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On Multicriteria Business Performance Measurement

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Summary

1. **Shareholder Value Analysis (SVA) and Multicriteria**

2. **The basic Corporate Strategies**
   - The Restructuring Hexagon (by Copeland)

3. **Criteria to measure Business Perfomance**
   a. Discounted Cash Flow (DCF) criterion
   b. Cash Flow Return On Investment (CFROI) criterion
   c. Value Return On Investment (ValueROI) criterion
   d. Payback Period (PP) criterion

4. **Limitations in monocriterion measurement**

5. **Multicriteria analysis of Corporate Strategies**
   - Tutorial Numerical Example

Shareholder Value Analysis (SVA) and Multicriteria

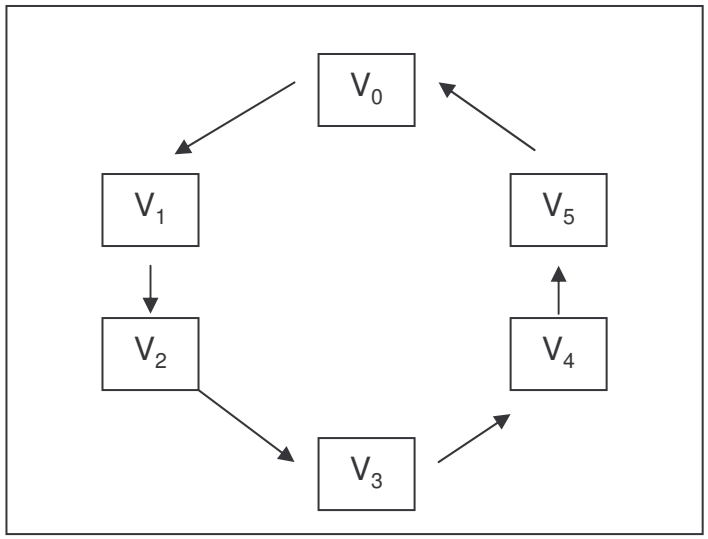
SVA: methodology to measure business performance

Shareholder Value (measured by DCF) is the performance metric that uses the best and most complete set of information

The three main objectives of the paper

- The evaluation of a business strategy cannot be conducted by the maximization of a unique criterion (as in the traditional monocriterion SVA)
- It is impossible to maximize in more than one dimension. The strategic choice has to be *satisfacing* and not *maximizing* (Simon, 1969, 1983)
- It is possible to obtain logically rigorous solutions by an outranking multicriteria algorithm

The basic Corporate Strategies



The Restructuring Hexagon
(Copeland, *et al.* 2000)

V_0 = Market Current Value

Strategies:

a_1 = do nothing - "as is" scenario → V_1 value
a_2 = "internal improvement" → V_2 value
a_3 = "external improvement" → V_3 value
a_4 = "new growth opportunity" → V_4 value
a_5 = "financial engineering" → V_5 value

Criteria to measure Business Performance

a. Discounted Cash Flow (DCF) criterion

$$DCF = \sum_{t=0}^{T} CF(t)(1+i)^{-t}$$

$CF(t)$ = Cash Flow at the time t

i = Weighted Average Cost of Capital

$$\Delta wealth = DCF$$

Strategy a* such that:

$$DCF(a^*) = \max DCF$$

b. The ROI criterion in terms of Cash Flow (Cash Flow ROI – CFROI)

$$CFROI = i^* \text{ such that } DCF(i^*) = 0$$

Strategy a* such that:

$$i(a^*) = \max i$$

c. The Value ROI criterion

$$Value\,\text{ROI} = \frac{DCF}{I}$$

I = Value of Investment (Cost) related to the DCF

Strategy a* such that:

$$Value\text{ROI}(a^*) = \max Value\text{ROI}$$

d. The Payback Period (PP) criterion

$$PP = \min T^* \text{ such that } DCF = \sum_{t=0}^{T^*} CF(t)(1+i)^{-t} \geq 0$$

Strategy a* such that:

$$PP(a^*) = \min PP$$

Limitations in monocriterion measurement

All measures are estimates!

- cost of capital (wacc)
- individual cash flows
- length of planning horizon

Sensitivity analysis
"What should be the DCF of a strategy if the WACC were overstated by 5%?"

It is generally difficult to assign a probability distribution to the occurrences of the values

then

sensitivity analysis can be a pragmatic way to handle strategic uncertainty

Criteria / Strategies	DCF	Sensitivity
a_1	4	medium
a_2	10	high
a_3	9	low

DCF (profitability) and sensitivity

Strategy a_3 could be the satisfactory one

Limitations in monocriterion measurement

Example: **Matrix of multicriteria evaluation (*i* = 10%)**

Criteria / Strategies	*DCF*	*CFROI*	*Value ROI*	*PP*
a_1	199	13%	7,9%	4,57 years
a_2	186	70%	186%	1,5 years

DCF and CFROI

DCF (a_1) =199 > DCF (a_2) = 186 *but* CFROI (a_2) = 70% > CFROI (a_1) = 13%

CFROI can be interpreted as the DCF "break-even value"

"quality" of DCF (a_1) < "quality" of DCF (a_2)

Let suppose: i = 10% ⟶ *15%*

CFROI (a_2) = 70% > *i* = 15% DCF (a_2) > 0 also for *i* = 15%

a_2 maintains its ability to create value

CFROI (a_1) = 13% < *i* = 15% DCF (a_1) < 0 for *i* = 15%

a_1 destroys value

Limitations in monocriterion measurement

DCF and ValueROI

What is the error in the discounted inflow (cash in) estimate that makes the DCF equal to zero?

DCF = B – C

B = discounted cash inflows

C = discounted cash outflows

Safety margin = $\frac{B - B^*}{B} = \frac{\Delta B}{B}$

$B^* = B_{bep}$

(B s.t. DCF = 0)

It can be simply obtained that: $\frac{\Delta B}{B} = 1 - \frac{1}{1 + ValueROI}$ **The higher the Value ROI, the higher the Safety margin**

$$\frac{\Delta B}{B}(a_1) = 1 - \frac{1}{1 + 0{,}079} = 0{,}069\ (6{,}9\%)$$

$$\frac{\Delta B}{B}(a_2) = 1 - \frac{1}{1 + 1{,}86} = 0{,}65\ (65\%)$$

} “quality” of DCF (a_2) > “quality” of DCF (a_1)

DCF and Payback Period (PP)

What will happen to the DCF if the effects of the strategy are interrupted before the estimated final time T?

Safety margin (in terms of payback) (let suppose T = 5)

$$\frac{\Delta T}{T} = \frac{T - T^*(a_1)}{T} = \frac{5 - 4{,}7}{5} = 0{,}086\ \ (8{,}6\%)$$

$$\frac{\Delta T}{T} = \frac{T - T^*(a_2)}{T} = \frac{5 - 1{,}5}{5} = 0{,}7\ \ (70\%)$$

} “quality” of DCF (a_2) > “quality” of DCF (a_1)

Multicriteria analysis of Corporate Strategies

Set of strategic alternatives $A = \{a_1, a_2, ..., a_n\}$ **Set of evaluation criteria $G = \{g_1, g_2, ..., g_m\}$**

***Problem*: taking into account of all the criteria contemporaneously, choose the satisfactory strategic alternative, that is the alternative that outranks the others**

Let:

$A = \{a_1, a_2, a_3, a_4, a_5\}$
a_1 = do nothing ("as is") strategy
a_2 = "internal improvement" strategy
a_3 = "external improvement" strategy
a_4 = "new growth opportunity" strategy
a_5 = "financial engineering" strategy

$G = \{g_1, g_2, g_3, g_4\}$
g_1 = Discounted Cash Flow (DCF)
g_2 = Cash Flow ROI (CFROI)
g_3 = Value ROI (ValueROI)
g_4 = Payback Period (PP)

Multicriteria Matrix for the evaluation of Strategies

A \ G	g_1 (DCF billions)	g_2 (CFROI)	g_3 (Value ROI)	g_4 (Payback years)
a_1	8	14%	20%	1
a_2	9	16%	21%	2
a_3	12	18%	23%	5
a_4	7	17%	15%	3
a_5	10	20%	25%	4
weight	0,30	0,20	0,20	0,30

Multicriteria analysis of Corporate Strategies

Matrix of the Concordance Subsets (J^c)

$J^c(a_h, a_k) = \{j \in J / gj(a_h)$ *is weakly preferred to* $g_j(a_k)\}$
$h = 1, \ldots, 5$
$k = 1, \ldots, 5$

$J = \{1, 2, 3, 4\}$

	a_1	a_2	a_3	a_4	a_5
a_1		[4]	[4]	[1, 3, 4]	[4]
a_2	[1, 2, 3]		[4]	[1, 3, 4]	[4]
a_3	[1, 2, 3]	[1, 2, 3]		[1, 2, 3]	[1]
a_4	[2]	[2]	[4]		[4]
a_5	[1, 2, 3]	[1, 2, 3]	[2, 3, 4]	[1, 2, 3]	

Concordance Index and Concordance Matrix

$$C(a_h, a_k) = \sum_{j=J^c} w_j$$

where:

w_j **is the weight assigned to the** *j-th* **criterion**

	a_1	a_2	a_3	a_4	a_5
a_1		0,30	0,30	0,80	0,30
a_2	0,70		0,30	0,80	0,30
a_3	0,70	0,70		0,70	0,30
a_4	0,20	0,20	0,30		0,30
a_5	0,70	0,70	0,70	0,70	

Multicriteria analysis of Corporate Strategies

Concordance Test

Threshold C*

$$Tc\,(a_h, a_k) = \begin{cases} 1 \text{ if } C(a_h, a_k) > C^* \\ 0 \text{ if otherwise (test not passed)} \end{cases}$$

For C* = 0,5 (50%)

Results of the Concordance Test

	a_1	a_2	a_3	a_4	a_5
a_1		0	0	1	0
a_2	1		0	1	0
a_3	1	1		1	0
a_4	0	0	0		0
a_5	1	1	1	1	

Multicriteria analysis of Corporate Strategies

Discordance Test

When there is not unanimity [$C(a_h, a_k) > C^*$ and $C(a_h, a_k) = \Sigma w_j < 1$]
there is a minority of criteria whereby a_k is better then a_h [$g_j(a_k)$ *is preferred to* $g_j(a_h)$]

Ex. Let consider a_3 and a_1. $g_4(a_3) = 5 > g_4(a_1) = 1$

Threshold of discordance: $v_4^* = 3$ years

$g_4(a_3) - g_4(a_1)$ **= 4 years >** v_4^* **= 3 years** ⟶ **Veto on the superiority of a_3 over a_1 !**

$$T_d(a_3, a_1) = \begin{cases} \text{1 if } g_4(a_3) - g_4(a_1) \le 3 \text{ years (test passed)} \\ \text{0 if otherwise (test not passed)} \end{cases}$$

Discordance Matrix

	a_1	a_2	a_3	a_4	a_5
a_1		1	1	1	1
a_2	1		1	1	1
a_3	0	1		1	1
a_4	1	1	1		1
a_5	1	1	1	1	

Thresholds (C^*, v_j^*)

=

Simon' levels of aspiration
(Simon, 1969, 1983)

Multicriteria analysis of Corporate Strategies

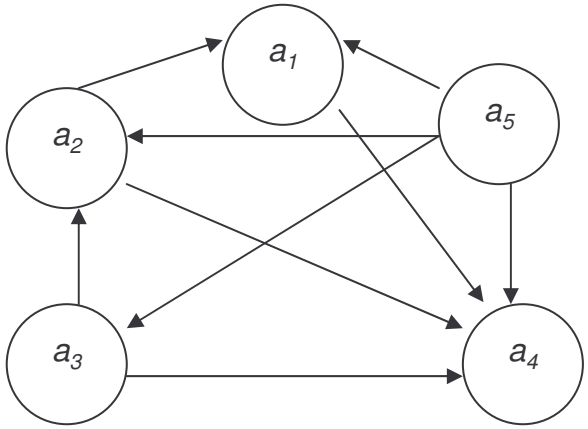
The binary Outranking Relation S

$$S(a_h, a_k) = \begin{cases} 1 \text{ if } Tc(a_h a_k) \text{ and } Td(a_h, a_k) \text{ are passed} \\ 0 \text{ if otherwise} \end{cases}$$

Outranking Matrix

	a_1	a_2	a_3	a_4	a_5
a_1		0	0	1	0
a_2	1		0	1	0
a_3	0	1		1	0
a_4	0	0	0		0
a_5	1	1	1	1	

Outranking Graph



Strategy a_5 "Financial Engineering" is the *satisfacing* strategic option

It is not the one that maximizes the DCF!

Conclusions

Corporate Finance literature: exclusive disjunction

method 1* or *method 2* or... or *method n

Satisfacing Multicriteria evaluation: conjunction

method 1 & method 2 &... & method n

Monocriterion Shareholder Value Analysis

"the ultimate objective of every enterprise is the maximization of shareholder value (profit)"

But "maximization of shareholder value (profit)" does not reveal the real behaviour of the strategic decision makers

The shareholder is interested in both the quantity and quality of profits