Multi Stage Growth

Capital Budgeting

- Calculating Cash Flows
- Capital Rationing

Price to Earnings Ratio (P/E)

A P/E ratio ("share price" over "earnings per share") is often viewed as an indicator of how "good" a firm is.

Using the Gordon Growth Model,

$$\frac{P_0}{EPS_1} = \frac{1-b}{r-g}$$

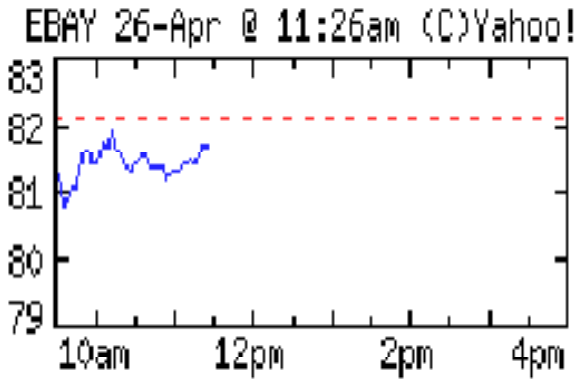
- P/E ratios are primarily affected by the growth rate
  - Compare firms in the same risk class and plowback ratio, i.e. "r" and "b" are more or less the same. Then, a high "g" means a high P/E ratio.

Lets look at some examples: *EBAY*, *DELL and General Motors*

EBAY INC (NasdaqNM:EBAY) Quote data by Reuters

Edit

Last Trade:	**81.734**	Day's Range:	79.90 - 81.98
Trade Time:	11:24AM ET	52wk Range:	45.955 - 83.15
Change:	0.406 (0.49%)	Volume:	4,597,212
Prev Close:	82.14	Avg Vol (3m):	6,702,136
Open:	80.08	Market Cap:	53.45B
Bid:	81.73 x 100	P/E (ttm):	99.92
Ask:	81.74 x 7800	EPS (ttm):	0.818
1y Target Est:	86.85	Div & Yield:	N/A (N/A)



1d 5d 3m 6m 1y 2y 5y max

Real-time charts for EBAY.
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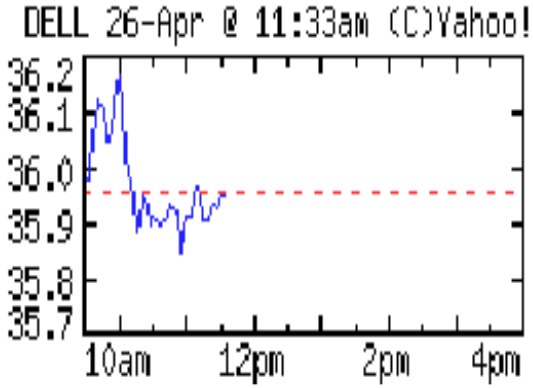
EBAY's P/E ratio is 99.92

DELL INC (NasdaqNM:DELL) Quote data by Reuters

Edit

Last Trade:	**35.96**	Day's Range:	35.80 - 36.19
Trade Time:	11:32AM ET	52wk Range:	28.637 - 37.18
Change:	**0.00 (0.00%)**	Volume:	4,165,567
Prev Close:	35.96	Avg Vol (3m):	16,449,454
Open:	35.98	Market Cap:	92.07B
Bid:	35.95 x 1000	P/E (ttm):	35.60
Ask:	35.96 x 2800	EPS (ttm):	1.01
1y Target Est:	42.05	Div & Yield:	N/A (N/A)



1d 5d 3m 6m 1y 2y 5y max

Real-time charts for DELL.
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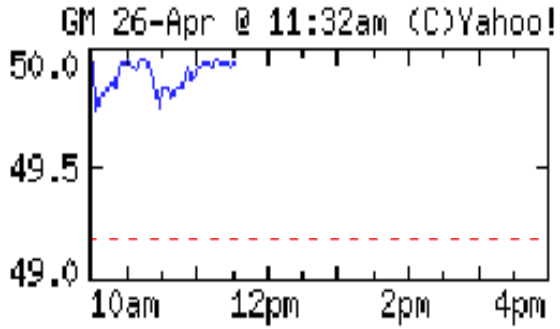
DELL's P/E ratio is 35.60

GENERAL MOTORS (NYSE:GM) Quote data by Reuters

Edit

Last Trade:	**49.92**	Day's Range:	49.69 - 50.00
Trade Time:	11:29AM ET	52wk Range:	32.84 - 55.55
Change:	↑ 0.74 (1.50%)	Volume:	2,781,800
Prev Close:	49.18	Avg Vol (3m):	5,534,409
Open:	49.95	Market Cap:	28.06B
Bid:	N/A	P/E (ttm):	11.13
Ask:	N/A	EPS (ttm):	4.484
1y Target Est:	57.25	Div & Yield:	2.00 (4.07%)



1d 5d 3m 6m 1y 2y 5y max

Real-time charts for GM.
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GM's P/E ratio 11.13

We will use the Gordon Growth Model to evaluate stocks of firms with time changing growth rates.

Multi Stage Growth

Example: Find the value of a firm for which:

- From year 1 through 12, ROE = 12%,and b=100% (high growth stage)
- From year 13 on, ROE =10% and b=40%
- BE_0 = \$50 and r=10%

The growth rate for the first 12 years is ROE x b = 12%

BE_{12} is $\$50(1+g)^{12} = \$194.8$.

The dividend at time 13 is $DIV_{13} = BE_{12}\ (10\%)(1-0.4) = \$11.68$.

The new growth rate is ROE_{new} x b_{new} = 10%(0.4) = 4.0%

Using GGM the stock price at time 12 is $P_{12}=DIV_{13}/(r-g)=\$194.8$

Multi Stage Growth

The share price is the discounted value of dividends .

There are no dividend payments for the first 12 years. The first dividend payment is due at time 13.

So … the current stock price is the discounted future stock price at time 12,

$$P_0 = \frac{1}{(1+r)^{12}} \times P_{12} + PV(\text{div's for first } 12 \text{ years})$$

$$\Rightarrow P_0 = \frac{1}{(1.10)^{12}} \times 194.8 = \$62.07$$

Capital Budgeting:

Net Present Value (NPV)

Capital Budgeting: Net Present Value (NPV)

*Corporations will choose a project only if the PV of outflows is smaller than the PV of inflows, i.e. if the **NPV is positive**.*

The NPV of a project is: $$NPV = C_0 + \frac{C_1}{(1+r)^1} + \ldots + \frac{C_n}{(1+r)^n}$$

Where "Net" refers to the fact that C_0 (for example) may be negative (outflow) and represent the investment in the project.

Decision rule*:*

(1) In the case of a single project (or many independent projects): accept the project if and only if NPV>0.

(2) In the case of mutually exclusive projects, accept the project with the highest NPV, if that NPV>0.

Calculating Cash Flows

To get a valid NPV we discount the actual, after-corporate-tax, incremental cash flows, that we get from taking on a project.

Rule 1: Use actual cash flow attributed to the project

- Use incremental cash flows
- Forget sunk costs
- Include opportunity cost of using existing equipment, facilities, etc. as outflows.

Rule 2: Be consistent in the treatment of taxes.

- Discount after-tax cash flows with the after-tax interest rate.

Rule 3: Use actual cash flows – not accounting earnings.

Calculating Project Cash Flows

$\mathbf{C_t}$ = (Project Cash Inflows)$_t$ – (Project Cash Outflows)$_t$

= (Project Operating Revenues)$_t$

– (Project Operating Expenses Except Depreciation)$_t$

– (Project Capital Expenditures)$_t$ – (Project Income Taxes)$_t$

- We don't include accounting depreciation as an expense because it is not a real expense.
- However, depreciation does affect cash flows because it reduces tax payments.

(Project Income Taxes)$_t$ = (Tax Rate)$_t$ x (Project Revenues)$_t$

– (Tax Rate)$_t$ x (Project Expenses Except Depreciation)$_t$

– (Tax Rate)$_t$ x (Depreciation)$_t$

Calculating Project Cash Flows

<u>key equation for project cash flows</u>

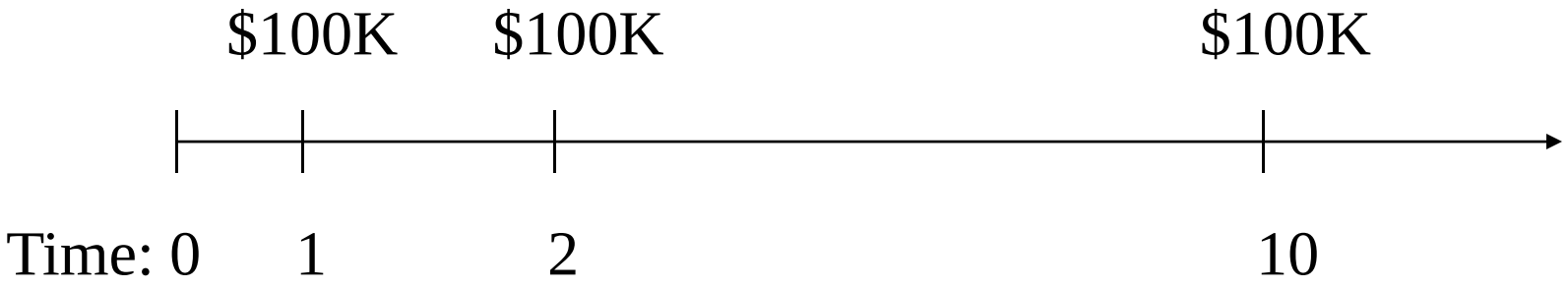
Taxable earnings = Project Operating Revenues **–** Operating Expenses
– Depreciation

$\mathbf{C_t}$ = Project Operating Revenues **–** Operating Expenses
– t(**Taxable earnings**) **–** Capital Expenditures

- Operating Expenses above are "Operating Expenses Except Depreciation" i.e. do **not** include Depreciation
- "t" is the corporation's marginal tax rate

Example: You have just purchased a machine for $1M with a life of 10 years. Each year it produces revenues of $300,000, and operating expenses of $100,000. Assume that the machine will be depreciated over 10 years using straight-line depreciation, and have no salvage value. The Corporate tax rate is 40%. What are your annual after-tax cash flows?

Depreciation schedule



Calculating Cash Flows:

Date 0: revenues are $0, expenses are $0, capital expenditures are $1M and depreciation is $0

Taxable earnings = $0 – $0

Cash flow = $0 – $0 – 0.4($0) – $1M = – $1M

Date 1-10: revenues are $300K, operating expenses are $100K, capital expenditures are $0 and depreciation is $100K

Taxable earnings = $300K – $100K – $100K = $100K

Cash flow = $300K – $100K – 0.4($100K) = $160K

Working Capital

There are typically timing differences between the accounting measure "**Sales – Cost of Goods Sold**" and cash flows. This difference is "**Working Capital**",

Working Capital = Inventories + Accounts Receivable – Accounts Payable

- **Inventory**: An increase in inventory is a real cost – even if these goods are not sold in the current year.

- **Accounts Receivable**: If we haven't received payments we shouldn't count it as a cash flow.

- **Accounts Payable**: If we haven't paid suppliers yet we shouldn't count it as a cash flow.

Change in Working Capital should be treated as an expense

Example 1: You run a chain of stores that sells sweaters. At time 0 you buy 1M sweaters at a price of $30 each. At time 1 you sell 500K sweaters for $60 each and at time 2 you sell 500K sweaters for $60 each. The corporate tax rate is 40%. What are your after tax cash flows?

T	After tax [Sales – Cost of Goods Sold]	Inventory	Change in Working Capital	Cash flow
0	$0	$30M	$30M	– $30M
1	0.5M($60 – $30)(1-0.4) = $9M	$15M	–$15	$9M+$15M= $24M
2	0.5M($60 – $30)(1-0.4) = $9M	$0	–$15	$9M+$15M= $24M

Example 2: The United Sporting Goods Company (USG) is thinking of replacing its eight-year-old machine used to finish aluminum baseball bats. The new machine will put a satin finish on the bats. Should USG undertake the project?

- A marketing study that cost $200K concludes that the new finish will allow USG to sell the bats for $0.30 more than the old bats which currently wholesale for $8.50. Also sales are predicted to increase by 10% to 176K units per year.
- The new machine costs $280K and has operating costs of $17K per year. The annual operating costs of the old machine are $25K.
- The material, labor, general and administrative costs will remain at $7.00 per bat.
- The machine will require an increase in accounts receivable and inventory net of payables of $40K which will be recovered at the end of the project.

Example 2 (continued):

- The old machine has been completely depreciated. Its current market value is $48K and it is expected to last another 7 years at which time it will have no salvage value.
- The new machine is expected to last 7 years at which time it will have a salvage value of $14K. It will be depreciated for accounting purposes using straight line depreciation assuming no salvage value.
- USG faces corporate tax rate of 34% and the appropriate discount rate is 16%.

Should the project be executed?

Incremental cash revenue: New machine produces 10% more bats and increases the sell price by $0.30. Thus, the incremental cash flow revenue is $0.30(160K) + ($8.80-$7)(16K) = $76.8K.

Incremental operating expenses: New machine has operating costs of $17K while the old machine has $25K. Thus, the incremental operating expenses are – $8K.

Annual depreciation new machine: Straight line depreciation, of $280K/7 = $40K.

Change in working capital: At time 0, an increase in WC of $40K. At time 7, a decrease in WC of $40K.

Capital expenditure: New machine costs $280 at time t=0. We receive $14K from selling the new machine, at time t=7 (salvage value is $0). We get $48K from selling the old machine (fully depreciated).

After tax interest rate: 16%(1-0.34) = 10.56%

	0	1-6	7
Incremental cash revenue	$0	$76.8K	$76.8K
Incremental operating expenses	$0	– $8K	– $8K
Capital expenditures	280K		
Depreciation		$40K	$40K
Other income	$48K		$14K
Taxable earnings	$48K	$84.8 – $40 = $44.8K	$44.8 + 14K = $58.8K
Taxes	$16.32K	$44.8K(0.34) =$15.2K	$58.8K(0.34)=$20K
Change in WC	+ $40K		– $40K
After tax operating cash flow	– $288K	$69.57K	$118.8K

$$\text{NPV} = -288 + \frac{69.57}{0.1056}\left(1 - \frac{1}{1.1056^{6}}\right) + \frac{118.8}{1.1056^{7}} = \$68.97\text{K}$$

Capital Rationing

In general we would like to think that funds will be made available for any positive NPV>0 project, but in practice this is not the case,

- *It is difficult to raise additional external funds*
- *Banks impose limits on firms' credit lines*

Example: You are a manager with $1M to invest and you have the following possible independent projects:

Project	Cost	PV inflows	Profitability index	NPV
A	$200,000	$300,000		$100,000
B	$500,000	$620,000		$120,000
C	$400,000	$700,000		$300,000
D	$200,000	$275,000		$75,000
E	$100,000	$130,000		$30,000
F	$100,000	$140,000		$40,000

Capital Rationing

To answer this question we calculate the **Profitability Index (PI)**:

$$PI = \frac{PV(\text{future cash flows})}{\text{Initial Investment}}$$

Decision rule:

(1) In the case of independent projects accept all projects with PI>1 (this is the same as accepting all projects with NPV>0)

(2) In the case of mutually exclusive projects, among projects with PI>1, start by choosing the one with the highest PI.

Example (continued):

Project	Cost	PV inflows	Profitability index	NPV
A	$200,000	$300,000	1.50	$100,000
B	$500,000	$620,000	1.24	$120,000
C	$400,000	$700,000	1.75	$300,000
D	$200,000	$275,000	1.38	$75,000
E	$100,000	$130,000	1.30	$30,000
F	$100,000	$140,000	1.40	$40,000

First rank the projects: C>A>F>D>E>B.

C $400,000

C+A $400,000+$200,000 = $600,000

C+A+F $600,000+$100,000 = $700,000

C+A+F+D $700,000+$200,000 = $900,000

C+A+F+D+E $900,000+$100,000 = $1M

You don’t have enough funds to finance project B.