Recent Developments in the Theory of Regulation

Mark Armstrong and David E.M. Sappington

Presented by:
Bruno Martins
Phillip Ross
Arthur Smith

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Motivation

How do we characterize optimal monopoly regulatory policy?

- What is the objective? What are we maximizing?
- What policies are feasible in ideal settings?
- What policies are feasible in practical settings?
- What happens when the setting is changed to include multiple firms?

Outline

- Optimal regulation in stylized settings
- Practical regulatory policies
- Optimal regulation with multiple firms

Optimal Regulation

- Regulator's objective
- Regulation under complete information
- Perturbations to the model
  - Adverse selection
  - Moral hazard
  - Partially informed regulators (audits)
  - Dynamic interactions

Optimal Regulation - Regulator's Objective

Maximize $S + \alpha R$ subject to the cost of raising funds, Λ

- S: Consumer surplus
- R: Monopoly rents
- $\alpha \in [0, 1]$: Weight regulator places on monopoly rents
- $\Lambda \geq 0$: Taxpayer welfare declines by $1 + \Lambda$ for every dollar raised in funds

Optimal Regulation - Complete information

Case 1 (Baron and Myerson): $(\alpha \in (0,1), \Lambda = 0)$

- Regulator compensates monopolist for fixed cost and sets price equal to marginal cost: used as the benchmark for other models here

Case 2 (Laffont and Tirole): $(\alpha = 1, \Lambda > 0)$

- Ramsey prices: rents contribute to tax reduction
- Total welfare: $v(p) + (1+\Lambda)\pi(p)$
- Maximizing over p yields: $\frac{(p-c)}{p} = [\frac{\Lambda}{1+\Lambda}]\frac{1}{\eta(p)}$ where $\eta(p)$ is the elasticity of demand for product p

Adverse Selection - Standard Framework

Benchmark example (as seen in class)

- Firm MC, $c_i \in \{c_L, c_H\}$
- c_L with probability ϕ; $\Delta^c = c_H - c_L > 0$
- Rent reporting truthfully: $R_i = Q(p_i)(p_i - c_i) - F + T_i$
- Rent reporting falsely: $Q(p_j)(p_j - c_i) - F + T_j = R_j + Q(p_j)(c_j - c_i)$
- IR_H: $R_H \geq 0$ binds
- IC_L: $R_L \geq \Delta^c Q(p_H)$ binds

Adverse Selection - Standard Framework

Policy in standard case

- $p_L = c_L$
- $p_H = c_H + \frac{\phi}{1-\phi}(1-\alpha)\Delta^c$
- $R_L = \Delta^c Q(p_H)$
- $R_H = 0$

Adverse Selection - Countervailing Incentives

Let fixed costs be such that

- $\Delta^F = F_L - F_H \geq 0$

Proposition

If a firm is informed about both fixed and marginal cost then:

- *If* $\Delta^F \in [\Delta^c Q(c_H), \Delta^c Q(c_L)]$ *then the full information outcome is feasible and optimal*
- *If* $\Delta^F < \Delta^c Q(c_H)$ *then* $p_H > c_H$ *and* $p_L = c_L$
- *If* $\Delta^F > \Delta^c Q(c_L)$ *then* $p_L < c_L$ *and* $p_H = c_H$

Regulator can gain from firm's increase in information!

Adverse Selection - other results

Unknown scope for cost reduction (observed MC, unobserved FC)

- $p_L = c_L$; $p_H = c_H$; $R_L = F_H(c_H) - F_L(c_L) > 0 = R_H$
- $Q(c_L) + F_L'(c_L) = 0$
- $Q(c_H) + F_L'(c_H) = -\frac{\phi}{1-\phi}(1-\alpha)(F_L'(c_H) - F_L'(c_L)) > 0$

Asymmetric demand information

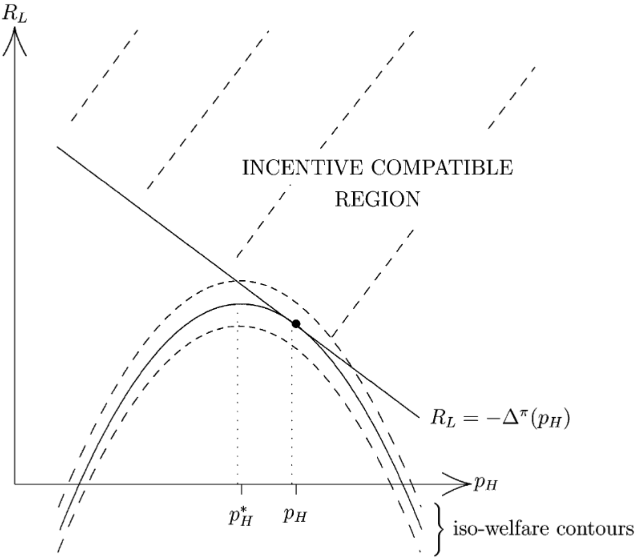
- If $C''(q) \geq 0$ the full-information outcome is feasible
- If $C''(q) < 0$ it is often optimal to set a single price and transfer payment for all demand realizations

Unified Result

If IC constraint for firm of type i does not bind, the price for firm j is not distorted, that is $p_j = p_j^*$

- Welfare expression:
  $W = \phi[w_L(p_L) - (1-\alpha)R_L] + (1-\phi)[w_H(p_H) - (1-\alpha)R_H]$
- Reduces to: $W = \phi[w_L(p_L) + (1-\alpha)\Delta^\pi(p_H)] + (1-\phi)w_H(p_H)$
- $\Delta^\pi(p) = \pi_H(p) - \pi_L(p)$

Unified Result



Moral Hazard - Framework

Model

- Firm chooses effort $\phi \in (0, 1)$; disutility of effort $D(\phi)$
- Regulator delivers utilities $\{U_L, U_H\}$ based on the observed realized state

Key Results

- If firms are risk neutral, full information outcome is possible
- If firms are risk adverse, incentives are weakened so rents are extracted
- Under limited liability, the low type can also extract rents (even at maximum punishment, the low type firm needs incentives for IC)

Partially Informed Regulator - Audits

- Firm's private marginal cost information: $c \in \{c_L, c_H\}$
- After contracting, a public signal is observed: $s \in \{s_L, s_H\}$
- Probability of observing a low signal: $\phi_i : \phi_L > \phi_H$
- Under limited liability, the low-cost firm attains rents (otherwise full-information outcome is feasible)
- If audits are costly, it becomes another choice variable (in the reported high cost case) assuming limited liability

Partially Informed Regulator - Regulatory Capture

- Probability regulator informed of low cost: $\psi = \phi\zeta$
- Probability of low-cost, given uninformed regulator: $\phi^U = \frac{\phi(1-\zeta)}{1-\phi\zeta} < 0$
- Extra cost of "bribing" regulator: θ
- Weight given to regulator's surplus: α_R
- Maximize $W = \phi[w_L(c_L) - (1-\alpha)\Delta^c Q(p_H)] + (1-\phi)w_H(p_H)$
- $p_H = \underbrace{c_h + \frac{\phi^U}{1-\phi^U}(1-\alpha)\Delta^c}_{\text{Baron-Myerson price}} + \underbrace{\frac{\psi}{(1-\psi)(1+\theta)(1-\phi^U)}(1-\alpha_R)\Delta^c}_{\text{Distortion to reduce firm stake in collusion}}$

Firm is worse off when regulatory capture is possible! (R_L lower and p_H higher)

Multi-dimensional private information

Consider two goods with different production costs (types $\{LL, LH, HL, HH\}$)

- $R_{ij} = Q(p_{ij}^1)(p_{ij}^1 - c_i) + Q(p_{ij}^2)(p_{ij}^2 - c_j) - F - T_{ij}$
- Only $R_{HH} = 0$ will bind - all other types can get rents from pretending to be that type
- $R_A \geq R_{HH} + \Delta^c Q(p_{HH})$
- $R_{LL} \geq R_{HH} + 2\Delta^c Q(p_{HH})$ and $R_{LL} \geq R_A + \Delta^c Q(p_H^A)$

Multi-dimensional private information - Results

Let ϕ_L (ϕ_H) be the probability of low cost given the cost of good one is L (H) Then maximization problem yields the following proposition

Proposition

The optimal policy in the symmetric multi-dimensional setting has the features:

- *There are no price distortions for low-cost products* $p_{LL} = p_L^A = c_L$
- *When correlations are strong* ($\phi_L \geq 2\phi_H$) *then* ($p_{HH} = p_H^A$) *and the regulatory policy for each product is independent (the IC constraint discouraging reporting type* c_{HH} *when the true type is* c_{LL} *dominates)*
- *When correlations are weak* ($\phi_L \leq 2\phi_H$) *then* ($p_{HH} > p_H^A$) *and the regulatory policy the two products are dependent (the IC constraint discouraging reporting type* c_{LH} *or* c_{HL} *when the true type is* c_{LL} *dominates)*

Dynamic interactions - Commitment and Renegotiation

Under full commitment (and shared discount factor)

- Prices and rents are the same each period as in the single period problem

When there is the potential for renegotiation

- Separating equilibrium requires a high allocation of rents (in a two period model)
- If the discount factor is high, a pooling payment in the first period is optimal (increases the regulator's commitment power)

Dynamic interactions - Short term contracts

Regulator cannot credibly commit to delivering second period payments

- When discount δ is small, standard adverse selection implemented in the first period, full information pricing in the second
- For intermediate values of δ separation is induced in the first period and full information in the second
- When δ is large enough, a partial pooling equilibrium is introduced in the first period

Practicality of Optimal Policies

Normative Approach has limitations:

- Information asymmetries are difficult to characterize precisely
- Optimal policy is unknown when information asymmetries are large and multi-dimensional
- Difficult to know complete specification of all relevant constraints
- Some optimal instruments are not available in practice (e.g., transfers)
- Goals of regulators are not always clear in all situations

Practicality of Optimal Policies

Policy Dimensions

1. Pricing flexibility
2. Implementation and revision of regulation policy over time
3. Link between regulated prices and realized costs
4. Level of discretion regulators have to formulate policy

Policies

Static

- Average Revenue (Armstrong & Vickers 1991)
- Tariff Basket (Armstrong & Vickers 1991)

Dynamic

- Dynamic Tariff Basket (Vogelsong 1989)
- Lagged Expenditure (Vogelsong & Finsinger 1979)
- Incremental Surplus Subsidy (Sappington & Sibley 1988)

Information Asymmetries

Under asymmetric cost information, let firms choose prices such that

$$\mathbf{p} \in \mathcal{P} = \left\{ \mathbf{p} | v(\mathbf{p}) \geq v(\mathbf{p}^0) \right\}. \tag{1}$$

Then, consumers are no worse off than under fixed price policy $\mathbf{p}^0$.

However, under asymmetric demand information, pricing flexibility may be less desirable, since if costs are known, the full-information outcome can be achieved by setting constraining prices to equal costs.

Average Price Regulation

Two variants of average price regulation:

- Average Revenue Regulation
- Tariff Basket Regulation

Since the consumer surplus function, $v(\mathbf{p})$, is convex, for any $\mathbf{p}^1$ and $\mathbf{p}^2$ with consumer demand $Q_i(\mathbf{p})$ for product i,

$$v(\mathbf{p}^2) \geq v(\mathbf{p}^1) - \sum_{i=1}^{n}(p_i^2 - p_i^1)Q_i(\mathbf{p}^1) \tag{2}$$

Average Revenue Regulation

Limits the average revenue a firm derives to a specified level, $\bar{p}$, such that the firm's price vector lies in:

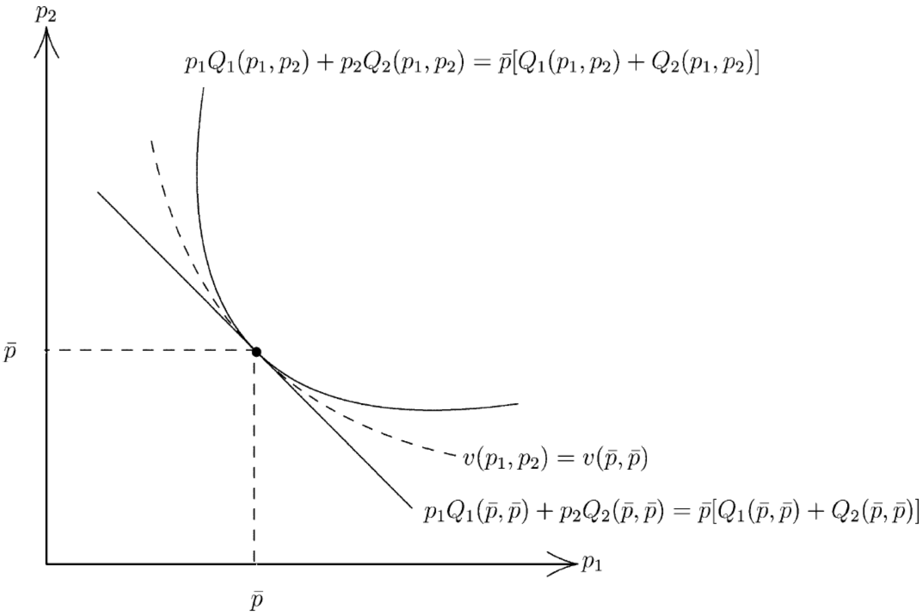
$$\mathbf{p} \in \mathcal{P}^{AR} = \left\{ \mathbf{p} \;\middle|\; \frac{\sum_{i=1}^{n} p_i Q_i(\mathbf{p})}{\sum_{i=1}^{n} Q_i(\mathbf{p})} \leq \bar{p} \right\} \tag{3}$$

To be implemented, only requires that the actual demands at this specified level be observed.

Average Revenue Regulation

Proposition

1. *Consumer surplus is lower under binding average revenue regulation when the firm is permitted to set any prices that satisfy (3) rather than being required to set each price at* $\bar{p}$.
2. *Total welfare could be higher or lower when the firm is permitted to set any prices that satisfy (3) rather than being required to set each price at* $\bar{p}$.
3. *Consumer surplus can decrease under average revenue regulation when the authorized level of average revenue* $\bar{p}$ *declines.*


p_2
$p_1Q_1(p_1,p_2) + p_2Q_2(p_1,p_2) = \bar{p}[Q_1(p_1,p_2) + Q_2(p_1,p_2)]$
$\bar{p}$
$v(p_1,p_2) = v(\bar{p},\bar{p})$
$p_1Q_1(\bar{p},\bar{p}) + p_2Q_2(\bar{p},\bar{p}) = \bar{p}[Q_1(\bar{p},\bar{p}) + Q_2(\bar{p},\bar{p})]$
p_1
$\bar{p}$

Tariff Basket Regulation

Regulator specifies reference prices $\mathbf{p}^0$ and permits the firm to offer any prices that would reduce what consumers pay for preferred consumption at $\mathbf{p}^0$, i.e. choose prices that lie in:

$$\mathbf{p} \in \mathcal{P}^{TB} = \left\{ \mathbf{p} \;\middle|\; \sum_{i=1}^{n} p_i Q_i(\mathbf{p}^0) \leq \sum_{i=1}^{n} p_i^0 Q_i(\mathbf{p}^0) \right\} \tag{4}$$

Note that the set in (4) lies within the set from (1). Thus consumers are better off.

Firm is also better off since (4) allows the firm to flexibly choose prices.

Tariff Basket Regulation

Tariff Basket will increase consumer surplus, but requires knowledge of demands at the reference prices, which are unobservable when these prices are not chosen.

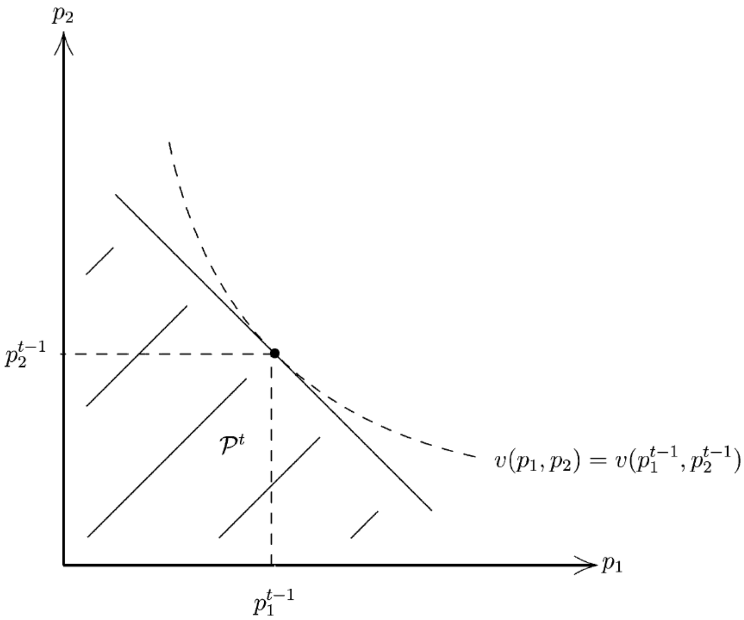
This contrasts with Average Revenue Regulation, where the price index weights reflect actual, realized, observable demands.

Dynamic Tariff Basket Regulation

Given the price vector in period $t-1$, $\mathbf{p}^{t-1}$, then the firm can choose any price vector $\mathbf{p}^t$ in period t that satisfies:

$$\mathbf{p}^t \in \mathcal{P}^t = \left\{ \mathbf{p}^t \;\middle|\; \sum_{i=1}^{n} p_i^t q_i^{t-1} \leq \sum_{i=1}^{n} p_i^{t-1} q_i^{t-1} \right\} \tag{5}$$

Any price vector in this set will generate levels of consumer surplus such that $v(\mathbf{p}^t) \geq v(\mathbf{p}^{t-1})$, and the issue with static tariff basket regulation is now solved by using the observable demand at $t-1$.


p_2
p_2^{t-1}
$\mathcal{P}^t$
$v(p_1, p_2) = v(p_1^{t-1}, p_2^{t-1})$
p_1
p_1^{t-1}

Dynamic Tariff Basket Regulation

Issues:

- This can lead to strategic pricing by the firm to set initial prices in order to affect the weights in future constraints.
- If consumer demand is changing over time, lagged output levels understate the actual losses a price increase imposes on consumers.
- Consumer surplus may not be particularly high as the firm may continue to make positive rents in the long run

Dynamic Average Price Regulation

Equation (5) can be modified to require average prices to fall proportionally over time. Below will require the average prices to fall proportionally by a factor X.

$$\mathbf{p}^t \in \mathcal{P}^t = \left\{ \mathbf{p}^t \;\middle|\; \sum_{i=1}^{n} \frac{R_i^{t-1}}{R^{t-1}} \left[\frac{p_i^t - p_i^{t-1}}{p_i^{t-1}} \right] \leq -X \right\} \tag{6}$$

where $R_i^{t-1} = p_i^{t-1} q_i^{t-1}$ is the revenue for product i at $t-1$ and R^{t-1} is the total revenue from n products at $t-1$.

However, knowing the optimal choice of X is difficult.

If X is too small, the firm can be afforded large, persistent rent. If X is too large, the firm may incur losses.

Lagged Expenditure Policy

Suppose firm's observable production expenditures in year t are E^t, then allow the firm to select any set of prices in t such that:

$$\mathbf{p}^t \in \mathcal{P}^t = \left\{ \mathbf{p} \;\middle|\; \sum_{i=1}^{n} p_i q_i^{t-1} \leq E^{t-1} \right\} \tag{7}$$

Then, (2) and (7) together imply that

$$v(\mathbf{p}^t) \geq v(\mathbf{p}^{t-1}) + \Pi^{t-1}$$

where $\Pi^t = \sum_{i=1}^{n} p_i^t q_i^t - E^t$. Thus, any profit the firm enjoys in period $t-1$ is transferred to consumers in period t.

Lagged Expenditure Policy

In order to implement this policy, the regulator only needs to observe the firm's realized revenues and costs.

Proposition

Suppose demand and cost functions do not change over time and the firm's technology exhibits decreasing ray average cost. Further suppose the regulated firm maximizes profit myopically each period. Then the lagged expenditure policy induces the firm to set prices that converge to Ramsey prices.

Lagged Expenditure Policy

Issues:

What if demand or cost functions shift over time?

- Convergence not guaranteed
- Financial distress to the firm

Non-myopic firms can delay convergence and reduce welfare.

Can induce high average prices when the firm can affect its production costs as it provides poor incentives to control costs.

Incremental Surplus Subsidy

In a dynamic setting, possible to return surplus to consumers over time and maintain marginal-cost pricing

In each period t the firm can set any price p^t. The regulator pays the firm a transfer each period equal to:

$$T^t = \left[v(p^t) - v(p^{t-1})\right] - \Pi^{t-1} \tag{8}$$

Thus, firms maximize profits and consumer surplus (since this maximizes transfers)

Incremental Surplus Subsidy

Proposition

In a stationary environment the incremental surplus subsidy policy ensures:

1. *Marginal-cost pricing from the first period onwards*
2. *The absence of pure waste*
3. *Zero rent from the second period onwards*

Proof.

Sketch: Since the firm wants to maximize profits and its transfer payments, the firm will choose price to maximize $\pi(p^t) + v(p^t)$ where $\Pi^t = \pi(p^t)$ is observed. This entails marginal cost pricing in all periods, which is constant from period 2 onwards. $\square$

Incremental Surplus Subsidy

Issues:

- If costs rise over time, imposes financial hardship on firms
- Initially large subsidy payments are socially costly when the regulator prefers consumer surplus to rent
- Regulator must know consumer demand
- Does not preclude "abuse" where expenditures in excess of minimal costs provide direct benefits to the firm's employees or managers

If the functional form of the demand curve is unknown, can be approximated by the following:

$$T^t = q^{t-1}\left[p^{t-1} - p^t\right] - \Pi^{t-1}$$

Regulator Behavior

How much discretion to give to the regulator?

- Opportunistic regulator who maximizes ex post welfare in such a way to distort the ex ante incentives of the firm
- Captured regulator who succumbs to industry pressure and acts in a non-benevolent manner

Policy Credibility

Credible commitment may be achieved by:

- Limiting the regulator's policy discretion by imposing a specified rate of return on assets
- Employing a regulator who values industry profit more than the government
- Dividing regulatory responsibilities among many regulators
- Increasing political costs by privatizing and promoting widespread ownership of the firm

Regulator Incentive Issues

Myopic regulator with a term limit will only maximize consumer surplus over length of term and could pass excessive costs on to future generations.

Guarding against regulatory capture through complete contracting is difficult, instead:

- Prohibit regulators from future employment in the regulated sector
- Preclude transfer payments

Optimal regulation with multiple firms

What if the market is not a monopoly?

- Correlation between firms
- Auctions
- Economies of scope

Potential benefits:

- Reducing rents - Less benefits from hiding private information
- Sampling - Likelihood of having an efficient supplier in the market

Yardstick competition

Main idea: Compare a firm's performance with the performance of firms in other markets. (Shleifer, 1985)

Example (symmetric markets):

- n identical and independent markets, each one has a monopolist firm
- Same demand curve in all markets $Q(p)$
- Each firm has identical opportunities to reduce marginal cost c
- $F(c)$ is the fixed cost required to achieve marginal cost c

Yardstick competition

Example

The regulator

- Does not know $Q(\cdot)$ or $F(\cdot)$
- Observes realized marginal cost c_i and cost-reducing expenditure F_i in each market $i = 1, \ldots, n$
- Specifies price p_i and transfer T_i
- Maximizes the total surplus subject to non-negative profits

Firms maximize profits by choosing c_i simultaneously after regulator's action.

Yardstick competition

Example

Proposition

Ensuring the full-information outcome:

$$p_i = \frac{1}{n-1}\sum_{j\neq i} c_j; \quad T_i = \frac{1}{n-1}\sum_{j\neq i} F_j \quad \textit{for } i = 1, \ldots, n \tag{9}$$

Proof.

1. p_i and F_i independent of i.
2. Each firm maximizes $Q(p_i)(p_i - c_i) - F(c_i) + T_i$
3. F.O.C.: $Q(c_i) + F'(c_i) = 0$ identical to all firms $\rightarrow c_i = c_j$
4. Therefore, $p_i = \frac{n-1}{n-1}c_j = c_i$ and $T_i = \frac{n-1}{n-1}F_j = F_i$

$\square$

Yardstick competition

Limitations of yardstick competition:

- Failure to account for differences in operating environments
- Uncertainty and risk aversion (Mookherjee, 1984)
- Innovation discouragement with spillovers (Daler, 1998; Sobel, 1999)

Monopoly franchise

N suppliers compete to be the single monopolist in a market:

- Each firm has low marginal cost c_L with probability ϕ or high marginal cost c_H
- The single firm who supplies the market has a high enough fixed cost F
- Firms announce their marginal cost realization to the regulator

Monopoly franchise

If all firms report to have high marginal cost, supplier will be chosen randomly

If at least one firm reports low marginal cost, supplier will be chosen randomly among these

Regulator sets price p_i and transfer T_i for the firm that is chosen to supply the market

Rent: $R_i = Q(p_i)(p_i - c_i) - F + T_i$

Monopoly franchise

Let ρ_i be the probability that a firm is selected to produce

In a truthful telling equilibrium:

$$\rho_H = \frac{(1-\phi)^{N-1}}{N} \qquad \text{High cost firm}$$

$$\rho_L = \frac{1-(1-\phi)^N}{N\phi} \qquad \text{Low cost firm}$$

Note: $\rho_L \geq \rho_H$

Expected rent is $\rho_i R_i$ for a firm with marginal cost c_i

Monopoly franchise

Incentive compatibility:

$$\rho_L R(c_L, c_L) \geq \rho_H R(c_H, c_L) \Leftrightarrow R_L \geq \frac{\rho_H}{\rho_L}\left[R_H + \Delta^c Q(p_H)\right]$$

If $N = 1$, $\frac{\rho_H}{\rho_L} = 1$. Competition reduces rent by relaxing I.C.: Rent reducing effect. Also, rent decreases as N increases.

Total expected welfare:

$$\begin{aligned} W = & (1 - (1-\phi)^N)\{\omega_L(p_L) - (1-\alpha)R_L\} \\ & + (1-\phi)^N\{\omega_H(p_H) - (1-\alpha)R_H\} \end{aligned}$$

With $N > 1$, probability that a low cost firm wins is higher: Sampling effect

Monopoly franchise

Williamson (1976)

Limitations:

- Contractual incompleteness
- Limited investment incentives
- Incumbency advantages

Dominant firm

Regulation in markets with many firms, but only one is dominant and regulated. What happens to welfare?

Suppose that there are a large number of rivals who supply the same product as the dominant firm.

Marginal cost of the dominant firm is either c_L or c_H. All other firms have a marginal cost c^R.

Competition among the fringe ensures that they supply at price c^R.

Dominant firm

Proposition

Consumer surplus and welfare are higher, and the rent of the dominant firm is lower, in the competitive fringe setting than in the corresponding setting where the fringe does not operate.

Proof.

- $c^R < c_L$: Welfare increases as price and production costs are lower when fringe is active
- $c_L < c^R < c_H$: Welfare increases. Regulator can set $p = c_L$. If MC is c_H, firm rejects and market is served by the fringe.
- $c_H < c^R < p_H$: Regulator can set $p = c^R$ instead of p_H.
- $c^R > p_H$: Fringe cannot compete. Benchmark solution is recovered. □

Monopoly vs. Oligopoly

Analysis so far took the market structure as given

But regulator can allow/deny entry of firms

Benefits of large number of firms:

- Increasing competition
- Increasing product variety/quality

Drawbacks of large number of firms:

- Increasing production costs (eg, replication of fixed costs)

Monopoly vs. Oligopoly

Armstrong, Cowan and Vicker (1999)

Regulated monopoly advantages:

- Industry prices can be controlled directly;
- Transfer payments to provide desired incentives
- Economies of scale

Unregulated oligopoly advantages:

- Sampling effect
- Correlated costs reduce informational advantage
- Avoid regulating costs

Integrated vs component production

Easier to regulate if production is separate (eg, yardstick competition)

But there may be technological/informational economics of scope

Three different cases:

- Independent products
- Complementary products
- Substitute products

Integrated vs component production

Independent products

If production is integrated in one firm:

- Full-insurance outcome can be recovered (Loeb and Magat, 1979)
- Marginal costs independently distributed

If production is separate:

- Correlation between marginal costs $\Rightarrow$ yardstick competition provides full-information outcome.

Integrated vs component production

Independent products

Franchise example (second-price auction):

- Two independent markets $m = \{1, 2\}$; Two firms $i = \{A, B\}$
- Cost of supplying both markets $c_i^1 + c_j^2$, returned to the firms through the regulator (T)
- Two separate auctions (no integration):

$$T = \max\{c_A^1, c_B^1\} + \max\{c_A^2, c_B^2\}$$

- One auction for both markets (integration):

$$T = \max\{c_A^1 + c_A^2, c_B^1 + c_B^2\}$$

Integrated vs component production

Complementary products

Simple example (Palfrey, 1983):

- A final product is produced using two perfect complementary inputs
- Demand is perfectly inelastic at 1 up until some reservation price
- Cost of producing the final good is the sum of the cost of each input: c_L (probability ϕ) or c_H (independent)
- Suppose that if c_H for both inputs, it is optimal not to produce
- R_{ij} is the rent when c_i is the cost for the 1st input and c_j for the 2nd

Integrated vs component production

Complementary products

Integrated production:

- $R_{LH} = R_{HL} = 0$ (benchmark problem)
- Incentive compatibility: $R_{LL} \geq \Delta^c$
- Expected rent with integration: $R_{INT} = \phi^2 \Delta^c$

Component production:

- If a firm says it has low cost: $R_L = T_L - c_L$
- If a firm says it has a high cost: $R_H = T_H - \phi c_H = 0$
- Incentive compatibility: $R_L \geq T_H - \phi c_L = R_H + \phi \Delta^c = \phi \Delta^c$
- Total expected rent: $R_{COMP} = 2\phi^2 \Delta^c$

Integrated vs component production

Substitute products

Two products, consumer views them as substitutes and only wants one unit.

Same set up as before. Marginal cost can be c_L or c_H for each product (instead of firm)

Integrated production:

- Regulator gives payment c_H to ensure production.
- Rent is Δ^c unless firm has c_H for both products
- Expected rent $R_{INT} = (1 - (1 - \phi)^2)\Delta^c$

Integrated vs component production

Substitute products

Component production:

- The regulator can use an auction such as in a monopoly franchise
- $R_H = 0$ and $R_L = \frac{\rho_H}{\rho_L}\Delta^c$
- Probability that a low firm wins the auction $(1 - (1 - \phi)^2)$
- Expected rent $R_{COMP} = (1 - (1 - \phi)^2)\frac{\rho_H}{\rho_L}\Delta^c = \phi(1 - \phi)\Delta^c$

Rent is lower under component production

Conclusion

Asymmetry of information between regulator and firm allows the firm to extract rents

- Theoretical optimal policy is sensitive to the setting, so the regulator needs to tailor policies carefully to limit rents
- In practical settings, the regulator may induce firm to employ its superior information in the interest of consumers. In particular, the regulator can take advantage of dynamic settings.

Market competition can be used to reduce firm's rents and improve efficiency

- May also create a trade-off between rent's and efficiency
- Increases regulation complexity