Théorie Financière
2009-2010

1. Introduction –
Fondements certitude

Professeur André Farber
Organisation du cours

Brealey, R., Myers, S. and Allen, F. (BMA)
*Principle of Corporate Finance*

Berk, J. and P. DeMarzo
*Corporate Finance*
Pearson 2007

Farber, A. Laurent, M-P., Oosterlinck, K., Pirotte, H. (FLOP)
*Finance*

Site web: www.ulb.ac.be/cours/solvay/farber
Examen(s)
Exercices

- Assistants:
  - Benoit Dewaele
  - Benjamin Lorent
- 6 séances (Vendredi 10-12), 4 groupes
  - Groupe 1: A à F
  - Groupe 2: G à L
  - Groupe 3: M à P
  - Groupe 4: Q à Z

  Semaines 2, 4, 6, 9, 11, 13

  Semaines 3, 5, 8, 10, 12, 14
Plan du cours

• 1. Introduction - Fondements
• 2. Valeur actuelle
• 3. Cash flows, planning financier
• 4. Evaluation d’entreprises
• 5,6. Analyse de projets d’investissement
• 7,8. Rentabilité attendue et risque
• 9,10. Options
• 11, 12. Evaluation et financement
What is Corporate Finance?

• **INVESTMENT DECISIONS**: Which REAL ASSETS to buy?
  - *Real assets*: will generate future cash flows to the firm
  - Intangible assets: R&D, Marketing,..
  - Tangible assets: Real estate, Equipments,..
  - Current assets: Inventories, Account receivables,..

• **FINANCING DECISIONS**: Which FINANCIAL ASSET to sell?
  - *Financial assets*: claims on future cash flows
  - Debt: promise to repay a fixed amount
  - Equity: residual claim

• **DIVIDEND DECISION**: How much to return to stockholders?
Accounting View of the Firm

- **Balance sheet**
  - Current assets
  - Net Working Capital
  - Current liabilities
  - Long-term debt
  - Shareholders’ equity

- **Income statement**
  - Sales
    - Operating expenses
  - = Earnings before interest and taxes (EBIT)
    - Interest expenses
    - Taxes
  - = Net income (earnings after taxes)
    - Retained earnings
    - Dividend payments
Cash Flows of the Firm

Firm invest

Cash flow from operations

Firm

Firm issue securities

Financial markets

Dividend and debt payments

Investors

Timing of cash flows + uncertainty
Market Value of the Firm

- Book values
  - Total capital
    - Fixed Assets + Net Working Capital
  - Book equity
  - Debt

- Market values
  - Market value of equity
  - Market capitalization
  - Market value of debt
Value creation

- Market value added (MVA)
  - = Market value of the firm’s capital – Total capital employed

  \[
  \text{Market value of equity} + \text{Market value of debt} = \text{Stockholders’ equity} + \text{Financial debt}
  \]

- VALUE CREATION : 2 strategies
  - **Strategy 1**
    - Buy assets at a cost lower than the value of the future revenues
      - real assets
      - financial assets

  - **Strategy 2**
    - Sell financial assets for a price higher than the value of future payments
## Examples (Aug. 30, 2009)

<table>
<thead>
<tr>
<th></th>
<th>Microsoft</th>
<th>Wal-Mart</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market Cap $billion</strong></td>
<td>219.92</td>
<td>198.95</td>
</tr>
<tr>
<td>Capitalisation boursière (milliards USD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stockholders’ Equity $b</strong></td>
<td>39.56</td>
<td>65.29</td>
</tr>
<tr>
<td>Fonds propres</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Revenues ($b)</strong></td>
<td>58.44</td>
<td>405.61</td>
</tr>
<tr>
<td>Chiffre d’affaires</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net Income $b</strong></td>
<td>14.57</td>
<td>13.40</td>
</tr>
<tr>
<td>Résultat net</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Price/Book</strong></td>
<td>5.56</td>
<td>3.05</td>
</tr>
<tr>
<td><strong>Return on Equity (ROE)</strong></td>
<td>36.83%</td>
<td>20.52%</td>
</tr>
<tr>
<td><strong>Price-Earnings Ratio (P/E)</strong></td>
<td>15.09</td>
<td>14.85</td>
</tr>
</tbody>
</table>
The Cost of Capital

- The firm can always give cash back to the shareholders

- Capital employed by the firm has an **opportunity cost**
- The opportunity **cost of capital** is the expected rate of return offered by equivalent investments in the capital market
- The **weighted average cost of capital** (WACC) is the (weighted) average of the cost of equity and of the cost of debt
Stockholders’ problem

Company

ROE
Return on Equity

Capital market

Expected return

\[ ROE = \frac{\text{Net Income}}{\text{Stockholders' equity}} \]

\[ r = \frac{\text{Div}_1 + \text{Capital Gain}}{\text{Initial Investment}} \]
How to measure value creation?

1. Compare market value of equity to book value

\[
\text{Market-to-book (M/B)} = \frac{\text{Stock price}}{\text{Book value per share}}
\]

- Value creation if M/B > 1

2. Compare return on equity to the opportunity cost of equity

\[
\text{Return on equity (ROE)} = \frac{\text{Net Income}}{\text{Stockholders' equity}}
\]

- Value creation if ROE > Opportunity Cost of Equity
Value creation: Example

- Data:
  - Book value of equity = €10 b
  - Net income = €2 b/year
  - Cost of equity \( r = 10\% \)

- Return on equity ROE = \( 2 / 10 = 20\% \) > 10\%

- Market value of equity = \( NI / r = 2 / 10\% = €20 b \)
- Market value added: MVA = 20 – 10 = €10 b
- Market to Book \( M/B = 20 / 10 = 2 \)
M/B vs ROE

- **Simplifying assumptions:**
  - Expected net income = constant
  - Net income = dividend

- **Market value determination:**
  - Net income = Expected return × Market value of equity
  - \( NI = r \times MV_{eq} \)

- **ROE (definition):**
  - Return on equity = Net income / Book value of equity
  - \( ROE = \frac{NI}{BV_{eq}} \)
  - \( = \frac{r \times MV_{eq}}{Bveq} \)

- **Conclusion:** in this simplified setting,
  - \( M/B = \frac{MV_{eq}}{BV_{eq}} > 1 \iff ROE > r \)
Drivers of ROE

• PROFITABILITY (du Pont system)

\[ ROE = \frac{\text{Net Income}}{\text{Book Equity}} \]

• Three determinants:

\[ ROE = \frac{\text{Net Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} \]

- Profit Margin
- Asset Turnover
- Financial Leverage
Example (Aug. 30, 2009)

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<tr>
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<td>Revenues</td>
<td>58.44</td>
<td>405.61</td>
</tr>
<tr>
<td>Net Income</td>
<td>14.57</td>
<td>13.4</td>
</tr>
<tr>
<td>Total Assets</td>
<td>77.89</td>
<td>163.43</td>
</tr>
<tr>
<td>Book Equity</td>
<td>39.56</td>
<td>65.29</td>
</tr>
<tr>
<td>ROE</td>
<td>36.83%</td>
<td>20.52%</td>
</tr>
<tr>
<td>Profit margin</td>
<td>24.93%</td>
<td>3.30%</td>
</tr>
<tr>
<td>Asset Turnover</td>
<td>0.75</td>
<td>2.48</td>
</tr>
<tr>
<td>Leverage</td>
<td>1.97</td>
<td>2.50</td>
</tr>
</tbody>
</table>
Foundations of Finance
• A young science
• Finance has been around for many centuries, of course…
• Main problem: calculation!!
• Imagine having to calculate the future value of 1 euro invested for 13 years when the annual interest rate is 4.35% (with annual compounding):

\[ \text{Future value} = (1.0435)^{13} \]

• A nightmare…..
• This problem disappeared after WWII with the development of computers.
• Now we have calculators and spreadsheets…..
• We also have large data bases
Irving Fisher

• Finance has its roots in economics
• Irving Fisher laid the foundations of modern theory of finance.
• Takes into account the time dimension of financial decisions
• Main ideas:
  • Decisions should be based on present value
  • Net Present Value (NPV): a measure of additional wealth
  • With perfect capital markets: independent of preferences
Present value: 1 period, certainty

- Perfect capital market
- Risk-free interest rate: $r_f$
- Future cash flow $C_1$
- Present value:
  \[ PV(C_1) = \frac{C_1}{1 + r_f} \]

  or:
  \[ PV(C_1) = v_1 \times C_1 \]
  
  with \[ v_1 = \frac{1}{1 + r_f} \]

Interpretation: $v_1 = 1$-year discount factor
price of 1€ to be received in one year
price of unit 1-year zero coupon
Using present value: 1-year bond valuation

Consider a risk-free zero coupon bond:

- Face value = 100
- Maturity = 1 year

Suppose 1-year risk-free interest rate = 5%

How much would you be willing to pay for this bond?

\[ P_0 = \frac{100}{1.05} = 100 \times 0.9524 = 95.24 \]
No arbitrage – 1st pass

If $P_0 \neq 95.24$: arbitrage opportunity

Suppose $P_0 = 95.50$

$\begin{align*}
t = 0 & \\
\text{Sell one bond} & + 95.50 \\
\text{Invest} & - 95.24 \\
\text{Total} & = 0.26
\end{align*}$

$\begin{align*}
t = 1 & \\
& - 100 \\
& + 100 \\
& = 0
\end{align*}$

NO FREE LUNCH
There are no arbitrage opportunities in competitive markets

Suppose $P_0 = 95$

$\begin{align*}
t = 0 & \\
\text{Buy one bond} & - 95.00 \\
\text{Borrow} & + 95.24 \\
\text{Total} & = 0.24
\end{align*}$

$\begin{align*}
t = 1 & \\
& + 100 \\
& - 100 \\
& = 0
\end{align*}$
Microeconomics: a review

• Consumption over time:
  • 1 periods, certainty
  • Perfect capital markets => budget constraint

\[ Q_0 + \frac{Q_1}{1 + r_f} = Y_0 + \frac{Y_1}{1 + r_f} = W_0 \]

\[ Q_0 + \nu_1 \times Q_1 = W_0 \]

» Slope = -(1+r)

» Intercept = W_0(1+r)

• Optimum:
  » Marginal Rate of Substitution (MRS) = 1+r
  » Optimal consumption independent of timing of income
Economic foundations of net present value

I. Fisher 1907, J. Hirshleifer 1958

Perfect capital markets
Separate investment decisions from consumption decisions

\[
\text{Slope} = - (1 + r_f) = - (1 + 5\%)
\]
Suppose the risk-free rate is $r_f = 5\%$

Consider the following investment project:

Initial cost: $I$ (50)

Future cash flow: $C_1$ (60)

\[
NPV = -I + v_1 \times C_1 \\
= -50 + 0.9524 \times 60 \\
= 7.14
\]

Budget constraint with project:

\[
Q_0 + v_1 Q_1 = (Y_0 - I) + v_1 (Y_1 + C_1) = W_0 + NPV
\]
Fisher Separation Theorem

I. Fisher 1907, J. Hirshleifer 1958

Perfect capital markets

Investment decision independent of:
- initial allocation
- preferences (utility functions)

\[
\text{Slope} = - (1 + r) = - (1 + 5\%)
\]
Internal Rate of Return

- Alternative rule: compare the internal rate of return for the project to the opportunity cost of capital
- Definition of the Internal Rate of Return: IRR (1-period)
  \[ \text{IRR} = \frac{\text{Profit}}{\text{Investment}} = \frac{C_1 - I}{I} \]
- In our example:
  \[ \text{IRR} = \frac{60 - 50}{50} = 20\% \]

- The Rate of Return Rule: Invest if IRR > r

- In this simple setting, the NPV rule and the Rate of Return Rule lead to the same decision:

  - NPV = \(-I + \frac{C_1}{1+r}\) > 0 ⇔ \(C_1 > I(1+r)\) ⇔ \(\frac{C_1 - I}{I} > r\) ⇔ IRR > r
IRR: a general definition

- The Internal Rate of Return is the discount rate such that the NPV is equal to zero.

\[-I + \frac{C}{1+IRR} \equiv 0\]

- In our example:
  - \(-50 + \frac{60}{1+IRR} = 0\)
  - \(\Rightarrow IRR = 20\%\)
Suppose an all equity financed company is created for this project.

### Step 1: Creation

<table>
<thead>
<tr>
<th>Assets</th>
<th>Equity</th>
<th>Cash flows</th>
<th>Market Cap.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>$t = 0$</td>
<td>$t = 1$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-50</td>
<td>+60</td>
</tr>
</tbody>
</table>

\[
NPV = -50 + \frac{60}{1.05} = 7.14
\]

### Step 2: Equity offering + investment

<table>
<thead>
<tr>
<th>Assets</th>
<th>Equity</th>
<th>Cash flows</th>
<th>I+NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>50</td>
<td>$t = 0$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$t = 1$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+60</td>
<td></td>
</tr>
</tbody>
</table>

\[
I+NPV = \frac{60}{1.05} = 57.14
\]
Suppose that the company borrows 40 to finance part of the project.

**Step 1: Creation**

<table>
<thead>
<tr>
<th>Assets</th>
<th>Equity</th>
<th>Cash flows to equity</th>
<th>Market Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>$t = 0$ $t = 1$</td>
<td></td>
</tr>
<tr>
<td>-10</td>
<td>+60</td>
<td>$-10 + 60 - 42 = 18$</td>
<td>Equity = $-10 + \frac{18}{1.05} = 7.14$</td>
</tr>
</tbody>
</table>

**Step 2: Borrow + investment**

<table>
<thead>
<tr>
<th>Assets</th>
<th>Equity</th>
<th>Debt</th>
<th>Cash flows to equity</th>
<th>Market Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>10</td>
<td>40</td>
<td>$t = 0$ $t = 1$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+18</td>
<td>+42</td>
<td></td>
<td>Equity = $\frac{18}{1.05} = 17.14$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Debt = $\frac{42}{1.05} = 40$</td>
</tr>
</tbody>
</table>

Enterprise = 57.14
Entreprise Value Maximisation

Numerical example

\[ r = 5\% \]

<table>
<thead>
<tr>
<th>Project</th>
<th>( CF_0 )</th>
<th>( CF_1 )</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-100</td>
<td>115</td>
<td>9.5</td>
</tr>
<tr>
<td>2</td>
<td>-100</td>
<td>110</td>
<td>4.8</td>
</tr>
<tr>
<td>3</td>
<td>-100</td>
<td>105</td>
<td>0.0</td>
</tr>
<tr>
<td>4</td>
<td>-100</td>
<td>103</td>
<td>-1.9</td>
</tr>
</tbody>
</table>

\[ CF_1 \quad \text{MktVal} \quad \text{Inv} \quad \text{NPV} \]

<table>
<thead>
<tr>
<th></th>
<th>115</th>
<th>109.5</th>
<th>100</th>
<th>9.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2</td>
<td>225</td>
<td>214.3</td>
<td>200</td>
<td>14.3</td>
</tr>
<tr>
<td>1,2,3</td>
<td>330</td>
<td>314.3</td>
<td>300</td>
<td>14.3</td>
</tr>
<tr>
<td>1,2,3,4</td>
<td>433</td>
<td>412.4</td>
<td>400</td>
<td>12.4</td>
</tr>
</tbody>
</table>

September 15, 2009