Financial Bear Traps in PFI Contracts

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Many a Slip...

- Various financial concepts are used in PFI deals:
  - IRR (*e.g.* "Base Case Equity IRR")
  - NPV
  - Pre- and post-tax cash flows
  - Nominal and real cash flows
- These may be outputs from the financial model or future calculations set out in the PFI Contract
- Problems in the use of such financial concepts in PFI:
  - Understanding
  - Misuse
  - Mistaken use
  - Gaps in standard PFI Contract provisions

Net Present Value (NPV)

- Basic NPV calculation -

Discount rate **10 %**

Year	Discount factor	Investment A Cash flow	Investment A NPV	Investment B Cash flow	Investment B NPV
0	1.0000	-1,000	-1,000	-1,000	-1,000
1	1.1000	340	309	200	182
2	1.2100	305	252	235	194
3	1.3310	270	203	270	203
4	1.4641	235	161	305	208
5	1.6105	200	124	340	211
Total		**350**	**49**	**350**	**-2**

Internal Rate of Return (IRR)

- Basic IRR calculation -

	Investment A			Investment B		
Year	Cash flow	Discount factor *	NPV	Cash flow	Discount factor *	NPV
0	-1,000	1.0000	-1,000	-1,000	1.0000	-1,000
1	340	1.1208	303	200	1.0994	182
2	305	1.2561	243	235	1.2087	194
3	270	1.4078	192	270	1.3288	203
4	235	1.5778	149	305	1.4609	209
5	200	1.7684	113	340	1.6061	212
Total	**350**		**0**	**350**		**0**
IRR	**12.08%**			**9.94%**		** @ IRR rate*

Is the IRR calculation realistic?

- Calculation depends on reinvestment at IRR rate:

End Year	Investment C	Investment D	Investment D @ 15%
0	-1,000	-1,000	
1	0	298	522
2	0	298	454
3	0	298	395
4	0	298	343
5	2,011	298	298
Total:	**1011**	**492**	**2011**
IRR:	**15.0%**	**15.0%**	
NPV:	**249**	**131**	

(NPV discount rate: 10.0%)

Modified IRR (MIRR)

- MIRR uses a realistic reinvestment rate -

End Year	Investment C	Investment D	Reinvestment of Investment C		MIRR calculation
			15.0%	10.0%	
0	-1,000	-1,000			-1,000
1	0	298	522	437	0
2	0	298	454	397	0
3	0	298	395	361	0
4	0	298	343	328	0
5	2,011	298	298	298	1,821
Total	**1,011**	**492**	**2,011**	**1,821**	**821**
NPV	**338**	**176**			
IRR	**15.0%**	**15.0%**			**12.7%**
MIRR	**15.0%**	**12.7%**			

NPV discount rate: 8.5%
Cost of capital: 10.0%
Reinvestment rate: 10.0% (= cost of capital)

The Green Book - use of NPV

- The new Green Book relies on NPV alone to evaluate projects because of the distortions caused by using IRR
- But this does not take account of the distortions caused by using only NPV for different-sized projects
- Which can be dealt with by looking at the cost/benefit ratio (but the Green Book does not say this):

Original Investment		-1,000	-2,000
Return after 1 year		1,400	2,600
NPV @	**10 %**	**273**	**364**
	IRR	**40 %**	**30 %**
NPV of benefits		*1,273*	*2,364*
Cost/benefit ratio (:1)		*1.273*	*1.182*

IRR: (1) VfM clause

- MoD PFI contracts commonly have a "value for money" clause which states that if the IRR exceeds *x%* (measured say every 5 years), the excess is shared with MoD (perhaps kept in escrow until end of term)
- But reaching the threshold in the early years is very difficult - IRR is a project life measurement:

Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
15% IRR:	-1000	200	200	200	200	200	200	200	200	200	200
IRR to date:				-22%	-8%	0%	5%	9%	12%	14%	**15%**
30% IRR	-1000	320	320	320	320	320	320	320	320	320	320
IRR to date:			-25%	-2%	11%	18%	23%	25%	27%	29%	**30%**
30% IRR	-1000	410	410	410	410	410	410	410	410	410	410
@ year 5						**30%**					**40%**

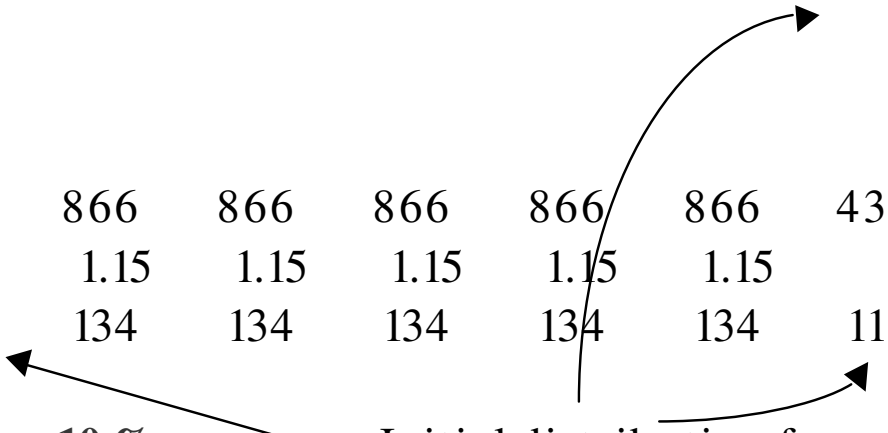
IRR: (2) Refinancing Gain-sharing

- A Refinancing Gain is defined in SoPC as:
  - the NPV of equity distributions post-refinancing

  minus
  - the NPV of equity distributions pre-refinancing
- OGC recommends the nominal post-tax Base Case Equity IRR as the NPV discount rate
- No sharing of refinancing gains if projected (post-tax) Equity IRR (over project life) is below Base Case
- Issues:
  - Paradox that a higher discount rate generally produces a higher NPV (& hence gain to be shared)
  - Measuring performance against Base Case IRR - cash *v*. commitment (also relevant to other IRR-related provisions such as VfM clause)

Refinancing Gain - Discount Rate

	Year:	1	2	3	4	5	Total
Project cash flow (before debt service)		1000	1000	1000	1000	1000	5000
Initial loan amount	**3300**						
Interest rate	5%						
Annual debt service		762	762	762	762	762	3811
Cover ratio		1.31	1.31	1.31	1.31	1.31	
Distributions to investors	0	238	238	238	238	238	1189
Refinanced loan amount	**3750**						
Interest rate	5%						
Annual debt service		866	866	866	866	866	4331
Cover ratio		1.15	1.15	1.15	1.15	1.15	
Distributions to investors	450	134	134	134	134	134	1119
Discount rate:	**15%**	**10%**					
NPV of distributions							
- post refinancing	899	957					
- pre refinancing	797	901					
Net gain to be shared	**102**	**56**					



Base Case IRR: Cash *v* Commitment

- IRR (*e.g.* for Base Case equity return threshold) should be measured on cash not commitment:

Year:	0	1	2	3	4	5	6	7	8
Cash basis									
Investment	-250	-250	-250						
Revenue				205	205	205	205	205	205
Cash flow	-250	-250	-250	205	205	205	205	205	205
IRR =	**12%**								
Commitment basis									
Investment	-750								
Revenue		0	0	205	205	205	205	205	205
Notional cash flow	-750	0	0	205	205	205	205	205	205
IRR =	**10%**								
Credit for return on undrawn investment									
Nominal Return *		25	12.5						
Notional cash flow	-750	25	12.5	205	205	205	205	205	205
IRR =	**11%**								

* *i.e.*, notional interest saved on undrawn investment @ 5%

Termination - Contractor Default

- Compensation payment by the Authority on termination for contractor default
- "Estimated Fair Market Value" method (where there is no actual market) of calculating CompOnTerm =
  - NPV of future Unitary Charges

  minus
  - NPV of estimated future costs to the Authority
- NPV discount rate is real pre-tax equity IRR
- Traps (small points with large financial effects):
  - Mixing up real and nominal cash flows, especially where Unitary Charge is partly indexed
  - Use of post-tax IRR instead of pre-tax
  - Inadequate compensation for cost overruns

  —*Any of which inflate the termination sum payment*

Trap (1) - Real & Nominal Numbers

- Termination sum calculation based on NPV of
  - inflated cash flow at nominal discount rate, *or*
  - deflated cash flow at real discount rate

RPI **2.5%**

NPV discount rate **10.0%** (= real pre-tax equity IRR)

	Year	**0**	**1**	**2**	**3**	**4**	**5**
Unitary charge inflated							
- 50% unindexed		100.00	100.00	100.00	100.00	100.00	100.00
- 50% indexed		100.00	102.50	105.06	107.69	110.38	113.14
NPV @ **12.8%** = **932.96**		200.00	202.50	205.06	207.69	210.38	213.14
Unitary charge deflated							
- 50% unindexed		100.00	97.56	95.18	92.86	90.60	88.39
- 50% indexed		100.00	100.00	100.00	100.00	100.00	100.00
NPV @ **10.0%** = **932.96**		200.00	197.56	195.18	192.86	190.60	188.39
Wrong answer							
- 50% unindexed		100.00	100.00	100.00	100.00	100.00	100.00
- 50% indexed		100.00	100.00	100.00	100.00	100.00	100.00
NPV @ **10.0%** = **958.16**		200.00	200.00	200.00	200.00	200.00	200.00

Trap (2) - Pre- and Post Tax

- As projected Unitary Charges are pre-tax the discount rate for the termination sum must also be pre-tax:-

RPI	**2.5%**
Pre-tax real equity IRR	**10.0%**
Post-tax real equity IRR	**7.0%**

Year	**0**	**1**	**2**	**3**	**4**	**5**
Unitary charge deflated						
- 50% indexed	100.00	100.00	100.00	100.00	100.00	100.00
- 50% unindexed	100.00	97.56	95.18	92.86	90.60	88.39
	200.00	197.56	195.18	192.86	190.60	188.39

NPV @ **10.0% = 932.96**

NPV @ **7.0% = 992.27**

- *i.e.* don't mix apples and oranges

Trap (3) - Covering Cost Overruns

- Authority's future costs are deducted from the future Unitary Charges to produce net termination sum
- But discounting future costs at Equity IRR does not cover the Authority for future cost overruns :

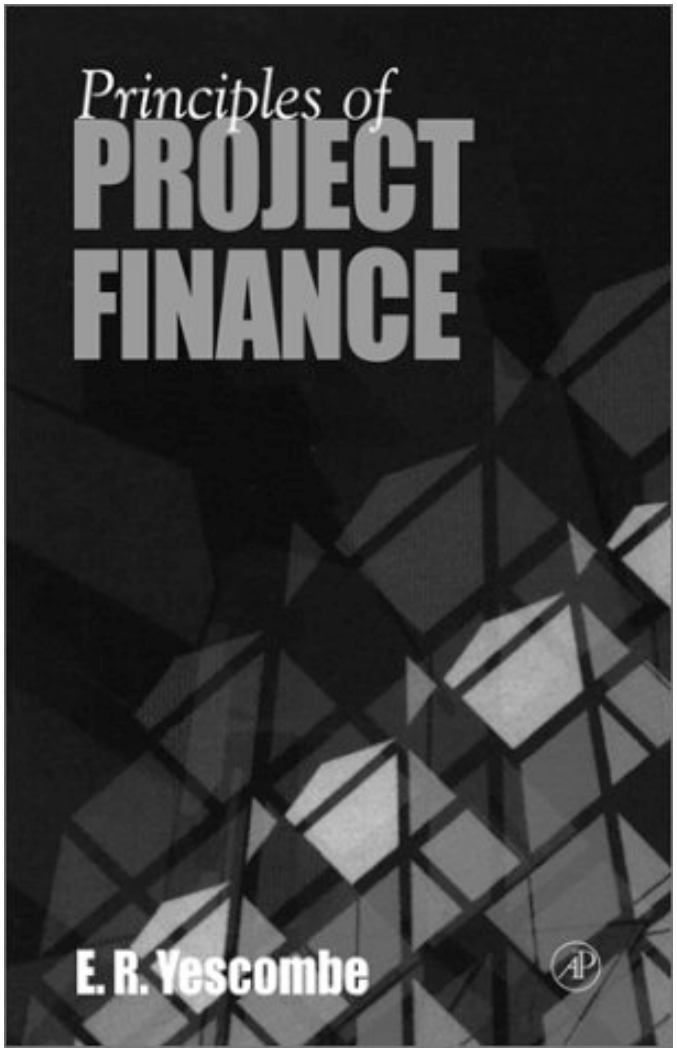
				Year:	**0**	**1**	**2**
Base Case construction cost					-100.0	-100.0	-100.0
NPV @	**12%**	=	-269.0				
Construction cost on termination*					-120.0	-120.0	-120.0
NPV @	**12%**	=	-322.8				
Extra cost					-20.0	-20.0	-20.0
Extra deduction from termination sum			**53.8**				

* PFI contract assumed to terminate the day after it is signed

Authority's cash flow post-termination			
Deduction from termination sum	53.8		
- interest on balance @ **4%**		0.0	1.4	0.6
- covering extra costs		-20.0	-20.0	-20.0
- balance C/F		33.8	13.8	**-6.2**

Conclusions

- Modeller must be part of the team, not stuck in a cupboard, and must understand what the PFI Contract is trying to do
- Contract standardisation (SoPC) does not remove the need for thought
- Small documentation changes may have large financial consequences
- Documents govern the model, not *vice-versa*
- Financial advisers are not infallible…



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