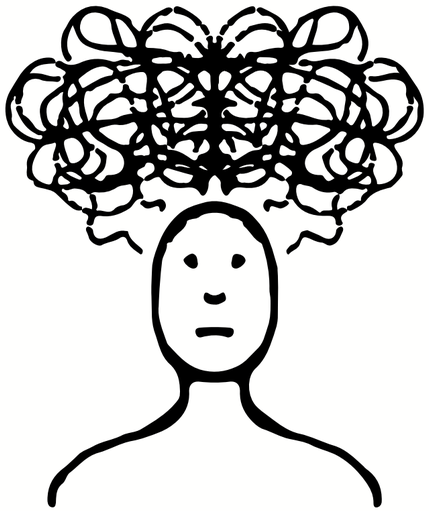
Edward I. Atman

PREDICTION OF CORPORATE BANKRUPTCY

ELISA PONTIVI

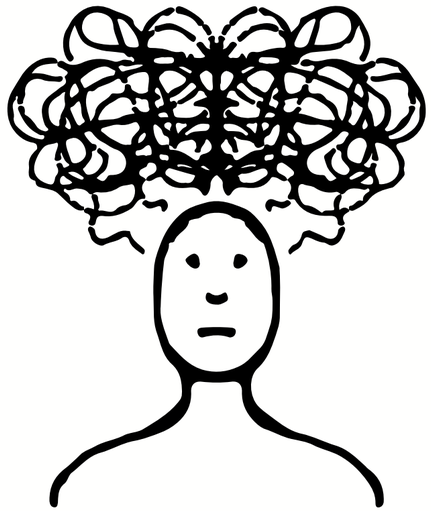
"A firm with poor profitability and/or solvency record may be regarded as a potential bankrupt. However because of its above average liquidity the situations may not be considered seriously."

Altman, 1968



WHICH **RATIOS** ARE MOST IMPORTANT IN DETECTING BANKRUPTCY POTENTIAL, WHAT **WEIGHTS** SHOULD BE ATTACHED TO THOSE SELECTED RATIOS AND **HOW SHOULD THE WEIGHTS BE OBJECTIVELY ESTABLISHED**?

Altman, 1968



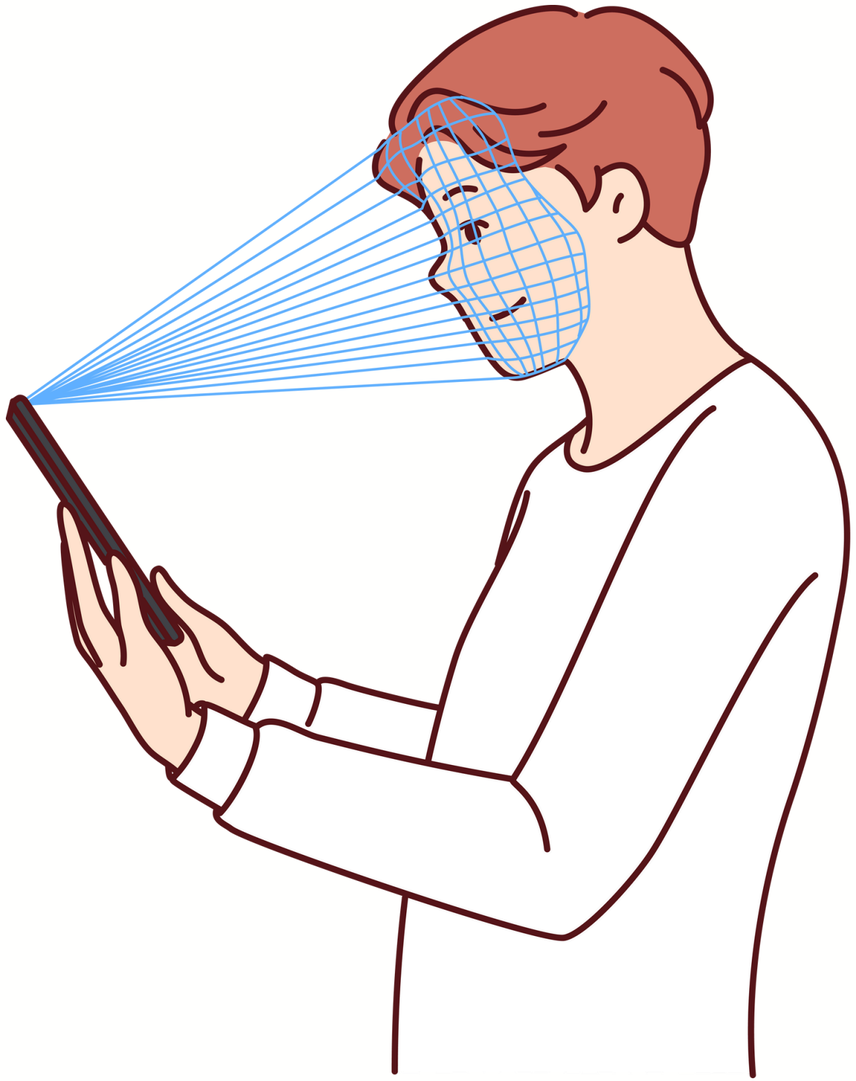
L'obiettivo di Altman è quello di identificare un modello per prevedere il rischio di **default** *di una società, partendo dai dati di bilancio.*

mda

MULTIPLE DISCRIMINANT ANALYSIS

The objective of discriminant analysis is to determine group membership of samples from a group of predictors by finding linear combinations of the variables which maximize the differences between the populations being studied, with the objective of establishing a model to sort objects into their appropriate populations with minimal error.

Brown, 1998



33 società fallite

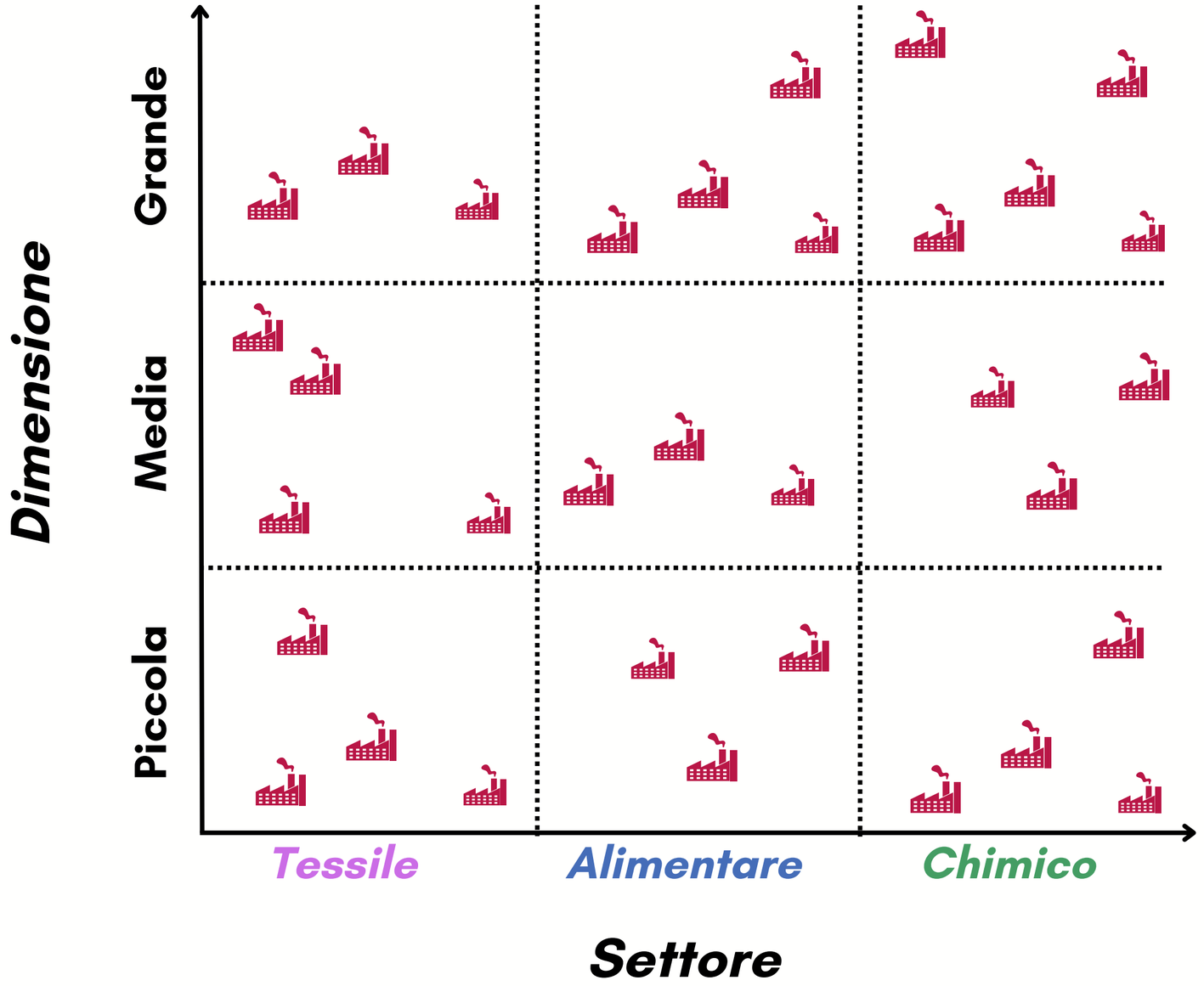
- *Società **manifatturiere** che avevano presentato istanza di fallimento secondo il Capitolo X del National Bankruptcy Act nel periodo 1946–1965.*
- *Dimensione media degli asset: $6,4 milioni*
- *Range dimensionale: da $0,7 a $25,9 milioni*

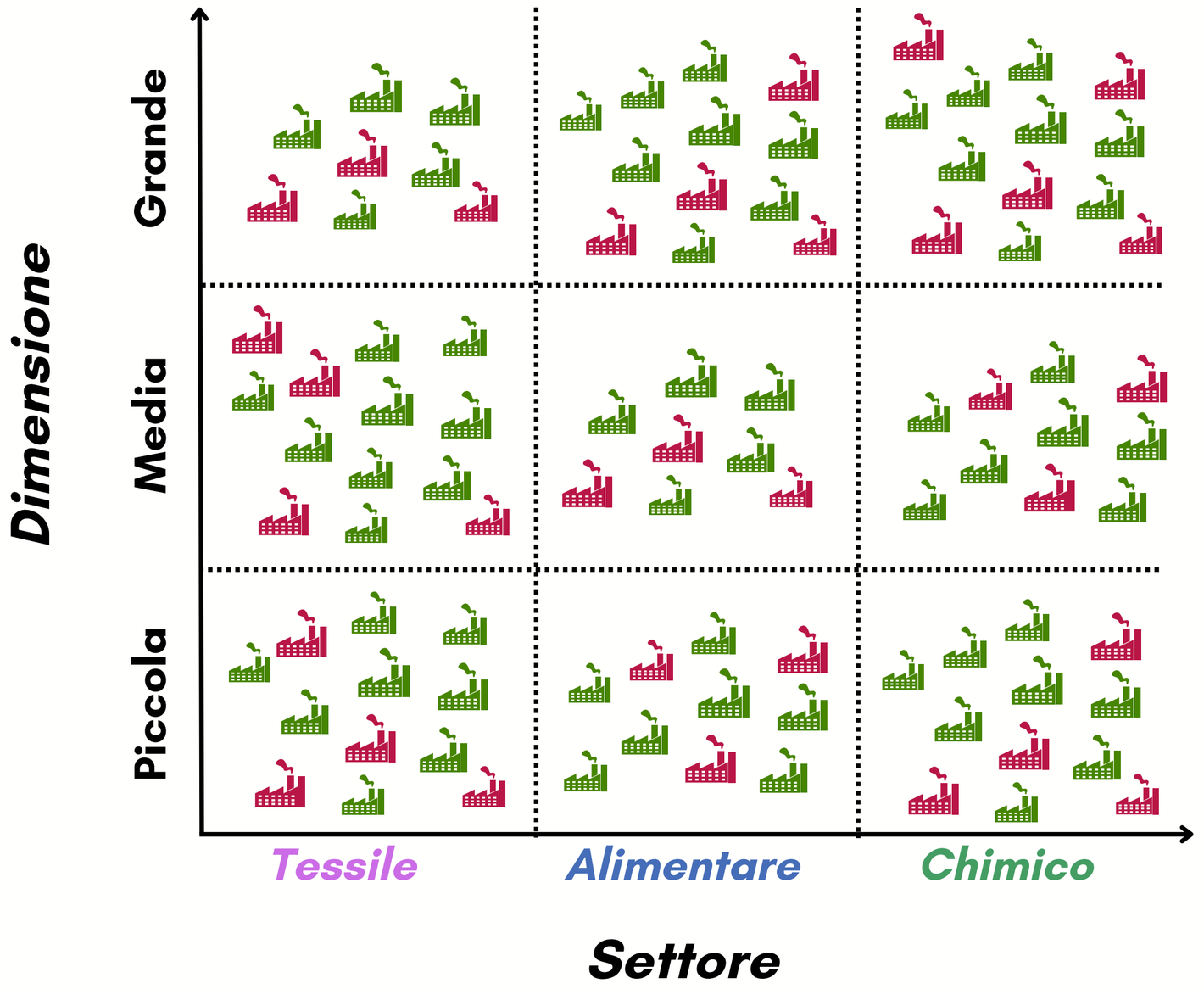
33 società fallite

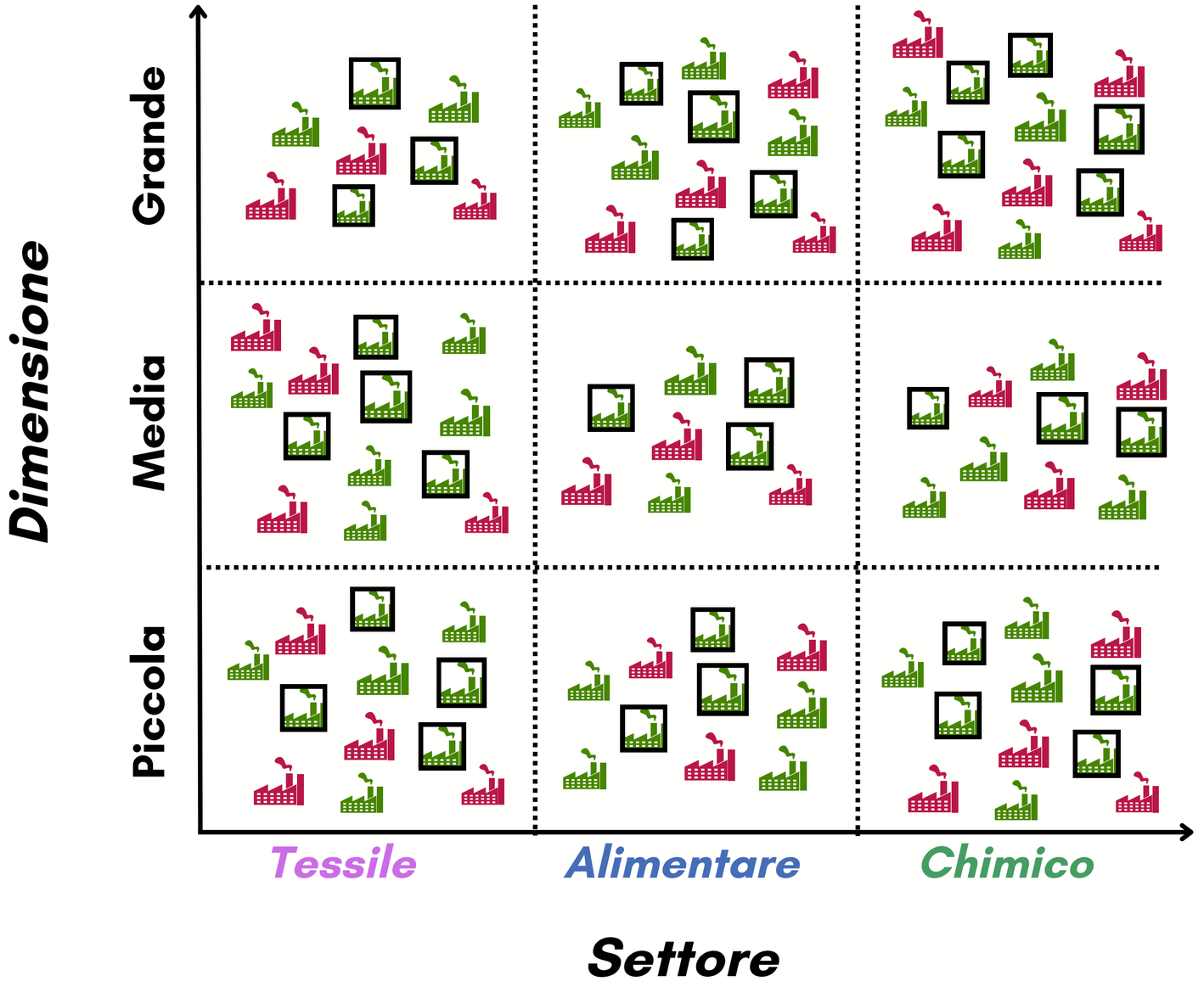
- *Società **manifatturiere** che avevano presentato istanza di fallimento secondo il Capitolo X del National Bankruptcy Act nel periodo 1946–1965.*
- *Dimensione media degli asset: $6,4 milioni*
- *Range dimensionale: da $0,7 a $25,9 milioni*

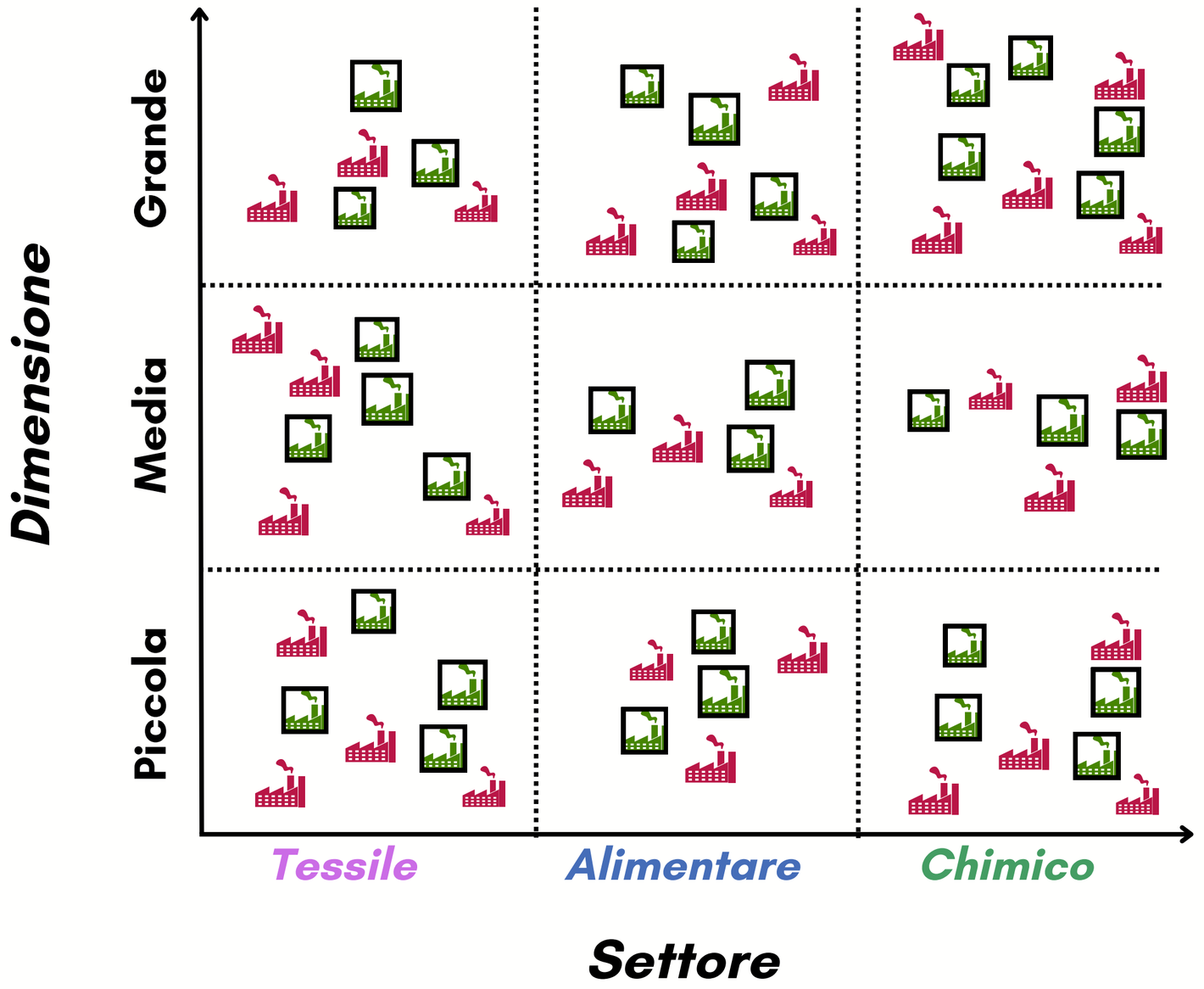
33 società non fallite

- *Selezionate con **campionamento casuale stratificato per settore e dimensione***
- *Range dimensionale limitato: da $1 a $25 milioni*
- *Dimensione media degli asset: $9,6 milioni (leggermente superiore al Gruppo 1)*
- *Range dimensionale: da $0,7 a $25,9 milioni*


Dimensione
Grande
Media
Piccola
Tessile
Alimentare
Chimico
Settore


Dimensione
Grande
Media
Piccola
Tessile
Alimentare
Chimico
Settore


Dimensione
Grande
Media
Piccola
Tessile
Alimentare
Chimico
Settore


Dimensione
Grande
Media
Piccola
Tessile
Alimentare
Chimico
Settore

DAI BILANCI CALCOLANO 22 INDICI

- *LIQUIDITY: liquidità*
- *PROFITABILITY: redditività*
- *LEVERAGE: leva finanziaria*
- *SOLVENCY: solvibilità*
- *ACTIVITY RATIOS: indicatori di attività*

si massimizza la distanza tra i valori medi dei due gruppi

si minimizza la varianza del gruppo

si minimizza la varianza del gruppo

$$Z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + + \beta_p x_p$$

si massimizza la distanza tra i valori medi dei due gruppi

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si minimizza la varianza del gruppo

$$Z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + + \beta_p x_p$$

COEFFICIENTI
calcolati con la MDA

INDICI DI BILANCIO

DAI BILANCI CALCOLANO 22 INDICI

- *LIQUIDITY: liquidità*
- *PROFITABILITY: redditività*
- *LEVERAGE: leva finanziaria*
- *SOLVENCY: solvibilità*
- *ACTIVITY RATIOS: indicatori di attività*

1. *Observation of the statistical significance of various alternative functions including determination of the relative contributions of each independent variable;*
2. *Evaluation of inter-correlations between the relevant variables;*
3. *Observation of the predictive accuracy of the various profiles;*
4. *Judgment of the analyst.*

Edward I. Altman

Z SCORE

$$Z = 1.2\,X_1 + 1.4\,X_2 + 3.3\,X_3 + 0.6\,X_4 + 1.0\,X_5$$

X_1 = Working Capital/Total Assets

X_2 = Retained Earnings/Total Assets

X_3 = Earnings before Interest and Taxes/Total Assets

X_4 = Market Value of Equity/Book Value of Total Liabilities

X_5 = Sales/Total Assets

Z = Overall Index or Score

FIGURE 11.3 The Z-Score Model

Source: Altman (1968).

Altman, 1993

DISTRESS AREA

GREY AREA

SAFE AREA

1,81

2,99

Modello	Formula	Soglie	Applicazione
Z-Score (1968)	$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$	✓ > 2.99: Sicura ⚠ 1.81-2.99: Grigia ✗ < 1.81: Rischio	Aziende quotate manifatturiere
Z'-Score (1983)	$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$	✓ > 2.9: Sicura ⚠ 1.23-2.9: Grigia ✗ < 1.23: Rischio	Aziende private manifatturiere
Z"-Score (1983)	$Z'' = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$	✓ > 5.85: Rating BBB+ ⚠ 4.15-5.85: BB-B ✗ < 1.75: Default	Aziende private tutti i settori
EM Score (1995)	Base: $Z'' = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$ Modificato con processo in 6 fasi qualitative	Valutazione integrata quantitativa e qualitativa	Mercati emergenti obbligazioni in valuta estera

Legenda variabili:

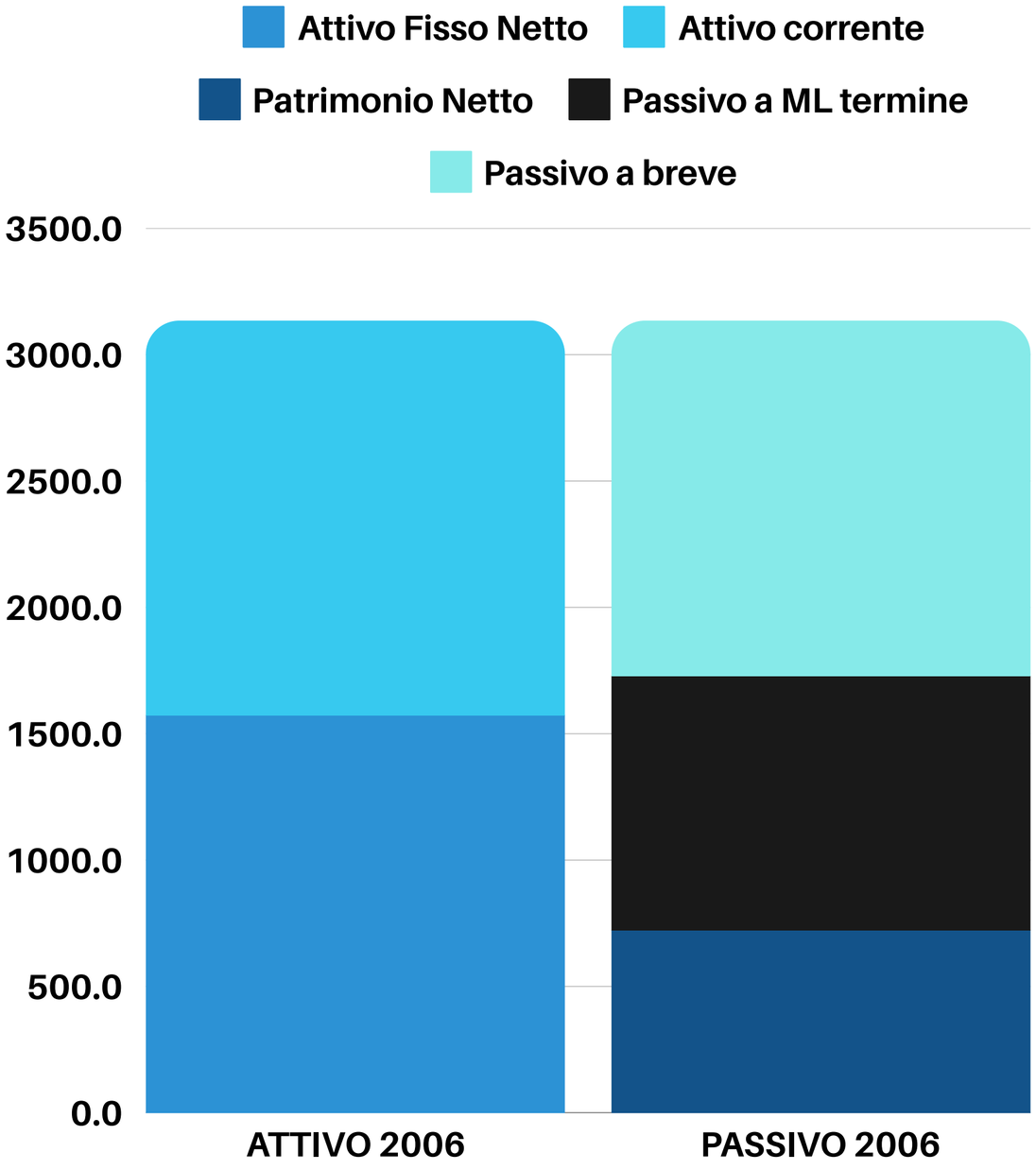
X_1 = Capitale Circolante/Totale Attivo

X_2 = Utili non distribuiti/Totale Attivo

X_3 = EBIT/Totale Attivo

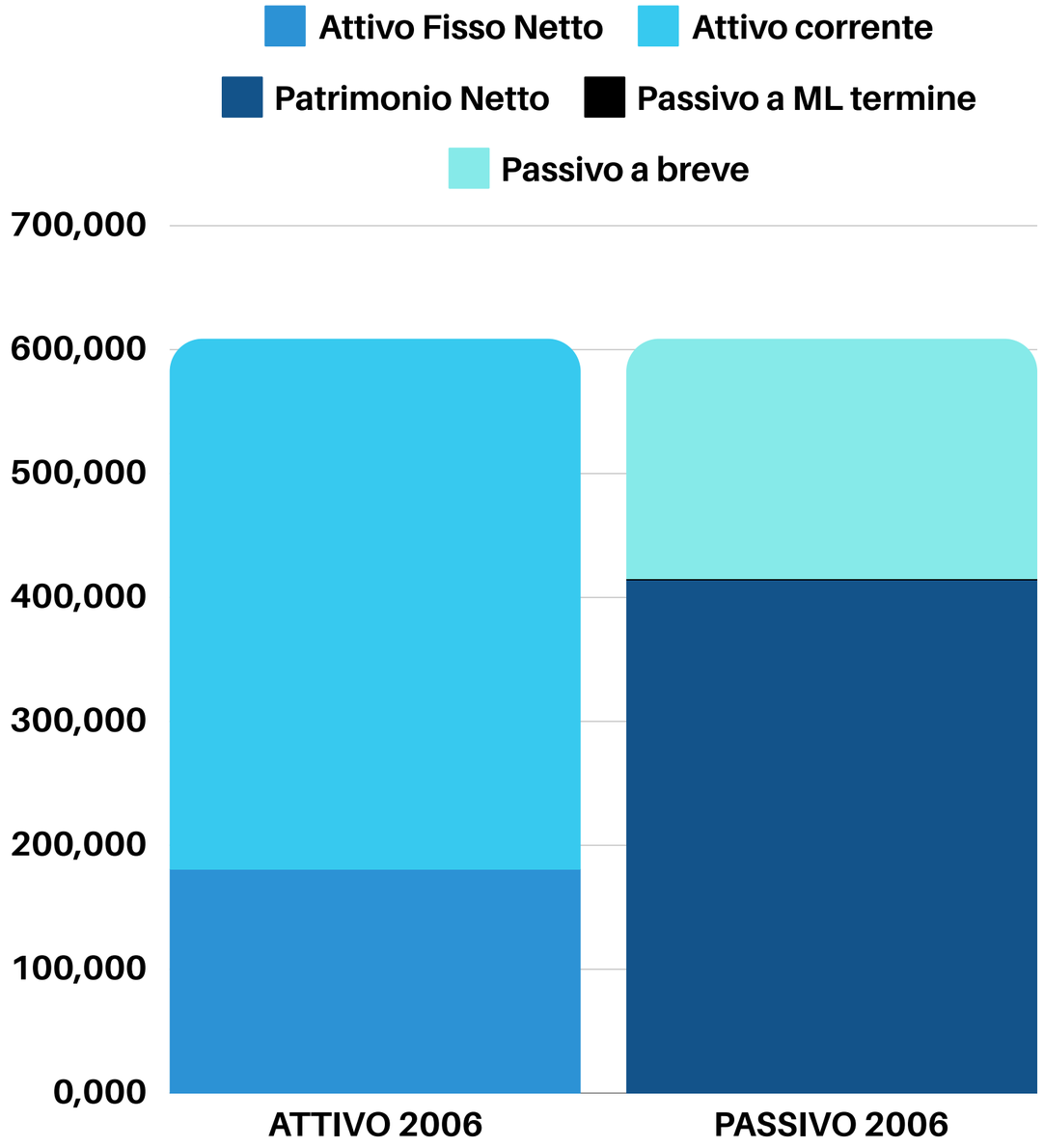
X_4 = Val. di mercato (o contabile) capitale/Val. contabile debito

X_5 = Vendite/Totale Attivo



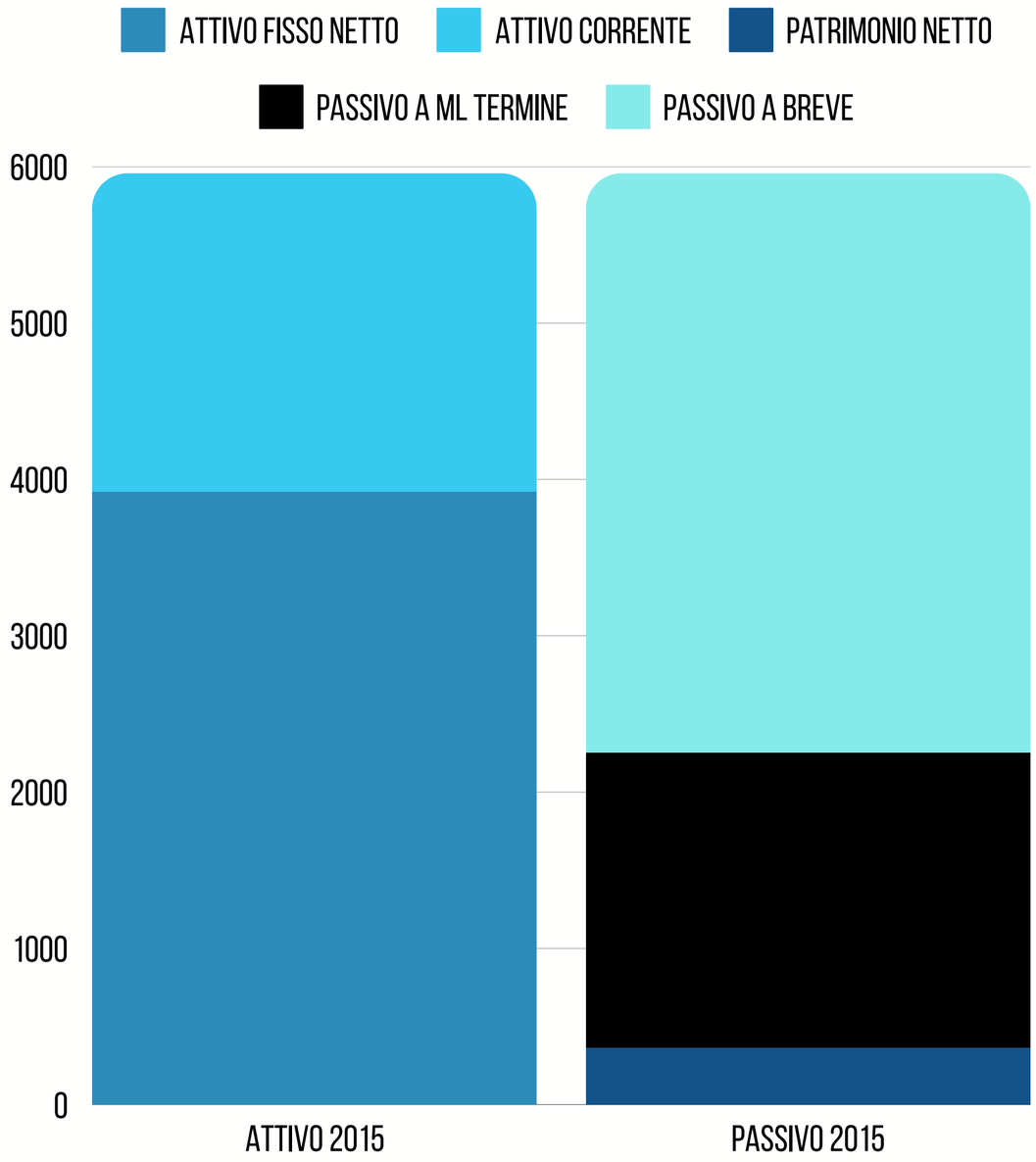
	$ (in milioni)
Vendite	5522,2
Costo del Venduto	2479,7
GROSS PROFIT	**3042,5**
Altre spese operative	2968,9
EBIT	**73,6**
Interessi e tasse	34,4
NET INCOME	**39,2**

BLOCKBUSTER, 7 ANNI PRIMA DEL FALLIMENTO



	$ (in migliaia)
Vendite	996,660
Costo del Venduto	626,985
GROSS PROFIT	**369,675**
Altre spese operative	305,261
EBIT	**64,414**
Interessi e tasse	15,332
NET INCOME	**49,082**


NETFLIX



	£ (in milioni)
Vendite	7834
Costo del Venduto	6062
GROSS PROFIT	**1772**
Altre spese operative	1561
EBIT	**211**
Interessi e tasse	192
NET INCOME	**19**

THOMAS COOK, 4 ANNI PRIMA DEL FALLIMENTO

BLOCKBUSTER (2006)

$$X_1 = \frac{\text{Working capital}}{\text{Total asset}} =$$

$$X_2 = \frac{\text{Retained earnings}}{\text{Total asset}} =$$

$$X_3 = \frac{\text{EBIT}}{\text{Total asset}} =$$

$$X_4 = \frac{\text{Book value equity}}{\text{Book value of total debt}} =$$

$$X_5 = \frac{\text{Sales}}{\text{Total asset}} =$$

CURRENT ASSET	1562,4
LONG TERM ASSETS	1572,2
CURRENT LIABILITIES	1405,4
LONG TERM LIABILITIES	1005,9
EQUITY	723,3
RETAINED EARNINGS	-4781,9
SALES	3413,1
EBIT	73,6

BLOCKBUSTER (2006)

$$X_1 = \frac{\text{Working capital}}{\text{Total asset}} = \frac{1562,4-1405,4}{1562,4+1572,2} = 0,0500$$

$$X_2 = \frac{\text{Retained earnings}}{\text{Total asset}} =$$

$$X_3 = \frac{\text{EBIT}}{\text{Total asset}} =$$

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$$X_2 = \frac{\text{Retained earnings}}{\text{Total asset}} = \frac{-4781,9}{1562,4+1572,2} = -1,5255$$

$$X_3 = \frac{\text{EBIT}}{\text{Total asset}} =$$

$$X_4 = \frac{\text{Book value equity}}{\text{Book value of total debt}} =$$

$$X_5 = \frac{\text{Sales}}{\text{Total asset}} =$$

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$$X_2 = \frac{\text{Retained earnings}}{\text{Total asset}} = \frac{-4781,9}{1562,4+1572,2} = -1,5255$$

$$X_3 = \frac{\text{EBIT}}{\text{Total asset}} = \frac{73,6}{1562,4+1572,2} = 0,02348$$

$$X_4 = \frac{\text{Book value equity}}{\text{Book value of total debt}} =$$

$$X_5 = \frac{\text{Sales}}{\text{Total asset}} =$$

CURRENT ASSET	1562,4
LONG TERM ASSETS	1572,2
CURRENT LIABILITIES	1405,4
LONG TERM LIABILITIES	1005,9
EQUITY	723,3
RETAINED EARNINGS	-4781,9
SALES	3413,1
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$$X_2 = \frac{\text{Retained earnings}}{\text{Total asset}} = \frac{-4781,9}{1562,4+1572,2} = -1,5255$$

$$X_3 = \frac{\text{EBIT}}{\text{Total asset}} = \frac{73,6}{1562,4+1572,2} = 0,02348$$

$$X_4 = \frac{\text{Book value equity}}{\text{Book value of total debt}} = \frac{723,3}{1405,4+1005,9} = 0,3000$$

$$X_5 = \frac{\text{Sales}}{\text{Total asset}} =$$

CURRENT ASSET	1562,4
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$$X_3 = \frac{\text{EBIT}}{\text{Total asset}} = \frac{73,6}{1562,4+1572,2} = 0,02348$$

$$X_4 = \frac{\text{Book value equity}}{\text{Book value of total debt}} = \frac{723,3}{1405,4+1005,9} = 0,3000$$

$$X_5 = \frac{\text{Sales}}{\text{Total asset}} = \frac{3413,1}{1562,4+1572,2} = 1,0888$$

CURRENT ASSET	1562,4
LONG TERM ASSETS	1572,2
CURRENT LIABILITIES	1405,4
LONG TERM LIABILITIES	1005,9
EQUITY	723,3
RETAINED EARNINGS	-4781,9
SALES	3413,1
EBIT	73,6

BLOCKBUSTER (2006)

$$Z' = 0{,}717X_1 + 0{,}847X_2 + 3{,}107X_3 + 0{,}42X_4 + 0{,}998X_5$$

Current Asset	**1562,4**
Long term assets	1572,2
Current liabilities	1405,4
Long term liabilities	1005,9
Equity	723,3
Retained earnings	-4781,9
Sales	3413,1
EBIT	73,6

$X_1 = 0{,}0500$

$X_2 = -1{,}5255$

$X_3 = 0{,}02348$

$X_4 = 0{,}3000$

$X_5 = 1{,}0888$

$$Z' = 0{,}717 * 0{,}05 + 0{,}847 * (-1{,}5255) + 3{,}107 * 0{,}02348 + 0{,}42 * 0{,}300 + 0{,}998 * 1{,}088 = 0{,}0294$$

DISTRESS AREA

GREY AREA

SAFE AREA

1,23

2,90

DISTRESS AREA

GREY AREA

SAFE AREA

0,0294

1,23

2,90

BLOCKBUSTER (2006)

$$Z'' = 3{,}25 + 6{,}56X_1 + 3{,}26X_2 + 6{,}72X_3 + 1{,}05X_4$$

Current Asset	**1562,4**
Long term assets	1572,2
Current liabilities	1405,4
Long term liabilities	1005,9
Equity	723,3
Retained earnings	-4781,9
Sales	3413,1
EBIT	73,6

$X_1 = 0{,}0500$

$X_2 = -1{,}5255$

$X_3 = 0{,}02348$

$X_4 = 0{,}3000$

$$Z'' = 3{,}25 + 6{,}56 * 0{,}05 + 3{,}26 * (-1{,}5255) + 6{,}72 * 0{,}02348 + 1{,}05 * 0{,}300 = -0{,}9219$$

THOMAS COOK

NETFLIX

DISTRESS AREA

GREY AREA

SAFE AREA

4,75

6,25

THOMAS COOK

NETFLIX

DISTRESS AREA

GREY AREA

SAFE AREA

-0,92

4,75

6,25

THOMAS COOK

NETFLIX

DISTRESS AREA

GREY AREA

SAFE AREA

0,029

0,997

1,23

2,90

3,08

THOMAS COOK

NETFLIX

DISTRESS AREA

GREY AREA

SAFE AREA

-0,92

0,75

4,75

6,25

8,51

GLI INDICI DI BILANICO SONO SUFFICIENTI?

- Payment behavior variables
- Management board related variables
- Employee-related variables

OMEGA SCORE (ALTMAN ET AL. 2022)

Be good to be wise: Environmental, Social, and Governance awareness as a potential credit risk mitigation factor

Marina Brogi | Valentina Lagasio | Pasqualina Porretta

- Esamina la relazione tra la consapevolezza ESG delle aziende e il loro rischio di credito, misurato tramite l'Altman Z-score.
- **ESG (Environmental, Social, and Governance): rappresenta un insieme di fattori di sostenibilità utilizzati per misurare l'attenzione delle aziende verso l'ambiente, le pratiche sociali e la governance aziendale.**
- I risultati mostrano che un'elevata consapevolezza ESG è fortemente associata a una migliore affidabilità creditizia: maggiore è lo score ESG, minore è il rischio di credito dell'azienda.

REFERENCES: