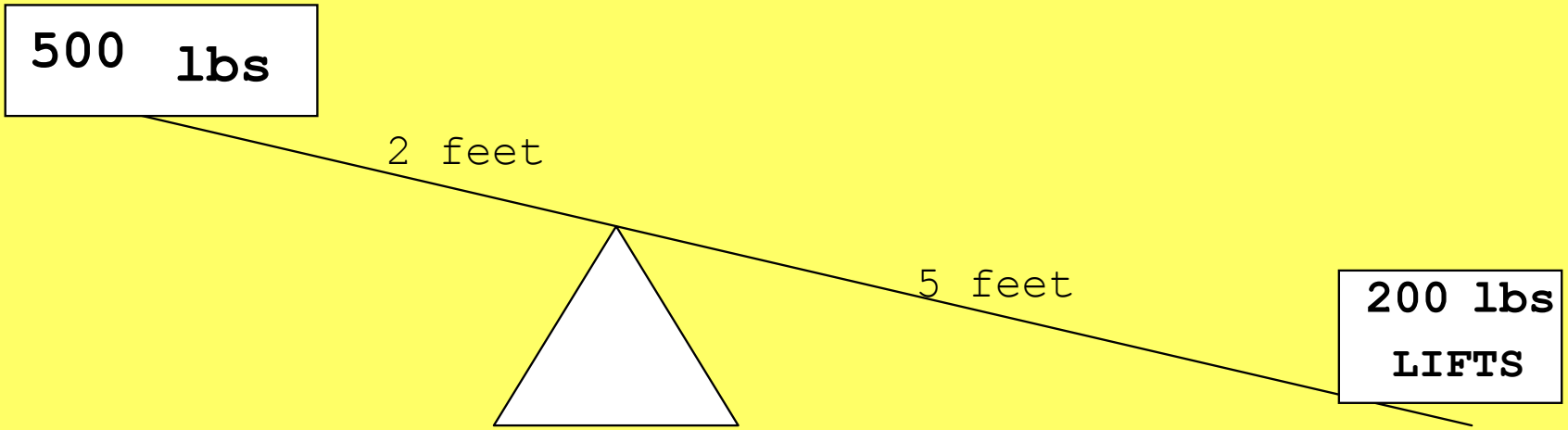
CHAPTER 13: LEVERAGE.

(The use of debt)

The analogy of physical leverage & financial leverage...

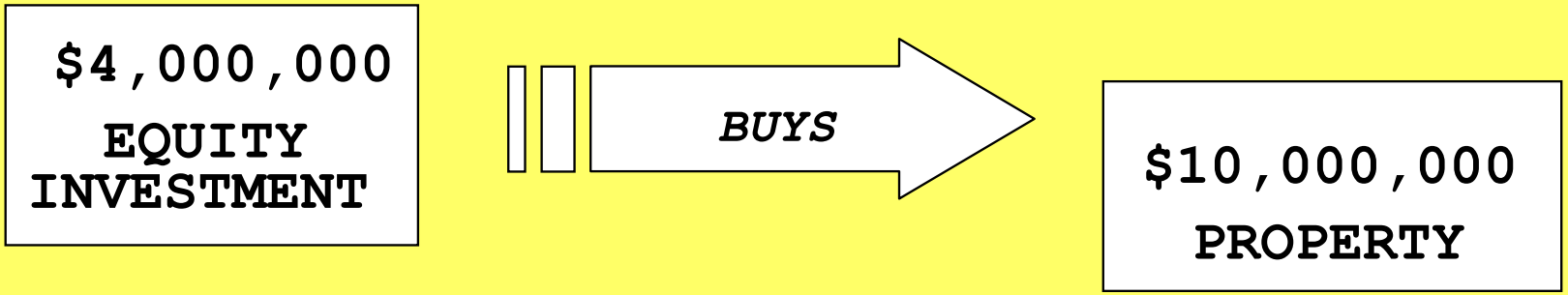
A Physical Lever...



"Leverage Ratio" = 500/200 = 2.5

"Give me a place to stand, and I will move the earth."
- Archimedes (287-212 BC)

Financial Leverage...



"Leverage Ratio" = $10,000,000 / $4,000,000 = 2.5

Equity = $4,000,000

Debt = $6,000,000

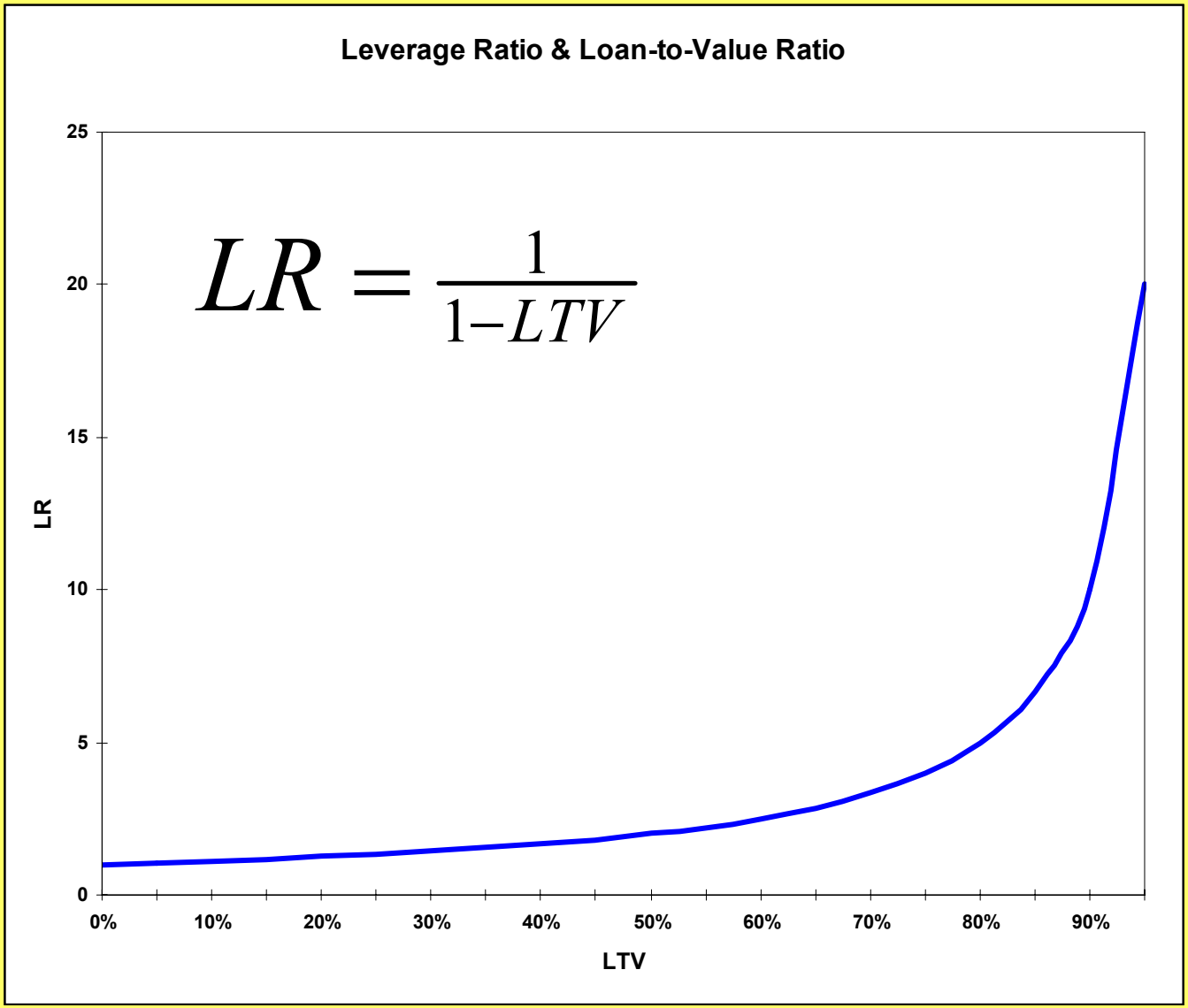
Terminology...

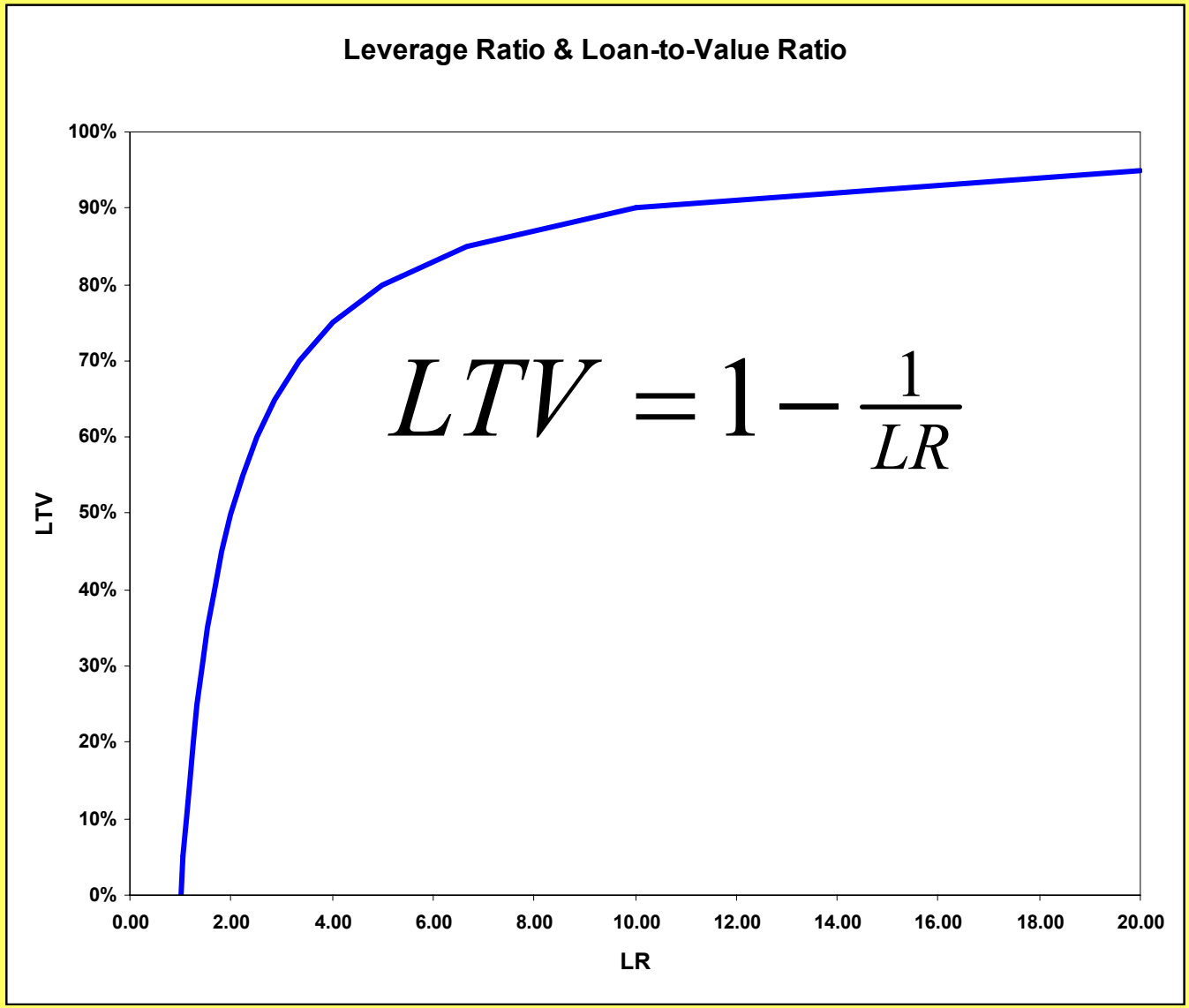
"Leverage"

"Debt Value", "Loan Value" (L) (or "D").
"Equity Value" (E)
"Underlying Asset Value" (V = E+L):
"Leverage Ratio" = LR = V / E = V / (V-L) = 1/(1-L/V)
(Not the same as the "Loan/Value Ratio": L / V,or "LTV" .)

"Risk"

The **RISK** that matters to investors is the risk in their <u>total</u> return, related to the **standard deviation** (or range or spread) in that return.


Leverage Ratio & Loan-to-Value Ratio
$LR = \frac{1}{1-LTV}$
25
20
15
10
5
0
LR
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
LTV


Leverage Ratio & Loan-to-Value Ratio
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
LTV
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
LR
$LTV = 1 - \frac{1}{LR}$

Effect of Leverage on Risk & Return (Numerical Example)…

Example Property & Scenario Characteristics:

Current (t=0) values (known for certain):

$E_0[CF_1] = \$800{,}000$

$V_0 = \$10{,}000{,}000$

Possible Future Outcomes are risky (next year, t=1):

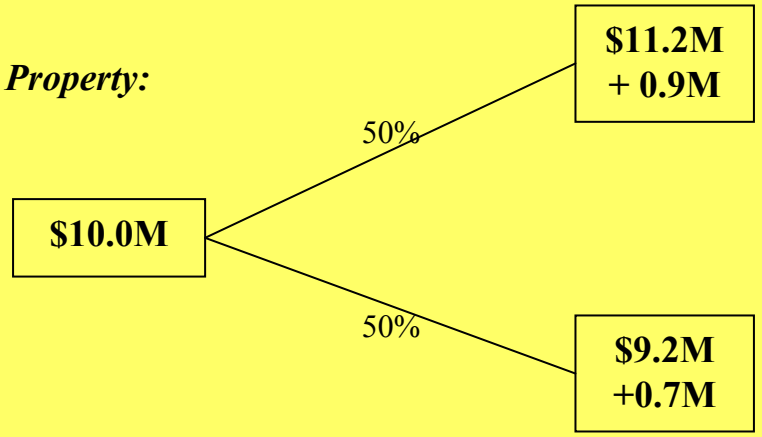
"Pessimistic" scenario (**1/2 chance**):

$CF_1 = \$700{,}000$; $V_1 = \$9{,}200{,}000$.

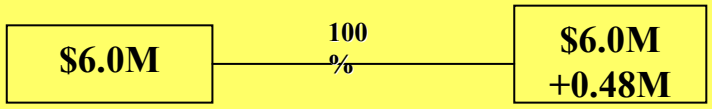
"Optimistic" scenario (**1/2 chance**):

$CF_1 = \$900{,}000$; $V_1 = \$11{,}200{,}000$.

Property:



Loan:



Case I: All-Equity (No Debt: Leverage Ratio=1, L/V=0)...

Item	Pessimistic	Optimistic
Inc. Ret. (y):	700/10000= 7%	
Ex Ante:		
RISK:		
App. Ret. (g):		
Ex Ante:		
RISK:		

Case II: Borrow $6 M @ 8%, with DS=$480,000/yr (Leverage Ratio=2.5, L/V=60%)...

Item	Pessimistic	Optimistic
Inc. Ret.:		
Ex Ante:		
RISK:		
App. Ret.:		
Ex Ante:		
RISK:		

Effect of Leverage on Risk & Return (Numerical Example)…

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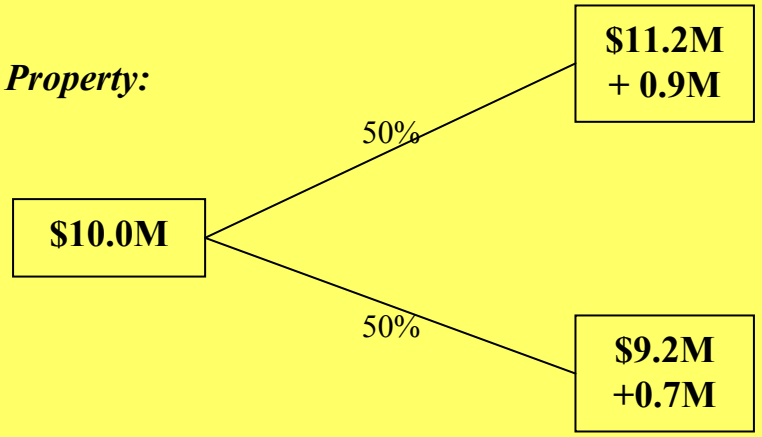
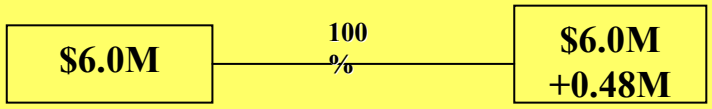
Property:



Loan:



Case I: All-Equity (No Debt: Leverage Ratio=1, L/V=0)...

Item	Pessimistic		Optimistic
Inc. Ret. (y):	700/10000= 7%		900/10000= 9%
Ex Ante:		(1/2)7% + (1/2)9% = 8%	
RISK:		±1%	
App. Ret. (g):	(9.2-10)/10 = -8%		(11.2-10)/10=+12%
Ex Ante:		(1/2)(-8) + (1/2)(12) = +2%	
RISK:		±10%	

Case II: Borrow $6 M @ 8%, with DS=$480,000/yr (Leverage Ratio=2.5, L/V=60%)...

Item	Pessimistic		Optimistic
Inc. Ret.:	(0.7-0.48)/4.0= 5.5%		(0.9-0.48)/4.0= 10.5%
Ex Ante:		(1/2)5.5 + (1/2)10.5 = 8%	
RISK:		±2.5%	
App. Ret.:	(3.2-4.0)/4.0 = -20%		(5.2-4.0)/4.0 = +30%
Ex Ante:		(1/2)(-20) + (1/2)(30) = +5%	
RISK:		±25%	

Exhibit 13-2: Typical Effect of Leverage on Expected Investment Returns

	Property	Levered Equity	Debt
Initial Value	$10,000,000	$4,000,000	$6,000,000
Cash Flow	$800,000	$320,000	$480,000
Ending Value	$10,200,000	$4,200,000	$6,000,000
Income Return	8%	8%	8%
Apprec.Return	2%	5%	0%
Total Return	10%	13%	8%

Exhibit 13-3: Sensitivity Analysis of Effect of Leverage on Risk in Equity Return Components, as Measured by Percentage Range in Possible Return Outcomes. ($ Values in millions)

	Property (LR=1)			Levered Equity (LR=2.5)			Debt (LR=0)		
	OPT	PES	RANGE	OPT	PES	RANGE	OPT	PES	RANGE
Initial Value	$10.00	$10.00	NA	$4.0	$4.0	NA	$6.0	$6.0	NA
Cash Flow	$0.9	$0.7	±$0.1	$0.42	$0.22	±$0.1	$0.48	$0.48	0
Ending Value	$11.2	$9.2	±$1.0	$5.2	$3.2	±$1.0	$6.0	$6.0	0
Income Return	9%	7%	±1%	10.5%	5.5%	±2.5%	8%	8%	0
Apprec.Return	12%	-8%	±10%	30%	-20%	±25%	0%	0%	0
Total Return	21%	-1%	±11%	40.5%	-14.5%	±27.5%	8%	8%	0

OPT = Outcome if "Optimistic" Scenario occurs.
PES = Outcome if "Pessimistic" Scenario occurs.
RANGE = Half the difference between "Optimistic" Scenario outcome and "Pessimistic" Scenario outcome.
Note: Initial values are known deterministically, as they are in present, not future, time, so there is no range.

- ➔ Return risk (y,g,r) directly proportional to Levg Ratio (not L/V).
- ➔ E[g] directly proportional to Leverage Ratio.
- ➔ E[r] increases with Leverage, but not proportionately.
- ➔ E[y] does not increase with leverage (here).
- ➔ E[RP] = E[r]-rf is directly proportional to Leverage Ratio (here)…

Exhibit 13-4: Effect of Leverage on Investment Risk and Return: The Case of Riskless Debt...

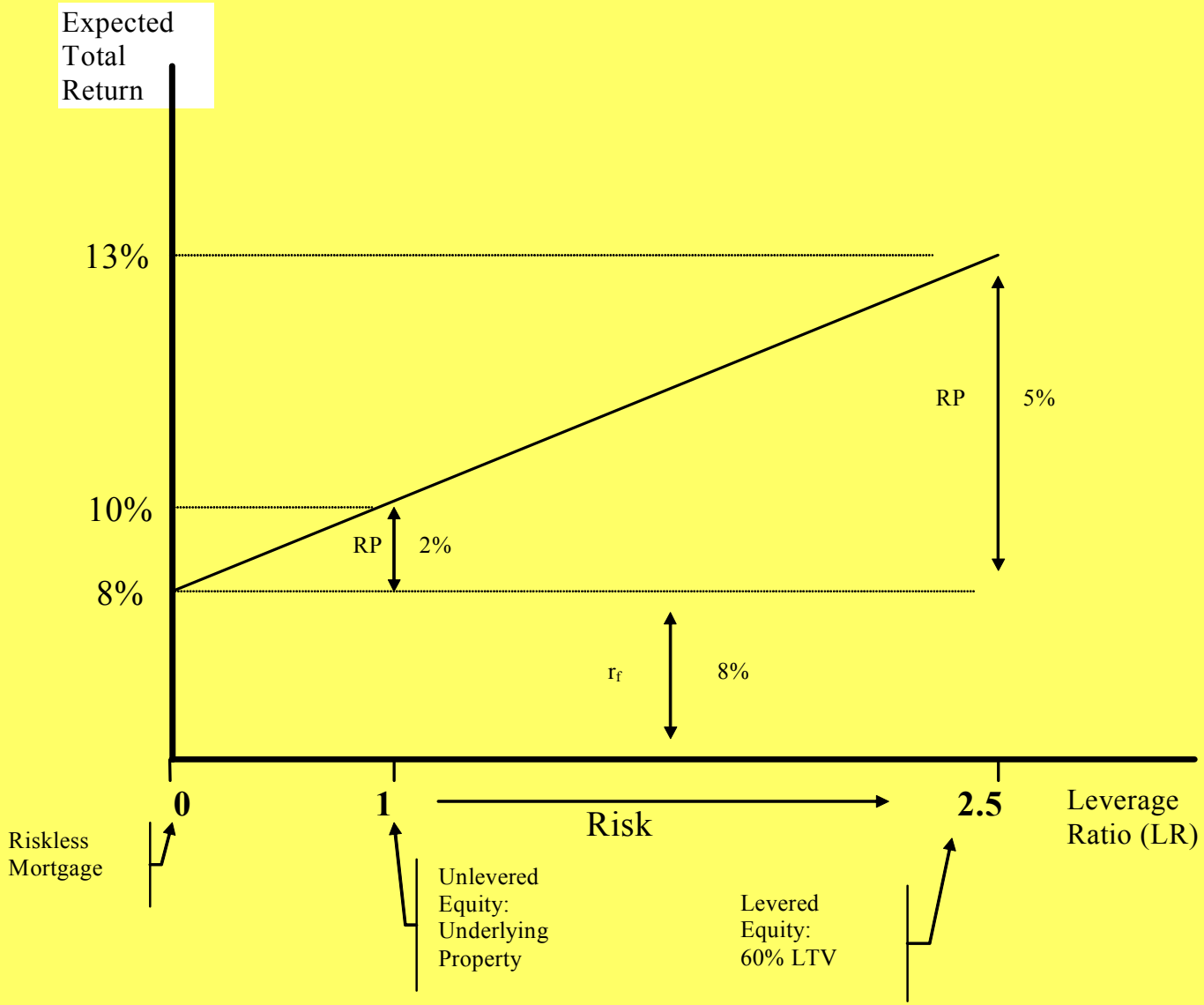
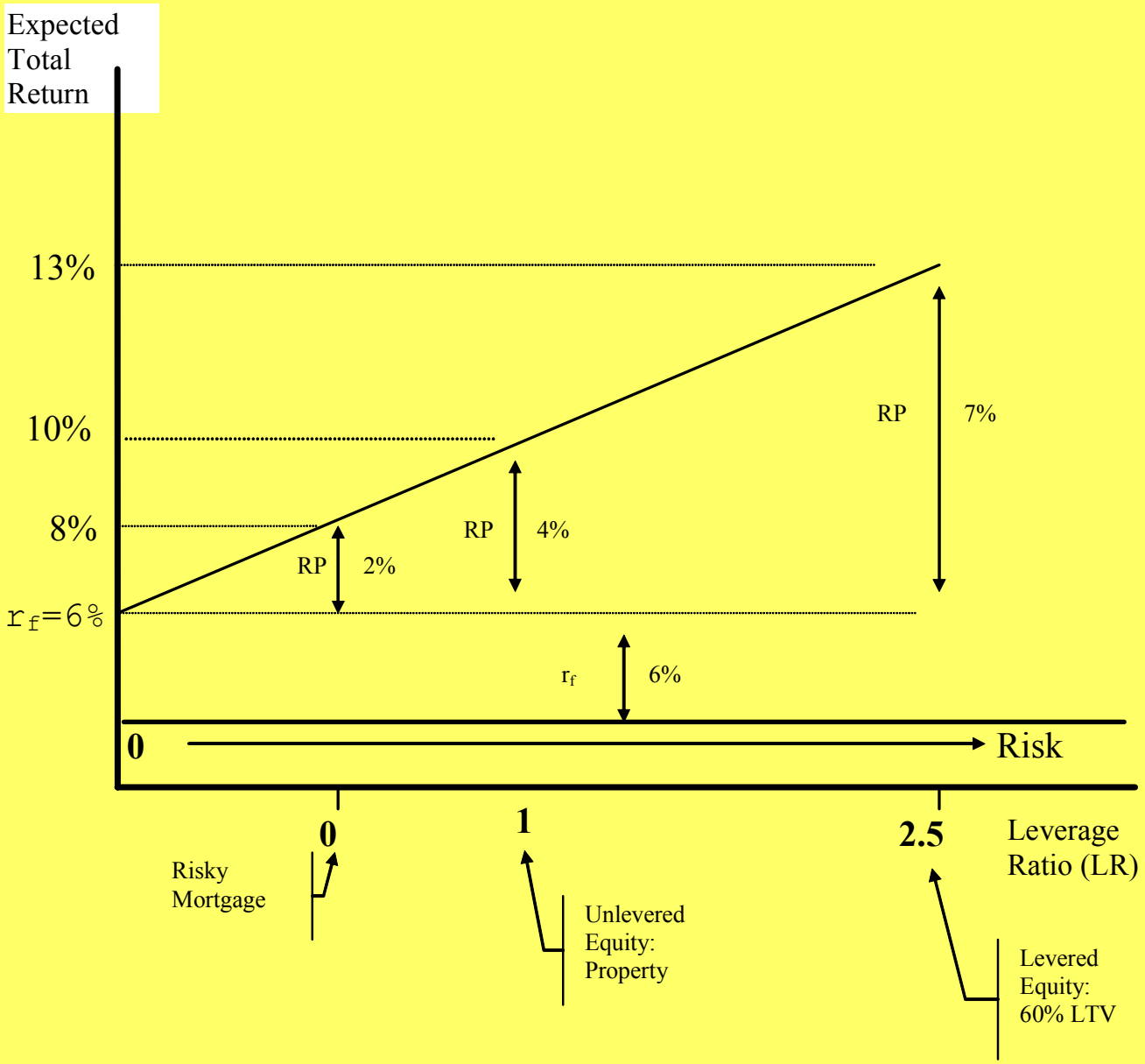


Exhibit 13-5: Effect of Leverage on Investment Risk and Return: The Case of Risky Debt...



A *really* useful formula. . .

The "Weighted Average Cost of Capital" (WACC) Formula . . .

$$r_P = (L/V)r_D + [1-(L/V)]r_E$$

Derivation of the WACC Formula: $V = E+D$

$$\Rightarrow \frac{\Delta V}{V} = \frac{\Delta E}{V} + \frac{\Delta D}{V} = \frac{\Delta E}{V}\frac{E}{E} + \frac{\Delta D}{V}\frac{D}{D} = \frac{E}{V}\frac{\Delta E}{E} + \frac{D}{V}\frac{\Delta D}{D} = \left(\frac{V-D}{V}\right)\frac{\Delta E}{E} + \frac{D}{V}\frac{\Delta D}{D}$$

$$\Rightarrow \frac{\Delta V}{V} = \left(1-\frac{D}{V}\right)\frac{\Delta E}{E} + \frac{D}{V}\frac{\Delta D}{D}$$

Where: r_E = Levered Equity Return,

r_P = Property Return,

r_D = Debt Return,

LTV=Loan-to-Value Ratio (*D/V*).

$$\Rightarrow WACC:$$

$$r_P = (1-LTV)r_E + (LTV)r_D$$

Invert for equity formula:

$$r_E = \frac{r_P - (LTV)r_D}{(1-LTV)}$$

Or, equivalently, if you prefer . . .

$$E = V\text{-}D$$

$$\Rightarrow \frac{\Delta E}{E} = \frac{\Delta V}{E} - \frac{\Delta D}{E} = \frac{\Delta V}{E}\frac{V}{V} - \frac{\Delta D}{E}\frac{D}{D} = \frac{V}{E}\frac{\Delta V}{V} - \frac{D}{E}\frac{\Delta D}{D}$$

$$\Rightarrow \frac{\Delta E}{E} = \frac{V}{E}\frac{\Delta V}{V} - \frac{(V-E)}{E}\frac{\Delta D}{D} = \frac{V}{E}\frac{\Delta V}{V} - \left(\frac{V}{E} - 1\right)\frac{\Delta D}{D} = \frac{\Delta D}{D} + \frac{V}{E}\left(\frac{\Delta V}{V} - \frac{\Delta D}{D}\right)$$

$$\Rightarrow WACC:$$

$$r_E = (LR)r_P + (1-LR)r_D = r_D + (r_P - r_D)LR$$

Where: r_E = Levered Equity Return,

r_P = Property Return,

r_D = Debt Return,

LR=Leverage Ratio (*V/E*).

Using the WACC formula in real estate:

The "Weighted Average Cost of Capital" (WACC) Formula . . .

$$r_P = (L/V)r_D + [1-(L/V)]r_E$$

(L/V) = Loan/value ratio

r_D = Lender's return (return to the debt)

r_E = Equity investor's return.

Apply to r, y, or g. . .

E.g., in previous numerical example:

$$E[r] = (.60)(.08) + (.40)(.13) = 10\%$$
$$E[y] = (.60)(.08) + (.40)(.08) = 8\%$$
$$E[g] = (.60)(0) + (.40)(.05) = 2\%$$

(Can also apply to RP.)

In real estate,

Difficult to directly and reliably observe levered return,

But can observe return on loans,

and can observe return on property (underlying asset).

So, "invert" WACC Formula:

Solve for unobservable parameter as a function of the observable parameters:

$$r_E = \{r_P - (L/V)r_D\} / [1 - (L/V)]$$

(Or in y or in g.)

(In y it's "cash-on-cash" or "equity cash yield")

Note:

WACC based on accounting identities:

Assets = Liabilities + Owners Equity,

Property Cash Flow = Debt Cash Flow + Equity Cash Flow

WACC is *approximation*,

Less accurate over longer time interval return horizons.

Using WACC to avoid a common mistake. . .

Suppose REIT A can borrow @ 6%, and REIT B @ no less than 8%. Then doesn't REIT A have a lower cost of capital than REIT B?

Answer: Not necessarily. Suppose (for example):

REIT A: D/E = 3/7. ➔ D/V = L/V = 30%.

REIT B: D/E = 1. ➔ D/V = L/V = 50%.

& suppose both A & B have cost of equity = $E[r_E]$ = 15%.

Then:

WACC(A) =(0.3)6% + (0.7)15% = 1.8% + 10.5% = 12.3%

WACC(B) =(0.5)8% + (0.5)15% = 4% + 7.5% = 11.5%

So in this example REIT A has a higher cost of capital than B, even though A can borrow at a lower rate. (Note, this same argument applies whether or not either or both investors are REITs.) You have to consider the cost of your equity as well as the cost of your debt to determine your cost of capital.

"POSITIVE" & "NEGATIVE" LEVERAGE

"Positive leverage" = When more debt will increase the equity investor's (borrower's) return.

"Negative leverage" = When more debt will decrease the equity investor's (borrower's) return.

"POSITIVE" & "NEGATIVE" LEVERAGE

Whenever the Return Component is higher in the underlying property than it is in the mortgage loan, there will be "Positive Leverage" in that Return Component...

See this via The "leverage ratio" version of the WACC. . .

$$r_E = r_D + LR*(r_P - r_D)$$

Derivation of the Leverage Ratio Version of the WACC:

$$E = V\text{-}D$$

$$\Rightarrow \frac{\Delta E}{E} = \frac{\Delta V}{E} - \frac{\Delta D}{E} = \frac{\Delta V}{E}\frac{V}{V} - \frac{\Delta D}{E}\frac{D}{D} = \frac{V}{E}\frac{\Delta V}{V} - \frac{D}{E}\frac{\Delta D}{D}$$

$$\Rightarrow \frac{\Delta E}{E} = \frac{V}{E}\frac{\Delta V}{V} - \frac{(V-E)}{E}\frac{\Delta D}{D} = \frac{V}{E}\frac{\Delta V}{V} - \left(\frac{V}{E} - 1\right)\frac{\Delta D}{D} = \frac{\Delta D}{D} + \frac{V}{E}\left(\frac{\Delta V}{V} - \frac{\Delta D}{D}\right)$$

$$\Rightarrow WACC:$$

$$r_E = (LR)r_P + (1-LR)r_D = r_D + (r_P - r_D)LR$$

Where: r_E = Levered Equity Return,

r_P = Property Return,

r_D = Debt Return,

LR=Leverage Ratio (*V/E*).

Exhibit 13-6: Typical relative effect of leverage on income and growth components of investment return (numerical example)...

Property total return (r_P): 10.00%
Cap rate (y_P): 8.00%

Positive cash-on-cash leverage...
Loan Interest rate (r_D): 6.00%
Mortgage Constant (y_D): 7.00%

		Equity return component:		
LR	LTV	y_E	g_E	r_E
1	0%	8.00%	2.00%	10.00%
2	50%	9.00%	5.00%	14.00%
3	67%	10.00%	8.00%	18.00%
4	75%	11.00%	11.00%	22.00%
5	80%	12.00%	14.00%	26.00%

Negative cash-on-cash leverage...
Loan Interest Rate (r_D): 8.00%
Mortgage Constant (y_D): 9.00%

		Equity return component:		
LR	LTV	y_E	g_E	r_E
1	0%	8.00%	2.00%	10.00%
2	50%	7.00%	5.00%	12.00%
3	67%	6.00%	8.00%	14.00%
4	75%	5.00%	11.00%	16.00%
5	80%	4.00%	14.00%	18.00%

e.g.:

Total: 10% = (67%)*6%+(33%)*18%

Yield: 8% = (67%)*7% + (33%)*10%

Growth: 2% = (67%)*(-1%)+(33%)*8%

Leverage skews total return relatively toward growth component, away from current income yield.

SUMMARY OF LEVERAGE EFFECTS...

(1) Under the typical assumption that the loan is less risky than the underlying property, leverage will increase the ex ante total return on the equity investment, by increasing the risk premium in that return.

(2) Under the same relative risk assumption, leverage will increase the risk of the equity investment, normally proportionately with the increase in the risk premium noted in (1).

(3) Under the typical situation of non-negative price appreciation in the property and non-negative amortization in the loan, leverage will usually shift the expected return for the equity investor relatively away from the current income component and towards the growth or capital appreciation component.

Real world example:

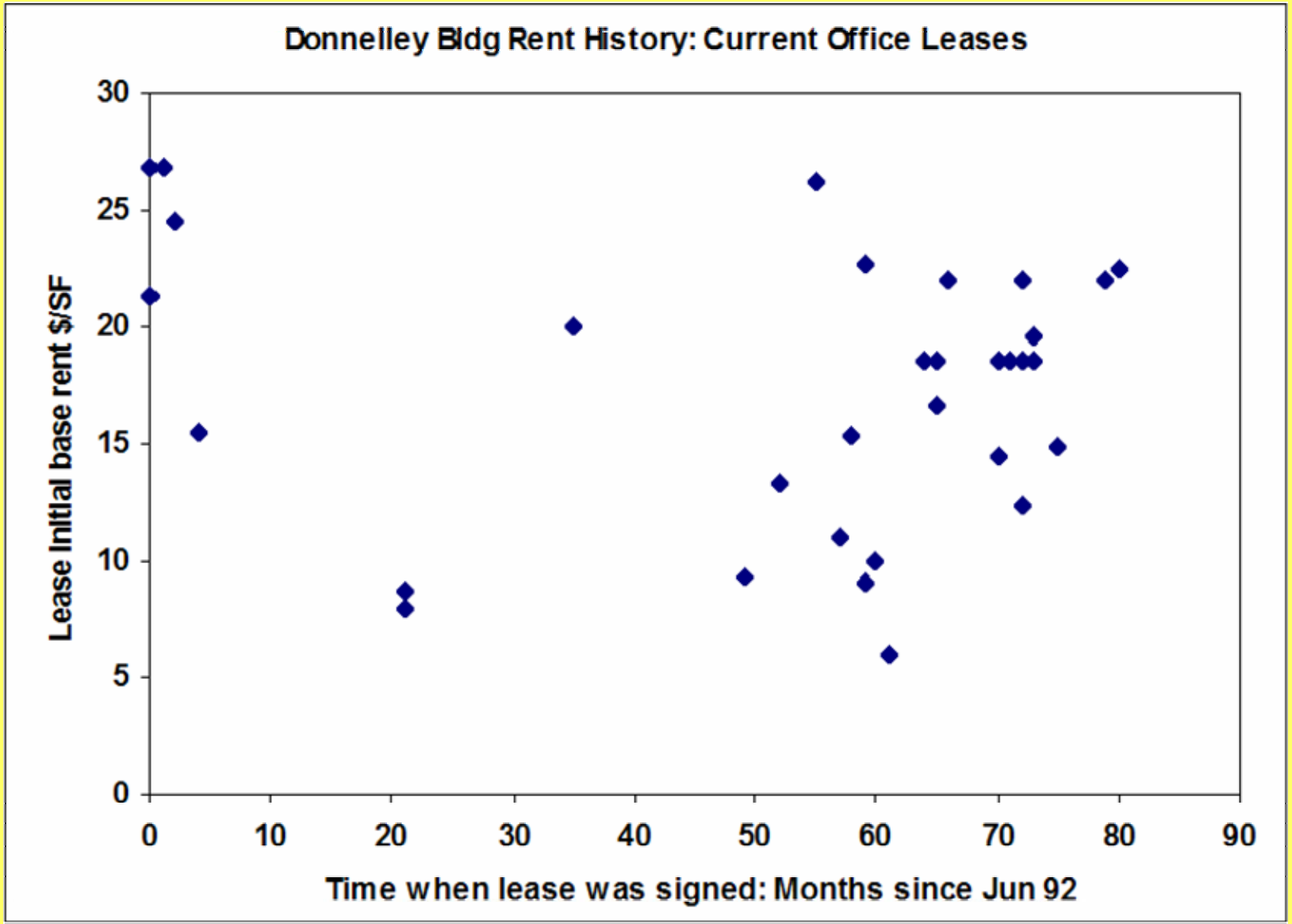
Recall…

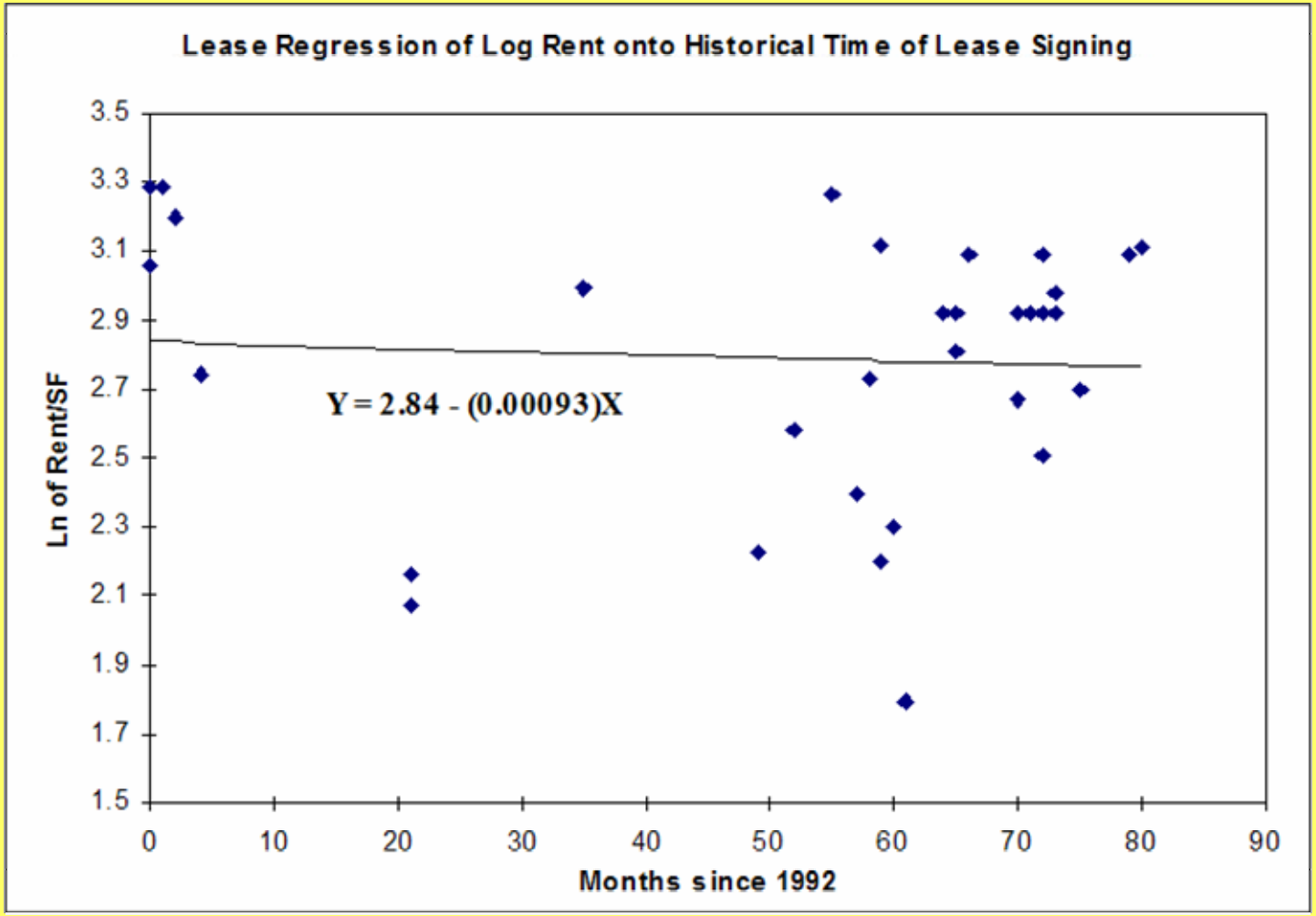
The R.R. Donnelly Bldg, Chicago

$280 million,
945000 SF,
50-story
Office Tower

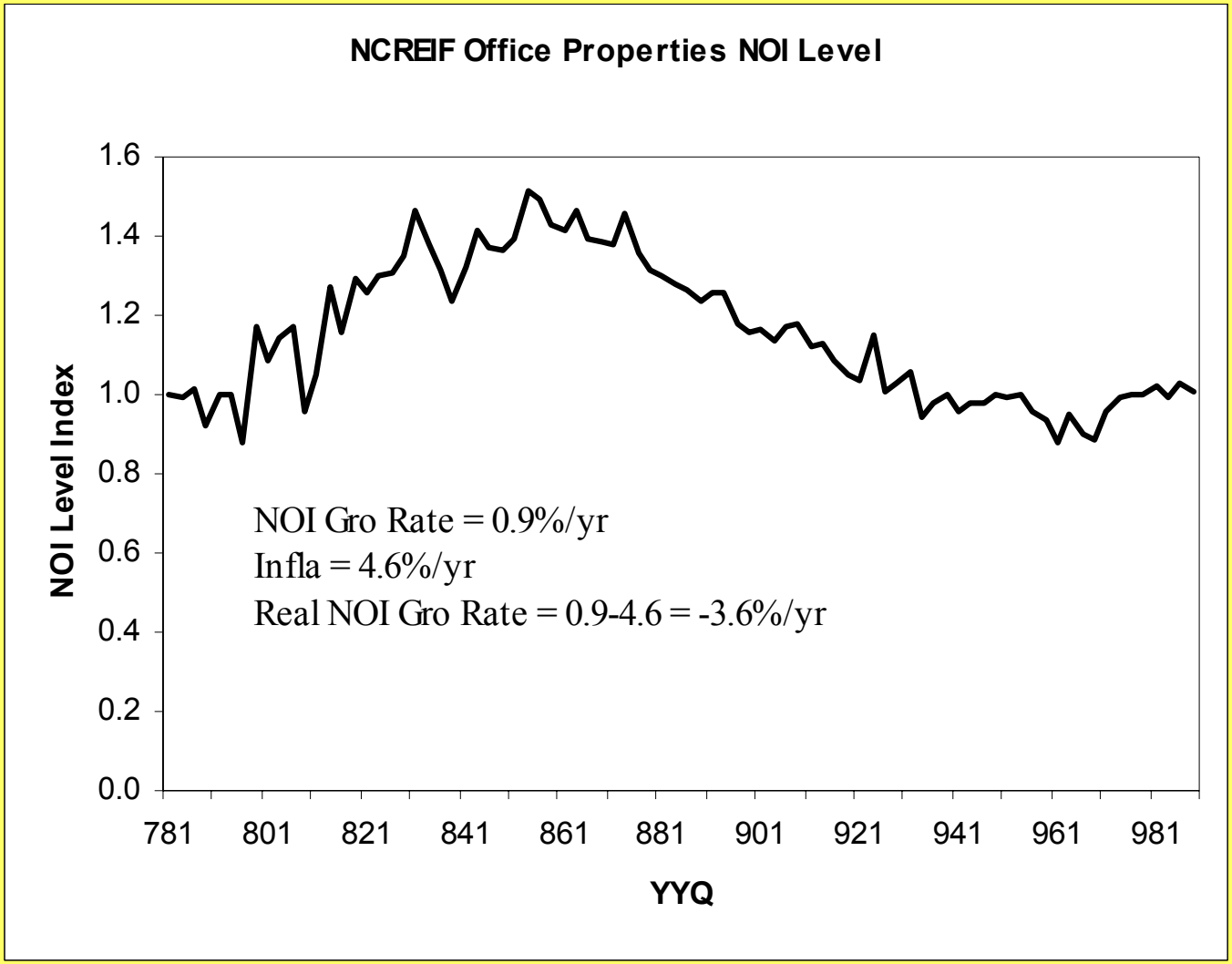
Donnelley Bldg Pro Forma...

RR Donnelley Bldg Annual Cash Flow Projection											
Year:	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
POTENTIAL GROSS REVENUE											
Base Rental Revenue	24033811	24991054	25635350	26383811	27922939	28654131	29373663	30057496	29525448	29850252	30742749
Absorptn & Turnover Vac.	0	-122098	-45383	-284864	-538960	-64691	-280794	-98390	-3542566	-468748	-133817
Scheduled Base Rent Rev.	24033811	24868956	25589967	26098947	27383979	28589440	29092869	29959106	25982882	29381504	30608932
CPI & Other Adjustmt Rev.	1295978	1489696	1688258	1891784	2100397	2314227	2533401	2758056	465942	0	0
Expense Reimbursmt Rev.	13830780	14359735	14886942	15215378	15588172	16665170	17028629	17626489	16203409	18857047	19661109
Miscellaneous Income	270931	279059	287430	296054	304935	314082	323505	333212	343207	353504	364108
TOTAL PGR	39431500	40997446	42452597	43502163	45377483	47882919	48978404	50676863	42995440	48592055	50634149
Collection Loss	-561044	-592080	-625946	-638690	-681665	-759463	-770676	-811778	-827703	-867105	-921832
EFFECTIVE GROSS REVENUE	38870456	40405366	41826651	42863473	44695818	47123456	48207728	49865085	42167737	47724950	49712317
OPERATING EXPENSES											
Repairs & Maintenance	1723900	1775613	1829188	1883220	1938829	1998749	2057947	2120365	2171717	2248204	2316872
Contract Cleaning	1033459	1064415	1100189	1122605	1145141	1201526	1227982	1273344	1157614	1334681	1390062
Security	738946	761114	783949	807466	831690	856640	882340	908811	936075	964158	993081
Utilities	1076597	1108856	1145319	1170863	1196712	1250955	1280500	1326010	1237641	1393269	1447839
General & Administrative	741398	763639	786549	810146	834450	859483	885267	911825	939179	967355	996376
Insurance	14 4503	148838	153303	157902	162639	167518	172544	177720	183052	188543	194200
Real Estate Taxes	7943834	8182149	8427614	8680442	8940855	9209081	9485	9769914	10063012	10364902	10675849
Management Fee	971761	1010134	1045666	1071587	1117395	1178086	1205193	1246627	1054193	1193124	1242808
Non-Reimbursable	11 8890	122456	126131	129915	133812	137826	141961	146220	150607	155124	159778
TOTAL OPERATING EXPENSES	14493288	14937	15397908	15834146	16301523	16859864	17339088	17880836	17893090	18809360	19416865
NET OPERATING INCOME	24377168	25468152	26428743	27029327	28394295	30263592	30868640	31984249	24274647	28915590	30295452
LEASING & CAPITAL COSTS											
Tenant Improvements	272920	390507	138182	870713	1239057	621936	864411	233947	10949093	1439521	
Leasing Commissions	83615	121036	44684	456082	396166	289709	371606	74189	6473182	461531	
Structural Reserves	95281	98139	101084	104116	134759	220920	227548	234374	241405	248648	
RR Donnelley TI	0	0	0	100000	0	0	0	0	0	0	
TOTAL CAPITAL COSTS	451816	609682	283950	1530911	1769982	1132565	1463565	542510	17663680	2149700	
OPERATING NET CASH FLOW	23925352	24858470	26144793	25498416	26624313	29131027	29405075	31441739	6610967	26765890	
Reversion @8.75%, 1%Cost										342771400	
TOTAL NET CASH FLOW	23925352	24858470	26144793	25498416	26624313	29131027	29405075	31441739	6610967	369537290	


Donnelley Bldg Rent History: Current Office Leases
Lease Initial base rent $/SF
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
90
Time when lease was signed: Months since Jun 92



$Rent_t = (Rent_0)e^{tg}$
$Ln(Rent_t) = Ln(Rent_0) + tg$
$(Rent_{12}/Rent_0) - 1 = e^{12g} - 1 = (2.7183)^{12*(-0.00093)} - 1 = -1.1\%$ per year = Ann. rent trend, 92-98.
Infla (92-98) = 2.4%/yr.
➔ Real rent trend = -1.1% - 2.4% = -3.5%/yr.


NCREIF Office Properties NOI Level
NOI Level Index
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
781
801
821
841
861
881
901
921
941
961
981
YYQ
NOI Gro Rate = 0.9%/yr
Infla = 4.6%/yr
Real NOI Gro Rate = 0.9-4.6 = -3.6%/yr

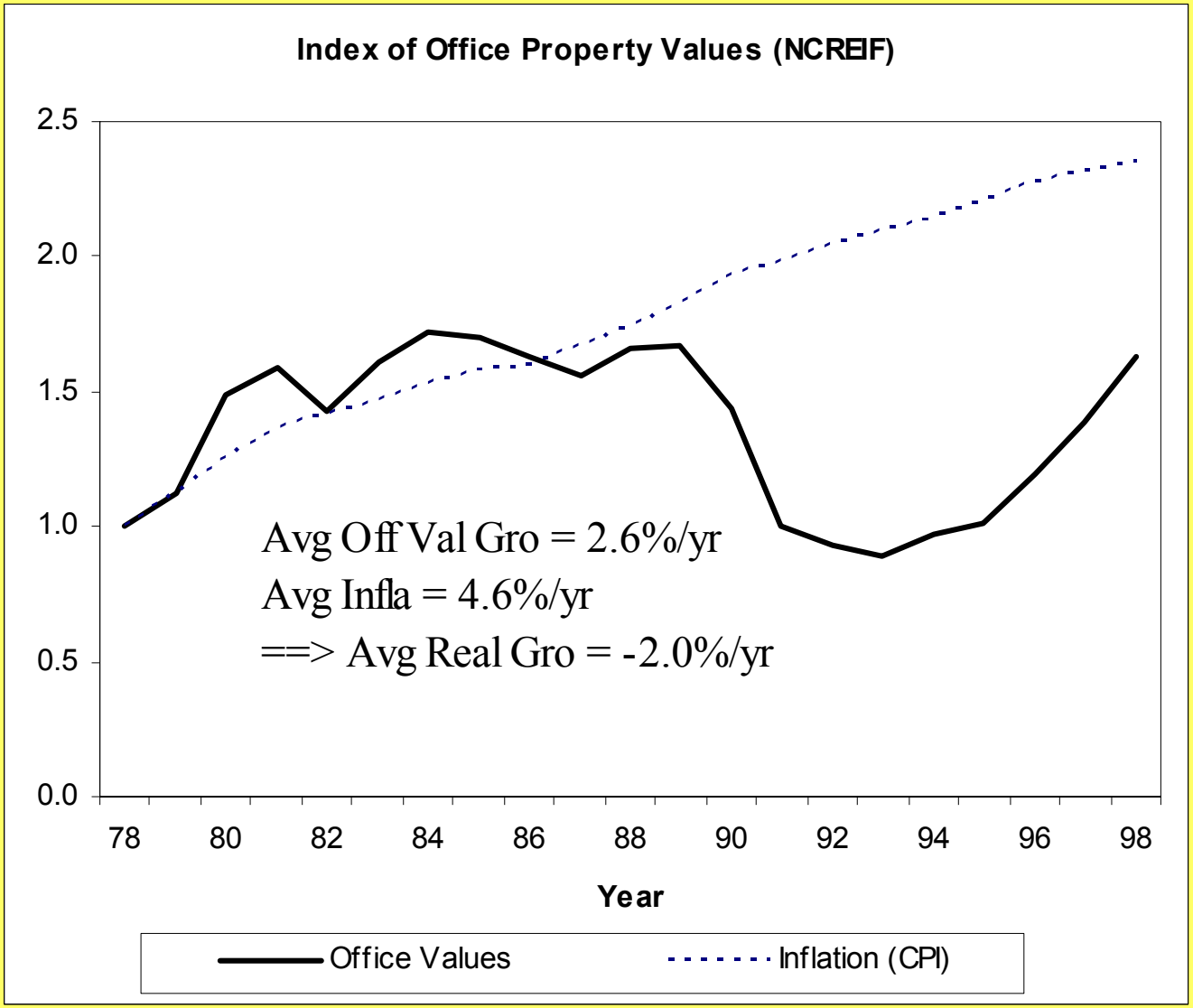

Index of Office Property Values (NCREIF)
2.5
2.0
1.5
1.0
0.5
0.0
78
80
82
84
86
88
90
92
94
96
98
Year
Avg Off Val Gro = 2.6%/yr
Avg Infla = 4.6%/yr
==> Avg Real Gro = -2.0%/yr
Office Values
Inflation (CPI)

Exhibit 1: Presentation cash flow pro-forma for sale purposes

Assumptions (Staff's):		**Implied Returns:**	
Price	**280000**	**Going-inCap**	**8.71%**
Terminal Cap Rate	**8.75%**	**IRRs:**	
CFGroRate Adjustment	**0.00%**	**Property (Unlevered)**	**10.40%**
Cap.Imp.Adjustmt Factor	**1**	**Levered (Undifferentiated)**	**14.36%**
		OTR (overall levered)	**12.76%**
		Prime (levered)	**19.24%**

Cash flow computations, Yr:	**IRRs:**	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***
End Jun		***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***
Staff NOI			**24377**	**25468**	**26429**	**27029**	**28394**	**30264**	**30869**	**31984**	**24275**	**28916**	**30295**
Staff CI			**452**	**610**	**284**	**1531**	**1770**	**1133**	**1464**	**543**	**17664**	**2150**	**752**
Adjstd NOI			**24377**	**25468**	**26429**	**27029**	**28394**	**30264**	**30869**	**31984**	**24275**	**28916**	**30295**
Adjstd CI			**452**	**610**	**284**	**1531**	**1770**	**1133**	**1464**	**543**	**17664**	**2150**	**752**
Unlevered Property Level:													
CF			**23925**	**24858**	**26145**	**25498**	**26624**	**29131**	**29405**	**31441**	**6611**	**26766**	**29543**
Reversion												**342766**	
PBTCFs	**10.40%**	**-280000**	**23925**	**24858**	**26145**	**25498**	**26624**	**29131**	**29405**	**31441**	**6611**	**369532**	
DS			**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	
OLB												**132864**	
DebtCFs	**7.00%**	**-170000**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**147452**	
AfterDS: Levrd(Undiff)…													
Operating			**9337**	**10270**	**11557**	**10910**	**12036**	**14543**	**14817**	**16853**	**-7977**	**12178**	
ECFs	**14.36%**	**-110000**	**9337**	**10270**	**11557**	**10910**	**12036**	**14543**	**14817**	**16853**	**-7977**	**222080**	
OTR Positions…													
Preferred	**9.50%**	**-66000**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**72270**	
OTRprorata	**19.24%**	**-22000**	**1534**	**2000**	**2644**	**2320**	**2883**	**4137**	**4274**	**5292**	**-7124**	**74905**	
OTRTotal	**12.76%**	**-88000**	**7804**	**8270**	**8914**	**8590**	**9153**	**10407**	**10544**	**11562**	**-854**	**147175**	
Prime Position:													
PrimeTotal	**19.24%**	**-22000**	**1534**	**2000**	**2644**	**2320**	**2883**	**4137**	**4274**	**5292**	**-7124**	**74905**	

Exhibit 2: More realstic cash flow projections

Assumptions (Geltner's):		**Implied Returns:**											
Price	**280000**	**Going-inCap**	**8.71%**										
Terminal Cap Rate	**8.75%**	**IRRs:**											
CFGroRate Adjustment	**-1.60%**	**Property (Unlevered)**	**8.29%**										
Cap.Imp.Adjustmt Factor	**1.5**	**Levered (Undifferentiated)**	**10.02%**										
		OTR (overall levered)	**9.83%**										
		Prime (levered)	**10.68%**										
Cash flow computations, Yr:	**IRRs:**		***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***
End Jun			***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***
Staff NOI				**24377**	**25468**	**26429**	**27029**	**28394**	**30264**	**30869**	**31984**	**24275**	**28916**	**30295**
Staff CI				**452**	**610**	**284**	**1531**	**1770**	**1133**	**1464**	**543**	**17664**	**2150**	**752**
Adjstd NOI				**24377**	**25061**	**25590**	**25752**	**26620**	**27919**	**28022**	**28569**	**21336**	**25009**	**25782**
Adjstd CI				**678**	**915**	**426**	**2297**	**2655**	**1700**	**2196**	**815**	**26496**	**3225**	**1128**
Unlevered Property Level:														
CF				**23699**	**24146**	**25164**	**23456**	**23965**	**26220**	**25826**	**27755**	**-5160**	**21784**	**24654**
Reversion													**291708**	
PBTCFs	**8.29%**		**-280000**	**23699**	**24146**	**25164**	**23456**	**23965**	**26220**	**25826**	**27755**	**-5160**	**313492**	
DS				**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	
OLB													**132864**	
DebtCFs	**7.00%**		**-170000**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**147452**	
AfterDS: Levrd(Undiff)…														
Operating				**9111**	**9558**	**10576**	**8868**	**9377**	**11632**	**11238**	**13167**	**-19748**	**7196**	
ECFs	**10.02%**		**-110000**	**9111**	**9558**	**10576**	**8868**	**9377**	**11632**	**11238**	**13167**	**-19748**	**166040**	
OTR Positions…														
Preferred	**9.50%**		**-66000**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**72270**	
OTRprorata	**10.68%**		**-22000**	**1421**	**1644**	**2153**	**1299**	**1553**	**2681**	**2484**	**3448**	**-13009**	**46885**	
OTRTotal	**9.83%**		**-88000**	**7691**	**7914**	**8423**	**7569**	**7823**	**8951**	**8754**	**9718**	**-6739**	**119155**	
Prime Position:														
PrimeTotal	**10.68%**		**-22000**	**1421**	**1644**	**2153**	**1299**	**1553**	**2681**	**2484**	**3448**	**-13009**	**46885**	

Exhibit 2: Cash flow adjustments (Optmistic)

Assumptions (Geltner's):		**Implied Returns:**	
Price	**280000**	**Going-inCap**	**8.71%**
Terminal Cap Rate	**7.50%**	**IRRs:**	
CFGroRate Adjustment	**0.0150**	**Property (Unlevered)**	**13.14%**
Cap.Imp.Adjustmt Factor	**1**	**Levered (Undifferentiated)**	**19.12%**
		OTR (overall levered)	**16.30%**
		Prime (levered)	**26.73%**

Cash flow computations, Yr:	**IRRs:**	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
End Jun		*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
Staff NOI			**24377**	**25468**	**26429**	**27029**	**28394**	**30264**	**30869**	**31984**	**24275**	**28916**	**30295**
Staff CI			**452**	**610**	**284**	**1531**	**1770**	**1133**	**1464**	**543**	**17664**	**2150**	**752**
Adjstd NOI			**24377**	**25850**	**27228**	**28264**	**30136**	**32603**	**33754**	**35497**	**27346**	**33062**	**35159**
Adjstd CI			**452**	**610**	**284**	**1531**	**1770**	**1133**	**1464**	**543**	**17664**	**2150**	**752**
Unlevered Property Level:													
CF			**23925**	**25240**	**26944**	**26733**	**28366**	**31470**	**32290**	**34954**	**9682**	**30912**	**34407**
Reversion												**464093**	
PBTCFs	**13.14%**	**-280000**	**23925**	**25240**	**26944**	**26733**	**28366**	**31470**	**32290**	**34954**	**9682**	**495006**	
DS			**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	
OLB												**132864**	
DebtCFs	**7.00%**	**-170000**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**147452**	
AfterDS: Levrd(Undiff)…													
Operating			**9337**	**10652**	**12356**	**12145**	**13778**	**16882**	**17702**	**20366**	**-4906**	**16324**	
ECFs	**19.12%**	**-110000**	**9337**	**10652**	**12356**	**12145**	**13778**	**16882**	**17702**	**20366**	**-4906**	**347554**	
OTR Positions…													
Preferred	**9.50%**	**-66000**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**72270**	
OTRprorata	**26.73%**	**-22000**	**1534**	**2191**	**3043**	**2937**	**3754**	**5306**	**5716**	**7048**	**-5588**	**137642**	
OTRTotal	**16.30%**	**-88000**	**7804**	**8461**	**9313**	**9207**	**10024**	**11576**	**11986**	**13318**	**682**	**209912**	
Prime Position:													
PrimeTotal	**26.73%**	**-22000**	**1534**	**2191**	**3043**	**2937**	**3754**	**5306**	**5716**	**7048**	**-5588**	**137642**	

Exhibit 2: Cash flow adjustments(Pesimistic)

Assumptions (Geltner's):		**Implied Returns:**	
Price	**280000**	**Going-inCap**	**8.71%**
Terminal Cap Rate	**10.00%**	**IRRs:**	
CFGroRate Adjustment	**-0.0450**	**Property (Unlevered)**	**3.60%**
Cap.Imp.Adjustmt Factor	**2**	**Levered (Undifferentiated)**	**-4.38%**
		OTR (overall levered)	**2.56%**
		Prime (levered)	**#NUM!**

Cash flow computations, Yr:	**IRRs:**	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***
End Jun		***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***
Staff NOI			**24377**	**25468**	**26429**	**27029**	**28394**	**30264**	**30869**	**31984**	**24275**	**28916**	**30295**
Staff CI			**452**	**610**	**284**	**1531**	**1770**	**1133**	**1464**	**543**	**17664**	**2150**	**752**
Adjstd NOI			**24377**	**24322**	**24104**	**23542**	**23618**	**24040**	**23418**	**23172**	**16795**	**19106**	**19116**
Adjstd CI			**904**	**1220**	**568**	**3062**	**3540**	**2266**	**2928**	**1086**	**35328**	**4300**	**1504**
Unlevered Property Level:													
CF			**23473**	**23102**	**23536**	**20480**	**20078**	**21774**	**20490**	**22086**	**-18533**	**14806**	**17612**
Reversion												**189252**	
PBTCFs	**3.60%**	**-280000**	**23473**	**23102**	**23536**	**20480**	**20078**	**21774**	**20490**	**22086**	**-18533**	**204058**	
DS			**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	
OLB												**132864**	
DebtCFs	**7.00%**	**-170000**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**14588**	**147452**	
AfterDS: Levrd(Undiff)…													
Operating			**8885**	**8514**	**8948**	**5892**	**5490**	**7186**	**5902**	**7498**	**-33121**	**218**	
ECFs	**-4.38%**	**-110000**	**8885**	**8514**	**8948**	**5892**	**5490**	**7186**	**5902**	**7498**	**-33121**	**56606**	
OTR Positions…													
Preferred	**9.50%**	**-66000**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**6270**	**72270**	
OTRprorata	**#NUM!**	**-22000**	**1308**	**1122**	**1339**	**-189**	**-390**	**458**	**-184**	**614**	**-19695**	**-7832**	
OTRTotal	**2.56%**	**-88000**	**7578**	**7392**	**7609**	**6081**	**5880**	**6728**	**6086**	**6884**	**-13425**	**64438**	
Prime Position:													
PrimeTotal	**#NUM!**	**-22000**	**1308**	**1122**	**1339**	**-189**	**-390**	**458**	**-184**	**614**	**-19695**	**-7832**	

Summary of Sensitivity Analysis

& Risk/Return Analysis

	Presentn	Realistic	Optimist	Pessimist	RANGE	RP*	RP/RANGE
Assumptions:							
NOI Gro	2.20%	0.56%	3.73%	-2.40%	6.13%		
CI/NOI	10.00%	15.00%	10.00%	20.00%	10.00%		
Term Cap	8.75%	8.75%	7.50%	10.00%	2.50%		
Expected Returns (Going-in IRR):							
Property	10.40%	8.29%	13.14%	3.60%	9.54%	1.54%	0.16
Levrd Eq (Undiff)	14.36%	10.02%	19.12%	-4.38%	23.50%	3.27%	0.14
Teachers	12.76%	9.83%	16.30%	-4.38%	20.68%	3.08%	0.15
Prime	19.24%	10.68%	26.73%	-100.00%	126.73%	3.93%	0.03
*Realistic Exptd Going-in IRR Minus 6.75% prevailing T-Bill Yield							

Financial Leverage & Operational Leverage: Implications for Investment in Real Estate *Development* Projects*

- **Use of debt financing provides "*financial leverage*" to the equity investment.**
- **More fundamentally and generally, leverage occurs whenever the investment return can be modeled as the future outcomes to a combination of "long" and "short" positions (e.g., "benefits" and "costs" that occur in the future beyond when the investment decision is made).**
- **Leverage that exists without the use of debt financing is often called "*operational leverage*".**
- **Real estate development projects are characterized by operational leverage, even in the absence of the use of debt financing (although such financing is almost universally employed in R.E. development, and adds to the operational leverage that is already there).**

*This material is drawn largely from Chapter 29.

The Fundamental Nature of Real Estate Development Investment:

- ***A <u>forward</u> purchase commitment in a stabilized fully operational (leased up) property:***
  - **Buy (incur opportunity cost of) land *now*,**
  - **Get stabilized property *later*.**

- ***A <u>levered</u> investment in the stabilized (core) property:***
  - **Up front the only cost is the purchase of (or incurring the opportunity cost of) the *land*.**
  - **This can be viewed as the *equity* investment to obtain (*a long position in*) the future stabilized property (*a volatile asset*),**
  - ***Subject to the payment of construct costs* (*a relatively fixed outlay that will occur in the future, i.e., subsequent to the time when the land cost is incurred*).**
  - **The development investment is thus equivalent to having a *long* position in the stabilized property combined with a *short* position in the construction costs.**

The Fundamental Nature of Real Estate Development Investment…

Let "E" = Up front investment in devlpt project (land cost);
"V" = Value of completed stabilized property;
"D" = Cost of construction (exclusive of land).

The following should look familiar . . .

$$E = V\text{-}D$$

$$\Rightarrow \frac{\Delta E}{E} = \frac{\Delta V}{E} - \frac{\Delta D}{E} = \frac{\Delta V}{E}\frac{V}{V} - \frac{\Delta D}{E}\frac{D}{D} = \frac{V}{E}\frac{\Delta V}{V} - \frac{D}{E}\frac{\Delta D}{D}$$

$$\Rightarrow \frac{\Delta E}{E} = \frac{V}{E}\frac{\Delta V}{V} - \frac{(V-E)}{E}\frac{\Delta D}{D} = \frac{V}{E}\frac{\Delta V}{V} - \left(\frac{V}{E}-1\right)\frac{\Delta D}{D} = \frac{\Delta D}{D} + \frac{V}{E}\left(\frac{\Delta V}{V} - \frac{\Delta D}{D}\right)$$

$$\Rightarrow WACC:$$

$$r_E = (LR)r_P + (1-LR)r_D = r_D + (r_P - r_D)LR$$

Only in this case . . .

The Fundamental Nature of Real Estate Development Investment…

$$\Rightarrow WACC:$$

$$r_E = g_E = (LR)g_V + (1-LR)g_D = g_D + (g_V - g_D)LR$$

r_E =Return on devlpt project up-front investment (purely appreciation, g_E, no income).

LR=Effective leverage in the devlpt project (V_T/E) (= Completed stabilized property value divided by up-front land cost).

g_V = Appreciation return on stabilized property during development phase (as if it existed completed already).

g_D = Percentage change in total (final) construction cost (exclusive of land) during development phase (e.g. zero for guaranteed fixed-price contract).

Numerical Example…

- **Project to build an apartment building.**
- **Similar (stabilized) properties are currently worth $10,000,000.**
- **Construction will take 1 year.**
- **Construction cost is $7,680,000 (fixed-price contract to be paid on completion).**
- **Land (opportunity value, i.e., what land could be sold for) & up-front fees (e.g., architect) cost $2,000,000.**
- **Assuming expected appreciation in this property type is zero over the next year, expected return on the development investment is 16%:**

$$16\% = \frac{E[EndVal] - BegVal}{BegVal} = \frac{(\$10{,}000{,}000 - \$7{,}680{,}000) - \$2{,}000{,}000}{\$2{,}000{,}000}$$

Numerical Example (cont.)…

- **Now suppose between now and next year apartment property values take an unexpected plunge of 10%, to $9,000,000.**
- **For an unlevered investor in pre-existing stabilized property the return hit is just this 10% loss.**
- **But to our development investment our *loss is magnified* to 50% below the previous +16% expectation (as –34% is 50 points below +16%):**

$$-34\% = \frac{(\$9{,}000{,}000 - \$7{,}680{,}000) - \$2{,}000{,}000}{\$2{,}000{,}000} = \frac{-\$680{,}000}{\$2{,}000{,}000}$$

- **The reason for the magnification of the impact on the return is that the construction cost ($7,680,000) did not change with the change in stabilized property value (from $10,000,000 to $9,000,000).**
- **The reason the magnification was 5-times (-50%/-10%) is because the effective *Leverage Ratio* in the development is 5 (in this case):**

$$LR = V_T / E = \$10{,}000{,}000 / \$2{,}000{,}000 = 5.$$

The effective operational leverage will not be so great if some of the construction cost is paid by the equity investor up front or during the construction phase (e.g., no construction loan, contractor requires payments as costs are incurred).

e.g., in the previous example, suppose half the fixed-price construction cost had to be paid up-front (but it was still the same $7,680,000 amount)…

Then the original expected return would have been 5.5%:

$$5.5\% = \frac{E[EndVal\ ] - BegVal}{BegVal} = \frac{(\$10{,}000{,}000 - \$3{,}840{,}000) - (\$2{,}000{,}000 + \$3{,}840{,}000)}{\$2{,}000{,}000 + \$3{,}840{,}000}$$

And the loss to the development investor caused by the 10% drop in apartment values would have been only 17.1%, reflecting the effective leverage ratio 1.71 (= $10,000,000 / $5,840,000), as -11.6% is 17.1% below the previous expectation of 5.5%:

$$-11.6\% = \frac{E[EndVal\ ] - BegVal}{BegVal} = \frac{(\$9{,}000{,}000 - \$3{,}840{,}000) - (\$2{,}000{,}000 + \$3{,}840{,}000)}{\$2{,}000{,}000 + \$3{,}840{,}000}$$

But note there is still leverage even here. And of course in the real world, most development is financed by construction loans covering 100% of construction costs (for a variety of reasons), loans that are paid off by the developer (the equity development investor) only upon completion of construction, thereby maximizing leverage.

The Fundamental Nature of Real Estate Development Investment…

Implications of development's operational leverage:

Realized development project investment returns are:

- ***Highly correlated*** **with stabilized property appreciation returns.**
- ***More volatile*** **than stabilized property appreciation returns.**

Therefore, development investment is *more risky* than investment in stabilized pre-existing property *(no surprise)*.

But note that:
Risk is *added by leverage*, and thus:

- **Would exist even for pre-leased projects *(i.e., development risk is not caused only by speculation)*, and would exist even in the absence of a wide-amplitude development demand cycle.**
- **Added risk implies development should have a higher *risk premium* than stabilized investment, in the *ex ante ("going-in") IRR* (and on average over the long run, *ex post* as well).**
- **WACC formula can be useful in estimating appropriate risk premium for development investment, relating development phase RP to typical stabilized property-level RP.**

Ex Ante "Spreads" over stabilized real estate investment …

How big should the development phase risk premium be?

(i.e., What is development OCC?)

The *WACC* Formula is a useful approximation to see how big the development phase *equity* return should be relative to:

- **The stabilized property (i.e., *underlying asset, e.g., NCREIF*) return,**
- **The construction cost (i.e., *debt*) return.**

Recall: $$r_C = r_D + (r_V - r_D)LR$$

Where:

r_C ***=Return on devlpt project up-front investment (construction phase).***

LR=Effective leverage in the devlpt project (V_T/E) ***= Completed stabilized property value divided by up-front land cost (& fees).***

r_V ***= Total return on stabilized property during development phase (as if it existed completed already).***

r_D ***= Total return on construction debt.***

Apply the WACC to the risk premium:

$$E[RP_E] = E[RP_D] + (E[RP_P] - E[RP_D])LR$$

Example:

***E*[*RP*$_P$] = 300 bp**
(Typical for E[RP$_{NCREIF}$], more for spec)
***E*[*RP*$_D$] = 100 bp**
(Remember: E[r], not "stated interest", See Ch.18)
***LR* = 5**
(as in our apartment example)

Then:

$$E[RP_c] = 100bp + (300bp - 100bp) * 5 = 1100bp$$

e.g., If T-Bills are yielding 5%, then the expected return on the construction project is 16%:

$$E[r_E] = 5\% + 11\% = 16\%$$

(as in our apartment example)

The Fundamental Nature of Real Estate Development Investment…

The framework described here can be used, in conjunction with an index of periodic appreciation returns to stabilized property (such as the NCREIF Index), to simulate what the ex post IRRs to typical development investments would have been, during specific historical periods of time…