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Barcelona, 6 i 7 de juny de 2019
IQS School of Management



A decision tree study on the impacts of firm-specific and industry-specific factors on Spanish new firm survival during the recent depression period

Ramon Saladrigues

University of Lleida

Faculty of Law, Economics and Tourism

Yehui Tong

University of Beira Interior

Faculty of Human and Social Sciences

Purpose

- Exploring the impacts of firm-specific factors (mainly financial factors) and industry-specific factors on the survival of Spanish new firms in manufacturing sector during the recent depression period.

Methodology

- Decision tree approach is used for comparing the impacts between different factors and for observing the change of factors' impacts with firm's ageing and after industry adjustment.

Background

- Business failure is a hot topic that has been researched for several decades at least since 1960s last century (Balcaen and Ooghe, 2006); including the research of Beaver (1966) and Altman (1968)—as pointed out by Gepp and Kumar (2015).
- With regard to new firms, reducing business dissolution is one of the important issues of start-up research (Van Praag, 2003).
- Survival is the basis for firm success in (for example) market share or profitability (Suárez and Utterback, 1995).

Literature review

- As summarized by Fackler et al. (2013), survival and exit are crucial research topics in different academic areas—for example, resource-based theory, organizational ecology, and industrial economics including the well-cited passive learning model (Jovanovic, 1982) saying that firms can learn their efficiency only after operation.
- The resource-based view and the industrial organization view separately highlight firm's internal sources for sustained competitive advantage and the impacts of outside industry structure (Kraaijenbrink et al., 2010).
- There are also two well-cited theories of liability: liability of smallness (Aldrich and Auster 1986) stresses the high likelihood of exit on small firms; liability of newness (Stinchcombe, 1965) highlights the disadvantages of young firms.

Sample

- The firms incorporated in 2008 in SABI database (Iberian Balance sheet Analysis System developed by Bureau Van Dijk) are candidates for the sample and each firm is tracked for five years after the incorporation year.
- 2.415 newly incorporated firms are selected in Spanish manufacturing sector as the sample firms.

Dependent variables

Dependent variable

Survival or failure	Two consecutive years without reporting operating revenues as the signal of failure	It equals 1 representing survival if not showing the signal of failure; equals 0 if showing the signal of failure.
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Independent variables

Independent variables

Financial factor	Profitability	Return on total assets (ROA): Profits before tax / Total assets
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Adjusted format: Firm's ROA — Industry median ROA

	Solvency	Indebtedness: (Total shareholders funds and liabilities — Shareholders equity) / Total shareholders funds and liabilities
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Adjusted format: Firm's indebtedness / Industry median indebtedness

	Liquidity (General liquidity)	Current ratio: Current assets/Current liabilities
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Adjusted format: Firm's current ratio / Industry median current ratio

Independent variables

Firm size Total assets Total assets in thousands of Euros

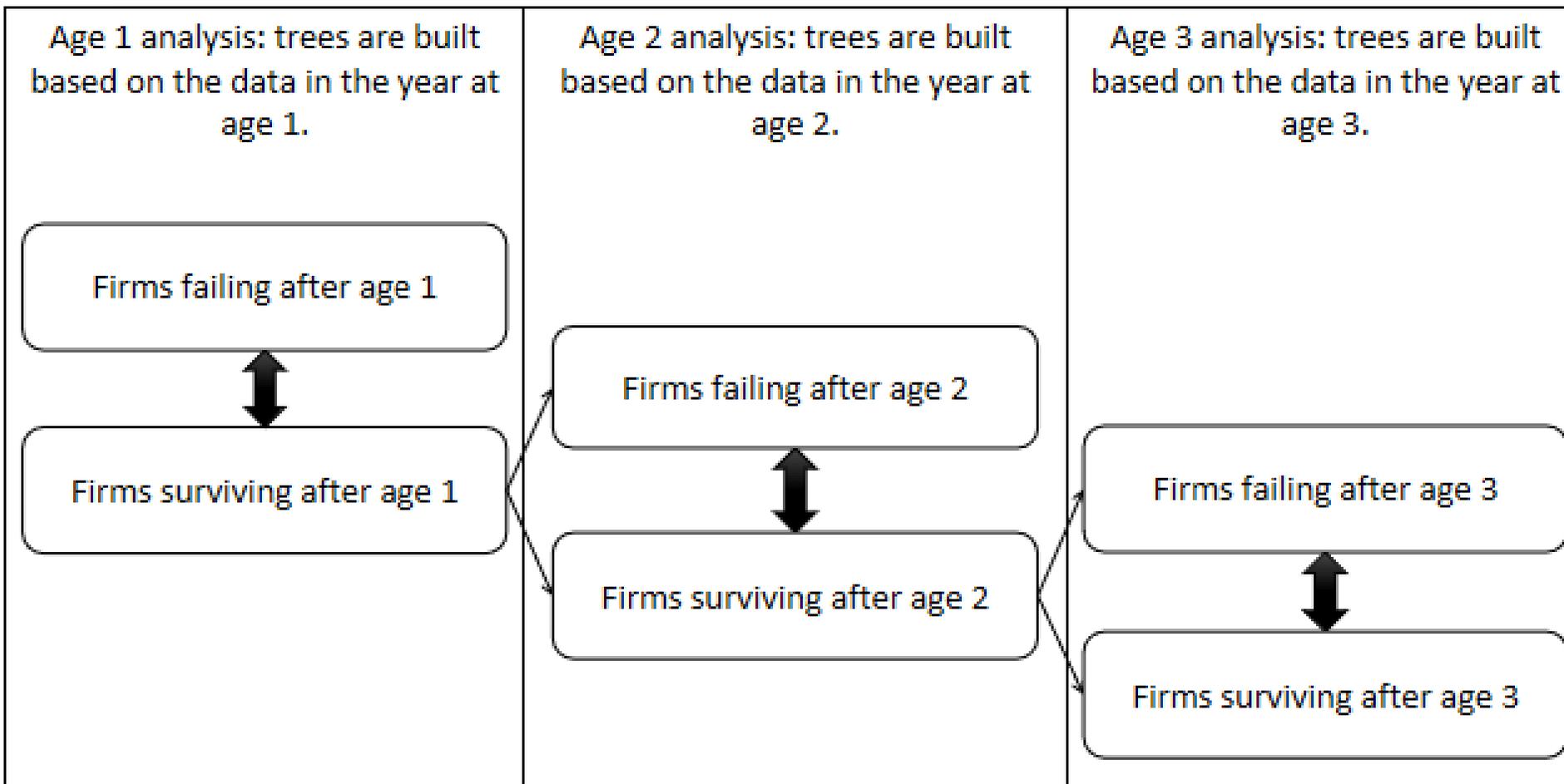
Adjusted format: Firm's total assets /
Industry median total assets

Group Whether being Membership in a group, equals 1 if the
members in a group number of companies in corporate group
hip is more than zero; equals 0 if the number
of companies in corporate group is zero.

Independent variables

<p>Industrial factors (identified in two-digit code industry division)</p>	<p>Entry rate</p>	<p>The number of incorporated firms within a year in a selected industry / The number of the firms reporting total assets in that industry in the same year</p>
	<p>Concentration rate</p>	<p>The total amount of operating revenues of the top 10 percent firms in a selected industry in a year / The total amount of operating revenues in that industry in the same year (López-García and Puente, 2006)</p>
	<p>Industry growth rate</p>	<p>(Operating revenues in a selected industry in a year — the operating revenues in that industry one year before) / The operating revenues in that industry one year before</p>

Methodology (referring to Persson (2004))



Decision trees

Bastos and Ramalho (2016, p.349) point out that: “Decision trees are one of the simplest techniques of pattern recognition, deriving their predictive power by recursively partitioning the original data set, in accordance with some criteria, into smaller mutually exclusive subsets, until all observations are allocated to a terminal node.”

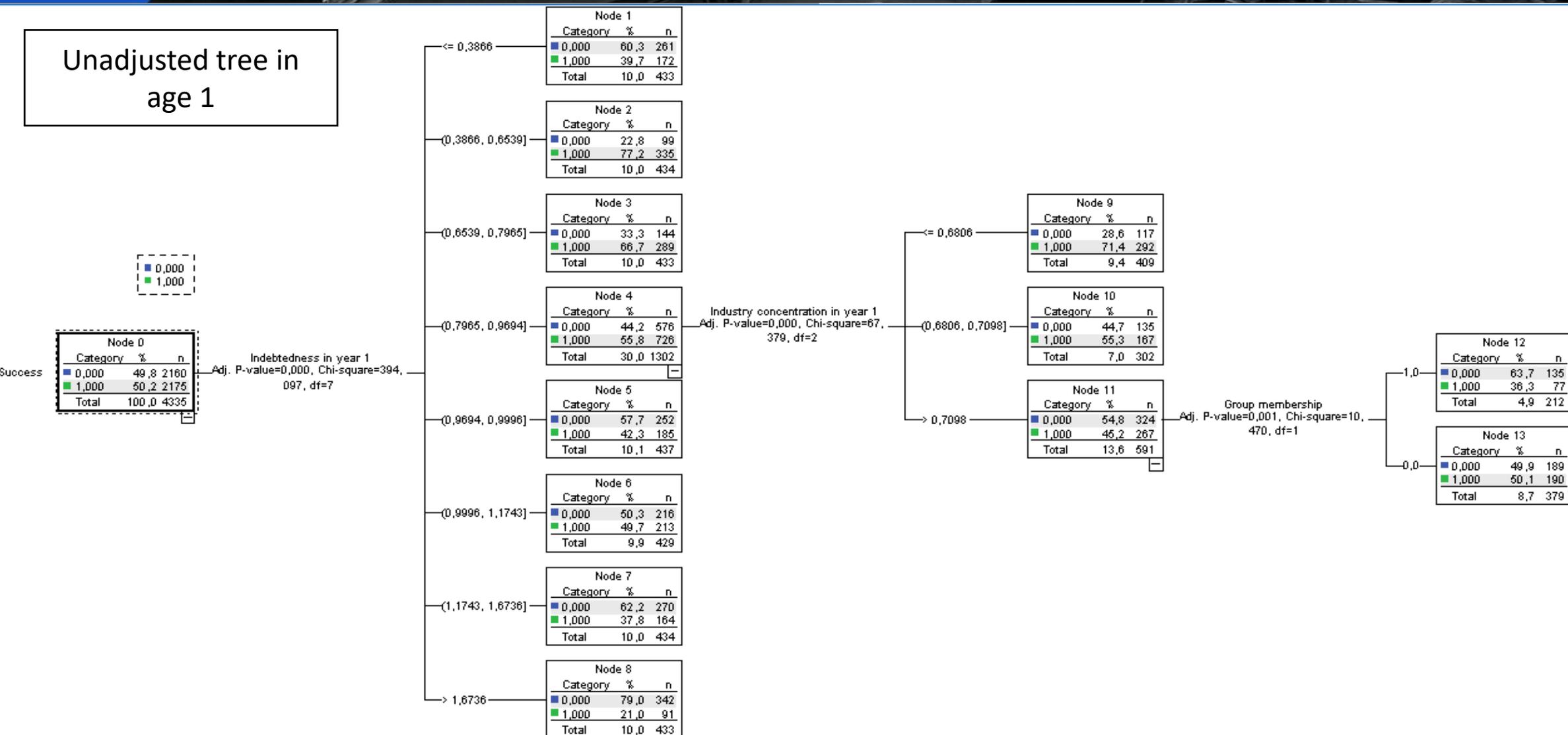
Chi-squared Automatic Interaction Detector (CHAID)

The first independent variable is the one with the lowest p-value, which is most closely associated with the dependent variable; provided that the p-value is equal to or lower than the predefined level of significance, the node would be split; this process keeps on going till the p-values of all the observed independent variables are higher than the split threshold; in the merging process, categories are merged for forming statistically significant difference between them (Milanović and Stamenković, 2016).

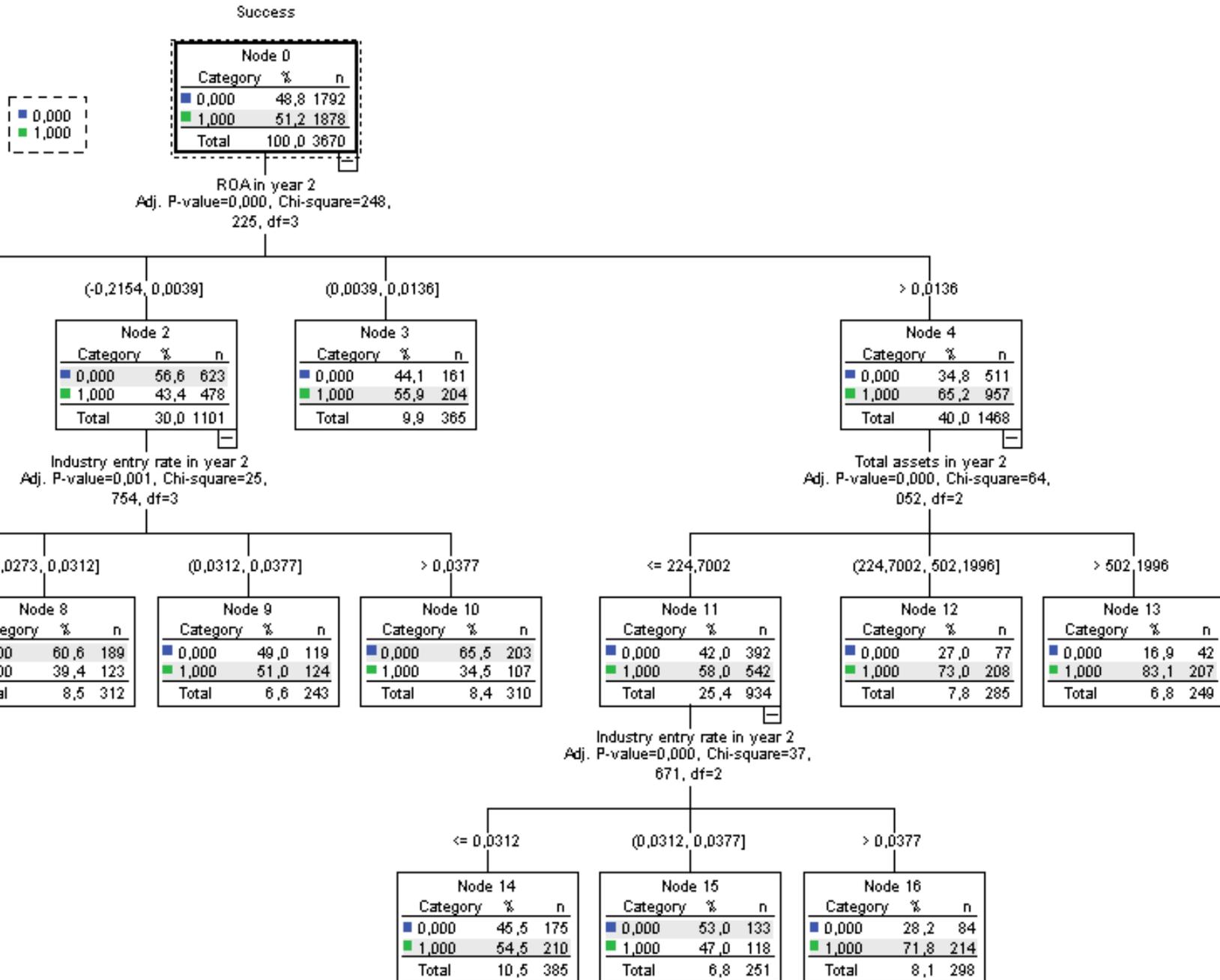
Originality

- Observing the change of factors' impacts with ageing
- Comparing the industry-adjusted model with the unadjusted model

Unadjusted tree in age 1



Unadjusted tree in age 2

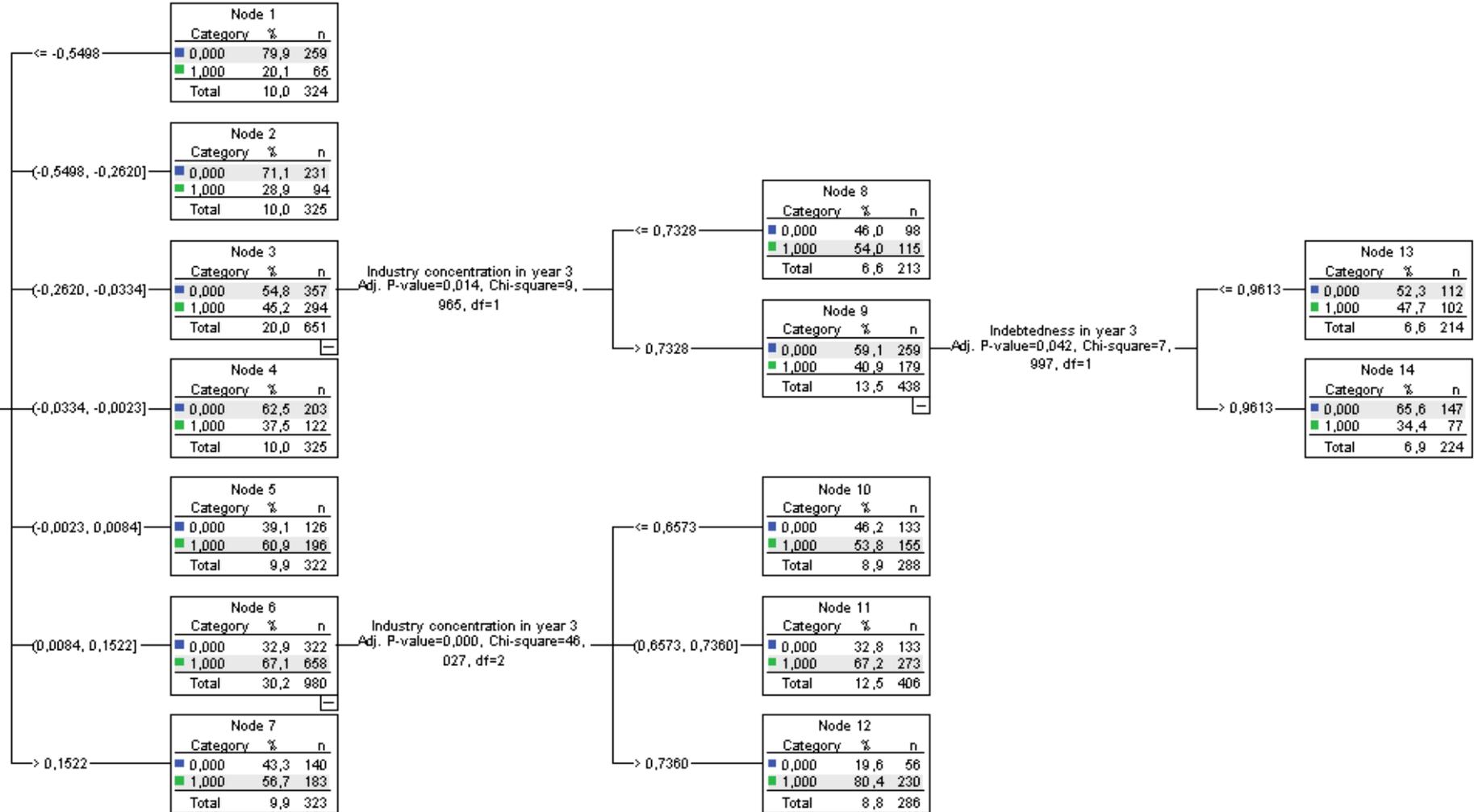


Unadjusted tree in age 3

0,000
 1,000

Node 0		
Category	%	n
0,000	50,4	1638
1,000	49,6	1612
Total	100,0	3250

ROA in year 3
 Adj. P-value=0,000, Chi-square=336, 151, df=6

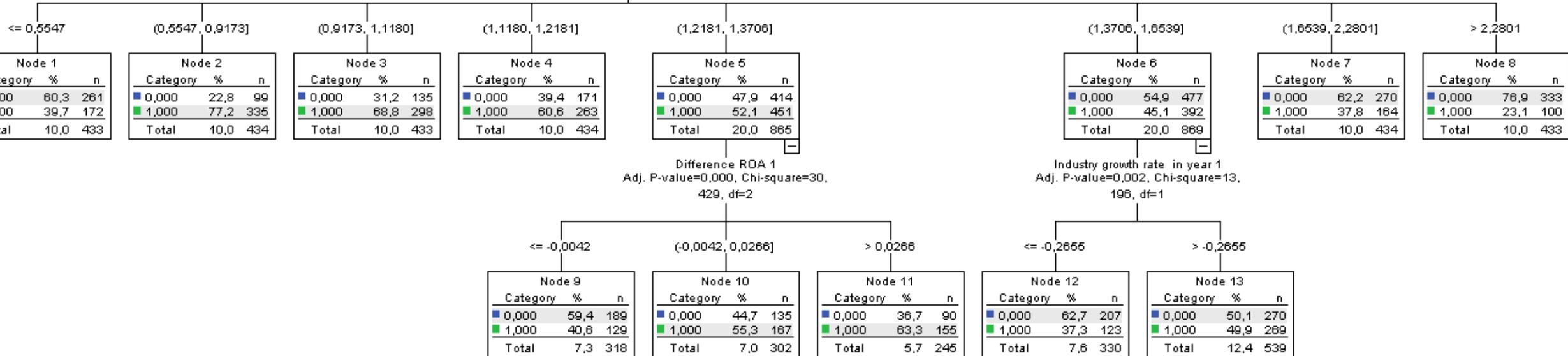


Adjusted tree in age 1

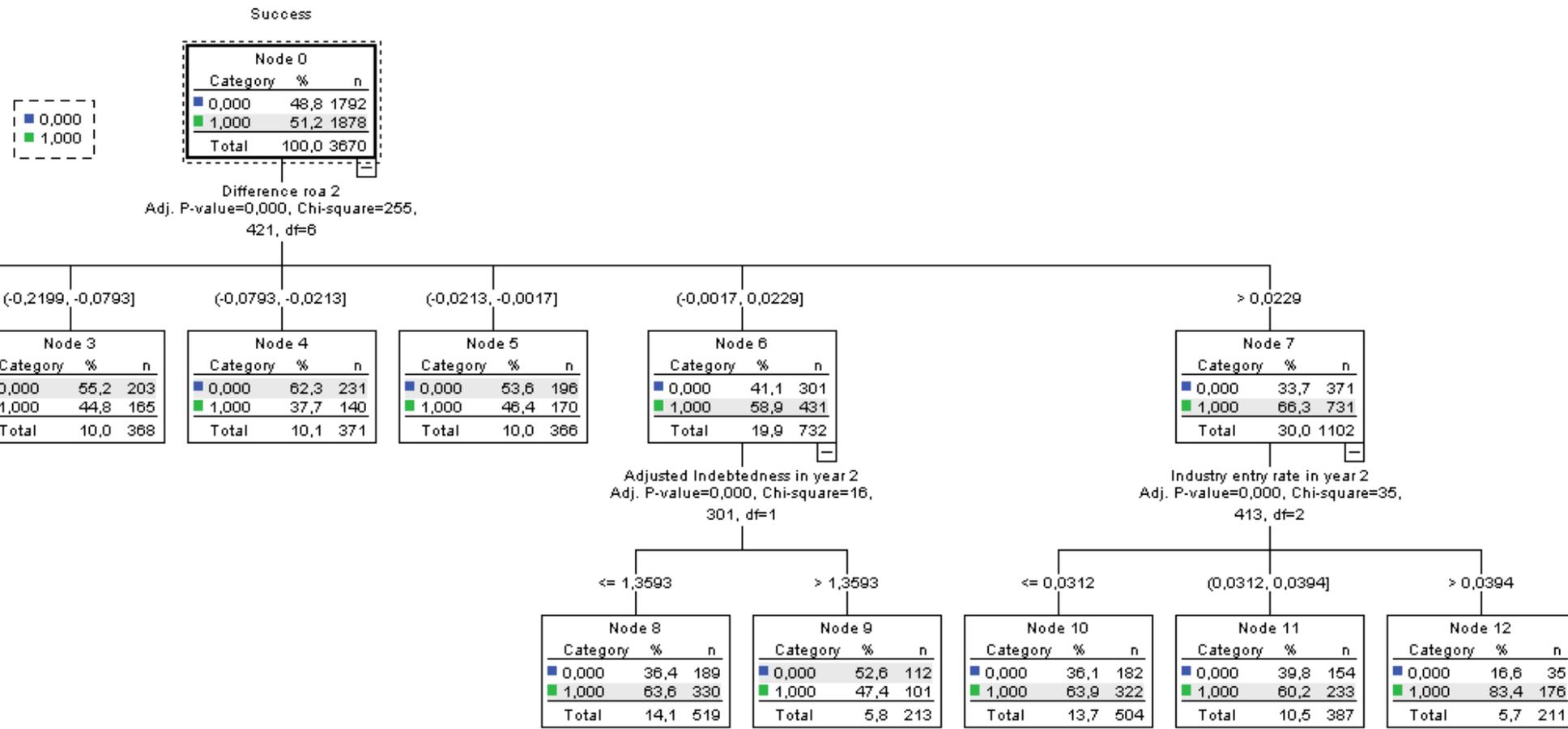


Node 0		
Category	%	n
0,000	49,8	2160
1,000	50,2	2175
Total	100,0	4335

Adjusted Indebtedness in year 1
 Adj. P-value=0,000, Chi-square=388,
 805, df=7



Adjusted tree in age 2



Adjusted tree in age 3



Success

Node 0		
Category	%	n
0,000	50,4	1638
1,000	49,6	1612
Total	100,0	3250

Difference roa 3
Adj. P-value=0,000, Chi-square=300,758, df=6

$\leq -0,5513$ $(-0,5513, -0,2626]$ $(-0,2626, -0,1122]$ $(-0,1122, -0,0063]$ $(-0,0063, 0,0520]$ $(0,0520, 0,1473]$ $> 0,1473$

Node 1

Category	%	n
0,000	79,9	259
1,000	20,1	65
Total	10,0	324

Node 2

Category	%	n
0,000	70,9	231
1,000	29,1	95
Total	10,0	326

Node 3

Category	%	n
0,000	60,1	196
1,000	39,9	130
Total	10,0	326

Node 4

Category	%	n
0,000	52,8	343
1,000	47,2	307
Total	20,0	650

Node 5

Category	%	n
0,000	38,1	371
1,000	61,9	603
Total	30,0	974

Node 6

Category	%	n
0,000	30,2	98
1,000	69,8	227
Total	10,0	325

Node 7

Category	%	n
0,000	43,1	140
1,000	56,9	185
Total	10,0	325

Adjusted Total assets in year 3
Adj. P-value=0,000, Chi-square=16,538, df=1

Adjusted Total assets in year 3
Adj. P-value=0,000, Chi-square=22,256, df=1

$\leq 0,3981$ $> 0,3981$

$\leq 0,3981$ $> 0,3981$

Node 8

Category	%	n
0,000	61,8	175
1,000	38,2	108
Total	8,7	283

Node 9

Category	%	n
0,000	45,8	168
1,000	54,2	199
Total	11,3	367

Node 10

Category	%	n
0,000	47,2	182
1,000	52,8	204
Total	11,9	386

Node 11

Category	%	n
0,000	32,1	189
1,000	67,9	399
Total	18,1	588

Industry concentration in year 3
Adj. P-value=0,000, Chi-square=26,920, df=1

$\leq 0,6814$ $> 0,6814$

Node 12

Category	%	n
0,000	44,3	105
1,000	55,7	132
Total	7,3	237

Node 13

Category	%	n
0,000	23,9	84
1,000	76,1	267
Total	10,8	351

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Age	Unadjusted	Adjusted
1	I IC G	I R IG
2	R I _{IC} , R A _{IE}	R I , R IE
3	R IC , R IC	R A - , R A IC

Conclusions:

- Leverage and profitability are the most significant impacting factors to new firm survival;
- Industry entry and industry concentration impact more on new firm survival during the recent depression period than industry growth does;
- Industry adjustment tends to reduce the influence of industry-specific factors;
- Industry adjustment impacts little on the correct percent of classification.
- When profitability is high, Industry concentration factor tend to be significant.

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Thanks a lot