Analyzing Merger Activity

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- How can text analysis supplement traditional economic understanding ?
- Can statistical learning add to economics empirical methods ?

- **Merger activity** definition.
- Coase (1937), Gort (1969), Jovanovic and Rousseau (2001, 2002)
- But what about situations that do not fall in any of these categories?
- Machine learning and big data offers advantages in empirical studies

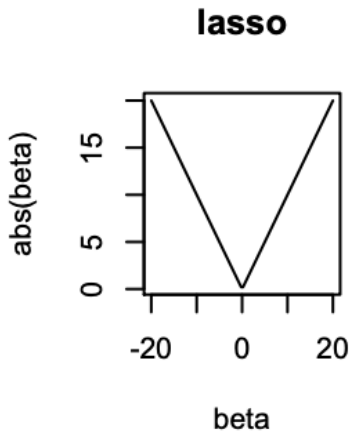
The Significance of Annual 10-K SEC Filings

- Used by bankers in the past
- Lengthy !

Section	Description
Item 1 — Business	Recent events, competition, regulations, special operating costs, seasonal factors, labor issues, insurance matters
Item 1A — Risk Factors	Anything that the company thinks could go wrong
Item 2 — Properties	Significant properties, physical assets, of the company
Item 7 – MDA	Management discusses the company in detail
Item 12	Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters

TABLE – Example of 10-K document sections

The Lasso



(Gentzkow, Shapiro, Taddy via Tibshirani)

Note that this is different from unsupervised learning.

- Gentzkow and Shapiro (2010)
- Hoberg and Phillips (2010)
- Routledge, Sacchetto, and Smith (2017)

Methods

- Bag-of-Words
- tf-idf
- Ridge
- Elastic Net

My final equation looks like this :

$$\hat{\beta} = \arg\max_{\beta} \sum_{n=1}^{N} \log p(y_n|x_n) + \lambda_1 ||\beta||_1 \tag{1}$$

This is a regression problem like any other, except that the high-dimensionality of c_*i* makes OLS and other standard techniques infeasible. I used the "glm-net" package in R.

Logistic Regression

To model the relationship between $p(X) = Pr(Y=1|X)$ and X, we use the logistic regression :

$$p(y = 1|\mathbf{x}) = \frac{\exp(\beta_0 + \beta^\tau x)}{1 + \exp(\beta_0 + \beta^\tau x)} = \frac{1}{\exp(-\beta_0 - \beta^\tau x)} \tag{2}$$

Y is the probability that a firm will merge in the subsequent time period between 2014-2017, or the next three years.

Observation Count	
Involved in a Merger (Total)	Not Involved (Total)
5,379	17,073
Training Observations	Test Observations
70 percent	30 percent

I use the entire document in my findings.
Total observations are 22,418 from years 2013-2017.
Merger events are drawn through Thomson Reuters' SDC Platinum Database

Test Data Results

Table 11:

	Dependent variable:
	lasso.predict.four
fourteen_y[test]	0.126***
	(0.009)
Constant	0.665***
	(0.008)
Observations	1,177
R^2	0.131
Adjusted R^2	0.130
Residual Std. Error	0.136 (df = 1175)
F Statistic	177.062*** (df = 1; 1175)
Note:	*p<0.1; **p<0.05; ***p<0.01

Although hypothesis testing breaks down, the accuracy rate is roughly 85 percent !

What did the words tell us ?

TABLE – Words Picked by the Lasso

iii	reasonable	director	security	but	chief
-263.634	-21.447	-9.736	-7.983	-4.556	1.599
indicate	controls	disclosures	procedures	registered	disclosure
39.172	44.864	146.363	192.412	390.211	1,648.075

Next Steps

- Finding a firm's uniqueness (or perhaps culture)
- Horizontal and vertical mergers are well defined. What about a situations where it is more "unique", or more unclear of a motive ?
- Ex. Amazon and Whole Foods, Intel and Caring.com, Delta Airlines and Refinery Phillips 66

Thanks

Thank you !