Probability of Default Analysis

Discussion of Results

1. Data Preparation and Sample Definition
The analysis uses Italian companies from AIDA. The final sample contains 48,243 uniq
Default (Value=1) is flagged when legal status contains distress terms (e.g., 'falli
'liquidazione coatta').
The observed class imbalance shows a default rate of approximately 2.9%.
Outliers in financial ratios were winsorized at the 1st and 99th percentiles to limi

2. Descriptive Statistics
Defaulted firms differ materially from healthy firms:
- Liquidity is lower for defaulted firms, pointing to tighter short-term cash buffer
- Solvency (equity over assets) is lower among defaulters, indicating higher leverag
- Profitability (ROE, ROI) is weaker or negative ahead of default.
These patterns support the predictive relevance of the selected ratios (see descript

3. Econometric Results (Logistic Regression)
Liquidity ratio: Negative coefficient – higher liquidity reduces PD.
Solvency ratio: Negative coefficient – higher capitalization reduces PD.
Profitability (ROE): Negative; (ROI): Negative – higher profitability reduces PD.
The strongest single predictor by magnitude is: Solvency ratio (%) % 2017.

4. Model Validation and Performance
On the hold-out test set (30%), the confusion matrix shows 163 true positives.
ROC-AUC on the test set is 0.730. Interpreting AUC: 0.5=random, 1.0=perfect; this is
Calibration diagnostics indicate probabilistic predictions are reasonable (see relia

5. Conclusion
Financial ratios from 2017—liquidity, solvency, and profitability—are statistically
default.
The balanced logistic regression achieves good predictive performance (AUC=0.730).
These results support its use for credit-risk screening, with scope to improve via m
alternative models (e.g., gradient boosting).

Logistic Regression Coefficients (page 1)

Variable	Coefficient
EBITDA/Vendite (%) % 2017	0.255
Liquidity ratio 2017	-0.012
Debt/Equity ratio % 2017	-0.036
Return on equity (ROE) (%) % 2017	-0.094
Return on investment (ROI) (%) % 2017	-0.511
Solvency ratio (%) % 2017	-0.978

Descriptive Statistics by Default (page 1)

Variable	Statistic	0	1
Liquidity ratio 2017	count	35718.0	769.0
Liquidity ratio 2017	mean	1.377	1.027
Liquidity ratio 2017	std	1.039	0.809
Liquidity ratio 2017	min	0.17	0.17
Liquidity ratio 2017	25%	0.75	0.57
Liquidity ratio 2017	50%	1.08	0.86
Liquidity ratio 2017	75%	1.63	1.2
Liquidity ratio 2017	max	6.133	6.133
Solvency ratio (%) % 2017	count	35718.0	769.0
Solvency ratio (%) % 2017	mean	31.297	18.34
Solvency ratio (%) % 2017	std	21.116	14.952
Solvency ratio (%) % 2017	min	0.96	0.96
Solvency ratio (%) % 2017	25%	13.9	7.04
Solvency ratio (%) % 2017	50%	27.3	14.88
Solvency ratio (%) % 2017	75%	45.69	25.71
Solvency ratio (%) % 2017	max	84.511	84.511
Return on equity (ROE) (%) % 2017	count	35718.0	769.0
Return on equity (ROE) (%) % 2017	mean	8.197	-0.149
Return on equity (ROE) (%) % 2017	std	16.37	24.063
Return on equity (ROE) (%) % 2017	min	-66.625	-66.625
Return on equity (ROE) (%) % 2017	25%	1.69	-4.9
Return on equity (ROE) (%) % 2017	50%	7.25	1.86
Return on equity (ROE) (%) % 2017	75%	15.5	10.27
Return on equity (ROE) (%) % 2017	max	58.613	58.613

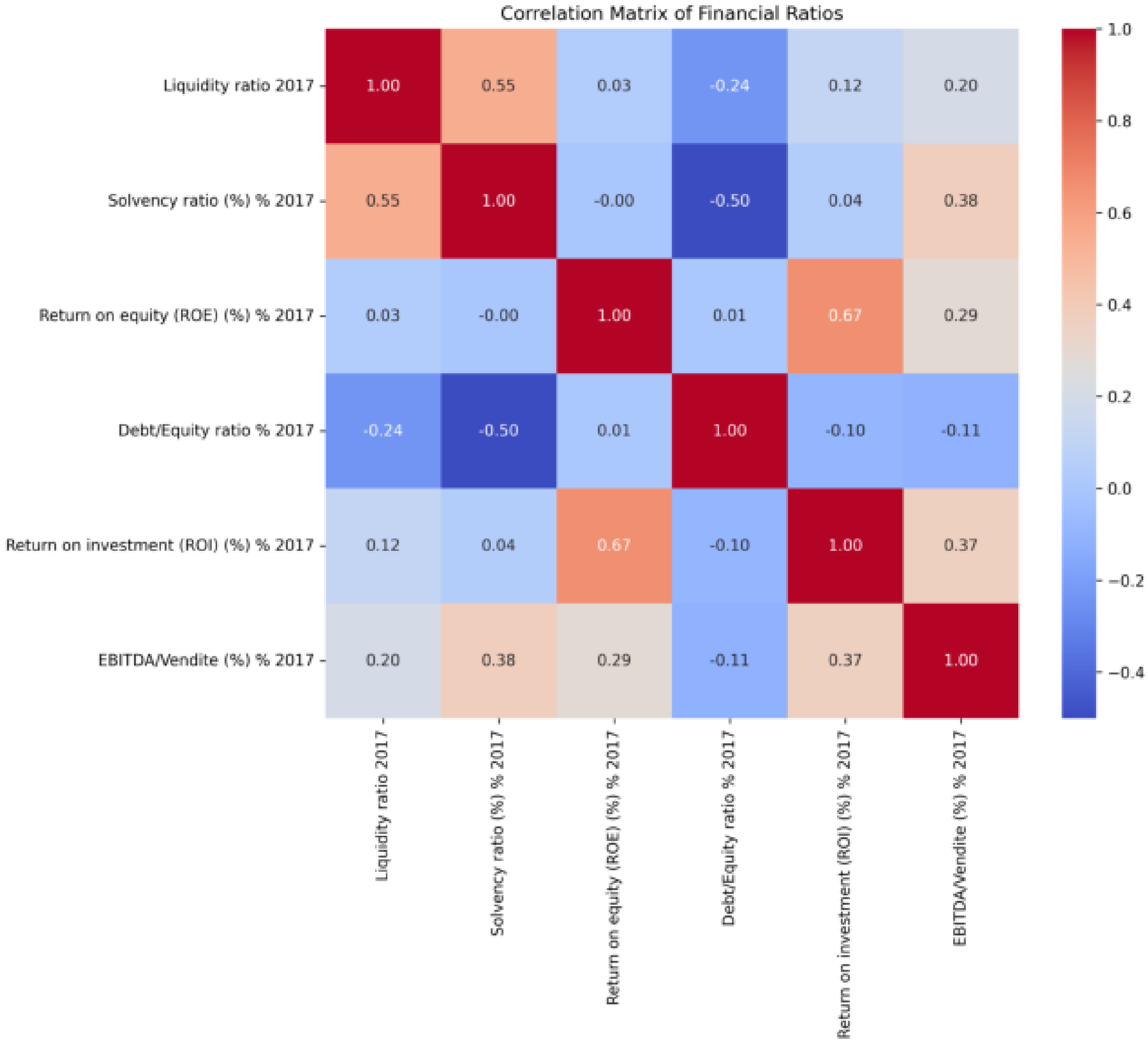
Descriptive Statistics by Default (page 2)

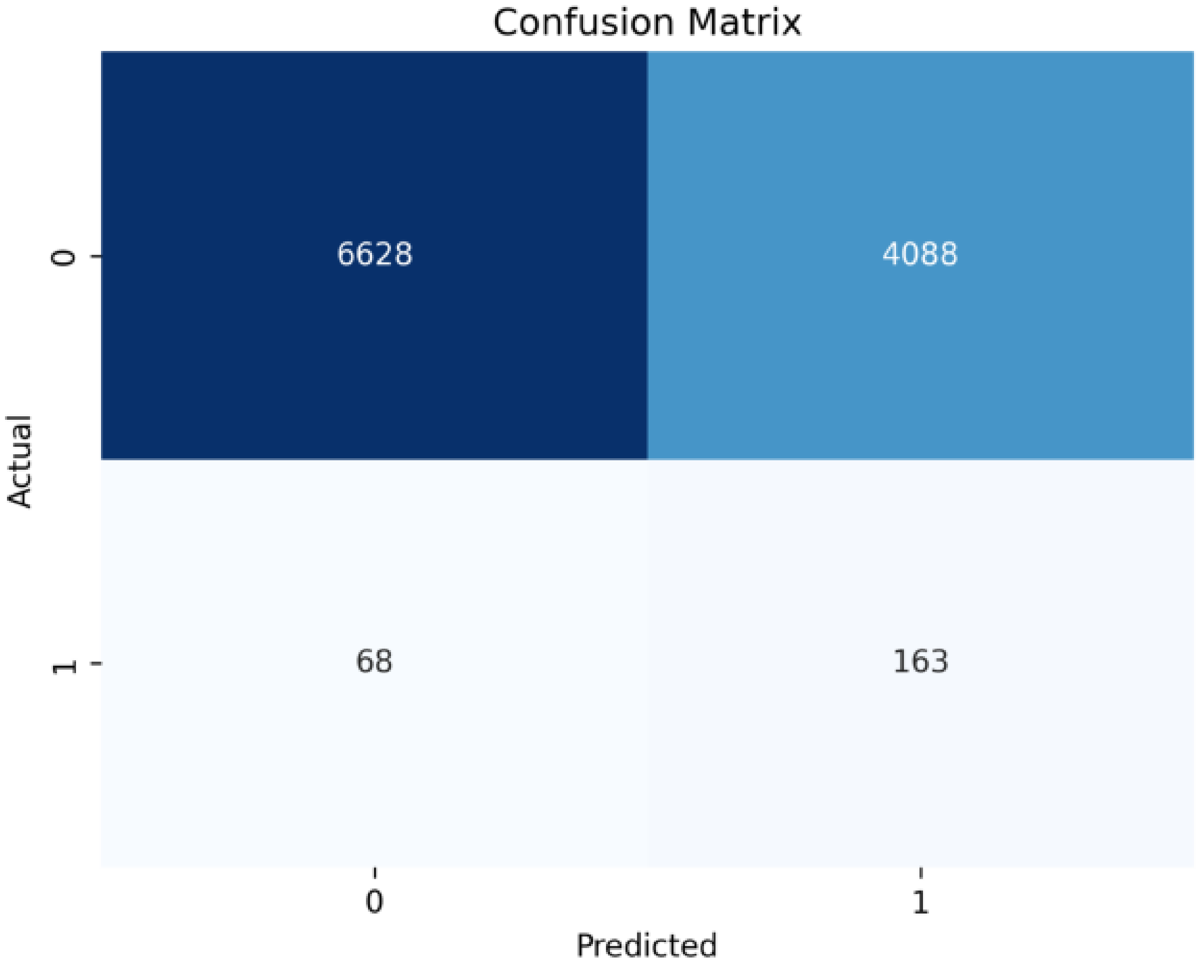
Variable	Statistic	0	1
Debt/Equity ratio % 2017	count	35718.0	769.0
Debt/Equity ratio % 2017	mean	1.599	3.036
Debt/Equity ratio % 2017	std	2.918	4.362
Debt/Equity ratio % 2017	min	0.0	0.0
Debt/Equity ratio % 2017	25%	0.09	0.51
Debt/Equity ratio % 2017	50%	0.63	1.49
Debt/Equity ratio % 2017	75%	1.78	3.28
Debt/Equity ratio % 2017	max	19.853	19.853
Return on investment (ROI) (%) % 2017	count	35718.0	769.0
Return on investment (ROI) (%) % 2017	mean	8.882	4.242
Return on investment (ROI) (%) % 2017	std	9.067	9.607
Return on investment (ROI) (%) % 2017	min	-19.496	-19.496
Return on investment (ROI) (%) % 2017	25%	3.28	0.06
Return on investment (ROI) (%) % 2017	50%	7.68	4.36
Return on investment (ROI) (%) % 2017	75%	14.59	9.32
Return on investment (ROI) (%) % 2017	max	28.9	28.9
EBITDA/Vendite (%) % 2017	count	35718.0	769.0
EBITDA/Vendite (%) % 2017	mean	8.091	6.032
EBITDA/Vendite (%) % 2017	std	7.502	7.986
EBITDA/Vendite (%) % 2017	min	-7.891	-7.891
EBITDA/Vendite (%) % 2017	25%	3.31	1.82
EBITDA/Vendite (%) % 2017	50%	6.29	4.66
EBITDA/Vendite (%) % 2017	75%	10.87	8.57
EBITDA/Vendite (%) % 2017	max	38.891	38.891

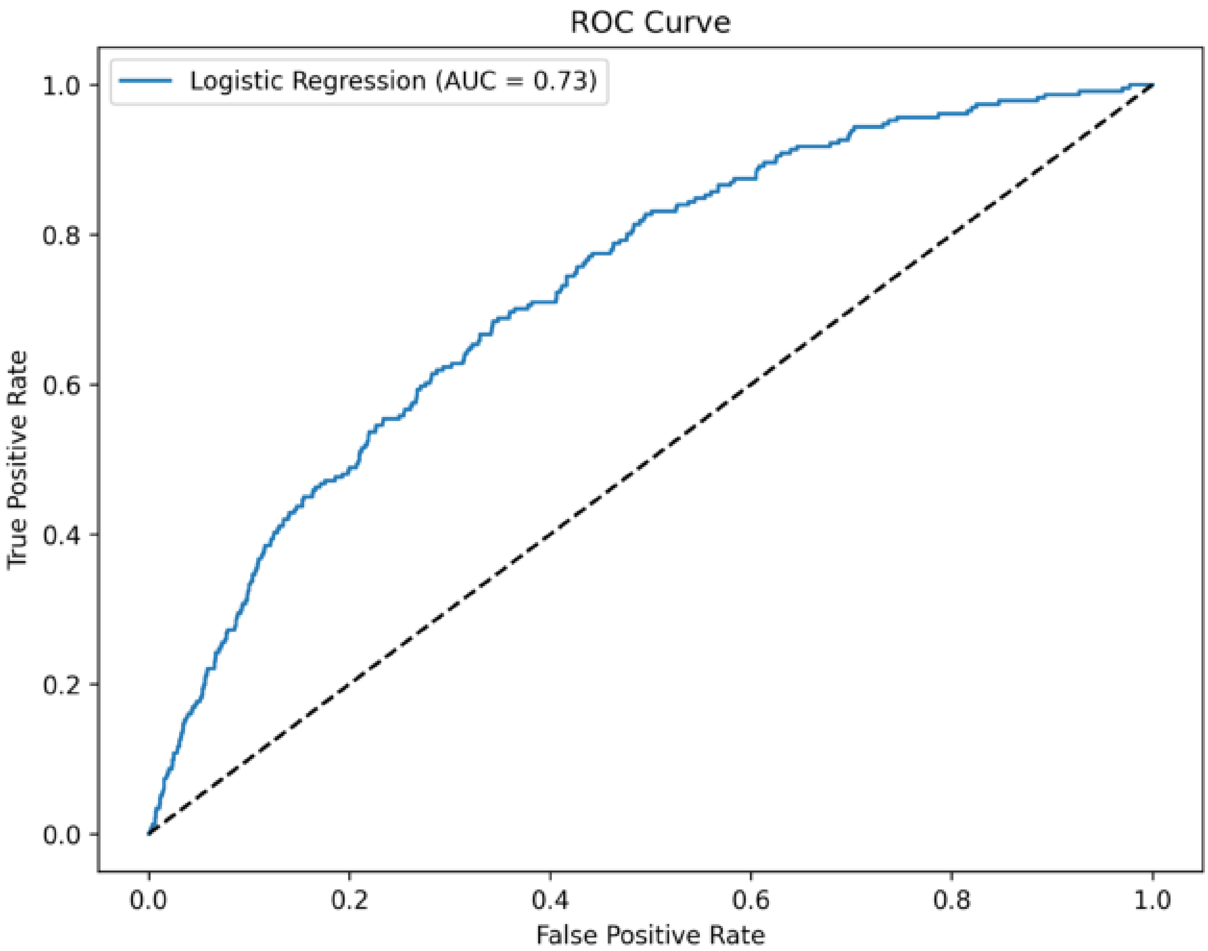
Classification Report

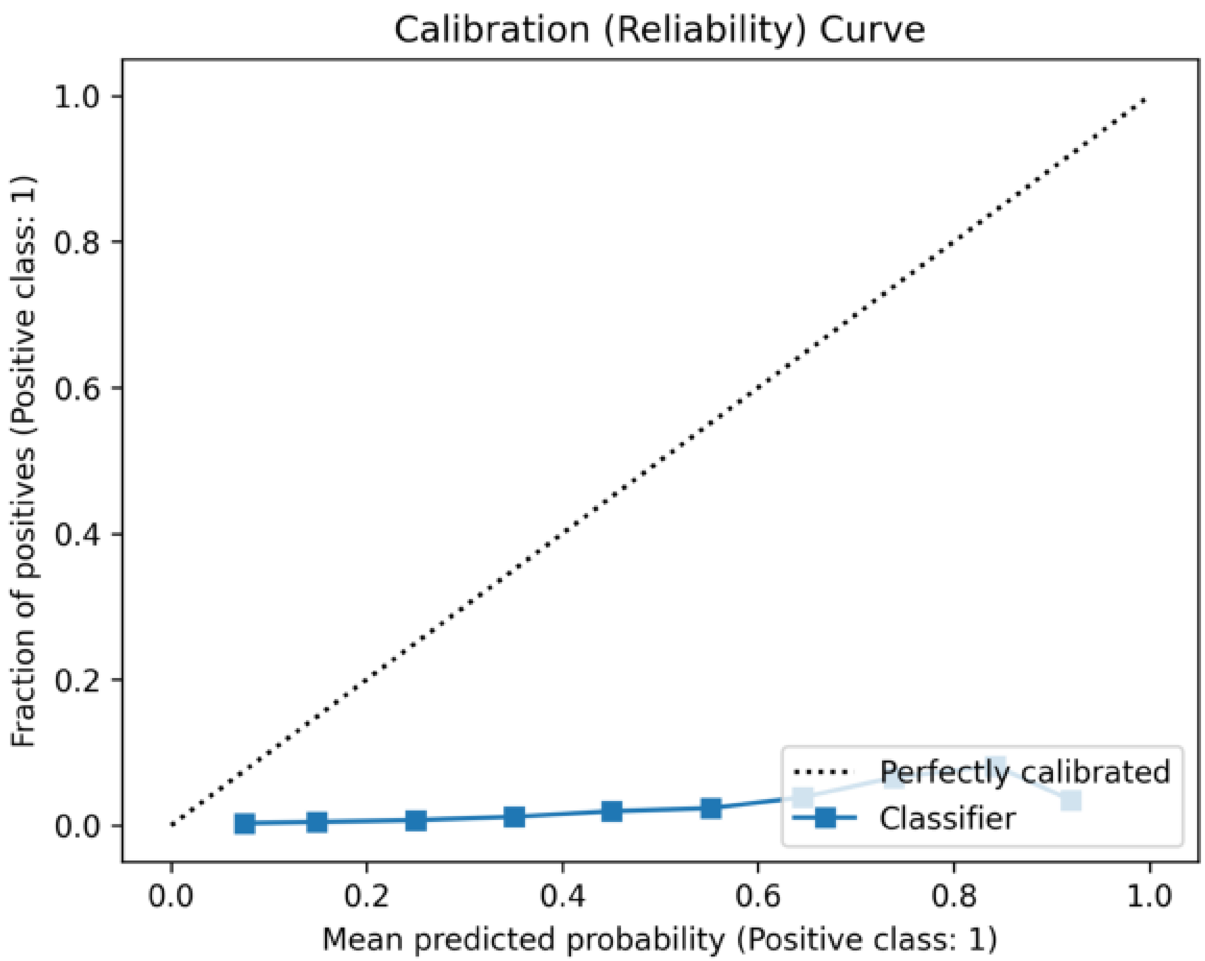
Classification Report

	precision	recall	f1-score	support
0	0.99	0.62	0.76	10716
1	0.04	0.71	0.07	231
accuracy			0.62	10947
macro avg	0.51	0.66	0.42	10947
weighted avg	0.97	0.62	0.75	10947


Correlation Matrix of Financial Ratios
Liquidity ratio 2017
Solvency ratio (%) % 2017
Return on equity (ROE) (%) % 2017
Debt/Equity ratio % 2017
Return on investment (ROI) (%) % 2017
EBITDA/Vendite (%) % 2017
1.00 0.55 0.03 -0.24 0.12 0.20
0.55 1.00 -0.00 -0.50 0.04 0.38
0.03 -0.00 1.00 0.01 0.67 0.29
-0.24 -0.50 0.01 1.00 -0.10 -0.11
0.12 0.04 0.67 -0.10 1.00 0.37
0.20 0.38 0.29 -0.11 0.37 1.00
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4


Confusion Matrix
6628
4088
68
163
Actual
Predicted
0
1
0
1


ROC Curve
Logistic Regression (AUC = 0.73)
1.0
0.8
0.6
0.4
0.2
0.0
True Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
False Positive Rate


Calibration (Reliability) Curve
1.0
0.8
0.6
0.4
0.2
0.0
Fraction of positives (Positive class: 1)
0.0
0.2
0.4
0.6
0.8
1.0
Mean predicted probability (Positive class: 1)
Perfectly calibrated
Classifier