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Abstract

This paper explores why competing firms can choose to outsource to an external common supplier that does not have a cost advantage in input production. The supplier, through its contract offers, manages to generate asymmetry, to alter product market competition, and to extract profits from the competing firms. Two-part tariffs and sequential contracting are both crucial for the emergence of outsourcing. The supplier purposefully avoids industry profit maximization to enlarge its profits share. Both consumer and total welfare benefit from the presence of an otherwise redundant supplier in the market.

JEL-Codes: D430, L110, L220, L230, L240.

Keywords: outsourcing, strategic outsourcing, make-or-buy, two-part tariffs, common supplier, sequential contracting.

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1 Introduction

Nowadays, it is rare to find a firm that does not outsource part of its production.¹ The most obvious and extensively studied motive for outsourcing is cost-reduction, typically due to external suppliers' cost advantages in input production.² This is consistent with many instances of outsourcing to suppliers located in countries with low labor or material costs, such as China and India (Deloitte, 2016). Not all firms, however, outsource to suppliers with lower costs. Boeing, for example, outsources the production of a significant percentage of its aircraft fuselage to IHI, a Japanese consortium, although neither labor costs nor other costs in the Japanese aircraft industry are known to be lower than in the US.^{3,4} In fact, wages in Japan as well as in several other countries where key Boeing suppliers hang their hats, such as Germany and France, are high. Furthermore, with the cost advantages of suppliers from countries such as China and India steadily deteriorating in recent years, many US firms have started to outsource domestically; they procure inputs from suppliers with access to the same production factors as them.⁵ In line with this trend, input suppliers, such as Dow Chemicals and Flex n Gate, have opened or expanded their production plants in the US.

Widespread outsourcing goes hand in hand with the emergence of large input suppliers – contract manufacturers – that commonly serve competing firms.⁶ For instance, both Boeing and Airbus source jet engine components from IHI, Apple and Samsung procure ceramic capacitors from Murata, Ford Motors and General Motors purchase automotive electronics from Visteon and exterior automotive components from Flex n Gate, Mercedes-Benz and BMW assign their cars assembly to Magna, Cisco and HP contract out the design engineering of their network hardware to Jabil.

Motivated by these observations, we explore in this paper the incentives of competing firms

¹For information on the extent of outsourcing, see e.g., Statista (2022).

²The cost-reduction motive for outsourcing has been extensively studied in the literature (e.g., Lewis and Sappington, 1989, van Mieghem, 1999, Shy and Stenbacka, 2003). Another well recognized motive for outsourcing is firms' intention to focus on their core activities, such as product design, innovation, and marketing (e.g., Quinn and Hilmer, 1994).

³See Chen et al. (2011) for details.

⁴Similarly, Ford Motors sources automotive electronics from its spin-off, Visteon. As Grahovac et al. (2015) argue, Visteon maintains high-wage unionized operations, and thus, Ford's decision to source inputs from Visteon is not driven by Visteon's access to cheaper production factors.

⁵The deterioration of the cost advantages of China and India is mainly due to increases in local wages as well as in transportation costs and/or tariffs on imports from these countries. For evidence of the domestic outsourcing trend, see e.g., Local Outsourcing on Rise in US, *The Economic Times* (August 4, 2012), Outsourcing and Offshoring: Here, There and Everywhere (special report), *The Economist* (January 19, 2013), Pearce (2014), Why 'Nearshoring' Is Replacing 'Outsourcing', *The Wall Street Journal* (June 4, 2014), and 'Made in China' Isn't so Cheap Anymore and that could Spell Headache for Beijing, *CNBC* (February 27, 2017). For case studies, visit: <http://www.reshorennow.org>.

⁶In the electronics sector, the Chinese Foxconn is the largest contract manufacturer reporting more than \$138 billion profits in 2017. In the biotechnology sector, the profits of the US contract manufacturer Freudenberger Medical exceeded \$1 million in 2016.

to outsource input production to a common supplier without a cost advantage in production rather than to undertake input production in-house. We abstract intentionally from the cost-reduction rationale of outsourcing, to focus on the strategic role of contracting on firms' input sourcing patterns and their efficiency. We show that the role that outsourcing to an external common supplier can play is to provide a mechanism by which firms can credibly commit to input sourcing costs that generate asymmetry in product market competition and rents for an otherwise *redundant* external supplier.

In our initial framework, two competing firms produce a homogenous final good using an input that they either produce in-house or source from a monopolistic external supplier. The supplier faces the same input production cost as its potential customers and makes *sequential* two-part tariff offers to the two firms. Firms 'outsource' when they accept the supplier's offers, before they compete in the final good market in quantities.

Both firms outsource in equilibrium. The emergence of outsourcing hinges on the external supplier's ability to intensify competition to extract surplus from the competing firms. More specifically, it hinges on its ability to manipulate, through its contracting offers, the input sourcing costs of its customers and generate cost asymmetry between them. Two-part tariffs grant such flexibility; they allow the supplier to charge a wholesale price in order to favor or disfavor a customer and, in turn, use the fixed fee to recuperate or compensate. In the event that the supplier served only one firm, it would offer a low wholesale price and transform its unique customer to a Stackelberg leader. Given this, the supplier manages to induce outsourcing by both firms, setting a positive mark-up to the firm with which it trades first, subsidizing the second firm, and sufficiently compensating both of them for their Stackelberg follower and leader outside options respectively. This reveals a novel motive for outsourcing: by delegating input production to a common supplier, competing firms make credible otherwise unattainable product market choices.

Interestingly, the supplier serves both firms not in order to enjoy higher input demand, but to increase the profits that it makes and extracts from the second firm. Industry profits would be maximized if a firm was fully foreclosed from the market, but the supplier prefers to keep both firms active. The reason is that foreclosure would reinforce its preferred customer's – the second firm's – outside option of in-house production. Stated differently, the supplier incorporates both the rent generation and the distributional effects of contracting.

Outsourcing to a common supplier benefits consumers and welfare. This is driven by the subsidization of the second firm, via the wholesale price, that reduces the retail price. It follows that the presence of a large contract manufacturer in the market – even when it is *redundant* and not more efficient than original brand manufacturers – can be socially efficient.

The ability and the incentives of the supplier to induce outsourcing are contract dependent. With wholesale price contracts, a supplier without a cost advantage is unable to generate downstream asymmetry and rents for itself. As a consequence, the supplier prefers to make two-part tariff offers to its potential customers rather than wholesale price contract offers.

The timing of contracting between the supplier and its potential customers also affects the efficiency of contracting and the generated rents. Importantly, it affects rent-shifting: if the supplier contracted with the two firms simultaneously, it would be unable to induce outsourcing profitably for itself; hence, it would not have incentives to enter into the market. The same would occur if the supplier did not disclose to its customers their rival's contract terms. In light of this and in line with the assumptions of our initial model, we show that the supplier optimally chooses to contract sequentially with the competing firms as well as that it would choose to disclose their contracting terms.

Extending our main analysis, we show that the external supplier manages to induce outsourcing by both firms when their products are imperfect substitutes as well as when they compete in prices. Interestingly, we observe in the former case that the supplier's profits increase with product substitutability. This contrasts with the vertical contracting literature (e.g., Rey and Tirole, 2007) which demonstrates, instead, that when products become closer substitutes, and thus, competition intensifies, a monopolist supplier suffers more from opportunism and makes less profits. The increase in product substitutability, as we show, has an additional effect when the supplier's customers have an outside option, as in our framework: it weakens the outside option of in-house production, and allows the supplier to extract a higher share of its customers' profits.

The structure of the rest of the paper is as follows. In Section 2, we review the related literature. In Section 3, we describe our model and present the benchmark case of in-house input production. In Section 4, we explore the implications and incentives of outsourcing. In Section 5, we endogenize the observability of contract terms, the timing of contracting, and the contractual form, as well as we discuss their strategic role. In Section 6, we extend our model to consider negotiations, product differentiation, and price competition. In Section 7, we conclude. All the proofs are relegated to the Appendix unless a proof is straightforward in which case it is omitted.

2 Literature Review

Various fields of economics and management, including industrial organization, operational management, and marketing, study outsourcing.⁷ Many explore its cost-saving motives (e.g., Lewis and Sappington, 1989, van Mieghem, 1999, Shy and Stenbacka, 2003). Others provide strategic explanations for outsourcing by competing firms. Within the latter, some focus on outsourcing to multiple suppliers or to vertically integrated suppliers (e.g., Chen et al., 2004, Chen et al., 2011, Feng and Lu, 2012 and 2013, Bakaouka and Milliou, 2018, Colombo and Scrimatore, 2018), while others, as our paper, focus on outsourcing to a common external supplier (e.g., Cachon and Harker, 2002, Buehler and Haucap, 2006, Gilbert et al., 2006, Arya et al. 2008, Feng and Lu, 2012 and 2013, Grahovac et al., 2015). According to most of this literature, there is a collusive motive behind outsourcing to a common supplier. In particular, in Cachon and Harker (2002) outsourcing mitigates the intensity of price competition that arises from scale economies. In Buehler and Haucap (2006) outsourcing softens competition by resulting in exogenously assumed higher wholesale prices and in Gilbert et al. (2006) and Grahovac et al. (2015) by curbing overinvestment in cost-reduction. In Arya et al. (2008), instead, a firm outsources to the supplier of its rival to alter the supplier's vested interests in its rival and increase its wholesale price. A common assumption that these papers make is that the common supplier enjoys a cost advantage; without this assumption, outsourcing to a common supplier does not arise in their environments.^{8:9}

Our paper complements these works in three respects. First, we demonstrate that a cost advantage is not necessary for the emergence of outsourcing to a common supplier and thus provide a justification for the documented cases of outsourcing to suppliers with access to similar production factors as their customers. Second, we put forward a novel mechanism to explain outsourcing. That is, a rent-shifting mechanism from the competing firms to the common external supplier through the latter's ability to convert, through sequential contracting, Cournot competition to Stackelberg competition. Third, we study outsourcing under a different contractual form, two-part tariffs, than the commonly assumed in the outsourcing

⁷A large branch of the economics literature, starting with Coase (1937), focuses on firm's boundaries and points out that asset specificity and contract incompleteness contribute to the expansion of boundaries, thereby restrict outsourcing (e.g., Grossman and Hart, 1986, Grossman and Helpman, 2002).

⁸An exception is Cachon and Harker (2002), who consider a common supplier without a cost advantage, but for outsourcing to arise in their setting the presence of economies of scale in input production is crucial.

⁹Liu and Tyagi (2011) and Colombo and Scrimatore (2018) allow for suppliers without cost advantages but they do so in settings with outsourcing to different suppliers, and *not* to a common supplier, and with a different focus: the role of product position and of strategic delegation respectively.

literature wholesale price contracts.^{10,11} Two-part tariffs, as a number of empirical studies (e.g., Villas-Boas, 2007, Bonnet and Dubois, 2010 and 2015) demonstrate, are used in various industry sectors and, as we discuss below, have wide support in the vertical contracting literature. We show the crucial role of the contractual form as well as of other contractual features (observability, timing) for the emergence of outsourcing.

Our paper is also related to the literature on vertical contracting which studies contracting in various environments, including when a monopolist input supplier transacts with multiple competing firms (e.g., Cremer and Riordan, 1987, Hart and Tirole, 1990, McAfee and Schwartz, 1994, Taylor, 2002, Rey and Vergé, 2004, Milliou and Petrakis, 2007). Two-part tariffs, as this literature extensively demonstrates, outperform wholesale price contracts by, among other things, not giving rise to the ‘double marginalization’ externality.¹² Some papers in this literature, McAfee and Schwartz (1994), Marx and Shaffer (2004), Möller (2007) and Bedre-Defolie (2012), Münster and Reisinger (2021), and Do and Miklós-Thal (2023), similarly to our paper, consider sequential contracting between a common upstream supplier and competing downstream firms. However, these papers, unlike ours, consider contracting to downstream firms that lack alternative input sourcing options, thus, they exogenously assume outsourcing.¹³ We contribute to this literature by showing how the contractual form and the timing of contracting can influence firm’s input sourcing strategy as well as by demonstrating how the existence of alternative input sourcing options can affect the incentives for vertical foreclosure. Importantly, we provide a justification for the typically exogenously assumed in this literature vertical structure of the market by providing an explanation for why firms do not undertake input production in-house.

3 The Model

There are two firms in the market, firm 1 and firm 2, that produce a homogeneous good. Market demand is given by the standard linear demand function: $p(q_1, q_2) = a - q_1 - q_2$, where p is the price and q_i is the quantity supplied by firm i , with $i = 1, 2$.

¹⁰In this sense, our paper is also related to contributions which explore how two-part tariffs can induce vertical separation in place of vertical integration (e.g., Bonanno and Vickers, 1988, Rey and Stiglitz, 1995, Jansen, 2003) and strategic delegation (e.g., Fershtman and Judd, 1987, Sklivas, 1987). Most of these contributions though focus on settings with exclusive-specialized input suppliers rather than with a common supplier.

¹¹Feng and Lu (2013) examine outsourcing with two-part tariffs, but, as mentioned above, they assume that the supplier has a cost advantage. Without the cost advantage, in their setting with simultaneous contracting, outsourcing does not arise.

¹²Still, as this literature also demonstrates, two-part tariffs, due to the monopolist’s inability to commit that it will not behave opportunistically, do not always suffice for the maximization of industry profits.

¹³Aghion and Bolton (1987) and Marx and Shaffer (2007) also study a three-players environment with sequential trade. However, in their environment, the common player is the buyer which trades with competing suppliers.

To produce the good, each firm i uses an input in an one-to-one proportion. Both firms produce the input in-house at marginal cost s or outsource it to an external firm, firm S , whose marginal cost is also s , with $7s > a > s > 0$.¹⁴ When firm i outsources, it trades with firm S via a two-part tariff contract, consisting of a wholesale price per unit of input, w_i , and a fixed fee, f_i .¹⁵

Firms play a three-stage game. In stage one, firm S offers (w_1, f_1) to firm 1. Firm 1 decides whether to accept or reject the offer. In stage two, firm S offers (w_2, f_2) to firm 2, and, in turn, firm 2 accepts or rejects the offer. If and only if a firm rejects firm S 's offer, it produces the input in-house.¹⁶ In the last stage, firm 1 and firm 2 choose their quantities simultaneously and separately.¹⁷ All past actions and decisions are observed.¹⁸

As it follows from the above, the external supplier makes the contracting offers to its potential customers sequentially – it contracts with one customer at a time. This assumption can be considered quite natural as in many situations contracting requires the physical presence of the supplier. The same assumption can be found both in the literature on vertical contracting (e.g., Marx and Shaffer, 2004, Münster and Reisinger, 2021) and in the literature on outsourcing (e.g. Arya et al., 2008, Buehler and Haucap, 2006).¹⁹ Sequential contracting can also be justified, as Arya et al. (2008) argue, in environments in which firm 1 is an incumbent and firm 2 is an entrant in the market or, as Münster and Reisinger (2021) argue, by the fact that multilateral agreements are not allowed by antitrust law and they can be too costly. Importantly, as we demonstrate in Section 5, it can be justified by the fact that the external supplier is better off when it approaches its potential customers and contracts with them sequentially rather than simultaneously.

We solve for the pure strategy subgame perfect equilibria of the above described game

¹⁴The upper limit on a guarantees that the optimal wholesale prices will be non-negative.

¹⁵We consider trading through wholesale price contracts in Section 5 and show that the input supplier chooses to trade with two-part tariffs than with wholesale price contracts.

¹⁶The outsourcing contract is binding for all parties. This is a standard assumption in the outsourcing literature (e.g., Shy and Stenbacka, 2003, Buehler and Haucap, 2006, Gilbert et al., 2006, Arya et al. 2008, Feng and Lu, 2012 and 2013, Colombo and Scrimatore, 2018, Lommerud et al., 2021) and be justified, for instance, when firms undertake specific investments for the external supplier's input, when firms shut-down their own input production facilities, and when there are considerable lead times for the application of procurement plans. Anderson and Parker (2002) show that, due to learning effects, it is very difficult to reverse a decision to outsource. Similarly, the external supplier respects the agreed contract in order to maintain a reputation for not acting opportunistically by renegotiating contracts (e.g., McAfee and Schwartz, 1994) and/or because it might be prohibitively costly for the supplier too to alter its production plans.

¹⁷In some of the examples mentioned in the Introduction, quantity competition is quite appropriate since firms are capacity constrained, as is the case, for instance, in the aircraft market. In Section 6 we discuss what happens when firms, instead, compete in prices.

¹⁸In Section 5 we consider what happens when the competing firms do not observe the contracting terms of their rival with firm S as well as we explore firm S 's decision to disclose them or not.

¹⁹Following most of the literature with sequential contracting, we assume that renegotiation is infeasible as, for instance, it requires high legal costs or a lot of time.

and reason by backward induction.

In the last stage, each firm i , with $i = 1, 2$, chooses q_i to maximize its (gross from f_i) profits: $\pi_i(q_i, q_j) = p(q_i, q_j)q_i - k_i q_i$, where k_i is firm i 's per unit cost, with $k_i = s$ and $k_i = w_i$ when firm i opts for insourcing and outsourcing respectively. The first order conditions give rise to: $R_i(q_j) = (a - k_i - q_j)/2$, with $i, j = 1, 2$ and $i \neq j$. The resulting quantities are:

$$q_i(k_i, k_j) = \frac{a - 2k_i + k_j}{3}. \quad (1)$$

In the benchmark case, there is no outsourcing; firm 1 and firm 2 both produce the input in-house – II case – and play the standard Cournot game with marginal costs $k_1^{II} = k_2^{II} = s$. The equilibrium net profits of the benchmark case, π_S^{II} , π_1^{II} and π_2^{II} , are included in Table 1. Clearly, the external supplier makes no profits when outsourcing does not occur.

4 Outsourcing: Incentives and Implications

In this section, we perform the equilibrium analysis and draw our conclusions regarding the incentives and the implications of outsourcing by the competing firms.

Stage 2

There are two types of second-stage subgames depending on whether or not firm 1 outsources in stage one. In what follows, we examine what happens in each of them.

- When firm 1 has not accepted to outsource, in stage two firm S offers (w_2, f_2) to firm 2 to maximize its own profits subject to the constraint that firm 2 accepts its offer; it solves the following:

$$\begin{aligned} \max_{w_2, f_2} \pi_S(w_2, f_2) &= (w_2 - s)q_2(w_2, s) + f_2, \\ \text{s.t. } \pi_2(q_2(w_2, s), q_1(s, w_2)) - f_2 &\geq \pi_2^{dIO}, \end{aligned} \quad (2)$$

where π_2^{dIO} is firm 2's disagreement payoff – outside option: $\pi_2^{dIO} = \pi_2^{II}$. The constraint is binding, and we rewrite (2) as:

$$\max_{w_2} \pi_S(w_2) = [p_2(q_2(w_2, s), q_1(s, w_2)) - s]q_2(w_2, s) - \pi_2^{II}.$$

This yields: $w_2^{IO} = \frac{5s-a}{4} < s$. Thus, firm S subsidizes the production of its only customer. As the literature on strategic delegation (e.g., Fershtman and Judd, 1987, Sklivas, 1987) and on vertical separation (e.g., Bonanno and Vickers, 1988, Rey and Stiglitz, 1995, Jansen, 2003) has explained, the upstream supplier has incentives to enhance the output of its downstream customer to increase its profits that it partially extracts through the fixed fee. A

straightforward implication is that firm 1 has a cost disadvantage in the final good market. An additional implication is that firm S manages, through contracting, to transform firm 2 to a Stackelberg leader and firm 1 to a Stackelberg follower, that produce $q_2^{IO} = \frac{a-s}{2}$ and $q_1^{IO} = \frac{a-s}{4}$ respectively.

From the appropriate substitutions, we obtain firms' net profits when firm 1 insources and firm 2 outsources – IO case – and include them in Table 1. We observe that $\pi_S^{IO} > \pi_S^{II}$. Therefore, when firm 1 insources, firm S can offer $(w_2^{IO}, f_2^{IO} - \varepsilon)$ to firm 2, with $f_2^{IO} = \pi_2(w_2^{IO}, s) - \pi_2^{II}$, $\varepsilon > 0$ and $\varepsilon \rightarrow 0$, and profitably induce outsourcing by firm 2.

- When, instead, firm 1 has accepted to outsource, in stage two firm S offers (w_2, f_2) to firm 2 given (w_1, f_1) from the previous stage. That is, firm S solves:

$$\begin{aligned} \max_{w_2, f_2} \pi_S(w_1, w_2, f_1, f_2) &= (w_1 - s)q_1(w_1, w_2) + (w_2 - s)q_2(w_2, w_1) + f_1 + f_2, & (3) \\ \text{s.t. } \pi_2(q_2(w_2, w_1), q_1(w_1, w_2)) - f_2 &\geq \pi_2^{dOO}, \end{aligned}$$

where the outside option of firm 2 now is the profits that it makes when it produces the input in-house whereas its rival outsources, $\pi_2^{dOO} = \pi_2(s, w_1)$; these profits do not depend on w_2 . The constraint is binding, and (3) results in:

$$w_2(w_1) = \frac{3s + 2w_1 - a}{4}. \quad (4)$$

We note that $\partial w_2 / \partial w_1 > 0$. This is because when w_1 increases, firm 2 enjoys a larger competitive advantage that allows firm S to increase w_2 without restricting too severely firm 2's input purchases. The opposite holds for the fixed fee: $\partial f_2 / \partial w_1 < 0$. The higher is w_1 , the higher is the advantage that firm 2 enjoys relative to its competitor when firm 2 rejects firm S 's offer, and thus, the lower is the share of profits that firm S extracts from firm 2.

Stage 1

In stage one, when firm 1 rejects firm S 's offer, its profits are π_1^{IO} from above. In light of this, firm S solves the following when it makes its offer to firm 1:

$$\begin{aligned} \max_{w_1, f_1} \pi_S(w_1, f_1) &= (w_1 - s)q_1(w_1, w_2(w_1)) + (w_2(w_1) - s)q_2(w_2(w_1), w_1) + f_2(w_1) + f_1, & (5) \\ \text{s.t. } \pi_1(q_1(w_1, w_2(w_1)), q_2(w_2(w_1), w_1)) - f_1 &\geq \pi_1^{IO} \end{aligned}$$

The constraint is binding, and we rewrite (5) as:

$$\begin{aligned} \max_{w_1} \pi_S(w_1, f_1) &= (w_1 - s)q_1(w_1, w_2(w_1)) + (w_2(w_1) - s)q_2(w_2(w_1), w_1) + f_2(w_1) \\ &\quad + \pi_1(q_1(w_1, w_2(w_1)), q_2(w_2(w_1), w_1)) - \pi_1^{IO}. \end{aligned}$$

The resulting wholesale price offered to firm 1 is: $w_1^{OO} = \frac{a+25s}{26} > s$. The wholesale price offered to firm 2 follows from substitution of w_1^{OO} into (4): $w_2^{OO} = \frac{16s-3a}{13} < s$. We observe that $w_1^{OO} > w_2^{OO}$. Firm S favors firm 2; hence, firm 1 faces a cost disadvantage even when, similarly to its rival, it outsources.

Next, we evaluate the implications of outsourcing by firm 1 on the input sourcing terms.

Proposition 1 *When firm 1 outsources, it raises both its own and its rival's per unit cost, $k_1^{OO} > k_1^{IO}$ and $k_2^{OO} > k_2^{IO}$.*

Proposition 1 informs us that when firm 1 outsources, it raises its rival's cost at the expense of increasing its own cost. A similar result can be found in Arya et al. (2008).

Corollary 1 *When firm 1 outsources, it raises its own cost more than its rival's cost, $k_1^{OO} - k_2^{OO} > k_1^{IO} - k_2^{IO}$.*

Here though, in contrast to Arya et al. (2008), firm 1's cost increases more than its rival's cost. This means that opting for outsourcing, firm 1 inflicts itself a higher damage, in terms of per unit cost, than the damage it inflicts to its rival. An implication is that outsourcing deteriorates firm 1's market share and competitive position. In particular, its output decreases, $q_1^{OO} = \frac{3(a-s)}{13} < q_1^{IO}$, while it leaves firm 2's output intact, $q_2^{OO} = q_2^{IO}$. This is because from (1), we have: $dq_1/dw_1 = \frac{\partial q_1}{\partial w_2} \frac{\partial w_2}{\partial w_1} + \frac{\partial q_1}{\partial w_1} < 0$ and $dq_2/dw_1 = \frac{\partial q_2}{\partial w_2} \frac{\partial w_2}{\partial w_1} + \frac{\partial q_2}{\partial w_1} = 0$. A further implication is that firm S compensates firm 1 for the damage via the fixed fee, $f_1^{OO} < 0$, while it uses the fixed fee to extract part of firm 2's profits, $f_2^{OO} > 0$.

Offering $(w_1^{OO}, f_1^{OO} - \varepsilon)$ and $(w_2^{OO}, f_2^{OO} - \varepsilon)$, firm S profitably induces outsourcing by both firms in equilibrium.

Proposition 2 *Outsourcing by both firms always arises in equilibrium.*

When firm 1 produces the input in-house, firm S 's revenues come exclusively from firm 2, thereby, firm S has vested interests only in firm 2. When, alternatively, firm 1 outsources, firm S can generate revenues from firm 1 too. Still, firm S continues to have higher vested interests in firm 2. This is due to the fact that firm S can transform the firm with which it trades second into a more aggressive competitor (McAfee and Schwartz, 1994, Bedre-Defolie,

2012). When firm S serves firm 1, it improves the position of the firm in which it has higher vested interests; it increases the downstream cost asymmetry in favor of firm 2. This leads, as mentioned above, to a lower output for firm 1 and to monopoly output for firm 2. Firm S manages to do this and at the same time decreases its subsidy to firm 2: $w_2^{OO} > w_2^{IO}$ and $f_2^{OO} = f_2^{IO}$. Stated differently, outsourcing to firm 1 allows firm S "to kill two birds with one stone": it improves the competitive position – market share – of its preferred customer and increases its own revenues.

In fact, firm S purposely makes a net loss from its transactions with firm 1. Firm S serves firm 1 not to enjoy higher input demand. It serves firm 1 to increase the profits that it makes from its sales to firm 2. Industry profits would be maximized and monopoly profits would be achieved if firm S fully foreclosed firm 1 from the market. To do so, it would have to offer a higher w_1 than w_1^{OO} . This, though, would reinforce the competitive position of firm 2 under in-house production, and thus, enlarge its outside option; recall that f_2 decreases with w_1 . In other words, firm S would not be able to extract a large share of the monopoly profits.²⁰ For this reason, it prefers to not maximize industry profits – to generate a smaller pie – and extract a larger share of the smaller pie. In other words, the external supplier takes into account not only the rent generation effects of vertical contracting but also its distributional effects.²¹

It is important to stress that although the supplier does *not* have a cost advantage, it induces outsourcing. In fact, the supplier can induce outsourcing even when it has a cost disadvantage as long as its disadvantage is sufficiently small.²² Recall that the reverse – the existence of a cost advantage – is a necessary condition for the emergence of outsourcing to a common supplier in the literature (e.g., Arya et al., 2008, Buehler and Haucap, 2008, Feng and Lu, 2012 and 2013). As we explain in Section 5, this difference hinges mainly on the contractual form.

Outsourcing, here, is not motivated by collusion, in contrast to Buehler and Haucap

²⁰When products are homogeneous and firm S can fully extract firm 2's profits, as is the case, for instance, when firm 2 does not have input production capability, firm S can fully foreclose firm 1 from the market (e.g., Hart and Tirole, 1990, McAfee and Schwartz, 1994). When products are differentiated, and thus, industry profits are not maximized with foreclosure, as the vertical contracting literature shows (e.g., McAfee and Schwartz, 1994, Rey and Vergé, 2002, Milliou and Petrakis, 2007), an upstream monopolist dealing with competing downstream firms via nonlinear contracts is unable to maximize industry profits because it suffers from the 'opportunism problem': when it makes an offer to a firm, it cannot commit that it will not make a better offer to the rival firm.

²¹Clearly, the supplier can not induce the monopoly outcome through the inclusion of exclusivity clauses in its contract offers either since the excluded firm would be able to produce in-house. Furthermore, the supplier does not have incentives to precommit to exclusive dealing because then not only it does not generate the monopoly outcome but it also enhances its exclusive customer's outside option.

²²It can be shown that when firm S 's marginal input production cost is z , with $z > s$, firm S profitably induces outsourcing by both firms in equilibrium if $z < \frac{(26\sqrt{3}-45)a}{2}$.

(2006), Gilbert et al. (2006), and Grahovac et al. (2015). The price of the final good is lower when both firms outsource than when neither firm does, $p^{OO} < p^{II}$, due to the lower variable input sourcing cost that firm 2 faces when it outsources.

Although when firm 1 outsources, it raises its rival's cost, in contrast to Arya et al. (2008) it deteriorates its competitive position since the supplier generates more cost asymmetry against firm 1. This is consistent with the empirical findings of Görzig and Stephen (2002) and Marjit and Mukherjee (2008), according to which outsourcing can reduce firm's profitability. When firm 1 does not outsource, it cannot avoid becoming a Stackelberg follower, while when it outsources, it receives through the fixed fee (slightly) higher profits than those of a Stackelberg follower. The weaker competition faced by firm 2 when both firms outsource works in favor of firm S ; while firm 2 generates higher profits than a Stackelberg leader, it receives the profits of a Stackelberg leader plus ε , and firm S appropriates the profits difference.²³

Importantly, outsourcing arises because the use of the external supplier works as a means for the competing firms to commit, by accepting the contract terms, to asymmetric input costs that affect their output choices and guarantee them Stackelberg instead of symmetric Cournot profits. Clearly, this mechanism has the flavor of the Bertrand-Edgeworth model. There, firms transform Bertrand to Cournot competition by committing through their sunk costs in capacity. In our environment, the supplier makes firm 1 commit to a higher unit cost, in return of a lump-sum payment, thereby allowing firm 2 to make Stackelberg profits. Firm S , therefore, does not provide lower input costs to its customers, it provides them a commitment mechanism.

The above mechanism could especially explain the instances in which firms outsource to their spun-off input production units which clearly do not offer other advantages, either cost or quality related, than in-house production would. This could be, for example, the case of Ford Motors and General Motors both outsourcing to the former's spun-off Visteon, and AT&T and MCI outsourcing to Lucent – AT&T's spun-off equipment division.

We have already established that a technologically redundant input supplier can enter into the upstream segment of an oligopolistic market and alter the latter's equilibrium outcomes non-trivially. It remains to check to which direction consumers and the economy will be affected.

Proposition 3 *When firm 1 and firm 2 both outsource:*

²³Firm 1 is worse off when both firms outsource than when neither outsources, while the opposite holds for its rival: $\pi_1^{OO} < \pi_1^{II}$ and $\pi_2^{OO} > \pi_2^{II}$.

(i) consumer surplus is higher than when neither firm outsources and lower than when only one firm outsources, $CS^{IO} > CS^{OO} > CS^{II}$,

(ii) producer (industry) surplus is lower than when neither firms outsources and higher than when only one firm outsources, $PS^{II} > PS^{OO} > PS^{IO}$, and

(iii) welfare is higher than when only one firm outsources, while it is higher in the latter case than when neither firm outsources, $W^{OO} > W^{IO} > W^{II}$.

Outsourcing enhances consumer surplus and welfare. In disparity with the outsourcing literature, this result is not driven by the fact that a more efficient supplier produces the input. Actually, it can be shown that it also holds when the external supplier faces higher marginal cost and profitably induces outsourcing by both firms. This result is exclusively induced by vertical contracting, which entails lower unit input sourcing cost for one of the firms. On this basis, we can conclude that the presence of an otherwise redundant and not more efficient firm in the upstream market segment can be socially desirable.

5 Disclosure, Timing, and Form of Contracting

In this section, we endogenize the preassumptions of our model regarding the observability of contract terms, the timing of contracting, and the contractual form, and discuss their strategic role.

5.1 Disclosure of contract terms

So far we have assumed that the contract terms between firm S and firm 1 are known by firm 2 when firm S makes its contract offer to the latter. In this subsection, we explore whether firm S has the incentive to disclose the contracting terms. In order to do so, we expand our model by adding an intermediate stage between stage one and stage two, where firm S decides whether it will disclose to firm 2 its contract terms with firm 1.

When in the intermediate stage firm S does not disclose to firm 2 its contract terms with firm 1, we have to distinguish among two cases depending on whether or not the contract terms are ex post observable, i.e., whether or not firm 1 and firm 2 observe their rival's contract terms in stage three before they compete in the product market. In the case of ex post observable contract terms, firm S does not manage to generate outsourcing by both firms unless firm 2 learns in stage two whether or not there has been an agreement between firm S and firm 1. In fact, when the latter occurs, the analysis coincides with the analysis in Section 3 and for this reason we omit it here.

In the case in which the rival's contract terms are never observed by firm 1 and firm 2, independently of whether or not they learn their rival's acceptance or rejection decision, firm S cannot profitably induce outsourcing. In particular, when firm 1 agrees to outsource, in the last stage, maximization of each firm i 's profits leads to $q_i^{BR}(k_i, q_j^*) = \frac{a-k_i-q_j^*}{2}$. In stage two, firm S solves:

$$\max_{w_2, f_2} \pi_S(w_1, f_1, w_2, f_2) = (w_1 - s)q_1^{BR}(w_1, q_2^*) + f_1 + (w_2 - s)q_2^{BR}(w_2, q_1^*) + f_2, \quad (6)$$

$$\text{s.t. } \pi_2(q_2^{BR}(w_2, q_1^*), q_1^*) - f_2 \geq \pi_2(q_2(s, q_1^*), q_1^*).$$

Substituting the binding constraint, and solving, we find $w_2^{OOu} = s$. In the previous stage, firm S solves:

$$\max_{w_1, f_1} \pi_S(w_1, f_1) = (w_1 - s)q_1^{BR}(w_1, q_2^*) + f_1, \quad (7)$$

$$\text{s.t. } \pi_1(q_1^{BR}(w_1, q_2^*), q_2^*) - f_1 \geq \pi_1(q_1(s, q_2^*), q_2^*).$$

This also results in $w_1^{OOu} = s$, and in turn, $f_1^{OOu} = f_2^{OOu} = 0$, leaving firm S without profits. The following conclusion is a straightforward implication of this.

Proposition 4 *The external supplier always discloses its contract terms with firm 1 to firm 2.*

The supplier clearly opts for disclosing the contract terms.²⁴ Intuitively, the contract terms play a strategic role only when they are observed by the rival firm. Their strategic role works in favor of the supplier allowing it to generate positive profits. In light of this, our conclusions continue to hold when the disclosure of contract terms is endogenous.

5.2 Simultaneous contracting

Our assumption of sequential contracting with firm 1 and firm 2 seems natural in the case of a single supplier and one can think of many real world cases in which indeed a supplier approaches its potential customers sequentially. Still, next we examine what happens when the supplier approaches its potential customers simultaneously, for instance, through the use of two representatives who act on its behalf. Importantly, we explore whether the supplier

²⁴A number of papers (e.g., Caillaud et al., 1995, Arya and Mittendorf, 2011, Miklós-Thal and Piccolo, 2012, Pagnozzi and Picolo, 2012, Skartados and Petrakis, 2022) explore firms' incentives to disclose the terms of wholesale contracts. Skartados and Petrakis (2022) show that an upstream supplier has incentives to disclose the rival's terms of two-part tariff contracts in a setting in which it contracts simultaneously with two competing downstream firms. Caillaud et al. (1995) show that under asymmetric information, an upstream supplier has incentives to publicly disclose the contract that it signs with its customer-agent even when secret renegotiation is possible.

prefers simultaneous to secret contracting. To do so, we add a stage zero in our model in which firm S chooses between sequential and simultaneous contracting. Stages one and two remain the same as in our initial model when firm S chooses sequential contracting, whereas when firm 2 chooses simultaneous contracting, stage one disappears and in stage two, the two representatives of firm S make their offers to firm 1 and firm 2 over (w_1, f_1) and (w_2, f_2) respectively.

In the case of simultaneous contracting, since the supplier's representatives make their offers independently, the rival's contracts terms are not observed by firm 1 and firm 2 when they decide whether or not to accept the offers that they have received.²⁵ In such situations, multiple equilibria can arise due to the multiplicity of the beliefs that firms can form when they receive out-of-equilibrium offers. We obtain a unique equilibrium by adopting, as in Cremer and Riordan (1987), Horn and Wolinsky (1988), O'Brien and Shaffer (1992), Gans (2007), Milliou and Petrakis (2007), Allain and Chambolle (2011), Milliou and Pavlou (2013, 2020), and Rey and Vergé (2020), the contract equilibrium concept.²⁶

When the contract terms are ex post observable, i.e., each firm although it does not observe its rivals terms at the contracting stage, it observes them before choosing its output, the solution of the last stage is given again by (1).²⁷ When, in stage two, firm S outsources to both firms, it offers (w_i, F_i) to firm i , taking as given its equilibrium offer to firm j , $(\tilde{w}_j^{OO}, \tilde{f}_j^{OO})$. It solves:

$$\max_{w_i, f_i} \pi_S(w_i, f_i) = (w_i - s)q_i(w_i, \tilde{w}_j^{OO}) + (\tilde{w}_j^{OO} - s)q_j(\tilde{w}_j^{OO}, w_i) + f_i + \tilde{f}_j^{OO}, \quad (8)$$

$$\text{s.t. } \pi_i(q_i(w_i, \tilde{w}_j^{OO}), q_j(\tilde{w}_j^{OO}, w_i)) - f_i \geq \tilde{\pi}_i^{dOO},$$

where firm i 's disagreement payoff coincides with its profits in the IO of the main analysis: $\tilde{\pi}_i^{dOO} = \pi_1^{IO}$. The constraint is binding; rewriting (8) and solving for w_i , we find: $\tilde{w}_i^{OO} = \frac{3s-a+s}{2}$. Again, the supplier does not maximize industry profits. Now, though, not because of its customer's outside option but because of the 'opportunism problem' (e.g., Hart and

²⁵This is in line with a large branch of the vertical contracting literature (e.g., Hart and Tirole, 1990, O'Brien and Shaffer, 1992, McAfee and Schwartz, 1994, Rey and Vergé, 2004, Rey and Tirole, 2007) which assumes in settings with simultaneous contract offers to competing firms, that the offers are made separately to firms and thus secretly; hence, the rival's contract terms are secret at the contracting stage.

²⁶The contract equilibrium - referred also as pairwise proofness - requires that a contract between an upstream monopolist and a downstream firm is immune to a bilateral deviation of the upstream supplier with a rival downstream firm, holding the contract with the first downstream firm constant.

²⁷This is also referred to as 'interim observable' case. Feng and Lu (2012 and 2013) also consider a setting with simultaneous and secret offers which are observable in the last stage. Similarly, in many papers in the vertical contracting literature (e.g., McAfee and Schwartz, 1994, Rey and Vergé, 2004, Milliou and Petrakis, 2007), the contracts terms are not observable in the contracting stage, while they are observable in the quantity competition stage.

Tirole, 1990, McAfee and Schwartz, 1994, Rey and Vergé, 2004, Milliou and Petrakis, 2007). A straightforward implication is that outsourcing does not generate cost asymmetry, and it is unprofitable for firm S .

When the contract terms are ex post unobservable, i.e., when firms never observe their rival's contract terms, then as we saw in subsection 5.1, the equilibrium outcome is for the supplier to set the wholesale prices equal to marginal cost s (e.g., McAfee and Schwartz, 1994, Rey and Tirole, 2007, Pagnozzi and Piccolo, 2012). Therefore, outsourcing is again unprofitable for the supplier.

Clearly, since outsourcing does not arise profitably when contracting takes place simultaneously, the supplier has no desire to enter into the market. On the contrary, as we saw in our main analysis, when contracting is sequential, the supplier can create a profitable market for itself. On this basis, we reach the next conclusion.

Proposition 5 *The external supplier contracts with firm 1 and firm 2 sequentially rather than simultaneously.*

In three-party trading, the order in which trading occurs may affect both the size and the division of the generated pie. The supplier clearly prefers sequential to simultaneous contracting as implicitly assumed in our initial model, because under simultaneous contracting, due to the presence of the opportunism problem, the size of the pie is smaller, and importantly because it cannot get a piece of the pie.

5.3 Wholesale price contracts

We examine next whether the supplier prefers to trade with its potential customers through two-part tariff contracts or through wholesale price contracts, that include only a wholesale price w_i . To do so, we include an initial stage in the game, stage zero, where firm S chooses between two-part tariff contracts and wholesale price contracts. When wholesale price contracts are used, if firm 1 has insourced, in stage two firm S solves: $\max_{w_2} \pi_S(w_2) = (w_2 - s)q_2(w_2, s)$. This yields: $\hat{w}_2^{IO} = (a + 3s)/4$. As expected, in the absence of a fixed fee, firm S sets a positive mark-up and generates a cost disadvantage for firm 2. In turn, firm 2 is better off if it rejects the offer, $\pi_2^I > \pi_2(\hat{w}_2^{IO}, s)$. Firm 2 would outsource only if $w_2 < s$, but then firm S would make a loss; hence, IO cannot arise in equilibrium.

If firm 1 has outsourced, in stage two firm S solves: $\max_{w_2} \pi_S(w_1, w_2) = (w_1 - s)q_1(w_1, w_2) + (w_2 - s)q_2(w_2, w_1)$. This leads to: $w_2(w_1) = (a + s + 2w_1)/4$. In the previous stage, firm S optimally offers $\hat{w}_1^{OO} = s$ and, in turn, $\hat{w}_2^{OO} = s$. Firm 1, though, would accept firm S 's offer if and only if $w_1 > s$. But $w_1 < s$ would trigger a lower w_2 , since $dw_2/dw_1 > 0$, and result in

higher q_1 , since $dq_1/dw_1 < 0$, and no change in q_2 , since $dq_2/dw_1 = 0$. Hence, firm S would end up selling more units to firm 1 at a loss and the same amount of units to firm 2 at a lower wholesale price than before. In other words, the supplier would experience a loss from one customer and a decrease in its revenues from the other.

It follows that an external supplier without a cost advantage is not in the position to profitably induce outsourcing with wholesale price contracts. A similar result can be found in Arya et al. (2008). Without the fixed fees, the supplier cannot generate cost asymmetry so as to increase the size of the pie and in turn use the fees to compensate and extract. From Proposition 2, we know that the opposite holds with two-part tariffs. Therefore, the contractual form is not innocuous: it can have significant implications for the input sourcing pattern that emerges in equilibrium.

This together with Proposition 3 indicates that, as standard in the vertical contracting literature, two-part tariffs generate higher consumer surplus and welfare than wholesale price contracts. Given the contractual form's crucial role for market outcomes, next we provide the answer to the question which form firm S chooses to use in equilibrium.

Proposition 6 *The external supplier contracts with firm 1 and firm 2 through two-part tariffs rather than through wholesale price contracts.*

A supplier always prefers to use two-part tariffs to wholesale price contracts. With two-part tariffs, unlike with wholesale price contracts, it profitably induces outsourcing.^{28 29}

6 Extensions

In this section, we consider three extensions of our model to extract additional insights.³⁰ First, we consider what would happen if there were negotiations between the supplier and its potential customers. Then, we consider what would happen if the products of the competing firms were differentiated, and finally, we consider what would happen if the competing firms competed in prices.

²⁸Firm 2 is also better off with two-part tariffs, $\pi_2^{OO} > \pi_2^{II}$. Even though firm 1 makes higher profits with wholesale price contracts, if its rival trades with a two-part tariff, it can be convinced by firm S , through an appropriate transfer, to trade with a two-part tariff.

²⁹Note that our main results hold also under non-linear quantity-forcing contracts, $T_i(\bar{q}_i) = \bar{f}_i$. Under such contracts, the mechanism behind the emergence of outsourcing is the same as with two-part tariffs: outsourcing arises because the supplier can transform Cournot to Stackelberg competition.

³⁰When the detailed analysis is not included in the paper, it is available from the author upon request.

6.1 Negotiations

In our model, we have assumed that firm S makes take-it-or-leave-it offers to its potential customers. Next, we explore what happens when, instead, firm S engages in bilateral negotiations over the contract terms with firm 1 and firm 2. To do so, we modify our model and assume that the bargaining power of firm S and firm i , with $i = 1, 2$, is β and $1 - \beta$ respectively, with $\beta \in [0, 1)$.

In stage two, if firm 1 has not reached an agreement with firm S , firm S and firm 2 solve:

$$\max_{w_2, f_2} [\pi_S(w_2) + f_2]^\beta + [\pi_2(w_2, s) - \pi_2^{dIO} - f_2]^{1-\beta}. \quad (9)$$

Maximizing with respect to f_2 , we find: $f_2 = \beta[\pi_2(w_2, s) - \pi_2^{dIO}] - (1 - \beta)\pi_S(w_2)$. From this it follows that (11) corresponds to an expression which is proportional to the joint profits of firm 2 and firm S minus firm 2's disagreement payoff. This expression is maximized again by w_2^{IO} , while the fixed fee now depends on the distribution of the bargaining power: $f_2^{IO} = \frac{(9+\beta)(a-s)^2}{72}$. If firm 1 has agreed to outsource, (11) becomes:

$$\max_{w_2, f_2} [\pi_S(w_1, w_2) + f_1 + f_2 - \pi_S^{dOO}]^\beta + [\pi_2(w_2, w_1) - \pi_2^{dOO} - f_2]^{1-\beta}. \quad (10)$$

Note that firm S has a disagreement payoff too now: $\pi_S^{dOO} = \pi_S^{OI}$. Maximization results in (4). Taking this into account, we move to the first stage of the game, in which firm S bargains with firm 1 over (w_1, f_1) . They solve:

$$\max_{w_1, f_1} [\pi_S(w_1, w_2(w_1)) + f_1 + f_2(w_1) - \pi_S^{dOO}]^\beta + [\pi_1(w_1, w_2) - \pi_1^{dOO} - f_1]^{1-\beta}.$$

This yields: $w_1^{OOn} = \frac{a(3-2\beta)+s(27-2\beta)}{30-4\beta} > s$ and $w_2^{OOn} = \frac{-3a+2s(9-\beta)}{15-2\beta} < s$. So, in line with our main analysis, firm S continues to favor firm 2. However, the profits of firm S are lower now since its customers, due to their bargaining power, extract a bigger piece of the joint profits. Still, outsourcing by both firms arises in equilibrium.

The above points out that our main results extend to situations where the bargaining power is more evenly distributed between the supplier and its potential customers, including situations where outsourcing is initiated by powerful original brand manufacturers.

6.2 Product differentiation

We relax now the assumption that firm 1 and firm 2 produce a homogeneous good, and analyze the case in which their products are differentiated. Specifically, we assume that the market demand for firm i 's product, with $i, j = 1, 2$ and $i \neq j$, is given by $p_i = a - q_i - \gamma q_j$,

where γ , with $\gamma \in (0, 1)$, denotes the degree of product differentiation.

Firm S now, when it serves both firms, suffers from the opportunism problem and does not maximize industry profits for this reason. Still, outsourcing by both firms arises in equilibrium, and it is procompetitive. Outsourcing is again motivated by the fact that the external supplier affects product market competition.

Typically, when products become closer substitutes, and thus, competition becomes fiercer, the supplier's opportunism problem gets more severe and its profits decrease (e.g. Rey and Tirole, 2007). In contrast, here, the supplier's profits increase with product substitutability. The reason is that the profits of a firm that produces the input in-house decrease with the intensity of competition. This means that the disagreement payoff of the supplier's customer decreases and the supplier extracts a larger share of profits. An implication of this finding is that outsourcing is more likely to take place when competition is intense because then the departure from the symmetric Cournot competition is more valuable. An interesting insight results: The impact of downstream competition intensity on upstream profits can crucially depend on the downstream firms' input sourcing options.

6.3 Price competition

In what follows, we examine whether outsourcing arises when firms compete in prices with differentiated products. Reverting the demand function that we have used in subsection 6.2, we have that the demand for firm i 's product, with $i, j = 1, 2$ and $i \neq j$, is given by:

$$q_i(p_i, p_j) = \frac{(a-p_i) - \gamma(a-p_j)}{1-\gamma^2}.$$

With the prices being strategic complements, firm S does not wish its customer(s) to behave aggressively (e.g., Bonanno and Vickers, 1988, Rey and Stiglitz, 1995); hence, it does not subsidize them. Specifically, when firm S serves only one firm, it sets a positive mark-up to its unique customer, $w_2^{IOb} > s$, it relaxes downstream competition and, in turn, increases final prices and industry profits, $p_i^{IOb} > p_i^{IIb}$ and $PS^{IOb} > PS^{IIb}$. Firm S further increases industry profits when it serves both firms, by setting a positive mark-up on both firms, $w_i^{OOB} > s$, and by raising its mark-up on firm 2, $w_2^{OOB} > w_2^{IOb}$. Since firm S extracts via the wholesale prices now, a piece of the larger pie, it induces again outsourcing by both firms in equilibrium.

This implies that the external supplier's ability to induce outsourcing does not depend on the mode of competition. However, under price competition, outsourcing is motivated by collusion, and consequently, its welfare implications differ significantly from the respective ones under quantity competition. When firms compete in prices, the entry of a not more efficient dominant contract manufacturer in the market can harm consumers and welfare.

7 Conclusion

We have provided an explanation for outsourcing by competing firms to a common supplier without a cost advantage in input production. Outsourcing is driven by contracting: an external supplier uses its contract offers to create cost asymmetry that works in its favor. At the same time, the incumbents commit, through contracting with the external supplier, to input costs that generate Stackelberg instead of Cournot profits.

The contract terms and not production efficiency render outsourcing welfare-enhancing. In other words, the presence of a monopolist supplier in the market, although it is technologically redundant, can be socially desirable.

The use of two-part tariffs is crucial for the above findings. The supplier would not have incentives to enter into the market and serve its potential customers with wholesale price contracts. Thus, the supplier always prefers to trade with its potential customers through two-part tariffs rather than through wholesale price contracts. The supplier also always prefers to trade with its potential customers sequentially rather than simultaneously. With simultaneous contracting, not only the generated surplus would be lower but also rent extraction by the supplier would be impossible.

Our analysis suggests an explanation for the practice of outsourcing even absent the usual cost advantage of external suppliers. It suggests that the emergence of large contract manufacturers is not necessarily due to cost advantages; it can arise from their contract offers to original brand manufacturers. An important managerial is that outsourcing can bring about benefits to a firm even when it is to local input producers that do not produce inputs cheaper. This is particularly true when the outsourcing arrangements do not include only per unit wholesale terms.

Our conclusions persist qualitatively when products are differentiated and when firms negotiate over the contract terms. In all these cases, the supplier generates cost asymmetry and favors the firm with which it trades second, while it abstracts from maximizing industry profits to secure a larger share of the generated profits.

An interesting direction for future research is to explore the incentives to outsource to suppliers without cost advantages that are either exclusive or vertically integrated. An additional interesting direction is to allow for the possibility that outsourcing triggers supplier encroachment in the final product market.

8 Appendix

Table 1: Profits with symmetric input production costs

$\pi_S^{OO} = \frac{3(a-s)^2}{208}$	$\pi_1^{OO} = \frac{(a-s)^2}{16}$	$\pi_2^{OO} = \frac{81(a-s)^2}{676}$
$\pi_S^{II} = 0$	$\pi_1^{II} = \frac{(a-s)^2}{9}$	$\pi_2^{II} = \frac{(a-s)^2}{9}$
$\pi_S^{IO} = \frac{(a-s)^2}{72}$	$\pi_1^{IO} = \frac{(a-s)^2}{16}$	$\pi_2^{IO} = \frac{(a-s)^2}{9}$

Table 2: Profits with asymmetric input production costs ($k_1^{II} = s$ & $k_2^{II} = z$)

$\pi_S^{OOa} = \frac{3a^2 - 102as + 35s^2 + 32(3a+s)z - 64z^2}{208}$	$\pi_1^{OOa} = \frac{(a-s)^2}{16}$	$\pi_2^{OOa} = \frac{9(3a+s-4z)^2}{676}$
$\pi_S^{IIa} = 0$	$\pi_1^{IIa} = \frac{(a-2s+z)^2}{9}$	$\pi_2^{IIa} = \frac{(a-2z+s)^2}{9}$
$\pi_S^{IOa} = \frac{a^2 - 34as + s^2 + 32(a+s)z - 32z^2}{72}$	$\pi_1^{IOa} = \frac{(a-s)^2}{16}$	$\pi_2^{IOa} = \frac{(a-2z+s)^2}{9}$

Table 3: Profits with asymmetric input production costs ($k_1^{II} = z$ & $k_2^{II} = s$)

$\pi_S^{OOb} = \frac{3(a^2 - 28as - 12s^2 + 26(a+2s)z - 39z^2)}{208}$	$\pi_1^{OOb} = \frac{(a-3z+2s)^2}{16}$	$\pi_2^{OOb} = \frac{81(a-s)^2}{676}$
$\pi_S^{IIb} = 0$	$\pi_1^{IIb} = \frac{(a-2z+s)^2}{9}$	$\pi_2^{IIb} = \frac{(a-2s+z)^2}{9}$
$\pi_S^{IOb} = \frac{(a-2s+z)^2}{72}$	$\pi_1^{IOb} = \frac{(a+2s-3z)^2}{16}$	$\pi_2^{IOb} = \frac{(a-2s+z)^2}{9}$

Proof of Proposition 1: Recall from above that when firm 1 insources, in the following stage, firm S optimally induces outsourcing by firm 2. Thus, when firm 1 insources, its per unit cost is $k_1^{IO} = s$. When, instead, firm 1 outsources, its per unit cost is $k_1^{OO} = w_1^{OO}$. Since $w_1^{OO} > s$, it follows immediately that $k_1^{OO} > k_1^{IO}$.

The per unit cost of firm 2 is $k_2^{IO} = w_2^{IO}$ and $k_2^{OO} = w_2^{OO}$, when firm 1 insources and outsources respectively. We find that $w_2^{IO} - w_2^{OO} < 0$. Thus, $k_2^{OO} > k_2^{IO}$. ■

Proof of Proposition 2: We already know that firm S prefers to serve firm 2 when firm 1 insources; it prefers IO to II . When it serves only firm 1, in the OI case, outcomes are as in the IO case, with the roles of firm 1 and firm 2 reversed. Thus, $\pi_S^{IO} = \pi_S^{OI} > \pi_S^{II}$. Does firm S prefer to serve both firms? From the appropriate substitutions, we obtain the equilibrium profits in the OO case and include them in Table 1. Comparing firm S 's profits with OO and IO/OI , we find: $\pi_S^{OO} - \pi_S^{IO} > 0$. It follows that firm S prefers to induce outsourcing by both firms. Firm S can do so by offering $(w_1^{OO}, f_1^{OO} - \varepsilon)$ and $(w_2^{OO}, f_2^{OO} - \varepsilon)$ to firm 1 and firm 2 respectively. Its offers will be accepted since $\pi_1^{OO} + \varepsilon > \pi_1^{IO}$ and $\pi_2^{OO} + \varepsilon > \pi_2^{OI}$. ■

Proof of Proposition 3: (i) Consumer surplus is given by $CS = aq_1^v + aq_2^v - (1/2)(q_1^{v2} + q_2^{v2} + q_1^v q_2^v) - (a - q_1^v - q_2^v)q_1 - (a - q_2^v - q_1^v)q_2^v$, with $v = OO, IO, OO$. We find: $CS^{OO} - CS^{II} = \frac{545(a-s)^2}{12168} > 0$ and $CS^{OO} - CS^{IO} = \frac{-77(a-s)^2}{5408} < 0$.

(ii) Producer (industry) surplus is given by $PS^v = \pi_1^v + \pi_2^v + \pi_S^v$. We find: $PS^{OO} - PS^{II} = \frac{-150(a-s)^2}{6084} < 0$ and $PS^{OO} - PS^{IO} = \frac{25(a-s)^2}{2704} > 0$.

(iii) Welfare is given by $W^v = PS^v + CS^v$. We find: $W^{OO} - W^{IO} = \frac{109(a-s)^2}{416} > 0$ and $W^{IO} - W^{II} = \frac{7(a-s)^2}{288} > 0$. ■

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