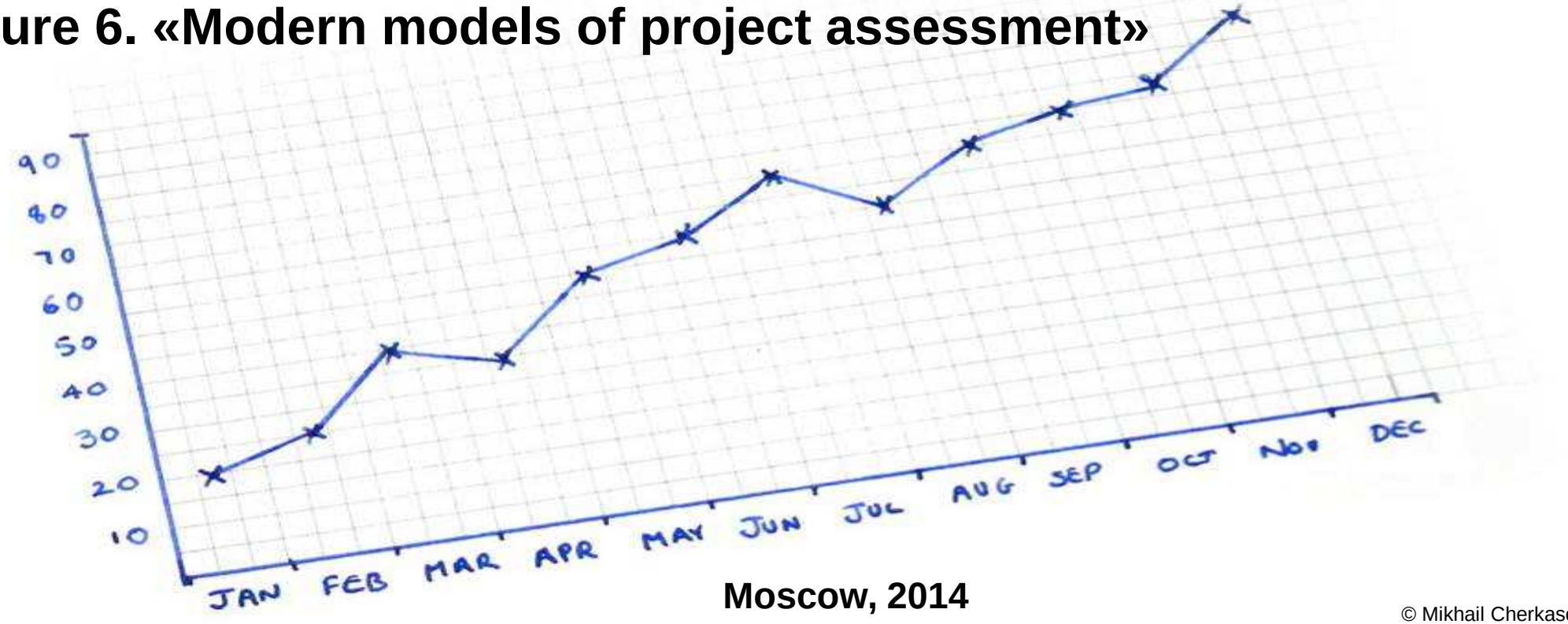
National Research University – Higher School of Economics

Investment Project Management

Lecture 6. «Modern models of project assessment»



Moscow, 2014

Accounting Profitability Ratios

Economic and financial theories created numerous accounting profitability ratios. The key ones:

Accounting Profitability Ratios		Y0	Y1	Y2	Y3	Y4	Y5	Total for the period
Gross Profit		0	6 750	2 769	11 836	14 584	17 581	**53 520**
Operating Income	***OI***	0	4 525	-1 256	7 055	9 791	12 706	**32 821**
Earnings Before Interest and After Taxes (EBIAT)	***EBIAT***	0	3 620	-1 005	5 644	7 832	10 165	**26 257**
Earnings Before Interest and Taxes (EBIT)	***EBIT***	0	4 525	-1 256	7 055	9 791	12 706	**32 821**
Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA)	***EBITDA***	0	4 750	-231	8 656	11 245	14 092	**38 512**
Earnings Before Interest, Taxes, Depreciation, Amortization, Rent (EBITDAR)	***EBITDAR***	0	5 050	219	9 133	11 746	14 615	**40 763**
Earnings Before Interest, Taxes, Depreciation, Amortization, Rent and Management Fees (EBITDARM)	***EBITDARM***	0	5 450	819	9 769	12 414	15 313	**43 765**
Earnings Before Taxes (EBT)	***EBT***	0	3 825	-2 096	6 075	8 671	11 446	**27 921**
Net profit = Net income after tax	***Net income***	0	3 060	-2 096	4 860	6 936	9 157	**21 918**
NOPLAT (NOPAT) - Net Operating Profit Less Adjusted Taxes, Net Operating Profit After Tax	***NOPLAT***	0	3 620	-1 005	5 644	7 832	10 165	**26 257**
NOPLAT (NOPAT) - Net Operating Profit Less Adjusted Taxes, Net Operating Profit After Tax	***NOPAT***	0	3 620	-1 005	5 644	7 832	10 165	**26 257**
OIBDA (Operating Income Before Depreciation and EBITDA)	***OIBDA***	0	4 750	-231	8 656	11 245	14 092	**38 512**
Dividend Yield (Non-Market)	***Yield***		0,00%	6,38%	0,00%	10,13%	14,45%	**10,32%**

Accounting Profitability Ratios

Economic Profitability Ratios		Y0	Y1	Y2	Y3	Y4	Y5	Average for the period
WACC (Weighted Average Cost of Capital)	***WACC***		25,00%	17,31%	18,59%	17,62%	16,67%	**19,04%**
ROA (Return on Assets)	***ROA***		29,08%	-15,81%	26,06%	26,93%	26,09%	**27,04%**
ROAA (Return on Average Assets)	***ROAA***		19,80%	-10,93%	19,02%	20,61%	20,82%	**20,06%**
ROACE (Return on Average Capital Employed)	***ROACE***		44,98%	-9,69%	39,58%	39,54%	37,46%	**40,39%**
ROAE (Return on Average Equity)	***ROAE***		30,42%	-16,17%	27,27%	28,01%	27,00%	**28,17%**
ROC (Return on Capital)	***ROC***		27,26%	-5,80%	29,68%	40,55%	51,50%	**37,25%**
ROCE (Return on Capital Employed)	***ROCE***		44,98%	-9,69%	39,58%	39,54%	37,46%	**40,39%**
ROD (Return on Debt)	***ROD***		61,20%	-34,93%	69,43%	86,71%	101,74%	**79,77%**
ROE (Return on Equity)	***ROE***		30,42%	-16,17%	27,27%	28,01%	27,00%	**28,17%**
ROE (Return on Equity) Du Pont formula	***ROE Du Pont***		30,42%	-16,17%	27,27%	28,01%	27,00%	**28,17%**
ROI (Return on Investment)	***ROI***		43,71%	-17,47%	40,50%	57,80%	76,31%	**54,58%**
ROIC (Return on Invested Capital)	***ROIC***		51,71%	-8,37%	47,03%	65,27%	84,71%	**62,18%**
ROMI (Return on Marketing Investments)	***ROMI***		No entries in the Case					
RONA (Return on Net Assets)	***RONA***		36,65%	-18,40%	40,14%	60,71%	84,32%	**55,46%**
ROR (Return on Revenue)	***ROR***		20,40%	-33,27%	17,72%	20,26%	22,05%	**20,11%**
RORC (Return on Research Capital)	***RORC***		No entries in the Case					

Accounting Profitability Ratios

Economic Profitability Ratios		Y0	Y1	Y2	Y3	Y4	Y5	Average for the period
RORE (Return on Retained Earnings)	***RORE***		100,00%	-9,49%	104,09%	155,42%	198,79%	**139,58%**
ROS (Return on sales, Operating margin)	***ROS***		30,17%	-19,94%	25,72%	28,60%	30,59%	**28,77%**
Profit Volume Ratio	***Profit Volume***		0,00%	12,14%	0,00%	3,55%	4,17%	**6,62%**
Net profit margin	***Net Profit margin***		20,40%	-33,27%	17,72%	20,26%	22,05%	**20,11%**
Investments Turnover	***Investments Turnover***		142,56%	47,52%	147,11%	132,91%	118,33%	**117,69%**
Gross profit margin (Gross Margin)	***Gross Margin (GM)***		45,00%	43,95%	43,15%	42,60%	42,33%	**43,41%**
CROCI (Cash Return on Capital Invested)	***CROCI***		67,86%	-1,93%	72,13%	93,71%	117,43%	**87,78%**
Operating Expense Ratio (OER)	***OER***		5000,00%	1400,00%	5750,79%	6835,22%	7936,27%	**5384,45%**
Capital Employed	***Capital Employed***		10 060	12 964	17 824	24 761	33 918	
Cash Flow Return on Investment (Non-market)	***CFROI***		17,01%	-1,08%	23,25%	30,78%	28,66%	**24,92%**
Interest Tax Shield	***Tax Shield***		140,00	168,00	196,00	224,00	252,00	**980**

Accounting Profitability Ratios

Liquidity Ratios		Y0	Y1	Y2	Y3	Y4	Y5	Average for the period
Free Cash Flow to the Firm	***FCFF***		271	-4 049	4 928	8 517	10 730	**6 111**
Free Cash Flow to Equity	***FCFE***		-289	-5 140	4 144	7 621	9 722	**7 162**
Sales to Receivables	***Receivables Turnover Ratio***		10,51	10,41	10,34	10,29	10,27	**10,37**
Cost of Sales to Payables	***Cost of Sales to Payables***		17,88	12,06	18,97	19,71	20,23	**17,77**
Days payables Ratio	***Days payables Ratio***		20,42	30,27	19,24	18,52	18,04	**21,30**
Days receivables Ratio	***Days receivables Ratio***		34,73	35,05	35,29	35,46	35,54	**35,21**
Quick Ratio (Acid Test)	***Acid Test***		6,80	7,43	10,18	16,71	22,89	**12,80**
Cash to Total Assets	***Cash to Total Assets***		0,16	0,12	0,31	0,52	0,66	**0,35**
Cash Turnover	***Cash Turnover***		9,53	9,80	9,27	9,18	9,13	**9,38**
Current Ratio	***Current Ratio***		8,12	8,56	11,55	18,11	24,32	**14,13**
Fixed to Worth Ratio	***Fixed to Worth Ratio***		0,67	0,75	0,48	0,29	0,18	**0,48**
Non-current assets to Net Worth	***Non-current assets to Net Worth***		0,67	0,83	0,51	0,31	0,19	**0,50**
Earnings Retention Ratio (Non-Market, if paid)	***Earnings Retention Ratio***		100,00%	136,50%	100,00%	82,48%	81,06%	**100,01%**
Free Cash Flow to Operating Cash	***FCF to Operating Cash***		11,24%	-578,38%	96,17%	97,44%	97,71%	**75,64%**

Accounting Profitability Ratios

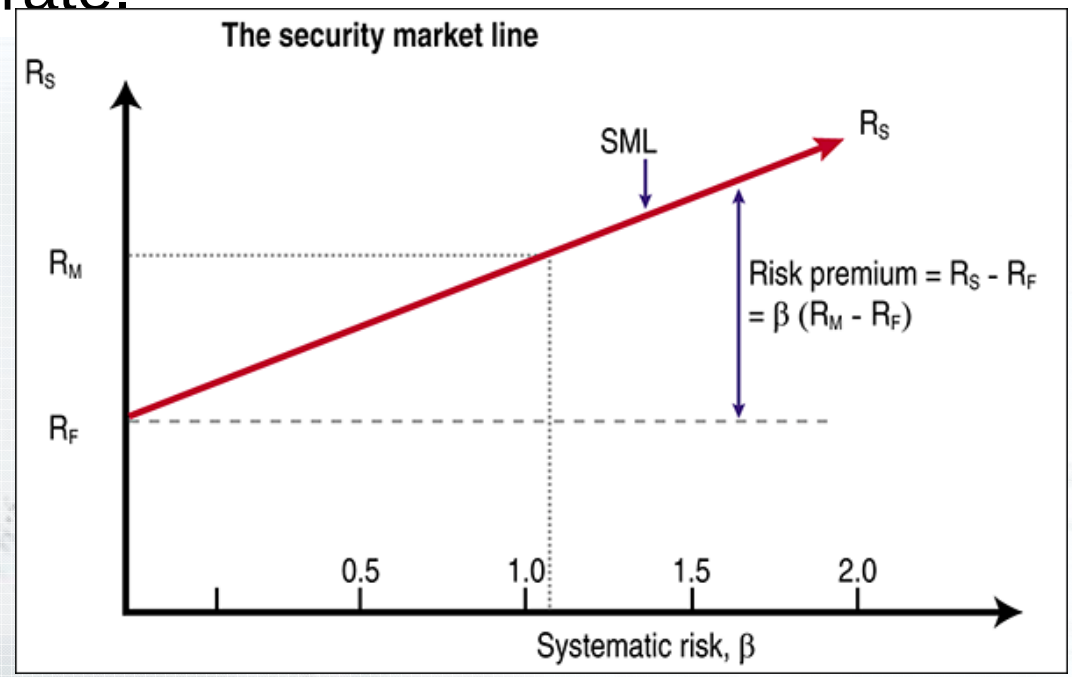
Debt Ratios		Y0	Y1	Y2	Y3	Y4	Y5	Average for the period
Debt Ratio	***Debt Ratio***		46,87%	44,64%	37,03%	30,63%	25,29%	**36,89%**
Debt to Equity Ratio	***Debt to Equity Ratio***		49,02%	45,65%	38,73%	31,87%	26,17%	**38,29%**
Interest Coverage	***Interest Coverage***		6,46	-1,50	7,20	8,74	10,08	**8,12**
Net Interest Margin	***Net Interest Margin***		35,74%	-9,47%	31,32%	31,28%	29,68%	**32,00%**
Cash Flow Coverage Ratio	***CF coverage***		48,89%	11,83%	74,21%	110,78%	123,72%	**73,89%**

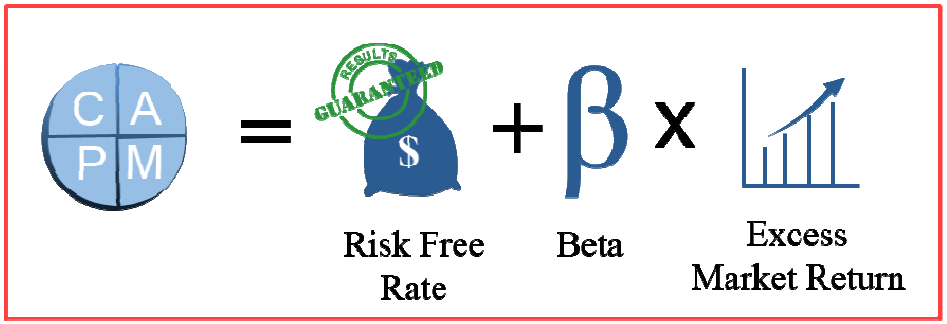
Accounting Profitability Ratios

Efficiency Ratios		Y0	Y1	Y2	Y3	Y4	Y5	Average for the period
Accounts Receivable Turnover	***Accounts Receivable Turnover***		4,06	4,06	4,06	4,06	4,06	**4,06**
Annual Inventory Turnover	***Annual Inventory Turnover***		30,42	30,42	30,42	30,42	30,42	**30,42**
Collection Period	***Collection Period***		90,00	90,00	90,00	90,00	90,00	**90,00**
Inventory Holding Period	***Inventory Holding Period***		12,00	12,00	12,00	12,00	12,00	**12,00**
Inventory to Assets Ratio	***Inventory to Assets Ratio***		2,58%	0,88%	2,75%	2,51%	2,24%	**2,19%**
Overhead ratio	***Overhead ratio***		2,27	-5,20	2,66	2,35	2,16	**2,36**
Revenue per Employee	***Revenue per Employee***		100	32	110	114	119	**94,80**

DCF: Required Rate of Return

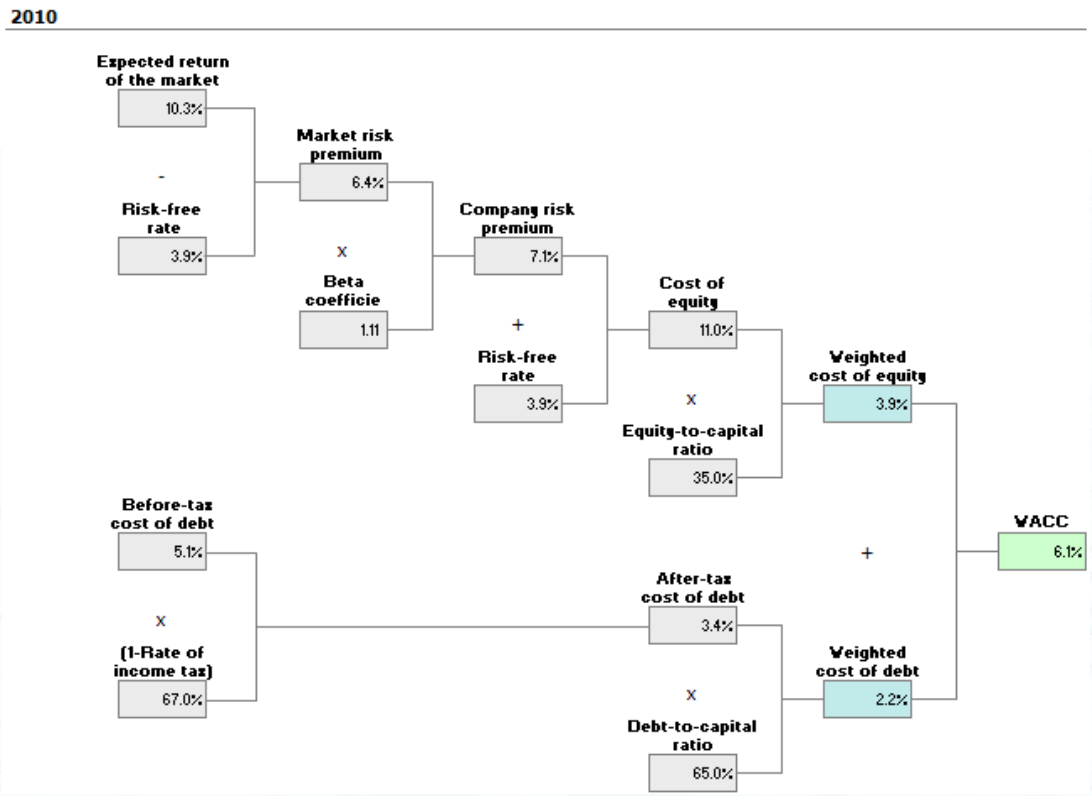
All DCF Project valuation models use the **Required Rate of Return** which is composed of (according to **CAPM** (**Capital Asset Pricing Model**)): **Risk-free** rate, **Beta** (as he sensitivity of the expected excess asset returns to the expected excess market returns) and **Market Return** rate.





DCF: Required Rate of Return

Due to the reason that CAPM properly works in the developed stock markets and looks not so definite for the emerging markets, specific assets and various market anomalies very often it's necessary to prove the Required rate of return chosen for the Asset/Project using additionally some other models.



DCF: Required Rate of Return

Global Company (XXX) is planning to enter into a new line of business using equity increase.

Benchmark Company (ZZZ) is a firm in mentioned segment of industry.

XXX has a D/E of 1/3, ZZZ has a D/E of 2/3. After creating of new business division XXX D/E remains the same = 1/3 (or ¼ of Debt + ¾ of Equity).

Borrowing rate for XXX is 10 %

Borrowing rate for ZZZ is 12 %

Given: Market risk premium = 8.5 %, R_f = 8%, T_c= 40%

What is the **appropriate discount rate** for XXX to use for this takeover?

Step 1. Determining ZZZ's cost of Equity Capital (r_E)

$$\text{ZZZ } r_E = R_f + \beta \times (R_M - R_f) = 8\% + 1,5 \times$$

$$8,5\% = 20,75\%$$

DCF: Required Rate of Return

Step 2. Determining ZZZ's Hypothetical All-Equity Cost of Capital. (r_0)

$$r_E = r_0 + \frac{D}{E} \times (1 - T) \times (r_0 - r_D)$$

$$20,75\% = r_0 + 2/3 \times (0,6) \times (r_0 - 12\%)$$

$$r_0 = 18,25\%$$

Step 3. Determining r_E for XXX's assuming that the business risk of XXX and ZZZ is the same

$$\text{XXX } r_E = 18,25\% + \frac{1}{3} \times (0,6) \times (18,25\% - 10\%) = 19,9\%$$

NOTE : $r_{s\ (XXX)} < r_{s\ (ZZZ)}$ because $D/E_{\ (XXX)} < D/E_{\ (ZZZ)}$

DCF: Required Rate of Return

Step 4. Determining r_{WACC} for XXX's united company.

$$r_{WACC} = \frac{E}{D+E} \times r_E + \frac{D}{D+E} \times r_D \times (1 - T)$$

$$r_{WACC} = \frac{3}{4} \times 19,9\% + \frac{1}{4} \times 10\% \times (1 - 40\%) = 16,425\%$$

We calculate D+E as 4 according to the initial proportion D/E = 1/3.

DCF 3 methods: Adjusted Present Value

Adjusted Present Value (**APV**) is the net present value calculated with all effects sourced by Project debt financing. In general, it means that APV assumes that the project is financed only by equity.

$$\boldsymbol{Adjusted\ Present\ Value\ (APV) = Unlevered\ NPV + NPVF\ (NPV\ of\ Financing\ effects)}$$

There are following main side effects of financing:

- The Tax Shield to Debt
- The Costs of Issuing New Securities
- The Costs of Financial Distress

DCF 3 methods: Adjusted Present Value

In order to calculate **APV** it's necessary to split the cash flows to 2 parts: **Unlevered** cash flows discounted by **ROI** (**Return on Investments**) and the **Debt effects** discounted by **Cost of Debt** rate:

Net Operating Profit After Tax (NOPAT)
+ Non-cash items in EBIT
- Working Capital changes
- Capital Expenditures and Other Operating Investments
=Free Cash Flows (FCF)

Unlevered PV = FCF discounted by ROI.

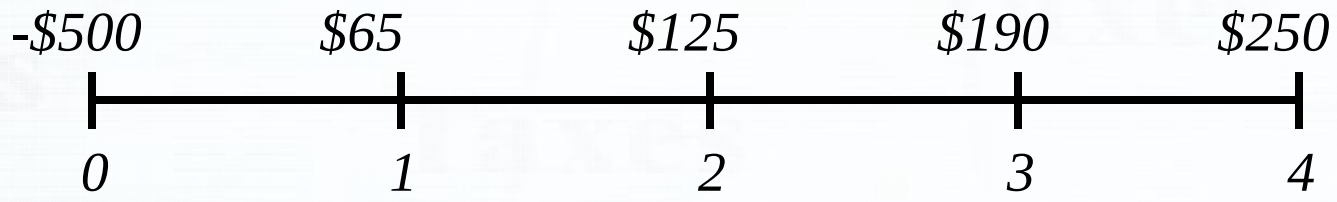
+ Debt effects (Tax shield - New Issuance costs - Cost of distress)

Levered PV = FCF discounted by Cost of Debt.

APV = Unlevered PV + Levered PV

DCF 3 methods: Adjusted Present Value

Consider Project where the timing and size of the incremental after-tax cash flows for an all-equity firm are:



The unlevered cost of equity (Required ROI) is r_0 = **10%**:

Unlevered NPV	-500	59	103	143	171	**-24,10**

The project would be **rejected** by an all-equity firm: $NPV < 0$.

DCF 3 methods: Adjusted Present Value

Now, imagine that the firm finances the project with $300 of debt at r_D = 8%. Tax rate is 40%, so they have an interest **Tax Shield** worth $T_C Br_B$ = .40×$300×.08 = $9.60 each year. The APV is calculated:

$$\boldsymbol{APV = NPV + NPVF}$$

$$\boldsymbol{APV = -24.10 + \sum_{t=1}^{4} \frac{9.60}{(1.08)^t} = -24.10 + 31.80 = +7.70}$$

The project should be **accepted** with debt because NPV >0. The same result will be achieved if calculate the full NPV of the loan:

Loan NPV discounted by Cost of Loan = **Tax Shield** discounted by Cost of Loan.

DCF 3 methods: Flow to Equity Approach

Flow to Equity Approach (**FTE**) represents a discount of the project cash flow to the equity holders of the levered firm at the cost of levered equity capital, r_E.

There are three steps in the FTE Approach:

- **Step One**: Calculate the levered cash flows
- **Step Two**: Calculate r_E.
- **Step Three**: Valuation of the levered cash flows at r_E.

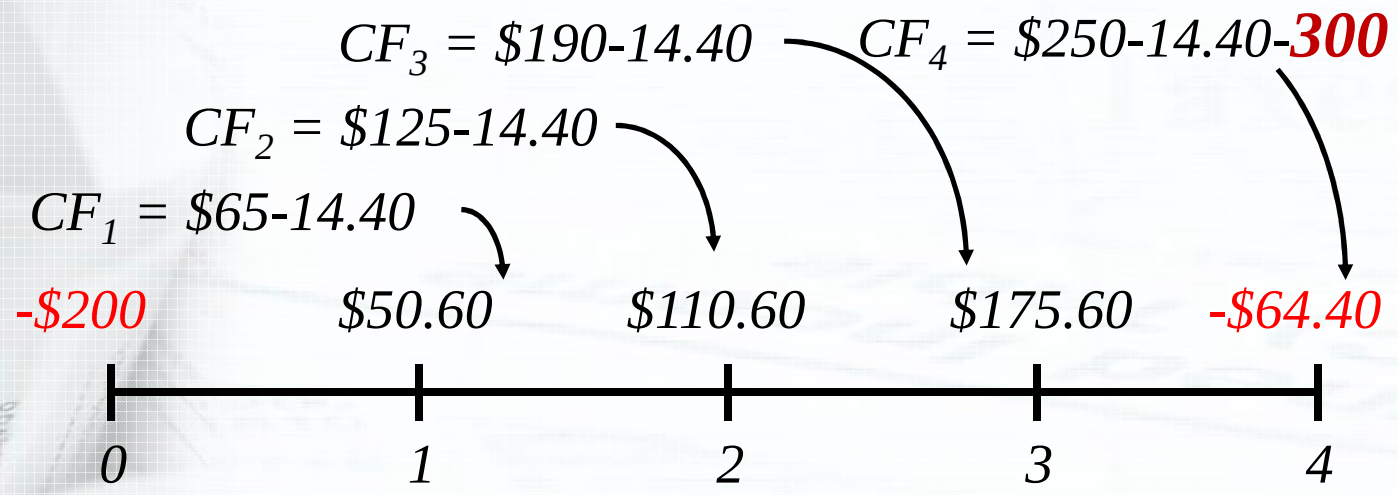
DCF 3 methods: Flow to Equity Approach

Flow to Equity Approach (**FTE**) represents a discount of

Since the firm is using $300 of debt, the equity holders only have to come up with $200 of the initial $500.

Thus, CF_0 = -$200

Each period, the equity holders must pay interest expense. The after-tax cost of the interest is $B \times r_B \times (1-T_C)$ = $300×.08×(1-.40) = $14.40



DCF 3 methods: Flow to Equity Approach

$$r_E = r_0 + \frac{D}{E} \times (1 - T) \times (r_0 - r_D)$$

To calculate the debt-to-equity ratio, ***D/E***, start with the debt to value ratio.

PV of the project cash flows (including **Tax Shield**) since period 1 is:

$ 507.70.

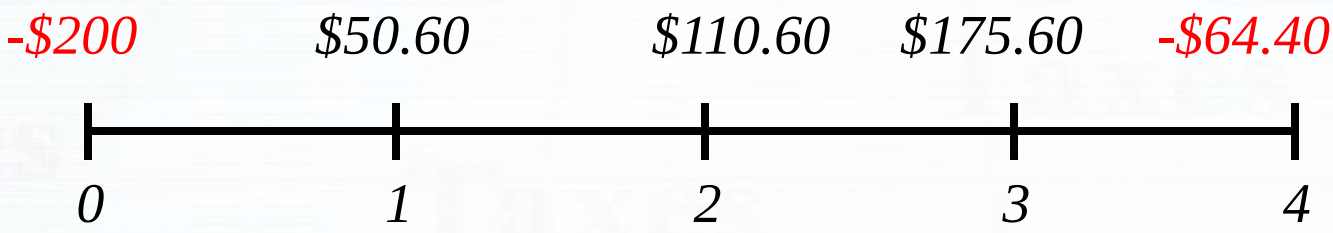
$$PV = \frac{65}{(1.10)^1} + \frac{125}{(1.10)^2} + \frac{190}{(1.10)^3} + \frac{250}{(1.10)^4} + \sum_{t=1}^{4} \frac{14.40}{(1+0.8)^t}$$

D = $ 300; E = $ 507.70 - $ 300 = $ 207.70.

$$r_E = 10\% + \frac{300}{207.70} \times (1 - 40\%) \times (10\% - 8\%) = 11,73\%$$

DCF 3 methods: Flow to Equity Approach

Discounting the cash flows to equity holders at r_E = 11.73%



$$PV_{r_E} = -\$\,200 + \frac{\$\,50.60}{(1.1173)} + \frac{\$\,110.60}{(1.1173)^2} + \frac{\$\,175.60}{(1.1173)^3} + \frac{-\$\,64.40}{(1.1173)^4} = \$\,18,44$$

DCF 3 methods: WACC

The **Weighted Average Cost of Capital** (**WACC**) is the rate that a company is expected to pay on average to all its security and debt holders to finance its assets. The WACC is the minimum return that a company must earn on an existing asset base to satisfy its creditors, owners, and other providers of capital, or they will invest elsewhere.

$$r_{WACC} = \frac{E}{D+E} \times r_E + \frac{D}{D+E} \times r_D \times (1 - T)$$

$$r_{wacc} = \frac{200}{300} \times 11.73\% + \frac{300}{200} \times 8\% \times (1 - 40\%) = 7{,}57\%$$

$$PV_{r_{WACC}} = \$7{,}87$$

DCF 3 methods: APV, WACC, Flow to Equity

All three methods: **APV**, **WACC** and **Flow to equity** are focused at the same task: valuation in the Presence of the Project/Entity with debt financing.

Guidelines:

We use **WACC** or **FTE** if the firm's target debt-to-value ratio applies to the project over the life of the project.

We use the **APV** if the project's level of debt is known over the life of the project.

In the real world, the **WACC** is the most widely used approach by far.

DCF 3 methods: APV, WACC, Flow to Equity

	APV	WACC	FTE
Initial Investment	All	All	Equity Portion
Cash Flows	*UnleveredCF*		*LeveredCF*
Discount Rates	r_0	r_{WACC}	r_E
PV of financing effects	Yes	No	No

Which approach is **best**?

- We use **APV** when the *level* of debt is constant
- We use **WACC** and **FTE** when the debt **ratio** is constant

DCF 3 methods: back to APV

Let's calculate the **APV** for certain project:

A Company is considering a $5 million expansion of their existing business.

- The initial expense will be depreciated straight-line over 5 years to zero salvage value
- The pretax salvage value in year 5 will be $500,000.
- The project will generate pretax earnings of $1,500,000 per year, and not change the risk level of the firm.
- The firm can obtain a five-year $3,000,000 loan at 12.5% to partially finance the project.
- If the project were financed with all equity, the cost of capital would be 18%. The corporate tax rate is 34%, and the risk-free rate is 4%.
- The project will require a $100,000 investment in net working capital.

DCF 3 methods: back to APV

In considered project we should extract the **Tax benefits** generated by the **Depreciation** and **Interest**.

$$APV = -Outlay + PV_{Unlevered} + PV_{Depreciation\ Tax\ shield} + PV_{Interest\ Tax\ shield}$$

The cost of the project is not equal to Outlay amount. We must include the round trip in and out of Net Working Capital (**NWC**) and the after-tax **Salvage value**. NWC is riskless, so we discount it at r_f (**Cost of Financing**). Salvage value should have the same risk as the rest of the firm's assets, so we use r_0.

$$\mathbf{Outlay} = -\$5.1m + \frac{100\,000}{(1+12{,}5\%)^5} + \frac{500\,000 \times (1-34\%)}{(1+18\%)^5} = \mathbf{-\$4{,}9m}$$

DCF 3 methods: back to APV

Let's calculate all entries:

$$PV_{unlevered} = \sum_{t=1}^{5} \frac{UCF_t}{(1+r_0)^t} = \sum_{t=0}^{5} \frac{\$1{,}5m \times (1-34\%)}{(1{,}18)^t} = \$3{,}096m$$

$$PV_{Depreciation\ Shield} = \sum_{t=1}^{5} \frac{D \times T}{(1+r_f)^t} = \sum_{t=1}^{5} \frac{\$1m \times 34\%}{(1{,}04)^t} = \$1{,}513m$$

$$PV_{Interest\ Tax\ Shield} = \sum_{t=1}^{5} \frac{T \times r_D \times \$3m}{(1+r_D)^t} = \sum_{t=1}^{5} \frac{34\% \times 0{,}125 \times \$3m}{(1{,}125)^t} = \$0{,}454m$$

APV = -$4,9m + $3,096 + $1,513 + $0,454 = **$0,190**

Since the project has a **positive APV**, it looks like a go.

Other valuation methods: EVA or EP

Economic Value Added (**EVA**, trademark of Stern-Stewart) or **Economic Profit** (**EP**, trademark of McKinsey & Co.) represents is the profit earned by the firm less the cost of financing the firm's capital.

$$\boldsymbol{EVA = NOPAT - \$WACC}$$

$$NOPAT = EBIT \times (1 - Tax\ rate)$$

$$\$WACC = WACC \times Capital$$

or $\boldsymbol{EP = (ROI - WACC) \times Invested\ Capital}$

EVA allows to create a link between the current earnings and assets and measures the actual profitability more precisely than Accounting ratios. But it doesn't consider any future cash flows: extra-maximizing of EVA in current period might cause the decrease of the profitability in upcoming periods.

Other valuation methods: EVA or EP

NPV calculated on the cash flows of **Economic Value Added** (**EVA**) or is called **MVA** (**Market Value Added**):

$$NPV_{EVA} = MVA = \sum_{t=1}^{\infty} \frac{EVA_t}{(1 + WACC)^t}$$

Normally, if we calculate NPV_{EVA} by the rate = 1+WACC we find the same result as conventional calculation of company's valuation based on NPV.

Accounting Profitability Ratios

EVA-based Ratios		Y0	Y1	Y2	Y3	Y4	Y5	Average for the period
EVA (Economic Value Added)	***EVA***		2 370	-3 070	2 313	4 501	6 849	**12 963**
EVA Margin (Economic Value Added on Sales)	***EVA Margin***		15,80%	-48,74%	8,43%	13,15%	16,49%	**13,47%**
EVA Momentum growth rate	***EVA Momentum***			-36,27%	85,45%	7,98%	6,86%	
EROE (Economic Return on Equity)	***EROE***		33,86%	-25,59%	19,27%	37,51%	57,08%	**36,93%**
EROA (Economic Return on Assets)	***EROA***		22,53%	-23,16%	12,40%	17,47%	19,51%	**17,98%**
MVA (Market Value Added)	***MVA***		No entries in the Case					

Other valuation methods: Residual Income

Residual Income Valuation assesses the part of Shareholders' Equity not reflected in Equity Book Value.

Residual Income = Net Income - Equity Charge (Equity Charge = Equity Capital x Cost of Equity) or

$$PV_0 = BookValue_0 + \sum_{t=1}^{\infty} \frac{RI_t}{(1+r_E)^t}$$ or adding Net Terminal Value:

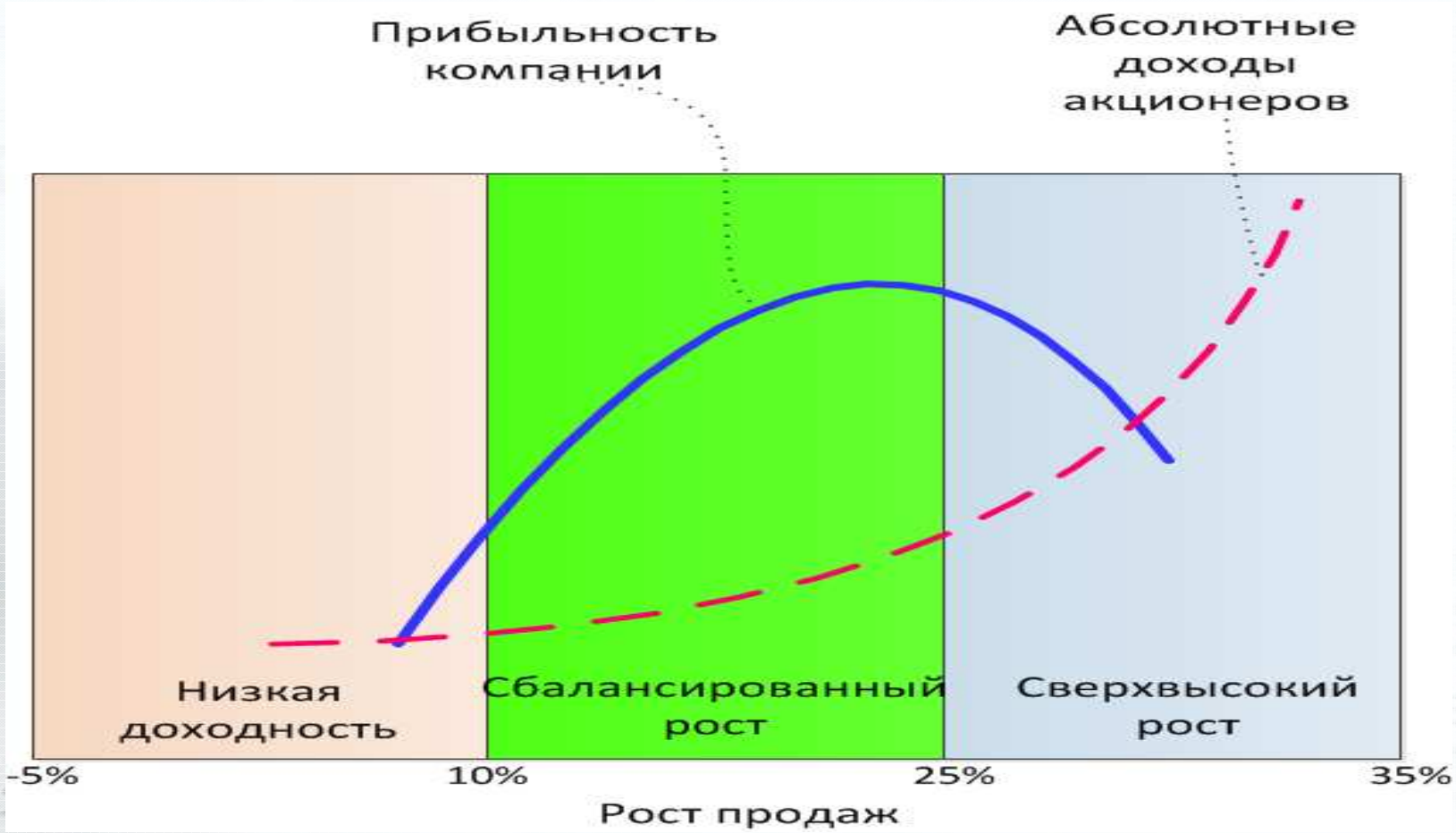
$$PV_0 = BookValue_0 + \sum_{t=1}^{m-1} \frac{RI_t}{(1+r_E)^t} + \frac{\frac{RI_m}{r_E - g}}{(1+r_E)^{m-1}}$$

Other valuation methods: Claims Valuation

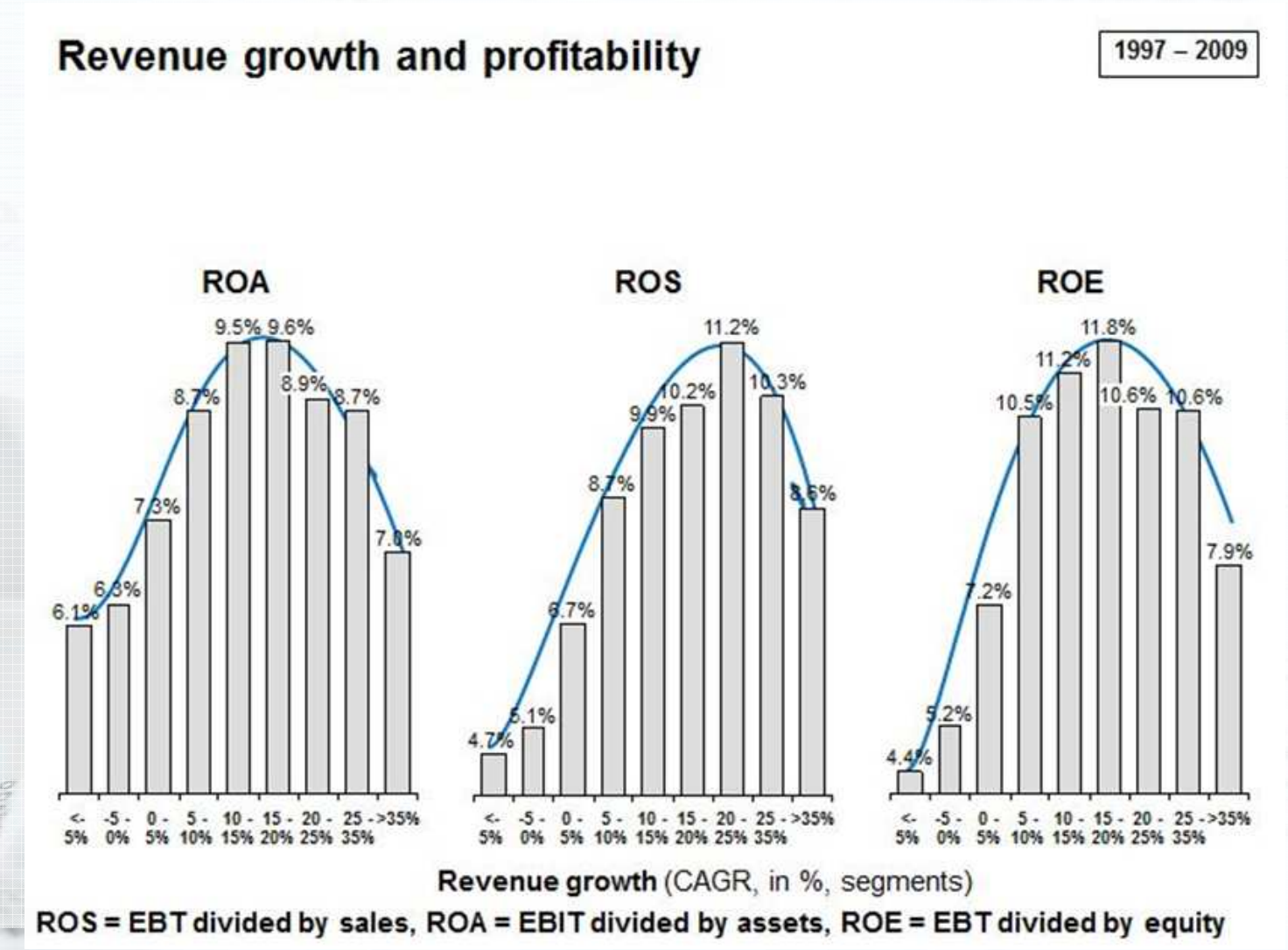
Claim Valuations Approach gives a final Present Value of shareholders' equity after the repayments of all debt obligations.

All principal and interest repayments are discounted by r_D (Cost of Debt rate, Levered Capital rate) and all future cash flows in favour of shareholders are discounted by r_E (Unlevered Capital rate). The difference between 2 amounts represents current Company's NPV.

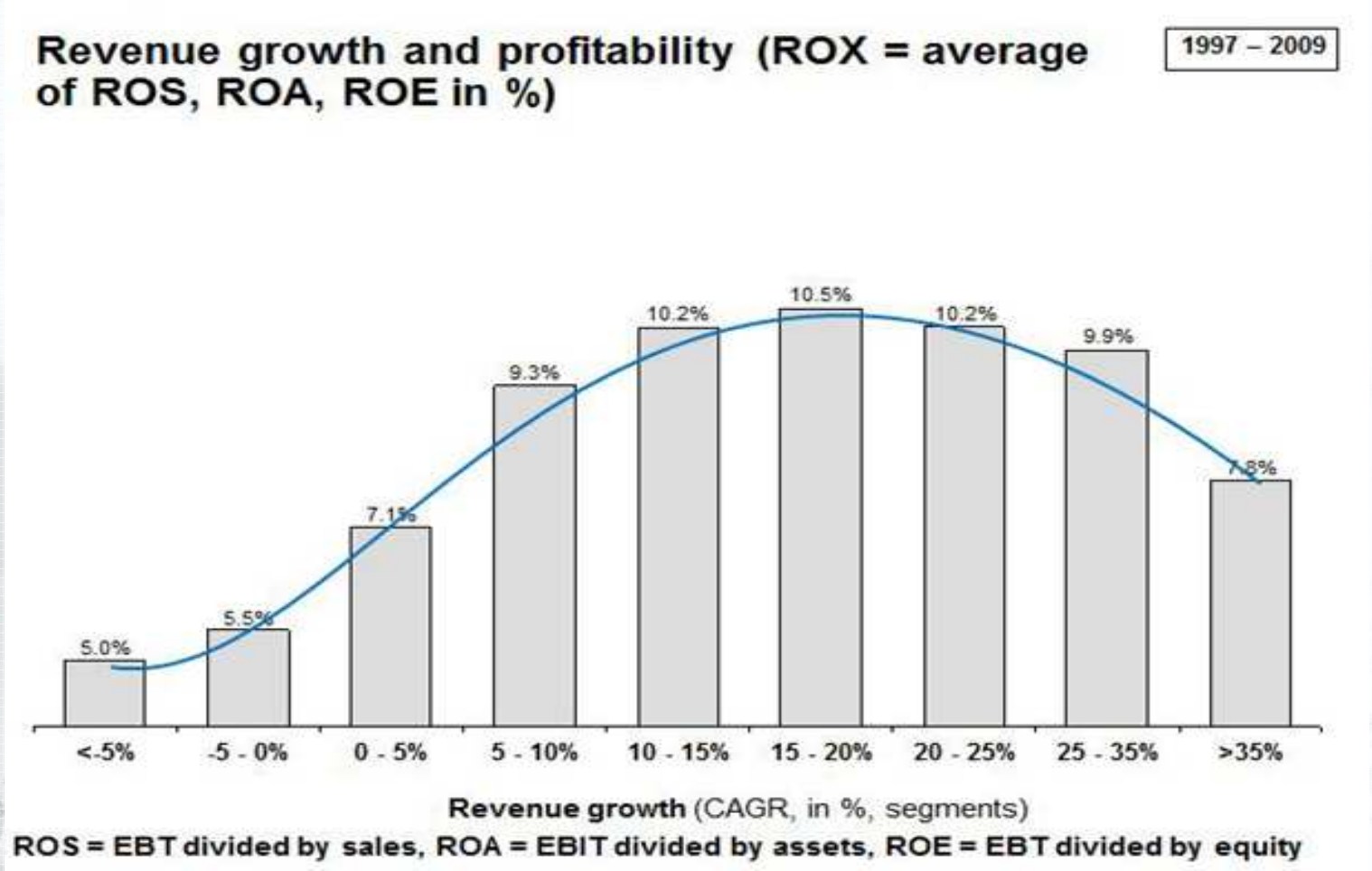
Other valuation methods: Sustainable Growth Rate



Other valuation methods: Sustainable Growth Rate



Other valuation methods: Sustainable Growth Rate



Other valuation methods: Sustainable Growth Rate

g* = (Sales/Assets) * (Net Profit/Sales) * Earnings Retention Rate (1 - Norm of Dividends) * (Assets/Equity)

g* = Earnings Retention Rate (1 - Norm of Dividends) * (Assets/Equity) * ROE (Return on Equity)

Other valuation methods:
Altman Z-score, Index of Creditworthness

Public Co. (5 factor model):

Z5 public = (Net current assets/Total Assets)*1,2 +(Net income (main activity)/Total assets)*3,3+(Accumulated Equity/Total assets)*1,4 + (Paid-up equity/Total liabilties)*0,6 + (Sales proceeds/Total assets)*0,999.

Norm – not lower than **2,71**.

Non-public Co. (5 factor model):

Z5 non-public = (Net current assets/Total Assets)*0,717 +(Retained earnings/Total assets)*0,84+ (Operating profit/Total Assets)*3,107 + (Shareholders' equity/Total liabilties)*0,42 + (Revenues/Total assets)*0,995.

Norm – not lower than **1,23**.

For all companies (2 factor model):

Z2 = 0,3877-1,0736*(Current assets/Short-term liabilities) + 0,0579*(Borrowings/Total assets).

Norm – not lower than **0**.