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"Enhancing profit measures of customer's profitability in revolving retail credit"

Luis Javier Sánchez Barrios

Galina Andreeva
Jonathan Ansell

August 2011

TABLE OF CONTENTS

1. BRIEF LITERATURE OVERVIEW

•Importance of profit scoring: Andreeva et al. 2007 ; Oliver and Wells 2001; Keeney and Oliver 2005; Finlay 2008; Ma et al. 2009; Thomas 2009

•Use of absolute measures in profit scoring: Stepanova and Thomas 2001; Verstraeten and Van den Poel 2004; Seow and Thomas 2006; Andreeva et al. 2007; Banasik and Crook 2009; Ma et al. 2009; Finlay 2010; Lieli and White 2010.

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2. THE DATA SET

ID	MONTH	Alternative 1: Observation period=30 months, before allowing for longitudinal analysis during the observation period per cohort
0	Mar-07	15 cohorts
1	Apr-07	482
2	May-07	772
3	Jun-07	826
4	Jul-07	3289
5	Aug-07	4536
6	Sep-07	2812
7	Oct-07	3995
8	Nov-07	5803
9	Dec-07	5237
10	Jan-08	910
11	Feb-08	262
12	Mar-08	1230
13	Apr-08	2475
14	May-08	1440
15	Jun-08	1496
16	Jul-08	
17	Aug-08	
18	Sep-08	
19	Oct-08	
20	Nov-08	
21	Dec-08	
22	Jan-09	
23	Feb-09	
24	Mar-09	
25	Apr-09	
26	May-09	
27	Jun-09	
28	Jul-09	
29	Aug-09	
30	Sep-09	
31	Oct-09	
32	Nov-09	
33	Dec-09	
34	Jan-10	
35	Feb-10	
36	Mar-10	
37	Apr-10	
38	May-10	
39	Jun-10	
40	Jul-10	
41	Aug-10	
42	Sep-10	
43	Oct-10	
44	Nov-10	
45	Dec-10	
	n	482 772 826 3,289 4,536 2,812 3,995 5,803 5,237 910 262 1,230 2,475 1,440 1,496
	CUMn	482 1,254 2,080 5,369 9,905 12,717 16,712 22,515 27,752 28,662 28,924 30,154 32,629 34,069 35,565

N=35,565 customers

(47,955 purchases)

Observation period: 30 months

T-test for means equality between cohorts 1 and 15

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3. SUGGESTED MEASURES PER CUSTOMER

CUMULATIVE

1.Cumulative variable contribution

$$VCcum_t = \sum_{n=1}^{t} VCcomp_n$$

2.Coverage against default

$$EBITcum_t = \sum_{n=1}^{t} EBITcomp_n$$

3.Percentage coverage against default

$$ROAcum_t = EBITcum_t \Big/ finalbalancedef_t$$

AVERAGES

4. Average variable contribution

$$AVVC_t = \frac{\sum_{n=1}^{t} VCdef_n}{t}$$

5.Average profit

$$AVEBIT_t = \frac{\sum_{n=1}^{t} EBITdef_n}{t}$$

6.Average return on assets

$$AVROA_t = \frac{\sum_{n=1}^{t} ROA_n}{t}$$

Where t=time in months

4. PROFITS vs. RETURN MEASURES: CUSTOMER LEVEL

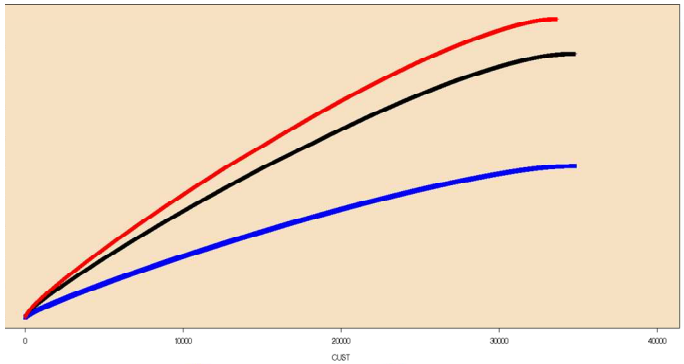
RESULTS from Spearman correlation test and Chi-Square test (based on customers' ranks according to each of 6 measures)

- Cumulative measures are less correlated than average measures
- ROAcum and AVROA are less correlated as time goes on.
- It can be inferred at a 1% S.L. that profit scoring and return scoring yield different distributions.
- Any of the four measures could be equally used to score customers.

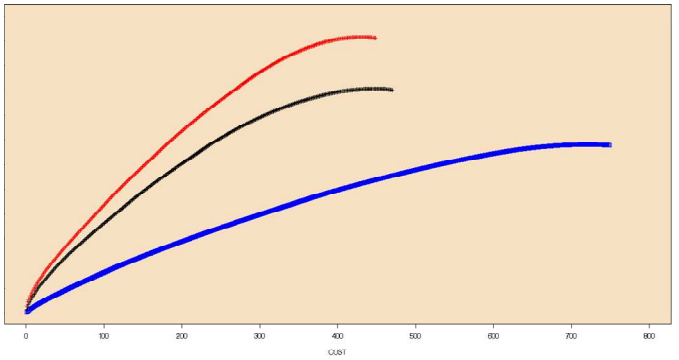
5. ASSESSING PORTFOLIO RESULTS

5.1 Cumulative profits and returns

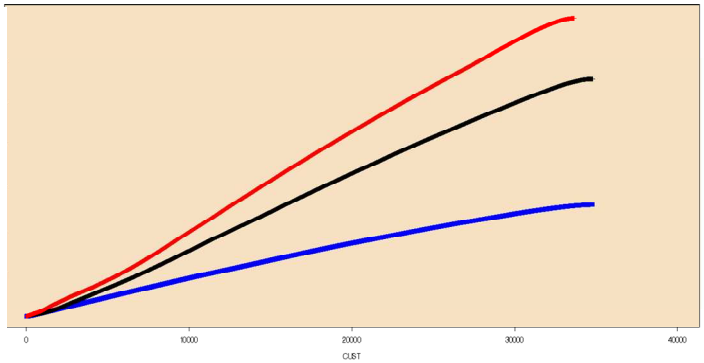
EBITcum, non-defaulters



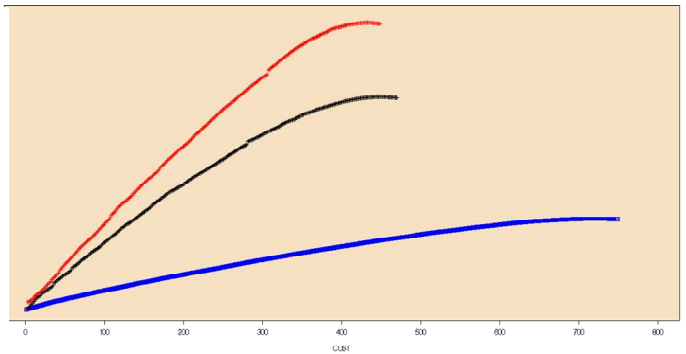
EBITcum, defaulters



ROAcum, non-defaulters



ROAcum, defaulters



T=12 T=24 T=30

5. ASSESSING PORTFOLIO RESULTS

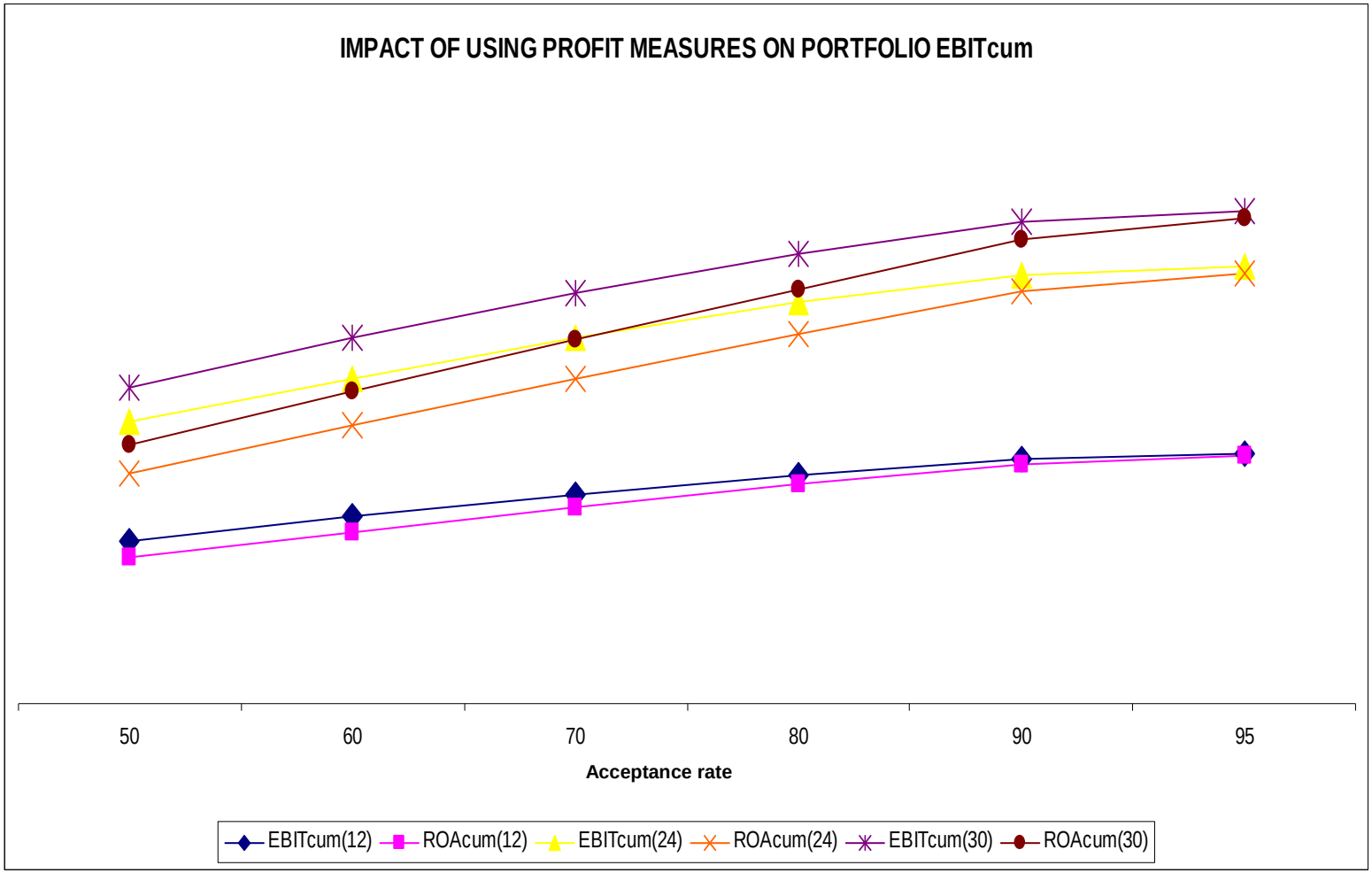
MEASURE	T	COMPLETE SAMPLE		NON-DEFAULTERS		DEFAULTERS	
		STC	VF	STC	VF	STC	VF
EBITCUM	12	17.1%	0.3%	16.9%	0.2%	22.4%	3.7%
	24	17.1%	0.6%	17.0%	0.6%	26.6%	4.3%
	30	16.5%	0.3%	16.4%	0.2%	24.6%	3.8%
AVEBIT	12	17.1%	0.3%	16.8%	0.2%	22.4%	3.7%
	24	17.1%	0.6%	16.9%	0.6%	26.6%	4.3%
	30	16.5%	0.3%	16.3%	0.2%	24.6%	3.8%
ROACUM	12	9.8%	0.3%	9.4%	0.2%	19.3%	3.7%
	24	2.7%	0.6%	2.3%	0.6%	20.4%	4.3%
	30	1.9%	0.3%	1.7%	0.2%	17.1%	3.8%
AVROA	12	89.6%	0.4%	90.7%	0.4%	19.3%	3.3%
	24	58.5%	1.6%	59.0%	1.5%	24.4%	4.7%
	30	69.1%	1.3%	69.6%	1.2%	21.1%	4.0%

STC=Stobachoff coefficient VF=Vulnerability factor

RESULTS

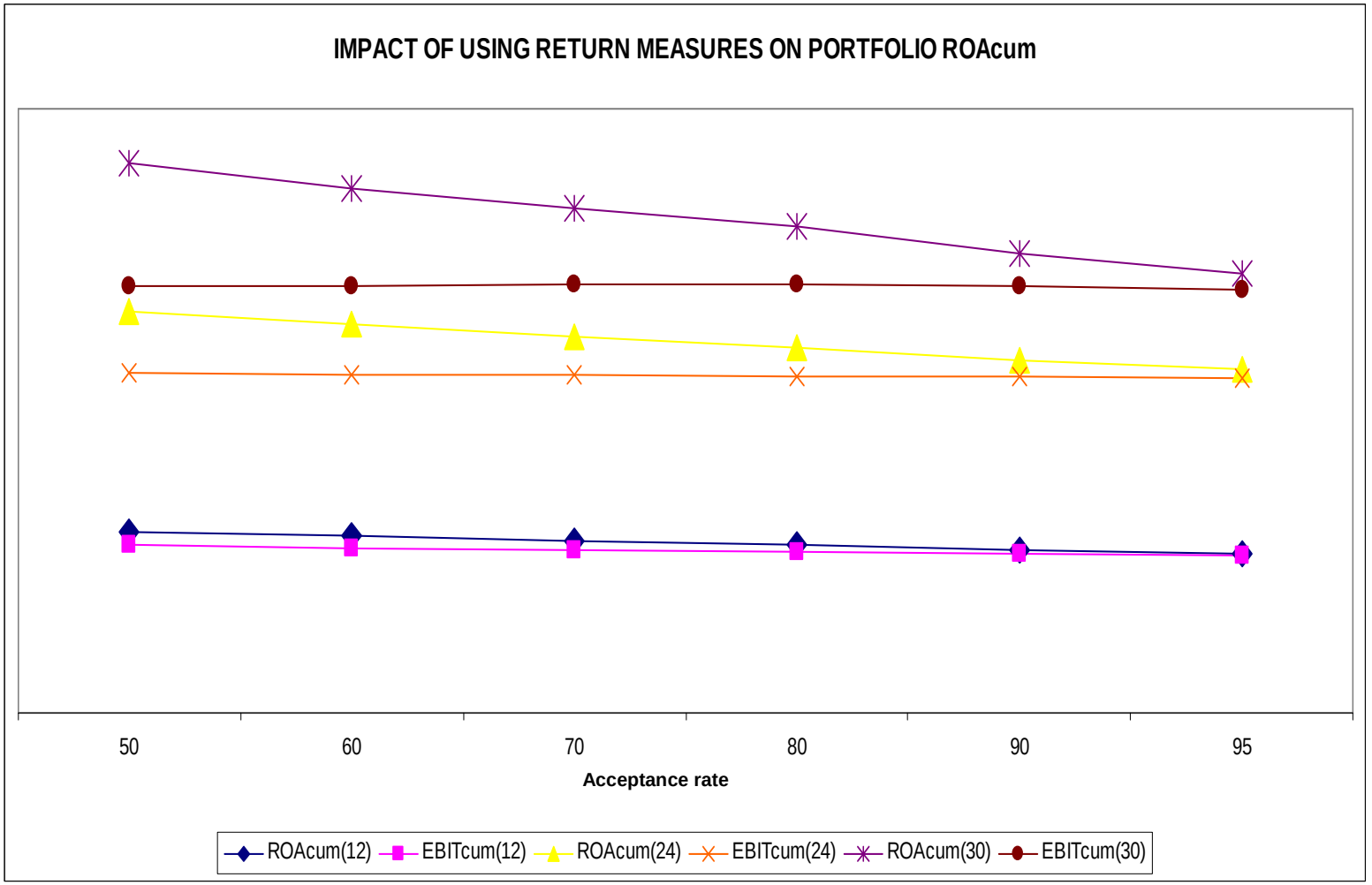
- This is a profitable business
- Low dependence and subsidisation
- Corporate returns are even less concentrated than profits
- Higher values for defaulters

6. PROFITS vs. RETURN MEASURES: PORTFOLIO LEVEL



PORTFOLIO EBIT $_{PROFITS}$ > PORTFOLIO EBIT $_{RETURNS}$

6. PROFITS vs. RETURN MEASURES: PORTFOLIO LEVEL



PORTFOLIO ROA $_{RETURNS}$ > PORTFOLIO ROA $_{PROFITS}$

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6. PROFITS vs. RETURN MEASURES: PORTFOLIO LEVEL

OPPORTUNITY COST ANALYSIS (CUMULATIVE MEASURES)

$$OC_{1COVERAGE_t} = PORTFCOVERAGE_{EBITCUM_t} - PORTFCOVERAGE_{ROACUM_t}$$

$$OC_{\%COVERAGE_t} = PORTFOLIO\%COVER_{EBITCUM_t} - PORTFOLIO\%COVER_{ROACUM_t}$$

$$OC_{2COVERAGE_t} = OC_{\%COVERAGE_t} \times finalbalance_{acceptrate_t}$$

$$MARGINALCOVERAGE_t = OC_{1COVERAGE_t} + OC_{2COVERAGE_t}$$

EBITCUM vs ROACUM	12	24	30
50	**1.00**	1.00	**1.00**
60	**0.81**	1.04	0.91
70	**0.35**	1.96	0.80
80	0.01	3.89	0.72
90	0.22	**7.56**	0.55
95	0.35	6.80	0.35

At t=30:

MARGINAL COVERAGE $_{RETURNS}$ > MARGINAL COVERAGE $_{PROFITS}$

6. PROFITS vs. RETURN MEASURES: PORTFOLIO LEVEL

OPPORTUNITY COST ANALYSIS (AVERAGES)

$$OC_{1PROFIT_t} = PORTFPROFIT_{AVEBIT_t} - PORTFPROFIT_{AVROA_t}$$

$$OC_{2ROA_t} = PORTFOLIOROA_{AVEBIT_t} - PORTFOLIOROA_{AVROA_t}$$

$$OC_{2PROFIT_t} = OC_{2ROA_t} \times finalbalance_{acceptrate_t}$$

$$MARGINALPROFIT_t = OC_{1PROFIT_t} + OC_{2PROFIT_t}$$

AVEBIT vs AVROA	12	24	30
50	1.00	**1.00**	1.00
60	0.84	**2.07**	0.96
70	2.76	**0.10**	0.94
80	3.53	89.90	4.42
90	0.24	92.41	4.80
95	**236.69**	**97.21**	**5.63**

At t=30:

MARGINAL PROFIT $_{RETURNS}$ > MARGINAL PROFIT $_{PROFITS}$

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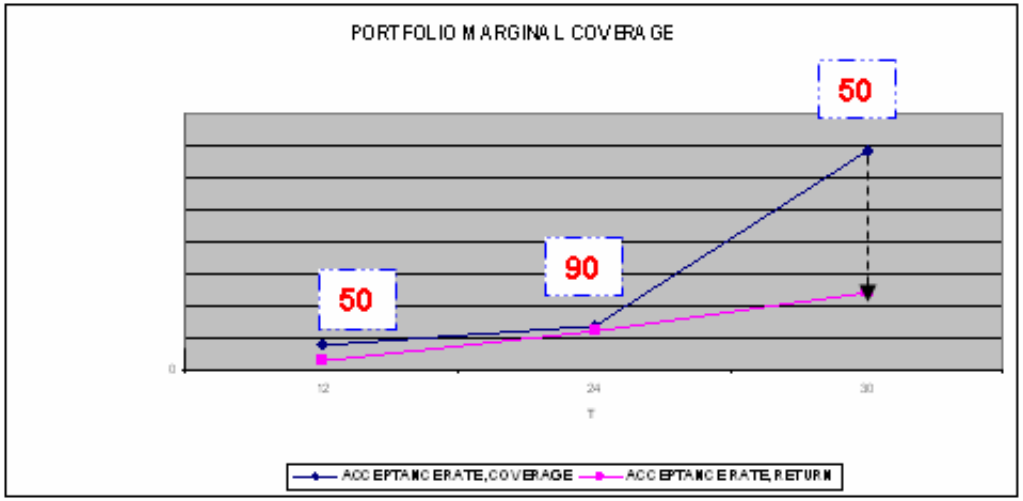
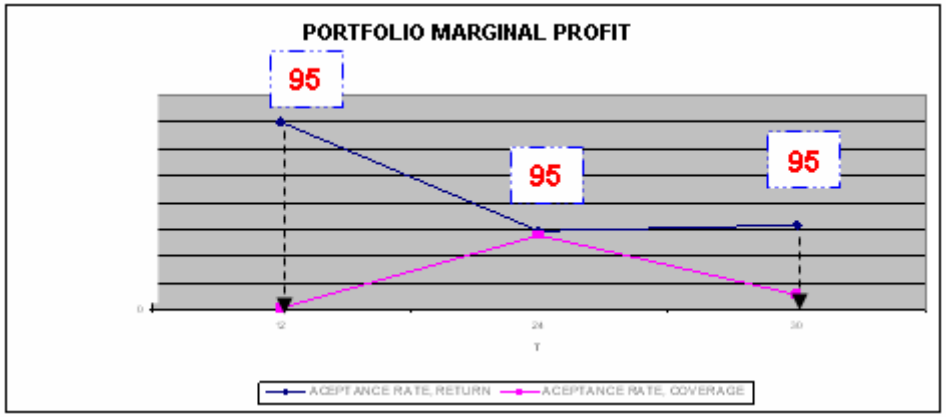
7. MARGINAL COVERAGE OR MARGINAL PROFITS?





RESULTS

- **Cost of enhancing the social scope of the programme**
- **Role of time to trade-off between marginal coverage and profit**

Acceptance rate range = [min $_{\text{social scope}}$, max $_{\text{coverage}}$]

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8. OPPORTUNITY COST OF DEFAULT SCORING

VARIABLE	REFERENCE CATEGORY	DUMMIES	Chi square test p-value	IV
Duration of first loan	loandur<=24 months	dumLOAN2 : 24 months <durloan<= 36 months dumLOAN3 : 36 months <durloan<= 48 months dumLOAN4 : 48 months <durloan<= 61 months dumLOAN5 : missing	0.00	44.54
First product purchased	qualifying context-related products and missing values	dumHOM1 : homeappliances dumFURN1 : furniture dumHARDW1 : hardware	0.00	44.04
Age	18<Age<= 35 years	dumAGE3: 35<Age<= 43.5 years dumAGE4: 43.5<Age<= 52 years dumAGE5: 52<Age<= 60.5 years dumAGE6: 60.5<Age<= 69 years dumAGE7: 69<Age<= 103 years	0.00	35.23
Credit limit usage (loan/ACL)	loanpr<=0.404	dumloanpr2 : 0.404<loanpr<= 0.748 dumloanpr3 : 0.748<loanpr<= 3.5	0.00	28.78
Marital status	single	dummar1 : cohabitators, married dummar2 : divorced, widow(er) dummar4 : missing	0.01	26.77
Approved credit limit	ACL=£300	dumACL2 : ACL= £310 dumACL3 : ACL= £350 £400 £500 or £600	0.01	16.33
Dependants	0 dependants	dumDEP1 : 1 dependants dumDEP2 : 2 dependants dumDEP3 : 3 dependants dumDEP4 : 4 dependants dumDEP5 : 5 or more dependants	0.24	11.46
Economic activity	services	dumactNA : Not applicable dumactOTH : Other industries dumactPROD : Manufacturing	0.46	4.25
Years at home	YAH<= 7.9 years	dumYAH2 : 7.9<YAH<= 16.8 years dumYAH3 : 16.8<YAH<= 25.7 years dumYAH4 : 25.7<YAH<= 34.6 years dumYAH5 : 34.6<YAH<= 43.5 years dumYAH6 : 43.5<YAH<= 90 years	0.87	3.15
Proportion of instalment (Instalment/loan)	inspr<=0.0325	duminspr2 : 0.0325<loanpr<= 0.0475 duminspr3 : 0.0475<loanpr<=0.10	0.52	2.38
Job status	employed	dumJOB2 : retired dumJOB3 : self-employed dumJOB4 : housewife, student, unemployed, missing	0.76	1.95
Type of contract	missing, other, or not applicable	dumcon2 : Any type of contract (permanent, temporary)	0.60	0.45
Socioeconomic stratum	stratum 1 (poor segments)	dumstra35: stratum>1	0.81	0.10
Level of studies	primary or secondary	dumSTU2 : College, higher dumSTU3 : missing	0.99	0.03
Location	rural (different to the capital city)	dumcitURB : urban (capital city)	0.97	0.00

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8. OPPORTUNITY COST OF DEFAULT SCORING

Pr (default)* within 12 months

$$Ln(P/(1-P))= \alpha+\beta1dumINSPR2+ \beta2dumLOANPR3- \beta3dumAGE6+ \beta4dumHOM1 + \beta5dumFURN1+ \beta6dumHARDW1- \beta7dumACL3))$$

SIGNIFICANT VARIABLES

- **Instalment proportion**
- **Credit limit usage**
- **Age**
- **Type of product**
- **Approved credit limit (stratum)**

***default= 3 missed consecutive payments**

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8. OPPORTUNITY COST OF DEFAULT SCORING

Opportunity cost analysis

$$OC = \frac{(\sum(netprofit \quad rejecteddefaulters) + (\sum netprofit_{misclassifieddefaulters})}{(\sum loss_{acceptednon-defaulters}) + (\sum netprofit_{missclassifednon-defaulters})}$$

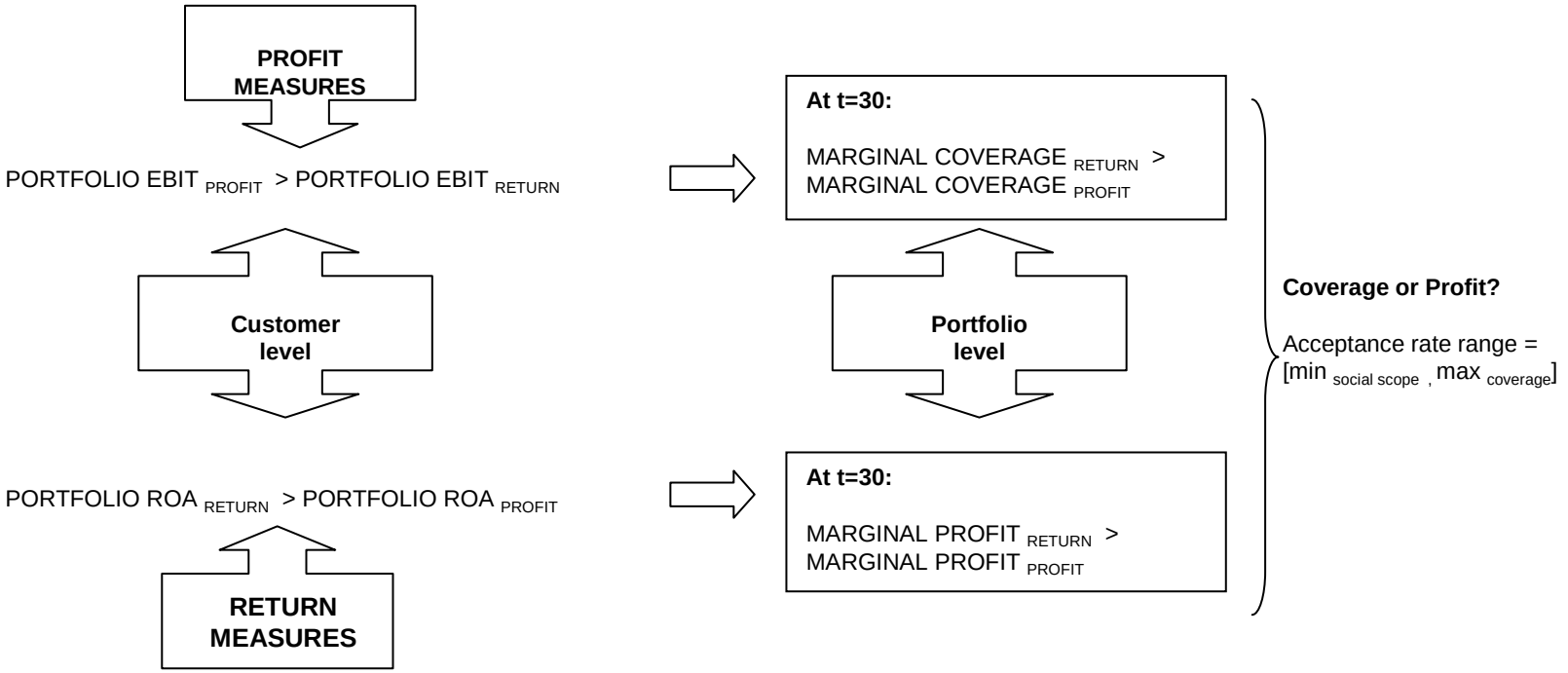
RESULTS

HOLDOUT SAMPLE

ACCEPTANCE RATE	52%	60%	61%	65%	66%	89%
PREDICTIVE ACCURACY	0.52	0.60	0.61	0.64	0.66	0.88

	ACCEPTANCE RATE					
OC	52%	60%	61%	65%	66%	89%
EBITCUM12	81	65	60	46	43	11
AVEBIT12	81	65	60	46	43	11
ROACUM12	81	65	60	46	43	11
AVROA12	74	59	54	42	39	10

9. CONCLUSIONS



- **Dilemma 1: Profits vs. returns**
- **Dilemma 2: Marginal coverage vs. marginal returns**
- **Social implications**
- **Role of time**

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THANKS FOR YOUR ATTENTION