15.401 Finance Theory I

Lecture Notes

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Part A Introduction

Chapter 1: Introduction to Finance

Chapter 2: Present Value
15.401 Finance Theory I

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Lecture 1: Introduction and Course Overview
Introduction: what is “finance”?

Course overview

How to get the most out of this course

Readings:

Brealey, Myers and Allen, Chapters 1 – 2

Bodie, Kane and Markus, Chapters 1 - 3
How to make a business decision?

Project

A

$10m

B

$5m

C

$5±em

15m

$15m

$5m

$5m

$5±em

$5±em

$5±em
January 1926 to December 2007

<table>
<thead>
<tr>
<th>Statistics</th>
<th>CRSP VW Market Return</th>
<th>US T-Bill Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.95%</td>
<td>0.31%</td>
</tr>
<tr>
<td>Volatility</td>
<td>5.40%</td>
<td>0.25%</td>
</tr>
<tr>
<td>Minimum</td>
<td>-29.01%</td>
<td>-0.03%</td>
</tr>
<tr>
<td>Maximum</td>
<td>38.37%</td>
<td>1.52%</td>
</tr>
<tr>
<td>Total Return*</td>
<td>$2,583</td>
<td>$20</td>
</tr>
</tbody>
</table>

Note: *Based on a $1.00 initial investment in January 1926.

Perfect Asset Allocation

<table>
<thead>
<tr>
<th>Rebalancing Base</th>
<th>Total Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>$241,061</td>
</tr>
<tr>
<td>Quarterly</td>
<td>$62,152,362</td>
</tr>
<tr>
<td>Monthly</td>
<td>$37,634,440,695</td>
</tr>
</tbody>
</table>

Note: 1. If both stock and bond returns are negative, invest in cash.
2. Prior 1941, 1 month T-bill returns are used to construct annual T-bill returns.
### 1802 - 1997 Realized p.a. Returns

<table>
<thead>
<tr>
<th>Statistics</th>
<th>US Stocks</th>
<th>US T-Bills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Year Holding Period:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum p.a. Return</td>
<td>66.6%</td>
<td>23.7%</td>
</tr>
<tr>
<td>Minimum p.a. Return</td>
<td>-38.6%</td>
<td>-15.6%</td>
</tr>
<tr>
<td><strong>10 Year Holding Period:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum p.a. Return</td>
<td>16.9%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Minimum p.a. Return</td>
<td>-4.1%</td>
<td>-5.1%</td>
</tr>
<tr>
<td><strong>20 Year Holding Period:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum p.a. Return</td>
<td>12.6%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Minimum p.a. Return</td>
<td>1.0%</td>
<td>-3.0%</td>
</tr>
</tbody>
</table>

Source: Siegel (1998), Figure 2-1.
Finance is about the bottom line of business activities

A business activity is a process of acquiring and disposing assets
- Real/financial
- Tangible/intangible

All business activities reduce to two functions:
- Grow wealth (create value)
- Manage wealth to best meet economic needs

Financially, a business decision starts with the valuation of assets
- “You can’t create and manage what you can’t measure”

Valuation is the central issue of finance

Financial markets reveal some asset values
Questions we would like to answer in this course:

1. How financial markets determine asset prices?

2. How corporations make financial decisions?
   - Investments: What projects to invest in?
   - Financing: How to finance a project?
     - Designing/selling financial securities/claims (debt, stock, …)
   - Payout: What to pay back to shareholders?
     - Paying dividends, buyback shares, …
   - Risk management: What risk to take or to avoid and how?

3. How households make financial decisions?
Corporate financial decisions

(1) Cash raised from investors by selling financial assets
(2) Cash invested in real assets (tangible and intangible)
(3) Cash generated by operations
(4) Cash reinvested
(5) Cash paid out (mandatory: debt payments, discretionary: dividends, etc.)
A firm’s cash flows
(1) Cash raised from investors by selling financial assets
(2) Cash invested in real assets (tangible and intangible)
(3) Cash generated by operations
(4) Cash reinvested
(5) Cash returned to investors (debt payments, dividends, etc.)

Management decisions --- manage cash flow (1), (2), (4), (5)
_ Investment: (2) $\sim$ (3) (valuing real assets)
_ Financing and payout: (1), (4), (5) (valuing financial assets)
_ Risk management: (1) and (5) (value financial assets)

Objective: Create maximum value for shareholders.
Sound business decisions rely on asset valuation.
Each asset is defined by its cash flow (CF)

Fundamental value of an asset = Value of its cash flow
Two important characteristics of a cash flow:

1. Time

Which one do you prefer? --- Time value of money

2. Risk

Which one do you prefer? --- Risk premium

Time and risk are two key elements in finance
Valuation of a project: theory

- A firm can always give cash back to shareholders
- The shareholders can (re)invest the cash.
- If the firm retains the cash, the shareholders miss out on investment opportunities in financial markets.

**Opportunity cost of capital** = the expected rate of return offered by equivalent (in time and risk) investments in financial markets

Market valuation of a project (i.e., its CF):

- The higher the cost of capital, the lower the value of the project.
- The value of a project is positive if the project yields a higher expected return than its cost of capital.
Valuation of a project: practical aspects

- We need to define “equivalent” assets (cash flows)

- If an assets is traded on a financial market, its price indicates the value of “equivalent” cash flows (assets): valuation by “matching”.

- Alternative: valuation based on an “equilibrium” relationship that maps cash flow characteristics into prices.
A firm can invest in a project that yields a cash flow with a market value of $100 M and requires an investment of $60 M. The firm has cash reserves of $62 M.

The firm has two owners. Owner A has high short-term consumption needs that owner B. Are the two owners unanimously in favor of the investment?
Conditions s.t. all shareholders agree that the firm should maximize the market value of its equity:

Shareholders’ consumption depends on the firm’s policies only through their budget.

- Shareholders can time their consumption by borrowing and investing in financial markets.
- Shareholders can use financial markets to trade “contingent” consumption (for all relevant contingencies).
- Perfect competition in financial markets, and all shareholders have similar “access” to all financial markets.
Financial markets - where financial assets are traded

- Money markets: Short-term debt securities
  - Short-term government, bank and corporate debt (T-bills, CDs, CPs, …)

- Capital markets: Long-term securities
  - Government and corporate bonds, asset-backed securities, …
  - Stocks, …

- Derivatives: Securities with payoffs tied to other prices
  - Forwards and futures, options, …

Financial Intermediaries - Own mostly financial assets

- Banks, insurance companies, S&Ls, …
- Mutual funds, hedge funds, private equity, …

Nonfinancial firms - Own mostly real assets

Households - Own both real and financial assets.
1. Allocating resources
   - Across time
     Example. Borrow money to buy a home
   - Across different states of the economy
     Example. Invest in stocks/bonds

2. Communicating information/price discovery
   - Market prices reflect available information
Four Parts

A. Introduction
   - Lecture 1: Introduction to finance
   - Lecture 2: Present value (principles of asset valuation)

B. Valuation
   - Lecture 3: Fixed income securities
   - Lecture 4: Common stocks
   - Lecture 5: Forwards and futures
   - Lecture 6: Options
C. Risk
   - Lecture 7: Risk and return (measuring risk)
   - Lecture 8: Portfolio theory (managing risk)
   - Lecture 9: The Capital Asset Pricing Model (incorporating risk into valuation methods)

D. Corporate Finance Applications
   - Lecture 10: Capital Budgeting (capital investment decisions)

Final Lecture: Market Efficiency (putting it all together)
   - Do financial markets always work well in discovering prices?
   - Where does money come from in financial markets?
   - How should finance theory be used in practice?
Course requirements

- Lectures and readings (attendance and participation)
- *Acid Rain* case study write-up
- Midterm exam
- Final exam
- Problem sets (optional)

Implicit Contract

- Faculty should
  - Come to class on time and be well prepared
  - Provide clear and time-appropriate exposition of material
  - Manage class discussions effectively
- Students should
  - Come to class on time and be well prepared
  - Contribute to class discussions
  - Refrain from non-class activities (email, newspapers, etc.)
How to get the most out of 401

Intro and overview

Theory vs. Practice

- Most of this course will be devoted to theory
- What about practice?
- The origins of theory is common elements deduced from practice!

Some helpful suggestions

- Do readings ahead of time (skim textbook chapters in advance)
- Take copious notes during lectures (lecture notes are not complete)
- Review the lectures afterwards with your study group
- Work on problem sets --- “Finance is not a spectator sport”
- Ask questions!!!
Evaluating a business boils down to valuation assets
An asset is defined by its cash flow (CF)
Two important characteristics of a CF: time and risk
Value of assets (CFs) are determined by financial markets
Cost of capital
The roles of financial markets