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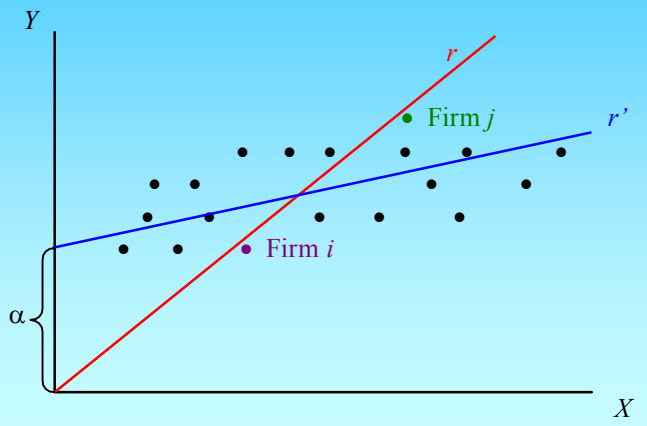
Assessing the liquidity of a firm: artificial neural networks as an alternative to the current ratio

Javier De Andrés
Pedro Lorca
Manuel Landajo
Universidad de Oviedo

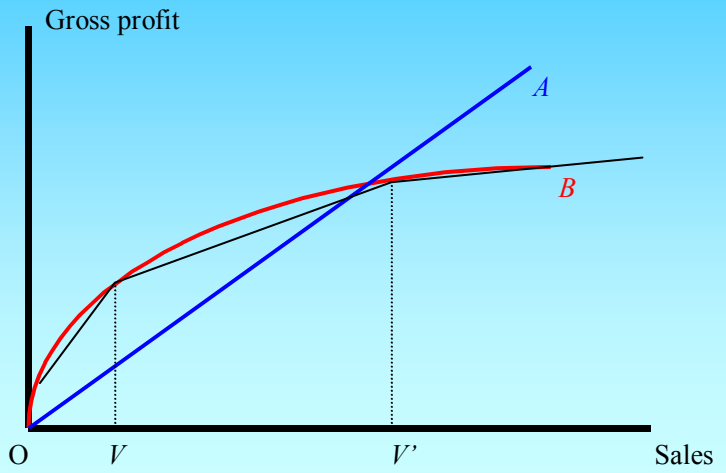
The measure of a firm's liquidity

- The relation between Current Assets (CA) and Current Liabilities (CL)
- The ratio form CA/CL is very popular
- Assumptions: the relation must be both:
  - Linear and,
  - Strictly proportional
- The ratio form is equivalent to a regression model with a null intercept

Disproportional relationship



Nonlinear relationship



Alternatives to the ratio form

- Linear regression:

$$Y = \alpha + \beta X + \varepsilon$$

- Weighted Least Squares regression:

$$\frac{Y}{X} = \frac{\alpha}{X} + \beta + \varepsilon'$$

- Loglinear regression:

$$Ln(Y) = \alpha + \beta Ln(X) + \varepsilon$$

- In the present research we test the suitability of Artificial Neural Networks (ANN)

The neural networks used

- Linear model augmented with a perceptron structure:

$$N_m(x) = \alpha_0 + \alpha x + \sum_{j=1}^{m} \beta_j F(\gamma_{0j} + \gamma_j x); \quad m = 0,1,...; \quad x \in IR$$

- Logistic sigmoids are taken as 'hidden units':

$$F(z) = 1/(1 + \exp(-z))$$

- *m* is the number of nonlinearities, ranges between 0 and 2 (small sample sizes)
- α, γ_j, α_0 and γ_{0j} are scalars

Two alternative learning situations

- Least Squares (LS) regression: we wish to learn the regression line which passes through conditional expectation of Y (CA) given X (CL)
- Least Absolute Deviation (LAD) regression: We want to estimate the regression line which passes through conditional medians of Y (CA)

The regression models

- Ratio form (linear regression without intercept term):
  - OLS
  - WLS
  - LAD
- Linear regressions
  - OLS
  - LAD
- Log-linear regression (OLS)

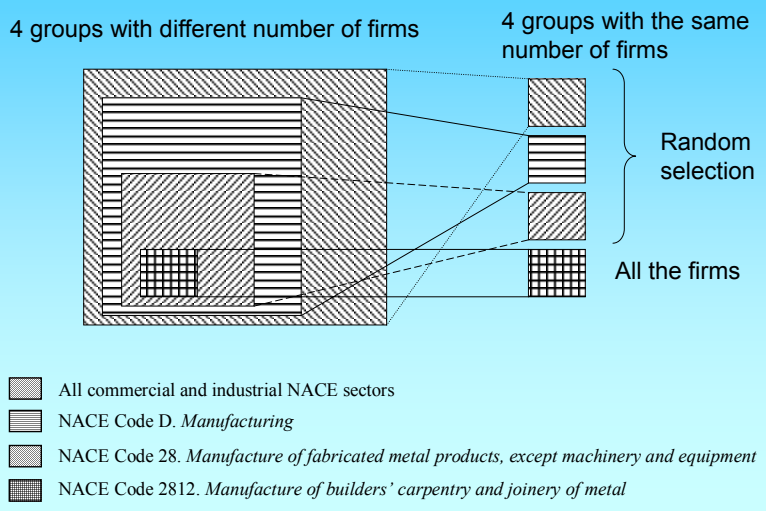
The neural models

- ANN models fitted by OLS
- ANN for logs (replaces CA and CL by their natural logs)
- ANN models fitted by WLS (the same weight as in the case that the ratio model is correct)
- LAD ANN
- Weighted LAD ANN

The database

- Bureau Van Dijk -Informa (SABI) database
- Small and medium enterprises
- Years 1998 through 2002
- Four-digit sector: *Manufacture of builders' carpentry and joinery of metal*
- Subsamples: Microenterprises, Small enterprises, Medium enterprises
- Heterogeneous sectors

Heterogeneous sectors



The design of the analysis

- Test set = [n/4], estimation set = [3n/4], both randomly selected
- The model is fitted using the estimation set
- Evaluation of the model's predictive performance: mean absolute error (MAE):

$$MAE = \frac{1}{ntest} \sum_{i=1}^{ntest} \left| y_i - f(x_i, \hat{\theta}) \right|$$

- f = model class, θ = parameters
- For each sector, size subsample and model, the scheme is repeated 100 times

Results (ANN vs. regressions)

SECTORS

Sector	% of the best models that are neural-based	% of the best models that are regression-based	*p*-value of a binomial test[a]
2812	50%	50%	1,000
28	65%	35%	0,263
D	60 %	40%	0,503
Firms from all sectors	45%	55%	0,824

SIZES

Size	% of the best models that are neural-based	% of the best models that are regression-based	*p*-value of a binomial test[a]
Micro-enterprises	80%	20%	0,012
Small enterprises	70%	30%	0,115
Medium-size enterprises	45%	55%	0,824
Firms of all sizes	25%	75%	0,041

ALL THE TESTS

	% of the best models that are neural-based	% of the best models that are regression-based	*p*-value of a binomial test[a]
	55%	45%	0,434

Results (AMAE of the best models)

Average error rates for each level of sectoral heterogeneity and each size sub-sample

	2812 NACE	28 NACE	D NACE	ALL SECTORS
1	0,003113782	0,004970466	0,002773776	0,001550522
2	0,014970824	0,022638738	0,013587406	0,006329424
3	0,111504862	0,160341132	0,080191232	0,056774652
A	0,012406176	0,019389416	0,011237648	0,006454936

1. Micro-enterprises **2**. Small enterprises **3**. Medium-size enterprises **A**. Firms of all sizes

Average error rates for each size sub-sample

1	2	3	A
0,003102137	0,014381598	0,10220297	0,012372044

1. Micro-enterprises **2**. Small enterprises **3**. Medium-size enterprises **A**. Firms of all sizes

Future research lines

- The study of other indicators (profitability ratios, etc.)
- The use of more general quantile model-free regressions
- The adoption of a dynamic perspective, including time evolution of CA and CL as relevant inputs