Buyer groups and buyer power: The effect on outsiders

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Abstract:

A buyer group is a subset of downstream firms that pool their demand for an upstream input to negotiate a better deal with suppliers. This paper develops a simple model that shows how a buyer group changes market behavior, focusing on the impact on downstream firms outside the buyer group. This impact critically depends on the ability of input suppliers to commit to a ‘list’ or ‘market’ price. If the input supplier can commit to a market price before bargaining, it will manipulate this price to control the ‘outside options’ in the bargaining process. Firms outside the buyer group pay a higher marginal price for the key input, compared to both the price paid by the members of the buyer group and the market price that arises absent the buyer group. However, a rise in the bargaining power of the buyer group lowers the market price. In contrast, if the upstream monopolist cannot commit to a market price before bargaining, then the formation of a buyer group may raise or lower the market price. The distribution of bargaining power is irrelevant in this situation. We illustrate these results using a simple example and discuss the implications for the debate on buyer power and competition.

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1. Introduction

A buyer group is a subset of downstream firms that pool their demand for an upstream input in order to negotiate a better deal with suppliers. If successful, the lower input price benefits the members of the group when they compete in the downstream market, raising their profits. It can also lower consumer prices, in part explaining why buyer groups are allowed and even actively encouraged in a variety of jurisdictions. However, what happens to those downstream firms who remain outside the buyer group? In particular, does the creation of a successful buyer group by some firms raise or lower the input price paid by their downstream rivals?

This paper develops a simple model to analyze how the formation of a buyer group alters market behavior. Downstream firms buy a key input from an upstream monopoly before competing with each other in retail sales. Downstream firms that are not in the buyer group are price takers for the input. However, if a subset of downstream firms forms a buyer group, then they can negotiate directly with the upstream monopolist over a two-part tariff.

The market effects of the buyer group depends on two key factors:

1. Whether or not the upstream supplier can commit to a market price (or a ‘list’ price) before negotiating with the buyer group; and

2. The relative bargaining power of the upstream supplier and the buyer group.

Suppose the upstream supplier can commit to a market price for the input before bargaining with the buyer group. The supplier will manipulate this price to control the ‘outside options’ in the bargaining process. Raising the market price reduces the outside options for both the buyer group and the supplier. If the supplier has most of the bargaining power it will raise the input price to increase the surplus generated from

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1 We use the term ‘buyer group’ to cover any purchasing agreement between downstream competitors, including purchasing joint ventures, which maintains the independence of the relevant firms in the downstream market. In other words, members cooperate on negotiating the purchasing price from an upstream supplier but otherwise do not cooperate in any way that limits competition.

2 Regardless of any effect on upstream prices, ‘outside’ firms may benefit from the formation of a buyer group if this limits downstream competition. See for example European Commission (2001) at 128. The use of a buyer group to facilitate collusion is beyond the scope of this paper and we do not consider it further.
negotiating with the buyer group. Downstream firms outside the buyer group pay this higher market price for the input. A rise in the relative bargaining power of the buyer group, however, encourages the supplier to improve its outside option by setting a lower input price. Thus the price paid by outsiders is inversely related to the bargaining power of the buyer group. Nevertheless, the formation of the buyer group always results in outside firms paying a higher input price.

In contrast, if the upstream monopolist cannot commit to a market price for the input before bargaining with the buyer group, then it will simply set this price to maximize its unilateral profit given its agreement with the buyer group. In this case, the formation of a buyer group may lead to a lower or higher input price for outsiders. Further, the distribution of bargaining power has no effect on the input price paid by outsiders.

The results from this paper are important for a number of reasons. Buyer groups are common in many countries. For example, retailers’ cooperatives in hardware and groceries exist in both the United States and Europe. However, much of the research on buyer groups assumes that they include all buyers. The effect of buyer groups on other downstream competitors and market behavior is a relatively unexplored part of economics. Our results show that the formation of a buyer group may either raise or lower the input market price paid by other firms.

Buyer groups are allowed and even actively encouraged by antitrust laws in a variety of jurisdictions. At the same time, authorities have raised concerns about the potential anticompetitive effects of buyer power, for example when it means that some firms receive a better deal from suppliers than their downstream competitors. Our results show that the competitive effects of buyer groups can be complex. For example, the formation of a buyer group may lead to a lower input price being paid by downstream rivals but the profit of these rivals can fall. Once formed, an increase in bargaining power for the buyer

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3 This inability to commit to an input price provides an incentive for the supplier to ‘encourage’ downstream competition, in a manner similar to the models of vertical foreclosure. See Rey and Tirole (2007).
4 For example, Ace Hardware is a cooperative of independently owned retail hardware stores that began in the United States. EDEKA is a German supermarket cooperative.
5 See for example Chipty and Snyder (1999) and Dana (2006).
6 Matthewson and Winter (1996) is a notable exception.
group may lead to a fall in the input price paid by competitive rivals although, again, this need not translate into greater profits for the rival firms.

Some jurisdictions, such as Australia, require an explicit evaluation of the costs and benefits of buyer groups under antitrust laws.\(^8\) Similarly, benefits due to increased buyer power are sometimes claimed as an efficiency defense for mergers subject to antitrust scrutiny.\(^9\) The results presented here are directly relevant to these benefits.

Our results are relevant for the economic debate on the competitive effects of buyer power. The recent UK inquiry into the grocery industry (Competition Commission, 2007) highlighted these concerns. Our results both reflect and extend some of the existing literature in this area, most notably Chen (2003).

A key innovation in this paper is to formalize the role of the buyer group. By forming a group, a subset of downstream firms can bargain one-on-one with the input supplier.\(^10\) This may be explained in terms of contractual transactions costs. While it is too expensive for the supplier to individually contract with a multitude of downstream buyers, it is worthwhile to set a single contract for a large enough subset of these buyers. Our model takes the subset of firms who form the buyer group as exogenous.\(^11\) This simplifies the analysis and allows us to concentrate on the effects on the input price.

Section 2 of the paper develops the formal model while sections 3 and 4 consider the two cases of market price commitment and no commitment respectively. The results are illustrated using a simple Cournot model in section 5. Section 6 considers the debate on buyer power while section 7 extends the model to market-price-contingent contracts. Section 8 concludes.

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\(^8\) For further details see Australian Competition and Consumer Commission (2007). In Europe, the relevant test under Article 81 of the EC Treaty considers both economic benefits and whether consumers receive a fair share of these benefits. See European Commission (2001) at 31-34.

\(^9\) Inderst and Shaffer (forthcoming) survey the antitrust debate about buyer power and mergers.

\(^10\) This may lead to increased profits for both the buyer group and the supplier by eliminating double marginalization. Thus, the rationale for the supplier bargaining with the buyer group is explained by the structure of the model. Similarly, this approach explains why input suppliers may not oppose the legal clearance of a buyer group. For example Australian Competition and Consumer Commission, 2008, involves a buyer group dealing with two separate monopoly input suppliers. Consistent with our model, neither supplier opposes the legal authorization of the buyer group but both oppose a measure that would increase the buyer group’s bargaining power once it is formed (paragraphs 2.12 and 2.13).

\(^11\) The appendix presents a simple extension to the model that makes endogenous the formation of the buyer group.
2. A general model of competition with a buyer group

Consider a market where $m$ downstream firms are supplied with an input by a single upstream supplier. The downstream firms are initially identical except that they are divided into two mutually exclusive groups, denoted by $g$ and $n$. Firms in group $g$ will form the buyer group while firms in group $n$ are ‘outsiders’ who will not be members of the group. In a slight abuse of notation, we assume that group $j$ has $j$ members so that $g + n = m$. Without loss of generality we number the downstream firms so that firms $i \in \{1, \ldots, g\}$ are in group $g$ and firms $i \in \{g+1, \ldots, m\}$ are in group $n$. We assume that $0 < g < m$.

The single upstream supplier sells a homogeneous input to each of the $m$ downstream firms. Each downstream firm uses one unit of the input to produce each unit of their final product.

Our aim is to determine the effects of the buyer group on the market. To do this, we consider the equilibrium in the absence of a buyer group compared with the equilibrium in the presence of a buyer group.

In the absence of a buyer group all firms act as price takers in the upstream input market. The upstream supplier simply sets the profit-maximizing uniform price for the input denoted by $w_0$. This price depends on both the final product demand and the nature of downstream competition. Taking this input price as given, the downstream firms compete to sell their final products to consumers. The final products need not be identical.

When the subset $g$ of downstream firms forms a buyer group the only change to the market is that the members of the buyer group are able to negotiate a non-linear tariff with the upstream supplier. For simplicity we only consider two-part tariffs that involve a fixed payment from the buyer group to the upstream supplier, denoted by $F$, and a per unit input price for each member of the buyer group $w_g$. Firms that are not in the buyer group continue to purchase the input at a uniform market price denoted by $w_n$. Of course, this price can (and will) in general differ from the market price $w_0$ that arises in the absence of a buyer group.
**Timing and bargaining**

We consider two alternative timings for market interactions in the presence of a buyer group. These alternative timings depend on whether or not the input supplier can commit to a market price $w_n$ prior to negotiating with the buyer group.

First consider the situation where the upstream supplier sets the market price for the input before negotiating with the buyer group. In this situation the timing of interactions is given by:

1. the upstream supplier sets a market price for the input $w_n$
2. the buyer group and the supplier then negotiate a two-part tariff $F$ and $w_g$. If negotiations are successful the buyer group pays $F$ to the supplier. If negotiations are unsuccessful, then all downstream firms face the same market price $w_n$.
3. all firms observe all input prices,\(^\text{12}\) make their input purchases; and independently compete in the sale of the final products.\(^\text{13}\)

This timing is relevant when the upstream supplier can commit to the market price prior to bargaining with the buyer group. This may be because the market price cannot be easily changed whereas the price for the buyer group can easily be renegotiated. We refer to this situation as the case with input market price commitment.

Alternatively, the upstream supplier may be unable to commit to a market price for the input before negotiating with the buyer group. This may reflect that bargaining between the buyer group and the supplier involve explicit contracts and these contracts may be difficult to alter. In contrast, the supplier has unilateral control over the market price for the input. In this situation the timing of interactions is given by:

1. the buyer group and the upstream supplier negotiate a two-part tariff $F$ and $w_g$. If negotiations are successful the buyer group pays $F$ to the supplier. If negotiations are unsuccessful, then all downstream firms will face the same market price $w_n$.

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\(^{12}\) The assumption that the marginal input price $w_g$ is known by all firms once it is negotiated means that we do not have to explicitly specify beliefs for firms in group $n$ about the input price paid by the rival firms in group $g$. Firms in group $g$ would obviously know $w_g$ and observe $w_n$ as the market input price.

\(^{13}\) In other words, the formation of the buyer group does not change the nature of downstream competition, for example, by facilitating collusion.
2. the upstream supplier sets the market price for the input \( w_n \);
3. all firms observe all input prices, make their input purchases, and independently
   compete in the sale of the final products.

We refer to this situation as the case without input market price commitment.

As we show below, the impact on the market of a buyer group differs significantly
depending on whether or not the upstream supplier can commit to a market price prior to
bargaining.

In either case, we consider a simple form of bargaining between the buyer group and the
supplier. In the case where the supplier can commit to the market price prior to
bargaining the buyer group and the upstream supplier negotiate so that, given the input
price set to other downstream firms, the buyer group and supplier choose an input price
\( w_g \) to maximize their joint profits. The fixed fee \( F \) is then chosen to divide the surplus
between the buyer group and the supplier, with the supplier’s share given by \( \alpha \in [0,1] \).

When the input supplier cannot commit to an input price prior to bargaining, the buyer
group and the supplier choose an input price \( w_g \) to maximize their joint profits given the
subgame perfect equilibrium market price that will be chosen by the supplier. Of course,
this market price will in general depend on the input price \( w_g \) chosen through the
bargaining process. Again, the fixed fee \( F \) is then chosen to divide the surplus between
the buyer group and the supplier, with the supplier’s share given by \( \alpha \in [0,1] \).

**General Assumptions on competition**

At this stage we do not explicitly specify the nature of downstream competition. Rather,
we consider a general set of input prices for the \( m \) downstream firms and make a number
of assumptions about the profits of the downstream firms and the upstream supplier.

Let \( \omega = (w_1, \ldots, w_m) \) be a vector of input prices where \( w_i \) is the per unit input price set by
the upstream supplier to downstream firm \( i \). Given the input price vector \( \omega \) we denote
the upstream supplier’s equilibrium profits by \( \pi_u(\omega) \) and the equilibrium profits of
downstream firm \( i \) by \( \pi_i(\omega) \). For simplicity, if all downstream firms face the same input
price \( w \) then we denote the input price vector by \( \omega = w \).
Assumption 1. Assume that $\pi_u(\omega)$ and $\pi_i(\omega)$ are both twice continuously differentiable in each element of $\omega=(w_1,\ldots,w_m)$.

Assumption 2. For any input vector $\omega=(w_1,\ldots,w_m)$, if $w_i = w_j$ where $i \neq j$, then

$$\frac{\partial \pi_u(\omega)}{\partial w_i} = \frac{\partial \pi_i(\omega)}{\partial w_j}.$$ 

Assumption 2 imposes ‘symmetry’ on downstream competition and reflects that all downstream firms are ex ante identical.

As our analysis focuses on two groups of firms, it is convenient to consider the general situation where downstream firms are divided into two arbitrary groups. Of course, our results will focus on the situation where the two groups are the buyer group and the outsiders.

Let $\xi$ refer to a non-empty subset of downstream firms. For example, $\xi$ may (but need not) refer to either the buyer group $g$ or the ‘outsiders’ $n$. We use $(w_\xi, w_{-\xi})$ to denote the input price vector where the upstream monopolist sets a per unit price of $w_i = w_\xi$ if $i \in \xi$ and a price of $w_i = w_{-\xi}$ if $i \notin \xi$. The equilibrium profit of the upstream firm is denoted by $\pi_u(w_\xi, w_{-\xi})$ and the equilibrium profit of downstream firm $i$ is given by $\pi_i(w_\xi, w_{-\xi})$. Of course, the downstream firm profit for firm $i$ will depend on whether or not $i \in \xi$. The sum of the profit of the upstream supplier and the downstream firms in subset $\xi$ is given by

$$\pi_u(w_\xi, w_{-\xi}) + \sum_{i \in \xi} \pi_i(w_\xi, w_{-\xi}).$$

If input prices are ‘too high’ for some downstream firms then those firms may maximize profits by ceasing production. Any higher input price will simply lead to no production and unchanged profits. We define $\tilde{w}_\xi(w_{-\xi})$ as the input price such that, given the input price $w_{-\xi}$, if $w_\xi \geq \tilde{w}_\xi$ then firms that are in $\xi$ produce no output and have constant profits. Without loss of generality we normalize these profits to zero. We can think of $\tilde{w}_\xi(\cdot)$ as the ‘choke price’ for firms in $\xi$. 

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**Assumption 3.** For all $\xi$ and $\left(w_{\xi}, w_{-\xi}\right)$ such that $w_{\xi} < \bar{w}_{\xi}\left(w_{-\xi}\right)$:

1. $\pi_i\left(w_{\xi}, w_{-\xi}\right)$ is strictly decreasing in $w_{\xi}$ and non-decreasing in $w_{-\xi}$;

2. both $\pi_i\left(w_{\xi}, w_{-\xi}\right)$ and $\pi_u\left(w_{\xi}, w_{-\xi}\right) + \sum_{i \in \xi} \pi_i\left(w_{\xi}, w_{-\xi}\right)$ are twice continuously differentiable and strictly concave in $w_{\xi}$.

Suppose that $\xi$ includes all downstream firms. Then we define $w^0$ as the input price $w_{\xi}$ that maximizes $\pi_u$; $w^m$ as the input price $w_{\xi}$ that maximizes $\pi_u + \sum_{i \in \xi} \pi_i$; and $\bar{w}$ as the choke price. In other words, $w^0$ is the uniform input price that maximizes the profit of the upstream supplier. This is the price that the supplier will set in the absence of any buyer group. In contrast, $w^m$ is the uniform input price that maximizes total industry profit. As $\pi_i$ is strictly decreasing in $w_{\xi}$ it follows that $w^0 > w^m$. This reflects standard ‘double marginalization’. Finally, $\bar{w}$ is the input price such that, if all firms faced any higher input price, they would produce no output.

**3. Buyer groups with input market price commitment**

In the presence of the buyer group the input price vector is $\omega = \left(w_{g}, w_{n}\right)$. We first consider the case where the input supplier can commit to the market price. In this situation, the input price that is set by negotiation with the buyer group, $w_{g}$, will depend on the pre-set market price, $w_{n}$. This market price will be paid by the outsiders and affects the outside alternative for both the buyer group and the input supplier.

Before considering the effect of the buyer group on the market, we require one further assumption. Define $\tilde{w}_{g}\left(w_{n}\right)$ as the input price for the buyer group members that maximizes $\pi_u\left(w_{g}, w_{n}\right) + \sum_{i \in g} \pi_i\left(w_{g}, w_{n}\right)$ given that outsiders pay input price $w_{n}$. To avoid trivial situations, we assume that $w_{n}$ is set at a level such that $\tilde{w}_{g}\left(w_{n}\right)$ leads to positive
production and profits for members of the buyer group.\textsuperscript{14} Then, by assumption 3, $\hat{w}_g(w_n)$ is well defined and unique for all buyer groups and $w_n$. Assumption 4 restricts how profits change as $w_n$ changes.

**Assumption 4.** $\pi_u(\hat{w}_g, w_n) + \sum_{i \in g} \pi_i(\hat{w}_g, w_n)$ is concave in $w_n$ with
\[
\frac{\partial \pi_u(\hat{w}_g, w_n)}{\partial w_n} + \sum_{i \in g} \frac{\partial \pi_i(\hat{w}_g, w_n)}{\partial w_n} \geq 0.
\]

The first part of assumption 4 ensures that the joint profits are well-behaved in the market price. The second part considers the situation where the market price for outsiders is set at its original level, $w^0$. Remember that this market price, if charged uniformly to all firms, maximizes the profit of the upstream supplier alone. Assumption 4 requires that, given the buyer group pays the optimal per-unit price to maximize joint profits at $w_n = w^0$, joint profits of the buyer group and the supplier are increasing in the market price paid by the outsiders. Clearly the second term in the inequality is positive by assumption 3, so assumption 4 requires that the effect on the upstream firm’s profits from increasing the price to the outside firms is not too negative at $w^0$.

Assumption 4 immediately leads to the following lemma.

**Lemma One:** $\pi_u(\hat{w}_g, w_n) + \sum_{i \in g} \pi_i(\hat{w}_g, w_n)$ has a maximum value at $w_n = w_n^*$ where $w_n^* \in [w^0, \infty]$.

**Proof:** $w_n^*$ maximizes $\pi_u(\hat{w}_g, w_n) + \sum_{i \in g} \pi_i(\hat{w}_g, w_n)$. Note that the first order condition for this maximization is given by:
\[
\frac{\partial \pi_u(\hat{w}_g, w_n)}{\partial w_n} + \sum_{i \in g} \frac{\partial \pi_i(\hat{w}_g, w_n)}{\partial w_n} + \left[ \frac{\partial \pi_u(\hat{w}_g, w_n)}{\partial \hat{w}_g} + \sum_{i \in g} \frac{\partial \pi_i(\hat{w}_g, w_n)}{\partial \hat{w}_g} \right] \frac{\partial \hat{w}_g}{\partial w_n} = 0
\]

\textsuperscript{14} This avoids the unlikely situation where the upstream supplier would find it profitable to set a market price that makes it unprofitable to ever sell to the buyer group.
But by definition, \( \frac{\partial \pi_u(\tilde{w}_g, w_n)}{\partial \tilde{w}_g} + \sum_{i \in g} \frac{\partial \pi_i(\tilde{w}_g, w_n)}{\partial \tilde{w}_g} = 0 \). Thus the first order condition is \( \frac{\partial \pi_u(\tilde{w}_g, w_n)}{\partial w_n} + \sum_{i \in g} \frac{\partial \pi_i(\tilde{w}_g, w_n)}{\partial w_n} = 0 \). But by assumption 4
\[
\frac{\partial \pi_u(\tilde{w}_g, w_n)}{\partial w_n} + \sum_{i \in g} \frac{\partial \pi_i(\tilde{w}_g, w_n)}{\partial w_n} < 0 \text{ at all } w_n < w^0.
\] The lemma immediately follows.

Lemma one shows that, given our assumptions, the market price that maximizes the joint profits of the upstream supplier and the buyer group will be no less than the original market price \( w^0 \). This implies that efficient bargaining between the upstream supplier and the bargaining group cannot lower the market price paid by outsiders when compared to the situation without a buyer group.

To explore whether or not this result is plausible, suppose the downstream firms have constant marginal costs, produce a homogenous good and imperfectly compete. To maximize the joint profit of the input supplier and the buyer group, it is desirable to set the input price to the other downstream firms sufficiently high so that they do not produce. The input price for the buyer group members can then be set so that, following downstream competition, the price of the downstream product is set equal to the vertically integrated monopoly price. Lemma one covers this situation as well as the case where, because of increasing marginal costs, it is worthwhile having some limited production from the downstream firms that are not in the buyer group.

Alternatively, take the situation where each downstream firm produces an independent good. In this case the optimal price to set firms that are not in the buyer group is equal to \( w^0 \). The price set to each member of the buyer group will be \( w^m \). Lemma one covers this case as well as the situation where downstream products are substitutes so that, from the perspective of the input supplier and the buyer group, it is profitable to raise the input price to downstream firms outside the buyer group.

Lemma one considers the market price that maximizes the joint profits of the input supplier and the buyer group. But it does not tell us the relationship between the marginal price paid by the buyer group and the price paid by the outsiders. Note however that in
both of the examples given above, the input price $w_{g}$ that maximizes the joint profits of the upstream supplier and the buyer group is less than the market price for outsiders. Lemma two shows that this is a general result.

**Lemma Two:** For all $w_{n} \geq w^0$, $\bar{w}_{g}(w_{n}) < w_{n}$.

**Proof:** Given $w_{n} \geq w^0$, we know that $\pi_{u}(w_{g},w_{n})$ is non-increasing in $w_{g}$ when $w_{g} = w_{n}$. To see this, note that when $w_{g} = w_{n}$, all downstream firms face the same input price so that by assumption 2, $\frac{\partial \pi_{u}}{\partial w_{g}}$ is the same for all downstream firms. But as $w_{n} \geq w^0$ we know that $\pi_{u}(w_{i_{1}},...,w_{i_{m}})$ is non-increasing in $w$ so that

$$\sum_{i=1}^{m} \frac{\partial \pi_{u}}{\partial w_{i}} = m \frac{\partial \pi_{u}}{\partial w_{i}} \leq 0$$

and

$$\frac{\partial \pi_{u}}{\partial w_{i}} \leq 0$$

for all $i$. Thus $\pi_{u}(w_{g},w_{n})$ is non-increasing in $w_{g}$ when $w_{g} = w_{n} \geq w^0$. Further, by assumption 3, $\pi_{i}(w_{g},w_{n})$ is strictly decreasing in $w_{g}$ for $i \in g$ so we know that $\pi_{u}(w_{g},w_{n}) + \sum_{i \in g} \pi_{i}(w_{g},w_{n})$ is decreasing in $w_{g}$ when $w_{g} = w_{n} \geq w^0$. But, by assumption 3,

$$\pi_{u}(w_{g},w_{n}) + \sum_{i \in g} \pi_{i}(w_{g},w_{n})$$

is strictly concave in $w_{g}$ for all $w_{n}$ so that

$$\bar{w}_{g}(w_{n}) < w_{n}.$$ 

Lemma two shows that the joint profit maximizing uniform price for the input supplier and the buyer group is always strictly less than the market price paid by the outsiders when the market price is at least $w^0$. Further, lemma one shows that the joint profit maximizing market price for the input supplier and the buyer group will be at least $w^0$. However, we must explicitly consider the bargaining between the input supplier and the buyer group to determine the actual input prices.

**Bargaining between the input supplier and the buyer group**

Given $w_{n}$, the upstream supplier and the buyer group will negotiate a two-part tariff where $w_{g}$ is the marginal price paid by the members of the buyer group for the upstream input. If the buyer group fails to reach agreement with the input supplier then all downstream firms buy at the market price $w_{n}$. 


Suppose that the input supplier has set the market price $w_n$. Then successful bargaining between the input supplier and the buyer group will involve setting a per unit price of $\tilde{w}_g(w_n)$ for the buyer group. The fixed fee is used to divide the surplus created by the agreement between the buyer group and the supplier. This surplus is given by:

$$S = \pi_u(\tilde{w}_g(w_n), w_n) + \sum_{i=1}^{g} \pi_i(\tilde{w}_g(w_n), w_n) - \pi_u(w_n) - \sum_{i=1}^{g} \pi_i(w_n)$$

In other words, the surplus is simply the joint profit of the input supplier and the buyer group when the members of the buyer group pay an input price $\tilde{w}_g(w_n)$, less the joint profit when the members of the buyer group pay the market price $w_n$. The total profit for the input supplier is given by $\Pi_u(w_n) = \pi_u(w_n) + \alpha S$ while the profit for each member of the buyer group is given by $\Pi_g(w_n) = \pi_i(w_n) + \frac{1-\alpha}{g} S$.

**Effect of a buyer group with input market price commitment**

We are now able to consider how the existence of the buyer group alters the market price paid by downstream firms who are not part of the group and how this input price depends on the relative bargaining power of the input supplier and the buyer group.

**Proposition three:** With a buyer group and input market price commitment:

(a) the input market price is at least as high as the input price in the absence of a buyer group and may exceed the joint profit maximizing price for the buyer group and the input supplier, $w_n^*$;

(b) if $\alpha > 0$ then the per unit input price paid by the buyer group will be strictly less than the market price;

(c) the input market price is non-decreasing in $\alpha$.

**Proof:** Note that when $\alpha = 1$ the input supplier gains all the surplus so that $\Pi_u(w_n) = \pi_u(\tilde{w}_g(w_n), w_n) + \sum_{i=1}^{g} \pi_i(\tilde{w}_g(w_n), w_n) - \sum_{i=1}^{g} \pi_i(w_n)$. By lemma one, $\pi_u(\tilde{w}_g(w_n), w_n)$ is maximized at $w_n^* \in \{w^0, \infty\}$ and, by assumption 4, is non-increasing for $w_n > w_n^*$. By assumption 3, $\sum_{i=1}^{g} \pi_i(w_n)$ is strictly decreasing in $w_n$ for $w_n < \tilde{w}$ and equal to zero for $w_n \geq \tilde{w}$. Thus, by subgame perfection,
when $\alpha = 1$ the input supplier will set the market price $w_n^f \geq w_n^*$ with $w_n^f > w_n^*$ if $w_n^* < \bar{w}$. This proves the last part of (a).

When $\alpha = 0$ the input supplier gains none of the surplus so that $\Pi_n(w_n) = \pi_n(w_n)$. By subgame perfection the input monopolist will set the market price $w^0$.

For $\alpha \in (0, 1)$:

$$\Pi_n(w_n) = (1-\alpha)\pi_n(w_n) + \alpha \left( \pi_n(\widehat{w}_g(w_n), w_n) + \sum_{i=1}^g \pi_i(\widehat{w}_i(w_n), w_n) \right) - \alpha \sum_{i=1}^g \pi_i(w_n).$$

Let $\Gamma(w_n) = (1-\alpha)\pi_n(w_n) + \alpha \left( \pi_n(\widehat{w}_g(w_n), w_n) + \sum_{i=1}^g \pi_i(\widehat{w}_i(w_n), w_n) \right)$. Note that by assumption 3 considered when $\xi$ includes all firms, $\pi_n(w_n)$ is strictly concave in $w_n$ with a maximum at $w^0$. By assumption 4, $\pi_n(\widehat{w}_g(w_n), w_n) + \sum_{i=1}^g \pi_i(\widehat{w}_i(w_n), w_n)$ is concave in $w_n$ with a maximum at $w^*_n \in [w^0, \infty)$. Thus, $\Gamma(w_n)$ is a convex combination of two functions that are concave in $w_n$, so $\Gamma(w_n)$ is concave with a maximum $w^*_n$ between $w^0$ and $w^*_n$. Further, as $w^*_n$ is no lower than $w^0$, $w^*_n$ is non-decreasing in $\alpha$.

As noted above, by assumption 3, $\sum_{i=1}^g \pi_i(w_n)$ is strictly decreasing in $w_n$ for $w_n < \bar{w}$ and equal to zero for $w_n \geq \bar{w}$. Thus, by subgame perfection, when $\alpha \in (0, 1)$ the input supplier will set the market price $w^*_n \geq w^0$ with $w^*_n < \bar{w}$ and $w^*_n = w^f_n$ when $w^*_n \geq \bar{w}$. Further, as $w^*_n$ is non-decreasing in $\alpha$ and $-\alpha \sum_{i=1}^g \pi_i(w_n)$ is increasing in $\alpha$ and, by assumption 1, continuous in $w_n$, $w^*_n$ is non-decreasing in $\alpha$.

Thus, for all $\alpha \in [0, 1]$, the subgame perfect equilibrium market price set by the input supplier will be at least as high as $w^0$, the market price in the absence of the buyer group. Further, this market price is non-decreasing in $\alpha$. Finally, by lemma 1, when $\alpha \in (0, 1]$ the marginal price paid by the buyer group, $w_g$, will be strictly less than the market price.

The presence of a buyer group, if the input supplier has significant bargaining power, will tend to increase the market price available to downstream firms outside the buyer group for two reasons. First, to the degree that the input supplier shares the profits it creates with the buyer group, the supplier has an incentive to minimize the flow of profits to downstream firms outside the buyer group and to ‘crowd them out’ of the market. This leaves more profit available for the input supplier and buyer group to share. Second, the
input supplier has an incentive to raise the market price as this reduces the outside option for members of the buyer group. If the buyer group fails to reach agreement with the input supplier then its members face the standard market price. By raising this price, the input supplier undermines the outside option resulting in it being able to seize more of the bargaining surplus.

The result is that the market price set by the input supplier can exceed the joint profit maximizing market price for the supplier and the buyer group.

If the input supplier has little bargaining power both of these effects are muted. The supplier is more concerned about maintaining its own outside option and so sets the market price below the joint profit maximizing price and closer to the standard monopoly price.

Regardless of bargaining power, however, the formation of a buyer group tends to lead to a higher market price for all downstream firms who are not members of the buyer group. Further, the market price faced by downstream firms outside the buyer group tends to rise when the input supplier has more bargaining power (higher $\alpha$).

The members of the buyer group will always receive a marginal input price less than the input market price. This follows from lemma two and is a consequence of double marginalization.

Proposition three allows for the possibility that the negotiated per unit price for the buyer group could exceed $w^0$. This possibility could be ruled out by making stronger assumptions on the joint profits of the buyer group and the input supplier. However, intuitively, setting a price for the buyer group that exceeds the initial market price is unlikely.

To see this, suppose that as the market price for outsiders increases, those firms become less effective competitors in the final market, so that, given the input price for the buyer group, the retail price tends to increase as the market input price increases. In other words, the ‘double marginalization problem’ worsens for the input supplier and the buyer group as the input market price for outsiders rises. To offset this, the joint profit maximizing input price for the buyer group and the supplier will tend to fall as the market
input price for outsiders rises. Thus as the input market price rises above \(w^0\) the bargained price between the buyer group and the supplier will tend to fall further below \(w^0\).

In summary, with input price commitment, the formation of a buyer group leads to a higher market price for the relevant input. Indeed, the market price may be higher than the price that maximizes the joint profits of the supplier and the buyer group. Further, the market price increases if the supplier has more bargaining power but decreases if the buyer group has more bargaining power. The buyer group receives a per unit input price less than the market price.

4. **Buyer groups without input market price commitment**

We now consider the situation when the input supplier cannot commit to the input market price prior to negotiating with the buyer group. In this situation the buyer group and the input supplier will negotiate a two-part tariff recognizing how this alters the incentive for the supplier to then set the market price for all firms outside the buyer group. Let \(\tilde{w}_n(w_g)\) be the input market price for the outside firms that maximizes \(\pi_u(w_g, w_n)\) given that the members of the buyer group pay input price \(w_g\). Subgame perfection implies that for any \(w_g\) agreed between the buyer group and the input supplier in bargaining, \(\tilde{w}_n(w_g)\) will be set as the market price by the supplier.

Because the market price is set after bargaining rather than before bargaining, assumption 4 is no longer relevant. It is replaced by assumption 4a.

**Assumption 4a.** \(\pi_u(w_g, \tilde{w}_n) + \sum_{i \in G} \pi_i(w_g, \tilde{w}_n)\) is strictly concave in \(w_g\) with
\[
\left|\frac{\partial \pi_i}{\partial w_g}\right| \geq \left|\frac{\partial \pi_i}{\partial w_n}\right|
\]
for \(i \in G\) when \(w_g = w_n = w^0\).

The first part of assumption 4a means that the bargaining problem facing the buyer group and the input supplier is well defined in the absence of commitment over the market price. There will be a unique value of \(w_g\) that maximizes the joint profit of the buyer group and the input supplier. The second part of the assumption requires that the ‘own input price’ effect on profits for a member of the buyer group is greater in absolute terms.
than the ‘cross input price’ effect at the initial market price. In other words, at this initial price, a rise in the input price for the buyer group reduces the profit of each member of that group by more than an equivalent rise in outside firms’ input price raises their profit. This is a relatively weak assumption in that it holds if a rise in input prices for all downstream firms at the initial market price lowers profits for each of those firms.

We are now able to explicitly consider how the formation of a buyer group alters the market outcome when the supplier cannot commit to the market price for outsiders. First consider how \( w_n \) will change as the value of \( w_g \) that is agreed between the buyer group and the input supplier changes. Given \( w_g \) the input supplier will set \( \hat{w}_n(w_g) \) to maximize its profits \( \pi_u(w_g, \hat{w}_n) \). Lemma four looks at whether \( \hat{w}_n(w_g) \) is increasing or decreasing in \( w_g \).

**Lemma Four:** If \( \frac{\partial^2 \pi_u}{\partial w_g \partial w_n} > 0 \) at \((w_g, \hat{w}_n)\) then \( \frac{d\hat{w}_n}{dw_g} > 0 \). If \( \frac{\partial^2 \pi_u}{\partial w_g \partial w_n} < 0 \) at \((w_g, \hat{w}_n)\) then \( \frac{d\hat{w}_n}{dw_g} < 0 \).

**Proof:** Note that by assumption 3, for all \( w_g \), \( \hat{w}_n(w_g) \) solves \( \frac{\partial \pi_u}{\partial w_n} = 0 \).

Totally differentiating, \( \frac{\partial^2 \pi_u}{\partial w_g^2} dw_n + \frac{\partial^2 \pi_u}{\partial w_g \partial w_n} dw_g = 0 \) so that \( \frac{d\hat{w}_n}{dw_g} = -\frac{\frac{\partial^2 \pi_u}{\partial w_g \partial w_n}}{\frac{\partial^2 \pi_u}{\partial w_g^2}} \).

As \( \frac{\partial^2 \pi_u}{\partial w_g^2} < 0 \) by assumption 3 the lemma immediately follows. \( \square \)

Lemma four underpins the input-price effect of the buyer group on outsiders in the absence of commitment. In contrast to lemma one (where the market price never decreased), lemma four shows that if the per unit input price for the buyer group falls below \( w^0 \) and if \( \frac{\partial^2 \pi_u}{\partial w_g \partial w_n} > 0 \) at \((w^0, w^0)\) then the input price facing outsiders will also fall.
To see if this is likely consider the case where the input supplier has a constant marginal cost of production given by $c$ so that

$$\pi_u = n(w_n - c)\tilde{q}_n + g(w_g - c)\tilde{q}_g$$

where $\tilde{q}_n$ and $\tilde{q}_g$ are the equilibrium outputs for the downstream firms in groups $n$ and $g$ respectively. Then:

$$\frac{\partial^2 \pi_u}{\partial w_g \partial w_n} = n \frac{\partial \tilde{q}_n}{\partial w_n} + g \frac{\partial \tilde{q}_g}{\partial w_n} + n[w_n - c] \frac{\partial^2 \tilde{q}_n}{\partial w_n \partial w_g} + g[w_g - c] \frac{\partial^2 \tilde{q}_g}{\partial w_n \partial w_g}.$$

The first two terms, $n \frac{\partial \tilde{q}_n}{\partial w_n} + g \frac{\partial \tilde{q}_g}{\partial w_n}$, represent a standard ‘demand shift’ effect. In general we would expect that both $\frac{\partial \tilde{q}_n}{\partial w_n} > 0$ and $\frac{\partial \tilde{q}_g}{\partial w_n} > 0$. Thus, if the input price faced by one group of downstream firms rises, we would expect that the equilibrium output of the other group to also rise. The group facing the higher input price is likely to be less effective competitors, enabling the other group to profitably expand their output in equilibrium. But this means that a fall in $w_g$ due to bargaining by the buyer group will tend to decrease the input demand of group $n$ making it profitable for the input monopolist to lower the market price paid by that group, $w_n$.

The second two terms of the condition, $n[w_n - c] \frac{\partial^2 \tilde{q}_n}{\partial w_n \partial w_g} + g[w_g - c] \frac{\partial^2 \tilde{q}_g}{\partial w_n \partial w_g}$, represent a ‘demand slope’ effect. Changing $w_g$ changes the slope of the demand function facing the upstream firm, $n\tilde{q}_n + g\tilde{q}_g$. A rise in $w_g$ is more likely to make a rise in $w_n$ profitable if it makes the input demand curve more sensitive to an input price change. This occurs if the rise in $w_g$ makes the slope of the demand curve more positive (i.e. less negative), in other words, when the cross-partial derivatives are positive.

While we would normally expect both $\frac{\partial \tilde{q}_n}{\partial w_n} > 0$ and $\frac{\partial \tilde{q}_g}{\partial w_n} > 0$, it is less clear that either $\frac{\partial^2 \tilde{q}_n}{\partial w_n \partial w_g}$ or $\frac{\partial^2 \tilde{q}_g}{\partial w_n \partial w_g}$ will be positive. However, as long as the cross partials are not too
negative it is likely that $\frac{\partial^2 \pi_u}{\partial w_i \partial w_n}$ will be positive and a fall in the input price for the bargaining group will lead to a fall in the profit-maximizing input price for firms not in the bargaining group. Thus, if the buyer group negotiates an input price less than $w^0$ this will often lead to a fall in the market price facing other downstream firms as well.

This said, lemma five shows that the decrease in the input price for outsiders is always less than the decrease for the buyer group. Further, lemma six shows that the input supplier and the buyer group will always negotiate a per unit price for the buyer group that is less than $w^0$.

Lemma Five: For all $w_g < w^0$, $\tilde{w}_n(w_g) > w_g$.

Proof: Remember that by assumption 3 and by definition, $\pi_u(w)$ has a unique optimum at $w_i = w^0$ for all $i$. Thus, for any input price vector $w_i = w$ for all $i$ where $w < w^0$ and by assumption 2, we know that $\frac{\partial \pi_u}{\partial w_i} = \frac{\partial \pi_u}{\partial w_j} > 0$ for all $i, j$.

Now consider any $w_g = \hat{w}$ where $\hat{w} < w^0$. It follows that at $w_n = w_g = \hat{w}$, $\frac{\partial \pi_u(\hat{w}, \hat{w})}{\partial w_n} > 0$. But then, given $w_g < w^0$, $\tilde{w}_n(w_g) > w_g$. □

Lemma Six: The value of $w_g$ that is set by bargaining between the input supplier and the buyer group is strictly less than $w^0$.

Proof: The bargaining group and the input supplier will set $w_g$ to maximize $\pi_u(w_g, \tilde{w}_n) + \sum_{i \in g} \pi_i(w_g, \tilde{w}_n)$. By assumption 4a, this is strictly concave. The first order condition for the optimal value of $w_g$ is given by:

$$\frac{\partial \pi_u}{\partial w_g} + \frac{\partial \pi_u}{\partial w_n} \tilde{w}_n + g \frac{\partial \pi_g}{\partial w_g} + g \frac{\partial \pi_g}{\partial w_n} \tilde{w}_n = 0$$

Suppose $w_g = w^0$. By definition and assumption 3, we know that $\tilde{w}_n(w^0) = w^0$.

Further, at $(w^0, w^0)$, $\frac{\partial \pi_u}{\partial w_g} = \frac{\partial \pi_u}{\partial w_n} = 0$. Thus the left hand side of the first order condition is equal to $g \frac{\partial \pi_g}{\partial w_g} + g \frac{\partial \pi_g}{\partial w_n} \tilde{w}_n$ when $w_g = w^0$. 

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By assumption 3 \( \frac{\partial \pi_g}{\partial w_g} < 0 \) so that by assumption 4a, \( g \frac{\partial \pi_g}{\partial w_g} + g \frac{\partial \pi_g}{\partial w_n} \frac{\partial \hat{w}_n}{\partial w_g} < 0 \)

when \( w_g = w^0 \) if \( \frac{\partial \hat{w}_n}{\partial w_g} < 1 \). But this follows directly from lemma 5. Thus, when \( w_g = w^0, \pi_n(w_g, \hat{w}_n) + \sum_{i \in g} \pi_i(w_g, \hat{w}_n) \) is decreasing in \( w_g \) so that by concavity the optimal value of \( w_g \) set by the buying group and the input supplier will be strictly less than \( w^0 \).

We can now summarize the outcome for the situation where the buyer group and the input supplier bargain in the absence of a commitment over the input market price that will be paid by downstream firms outside the bargaining group.

**Proposition Seven:** With a buyer group and bargaining without input market price commitment:

(a) the price paid by the members of the buyer group will be strictly less than the market price in the absence of the buyer group;

(b) the market price paid by downstream firms who are not in the buyer group will be strictly greater than the price paid by members of the buyer group; and

(c) the market price paid by downstream firms who are not in the buyer group may be above, below or the same as the market price that arises in the absence of the buyer group.

Proposition seven simply follows from lemma four, five and six. Comparing proposition seven and proposition three shows that the market outcomes that arise from the formation of a buyer group differ depending on the ability of the input supplier to commit to a market price for ‘outside’ firms before any negotiations with the buyer group. With commitment, the market price depends on the relative bargaining power of the input supplier and the buyer group. Without commitment, there is a unique market price that will be paid by outside firms and the degree of bargaining power is irrelevant for this market price.

Further, while outside firms always pay a price at least as high as \( w^0 \) when the input supplier can commit in advance to a market price, when the input supplier can’t commit to the market price in advance, the outside firms may pay a price lower than \( w^0 \). As
noted in lemma four, this will occur whenever \( \frac{\partial^2 \pi_u}{\partial w_g \partial w_n} > 0 \) at \( w_g = w_n = w^0 \), a situation that is likely to arise in many circumstances.

In the absence of market price commitment, the market price may fall after a buyer group is formed. However, this does not mean that firms outside the buyer group are better off. While the market price may fall, the marginal price paid by the members of the buyer group falls further. Thus, outside firms face more aggressive competition from the buyer group.

If the input price to all firms falls, then consumers would be expected to be better off. However, it is not clear what happens to the prices of the final products when the market price rises above its original level but the price paid by the members of the buyer group falls. To explore these issues further, in the next section we develop a simple example.

5. Example of Cournot competition with linear demand

Suppose that the \( m \) firms all produce a homogeneous good and interact as Cournot competitors. Downstream demand is given by \( \mathbf{R} - \mathbf{Q} = \mathbf{a} - \mathbf{bQ} \) where \( Q = \sum_{i=1}^{m} q_i \). Other than the relevant upstream input, the downstream firms have no other costs. The upstream firm has zero marginal cost. In this situation it is easy to solve for the equilibrium downstream outputs, profits and downstream price given input prices \( w_g \) and \( w_n \):

\[
q_g = \frac{a - (n + 1)w_g + nw_n}{b(1 + n + g)}; \quad q_n = \frac{a - (g + 1)w_n + gw_g}{b(1 + n + g)}; \quad Q = \frac{(g + n)a - gw_g - nw_n}{b(1 + n + g)};
\]

\[
P = \frac{a + gw_g + nw_n}{1 + n + g}; \quad \pi_g = \frac{(a - (n + 1)w_g + nw_n)^2}{b(1 + n + g)^2}; \quad \pi_n = \frac{(a - (g + 1)w_n + gw_g)^2}{b(1 + n + g)^2}.
\]

In the absence of the buyer group, \( w_g \) equals \( w_n \). The profit maximizing input price set by the upstream supplier is \( w^0 = \frac{a}{2} \).
Suppose that the input supplier can commit to the input market price prior to negotiating with the buyer group. Then the input price \( \hat{w}_g(w_n) \) will be set to maximize 
\[
\pi_u(w_g, w_n) + \sum_{i=1}^{g} \pi_i(w_g, w_n)
\]
subject to firms not in the buyer group producing non-negative output, \( q_i(w_g, w_n) \geq 0 \). Thus, \( a(g-n-1) - 2g(n+1)\hat{w}_g + 2ngw_n \leq 0 \) subject to \( a - (g+1)w_n + gw_g \geq 0 \). Substitution shows that the non-negativity constraint on \( q_n \) always binds when \( w_n \geq w^0 = \frac{a}{2} \). But if \( q_n=0 \) then \( \hat{w}_g = \frac{a(g-1)}{2g} \). Thus:
\[
\hat{w}_g = \text{Min} \left[ \frac{a(g-1)}{2g}, \frac{(g+1)w_n}{g} \right] \text{ when } w_n \geq \frac{a}{2}.
\]
Substitution shows that the minimum is always given by \( \hat{w}_g = \frac{a(g-1)}{2g} \) when \( w_n \geq \frac{a}{2} \) with \( q_n=0 \). Given that the same marginal input price is set for the buyer group regardless of the market price, \( \pi_u(\hat{w}_g(w_n), w_n) + \sum_{i=1}^{g} \pi_i(\hat{w}_g(w_n), w_n) \) is independent of \( w_n \) and, by substitution, is given by \( \frac{a^2}{4b} \). This is the integrated monopoly level of profit.

The upstream supplier will set the market price \( w_n \) to maximize
\[
\Pi_u(w_n) = (1-\alpha)\pi_u(w_n) + \alpha \left( \frac{a^2}{4b} - g\pi_g(w_n) \right).
\]
By substitution:
\[
\Pi_u(w_n) = (1-\alpha) \frac{m(a-w_n)w_n}{b(m+1)} + \alpha \left( \frac{a^2}{4b} - \frac{g(a-w_n)^2}{b(m+1)^2} \right).
\]
The first order condition for the optimal market input price is:
\[
\frac{m(1-\alpha)(a-2w_n)}{b(m+1)} + \frac{2g\alpha(a-w_n)}{b(m+1)^2} = 0.
\]
If the bargaining power all rests with the buyer group (\( \alpha = 0 \)) then the supplier will set the input price at \( w_n = w^0 = \frac{a}{2} \). If the supplier has all the bargaining power (\( \alpha = 1 \)) then
the supplier will set the input price at \( w_n = a > w^0 \). For \( \alpha \in (0,1), \)
\[
w_n = \frac{m(m+1)(1-\alpha)a + 2g\alpha}{2(m(m+1)(1-\alpha)a + g\alpha)}.\]
Solving for \( \frac{\partial w_n}{\partial \alpha} \) it is easy to show that \( \frac{\partial w_n}{\partial \alpha} > 0 \) for \( \alpha \in (0,1) \).

Thus, in the presence of a buyer group, and with commitment over the market price, the market price will be set by the supplier such that, after bargaining with the buyer group, those firms outside the group find it unprofitable to produce. Negotiations lead to an input price for the buyer group that does not depend on the market price and leads to the level of profit that would be obtained by a single vertically integrated monopoly.

Even though outsiders never produce in equilibrium, the market price still influences the bargain between the buyer group and the upstream supplier so that the market price is increasing in the bargaining power of the input supplier. In particular, the market price with the buyer group is never less than the market price in the absence of a buyer group, and is strictly greater than this level whenever the input supplier has some bargaining power.

Finally, it is worth noting that, due to the removal of double marginalization, the price faced by final consumers will fall after the creation of the buyer group.

Alternatively, suppose that the input supplier cannot commit to the market price for ‘outsiders’ before negotiating with the buyer group. The buyer group will negotiate a per unit input price of \( w_g \). The input supplier will set \( w_n \) to maximize its profits given \( w_g \). Substituting for \( q_n \) and \( q_g \) and differentiating gives the first order condition for \( w_n \)
\[
\frac{1}{b(n+g+1)}\left[ na - 2n(g+1)w_n + 2ngw_g \right] = 0
\]
Thus, \( w_n = \frac{a + 2gw_g}{2(g+1)} \). Note that

- if \( w_g = w^0 = \frac{a}{2} \) then \( w_n = \frac{a}{2} \);
- \( w_n \) is increasing in \( w_g \) so that when \( w_g < w^0 \) then \( w_n < w^0 \); and
when \( w_g \in [0, w^0) \) then \( w_n > w_g \).

Substituting \( w_n \) back into the profit functions of both types of firms we see that:

\[
\pi_g = \frac{1}{b(n + g + 1)^2} \left[ \frac{1}{2(g + 1)} \left( 2ga + 2a + na - 2gw_g - 2w_g - 2nw_g \right) \right]^2
\]

and

\[
\pi_n = \frac{1}{b(n + g + 1)^2} \left[ \frac{a}{2} \right]^2.
\]

Note that for the buyer group if \( w_g \in [0, w^0] \) then \( \frac{d\pi_g}{dw_g} < 0 \).

Further, once the feedback effect from the upstream supplier changing \( w_n \) in response to a change in \( w_g \) is taken into account, the profit of the outsider firms is independent of \( w_g \) and is the same profit as that made by the relevant firms prior to the formation of the buyer group. Thus the formation of the buyer group has no effect on the profit of the outsiders in this situation.

Substituting \( w_n \) into the joint profit of the input supplier and the buyer group, and solving for the optimal value of \( w_g \), we see that the bargaining group will set

\[
w_g = \frac{a}{2} - \frac{1}{2(g + 1)} \left( a + \frac{2g + an(g - 1)}{2(g + n + 1)} \right).
\]

Note that this is less than \( w^0 \). Further, as the input supplier and the buyer group could have set \( w_g = w^0 \) knowing that by subgame perfection this would lead to \( w_n = w^0 \), the joint profit of the buyer group and the input supplier must be higher in equilibrium than in the absence of the formation of the buyer group. The relative bargaining power of the parties will determine how this gain is divided.

Finally, note that as \( w_n > w_g \), members of the buyer group will prefer to purchase at the ‘group’ price rather than at the subsequent market price. Also, as \( \frac{d\pi_g}{dw_g} < 0 \) and \( w_g < w^0 \) the profit of the buyer group is higher after the buyer group is formed even if they have no bargaining power, so that (in the absence of any costs of forming the group) it is always in the relevant firms’ interest to form the buyer group. Further, as all input prices are lower, total output is higher so that the price faced by consumers will fall after the creation of the buyer group. In this sense, the creation of the buyer group in the absence of market price commitment leads to a weak Pareto improvement where the supplier, the
members of the buyer group and consumers are better off and the outside firms are no worse off.

In summary, in the case of Cournot competition with linear demand, the creation of the buyer group leads to significantly different market outcomes and effects on outsiders depending on whether the input supplier can commit to a market price before bargaining with the buyer group. If such commitment is possible, the input supplier will set a market price that drives outsiders from the market. In contrast, if commitment is not possible then the market price will be set lower than its value in the absence of the buyer group, and the profit of outsiders is unaffected by the creation of the buyer group. In both cases, however, final consumers benefit through lower prices.

6. Buyer power and outsiders

There is an on-going debate in the economics literature about the effect of buyer power on outsiders. Increased upstream buyer power for some downstream firms can affect the input prices paid by other downstream firms because it changes the nature of the input supply market.\(^{15}\) For example, ‘outsiders’ may lose due to cost shifting. If sellers have increasing returns to scale and some downstream firms can negotiate to pay only marginal cost, then in equilibrium sellers must recoup the groups’ ‘share’ of the inframarginal cost from all other buyers. Thus, the improved price received by some downstream firms is reflected in higher prices to other firms.\(^{16}\) This has been referred to by the UK Competition Commission as a ‘waterbed effect’.\(^{17}\)

Alternatively, increased buyer power for one downstream firm may alter the bargaining position of other downstream firms. Both Chen (2003) and Inderst (2007) analyze this possibility. Chen shows how an increase in bargaining power by a dominant firm can lead to lower input prices for fringe firms, as an upstream monopolist ‘rebalances’

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\(^{15}\) In the simplest case, if the upstream market has a single price to all downstream firms, the exercise of buyer power by some firms will lower the upstream market price and so lower the price paid by other downstream firms. Mills (2007) provides an example of this.

\(^{16}\) For example, see Mathewson and Winter (1996) and Majumdar (2005). Mathewson and Winter focus on a buyer group while Majumdar looks at the case of a merger. Costs and the related convexity or concavity of the surplus function may also affect the ability of large buyers to negotiate volume discounts. See, for example, Chipty and Snyder (1999) and Inderst and Wey (2007).

downstream competition to increase its profits. Inderst shows how an improved price to one downstream firm alters the relative profitability of an outside option to other downstream firms, undermining their bargaining position and raising their negotiated upstream price.  

In our model, increased ‘buyer power’ has two sources. When the buyer group is formed, the interaction between the members of the group and the supplier change. The market outcome, including the price charged to outside firms changes even if the input supplier has all the bargaining power ($\alpha = 1$). Second, if the buyer group has increased bargaining power ($\alpha$ decreases) this may again alter the price paid by outsiders.

When the input supplier commits to the market price before bargaining, the formation of the buyer group will raise the price paid by outsiders. In this sense, there is a ‘waterbed’ effect. However, if the bargaining power of the buyer group rises in this situation, the price paid by outside firms falls – the opposite of the ‘waterbed’ effect.

The intuition behind this second result is similar to Chen (2003). In Chen’s paper, the supplier lowers the price to outsiders when the dominant firm’s bargaining power rises as this ‘shifts’ some profits away from the bargained outcome. In our model, the supplier tends to lower the market price when faced by increased buyer power as this raises its outside option and improves its bargaining position. Unlike Chen, however, the change in market price does not depend on outside firms actually producing. Indeed, as the example presented above shows, increased bargaining power may lower the market price even though outside firms never produce in equilibrium.

Chen does not consider the market in the absence of the dominant firm. In contrast, our model shows that the ‘creation’ of buyer power, through the formation of a buyer group, can itself raise the market price to outside firms. The moderation of this price that occurs as the bargaining power of the buyer group increases merely serves to offset this initial price rise. Indeed, the market price only returns to its original level in our model when the buyer group has all the bargaining power. In this sense, the offsetting effect noted by Chen may merely serve to offset an initial price rise due to the ‘creation’ of the dominant

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18 Dobson and Waterson (1997) and von Urgern-Sternberg (1996) examine buyer power with explicit models of bargaining. However, these papers do not have ‘outsiders’ as all downstream firms remain symmetric.
firm. Further, even if the market price does not change, the profitability of the outside firms may still be greatly affected by the creation of a buyer group. In the example presented above, the outsiders always make zero profits after the buyer group is formed, even if the market price is unaltered.

If the input supplier cannot commit to the market price before bargaining then the effects of ‘buyer power’ on outsiders is very different. The formation of the buyer group may raise or lower the market price to outsiders because it changes the input demand of those outsiders. In the absence of a buyer group, downstream firms are price takers. Forming a buyer group enables a subset of downstream firms to negotiate directly with the upstream suppliers resulting in a lower marginal input price. As a result, the members of the buyer group become ‘more aggressive’ competitors in the downstream market. This has two-effects on the input demand function of other downstream firms: it will tend to reduce demand at any specific input price and it may also change the price-sensitivity of the demand function. The first of these effects will reduce the market price set by the input supplier. The second effect will depend on the direction of the change. If input demand by outsiders becomes more price sensitive, then this will also tend to reduce the equilibrium input price. The reverse is likely if input demand by outsiders becomes less price sensitive.

Once the buyer group is formed, however, the market price does not depend on the groups bargaining power. A change in bargaining power only changes the division of profits between the input supplier and members of the buyer group. In this sense, there is no relationship between changes in buyer power and the market price (i.e. no waterbed effect) although the formation of the buyer group may lead to an ambiguous change in the market price.

In brief, our model shows that the effect of buyer power is sensitive to the timing of bargaining and price setting. It also highlights two separate sources of market price change – the creation of buyer power through the formation of a buyer group and the change in bargaining power once the group is formed.
7. Contingent contracts

The importance of commitment in market settings is well known. As such, the significant difference between the results presented in propositions three and seven, due to the changing ability for a supplier to commit to a market price, is not unexpected. However, the model also only considers bargaining over two-part tariffs. In the situation without commitment, this restriction is important.

Suppose that in the absence of market price commitment, the buyer group and input supplier can set a menu of two-part tariffs that are contingent on the market price that is subsequently set by the input supplier after bargaining is complete. Thus the parties bargain over contracts \( (F, w_s; w_n) \). For any market price \( w_n \) set by input supplier post-bargaining, \( (F, w_s; w_n) \) specifies a particular two-part tariff \( (F, w_s) \) for the buyer group.

Take assumptions 1, 2, 3 and 4 as satisfied. Proposition 8 shows that in this situation the use of contingent contracts changes the results for the case without input price commitment considerably. But the results still differ significantly from the case with input price commitment.

**Proposition Eight:** With a buyer group and bargaining without input market price commitment but where bargaining occurs over market-price-contingent two-part tariffs:

(a) the market price will be \( w_n^* \);
(b) \( w_s < w_n \) and
(c) the bargaining power parameter, \( \alpha \), has no effect on the market price paid by outsiders.

**Proof:** Because bargaining occurs over market-price contingent contracts, bargaining will effectively set both \( w_n \) and \( w_s \). To see this note that any market price can be implemented by associating a finite fixed fee \( F \) with the relevant market price and \( F = -\infty \) for any other market price. In other words, the buyer group and input supplier can negotiate a forcing contract that effectively sets the market price by making it unprofitable for the input supplier to subsequently set any other market price.

In this situation, bargaining between the buyer group will involve contracts that effectively directly set \( w_n \) and \( w_s \) to maximize joint profits. From lemma one, it is optimal for the buyer group and input supplier to set \( w_n = w_n^* \). Point (a) follows directly. In other words, bargaining will lead to contingent contracts
\[ (F, w_g; w_n) \] where \( F \) is finite and non-negative and \( w_g = \tilde{w}_g(w_n) \) when the input supplier subsequently sets a market price of \( w_n = w_n^* \). If the supplier sets any other market price then \( F = -\infty \). By subgame perfection the input supplier will then set the market price \( w_n^* \).

Point (b) is a direct consequence of lemma two. Point (c) follows as the market price doesn’t vary with \( \alpha \).

Proposition 8 shows that, even with complete contingent contracts, the effect of the buyer group differs depending on the input supplier’s ability to commit to the market price. With commitment, the market price is established prior to bargaining and is manipulated by the input supplier to alter the outcome of the bargaining. In contrast, complete contingent contracts imply that the buyer group and supplier jointly set the market price through the bargaining process.

If the input supplier has significant bargaining power (\( \alpha \) close to unity) then the market price may be lower with complete contracts but no market price commitment. If bargaining power is stronger on the side of the buyer group, then the reverse is likely to hold. Importantly, however, with contingent contracts the market price is independent of \( \alpha \). In other words, once the buyer group is formed, there is no further variation to the market price depending on the ‘power’ of the buyer group. This has significant implications for the debate on buyer power as discussed above.

In the absence of market price commitment, setting contingent contracts will lead to at least as much, and generally more, profit for the input supplier and the buyer group than if they can only set a simple two-part tariff. This is obvious as the contingent contracts could always mimic the outcome of the simple two-part tariff but in general this will not maximize the joint surplus.

Such contracts, however, are likely to face significant antitrust hurdles. Authorities are likely to determine that contracts based on a contingent market price are an attempt by the buyer group and supplier to agree on the price that will be paid by the buyer groups’ direct competitors for an essential input. Such a view is, of course, correct, and is likely to lead to prosecution. In this sense, while contingent contracts may allow the buyer
group and input supplier to mitigate the commitment issue, they involve significant legal risk. ¹⁹

8. Conclusion

This paper has developed a simple model to explore the consequences of a buyer group on market behavior. In particular, the focus has been on the price paid by competitive rivals outside the buyer group. Our results show that the consequences of a buyer group can be highly sensitive to the exact timing of bargaining. Indeed, even the direction of change in the market price following the formation of a buyer group will depend on the ability of the upstream supplier to commit to that price prior to bargaining with the buyer group.

The results of this paper provide a warning to antitrust authorities and others who seek to encourage or evaluate buyer groups. The benefits from a subset of firms forming a buyer group may be significant. Indeed, in the Cournot example presented in this paper where the supplier cannot commit to the market price in advance, the formation of a buyer group led to a weak Pareto improvement. The buyer group, supplier and consumers all gained due to the reduction in double marginalization, while the outsiders were indifferent. The market price to outsiders fell but this was offset by the even lower marginal price received by group members. Overall, outsiders’ profits were unchanged.

At the same time, simply changing one parameter – the ability of the supplier to commit to the market price – significantly changes the consequences of the buyer group for outsiders. While consumers, the supplier and the members of the group all gain, the outsiders are rendered unprofitable and cease production.

This paper is complementary to a range of other literature involving buyer groups and bargaining. For example, our model takes membership of the buyer group as given. Thus, we avoid a variety of issues relating to the endogenous formation of coalitions and

¹⁹ The legal risk is highlighted by the recent European Commission decision regarding Intel. The Commission pursued Intel over agreements made between Intel and its customers relating to the purchase of inputs from Intel’s competitor. On the 13th May 2009 the European Commission imposed a fine of 1.06 billion Euro ($US 1.44 billion) on Intel for abuse of dominant position in violation of Article 82 of the EC Treaty.
bargaining groups. These issues are briefly explored in the appendix. The relationship between our results and the broad literature on buyer power has been discussed in section 5 above.

The mutually beneficial relationship between the buyer group and the supplier highlighted by the results in this paper explains why suppliers might support the creation of these groups. This situation is common in Australia where suppliers often favor the ‘authorisation’ of a buyer group under the relevant antitrust laws. The model, however, also highlights the incentives of a buyer group and a supplier to use contracts that effectively fix the input price for outsiders. This raises a variety of antitrust issues that are beyond the scope of this paper.

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20 Maschler, M. (1992) provides a survey of this literature.
References


Competition Commission (2003) *Safeway plc and Asda Group Limited (owned by Wal-Mart Stores Inc); Wm Morrison Supermarkets PLC; J Sainsbury plc; and Tesco plc*, Cm5950, HMSO.


The focus of this paper is on the effects of a buyer group on outsiders. The qualitative results presented in this paper do not depend on the specific size of the buyer group. Thus, the results presented in propositions three, seven and eight do not depend on the size of the buyer group and still hold true even if the size of the group changes as the ability of the input supplier to commit to the market price changes.

It is, however, worth considering the economic basis for forming a buyer group. This is driven by two factors. First, by forming a buyer group, some downstream firms can negotiate a non-linear tariff with the input supplier. In comparison to a linear market price, the non-linear tariff helps eliminate any double marginalization so it can be mutually beneficial to the buyer group and the input supplier. At the same time, there must be negotiating or organizational cost, or legal impediments, that prevent both (a) the input supplier simply negotiating a non-linear tariff individually with each downstream firm and (b) the buyer group simply absorbing all downstream firms so that effectively each downstream firm receives a non-linear tariff.

Intuitively, negotiating a non-linear tariff between the input supplier and the buyer group will involve additional negotiating, legal and contracting costs compared to the supplier simply setting a market price. Similarly, we would expect that the internal costs of organizing a buyer group will increase as the group increases in size.

To see how these costs impinge on the endogenous formation of a buyer group, consider a simple model. As a base, assume that there is no ‘negotiating cost’ to either the input supplier or a particular downstream firm if the supplier simply sets a uniform market price for that firm. In contrast, to engage in one set of negotiations with a buyer group, the input supplier faces a negotiating cost of $\gamma_g \geq 0$. To negotiate with more than one group (each of which may be a single firm) makes each set of negotiations infinitely expensive.

A buyer group that negotiates with the input supplier faces costs of $\gamma_g + G(g)$ where $\gamma_g$ is a constant, $\gamma_g \geq 0$, $g$ is the number of members in the buyer group, and $G(g) \geq 0$ at all $g$, is strictly increasing in $g$, and approaches infinity for $g = \bar{g}$ where $\bar{g} < m$.

These costs reflect the direct costs of bargaining between the input supplier and the buyer group as well as the internal coordination costs for the buyer group. In other words, $\gamma_u$ and $\gamma_g$ reflect the costs of bargaining between the supplier and buyer group, while $G(g)$ is the cost of coordinating the firms in the buyer group.

Suppose that prior to any market interaction, a buyer group can form to negotiate with the input supplier. Let $(\hat{w}_g, \hat{w}_n)$ refer to the equilibrium price vector that will arise if there are $g$ firms in the buyer group. These prices will, in general, depend on both the nature of the bargaining (either with or without input price commitment) and the number of firms in the buyer group. The total surplus to the members of the buyer group will be $g \pi_g (\hat{w}_g, \hat{w}_n) - \gamma_g - G(g)$ while sellers outside the buyer group will receive $\pi_n (\hat{w}_g, \hat{w}_n)$.
We can consider a buyer group to be stable if each member of the buyer group prefers to be in the group rather than to unilaterally leave the group and no firm outside the group can profitably join the group without making existing members worse off. In this situation, so long as $\gamma_u$, $\gamma_g$ and $G(1)$ are sufficiently small, then a stable buyer group with less than all firms will generally exist.

To see this, consider the linear Cournot example presented in section 5. Regardless of the nature of price commitment, a stable buyer group in that situation will have a single member. Note that in this example $\pi_n(\hat{w}_g, \hat{w}_n) = 0$ and $g\pi_g(\hat{w}_g, \hat{w}_n) - \gamma_g$ is constant regardless of the size of the buyer group. Thus as $G(1) < G(2)$, the stable buyer group has only one firm.

In contrast, suppose that all downstream firms sell independent products. In that situation, $(\hat{w}_g, \hat{w}_n)$, $\pi_g(\hat{w}_g, \hat{w}_n)$ and $\pi_n(\hat{w}_g, \hat{w}_n)$ do not depend on the size of the buyer group. A stable buyer group of size $g$ will exist for the smallest $g$ such that $G(g + 1) - G(g) > \pi_g(\hat{w}_g, \hat{w}_n) - \pi_n(\hat{w}_g, \hat{w}_n)$. With any smaller buyer group, an outside firm could offer to compensate the existing members of the buyer group for the increased costs they impose on the group while still finding it profitable to join the group. So long as $\gamma_u$, $\gamma_g$ and $G(1)$ are sufficiently small, double marginalization ensures that a buyer group will form with fewer than $m$ members.

In both of these examples, the size of the buyer group did not depend on the ability of the input supplier to commit to a market price before bargaining. However, this will not generally be the case. Generally to endogenize the formation of the buyer group it is necessary to specify how profits change as the size of the buyer group changes and, while this is generally possible using a specific competitive model, it is not possible in the general model analyzed in this paper. However, as already noted, this does not affect the qualitative results presented in this paper as they do not depend on the exact size of the buyer group. In this sense, a full model of buyer group formation and negotiation in a specific competition framework remains a topic for further research.