Ramsey Pricing

Ramsey pricing

- A regulated firm can be constructed as setting prices efficiently to meet a revenue requirement

- Ramsey pricing is the tariff to maximize an aggregate of customers' benefits, subject to the constraint that the firm's revenues recover its total cost

- The formulation of Ramsey pricing interprets efficiency in terms of maximizing consumers' surplus, using only the minimal monopoly power required to raise the required revenue

5.1 The price schedule of a regulated firm

- Ramsey pricing rule
  - Percentage profit margin should be the same fraction of the monopoly percentage profit margin on every unit

- Utility's price schedule should satisfy the condition

$$\frac{p(q) - c(q)}{p(q)} = \frac{\alpha}{\eta(p(q), q)}, \qquad (1)$$

p : price

c : cost

α : Ramsey number

η : price elasticity of the demand profile

Construction of Ramsey price schedules (1)

- producer's surplus

$$\mathrm{PS} \equiv \int_0^\infty N(p(q), q) \cdot [p(q) - c(q)]\, dq\,. \qquad (2)$$

- customer's surplus

$$\mathrm{CS} = \int_0^\infty \int_{p(q)}^\infty N(p, q)\, dp\, dq\,, \qquad (3)$$

- Maximize total surplus

$$\max_{p(q)} TS \qquad (4)$$

$$s.t \quad PS \geq R_*$$

Construction of Ramsey price schedules (2)

- Lagrangian

$$\mathcal{L}_* \equiv \mathrm{TS} + \lambda[\mathrm{PS} - R_*]\,, \qquad \text{or equivalently} \qquad \mathcal{L} \equiv \mathrm{CS} + [1+\lambda]\mathrm{PS}\,,$$

$$\mathcal{L} \equiv \int_0^\infty \left\{ \int_{p(q)}^\infty N(p,q)\,dp + [1+\lambda]\cdot N(p(q),q)\cdot[p(q)-c(q)] \right\} dq\,. \tag{5}$$

- optimality condition

$$-N(p(q),q) + [1+\lambda]\left\{ N(p(q),q) + \frac{\partial N}{\partial p}(p(q),q)\cdot[p(q)-c(q)] \right\} = 0\,. \tag{6}$$

$$\alpha = \frac{\lambda}{1+\lambda}$$

$$\eta(p,q) \equiv -\frac{p}{N}\frac{\partial N}{\partial p}\,.$$

$$\alpha N(p(q),q) + \frac{\partial N}{\partial p}(p(q),q)\cdot[p(q)-c(q)] = 0\,, \tag{7}$$

$$\frac{p(q)-c(q)}{p(q)} = \frac{\alpha}{\eta(p(q),q)}\,, \tag{8}$$

Construction of Ramsey price schedules (3)

- effect of Ramsey pricing is to reduce the monopoly percentage profit margin so that only the required revenue is obtained by the firm

- Regulation enforces behavior by the firm that is based on a price elasticity of the demand profile that is artificially inflated by $1/\alpha$

- Regulation enforces the firm to behave as if it were one of $1/\alpha$ firms offering products that are perfect substitutes

Efficiency aspects of Ramsey pricing (1)

- Efficiency aspects of Ramsey pricing
  - Nonlinear tariffs derived from the principles of Ramsey pricing suppose that the firm is allowed to charge different prices for different increments
  - Use of monopoly power to differentiate prices is the efficient way for the firm to meet its revenue requirement
  - The aggregate welfare loss incurred in meeting the revenue requirement is minimized by pricing increments differently depending on their price elasticities

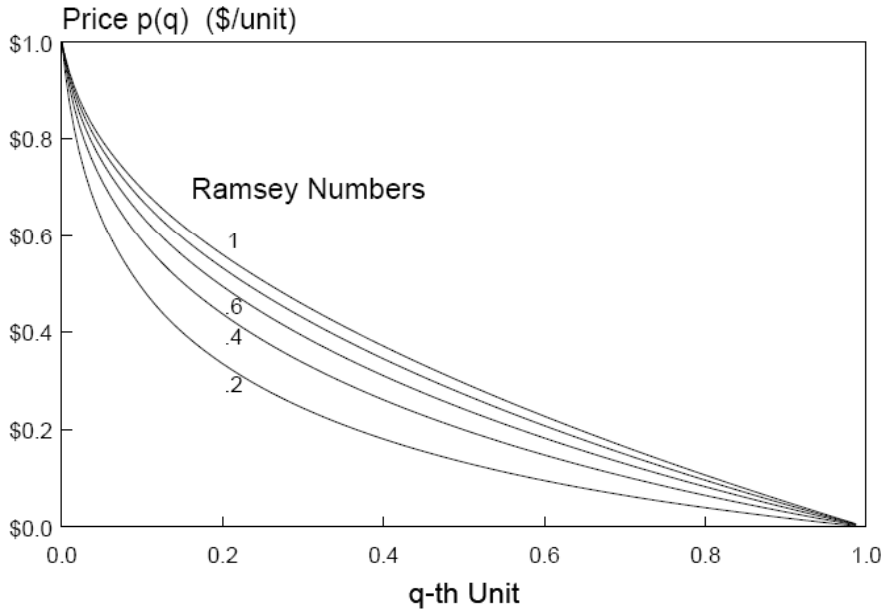
Efficiency aspects of Ramsey pricing (2)

- Example 5.1

$$N(p,q) = \frac{1-q}{1-p}$$

Optimal price schedule

$$p(q) = 1 + \frac{q}{2}\frac{1-\alpha}{\alpha} - \sqrt{\left(\frac{q}{2}\frac{1-\alpha}{\alpha}\right)^2 + q\frac{1-c}{\alpha}}.$$



Efficiency aspects of Ramsey pricing (3)

- Ramsey pricing can reduce the net benefits of customers making small purchase

- price cap
  - No customers is disadvantaged

$$p^{\circ}(q) = \min\{\bar{p}, p(q)\} = \begin{cases} \bar{p} & \text{if } q \leq \bar{q}, \\ p(q) & \text{if } q > \bar{q}. \end{cases}$$

5.2 Pareto-improving tariffs

- Two-part tariff

$$P_1(q) = P_1 + p_1 q \qquad P_2(q) = P_2 + p_2 q \qquad (p_2 < p_1)$$

- Quantity discount
  - Whenever the existing tariff has a marginal price exceeding marginal cost, an appropriately designed quantity discount is Pareto-improving

- Optimal nonlinear tariff segment

Long distance telephone tariffs (1)

- NYTel Company
- Uniform price : 7.56 ¢/min
- Marginal cost : 1 ¢/min

Table 5.2

Distribution of Usage and Elasticities

Type	Usage Band	% of Accounts	Monthly Minutes	Elasticities Current	Elasticities Alternative
1	0 - 60	74.03	14.55	.16	.16
2	61 - 1000	25.47	160.21	.16	.16
3	1001 - 2000	0.26	1364.46	.22	.50
4	2001 - 7000	0.17	3547.77	.22	.50
5	7001 - 20000	0.05	11026.07	.31	.70
6	20000+	0.02	67425.60	.31	.98

Long distance telephone tariffs (2)

- Nonlinear tariff : block-declining tariff

Table 5.3
Predicted Consequences of
NYTel's Proposed Tariff
(Alternative Elasticities)

Customer Type	Proposed Tariff	Change in Consumer Surplus	Change in Producer's Surplus
1	$.0961	$-0.29	$0.25
2	.0713	-0.80	0.89
3	.0484	16.85	0.36
4	.0352	119.61	-50.93
5	.0302	582.87	-214.14
6	.0269	5,061.42	-1,134.39
Average		$1.135	$-0.007

- Some customer types are disadvantaged

Long distance telephone tariffs (3)

- Optimized Tariff

Table 5.4
Optimized Tariff: I
(Alternative Elasticities)

Type	Fixed Fee $/mon.	Usage Charge $/min.	Change in Consumers' Surplus	Change in Producer's Surplus
1	$0	$.0756	$0	$0
2	0	.0756	0	0
3	0.52	.0752	0	0.23
4	29.18	.0674	0.82	12.06
5	342.17	.0446	66.00	170.61
6	3,495.58	.0238	2,350.00	1,956.60
Average			$0.50	$0.50