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BARGAINING BETWEEN RETAILERS AND THEIR SUPPLIERS

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Bargaining Between Retailers and their Suppliers

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1. Introduction

A BRANDED GOOD is supplied by a single firm. A private label good can be supplied by many. So competition is more extreme and conditions more uncertain for private label suppliers.

This chapter investigates the economic consequences of these differences. We outline a bargaining theory framework which helps one to understand why profits accrue where they do in supply chains. We focus on the buyer power of large retailers and its impact on the investment incentives of suppliers. The analysis applies to the retail sector generally and to supermarkets in particular.

Part of our motivation is to understand the economic effect of retailer size. This has become an important worldwide policy issue in recent years with the emergence of large retail firms such as Wal-Mart, Carrefour, and Tesco. It is often argued that large retailers have greater buyer power, i.e. can negotiate lower prices than a small retailer. It is sometimes further argued that a large retailer can have an upwards effect on prices negotiated by smaller retailers, with adverse consequences for their viability. This is called a *waterbed* effect. Finally, it is sometimes claimed that buyer power can reduce suppliers' incentives to invest in cost-reducing innovations. These issues have all come under intense scrutiny from competition authorities. For example, they are studied in the recent Competition Commission inquiry into the UK grocery market.[2]

We begin the chapter by reviewing the literature on retailer-supplier bargaining with an upstream monopolist. This framework is applicable to the case of a branded product. Here, to stock the product the retailer must strike an agreement with the monopoly supplier. We analyse buyer power, waterbed effects, and supplier investment incentives. The shape of the suppliers' cost function drives the results: for example if the branded supplier has economies of scale then (as we will explain) its actually secures a higher price from the larger retailers (while the reverse holds if it has diseconomies of scale). The analysis provides a benchmark case: a point of comparison for the case of private label products.

The fundamental point of difference between private label and branded products is that when procuring a private label product the retailer is not restricted to source from a single supplier. Furthermore the consumer is unaware of the supplier's identity so the retailer can change suppliers without consumers noticing any change. This reduces switching costs to the retailers and allows them to alter suppliers at relatively short notice. This in turn has the potential to create output uncertainty for any given supplier of a private label good as it cannot accurately forecast its success in securing contracts with retailers.

In the marketing literature, branded goods are often subdivided into two groups, primary and secondary. Primary brands, such as Coca-Cola, enjoy a high level of brand recognition from consumers and therefore are considered must-stock items for most retailers. Secondary brands are much weaker, and retailers can substitute one brand for another without much impact on consumers. Therefore secondary brands operate under competitive conditions very similar to private-label products. Hereafter for ease of presentation we will refer to branded and private label products, but we emphasise that we intend that secondary brands should be analyzed using the framework we set out for private label goods.

[2] Competition Commission (2007) *Grocery Market Investigation: Provisional Findings Report*.

To inform our understanding of the private label market we conducted interviews with a number of industry executives in a leading private label good market, fresh milk. We also discuss another private label goods market, the market for Carbonated Soft Drinks (CSD). In both cases the evidence confirms the importance of output uncertainty for suppliers of private label products.

We sketch a model developed by Smith and Thanassoulis, hereafter ST, that can be used to analyse the retailer-supplier interface for private label goods.[3] The framework in ST captures the main features of private label markets that emerged from the interviews and case studies. Thus it considers a retailer-seller bargaining interface where suppliers compete to supply a product that is homogeneous to consumers and competition between suppliers creates output uncertainty for individual suppliers.

We show how this model can be used to understand the profit split between retailers and suppliers for private label goods. We find that the competition faced by private label suppliers transforms the bargaining game, compared to the branded good benchmark case. We show that the supplier output uncertainty (brought about by competition) creates a new source of buyer power for large retailers, the logic of which can be explained as follows: sellers are uncertain of their total output when negotiating with a buyer. They therefore discount contracts they might win with other buyers due to this upstream competition – the more competition, the less likely the other contracts are to be won. Hence the supplier sees the buyer she is negotiating with as incremental business from a relatively low base. If the total cost curve is nonlinear this influences the expected costs of supplying the buyer, e.g. if there are economies of scale it reduces them and the large buyer can negotiate a better deal. This is the reverse of the finding (noted above) for the branded good case.

The theoretical prediction that buyer power is present in the case of private label goods but not for (primary) branded goods is supported by an empirical study of the prices paid to suppliers, recently published by the Competition Commission. [4] They use a large cross section of the prices paid by supermarket buyers of alternative sizes, with the aim of determining whether large buyers negotiate lower prices. Their results reveal a striking difference between primary-branded and non-primary-branded goods (the latter comprising private label and secondary brands). For primary brands there is no evidence of lower prices for large buyers. But for non-primary brands there is clear evidence that large buyers secure lower prices. For reasons explained in this chapter, this difference can be explained by the level of output uncertainty faced by each type of supplier.

We also explain how the uncertainty faced by private label suppliers generates waterbed effects which are not present for the branded products case; the direction of these waterbed effects depends on the shape of the suppliers' cost function but the most likely effect is to increase the price paid by smaller retailers. We also discuss the investment incentives of private label suppliers.

The outline of the chapter is as follows. We begin with a discussion of retailer-supplier bargaining in the case of branded goods. We then discuss case study evidence for two leading

[3] Smith and Thanassoulis (2006) *Upstream Competition and Downstream Buyer Power* Centre for Economic Policy Research Discussion Paper #5803.
[4] Op cit. Appendix 8.1, paragraphs 44 and 45.

examples of private label goods sold in supermarkets. The rest of the chapter uses the ST bargaining framework to analyze supply chains for private label products.

2. Upstream Monopoly: The Case of a Branded Product

The conventional textbook approach to vertically related markets is to assume a *market* interface: an upstream firm, say a manufacturer, chooses a price for a product which it then sells to the next stage in the supply chain, say the retailer.[5] In the simplest case (double-marginalization) the retailer takes the supplier's price as given and in turn sets its own retail price to final customers, considering only its own profits and treating the supplier's price as a marginal cost. The retailer sets a price that is too high and hence output which is too low (in terms of maximizing the sum of the profits of the manufacturer and retailer) because the retailer does not optimize output against true industry marginal cost. This in turn suggests the manufacturer can do better by using a two-part tariff in which the retailer pays an initial fixed fee and then a per-unit price equal to true marginal cost.

An obvious weakness of this overall approach is that it ignores the power of many retailers, i.e. retailers are treated as passive price takers when in reality we know that they often bargain actively with suppliers over prices. A literature has recently emerged which rectifies this weakness, by studying the implications of a *bargaining interface* between retailers and suppliers.[6]

Almost all of the bargaining interface literature has considered buyer power in the context of an upstream monopolist. The assumption of an upstream monopolist is appropriate for the setting of a branded good. This is true regardless of the presence, or otherwise, of secondary and tertiary branded goods. If such goods exist, while being of lower value than the branded good, retailers will seek to bargain with the branded good supplier. The secondary branded goods may strengthen the hand of the retailer in these negotiations as they provide a fall-back option for the retailer in case of bargaining deadlock with the branded supplier. This increases the profits the retailers secure, but doesn't alter the insights we go on to describe. We present the main results from this literature to help understand the economics of branded goods supply chains.

The bargaining interface literature has identified the *shape* of the supplier's cost function as an important influence on the bargained outcome. The key insight of the literature is that a monopoly upstream supplier with economies of scale actually bargains to a higher negotiated price from larger buyers, in contrast to the concerns expressed in the introduction.[7] That is large buyers are weak buyers. We now explain the economic logic behind this result.

An upstream monopoly knows that each retailer has no desirable alternative source of supply. With efficient bargaining the supplier can therefore expect to conclude deals with all retailers for whom supplying the product is beneficial. That is, at the conclusion of all negotiations, all

[5] Tirole, J, *The Theory of Industrial Organization* (1988) MIT Press Chapter 4

[6] The *market interface* and *bargaining interface* terminology is drawn from Inderst and Shaffer (2006), *The Role of Buyer Power in Merger Control*, mimeo, where a comprehensive literature survey may be found. The first papers to study a *bargaining interface* were Dobson and Waterson (1997), "Countervailing Power and Consumer Prices" *Economic Journal*, 107, 418-430 and von Ungern-Sternberg (1996), "Countervailing Power Revisited" *International Journal of Industrial Organisation*, 14, 507-520.

[7] Chipty and Snyder (1999), "The Role of Firm Size in Bilateral Bargaining: A study of the cable television industry" *Review of Economics and Statistics*, 81, 326-340

retailers for whom the branded good is desired will stock it. It follows that the branded supplier knows what his final output will be, i.e. the sum of the outputs agreed with each retailer. Let us call this final output Q.

Suppose that an individual retailer negotiates with the supplier over a fixed volume q, say the volume that maximizes the profits to be split in the negotiation. It is standard to assume that the two parties split the gains to be had from trade. These gains depend on the *incremental cost* Δc to the supplier of making the q units. As the supplier expects to produce Q units when all deals are agreed, the relevant incremental cost is the cost of producing Q minus the cost of producing (Q-q), i.e. $\Delta c = c(Q) - c(Q-q)$ where c(.) is the supplier's total cost function.

This is true for each retailer. The monopoly supplier therefore conducts every negotiation assuming all the other negotiations go according to plan and they bargain with each buyer assuming Q to be the post-negotiation reference output.

With this insight in hand, we can now show how retailer size affects the negotiated price. Suppose the cost curve c(.) is concave as in Figure 1: the case of economies of scale. The supplier's total output Q is marked at the right on the horizontal axis. Because of economies of scale the average cost of supplying the last few units of output is smaller than the average cost of supplying the last units for a larger number of units. This is illustrated by the two chords (linear segments) drawn on the diagram. Working back from Q the gradient of the small chord gives the average incremental cost $\Delta c/q$ of supplying a small buyer assuming that all other negotiations go to plan. This is flatter than the counterpart for the larger retailer. The small buyer's output thus has a lower average incremental cost than the large buyer's. As the supplier and retailer split the gains from their relationship this implies that the small buyer will be able to negotiate a lower price. [8]

Thus with upstream economies of scale large buyers are *weak*: they should get a higher price than smaller buyers. The intuition for this, perhaps surprising, result is that branded good manufacturers are able to extract a greater fraction of their infra-marginal costs from larger buyers. That is the larger buyers pay a greater proportion of costs incurred in getting to full output. If on the other hand there are diseconomies of scale the reverse conclusion holds and the large retailer has the greater buyer power (this can be seen by drawing a convex total cost curve instead of the concave one in Figure 1).

[8] This insight is formally shown in Chipty and Snyder (1999), Op. cit.

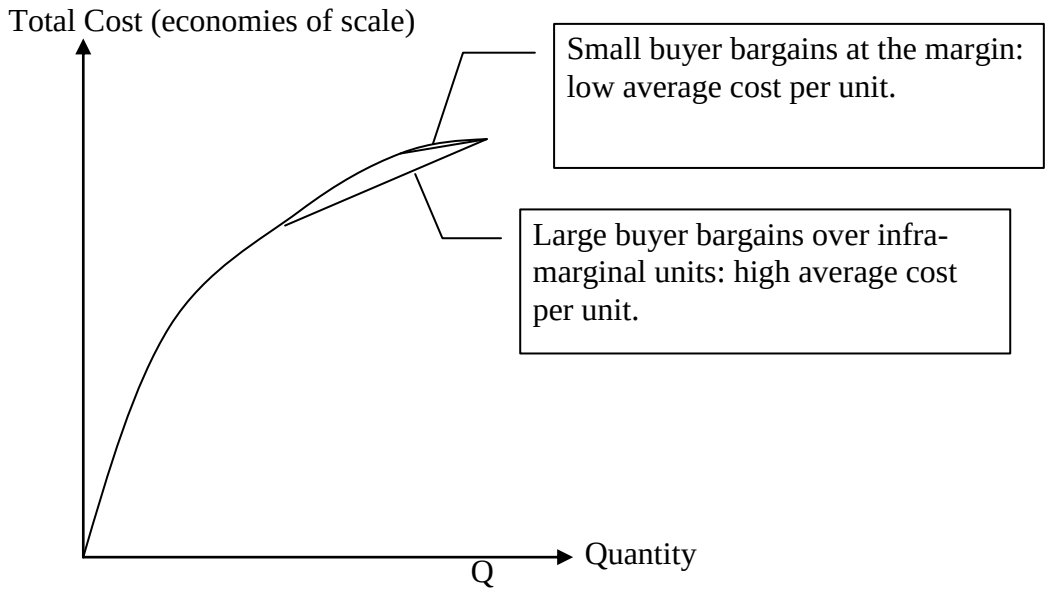

Figure 1: Buyer Power with Upstream Monopoly (the Branded Good Case)

The presence of scale economies for the monopoly supplier results in a concave total cost function. In turn this leads to lower average incremental cost Δc/q for small buyers than large buyers when the supplier assumes that its post-negotiation total output will be Q in both cases. Hence large buyers are weak buyers.

Whether upstream technology is characterized by economies of scale or not will depend on the particular industry. However where logistics form a substantial fraction of the cost base then the Operations Research literature has shown that economies of scale are to be expected.[9]

It is important to recall that the price secured by a given retailer from their supplier will not only depend upon the general costs of production, but also upon any retailer specific costs. If, for example, many small buyers are in far away or hard to reach places then this would increase the prices they pay – not because of a weakening of their bargaining power, but because these specific costs must be covered. Likewise if large buyers can order in (cheaper to deliver) full palette quantities, or are in easier to reach places, then the specific costs will be lower. Once again the final price agreed here will reflect these lower specific costs of service as well as general buyer power.

As we noted in the introduction, In their 2007 report into the UK Grocery Market the Competition Commission secured commercially sensitive retailer-supplier prices and conducted an empirical analysis of the magnitude of buyer power effects.[10] They were unable to find a statistically significant relationship between buyer size and net input price paid[11] for branded good supply. This would be the expected result if any large buyer weakness effect

[9] See, for example, Burns, Hall, Blumenfeld and Daganzo (1985), "Distribution Strategies that Minimize Transportation and Inventory Costs", *Operations Research*, 33, 469-490.
[10] Op cit. Appendix 8.1, paragraphs 44 and 45.
[11] The net price is the per unit price for supply adjusted by any promotions or other overall reductions received at the time of invoice.

arising from the economics of monopoly supply is counterbalanced by lower retailer specific costs of servicing a contract with a large buyer as we describe.

We now consider the effect of buyer size on supplier investment incentives. Concern is often expressed that large retailers may reduce supplier investment incentives. Inderst and Wey (2007) make an important counter-argument.[12] They consider the model we have just discussed. Suppose a supplier is considering an investment to reduce cost *at the margin* i.e. to reduce the cost function at point Q on the diagram. Because a small buyer's output approximates to the seller's marginal output the small buyer is able to capture a proportion of the cost reduction in the negotiations. But for a large buyer the incremental cost is determined further from the margin so the large buyer captures proportionately less of a cost reduction at the margin. Consequently an increase in the proportion of large buyers actually increases the incentive of the supplier to lower production costs at the margin. This in turn is welfare enhancing for consumers as it increases the efficient industry output.

Finally we ask whether there are any waterbed effects in the monopoly supplier framework, i.e. does an increase in the size of one retailer have adverse consequences for another smaller retailer? The answer is very simple: the growth of a large buyer (say by merger of any two buyers) has no effect on the price negotiated by a third party provided it has no effect on Q. Thus there are no waterbed effects that arise for any third party with demand q provided Q is unaffected.

Having discussed the economics of bargaining in branded good supply chains we now turn our attention to private label supply chains. To understand the empirical reality of the competitive environment facing private label suppliers we first discuss two case studies.

3 Private Label Goods: Two Case Studies

3.1 Milk

Milk is a clear example of a private label good. Each supermarket receives its liquid milk pre-packaged with the supermarket's own branding so that consumers do not differentiate between suppliers. The supermarkets vary in size. There are four big firms that sell about 60% of the liquid milk in the UK: Tesco, Wal-Mart, Morrison, and Sainsbury. But there are a number of other much smaller supermarkets such as Waitrose, Aldi, Somerfield and so on. The inequality in the size of the buyers allows scope for buyer power effects. Three suppliers supply nearly all of the milk to the big supermarkets: Arla, Dairy Crest, and Robert Wiseman.

To inform our understanding of private-label supply chains we conducted interviews with milk buying managers at major UK supermarkets and sales directors at UK milk suppliers. The following description emerged from these interviews.

The standard supply contract in the industry is a rolling one in which supermarkets need offer only 3 months notice of termination. The price per litre of milk is agreed in advance and is constant until renegotiation or contract termination. The executives we interviewed did not suggest that these standard features of the contracts varied by size of supermarket buyer. Renegotiation or termination of contracts does not happen at predictable times, nor in some dynamic order. Instead any or all supermarkets can seek to terminate and change suppliers at

[12] Inderst and Wey (2007), "Buyer Power and Supplier Incentives", *European Economic Review* 51, 647-667.

any given point in time. As a result, during a renegotiation phase a supplier may lose some of her existing contracts while gaining new ones. We do not have data as to times that renegotiation results in prices changing without a change in the supplier. However times when renegotiation resulted in one or more of the largest supermarkets terminating an existing contract were provided to us by one industry participant. These times confirm the unpredictability of renegotiation phases. Starting from October 2001, these contract terminations occurred after the following gaps: 6 months; 10 months; 10 months; 11 months; 2 months; 9 months; 6 months; 6 months.[13] Supermarkets have relative ease in switching suppliers as the milk is supplied in their own supermarket colours. Thus milk is an own label product and so final consumers would be unaware of any change in the identity of milk supplier.

The industry participants we interviewed informed us that the volumes associated with a given contract are very accurately predictable. One supermarket reported offering her supplier 15 years of data on the volumes of milk sold in any given store on any given day.[14] However as contracts can be won and lost the total volumes actually supplied by a given supplier are volatile. Industry sources provided the data contained in Table 1 on volume volatility to supermarket buyers as a result of competition between the three main suppliers. The table shows considerable volume variation for all processors. In fact, in the two months between November 2004 and January 2005 the three largest supermarkets (accounting for around half of all UK grocery sales) all changed their suppliers almost simultaneously.

Table 1: Volumes Sold to Largest 4 Supermarkets by Main UK Milk Processors

Date	Processor 1 mlpa	Processor 2 mlpa	Processor 3 mlpa	Total
12/03	585	690	870	2145
11/04	575	555	1020	2150
1/05	350	835	940	2125
10/05	430	760	920	2110

Data from industry sources

Though the product is homogeneous, supply requires the inter-working of complicated supply chain arrangements and so supermarkets do engage in negotiations with a supplier: auctions or arms length contracting are not practical. During these negotiations both parties make offers. This process was captured by the following quote: "*We [the supplier] suggest a pence per litre price X. They [the supermarket] respond by saying that is much too high, we could go to your rivals and get Y. And so it goes on.*"

Supermarkets either source from just one supplier, or divide their needs into two distinct geographical contracts and use one supplier for each of these contracts. The division is usually on a North-South basis in Great Britain. Thus it is not the case that supermarkets subdivide their contracts to source a bit from each of the main suppliers. In October 2006 the supermarket contracts of the largest supermarkets were given by the figures in Table 2 below (normalised into market shares).

[13] One medium sized chain store buyer was explicitly mentioned as an exception to the uncertain renegotiation phases described above. This supermarket sought to coordinate with the large supermarket buyers by following the large buyers' renegotiation phase and sourcing from suppliers who had been successful in winning the biggest contracts. This was not typical buyer behaviour in this industry.

[14] The exception is that milk sales become less predictable in the few days running up to Christmas.

Table 2: Table of Market Shares in October 2006

	Processor 1	Processor 2	Processor 3	Total
Supermarket 1		15.66	9.10	
Supermarket 2	5.08	5.61		
Supermarket 3			10.79	
Supermarket 4		1.69	2.96	
Supermarket 5	4.66		4.66	
Supermarket 6	1.90			
Supermarket 7	1.38			
Other buyers	19.37	9.21	7.94	
Total	*32.38*	*32.17*	*35.45*	*100*

Data from industry sources

Failure of negotiations between buyer and supplier can be very visible and lead to unwillingness of key negotiators to work together. A well reported, if extreme, example of such a split occurred one level up in the supply chain between a given supermarket supplier, and their supplier: a farmers' cooperative. This split resulted in the parties being unable to agree to do business directly with each other until key personnel retired.

Finally the supermarkets indicated that they have a good knowledge of the suppliers' cost conditions, which stems in part from the fact that supermarket buyers have contacts across many suppliers.

This picture of the negotiations is consistent with published sources. For example, the KPMG (2003) report into the dairy supply chain notes that:

> "Negotiations...seem to follow guidelines which are relatively common across most supermarket/supplier relationships. The trigger is usually an invitation to tender by the supermarket or a periodic supplier review programme similar to the Sainsbury initiative in early 2002. The invitation to tender usually contains a demand profile using assumed quantities and container sizes. Bids are made on a per-gallon basis regardless of actual product size and a supplier is selected." (KPMG §178-179)[15]

A feature which emerged very strongly from the interviews and from published sources is that there is considerable output uncertainty for suppliers. In its 2003 investigation of the milk processing industry, the Competition Commission wrote:

> "It is now the case that a high proportion of the sales of each processor to national multiples is concentrated in only three or four customers, such that the loss of any one of these is likely to have a serious consequence for the processor. The merger parties told us that the national multiples were fully aware of this fact and play off the major processors against each other. [The national multiples] have the ability to switch volumes easily between suppliers [...]. In contrast a processor cannot readily find another avenue to market if it loses sales to a national multiple." CC (2003, § 5.97)[16]

In sum we identified the following key features of the private label milk supply chain:

[15] KPMG (2003) *Prices and Profitability in the British Dairy Chain* Milk Development Council, UK
[16] Competition Commission (2003) *Arla Foods and Express Dairies plc: A report on the proposed merger*, The Stationary Office, UK

1. Supermarkets unilaterally start new procurement rounds at unpredictable points in time.
2. Supermarkets negotiate over a per unit transfer price taking as given the required quantities.
3. The suppliers' costs are well known to the supermarkets
4. Although the volumes demanded by any *individual* retailer are highly predictable, suppliers are uncertain which retailers they will supply in any period and hence they are uncertain at the point of negotiation about their total output.

3.2 Carbonated Soft Drinks

A recent investigation by the Competition Commission investigated a merger between two of the firms that operate in the Carbonated Soft Drinks (CSD) market: Cott Beverages Limited and McCaw (Holdings) Limited. The following information comes from their published report.[17]

The UK soft drink market is large, amounting to 230 litres per person annually. The CSD market accounts for about 50% of this. The CSD market includes drinks such as colas, lemonades, mixers, energy drinks, and carbonated flavoured waters. Unlike milk there are several well known CSD branded goods including Coca-Cola, Pepsi, Fanta, 7-Up, Tango, Lucozade, and Irn Bru. However the private label part of the market remains important at 25% of CSD production volumes.

The main economic features we found in the supply chain for milk also appear in the private-label supply chain for CSDs. As the Competition Commission report makes clear, the market is characterized by competition between suppliers, supplier dependency on retailers for output, and frequent retendering by retailers.

The Competition Commission noted that review of contracts was done by retailers on a regular basis:

> "Supply agreements for own-label CSDs are typically subject to annual review. Retailers' focus on price appears to be the main factor leading to the short duration of these supply agreements. At the end of a 12-month period, a retailer may continue the existing supply agreement at the existing price, extend it at a reduced price (often as a result of threatening to retender the business), or put the business out to tender." (§2.28)

The private label nature of the good facilitates ease of switching on the part of supermarkets:

> "Many retailers told us that switching suppliers was straightforward and inexpensive. Cott cites recent examples of Lidl, Tesco and Sainsbury's switching to Cott and being supplied in as little as two to 12 weeks. [...] Retailers own the brand name, packaging tends to be homogeneous and it is relatively straightforward to replicate a recipe. The only costs that a customer seems to have to bear when switching are administrative and logistical. Cott suggested that these costs were limited to tendering costs,

[17] Competition Commission (2006) *Macaw (Holdings) Ltd/Cott Beverages Ltd merger inquiry*, The Stationary Office, UK. See § 2.25, 2.28, 2.32, 5.19, 5.21, and 5.30

> establishing new product and supplier codes, and approving product specifications. Retailers also expressed similar views." (§5.21)

Accordingly, retendering is a game with no advantages for the incumbent supplier:

> "The ease of customer switching, and the practice of retailers periodically retendering their supply of own-label PET[18] bottled CSDs, means that there is generally limited competitive advantage to being the incumbent supplier in terms of obtaining future business when it is retendered." (§5.22)

As with the case of milk, the supplier of private label CSDs experiences output uncertainty as a result of competition for supermarket contracts:

> "The loss of an individual supply agreement with a retailer can have a significant impact on the supplier's overall financial performance. For example, in 2005 Macaw's CSD volumes decreased by just over 10 per cent as a result of losing a major supply agreement" (§5.30).

Thus we conclude that private label procurement has a number of common features with retailers using the threat to switch suppliers to attain low prices. We have investigated the effects of such bargaining interfaces and report the insights this work has generated in the following sections.

4. Competition Upstream: The Case of Private Label Suppliers

We now discuss the economics of private label supply chains. We draw on some insights from Smith and Thanassoulis (ST): a paper that adds to the literature on retailer-supplier bargaining by introducing upstream competition.[19] The effect of the upstream competition is to generate uncertainty for suppliers, a feature that is highlighted in our case studies of private label suppliers.[20] In the rest of the chapter we discuss buyer power, waterbed effects, and investment incentives in the private label supply chain.

We formalize our consideration of the private-label procurement bargaining interface. We here borrow from ST and consider a number U suppliers of a homogeneous good. By homogeneous we mean that the consumer is unaware of which supplier supplied the good, as is the case for own-label products.

The U upstream suppliers compete to supply D downstream retailers. Each retailer has a known demand q which may vary across retailers, i.e. we allow for retailers of different size.

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[18] Polyethylene Terephthalate, i.e. plastic used for soft drink bottles.

[19] Smith and Thanassoulis (2006) *Upstream Competition and Downstream Buyer Power* Centre for Economic Policy Research Discussion Paper #5803.

[20] Supplier competition where uncertainty is *absent* has been studied in Inderst and Wey (2003), "Bargaining Mergers and Technology Choice in Bilaterally Oligopolistic Industries" *RAND Journal of Economics*, 34, 1-19 and de Fontenay C. and J. Gans (2005) "Vertical Integration in the Presence of Upstream Competition ", *RAND Journal of Economics*, 36, 544-572. In both these models (as in ours) competing suppliers bargain with downstream firms in a manner that splits the gains from the relationship. However, the models imply that no supplier is a loser. This implication may be realistic in cases where the upstream firms are all highly differentiated, so that all downstream firms would like to source input separately from each of the upstream firms. However, it is unrealistic if upstream firms are substitutable, as in the case of private label supply, because it requires payments to the firms that fail to supply any product.

The U suppliers are symmetric in the sense that they have access to the same technology and so share the same total cost function c(Q). We assume that each retailer seeks only one supplier, perhaps because of the costs of contracting for example. In some real-world examples supermarkets have more than one supplier, but even in such cases negotiations are likely to be over relatively lumpy units.

Except in the special case where the supplier's cost function c(Q) is linear, the incremental cost Δc of serving a retailer with given demand q depends on the total overall output Q of the supplier. For example, with economies of scale the incremental cost Δc declines as Q increases. We saw this in Figure 1. However in the case of upstream competition the seller is likely to be uncertain of its overall output Q at the time of negotiation with any retailer. So it must form an *expectation* of incremental cost Δc. [21]

We can now determine natural upper and lower bounds to the negotiated price. The upper bound is determined by the supermarkets' ultimate outside option. If a supermarket fails to agree with any of the U suppliers then we assume it can source the private label product from outside the domestic market (or from a less desirable substitute supplier) at a high exogenous cost of κ per unit. This serves as an upper bound to the price agreed with the U suppliers: a retailer would not pay more to domestic suppliers than she would have to pay to other possible suppliers from outside the domestic market for the good, inclusive of all transport costs to get it to the retailer.

No supplier will agree to an overall price per unit of less than the expected per unit incremental cost $\Delta c/q$, as this would be loss making on average. Thus, expected per unit incremental cost $\Delta c/q$ acts as the lower bound for any bargaining agreement.

But how is the expectation of $\Delta c/q$ formed? As there are several competing suppliers, no individual supplier can assume that it will win orders from all the retailers. This is therefore a different situation from the monopoly (branded good) case. It is reasonable to assume that the supplier will condition on the size of the retailer that approaches it for negotiation and that the size of the retailer is a positive signal about the supplier's ultimate output. For example, if the supplier has economies of scale and a large buyer approaches it for supply, it can increase its forecast of its overall output Q; this in turn will reduce its forecast of incremental costs Δc for any given q.

To determine where the negotiated price will fall between these bounds, imagine a more specific modelling framework as follows:

1. Each supplier makes a separate agent available to deal bilaterally with each retailer.
2. Each retailer selects a supplier at random for negotiation.
3. Each supplier's agents negotiate simultaneously and separately. This implies uncertainty for each of the supplier's agents as to his firm's ultimate total supply.
4. If a negotiation should break down then a retailer can commence bargaining with another supplier. Ultimately, if the retailer fails to agree terms with all U suppliers then the good can be sourced from an external market at higher cost κ.

[21] We do not allow the buyers to coordinate their purchases on one supplier in the case of economies of scale. This would not be optimal in a repeated setting as the victorious supplier would then wield monopoly power. We note that such coordination on one supplier does not happen in any case in the UK milk or CSD supply chains.

This bargaining form captures the following implicit buyer threat: "You are only one of U suppliers. If we fail to strike a deal then I will still have U-1 suppliers I can source product from. Thus to get the business you must make it worth my while." However, as there are now fewer competing suppliers the retailer is a little disadvantaged at this point.

The retailer must therefore be able to get at least the profit it secures if only U-1 suppliers are left. But note that *if* there are only U-1 suppliers left the retailer's threat is weakened, because there are now even fewer suppliers left to threaten to move to. This means that there is an advantage (to both the U^{th} supplier and the retailer) of striking a deal (rather than moving to the next supplier). The monetary size of this advantage is the *incremental pie*. Thus the bargaining problem between U^{th} supplier and retailer is how to split the incremental pie. The exact way this is split is determined by the bargaining power of the supplier. We use the parameter λ to refer to the retailer's bargaining power; this is defined such that the incremental pie is split λ parts to the retailer and 1- λ parts to the supplier. λ is between 0 and 1.

The extent to which the supermarkets can negotiate price towards the lower bound (the supplier's expected per unit incremental cost $\Delta c/q$) is determined by two factors:

(i) The number of suppliers U: the more suppliers there are the more options the supermarket has to turn to before the ultimate outside option of sourcing abroad at κ.

(ii) The supermarket bargaining power parameter λ: the greater the bargaining power of supermarkets the greater their ability to bargain in any one-to-one negotiation with an individual supplier.

The total payment per unit by the retailer will depend on four industry parameters: κ (cost of sourcing abroad), $\Delta c/q$ (expected per unit cost of supply), λ (supermarket bargaining power) and U (number of upstream competitors). This is depicted in Figure 2. κ and $\Delta c/q$ give the upper and lower bound to the agreed per unit payment. The position of the agreed price between these limits is determined by the supermarkets' bargaining power λ and the number of competing processors U. An increase in either λ or U has a downward effect on the price negotiated with the supplier.

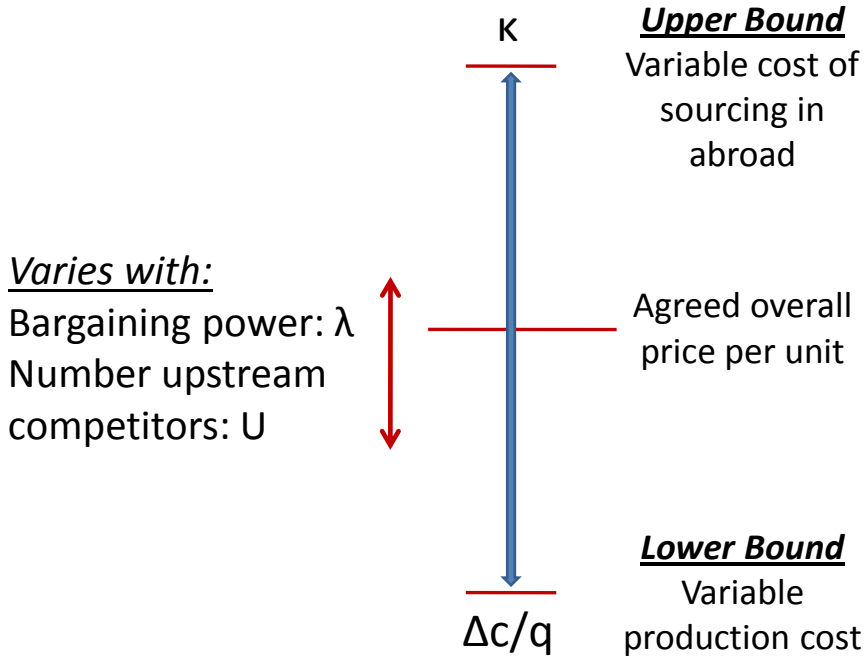

Figure 2: The Four Parameters Determining the Supermarket-Supplier Split

κ and Δc/q give the upper and lower bound to the agreed per unit payment. The position between these limits is determined by the supermarket's bargaining power λ and the number of competing suppliers of private label goods. An increase in either λ or U has a downward effect on the price negotiated with the supplier

The model delivers a simple expression for the actual per unit price paid by the supermarkets to the suppliers. This is done by working backwards through the U potential suppliers, i.e. we first compute the price that would be agreed with the last remaining supplier using κ as the outside option, this price then is in turn the outside option used when negotiating with the U-1'th supplier, and so on. As shown in ST the agreed per unit price which results is given as follows:

$$\begin{bmatrix}\text{Overall per unit}\\ \text{payment by retailers}\end{bmatrix} = \Delta c/q + (1-\lambda)^U(\kappa - \Delta c/q)$$

where Δc is expected incremental cost. This equation gives the price (i.e. payment per unit) paid by supermarkets to suppliers. This price is decreasing in both λ and U.

The term $(1-\lambda)^U$ is of key importance. It may take values in the range zero to one. It represents the bargaining position of the supplier. Thus the price paid by the retailer to the processor is pushed to its lower bound Δc/q as $(1-\lambda)^U$ goes to zero and is pushed in the other direction to its upper bound κ as $(1-\lambda)^U$ increases to one. $(1-\lambda)^U$ is the share of the *available* surplus (κ- Δc/q) that the supplier captures in the negotiations. Thus, private label manufacturers will be able to extract a higher share of the profit if they combine into fewer firms.

Our model highlights that there is an upper bound on the price the suppliers can extract in negotiations with supermarkets. This upper bound is determined by the cost κ to the supermarkets of going outside the immediate market for the input. As depicted in Figure 3, the per unit *bargained over surplus* is just (κ - Δc/q). It is of this that suppliers are in a position to receive a share of $(1-\lambda)^U$. Even though the supermarkets may be able to raise retail prices well above κ and enjoy additional surplus (depending on competitive retail market conditions) this additional surplus is *beyond the reach* of the suppliers via negotiations, as it is still available to the retailers if they dropped local suppliers and sourced from abroad.[22]

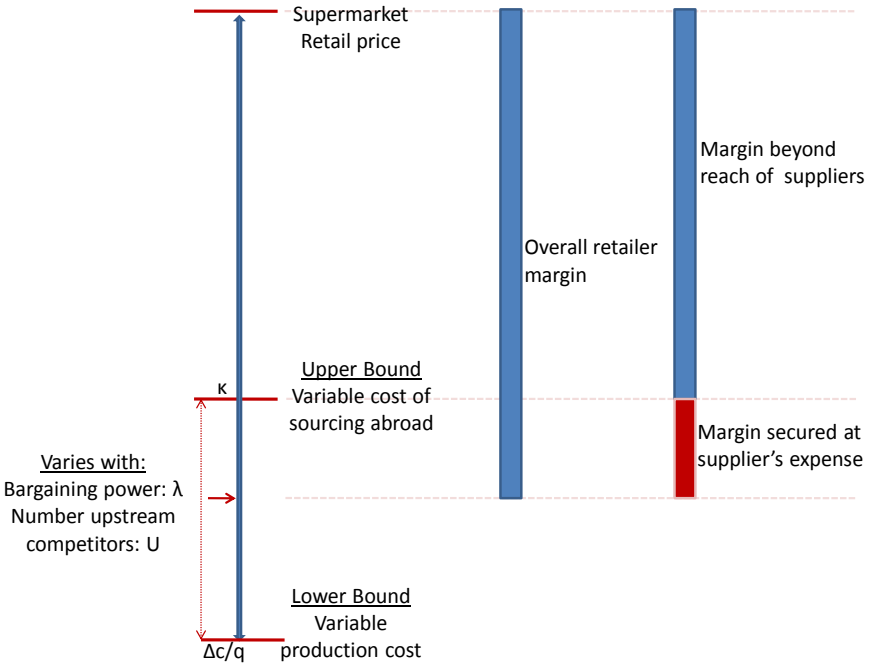

Figure 3: What the Supplier Can and Can't Bargain Over

The figure highlights the irrelevance of retailers' margins above κ. The supermarkets may be able to raise retail prices well above κ and enjoy additional surplus (depending on competitive retail market conditions). But this additional surplus is beyond the reach of the suppliers via negotiations, as it is still available to the retailers if they dropped local suppliers and sourced from further afield.

Example: Application to the Milk Market

The model can be used empirically to explore the implications of changes to costs and changes to market structure (e.g. via merger).[23] In the case of the milk market the option of going abroad to source milk is widely discussed and provides a natural figure for the upper

[22] Or alternatively from an inferior substitute supplier.
[23] In Smith and Thanassoulis (2007) "Estimating Bargaining Power In The Supply Chain", mimeo, Oxford University, we use data on supermarket-supplier payments to estimate a value for λ and hence provide an empirical analysis of bargaining power in the UK milk market.

bound κ.[24] As a benchmark figure we have computed that the bargained-over surplus (κ - $\Delta c/q$) is approximately 5 pence per litre, predominantly driven by the cost of transport between Northern Europe and Great Britain. Note that 5ppl is much lower than the overall difference between marginal costs and retail prices in the milk market: i.e. much of the supermarkets' surplus is out of reach to milk suppliers.

The best that suppliers can hope to do is to extract more of the bargained over surplus. Suppose, hypothetically, $\lambda = 0.5$. As the number of milk processors U is 3, this would imply that the proportion of the bargained-over surplus extracted by processors in the negotiations is given by $(1-0.5)^3 = 0.125$. However a merger of the processors would increase this to $(1-0.5)^2 = 0.25$.

5. Buyer Power

We now turn to buyer power in the private label goods market. Buyer power effects are determined by the shape of the supplier's total cost curve c(Q). We noted in the last section that the negotiated price is a function of the *expected* per unit incremental cost $\Delta c/q$. When forming this expectation, the buyer conditions on the observed size of the retailer with which it is negotiating. Therefore if the supplier is approached by a relatively large retailer, this is a positive signal about the supplier's expected total output and this changes the expected incremental cost. In the case of economies of scale it reduces the expected incremental cost Δc of supplying a given quantity q of output. This suggests that with economies of scale and private label goods it is the large buyers that wield the greatest power.

For a visual depiction of the result, consider Figure 4. Here we compare the expected incremental cost of serving two alternative retailers, one large and one small. The large retailer has volume q_1 and the small retailer has volume q_2. The figure depicts the expected per unit incremental costs $\Delta c/q$ for the seller conditioning on any realization of supplier volumes won from all other (D-2) possible retailers. If negotiating with the large buyer therefore there are two possibilities to form expectations over: the contract with the smaller retailer is (i) won and (ii) lost. The per unit incremental costs $\Delta c/q$ for each of these possibilities are given by the gradients of the two chords shown in the left hand panel of the figure. If negotiating with the small buyer the corresponding diagram is on the right.

[24] See DEFRA (2007), "The Potential for GB-European Trade in Liquid Milk".

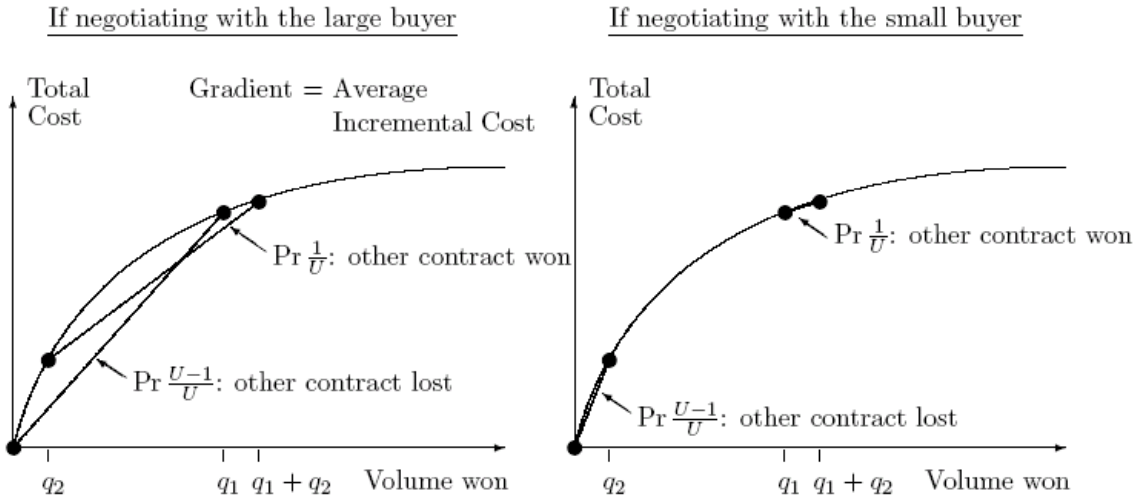

Figure 4: Buyer Power with Upstream Competition (the Private Label Case)

The presence of scale economies results in a concave total cost function. This leads to lower expected per unit incremental cost Δc/q when negotiating with the large buyer provided the seller does not attach a high probability to winning other contracts.

Suppose that the total number of suppliers U is larger than 2. In this case, as a result of upstream competition, each supplier is more likely to lose rather than win any other given contract. Thus more weight is put on the steeper of the two chords. In this sense competition causes suppliers to discount other contracts. The gradients of the chords drawn equal the per-unit incremental cost of delivering the required volumes. As the steeper of the two chords is flatter for the large buyer (left diagram) than for the small buyer (right diagram) the large buyer gets a better deal. In short, securing a large buyer is better news as to final volumes as other possible contracts are subject to competition and so only won with some probability. Thus a deal with a large buyer is more likely to help steer the supplier into profit. Therefore the supplier is willing to negotiate a lower price to such a buyer.

Thus we have identified that for private label goods and economies of scale there is a new source of buyer power, and large buyers enjoy more of it than small buyers. The result contrasts with our discussion in section 2 for a branded good supplier where (with economies of scale) the small buyer had the buyer power. Clearly, private label suppliers operate under very different conditions from branded suppliers.

We have focussed on the case of economies of scale. We have previously noted in the operations research literature that delivery and logistics naturally give rise to economies of scale as more customers often means a greater population density among customers, and with greater customer density more efficient routing algorithms are possible.[25] Thus, economies of scale is perhaps the most natural assumption for products delivered to supermarkets. If, however, diseconomies of scale are assumed, the model generates the opposite result: small buyers exert buyer power. (To see why, imagine Figure 4 with convex total cost functions).

[25] Burns et al. (1985), Op cit.

To the extent that the large buyers also have lower specific costs of being serviced (due, for example, to ordering in multiples of full palettes and being in easy to reach places with better infrastructure) we would predict a clear direction for buyer power: large retailers should have it in the case of private label goods (and secondary brands). This is indeed what the Competition Commission study into supplier prices found (as we noted in the introduction).[26] We have already noted that there was no such evidence of buyer power in the case of branded goods.

6. Waterbed effects

What happens to suppliers of private label goods when there are changes in concentration among retailers? We focus on the effects on small retailers when large retailers get bigger, i.e. waterbed effects.

Suppose that buyers become more asymmetric while holding their combined purchase volumes constant. For example, two retailers might merge or a large retailer may buy up stores from a small retailer. Then our model provides clear waterbed effect results for the other firms. The direction of these depends on the shape of *per-unit incremental costs*. Before we explain the intuition for this result we discuss what it means for the per-unit incremental cost to be convex or concave.

The per-unit incremental cost of serving a given client with demand q is the per unit cost for these q units from the existing volume base. Thus the per unit incremental cost is plotted as a function of the volumes already being supplied to others. With economies of scale this incremental cost per unit will be declining in volumes already won as each successive unit is a little cheaper to produce. If these incremental costs decline at a declining rate then these are convex.

When incremental costs are convex in this sense the increase in retailer asymmetry raises the transfer prices for all other downstream firms (i.e. there is a standard waterbed effect). The result is a simple consequence of (i) the fact that the bargained price obtained by any retailer is a function of expected per unit incremental costs $\Delta c/q$, and (ii) the fact that when a cost function is convex then the expected cost increases when the distribution of the seller's output undergoes a mean preserving spread.[27]

Hence our research identifies a mechanism by which downstream mergers or partial acquisitions can have adverse consequences for the supply terms of other retailers. Note that this effect is not present in the case with upstream monopoly, e.g. the case of a branded good, because the monopolist is certain of its final output. Note also that the effect we identify works on all retailers as the increased volatility in final volumes is felt by all suppliers. Hence even small buyers not in direct competition with the large merging retailer still see a deterioration in the deal they can secure from their suppliers.

Whether a given cost structure has a convex average incremental cost is an empirical question. However there are reasons to believe that with economies of scale the case of

[26] Op cit, Appendix 8.1, paragraphs 44 and45.
[27] This is a familiar result from risk theory.

convex average incremental costs is likely to be the most relevant.[28] Thus one would typically expect a standard waterbed effect to operate.

In their investigation into the UK Grocery Market, Competition Commission (2007) considered whether waterbed effects might operate in the UK. The model they used assumed an upstream monopolist and they noted that it was unclear how relaxing this assumption to upstream competition could generate waterbed effects.[29] The discussion in this section, and in ST more generally, highlights one mechanism through which this may happen.

7. Investment Incentives

We now ask how the presence of large buyers wielding buyer power alters the incentives of private label suppliers to invest in new technology. In many homogeneous good industries, such as liquid milk supply, a production innovation is unlikely to be covered by patents. For example, if cost reduction is due to better practice or larger plants using well understood technology then this is easily replicable. We therefore make use of the concept of *anticipatory equilibrium*: Does a supplier wish to invest after internalizing that its rivals will react by matching the investment? In support of our contention that this reciprocal investment is the relevant case note that in the current Competition Commission report into the UK Grocery Industry, 60% of suppliers responding to the CC's survey claim that they conduct innovation to "keep up with the market".[30]

We consider at what level of production a supplier would choose to deploy a small cost reducing innovation which lowers the cost of producing one unit by a small amount. The thought experiment here is whether incentives to invest are strongest 'at the margin' – that is at high levels of production; or perhaps incentives are strongest at low levels of production. This question is of interest for consumer welfare as innovations at the margin could be expected to filter down into lower retail prices and higher output.

We find that with competition upstream, suppliers facing the bargaining interface described would rather lower costs well inside their expected production levels. There are two reasons. Firstly when bargaining with buyers the supplier will be at pains to share as little of the cost reduction with the buyer as possible. A buyer can claim a fraction of the cost saving if its volume turns out to be pivotal in getting the supplier to access the lower cost unit. A cost reduction at high levels of production is more likely to be dependent on signing up any given buyer and so the buyers extract more of the rents. Secondly, after the input prices are agreed, the cost reduction is only triggered if volumes are sufficiently large. Thus, in the context of upstream competition, a cost reduction at high volume levels is less likely to be achieved. Combining therefore, if the cost reduction is deployed for a unit produced when volumes are low then costs are more certainly lowered but negotiated prices stay high. Thus the output uncertainty experienced by private label suppliers focuses their cost-reducing incentives towards the infra-marginal units rather than the marginal units of output (the latter being the more beneficial to consumers).

[28] With economies of scale, convex average incremental costs are implied by convex decreasing marginal costs: marginal costs falling increasingly gradually to some constant level as volumes increase. In contrast for the marginal cost function to be concave one would require the unnatural condition that marginal costs collapse at an ever increasing rate.
[29] See Op cit Appendix 5.4.
[30] Op cit, App 8.2, para 34.

An example of this result at work is the practice of suppliers focusing small cost improvements on peak load facilities rather than those production facilities used at the margin. Our case study interviews in milk confirmed that such practices are widespread.

7.1. Endogenous Technology Choice

If a sufficiently large downstream buyer emerges then one can ask how the upstream firms would seek to alter their entire production technology. Here ST identify a new effect: the presence of large buyers ensures that suppliers, if choosing between technologies yielding the same costs at expected volumes, prefer technologies with increasing returns to scale as opposed to decreasing returns to scale. These in turn favour large buyers over small ones who become relatively disadvantaged.

This might be thought of as surprising because if a large downstream buyer is created then, as a result of competition, only one supplier will be victorious in winning her business. On the other hand a technology exhibiting increasing returns to scale would result in small buyers (who are likely to be won) being more expensive to serve on their own. Nevertheless, even though suppliers realise that if they move to a technology of economies of scale their rivals will copy, the industry would still rather move to a technology from which they can charge the large buyer less.

The reason why this happens lies in the changes to the expected costs. By moving to a technology exhibiting economies of scale the expected costs of production for each supplier fall as volumes won have undergone a mean preserving spread. On the other hand the price reduction to the large buyer cannot be too great as the cost of sourcing from outside the domestic market remains high and constrains the bargaining agreement. Thus on balance the suppliers are happy to take their chances in competition with economies of scale as the expected cost reductions outweigh the lower input prices secured.

Of course a move to a technology exhibiting economies of scale disadvantages the smaller buyers as we have already established. A manifestation of this move to technology exhibiting economies of scale in the UK liquid milk industry is the continued move to ever larger dairies (super-dairies) at which substantial economies of scale can be realised. This move to super-dairies was initiated by one of the processors, but quickly emulated by the rival processors.

8. Strategic Interaction between Branded Goods and Private Labels.

In this final section we note that when private label goods are in competition with a branded product our two models interact. By having a private label good the retailer can erode the monopoly status of her branded good supplier. The private label good improves the outside option of the retailer and so allows her to extract a greater share of the surplus from the branded good supplier. We noted the link between the retailer's outside option and her bargaining split in Section 2. This effect increases the value of the private label good to the retailer. However, as Section 4 noted, this is unlikely to filter back to the private label suppliers if competition to supply the private label good from without the immediate domestic market exists.

The ability to lower the bargained returns to the branded good manufacturer will create an incentive to design the private label good to be as close a substitute as possible for the branded good. The economics literature has found evidence suggestive of this effect. Morton

and Zettelmeyer[31] note that retailers in their data sample of a number of grocery categories from some US supermarkets are more likely to carry a private label good if the share of the leading national brand is higher. Thus, assuming that higher market shares imply a brand is more of a 'must have' to a retailer, the authors conclude that retailers may be using private labels to try to create greater within store competition – and hence extract more of the surplus from branded good suppliers.

9. Conclusions

We discussed the economics of the bargaining interface between suppliers and retailers. We initially considered the case of a branded good supplier, which by definition enjoys a monopoly position and relative certainty regarding the total output supplied to retailers. If a branded good supplier enjoys economies of scale then we showed that the small buyer enjoys buyer power. We considered the effect of retailer size on supplier incentives: an increase in the average size of retailers will increase the supplier's investment incentives at the margin as the bargaining takes place further away from the marginal units and retailers are able to capture a lower fraction of the cost reduction.

After considering some case study evidence, which highlighted the importance of output uncertainty for suppliers of private label goods, we outlined a bargaining theoretic framework applicable for private label supply chains. We found results that contrasted with the branded good case, showing that the suppliers of private label goods are in a very different bargaining environment. We emphasised the point that negotiations with suppliers occur only over the *available* surplus between incremental cost and the retailer's outside option; this may be considerably less than the difference between incremental cost and retail price. We then showed how retailer size can affect the share of the available surplus appropriated by the retailer. Specifically, we showed that if the upstream technology exhibits economies of scale then large buyers wield buyer power (the opposite of the result for the branded good case). This buyer power is generated by the positive effect on expected output that results when a supplier is approached by a large buyer. The analysis also identifies a mechanism by which downstream mergers can result in waterbed effects that harm the interests of smaller retailers.

Next we showed that the output uncertainty experienced by private label suppliers focuses their cost-reducing incentives on infra-marginal rather marginal units of output, and innovations at the margin are of greater benefit to consumers. However, when considering suppliers' choices of the entire production technology a different insight surfaces. When choosing amongst technologies which maintained the costs of expected volumes, suppliers facing a large enough buyer would rather choose increasing as opposed to decreasing returns to scale. Thus the creation of large buyers for private label goods creates a pressure for upstream suppliers to move to overall technologies exhibiting increasing returns to scale. Such a production technology creates buyer power for the large buyer and hence smaller buyers will have to pay relatively higher prices.

Finally we note that having a private label product improves the outside option for a retailer dealing with a branded good supplier. The better the private label good, the greater the share of the surplus a retailer can extract from the branded good supplier. This creates an incentive to design the private label good to be a closer substitute for the branded good. This will raise

[31] Morton and Zettelmeyer (2004), "The Strategic Positioning of Store Brands in Retailer - Manufacturer Negotiations.", *Review of Industrial Organization*, 24, 161-194.

the value of the private label good itself to the retailer. However, this is not likely to filter back to private label suppliers as the prices they receive are kept in check by the competition to supply – both within and without the domestic market.