Overview: Transfer Pricing

- Framework and Economic Principles

- Cases Considered
  - No outside market for upstream good
  - Competitive outside market for upstream good
  - Market power in outside market for upstream good
  - Tax considerations

- Vertical Integration

Decision Making in a Large Firm

- Large firms comprised of divisions (small internal firms), each operating relatively independently

- How can efficient allocation of inputs/outputs across divisions be achieved?
  - **Centralization**: Dictate all quantities & transfers  
    *Problem*: communication is often prohibitive.
  - **Decentralization**: Let divisions decide on quantities and prices  
    *Problem*: how to make sure local units make decisions that maximize total profits?
Adam Smith and Alfred Sloan

- Adam Smith’s great insight:
  - given proper incentives, each individual pursuing his or her self interest maximizes the performance of the economy.
  - under certain conditions, market prices provide efficient incentives

- Alfred Sloan used this insight as a principle of organization within a firm
  - Divide into divisions (“profit centers”)
  - Each division maximizes profits

Transfer Pricing in a Large Firm

- Each division decides on its own production and on its own pricing for external parties, but is also responsible for its own profits.

- Terminology : P&L responsibility, BU's, profit centers

- This requires a way to value internal transfers (Transfer Pricing) such that divisional profit maximization implies firm profit maximization
  - Prices set by top management
  - Issues
Optimal Transfers

- NR(Q) is revenue from Q less cost of processing Q (in downstream division)
- Profits of the firm, in terms of Q, are $\Pi = NR(Q) - C(Q)$
- What is the profit maximizing level of Q? (Drum roll ...)

$$MC(Q) = NMR(Q)$$
Divisional Profit Maximization

- Q is priced at p for internal transfers.

- Upstream Division:
  - Revenues = p Q_u, Costs = C(Q_u)
  - (Internal) Profits \( \Pi_u = pQ_u - C(Q_u) \)
  - Maximizing: Produce \( Q_u \) such that \( p = MC(Q_u) \)

- Downstream Division:
  - Revenues = \( NR(Q_d) \), Costs = \( p Q_d \)
  - (Internal) Profits \( \Pi_d = NR(Q_d) - pQ_d \)
  - Maximizing: Order \( Q_d \) such that \( p = NMR(Q_d) \)

Setting the Transfer Price

- Optimal Transfer Price:
  \( p^* \) such that \( Q_d = Q_u \)

- We have \( p^* = MC(Q_u) = NMR(Q_d) \)
  - If wrong transfer price set, either
    - \( Q_d > Q_u \) (shortage of input)
    - \( Q_d < Q_u \) (surplus of input)
  - Much easier to set transfer price with competitive outside markets (follows after example)
Optimal transfer price $p^*$

Upstream Profits (No FC)

Downstream Profits (No FC)

Q (produced and processed)

MC (upstream)

NMR (downstream)

Internal Optimal Transfer Pricing (No Outside Market)
Example: Firm makes chips & computers (e.g. Apple and the 3 GHz chip)

- Upstream division makes chips
- Downstream divisions assembles computers
- Data:
  - **Upstream: Chip Manufacturing Plant:** Q is # of chips in thousands
    - Total Costs: \( TC_u = Q^2 \implies MC_u = 2Q \)
  - **Downstream: Computer Manufacture**
    - Need one chip per machine (Q also represents # computers)
    - Demand: \( P = 4000 - 4Q \) (Firm monopolizes their demand)
    - Assembly Costs (all costs except the chip) = 1500 Q:
      \[ MC^a = 1500 \]

Example: continued

- NMR is “Demand for Chips” from downstream division
  \[
  R = PQ = (4000 - 4Q)Q \\
  NR = (P - MC^a)Q = (2500 - 4Q)Q \\
  NMR = 2500 - 8Q
  \]
- Optimal chip production has NMR = MC_u
  \[
  NMR = 2500 - 8Q = 2Q = MC_u \\
  2500 = 10Q \\
  Q = 250
  \]
- Transfer Price: \( p = 2(250) = 500 \) (\( = MC_u \))
Example: continued

• Profits:
  Upstream Division: \( pQ - TC_u = 500(250) - (250)^2 = 62.5 \text{ m} \)
  Downstream Div: \( NR - pQ = 1500(250) - 500(250) = 250.0 \text{ m} \)
  Total Company Profits = \( 62.5 \text{ m} + 250 \text{ m} = 312.5 \text{ m} \)

(Note how transfer revenue/cost cancels out)
Various Issues

- If there are many divisions, do we need new principles for transfer pricing?
- What if there are outside sources of the chip?
- Why does each division’s internal “profit” matter?
- Are there tax considerations?
- Does market power matter?

Multiple Sources or Uses

1. Multiple Sources:

   \[
   C_1(Q_1) \quad \text{NR}(Q_1+Q_2) \quad M
   \]
   \[
   C_2(Q_2) \quad \text{NR}(Q_1+Q_2) \quad M
   \]

   Optimal Transfer Price: \( p^* = MC_1(Q_1) = MC_2(Q_2) = NMR(Q_1+Q_2) \)

2. Multiple Uses:

   \[
   C(Q_1+Q_2) \quad \text{NR}_1(Q_1) \quad M_1
   \]
   \[
   \text{NR}_2(Q_2) \quad \text{NR}_2(Q_2) \quad M_2
   \]

   Optimal Transfer Price: \( p^* = NMR_1(Q_1) = NMR_2(Q_2) = MC(Q_1+Q_2) \)
Application: Competitive Outside Market

- Competitive Outside Market
  - You can buy Q at price $p$ (market is a source)
  - You can sell Q at price $p$ (market is a use)
  - Set transfer price $p^* = p$, market price

- Easiest Case: No calculation required
  - Transfer price = market price (end of story)
Graphically

Back to the Example

Suppose there is a substitute chip available for $350

- So ………… Set transfer price $p = 350$
- Upstream (chip) division produces so that
  
  \[ p = MC_u, \text{ or } 350 = 2Q, \text{ or } Q = 175 \]
- Downstream (computer) division orders chips until
  
  \[ p = NMR, \text{ or } 350 = 2500 - 8Q, \text{ or } Q = 268.75 \]
- So, 175 (thousand) produced, 93.75 purchased outside, 268.75 computers made.

- Profits = NR(268.75) - TC(175) - 350(93.75) = 319.5 m
- Note: 319.5 m > 312.5 m; 7 m additional profit
Application: Outside Market Power

- You monopolize an outside market for intermediate product \((M_1)\)

- With market power, \(p^* = MR_{outside} < AR_{outside}\)

- Summary: Transfer at MC; the outside market price \(p\) is higher than transfer price \(p^*\).
Divisional Profits and Evaluation

- Internal Profits add to Firm Profits
- Are division profits useful for evaluating performance?
  - It depends: Can reflect efficiency gains in production
  - Yes, with outside competitive market
- Raises bargaining issues for prices
  - Increased $p$ raises upstream profits, lowers downstream profits
  - This is one reason $p$ is set by top management
- If a division can set $p$, losses typically result
  - Double Marginalization

Double Marginalization

Upstream Division Sets Transfer Price

Downstream Division Sets Transfer Price
Suppose Upstream (chip) division sets price.

- NMR is “Demand for Chips” from downstream division
  \[ NMR = 2500 - 8Q \]
  so Chip Revenue \( CR = (2500 - 8Q)Q \)

- Upstream Profit Max: produce chips until \( MCR = MC_u \)
  \[ MCR = 2500 - 16Q = 2Q = MC_u \]
  \[ 2500 = 18Q \]
  \[ Q = 138.9, \quad \text{Transfer Price} = 2500 - 8(138.9) = 1388.9 \]

- Profits:
  - Upstream Division: \( pQ - TC_u = 173.7 \text{ m} > 62.5 \text{ m} \)
  - Downstream Division: \( NR - pQ = 77.1 \text{ m} < 250 \text{ m} \)
  - Total Company Profits = \( 173.1 \text{ m} + 77.1 \text{ m} = 250.8 \text{ m} < 312.5 \text{ m} \)

- 61.7 m lost due to bad management of transfers
Tax Avoidance

• Suppose your divisions are located in different countries, with different tax rates.

• Separate books for taxes and for management
  – Legal limits on what can be reported for taxes

• Can adjust transfer prices to “move” profits from high tax countries to low tax countries
  – WSJ article for many examples

Tax Avoidance

• High tax for downstream division suggests raising transfer price, raising downstream costs and lowering downstream profits

• With common books, tradeoff between efficient production and tax avoidance
Notes on Vertical Integration

• Wrong arguments for vertical integration

• Reasons for vertical integration

• Costs of vertical integration

Wrong Arguments for VI

• Capture profits of suppliers
  – Need compensation for extra UCC
  – Future economic profits will be reflected in acquisition price

• Protect against price rises
  – Price rises are reflected in opportunity cost
Reasons for Vertical Integration

- Transaction cost economics (TCE)
- Hold-up
- Externalities and synergies
- Information flows stay within the firm
- Ability to decide on incentives
- Price discrimination

Costs of Vertical Integration

- Market discipline (competition) gives strong incentives.
- Non-integration maximizes flexibility and improves matching.
Take Away Points

• Transfer pricing brings the market in the firm and allows the creation of profit centers.
• The optimal transfer price equals the marginal cost.
• With competitive outside market, transfer price equals market price.
• Transfer prices have tax implications. Separate tax and internal books are typical.
• Integration is a complex trade-off. Always consider contracting as an alternative.