → FX → Bond Yields → Credit Spreads

Equity Shock (~20% drop):

- FX depreciate ↑ +62%

- Credit spreads widen ↑ +36.6%

- Bond yields ↓ –9.53%

Implication:
Equity shocks rapidly propagate; FX & credit spreads are early stress indicators.

Key Insights & Next Steps

Key Insights:

- Interpretability matters more than complexity

- Risk clusters align with default patterns

- Systemic contagion can be modeled transparently

Next Steps:

- Use SMOTE / cost-sensitive learning

- Deeper tuning for RF & XGBoost

- Integrate SHAP explainability

- Expand systemic stress-testing