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
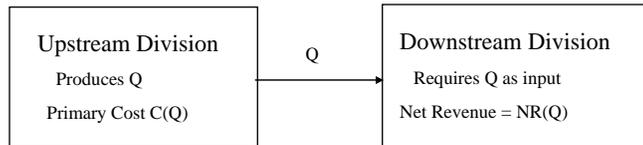   *Problem* : how to make sure local units make decisions that maximize total profits?

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

Upstream Division		Downstream Division
Produces Q		Requires Q as input
Primary Cost C(Q)	Q →	Net Revenue = NR(Q)

- NR(Q) is revenue from Q less cost of processing Q (in downstream division)

- Profits of the firm, in terms of Q, are Π = NR(Q) - C(Q)

- What is the profit maximizing level of Q? .... (Drum roll ...)
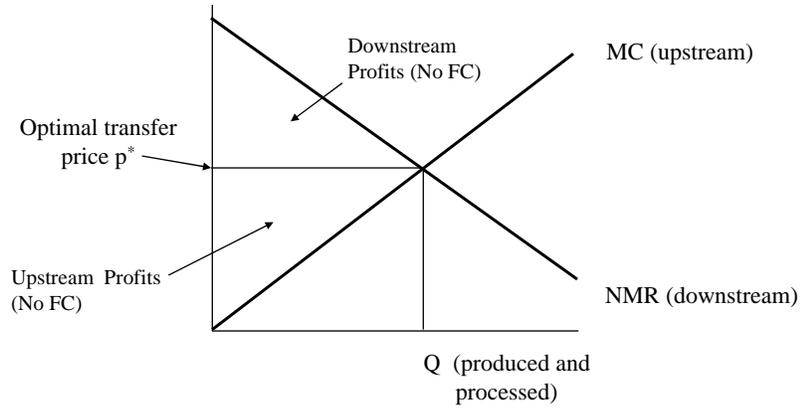
$$MC(Q) = NMR(Q)$$

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)

Graphically

Downstream
Profits (No FC)

MC (upstream)

Optimal transfer
price p*

Upstream Profits
(No FC)

NMR (downstream)

Q (produced and
processed)

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: $TC_u = Q^2 ==> MC_u = 2Q$
  - **Downstream: Computer Manufacture**
    - Need one chip per machine   (Q also represents # computers)
    - Demand: $P = 4000 - 4 Q$ (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
  $R = PQ = (4000 - 4 Q)Q$
  $NR = (P - MC_a)Q = (2500 - 4 Q)Q$
  $NMR = 2500 - 8 Q$

- Optimal chip production has $NMR = MC_u$
  $NMR = 2500 - 8 Q = 2 Q = MC_u$
  $2500 = 10 Q$
  $Q = 250$

- Transfer Price: $p = 2(250) = 500$ $(= MC_u)$

Example: continued

- Profits:

  Upstream Division: $pQ - TC_u = 500(250) - (250)^2 = 62.5$ m

  Downstream Div: $NR - pQ = 1500(250) - 500(250) = 250.0$ m

 Total Company Profits $= 62.5$ m $+ 250$ m $= 312.5$ 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?
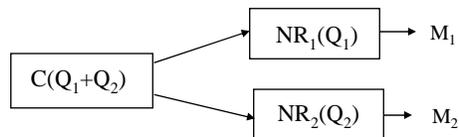- Are there tax considerations?
- Does market power matter?

Multiple Sources or Uses

1. Multiple Sources:

$$C_1(Q_1) \quad C_2(Q_2) \quad \rightarrow \quad NR(Q_1+Q_2) \rightarrow M$$
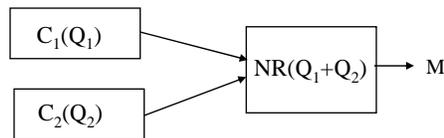
Optimal Transfer Price: $p^* = MC_1(Q_1) = MC_2(Q_2) = NMR(Q_1+Q_2)$

2. Multiple Uses:

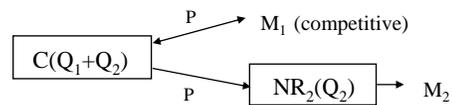$$C(Q_1+Q_2) \quad \rightarrow \quad NR_1(Q_1) \rightarrow M_1 \quad NR_2(Q_2) \rightarrow M_2$$

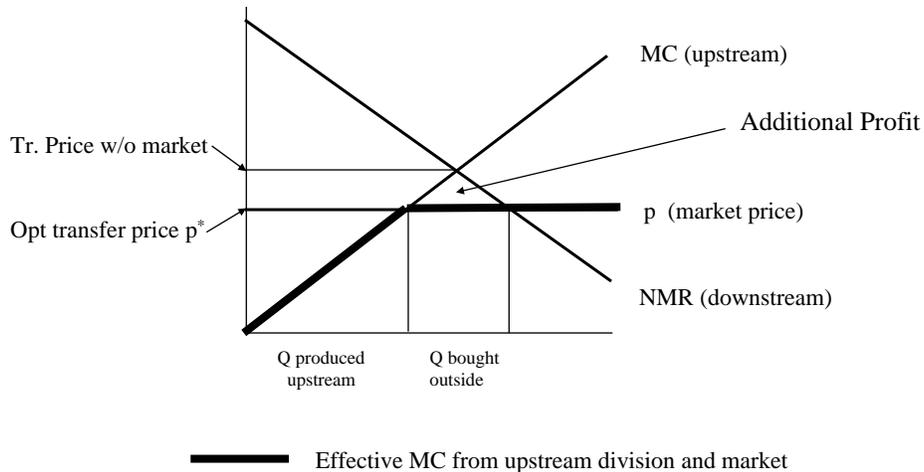Optimal Transfer Price: $p^* = NMR_1(Q_1) = NMR_2(Q_2) = MC(Q_1+Q_2)$

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

$$P \longrightarrow M_1 \text{ (competitive)}$$

| $C(Q_1+Q_2)$ | $\longrightarrow$ $NR_2(Q_2)$ $\longrightarrow$ M_2 |

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

Graphically

MC (upstream)

Additional Profit

Tr. Price w/o market

Opt transfer price p^*

p (market price)

NMR (downstream)

Q produced
upstream

Q bought
outside

━━━━━ Effective MC from upstream division and market


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
  $p = MC_u$, or   350 = 2Q,   or   Q = 175
- Downstream (computer) division orders chips until
  p = NMR, or   350 = 2500 - 8 Q,   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)

  C(Q_1+Q_2) ──P──→ M_1

  C(Q_1+Q_2) ──P*──→ NR$_2$(Q_2) ──→ M_2
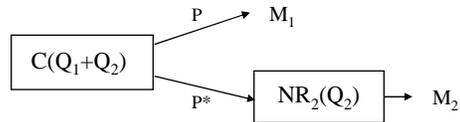
- With market power, $p^* = MR_{outside} < AR_{outside}$
  => $p^* < p$, the outside market price for intermediate product

- 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
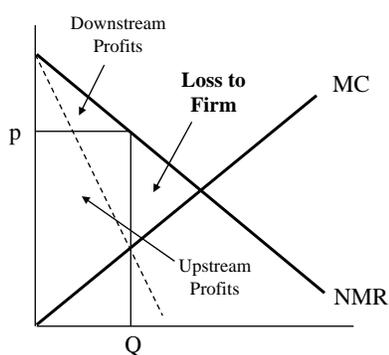
Upstream Division Sets
Transfer Price
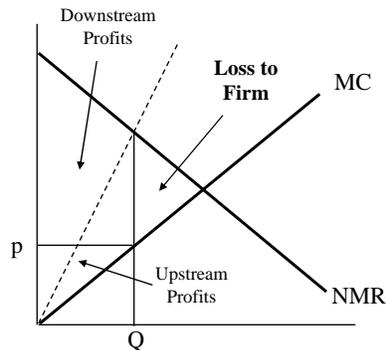
Downstream Division Sets
Transfer Price

Back to Example

Suppose Upstream (chip) division sets price.

- NMR is "Demand for Chips" from downstream division

  NMR = 2500 - 8 Q, so Chip Revenue = CR = (2500 - 8Q) Q

- Upstream Profit Max: produce chips until $MCR = MC_u$

  $MCR = 2500 - 16\ Q = 2Q = MC_u$

  $2500 = 18\ Q$

  $Q = 138.9$,   Transfer Price = 2500 - 8 (138.9) = 1388.9

- Profits:
  - Upstream Division: $pQ - TC_u = 173.7\ m\ >\ 62.5\ m$
  - Downstream Division: $NR - pQ = 77.1\ m\ <\ 250\ m$
  - Total Company Profits = 173.1 m + 77.1 m = 250.8 m < 312.5 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.