

The Taussig & Pigou Controversy

The T&P controversy boiled down to two questions: (1) Can price differentials that look like price discrimination be efficient? (2) Can these price differentials be sustained in the face of competition? The questions are similar. Typically we assume that if something is sustainable in a competitive market, it must be efficient.¹ Even so, the subtle differences between the two questions frame the discussion.

Recognize that price differentials exist in many industries:

Joint products:	Beef and hides Cotton and cotton seed Chickens and eggs
Peak load situations:	Electricity Telephone Hotels and resorts
Privately produced public goods:	Movies Music Books Artistic and sporting events

In all of these situations we generally consider the price differentials to be efficient.

In the joint products case, the price differential exist as a natural result of clearing the market when the goods are produced in strictly fixed proportions. However, even when there is a potential transformation between the two goods (i.e., cattle can be bred to generate marginally more or less beef relative to quality of the leather obtained from the hide), so long as the product transformation frontier² is concave to the origin, a price differential based on the relative demand intensities between the consumption groups will exist.

In peak load situations, the efficiency of differential prices has been thoroughly investigated.³ And we have discussed the case of privately produced public goods in some detail. Notice that I included artistic and sporting events in the mix. Rock concerts, operatic performances, and baseball games all have the characteristic that the seats have different prices. This phenomenon follows the general pattern of pricing public goods. Those with the most intense demands select themselves into the best seats where they pay highest prices.

The efficiency of price differentials was developed by Baumol and Bradford by application of the pricing principle of Ramsey. This is developed in an appended lecture. The structure of their model focused on the case of natural monopoly in which the regulatory authorities want the utility to be self sufficient but at the same time recognize that if price is not equal to marginal cost there are welfare gains lost to society. Hence, controlled price discrimination is a way of recapturing some of the welfare triangle under the demand curve between the falling average and marginal cost curves. In the B&B model, the regulator maximizes consumer surplus minus production cost subject to the condition that revenues equal cost. This gives the Ramsey pricing rule:

¹ We will discuss the situation of externalities and common access which mitigate this conclusion.

² Production possibilities frontier: See the discussion of bees.

³ See Alfred Kahn, *Economics of Regulation*, MIT Press. He gives all the references in historical context and detail.

$$\frac{\frac{P_1 - MC}{P_1}}{\frac{P_2 - MC}{P_2}} = \frac{1/\epsilon_1}{1/\epsilon_2}$$

While the Ramsey pricing rule was developed in the context of downward sloping average cost and natural monopoly, it applies equally well to the situation of privately produced public goods. Here we see firms producing at the minimum of their average cost curves, forced their by the pressures of competition. These firms are forced by this same competition to price differentially among the customers who buy their product, but competition saws away at each price until the sum of the prices across all the consumers served by a firm is equal to the average cost of production. These resulting price differentials will follow the Ramsey pricing rule shown above.⁴

Returning to the Taussig & Pigou debate, recall that Pigou saw the fixed costs embodied in the railroad capital as common not joint costs when applied to the choice of serving different classes and types of rr customers. He was absolutely right in this and Taussig was technically wrong.⁵ However, what Taussig was groping for was the analogy of joint production and public goods that Demsetz elucidated many years later. The physical plant of the railroad is like a unit of a public good.

The fixed plant in the railroad and physical phenomenon of railway transportation cause production to come in big units. I like to call this not a public good but rather a *bundled* good. The bundled good is like a unit of a public good in that until the capacity of the bundle is exhausted, an additional customer can be served at zero cost. For instance, adding another freight car to an under-subscribed train costs nothing to haul. The under-utilized bundle has the same characteristic of non-rivalrous consumption that is found in a unit of a public good.

Of course, railroads are not unique in this. Other industries produce bundled goods: Hotels and airlines are the closest examples in the characteristics of production as well as the pattern of pricing. However, now that we think of the problem this way, it may be more insightful to classify theaters, concerts, and sporting events as bundled goods rather than public goods. Indeed, the only difference between a bundled good and public good is that in a public good there is some element of the production process that has a limitless consumption characteristic. In a bundled good, there is some finite end to the non-rivalrous consumption.

The most important thing about bundled goods is that they are just like privately produced public goods. Price differentials based on the relative demand elasticities of the consumers thrown together in the bundle are necessary to defray the cost of the bundle. This means Ramsey pricing. And in this, Taussig was absolutely correct and Pigou wrong.

Now let's move to the second question posed at the beginning: Can competition achieve efficient pricing in the case of bundled goods? Before we try to answer that question explicitly, it is useful to consider the dynamics of the market for bundled goods and others like them. One characteristic of these markets is that they may not have a core. That is, there may be no unique equilibrium. Consider the simplest case. Let's say that there is no possibility for price

⁴ I think. I have never seen this explicitly derived, but I feel confident that it is true. If any of you would like to take a crack at proving it, I suspect it would make a note in a good journal.

⁵ Technically Pigou was right. The fixed costs in the rr physical plant can be transformed along a straight line between the production of coal freight or iron ore. In this sense, it is decidedly unlike the case of joint products which in the strict fixed proportions case has a production possibilities frontier that is shaped like an inverted L.

discrimination because all consumers are the same. Furthermore, let's assume that with n firms, all firms acting competitively make excess profits. These excess profits will entice the entry of another firm. What happens if given the market demand for the product and production capacity represented by the $n+1$ firm, market price is below average cost? Economic theory does not have a good answer for this, mainly because there are many possibilities. The markets for bundled goods often seem to have this non-integer characteristic.

The second point that I think we should consider before we directly tackle pricing in the bundled goods market is the fact that the recovery of sunk costs is a phenomenon that occurs in many markets. Anytime that production involves substantial research, exploration, or development costs, the marginal cost at the moment of production will be substantially lower than the average cost of production or what we generally call the long-run marginal cost of production. In the oil industry, the marginal cost of pumping oil out of the ground from a proven well is much less than the full cost of developing the field. Exploration and drilling are sunk costs when the oil starts flowing.

An even better example is the case of college textbooks. These days, college textbooks involve an enormous amount of development over and above the sunk cost of the author in writing it. Even more interesting is the fact that competing textbooks go head to head in the market. The incentive is there to cut price in order to capture the business. Surely some pricing cutting is done, but from my inside view of this market place, the price cuts are trivial compared to the sunk costs that are invested in the book. The rivals hold the line on price.

With these thoughts in mind, let's turn to pricing in markets with bundled goods. First of all, pricing in the railroad, airline, and hotel industries closely follow the pattern of pricing in the markets for public goods like movies. Airlines charge a vast array of prices to different customers. While the number of prices differs (and is a point of interest) there are usually gross difference across two main groups. People who book in advance pay less; people who wait until the last minute to buy their ticket pay more. On the route between Greenville-Spartanburg and LaGuardia, non-stop service is priced at \$260 if book one-month in advance and \$970 if purchased the day of the flight.⁶

The ability to price discriminate is the essence of the problem. In many cases firms cannot discriminate. McD's produces a bundled good in that its brand name can cover a lot of consumers (maybe we should think of this as a public good). However, when people show up to buy hamburgers, McD's can't tell whether these are people who are really scared to eat at the Gag-n-Puke down the street or who are just looking for a little variety. McD's charges the same price to everyone.

When the bundled good producer can distinguish among customers, there is still the question of why competition does not erase these price differentials. Recognize that it does in some cases. Business travelers with immediacy of demand for flight do not pay outrageous differentials on the most heavily traveled routes. In the air shuttle corridor of the north east (Boston, NYC, DC) everyone pays about the same, and it is about one-third of the cost of full coach fares on other routes.

It may be the case that the way that price discrimination unfolds in the airline and hotel markets, there is no direct pressure price competition for the highest paying customers. Consumers with immediacy of demand pay the most and these are the people who have the least opportunity to price search. If you arrive at a hotel at midnight without a reservation, you are not

⁶ These are 35 passenger planes. One wonders what the composition of passenger list looks like.

likely to desert one hotel in the search for a lower price at another. The hotel knows this and charges a high price without fear of losing the business. The same is true for airlines.

Hotels and airlines hold rooms and seats until the last moment in hopes of being able to supply last-minute buyers at very high prices. The process of price discounting up until the end is aimed at fully utilizing capacity and still having space for the late arrivers. Looked at in this way, there is little room for last minute discounting among rivals. One firm is not only competing against other firms in supplying service, but also competing against itself along the time-line to the moment of service. If an airline sells a seat too cheap early on, that is one less seat available for a higher paying customer later. Hence, the resistance to engage in price competition with rivals at any one stage along the time-line is muted. The driving force of competition resulting from entry of new firms affects prices for all classes of service, not just the highest priced demand groups.

Appendix: Derivation of the Ramsey Pricing Rule

The question here is how to set price under the assumption that average cost is downward sloping, demanders are heterogeneous, total revenue must equal total cost, and two-part pricing schemes are not allowed.

The situation is typified by the regulated monopoly. In the traditional case, the regulated firm is assumed to have a declining average cost function. The competitive outcome in this event is expected to be monopoly. This is true because one firm can satisfy market demand more cheaply than multiple competitors. As a result, public policy calls for rate regulation.

The intent of rate regulation is to mandate a price structure on the regulated firm such that total revenue equals total cost. Perfect public policy would set price equal to marginal cost. However, this level of perfection is eschewed in favor of mandating self sufficiency on the firm qua industry. In other words, marginal cost pricing in the face of declining average cost means that revenues would be less than total cost. Marginal cost pricing would require a subsidy. Subsidies are not politically attractive. The alternative is average cost pricing. While less efficient, the political viability of self sufficiency dominates the political balance.

If demanders are homogenous, average cost pricing is relatively simple. Price is set equal to the intersection of demand and average cost. However, if demanders are heterogeneous, the situation becomes somewhat more complicated. Even under the constraint that revenues must cover cost, consumer surplus can be increased by price discriminating across classes of customers. Consider a graph of two demand groups, A and B, and downward sloping average cost. Total demand is the horizontal summation across the two classes. Let's start from the single price position. That is, let price for each of the two groups equal the intersection of total demand and average cost. Call this P_0 .

Notice that at P_0 the marginal revenues across the two classes are different. The marginal revenue of the more inelastic demand group (A) is more negative than the marginal revenue of the less elastic group (B). This means that an additional unit of output sold to group A reduces revenues by more than a unit sold to B. In other words, one unit is reallocated from A to B, total revenue goes up. Hence, holding output at level Q_0 , reallocating revenues between the two groups until their marginal revenues are equal generates revenue in excess of cost. While reallocating output from one group to the other increases revenue, it may or may not, in and of itself increase consumer surplus. However, it does allow for the expansion of total output. That is, price discrimination is a way to push total output beyond the intersection of total demand and

average cost and toward the point of intersection of total demand and marginal cost. To prove that this raises consumer surplus let's model the problem formally.

The welfare maximization can be written as:

$$\max W = \int_0^{Q_1} P_1(q_1) dq + \int_0^{Q_2} P_2(q_2) dq - C(Q_1 + Q_2) + \lambda[P_1Q_1 + P_2Q_2 - C(\cdot)]$$

The first two FOC are:

$$P_i - MC + \lambda[MR_i - MC] = 0$$

Hence, we can write

$$\frac{P_1 - MC}{MR_1 - MC} = \frac{P_2 - MC}{MR_2 - MC}$$

This expression has an intuitive interpretation; the two sides of the expression are like marginal cost, marginal benefit ratios. The welfare maximum is achieved where the marginal cost to one group divided by its marginal benefit is equal to the marginal cost, marginal benefit ratio of the other group. Price minus marginal cost is marginal welfare cost. In other words, for maximum welfare we want price to equal marginal cost. As price is pushed away from marginal cost welfare declines. On the other hand, the constraint in this problem is to raise money to support the project. Marginal revenue minus marginal cost is the money raising benefit of moving price away from marginal cost. Like most economic problems, this one says equal cost-benefit ratios across alternatives.

Another way to write this expression is:

$$\frac{\frac{P_1 - MC}{P_1}}{\frac{P_2 - MC}{P_2}} = \frac{1/\epsilon_1}{1/\epsilon_2}$$

We can call the left-hand side of this equation the ratio of the tax rates. In this sense $\frac{P_1 - MC}{P_1}$ is

the proportion of price that is above marginal cost. The expression says that the efficient tax rates in this case are inversely proportional to the demand elasticities.