Mixed Pricing in Monopoly and Oligopoly: theory and implications for merger policy

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Introduction

Economists have studied a number of processes whereby prices and quantities supplied and demanded may be brought into balance in markets: auctions, tenders, bargaining and seller price setting. The last of these is the standard "textbook" mechanism of price theory, being the articulation of the principle of sellers offering a set price to potential customers on a rigid, take it-or-leave it (ToL) basis, usually following the profit-maximising principle of equating marginal revenue to marginal cost. This paper focuses on the third and fourth of these mechanisms -- bargaining and ToL pricing – which are probably the most common in practice.

Given that both parties to any potential transaction between a seller and a buyer generally have something to gain from coming to terms – potential "surplus" over their best alternatives – it is reasonable to ask why buyers would always acquiesce in allowing sellers to set those terms unilaterally. Although under normal civil conditions in a developed market economy firms do generally have the legal right to offer ToL prices – they cannot be forced to supply – it is empirically valid to note that, in very many instances, they do not exercise this right: they engage in bargaining over price (and other terms of transactions) with some customers, even though such will (obviously) result in a price lower than the ToL price (because buyers in developed market economies generally have the legal right to purchase at this price if they so choose). Why?

This paper addresses this question. Specifically, we will propose -- with some empirical support -- that a very common market situation has the selling firms engaged in what I will call "mixed pricing", meaning that they choose to sell to

some buyers at a ToL price, and to bargain prices individually with the remainder of their potential customer base. We will develop the theory of mixed pricing, which basically means determining where ToL ends and bargaining begins, in monopoly and Cournot-Nash oligopoly market settings. We note the implications for antitrust, of which the main one turns out to be that there is no deadweight loss from the restriction of output needed to exercise market power.

The two paradoxes of price theory

First, I note what might -- with some risk of hyperbole – be called the two paradoxes of standard price theory. The first is the hopeless inefficiency of the standard textbook monopolist. As Figure 1 reminds us (in the zero marginal cost simplifying scenario), even a sharp-as-a-tack monopolist (seller with a demand curve of its own) manages to capture as profits only 50% of the potential surplus available in its selling market. One quarter is kept as consumer surplus by its customers; one quarter is simply wasted by the restriction of output needed to push the market-clearing price up to its MR=MC level. Seriously – how plausible is this; how (in)consistent with the deeper faith most orthodox economists have in overall effectiveness of the free market system?

Well, what is the alternative? Again restricting ourselves to the textbook material we purvey to undergraduates, this is offered in the (single) chapter given to "price discrimination" -- the partitioning of the market into segments in each of which customers pay a different ToL price that in most cases is closer to their maximum willingness-to-pay (WTP). The extreme of price discrimination, in Pigou's classic taxonomy, is discrimination of the "1st degree", under which each customer pays a penny less than their maximum willingness to pay, such that (a) all potential customers are served (so there is no deadweight loss, and (b) all surplus is purloined by the seller. In a typical account, first degree price discrimination:

> "involves the seller negotiating separately with each individual customer. If the seller does this skilfully, it can result in each separate unit of the commodity selling at the very highest price its buyer is willing to pay for it….the seller can be rewarded handsomely for the negotiating effort." (Mills, 2002, p24)

Textbook accounts usually note the informational difficulties of achieving perfect price discrimination and move onto to more realistically implementable schemes under the rubrics of 2nd and 3rd degree discrimination. But there is an analytically deeper problem with discrimination of the first degree which, from my reading, has only been noted by Hal B. Varian, who implicitly notes that a price set at or only just below the WTP of each customer is the same as the customised ToL price for that customer, but:

> "Take-it-or-leave-it offers are not terribly common forms of negotiation for two reasons. First, the 'leave-it' threat lacks credibility: typically a seller has no way to commit to breaking off negotiations if an offer is rejected. And once an initial offer has been rejected, it is generally rational for the seller to continue to bargain." (Varian, 1988, p603)

In everyday terms, we can see the problem here. Once a seller has begun setting personalised prices and informed buyers of these, then each buyer is going to respond with something like: "Well, hello, pleased to meet you at last. Now that we are on first name terms, let's talk. Let us do some serious surplus-splitting here. Let's negotiate."

And, the result of this will be a personalised price that splits surplus between buyer and seller, perhaps 50/50, as in the Nash Bargaining model that is the mainstay of the price negotiation literature. If so, then the outcome will be as in Figure 2, with total surplus divided equally. This is the second paradox: *under the bargaining that will just about inevitably result from 1st degree price discrimination in practice, the monopolist earns no more profit than under standard ToL single pricing -- actually, less, once the transaction costs of bargaining are brought into the story!*

We will next find out that, under a mixed pricing regime, the paradoxes can be dissolved. A monopolist or oligopolist can plausibly increase their profits over their ToL level. First, we motivate the modelling by discussing mixed pricing as it is found in practice.

Examples of mixed pricing

Mixed pricing regimes are fairly common, though not ubiquitous, in consumer-only retail markets, sustained where they are found by attaching some customer costs to access to the lower, negotiated price – costs of time, of being a pest, and

perhaps of unwillingness to risk embarrassment – which sorts customers by their keenness to avoid paying the posted, ToL price.

Allen *et al* (2014) examine the effects of bank mergers on prices paid in local Canadian home mortgage markets. The banks all have nationally advertised interest rates which anyone can pay, but also generally concede discounts to those customers able and willing to 'gather information and negotiate' (2014, p3366). They find that these discounts are reduced for customers of all banks in local markets affected by merger (ie, losing an independent branch bank), whereas the posted price – which also applies to regional markets in which no or just one branch bank happens to belong to merging parents -- is unaffected.

In New Zealand, home insurers were recently revealed to be offering "secret" discounts to customers threatening to switch suppliers. The staff of one major insurer were told 'not to advertise the existence of the discretionary discounts to policyholders for fear of kicking off a wave of demands for premium reductions'[1] One insurer's representative said it is 'the same principle as when you go to buy a new television set', and indeed in New Zealand it is fairly well known that a prospective customer for consumer durables willing to ask for the "best price", or for the vendor to "sharpen the pencil" should normally be able to extract a discount in the 5-10% range.

It is probably a reasonable rule of thumb that the likelihood of bargaining emerging in retail situations is correlated with the value of the transaction (because of the time and other fixed costs of haggling), but this principle by no means holds universally. A traveller, for example, may expect to be able to negotiate a "corporate rate" or other discount on a stay in a hotel, but would get nowhere trying to persuade the airline that flies them to offer a deal on what may be an airfare of similar or greater value to the hotel room. And at the other end of the value spectrum, few of us would seek to haggle in a bookstore over the price of a new book[2], but we can and sometimes do access significant discounts off the meter prices of taxi fares.[3]

These examples are quite intriguing, but are not the direct focus of the paper. Here we are interested in situations in which mixed pricing *always* exists, and

[1] *Sunday Star Times*, 'Insurers go quiet on "discretionary discounts"', October 12, 2014.
[2] Of course, airfares (time of purchase) and book prices (hardcover/paperback) are discriminated by other means.
[3] Auckland's second largest taxi company, Discount Cabs, offers, for the asking, a $35 cash fare from the university to the airport. If you don't ask, you could pay a metered fare of up to twice as much, depending on traffic conditions. So ask!

where the seller *chooses* which customers will pay the ToL price and which will be allowed to haggle to receive a better deal. Such situations do seem to be just about ubiquitous in business-to-business markets, including such markets which also deal with the general public at retail.

For example, building supply stores negotiate a range of discount structures with their construction industry customers that result in prices around half or less of what casual household purchasers pay – almost surely a much larger differential than can be generally justified by different costs of supply.

Air freight forwarders are supplied with complex price schedules by the air carriers, which are applied to casual sales. Discounts may then be negotiated: 'based on the nature of the customer, for example whether it is a regular customer, and the nature of the contract, for example, whether it involves a spot contract or a long-term contract….Should the prices not be competitive, the freight forwarders return to source for alternative pricing, which may be another carrier or an indirect service.' (*anon.*)

The University of Auckland sets each year a schedule of fees payable by foreign students, this based to some extent on market conditions, such as the Australia/New Zealand exchange rate (Australian universities being our main competitor in the third country source market). Deans, however, are quietly authorised 'to award bursaries (effectively a discount) on international fees on the understanding that this should drive volume, that the published fee remains at the approved rate, and that standard University overheads are not compromised.'[4] (*anon*.)

Clemens and Gottlieb (2014) find that US Medicare's administratively determined prices for around 13,000 different medical procedures, which account directly for nearly one quarter of physicians' services in the US, are also used as guidelines for prices paid by large private insurers (managed care organisations). Small medical service provider groups are reimbursed according to the guidelines on a ToL basis; larger groups are allowed to negotiate for higher fees.

Many more examples of mixed pricing regimes could be given, and indeed it would be much harder to come up with a substantial list of industries or markets

[4] Such discounts will normally be offered to overseas (especially Chinese) agents, who can deliver blocks of fee-paying students.

in which mixed pricing is not observed.[5] But what we lack is a theoretical model explaining the practice: in particular, explaining as a rational profit-maximising decision the partitioning of firms' customers into ToL and bargaining sub-groups.

The two separate pricing literatures

What we do have are two separate theoretical literatures; one focussed on ToL pricing, the other on situations where firms bargain over prices.

Take-it-or-leave-it-pricing

ToL pricing is, as noted, the subject of standard textbook MR=MC price theory, sometimes extended to price discrimination, where different customers or groups of customers are offered different ToL prices. The interesting decision – analogous to the decision on pricing regimes modelled in the present paper – of how the firm or firms *choose* to partition their customers into different "price buckets" (as the airlines put it) has been explored for monopoly and Cournot-Nash oligopoly in Hazledine (2006, 2010, 2013). The present paper will not attempt to integrate ToL price discrimination into the mixed pricing regime setting.

Bargaining models

A smaller but impressive literature – not yet fully absorbed into mainstream textbooks – considers the situation of oligopolistic bargaining over prices, when one or both sides of the market have more than one (but usually not many) firms. The seminal paper here is Horn and Wolinsky (1988). These authors bring forward the clever idea that has come to be known as "Nash-in-Nash". A supplier and a customer bargain over price, given the prices set by other bargaining pairs, which include the downstream firm's close competitors, whose given prices therefore are of material interest to this firm. (Co-operative) bargaining splits the surplus over outside options as Nash suggested. Then the outcome is found as the set of bargained prices which generates a (non-cooperative) Nash equilibrium outcome.

Recent papers that have elaborated this setting include Iozzi andValletti (2014), Collard-Wexler, Gowrisankaran and Lee (2014), Grennan (2013), de Fontenay and Gans (2013). In these papers, all prices are set through bargaining, though

[5] Excepting large one-off projects, such as the construction of a road or a building.

Grennan (2013) replaces the usual 50:50 Nash surplus-splitting assumption with an exogenous 'bargaining ability' parameter, which, if set to zero for the downstream firm(s), results in the model collapsing to the standard ToL Bertrand-Nash outcome. [6]

These models are appropriate to "lumpy" situations, when the good being supplied by the upstream firm(s) is extremely important to downstream customers, and thus important to the terms on which the (small number of) customers compete. Such situations are to be found in the real world, perhaps notably in the health sector, which has been the focus of increasing attention on the part of US-based researchers. In that country, relatively large local health service providers, such as hospitals and physician groups, sell to managed care organizations acting for their insurees, to whom the product is then directly provided by the hospitals, etc, with little further value added by the agent.

Although Horn and Wolinsky (1988) were able to illuminate their original insight with an appealingly simple, tractable model, the papers that have followed them have become increasingly technical and complex, with theoretical predictions often highly sensitive to details of the model set-up, such as specification of outside options, and assumptions about how much firms know about each other's contracts. It seems to me that the complexity and fragility of these theories of bilateral oligopoly are such as to limit, at present, their usefulness for framing empirical work or guiding anti-trust.

Be this as it may or may not, two related papers by Katz (1987) and Stephen King (2013) do present tractable models with quite clear normative implications. Katz's seminal paper considers ToL price discrimination by a monopolist supplying retailers in a number of local duopoly markets, in each of which one downstream firm is independent, and the other is a member of a chain operating in all the markets.

The technology for producing the monopolist's good is freely available, but subject to economies of scale in production, such that only the chain might find it feasible to vertically integrate upstream and produce the good itself. The monopolist then charges the chain the highest price that would just deter it from,

[6] de Fontenay and Gans (2013) note the vertical contracting models of Segal (1999) and Segal and Whinston (2003) in which a single principal (who could be the upstream or the downstream party) makes ToL contract offers to N (>1) agents . These contracts can have more dimensions than just price, and they also differ from the ToL price discrimination set-up in that there are "externalities" across the agents, because, typically, they are competing with each other.

in effect, entering the upstream market, albeit in a possibly limited way (antitrust or other regulation may prevent the chain from selling to its independent competitors). In King's (2013) model, the outside option for the chain or buyer group is not vertical integration, but paying the (higher) ToL price charged to the independents. King takes the appealing step of allowing the buyer group to negotiate price or tariff with the upstream monopolist, and analyses welfare implications of effects on double marginalisation and other matters.

King (2013) thus deals directly with what I am here calling mixed pricing regimes, and is the only paper I have found that does so. He notes that an issue arising from his monopoly seller/many buyers setup, and "black boxed" in his paper (2013, p16), is the membership and organisation of the buyer group. This (and other) issues will be avoided in the present paper by limiting consideration to downstream markets in which customer firms are independent and not in competition with each other to a significant extent. Motivation for this follows.

Modelling mixed pricing

In this section we develop a model of mixed pricing, first for a monopoly seller, then for oligopoly. The assumption that buyers act independently (because there are no horizontal externalities generated by their actions) will turn out to yield some very low-hanging fruit, in terms of tractability of the analysis. It is useful, then, to motivate this assumption empirically. To do this I accessed the 2010 US Input-Output Use Matrix. For each industry row, the matrix shows the sales of the industry's products to each other industry, and to itself. For each industry column, the matrix shows that industry's purchases of inputs from each other industry, and from itself. The matrix is at the 4-digit NAICS level, including 146 utility, manufacturing and service industries. To get an idea of the extent of dispersion of output sales, and of input purchases, I have calculated for each row and column the Hirschman-Herfindahl Index (HHI), which is, for each of these industries, the sum of the squares of (i) shares of output going to each industry; and (ii) shares of inputs purchased from each industry.

So, if the firms in a downstream industry use just one input – as is assumed throughout the literature noted above – their HHI for purchases will be 1. If the downstream firms consume two separate inputs, each making up one half of material input costs, the HHI will be 0.5. The highest actual input HHI is 0.754, for the industry "Funds, Trusts, and Other Financial Vehicles", which

purchases nearly 87% of its inputs (cash?) from “Securities, Commodity Contracts, and Other Financial Investments and Related Activities”. The next two highest, not very surprisingly, are “Petroleum and Coal Products Manufacturing” (HHI = 0.720), and “Natural Gas Distribution" (0.645). There is then a big drop to an HHI of 0.364 for “Animal Slaughtering and Processing”.

Overall, in terms of total intermediate input use in the US economy, 75% of this is purchased by industries with input HHIs of 0.140 or less; 50% in industries with HHIs less than 0.094. To put this in perspective, note that an HHI = 0.1 has a “numbers equivalent” of ten, meaning that if the industry’s input purchases are evenly spread over ten different supplying industries, the measured HHI will be 0.1. Note too that the 4-digit industry level input HHI will surely in general underestimate the true dispersion of input purchases, because a supplying industry at this level of aggregation will in most cases be made up of more finely defined industries selling non-substitutable products, and – within these – firms selling ranges of products, some of which will be not substitutable for each other in use. For example, the NAICS industry 5617, “Services to Buildings and Dwellings” is made of five sub-industries: “Janitorial Services”, “Pest Control & Extermination”, “Carpet & Upholstery Cleaning”, “Landscaping Services”, and “Other Services to Buildings & Dwellings”.

The point is that, on the basis of these numbers, it must be reasonable to assume that a large fraction of input purchases -- perhaps a majority by total value – each make up no more than a few percent of any purchasing industry’s input costs (smaller still when primary inputs – labour, land, capital – are brought in), such that it is then reasonable for the modeller to disregard as insignificant “externalities” linking firms competing in the same market through differences in their input prices such as those focussed on in the bilateral oligopoly bargaining literature.

As for dispersion of sales, the HHIs on the selling side are even smaller: one half of total intermediate input sales are made by industries with sales HHIs smaller than 0.066. This number, however, likely over-estimates the true market dispersion of sales, because HHIs in non-competing (eg 5-digit) sub-industries will be larger than for the 4-digit HHI, unless all firms at this level are equally engaged in all the sub-industry activities, which in general is unlikely -- pest exterminators probably don’t usually double as landscapers, for example. However, the true HHI numbers are probably small enough to justify the

modelling assumption made below that the typical selling industry has a large number of customers spread across a number of industries.

The Model: Setup

To motivate matters, let us take the selling industry to be NAICS 56172, Janitorial Services, and the product routine cleaning of offices and factories. This product is essential and is produced, for each customer, according to fixed health and other standards, which for simplicity we could take to require exactly the same amount of cleaning for each customer (homogeneous product). That is, a unit quantity will always be consumed, with totally inelastic demand. The share of cleaning in total costs is so small that each purchaser of such services will have effectively zero interest in the price paid by other purchasers.[7] For an essential input differences in intrinsic use value are not relevant[8], and firms' outside options become key to the analysis. Following Katz (1987), we note that, as a matter of fact, just about all users of cleaning services must have the option to vertically integrate – do their own cleaning -- at a cost which may be higher or lower than the costs of the professional cleaning industry, and this will be what determines their maximum willingness to pay (WTP) for such services. We will assume a continuous distribution of do-it-yourself costs, which could, as in Katz (1987), be generated by economies of scale working through downstream firm size, and/or by other factors, such as security concerns.[9]

We normalise the professionals' costs at zero, so that, assuming linearity, we can without further loss of generality write the WTP schedule for commercially provided cleanings services purchased once or not at all by each potential customer:

$$(1) \qquad P = 1 - Q$$

where P is the maximum the Qth customer would be prepared to pay for a unit of cleaning, being the cost of producing it themselves.[10]

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[7] The Input-Output tables reveal that the parent 4-digit industry "Services to Buildings & Dwellings" accounts, on average, for exactly 1% of total customers' intermediate input costs.

[88] For an essential input, the intrinsic value would be the loss in profits to the firm if it has to cease production of the good or service, for lack of the input.

[9] In general, the customer's best outside option could include sourcing the input from outside the market (eg, importing it) or producing in-house (upward vertical integration).

[10] If there are a maximum of N similar-sized potential customer firms (ie, firms with higher self-cleaning costs than the professionals), a unit of cleaning will be of size 1/N. However, we will not be using the number of customers in the model. Of course, all firms who can self-clean at lower cost than the professionals will do so.

We will use x, X for individual firm and total industry Take it-or-Leave it (ToL) sales, and z, Z for individual firm and total industry negotiated sales[11], with each negotiation taking place one-on-one between a supplier and a purchaser

(2) $Q = X + Z$

And denote:

$$X = x_i + X_{-i} \; ; \; Z = z_i + Z_{-i}$$

For firm i .

Because all viable customers will be served, we have:

(3) $Z = 1 - X$

And also:

(4) $P_x = 1 - X$

We will at first assume that surplus in a bargaining situation, which, in our zero cost scenario is simply the willingness to pay of the customer, is split equally on standard Nash-bargaining lines, so that each bargaining customer ends up purchasing their unit of cleaning services for a price equal to one half of their willingness to pay. We assume zero costs of bargaining, for both parties.

Monopoly case

The monopolist has to decide how many customers will be charged the (same) publicly posted ToL price, and how many will be permitted to bargain individually for a lower price. But why would the monopolist ever want to let a customer get away with a lower price? Because (of course!) at the margin it is not the price, P, paid by the Qth ToL customer that matters, but marginal revenue at this point on the willingness to pay schedule. Lowering the price by epsilon (actually, by 1/N) to bring in another customer will also lower by this amount the revenues received from every one of the Q customers who now will also be paying a slightly lower ToL price. Thus, the analytics of the situation are very simple and are shown on Figure 3. Profits are maximised by charging a ToL price (which will be accepted, of course) of 2/3 to one third of the

[11] In practice, and especially in commercial retail situations such as building supplies, what will be negotiated will be a discount rate, or set of rates, off the ToL price(s), to be applied to all purchases over some future period.

customers, and bargaining prices ranging from 1/3 to zero for the other two thirds of viable customers.

Cournot oligopoly case

Suppose there are two or more independent firms competing to sell cleaning services. We now need to specify who gets the customers who are allowed to negotiate one-on-one deals. With a homogeneous product supplied by firms with constant and equal costs (here set to zero), it seems reasonable to assume that bargaining customers of each WTP type will be evenly spread between the firms (symmetry) so that:

$$(5) \quad z_i = Z/n = (1 - X)/n$$

Then, firm i's profit, π_i is

$$(6) \quad \pi_i = P_x x_i + P_x z_i / 4$$

which, using (4) and (5), becomes

$$(7) \quad \pi_i = (1 - X)x_i + (1 - X)^2 / 4n$$

Now, each firm has to decide how much ToL output, x_i, it should put on the market, given the amount of such output it expects the other firms to put on this segment of the market, and given its expected allocation of bargaining customers from (5), which will be determined by (3) from the total, X, of all the firms' ToL outputs.

Differentiating with respect to firm i's choice variable, x_i :

$$(8) \quad d\pi_i/dx_i = (1 - X)[1 - (dX/dx_i)/4n] - (dX/dx_i)[x_i + (1 - X)/4n]$$

Assuming Cournot conjectures ($dX/dx_i = 1$), equating to zero and rearranging, we get firm i's reaction function:

$$(9) \quad x_i = (1 - X_{-i})[(2n - 1)/(4n - 1)]$$

We should check at once that this expression gives the correct answer for the monopoly case ($X_{-i} = 0$; $n = 1$) – that is (from Figure 3), $x_i = 1/3$. Good.

Since our oligopoly is symmetric, we know the Nash Equilibrium will give a single value for x:

$$x_i = x \; ; \; X_{-i} = (n - 1)x$$

(10) $x = (2n - 1)/[n(2n + 1)]$

And total output sold at the ToL price, X, is given as:

(11) $X = nx = (2n - 1)/(2n + 1)$

We can note that, as n becomes large, X approaches 1. That is, with many firms, bargaining becomes less important and ToL output approaches its perfectly competitive level. Again, good – this is what we would want the model to predict.

From (11) and (4), the ToL price is:

(12) $P_x = 2/(2n + 1)$

And the average bargained price will be:

(13) $P_z^{AV} = (P_x/2 + 0)/2 = P_x/4$

So, using the quantity weights X and (1 – X) we can calculate that the average overall price paid under the mixed pricing regime is:

(14) $P^{AV} = (4n - 1)/(2n + 1)^2$

Since total output = 1, equation (14) also gives the producer surplus (profits) earned in the industry.

Welfare and antitrust analysis

We will be comparing outcomes under mixed pricing with the standard single-price Cournot-Nash oligopoly, for which the Nash Equilibrium market price is given by:

(15) $P = 1/(1 + n)$

We will just consider the situation in this particular market (eg, for cleaning services) for which, under mixed pricing, there will of course be no deadweight welfare loss, because all viable customers are served (subject to bargaining costs being insignificant). However, this is an intermediate good market: what of the downstream implications? As set up, there are no such implications, because it is assumed that cleaning services are consumed in fixed quantities. But, realistically, a downstream firm's cleaning requirements will depend on its size, and this will depend on its marginal costs, which will in turn be affected by differences in the unit price paid for cleaning. This issue requires attention.

Another worrying issue with the model as specified above is that the number of upstream competitors is assumed to have no bearing on the split of surplus in one-on-one bargaining – in particular, a downstream firm that is allowed to negotiate does not get a lower bargained price if there are more upstream possible suppliers. We return to this below.

Subject to these -- probably serious – reservations, we can go ahead and compare the arguably more realistic mixed-pricing scenarios with the standard single-price oligopoly model outcomes. The numbers are shown on Table 1 for three upstream industry structures; monopoly, duopoly, triopoly (n = 1,2,3).

Table 1: Cournot and Mixed Pricing Compared

	Cournot-Nash Oligopoly				Mixed Pricing Oligopoly				
N	P	PS	CS	DWL	Px	Pav	PS	CS	DWL
1	0.5	0.25	0.125	0.125	0.666	0.333	0.333	0.167	0
2	0.333	0.222	0.222	0.055	0.4	0.28	0.28	0.22	0
3	0.25	0.188	0.281	0.031	0.286	0.224	0.224	0.276	0

Look first at the "standard" outcomes, as might be predicted by, say, a merger simulation model. A monopolist (as in Figure 1) sets price, P, at 0.5, captures 0.25 in producer surplus or profit (PS); its customers pocket 0.125 in consumer surplus (CS), and a similar sum is wasted – the deadweight loss (DWL)resulting from the single-price monopolist having to restrict output to get the price up.

A symmetric duopoly results in a one third drop in price, equal producer and consumer surpluses, and less than one half of the monopoly deadweight loss. Adding a third competitor cuts market price further, shifts more surplus to consumers, and reduces deadweight losses to just under one quarter of the monopoly wastage. Of course, in this simple symmetric setup, the "merger paradox" arises for any merger short of merger to monopoly – profits of any two firms in the triopoly total about 0.125, whereas the merged unit in a duopoly would earn only 0.111.

Now look at the mixed pricing outcomes. The monopolist, although unable to purloin all the surplus as in the (unsustainable) 1st degree price discrimination scenario, still does better than under either single-pricing or full bargaining (Figure 2), by charging (as shown on Figure 3) prices which average to less than the single-price monopoly price. The two thirds of customers who get to negotiate their price are better off; the one third paying the ToL price are worse off; there is no deadweight loss, *pace* any downstream double marginalisation difficulties.

Moving to duopoly and triopoly, we see that the ToL price drops dramatically; overall (weighted) average prices much less so. Under mixed pricing, with zero costs and unit total output, weighted average price is also profit (PS). Consumer surplus varies less with market structure than under single-pricing. The merger paradox is attenuated almost to the point of disappearing in the triopoly to duopoly case, because one of the two factors that generate the paradox -- the need to restrict total output to raise price – is not present under mixed pricing.

Should bargaining power depend on market structure?

As noted, a possibly problematic feature of the model presented above is that the division of surplus following bargaining is not affected by the number of upstream firms. "Intuitively", we would expect that any downstream customer should be able to strike a better deal if they have more possible suppliers to bargain with.

But why? It could be argued, given all upstream firms here are identical, that any downstream negotiator threatening to take their business elsewhere unless their share of the pie is sweetened might be met by the upstream agent with something like: "Go elsewhere if you wish. But we are all the same and we all do 50/50 Nash bargaining, so you are unlikely to get a better offer than ours."

In sharp contrast, Aghion and Bolton (1987) proposed a Bertrand-type outcome: for any number of (identical) upstream firms greater than one, any profitable offer by one firm would be undercut by epsilon by another, until negotiated price is driven down to costs.

Empirical evidence does not seem to generally support either extreme position – and if it did, antitrust merger policy in the context of bargained prices would be redundant, either because totally ineffectual or totally unnecessary! Gowrisankaran *et al.* (2015) find strong evidence of bargaining power in the US

hospital industry being affected by market structure, refer to some other studies with similar findings (2015 n2), and conduct an analysis of an actual proposed hospital merger to the effect that this would have significantly raised prices. And, of course, the IO literature contains hundreds of empirical studies across many industries -- in many of which we would expect bargaining to be important if not pervasive – usually supporting the structural market power hypothesis.

Accordingly, we generalise the mixed pricing model to allow for bargaining strength differing from 50/50 outcome shares. Rewrite the profit function (6) as

(16) $\pi_i = P_x x_i + P_x z_i \alpha/2$

where α is the share of surplus captured by the seller in a negotiated settlement. With Cournot conjectures, the reaction function (9) becomes

(17) $x_i = (1 - X_{-i})[(n - \alpha)/(2n - \alpha)]$

So that, with symmetry, the Nash Equilibrium total output sold at the ToL price is

(18) $X = nx = (n - \alpha)/(n - \alpha + 1)$

So price of ToL output is

(19) $P_X = 1/(n - \alpha + 1) = 1 - X = Z$

and average price of all output, using (13) and the values for X and Z as weights, is:

(20) $P^{AV} = (2n - \alpha)/[2(n - \alpha + 1)^2]$

With no theory to guide us, we could try setting the bargaining share parameter so that it generates outcomes matching the decline in ToL prices as the number of firms increases in the Cournot-Nash setting of Table 1, so:

(21) $\alpha = 1/(n + 1)$

Table 2 shows the results of the welfare analysis under these conditions.

Table 2: Cournot and Mixed Pricing Compared, with variable bargaining power									
	Cournot-Nash Oligopoly				Mixed Pricing Oligopoly				
N	P	PS	CS	DWL	Px	Pav	PS	CS	DWL
1	0.5	0.25	0.125	0.125	0.666	0.333	0.333	0.167	0
2	0.333	0.222	0.222	0.055	0.375	0.258	0.258	0.242	0
3	0.25	0.188	0.281	0.031	0.267	0.204	0.204	0.296	0

Compared with Table 1 mixed pricing, consumers do better if there is some competition, and therefore lose more if mergers reduce competition, but there are no major differences. Overall, bringing mixed pricing into merger analysis forces a shift away from static inefficiency concerns and towards distributional matters, if these are admissible within the antitrust law of the jurisdiction.

Customers paying the highest, take it-or-leave it price suffer most, and these customers are likely to be relatively small economic units, such as households and small businesses. In addition, if we were to bring in the transaction costs of bargaining (these presumably exceeding the transaction costs of trading at the ToL price), mergers increase the proportion of sales made at bargained prices and so too the transaction costs involved. The merger paradox is slightly further attenuated with the improvement in bargaining outcomes when three firms become two firms, but it remains.

Conclusion

(to follow)

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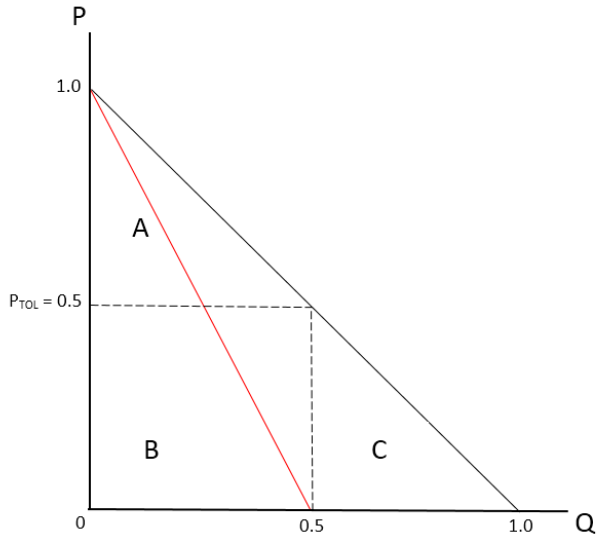

Figure 1: Monopoly

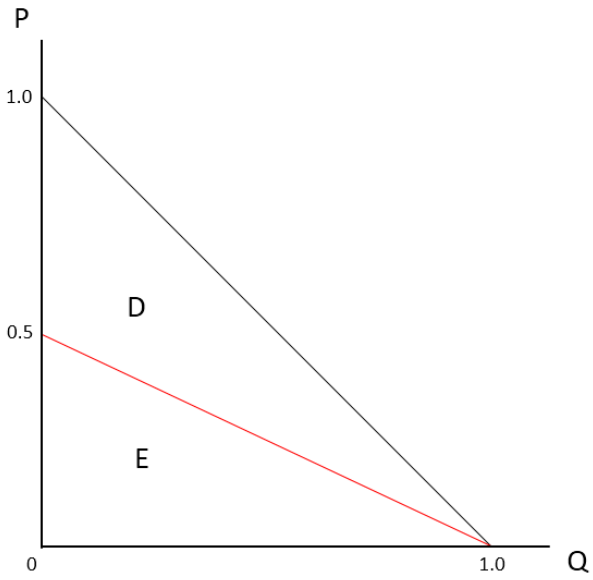

Figure 2: 1st Degree Bargaining

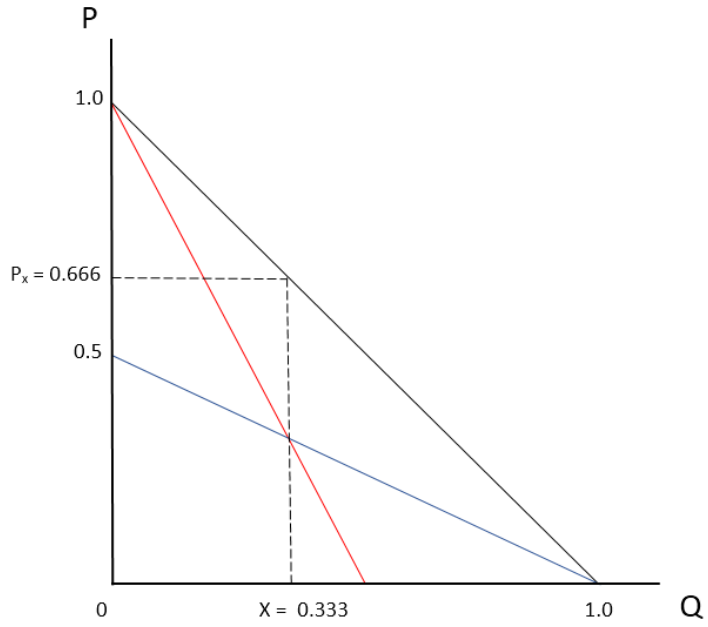

Figure 3: Mixed Pricing Regimes