Real Options & Cost Models

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Agenda

- Investment Theory
- Real Options Approach
- Uncertainties
- Overview of Cost Models
- Cost Models Applications
- Conclusions

Overview

"The new view of investment opportunities as options .... has shown that the traditional "net present value" rule can give very wrong answers."

Dixit & Pindyck

Investment under Uncertainty, page ix

Overview

"... depreciation and theoretical selling price must be computed simultaneously ..." to determine correct valuation.

Harold Hotelling, 1925.

Forward-looking Costs for Capital Inputs in a Competitive/Regulated Environment

Michael A. Salinger

AEI Conference, November 4th 1997

Overview

• Asset Valuation
  ▶ Price can only be determined if all costs -- including the depreciation--are included

Agenda

• Investment Theory
  ▶ Olde Tyme View

Dixit & Pindyck

Investment under Uncertainty, Chapters 1 & 2

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Investment Theory: Olde Tyme View

- Investment Valuation:
  - Net Discounted Present Value
  - Jorgenson’s User cost of capital
  - Tobin's q:

Olde Tyme: Discounted Value

- Discounted Present Value
  \[ \text{DPV} = \sum CF_t/(1 + r)^t, \text{ summed over } t = 0, n \]
  - Note the cash flow includes revenue!

Olde Tyme: Discounted Value

- Discounted Present Value
  \[ \text{DPV} = \sum CF_t/(1 + r)^t, \text{ summed over } t = 0, n \]
  - Revenue in the cash flow!
  - Price is endogenous

Olde Tyme: Discounted Value

- Discounted Present Value
  \[ \text{DPV} = \sum CF_t/(1 + r)^t, \text{ summed over } t = 0, n \]
  - Revenue in the cash flow
  - Price is endogenous
  - No Depreciation

Olde Tyme: Discounted Value

- Discounted Present Value
  \[ \text{DPV} = \sum CF_t/(1 + r)^t, \text{ summed over } t = 0, n \]
  - Revenue in the cash flow
  - Price in endogenous
  - No Depreciation
  - Except for tax consequences
  - Termination: Economic depreciation
Olde Tyme: Discounted Value

- Discounted Present Value
  \[ DPV = \sum_{i} \frac{CF_i}{(1 + r)^t}, \text{ summed over } t = 0, n \]
  - Revenue in the cash flow
  - Price in endogenous
  - No Depreciation
- "r" Constant
  - Constant discount rate over time
  - Opportunity cost of capital

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Real Options Approach

- Investment Theory
- Real Options Approach
  - Definition
  - Characteristics
  - Investment characteristics

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Real Options Approach

- Option definition
  - The "right" purchase an asset in the future but not the obligation
  - Value due to uncertainty of future

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Real Options Approach

- Options characteristic
  - Time limited
  - "Killed" or exercised terminates

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Real Options Approach

- Investment Characteristics
  - Irreversibility
  - Uncertainty
  - Timing

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Dixit & Pindyck

*Investment under Uncertainty, Chapters 1 & 2*
Real Options Approach

- Irreversibility
- Waiting
  - Preempt investments preclude
  - Cost of delay
    - Competitive entry
    - Foregone revenues

Real Options Approach

- Opportunity cost of option
  - Include in valuation
  - i.e. if the NDPV plus the option value > 0, invest

Agenda

- Investment Theory
- Real Options Approach
- Uncertainties

Uncertainties

- Regulation/Legislative
- Competition
- Technologies
- Costs
- Market

Uncertainties

- Regulation/Legislative
  - Courts: Suspension of FCC Orders
  - Regulation: Decisions on RBOC LD
  - Legislative: Re-regulation of Cable
  - etc.

Uncertainties

- Regulation/Legislative
  - Traditional: ATT/MFS/TPG
  - Incumbent's reaction(s)
  - Cable's Strategies
    - Entry into exchange market
    - Broadband modems
Uncertainties
- Regulation/Legislative
- Competition
- Technologies
  - Wireless impact
    - WinStar
    - Wireless local loop
  - ISP/Packet Network versus circuit switched

Costs
- Spectrum costs
- Unbundled Network Elements
- Right of way
- Leases

Market
- Product acceptance
- Price and cross-elasticities
- Size
- Growth

Cost Models
- "One-hoss shay"/Light bulb
- Assumptions
  - Constant price
  - Constant output
  - Constant expenses
  - Certainty of life

Depreciation
- Accounting Depreciation
  - Arbitrary cost allocation (over time)
  - Industry/regulators determine
  - Not an economic cost
  - Not equal to economic depreciation
Depreciation

- Accounting depreciation
  - Used for prices/rates
  - Regulatory Compact
    - Payments cover costs
    - Investment plus return

- Economic Depreciation
  - Determinants
    - Rental market
    - Secondhand markets
    - Profit generated
    - "Lemons" problem
    - Real options valuation

Depreciation

- Accounting Depreciation
- Economic Depreciation
- Sunk/Irreversible Costs
  - No rental or secondhand markets
  - Telecommunications systems

Prices

- Competition:
  - Constraints future prices.
- Forward-looking cost:
  - Limits future prices

Agenda

- Investment Theory
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- Uncertainties
- Overview of Cost Models
- Cost Models Applications

Cost Model Applications

<table>
<thead>
<tr>
<th>Module</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>No demand elasticity</td>
</tr>
<tr>
<td></td>
<td>No market share decrement</td>
</tr>
<tr>
<td></td>
<td>No growth</td>
</tr>
<tr>
<td></td>
<td>Constant output</td>
</tr>
</tbody>
</table>
Summary/Conclusions

- Present Value Inadequate
- Cost Models Inadequate
- Cost Models Adaptable

Summary

- Present Value Inadequate
- Cost Models Inadequate

Summary/Conclusions

- Present Value Inadequate
- Cost Models Inadequate
- Cost Models Adaptable
  - Real Options applicable
  - Competitive markets emulated

Summary/Conclusions

- Present Value Inadequate
- Cost Models Inadequate
  - No Dynamics
  - No Uncertainties
  - No Options Valuation

Summary

- Present Value Inadequate
- Cost Models Inadequate
  - Inadequate Specifications:
    - No change in cost of asset
    - No risk of underutilization
    - Revenue requirement level
    - Utilization rate level
    - No real option valuation

Forward-looking Costs & Option Valuation

- James Alleman
- Telecommunications Economics
- University of Colorado & Hagler Bailly

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