Predicting Bankruptcy:

A Financial & Textual Approach

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McGill UNIVERSITY

Project Background & Goals

We set out to identify trends observed in companies leading up to their bankruptcy

/ GUIDING QUESTIONS

- Does the **Dupont Analysis** of a company leading up to bankruptcy differ from industry norms?
- Is there a relationship between **corporate filing sentiment and** bankruptcy?
- Can we **predict** when a company will go bankrupt?

Understanding Our Unique Dataset

We creatively merged three datasets to lay the groundwork for our analysis

1. **WRDS data from 2000-2023**
   - **Quarterly** fundamentals
   - Active & inactive companies

2. **Bankruptcy data**
   - Non-exhaustive list **(~2k firms**) from *Stock Analysis*

3. **Sentiment data**
   - Loughran-McDonald Master Dictionary. **1993 - 2023**

/ DATA PREVIEW

- Isolated companies that are **present in both WRDS & Sentiment** datasets
- Restricted to one industry, **SIC 28**
- Added lagged values preceding bankruptcy (or a random date observed for non-bankrupt firms)

tic	date_in_question	bankrupt	N_Positive_lag1	niq_lag1	mkvaltq_lag1	N_Positive_lag2	atq_lag2
FRTX	2023-12-18	1	201	2.104	5.7482	115	9.842
IMPLQ	2023-12-15	1	314	-13.814	10.2121	396	44.807
EVLO	2023-12-11	1	513	-12.364	73.9077	507	20.819
TMBRQ	2023-11-29	1	112	-4.064	7.4042	85	6.277
BXRXQ	2023-11-15	1	285	-1.934	4.5023	144	21.316
...	...	...	...	...	...	...	...
GDNSF	2021-12-31	0	207	-6.871	128.0096	58	112.675
IMUX	2023-09-30	0	61	-23.999	111.6649	68	108.872
ARMP	2022-12-31	0	214	-8.614	152.5319	207	100.984
IBRX	2023-09-30	0	743	-137.879	1225.0737	726	343.400
INDP	2022-12-31	0	31	-3.466	17.8394	25	34.059

A snapshot of only some features

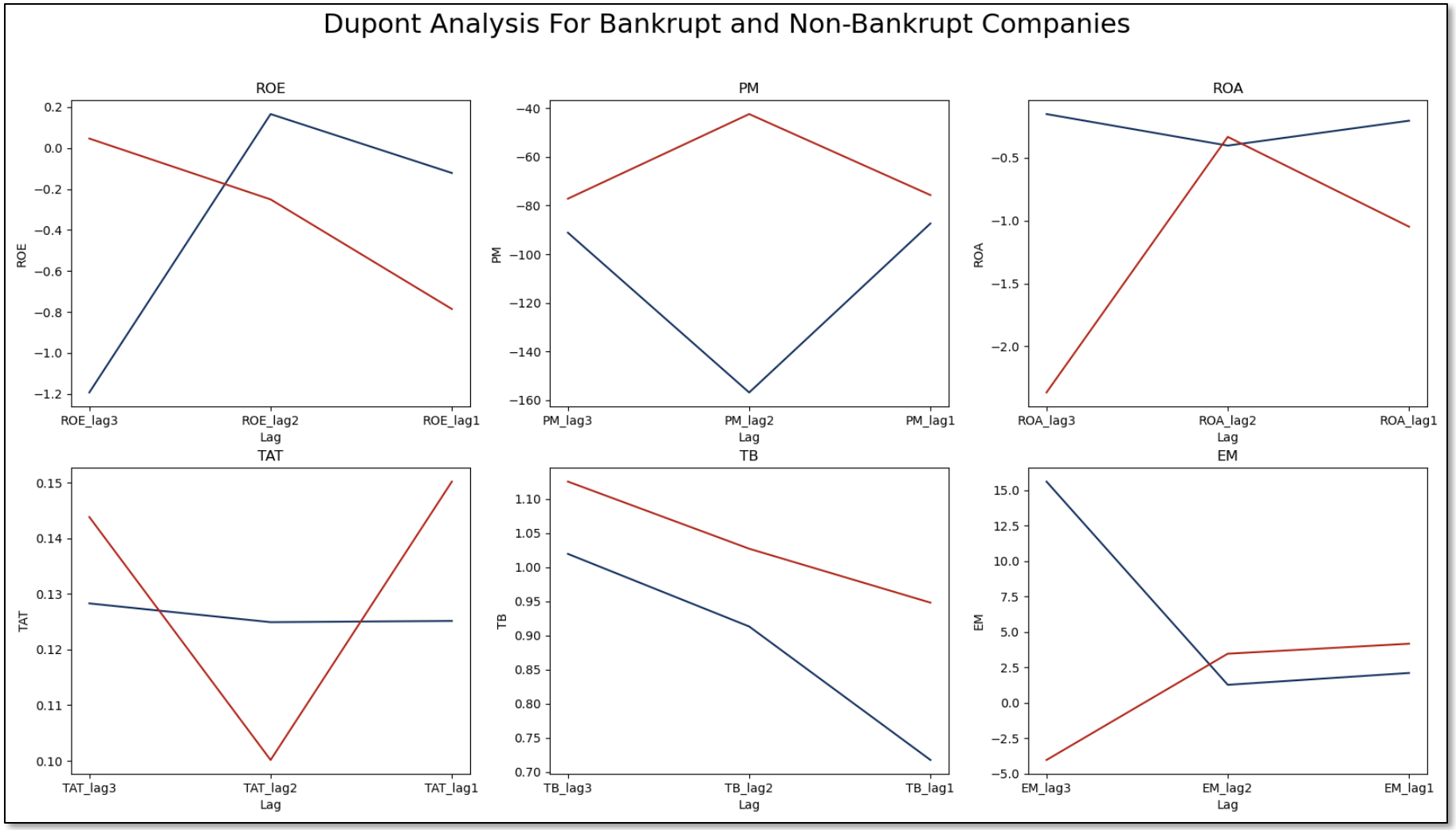
Dupont Analysis

Bankrupt **Not Bankrupt**

Key Takeaways

- **Increase in ROE** for bankrupt companies
- **PM decreases for bankrupt** companies
- **ROA decreases for bankrupt** companies
- **TAT increases for bankrupt** companies
- **TB on a steady decrease**
- **EM increases**

- A mix of expected and unexpected results



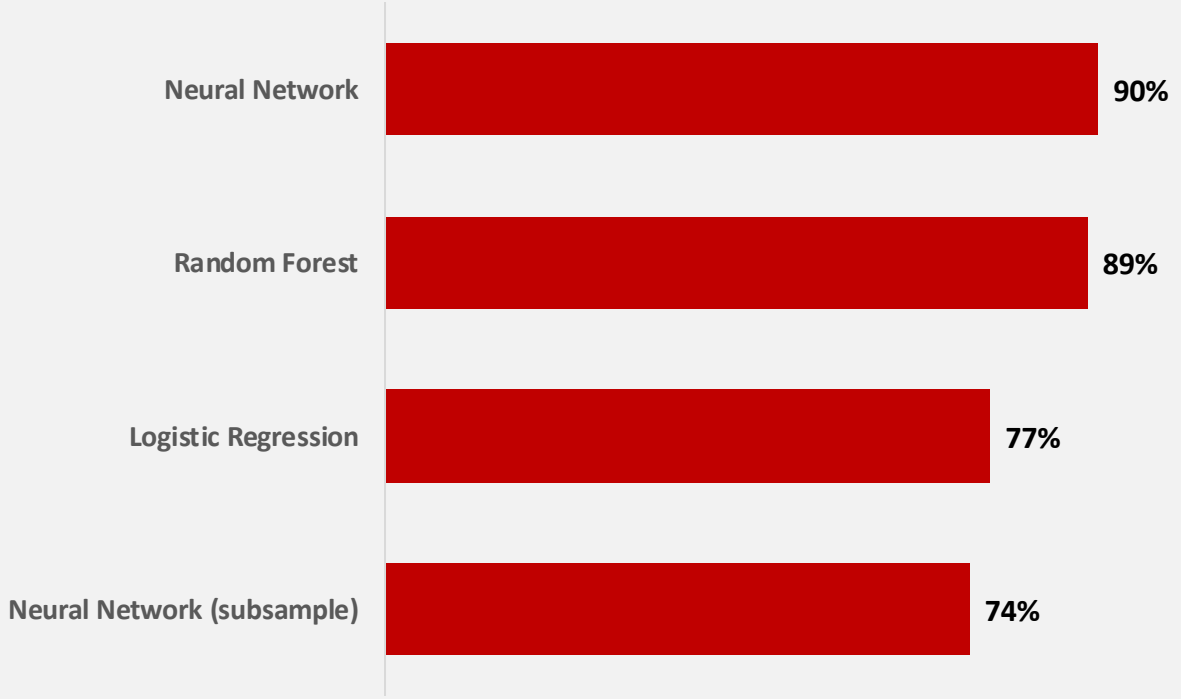
- ROE
  - **Debt Restructuring**: Reducing or restructuring debt can lower financial burdens, potentially improving net income relative to shareholders' equity.
  - **Asset Sales**: Selling off assets can lead to gains that affect equity and improve ROE.
- Profit Margin
  - **Loss of Revenue**: Bankruptcy can damage a company's reputation, leading to lost customers and decreased sales.
  - **Supply Chain Disruptions**: Companies in the Chemicals and Allied Products industry heavily rely on a stable supply chain for raw materials. Bankruptcy and the resulting operational shifts can disrupt these supply chains, leading to increased costs or delays that negatively affect profit margins.
- Return on Asset
  - **Costs Eating into Profits**: High costs for things like depreciation (the gradual charging off of the cost of an asset) can lower profits, which in turn reduces ROA.
  - **Debt Costs**: If the company has a lot of debt and the costs of that debt are high, it can reduce the profits made from the assets.
- Total Asset Turnover
  - **Strategic Asset Reduction**: If a company has sold off non-essential or underperforming assets and is still able to maintain or increase sales, TAT would increase. This is because it's generating the same amount or more revenue with fewer assets.
  - **Market Conditions**: Favorable market conditions, such as increased demand for chemical products, can lead to higher sales. When the market demand is high, companies can often sell more without necessarily increasing their asset base

Predictive Model

We tried to predict bankruptcy from previous (lagged) financial and textual features

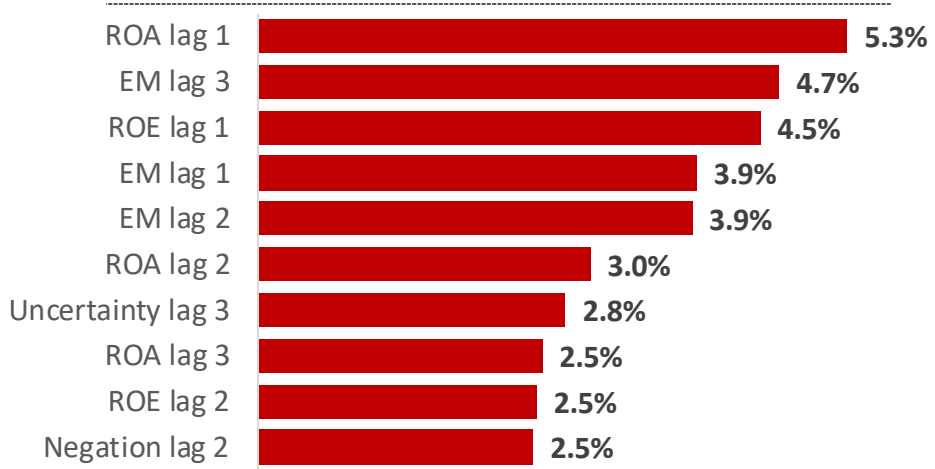
/ MODEL ACCURACY

We compared multiple models



N=484

Feature Importance



- **Logistic Regression performs best** as it handles class imbalance and small datasets
- Neural Network and Random Forest yield poor recall score

Conclusion and Limitations

Conclusions

- Clear relationship between weak ratios and bankrupt companies
- There is a **relationship between sentiment and bankruptcy**, seeing a better-than-chance (**AUC 0.68**) model
- **Logistic regression is a robust model** given sample size, yielding an accuracy of **77%**

Limitations

- These findings only apply to companies within the **Chemicals and Allied Products** industry
- We still **lack data** (WRDS or sentiment) on many companies that went bankrupt within this industry, causing our **small sample sizes**
- The **time periods** in our lagged values can **differ**

- **Bootstrapping** the non-bankrupt companies for DuPont can improve the quality of the analysis
- Dealing with **class imbalance** using Synthetic Minority Over-sampling Technique can improve ANN accuracy
- We would like to continue this research but working with **another industry**, namely **Business Services** (SIC 73)

Thank You

Appendix: Created Dataset Example View

	tic	date_in_question	bankrupt	N_Words_lag1	N_Unique_Words_lag1	N_Negative_lag1	N_Positive_lag1	N_Uncertainty_lag1	N_Litigious_lag1	N_StrongModal_lag1	...	cheq_lag3	cshfdq_lag3
0	FRTX	2023-12-18	1	49689	3233	1337	201	664	1451	228	...	10.764	3.757
1	IMPLQ	2023-12-15	1	41549	3033	1368	314	869	807	152	...	35.465	23.746
2	EVLO	2023-12-11	1	55666	3510	1770	513	1403	948	244	...	27.472	110.906
3	TMBRQ	2023-11-29	1	24142	1856	289	112	216	200	78	...	9.080	3.790
4	BXRXQ	2023-11-15	1	52914	2934	1002	285	392	1650	155	...	3.803	2.319
...	...	...	...	...	...	...	...	...	...	...	...	...	...
1030	GDNSF	2021-12-31	0	45286	2816	958	207	315	1811	90	...	40.562	116.104
1031	IMUX	2023-09-30	0	12731	1640	191	61	162	74	32	...	116.374	38.335
1032	ARMP	2022-12-31	0	26528	2540	838	214	688	345	142	...	46.408	28.996
1033	IBRX	2023-09-30	0	74333	3801	2198	743	1857	1336	323	...	107.184	403.666
1034	INDP	2022-12-31	0	8570	1267	124	31	146	71	19	...	36.178	8.259

Appendix: Classification reports

ANN

	precision	recall	f1-score	support
0	0.90	1.00	0.95	132
1	0.00	0.00	0.00	14
accuracy			0.90	146
macro avg	0.45	0.50	0.47	146
weighted avg	0.82	0.90	0.86	146

Logistic

	precision	recall	f1-score	support
0	0.91	0.83	0.87	132
1	0.12	0.21	0.15	14
accuracy			0.77	146
macro avg	0.51	0.52	0.51	146
weighted avg	0.83	0.77	0.80	146

Random Forest

	precision	recall	f1-score	support
0	0.91	0.98	0.94	132
1	0.25	0.07	0.11	14
accuracy			0.89	146
macro avg	0.58	0.52	0.53	146
weighted avg	0.85	0.89	0.86	146

ANN subsample (N=90)

	precision	recall	f1-score	support
0	0.79	0.83	0.81	18
1	0.62	0.56	0.59	9
accuracy			0.74	27
macro avg	0.71	0.69	0.70	27
weighted avg	0.73	0.74	0.74	27

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Research Report

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