

Universidade do Minho

Predicting takeover targets in Europe:  
Assessment of the main determinants and predicting quality

DISSERTATION – MASTER IN FINANCE

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## Objectives

1. Examine the main determinants of firm targeting behavior
2. Accurately classify and predict targets of acquisitions
3. Test if abnormal returns can be earned using this strategy

# Overview

1. Literature Review
2. Methodology
3. Data
  - 3.1. Sample
  - 3.2. Variable List
4. Results
  - 4.1. Sample statistics
  - 4.2. Probit
  - 4.3. Cutoffs calculation and selection
  - 4.4. Classification accuracy
  - 4.5. Predictive accuracy
  - 4.6. Average Cumulative Abnormal Returns (ACAR)
5. Conclusions

## Literature Review

A broad dispersion of studies has shown that target firm shareholders earn sizable abnormal returns from an acquisition – ranging from 8 to 47.5% (Bruner, 2002)



Desire to have a **long** position in the stocks of those firms (Powell, 2001)

# Literature Review

How can we find those firms in advance to the market?



Scholars have developed probabilistic models (e.g. Probit) with explanatory variables related to takeover motivations, such as:

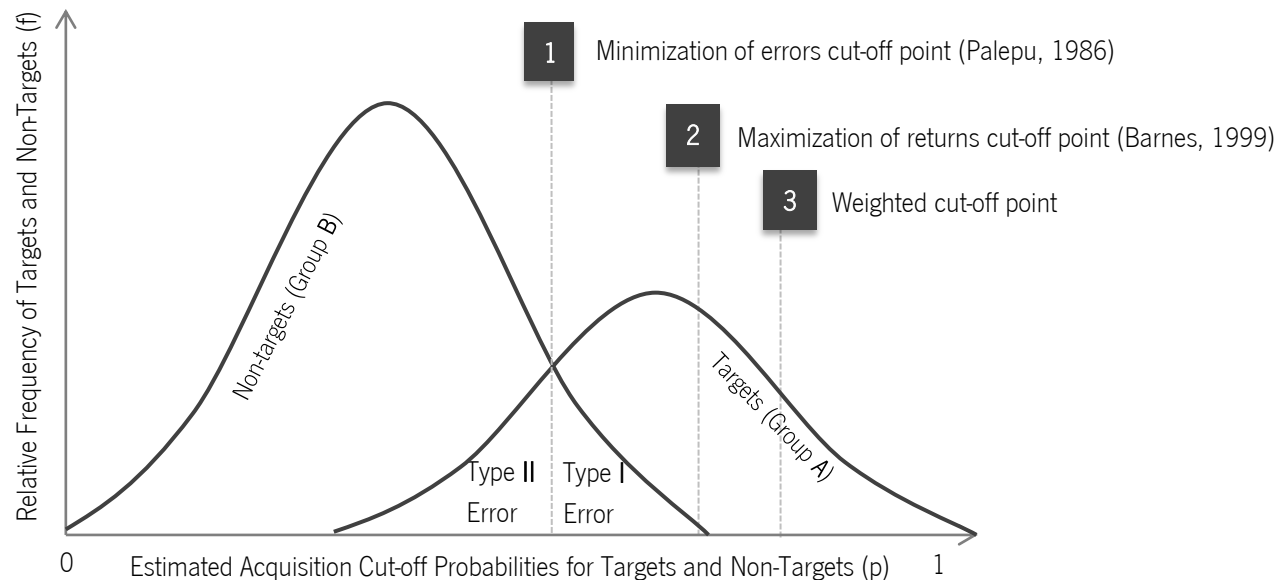
**H<sub>1</sub>**: Inefficient management

States that if a firm is managed in an inefficient way others will try to take control of that firm to make better use of the resources and improve its post-merger performance. (Scharfstein, 1998)

→ Firms with less than average profits (*ceteris paribus*) are more likely to become acquisition targets.

# Literature Review

The estimated parameters of the models are then used to compute the probability [0-1] that a firm will become a takeover target. After achieving these results, they defined a condition to classify a firm as target and non-target.



# Literature Review

The results about predictive accuracy are mixed in the literature. The early evidence shows **impressive rates ranging from 60% to 90%**, which contributed for the enthusiasm of both investors and academics.

e.g. Simkowitz and Monroe (1971) model was able to correctly classify **83%** of the cases drawn from the estimation sample and predict **64%** of the cases drawn from a holdout sample; Dietrich and Sorensen (1984) found a predictive accuracy of over **90%**.

However, Palepu (1986) pointed out that these results were overstated due to methodological flaws.

In the last 5 years, after correcting for these issues, some authors were able to predict accurately target firms and earn abnormal returns. (e.g. Brar, Giamouridis and Liodakis, 2009)

Increasing interest on the subject again.

# Methodology

- Univariate Analysis
- Probit
- Calculation of cutoffs:
  - Weighted
  - Palepu (1986)
  - Barnes (1999)
- Test of classification and prediction accuracy using:
  - Proportional Chance Criterion (Barnes, 1999)
  - Maximum Chance Criterion (Blake, 2004)
  - McNemar's chi-square test (Tsagkanos, Georgopoulos and Siriopoulos, 2006)
  - ROC curves (Pasiouras and Tanna, 2010)
- Average Cumulative Abnormal Returns (CAAR) using the MacKinlay (1997) market model



# Sample

## SDC

### Targets

- EU-27 publicly listed companies
- Focus on attempts and not just completed deals → avoid ex post selection bias (Song and Walkling, 1993)

### Acquirers

- Publicly listed companies worldwide
- Attempts to accumulate or acquire majority voting power ( $\geq 50,1\%$  of the voting shares)

## WORLDSCOPE

### Non-Targets

- Gathered a list of all companies with major security and primary quote constituent of the stock market indices of the 27 countries.
- Included delisted and inactive companies → avoid survivorship bias (Powell, 2001)
- Matched this data with target list of the period 1999-2012 in order to achieve a list of non-target companies.

# Sample

## WORLDSCOPE

- Finally, it is assigned a random sample of firms from the non-target population for every year of the period using the proportion of targets/total targets.

**For example:** if 7.5% of the acquisition attempts relative to the entire period took place in 2001, we randomly allocate 7.5% from the pool of non-targets to 2001.

### Instead of

- State-based sampling: equal number of targets and non-targets for each year

This way, **we avoid estimation problems**, as noticed by Powell (2001), Alcalde and Espitia (2003), Palepu (1986), and others.

From Worldscope, it is also gathered financial data relative to both target and non-target firms.

Found **+100** variables used to proxy frequently discussed hypotheses of determinants;

In order to avoid the selection bias discussed in Palepu (1986), we only maintain the variables:

- That appear to fully represent the hypotheses;
- Previously found to be statistical significant;
- Key items of Worldscope Database;
- With different denominators/numerators;

**That resulted in a final list of 22 variables**

# Variable List

Hypothesis and Variable(s)	Empirical Support <sup>a</sup>	Mnemonic
<b>H1: Inefficient Management</b>		
1. Return on Assets	Alzueta and Lucey (2001)	H1 - ROA
2. Return on Equity	Misra (2009), Alcalde and Espitia (2003), Song and Walkling (1993)	H1 - ROE
3. Operating Margin = Operating Profit/Net Sales	Powell (1997), Brar et al. (2009), Barnes (1999)	H1 - Op. Margin
4. Operating Profit/Capital Employed	Powell (2001); Asquith (1983); Kennedy and Limmack (1996); Hasbrouck (1985)	H1 - Op. Profit to Cap. Employed
<b>H2: Firm Undervaluation</b>		
5. Market-to-book Ratio	Powell (2001); Hasbrouck (1985); Alzueta and Lucey (2001); Song and Walkling (1993)	H2 - MB
6. Dividend Yield	Brar et al. (2009)	H2 - Div. Yield
7. Market Capitalization/Shareholders' Equity <sup>a</sup>	Barnes (1999)	H2 - Market Cap. to Sh. Equity
<b>H3: Free Cash Flow (FCF)</b>		
8. Operating Cash Flow/Total Assets	Jensen (1986); Palepu (1986); Lehn and Poulsen (1989); Powell (2001)	H3 - OCF to Total Assets
9. Free Cash Flow Per Share	Powell (1997); Blake (2007)	H3 - FCF per Share
<b>H4: Firm Size</b>		
10. Log of Total Assets	Palepu (1986); Powell (1997); Powell (2001); Alcade and Espitia (2003);	H4 - Log Total Assets
11. Market Capitalization	Barnes (1999); Brar et al. (2009)	H4 - Market Cap.
<b>H5: Industry disturbance hypothesis</b>		
12. Industry dummy	Palepu (1986)	H5 - Industry Dummy
<b>H6: Growth-Resource-Imbalance</b>		
13. Growth-resources dummy	Palepu (1986)	H6 - Growth-Resource Dummy
<b>Growth</b>		
14. Change in Total Sales	Palepu (1986); Powell (2001); Barnes (1999); Bartley and Boardman (1990)	H6 - Total Sales
15. CAPEX (Capital Expenditures) % Total Assets	Levine, Aaronovitch (1981); Blake (2007)	H6 - CAPEX to Total Assets
<b>Liquidity</b>		
16. Current Assets less Current Liabilities/Total Assets	Barnes (1999); Blake (2007)	H6 - CACL to Total Assets
<b>Leverage</b>		
17. Total Debt % Common Equity	Palepu (1986); Powell (2001); Brar et al. (2009), Misra (2009)	H6 - Total Debt to Common Eq.
<b>H7: Inefficient Financial Structure</b>		
18. Long Term Debt/Total assets	Barnes (1999)	H7 - LT Debt to Total Assets
19. Inventory Turnover	Bartley and Boardman (1990)	H7 - Inv. Turnover
<b>H8: Activity Ratio</b>		
20. Asset Turnover=Net Sales/Total Assets	Harris (1982), Blake (2007)	H8 - Asset Turnover
<b>H9: P/E</b>		
21. Price/Earnings Ratio	Song and Walkling (1993); Palepu (1986); Barnes (1999)	H9 - PE Ratio
<b>H10: Dividend Payout</b>		
22. Dividends Payout Ratio (Dividend/Net Profit)	Misra (2009), Rege (1984), Blake (2007)	H10 - Div. Payout

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# Sample description

Table 1 - Temporal distribution of the sample spanning from 2000 to 2011

Year	Total	Targets		Non-Targets		
		Number	Percent	Number	Percent	
2000	586	132	14,2%	454	14,2%	
2001	311	70	7,5%	241	7,5%	
2002	253	57	6,1%	196	6,1%	
2003	346	78	8,4%	268	8,4%	
2004	324	73	7,8%	251	7,8%	
2005	413	93	10,0%	320	10,0%	
2006	351	79	8,5%	272	8,5%	
2007	515	116	12,5%	399	12,5%	
2008	386	87	9,4%	299	9,4%	
2009	293	66	7,1%	227	7,1%	
<b>Estimation Sample<sup>1</sup></b>	2010	351	79	8,5%	272	8,5%
	<b>Subtotal</b>	4129	930	100%	3199	100%
<b>Prediction Sample</b>	2011	302	68	100%	234	100%
	<b>Total</b>	4431	998	100%	3433	100%

# Sample description

- Considerable number of companies from:
  - Materials (8,7%)
  - Computer Programming and Data Processing Services (8,02%)
  - Transportation (7,5%)
- Decreasing rate of deal success over the years (minimum of 35,9% in 2009)
- Friendly attempts around 70%
- Preference to pay with cash
- Firms involved are usually from the UK, both from the target (34.03%) and acquiror side (23.41%)
- United States are the only country extra-EU to appear in the top ten acquirors (11.33%)

# Probit results

	Expected Sign	(1)	(2)	(3)	(4)
<i>Variables</i>					
H1 - ROA	+/-	-0.0006 (0.0005)	-0.0011 (0.0008)	-0.0006 (0.0012)	<b>-0.0053*</b> (0.0029)
H1 - Op. Margin	+/-	<b>0.0001*</b> (0.0001)	0.0001 (0.0001)	0.0023 <sup>b</sup> (0.0001)	0.0001 (0.0002)
H1 - Op. Profit to Cap. Employed	+/-	0.0003 (0.0098)	-0.0003 (0.0120)	0.0014 (0.0207)	<b>0.1193**</b> (0.0589)
H2 - MB	+/-	0.9179 (0.8451)	1.2787 (1.0073)	-2.6875 (1.6457)	-1.7712 (2.6128)
H2 - Div. Yield	+/-	<b>0.0055*</b> (0.0032)	0.0014 (0.0043)	<b>0.0239**</b> (0.0103)	-0.0015 (0.0163)
H2 - Market Cap. to Sh. Equity	+/-	-0.0018 (0.0020)	-0.0025 (0.0026)	<b>0.0123**</b> (0.0060)	0.0152 (0.0100)
H3 - OCF to Total Assets	+	0.0217 (0.0156)	0.0281 (0.0193)	0.0292 (0.0393)	<b>0.1509*</b> (0.0784)
H3 - FCF per Share	+	0.0002 (0.0015)	-0.0008 <sup>a</sup> (0.0019)	0.0013 (0.0041)	-0.0027 (0.0073)
H4 - Log Total Assets	+/-	<b>0.0482***</b> (0.0051)	<b>0.0466***</b> (0.0062)	<b>0.0697***</b> (0.0134)	<b>0.1053***</b> (0.0224)
H4 - Market Cap.	+/-	0.0011 <sup>a</sup> (0.0022) <sup>a</sup>	0.0017 <sup>a</sup> (0.0025) <sup>a</sup>	<b>0.0257<sup>a***</sup></b> (0.0092) <sup>a</sup>	<b>0.0323<sup>a***</sup></b> (0.0122) <sup>a</sup>
H5 - Industry Dummy	+	<b>0.0880***</b> (0.0180)	<b>0.1270***</b> (0.0210)	<b>0.1277**</b> (0.0577)	<b>0.2150**</b> (0.0925)
H6 - Growth-Resource Dummy	+	0.0075 (0.0193)	0.0045 (0.0235)	0.0135 (0.0616)	0.0977 (0.1160)
H6 - Total Sales	n/a	<b>-0.0026<sup>a*</sup></b> (0.0014) <sup>a</sup>	<b>-0.0034<sup>a**</sup></b> (0.0016) <sup>a</sup>	-0.0055 <sup>a</sup> (0.0039) <sup>a</sup>	<b>-0.0116<sup>a***</sup></b> (0.0057) <sup>a</sup>
H6 - CAPEX to Total Sales	n/a	0.0001 (0.0009)	0.0011 (0.0013)	-0.0042 (0.0029)	<b>-0.0150***</b> (0.0053)

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# Probit results

H6 - CACL to Total Assets	n/a	0.0031 (0.0054)	0.0038 (0.0067)	-0.0013 (0.0129)	-0.0120 (0.0225)
H6 - Total Debt to Common Equity	-	<b>-0.0001*</b> (0.0001)	-0.0001 (0.0001)	-0.0002 (0.0002)	0.0030 <sup>b</sup> (0.0003)
H7 - LT Debt to Total Assets	-	1.4630 (2.1157)	-1.0809 (1.7153)	-5.8622 (5.0260)	<b>-15.3942*</b> (8.0234)
H7 - Inv. Turnover	-	<b>-0.0001**</b> (0.0035) <sup>b</sup>	-0.0001 (0.0074) <sup>b</sup>	-0.0001 (0.0001)	-0.0006 <sup>b</sup> (0.0001)
H8 - Asset Turnover	+/-	<b>0.0379***</b> (0.0105)	<b>0.0434***</b> (0.0131)	<b>0.0663**</b> (0.0275)	<b>0.1120**</b> (0.0495)
H9 - PE Ratio	-	0.0019 <sup>b</sup> (0.0002)	0.0001 (0.0003)	-0.0004 (0.0006)	0.0004 (0.0010)
H10 - Div. Payout	-	-0.0003 (0.0003)	-0.0004 (0.0005)	<b>-0.0024**</b> (0.0009)	-0.0015 (0.0017)
<i>Control Variables</i>					
SMTtotalTraded		<b>-0.0014***</b> (0.0003)	<b>-0.0014***</b> (0.0003)	<b>-0.0016***</b> (0.0005)	<b>-0.0023***</b> (0.0009)
SpamannADRI		0.0002 (0.0119)	-0.0057 (0.0152)	-0.0109 (0.0375)	-0.0552 (0.0646)
SMTurnover		<b>0.0009***</b> (0.0003)	<b>0.0011***</b> (0.0004)	<b>0.0012**</b> (0.0006)	<b>0.0018*</b> (0.0010)
GDPpercapitaPPPcurrentint		<b>0.0012<sup>b</sup>***</b> (0.0032) <sup>a</sup>	<b>0.0014<sup>b</sup>***</b> (0.0004) <sup>a</sup>	<b>0.0016<sup>b</sup>***</b> (0.0075) <sup>b</sup>	<b>0.0032<sup>b</sup>***</b> (0.0012) <sup>b</sup>
ReleaseFSMonth		-0.0019 (0.0022)	0.0004 (0.0027)	-0.0052 (0.0060)	<b>-0.0202*</b> (0.0104)
<i>Dummies</i>					
Year		Yes	Yes	Yes	Yes
Industry		Yes	Yes	Yes	Yes
<i>Statistics</i>					
N <sup>c</sup>		3,566	2,632	545	331
McFadden's R <sup>2d</sup>		8.63%	9.43%	28.92%	34.27%
P-value		<b>0.0000***</b>	<b>0.0000***</b>	<b>0.0000***</b>	<b>0.0000***</b>
Actual Prob.		0.2252	0.2462	0.2404	0.3444
Predicted Prob.		0.2074	0.2228	0.1807	0.2788

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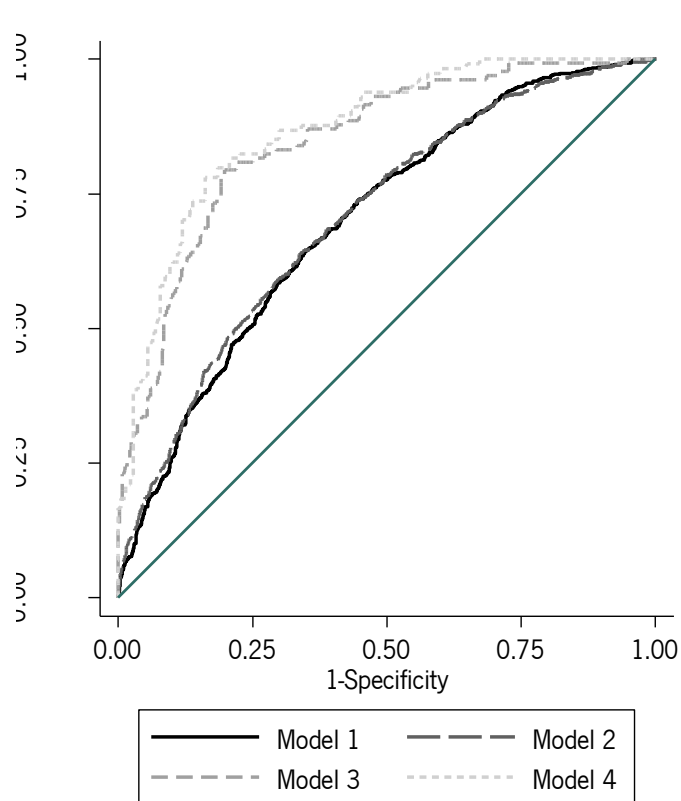
# Probit results

14 variables statistically significant providing evidence for 9/10 hypothesis

All of the results are in line with previous literature:, such as;

- Acquiror managers appear to be more concerned with the acquisition of large companies in order to **maximize the size of their firm**, instead of worrying about the transaction costs of the deal
- Firms from industries with recent history of takeovers are also **more likely to become takeover targets** (industry acquisition “waves”)
- Firms primarily focused on retaining earnings rather than paying out dividends are also more likely to become takeover targets because this suggests they are doing so to maintain enough financial slack to exploit future growth opportunities

# Classification accuracy – ROC curves



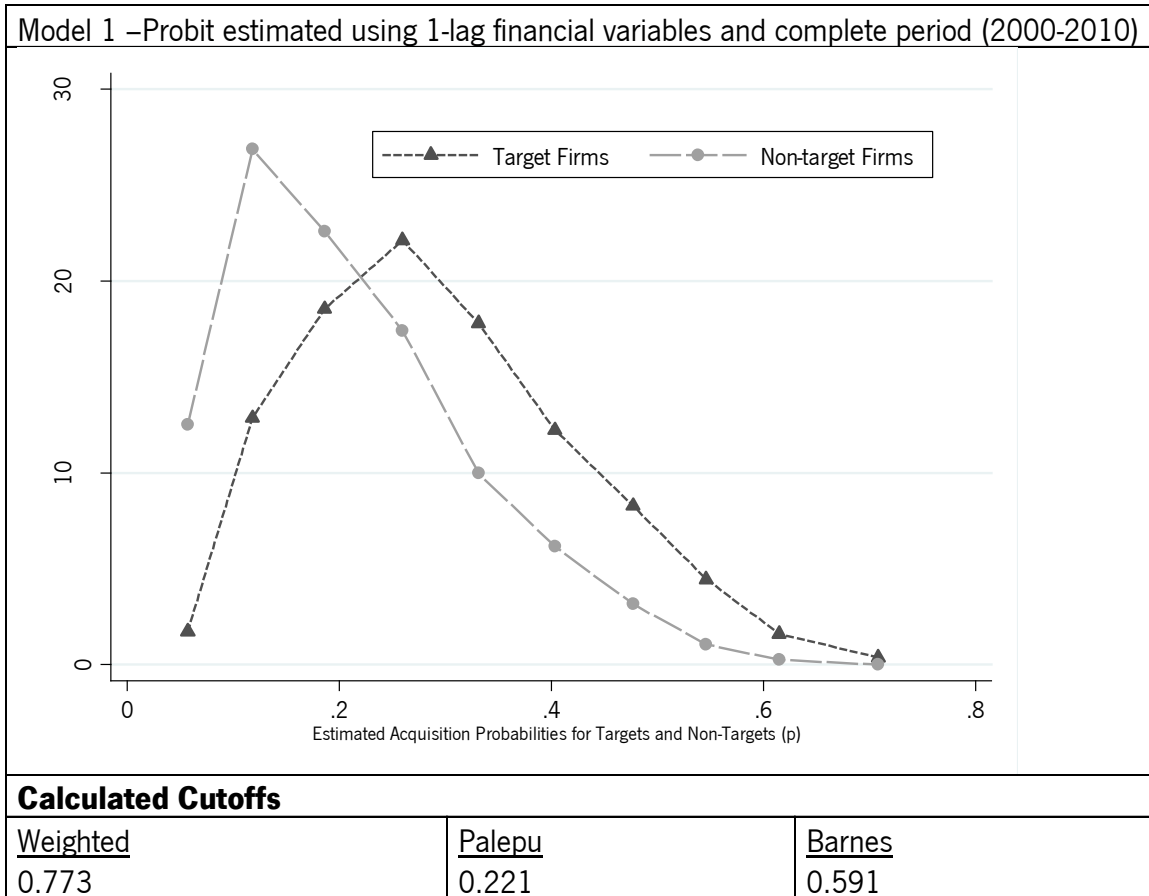
Model	N	AUC	Std. Error
Model (1)	3566	0.7005	0.0100
Model (2)	2632	0.7073	0.0114
Model (3)	545	0.8474	0.0190
Model (4)	331	0.8699	0.0199

t-test for equal AUC: p-value: **0.0000\*\*\***

According to the traditional academic point system:

- The classification accuracy of Model 1 and 2 is **fair**
- The classification accuracy of Model 3 and 4 is **good, almost excellent**

# Cutoff selection



# Classification accuracy

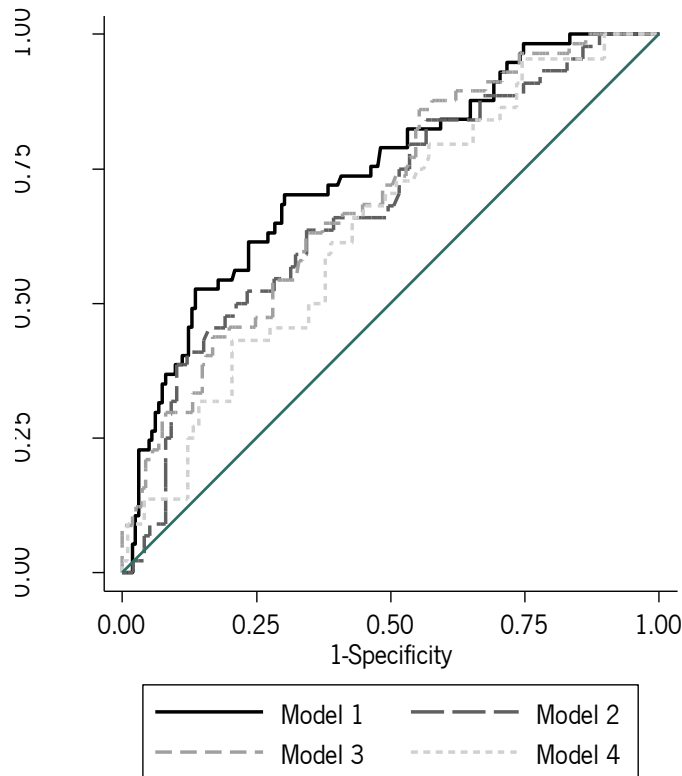
**Model 1** – 1-lag financial variables and complete period with Barnes cutoff (0.591)

		Predicted Outcomes		
		Target	Non-Target	Total
Actual Outcomes	Target	18	791 (Type I error)	809
	Non-Target	7 (Type II error)	2750	2757
	Total	25	3541	3566

Proportional Chance Criterion	Maximum Chance Criterion	McNemar's test
<p>p=0.65 W=0.78 t-statistic=<b>18.20***</b></p>	<p>Concentration ratio=18/25=72.00% Chance accuracy=809/3566=22.69% Relative to Chance=217.37% z-statistic=<b>33.49***</b></p>	<p>p-value=<b>0.0000***</b></p>

- The proportional chance criterion and McNemar's test show that all models are able to classify targets and non-targets jointly better than chance, at a 1% level of significance.
- Maximum Chance Criterion provides evidence that the models are also able to classify target firms better than chance **217.37%**, at a 1% level of significance.

# Predictive accuracy – ROC curves



Model	N	AUC	Std. Error
Model <b>(1)</b>	219	0.7403	0.0382
Model <b>(2)</b>	143	0.6811	0.0484
Model <b>(3)</b>	218	0.6964	0.0391
Model <b>(4)</b>	142	0.6412	0.0490

t-test for equal AUC

p-value: **0.4420**

According to the traditional academic point system:

- The predictive accuracy of Model 1 is fair
- The predictive accuracy of Model 2, 3 and 4 is poor.

# Prediction accuracy

**Model 1** – 1-lag financial variables and complete period with Barnes cutoff (0.591)

		Predicted Outcomes		
		Target	Non-Target	Total
Actual Outcomes	Target	20	37 (Type I error)	57
	Non-Target	12 (Type II error)	150	162
	Total	32	187	219

Proportional Chance Criterion	Maximum Chance Criterion	McNemar's test
p=0.61 W=0.78 t-statistic= <b>5.73***</b>	Concentration ratio=20/32=62.50% Chance accuracy=57/219=26.03% Relative to Chance=140.13% <b>Z=6.28***</b>	p-value= <b>0.0004***</b>

- The proportional chance criterion and McNemar's test shows that Model 1 is able to predict targets and non-targets jointly better than chance, at a 1% level of significance.
- Using Model 1, we are able to predict target firms of a takeover attempt **140.13%** better than chance.

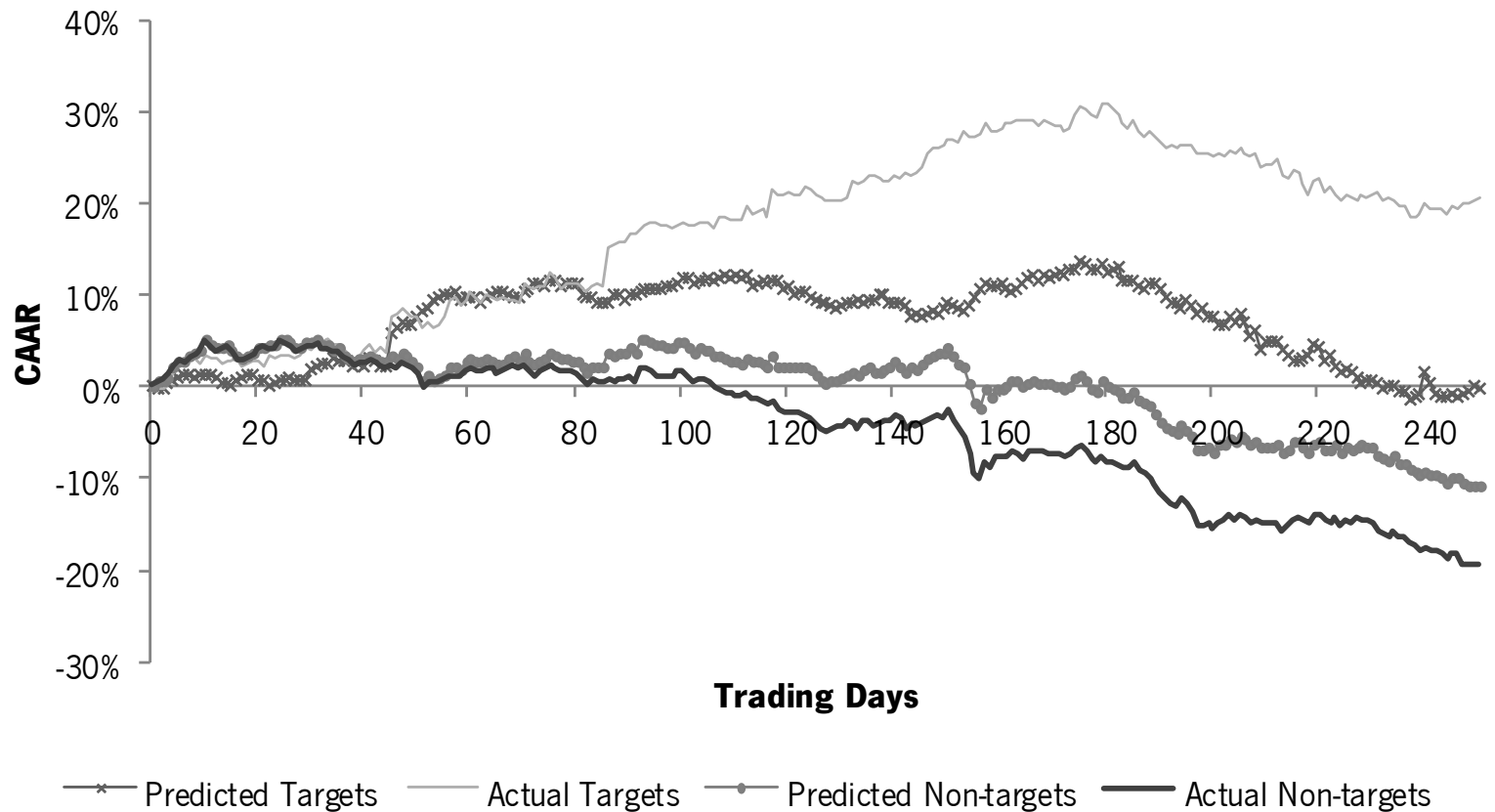
**This is one of the best results achieved so far.**

# Average Cumulative Abnormal Returns

- The last step is to test whether it is possible to earn abnormal returns from investing in the stocks of the firms predicted as targets according to the estimated models.
- As Palepu (1986), we conduct the abnormal return analysis for a equally weighted portfolio over a holding period of 250 days beginning in January 3, 2011. We use the market model suggested by MacKinlay (1997) and consider an estimation window for -280 to -30 days.
- The average cumulative abnormal returns are presented in the next graph.

# Average Cumulative Abnormal Returns

*Model 1 – Average daily abnormal returns over the 250-day holding period*





# Average Cumulative Abnormal Returns

- Although we are able to correctly predict **20 firms as targets** with only **12 misclassifications**, the ACAR for this group was found to be statistically insignificant.
- However, with a closer examination, we also find that predicted and actual targets are not able to provide positive statistical significant ACARs (1.81%). One possible explanation is that positive CARs resulting from the takeover announcement were diluted along the 250 trading days. For now, this supports Palepu (1986) pessimistic view on the subject. In a later stage, if the model maintains the predictive accuracy in a larger sample, we may expect more optimistic results.
- The ACAR for the 187 firms predicted as non-target was **-10.63%**, only statistically significant at a 10% level.
- As expected, and in line with most literature, actual target firms from the sample would yield positive ACAR of **20.65%** and actual non-targets **-19.46%**. Both are statistically significant at a 5% level.

# Conclusions

- Several variables related to takeover motivations were found as statistically significant, providing evidence for **9/10** of the included hypothesis. This is one of the most complete schemes presented for EU27 target companies.
- Models that consider a sub-period (2009 and 2010) in the estimation are able to classify targets of an acquisition attempt with higher accuracy than models that consider a complete period. This is also verified between 1 and 2-lag models, respectively, although with significant less expression.
- However, **this doesn't happen when we consider predictive accuracy**. In fact, they reported poor predictive accuracy according to the ROC curves. As suggested by Powell (2001), one can conclude that takeover motivations change over time and by considering the complete period in the estimation we are able to construct a more stable model.
- Using these models **we were unable to earn abnormal returns over a holding period of 250 days**, as argued by Palepu (1986).

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Obrigado pela atenção.

“If the stock market is a casino, then anyone who can predict takeover targets will surely break the bank.”

Barnes (1999)