The interplay between procurement and the organization of the firm: the use of transfer prices

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Abstract

We see that a firm can benefit from implementing a transfer price system when it is coupled with delegation of procurement to the factory, because the factory has more clout in negotiating contracts with suppliers than the whole firm. We see that what is strategically relevant is that a business unit do not internalise the overall profits of the firm. Hence, crucially, more clout can be obtained without strategic distortions of transfer prices. Moreover, Headquarters may intentionally introduce a distorted (too low) transfer price that create inefficiencies but also increase the bargaining power of the factory against suppliers. As a matter of fact distorted transfer prices could be counterproductive. A more centralized structure emerges when there exists risks that supplier may behave strategically.

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JEL classification: D24, D43, M11

1 Introduction

Nowadays, large organizations must decide whether to decentralize certain key activities to profit centers or business units or remain those activities centralized in a more widely functional unit. It is easy to observe that large firms tend to mix it by delegating some activities while integrating others. For instance Procter and Gamble prefers integrating certain activities such as product development or accounting while business units are responsible for sales, or procurement. Other firms like General Electric, though, centralizes sourcing, while decentralizing at business units sales or distribution.¹

These large organizations, in many cases multinational companies, decentralize activities within functional units in a particular way, through the use of internal pricing or transfer prices. The transfer price appears to be a revenue for the selling division and appears to be a cost for the buying division. Thus, divisions that are originally revenue or cost centers become profit centers (or business units). Because managers tend to be evaluated on how well his division performs, the introduction of a TP system becomes a

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powerful incentive mechanism that affects the decisions delegated to the manager in charge of the division (and eventually to the firm as a whole), to name but a few, production, financing or product choice.²

In our paper we focus on the internal organization, whether to delegate or centralize, a crucial activity: procurement of an essential input. According to KPMG survey (2008) procurement is one of those key activities (75% of respondents considered it of a high strategic priority) in which some firms prefer to centralize those activities while other firms decentralize it (nearly half of firm’s organizational structures takes some form of decentralized procurement). Most importantly, the survey highlights that the internal organization may affect pricing with suppliers.³

Our paper contributes to this idea by analyzing how the internal organization of the firm may improve firm’s clout when bargaining with suppliers. We show that announcing an structure in which both production and procurement are delegated to the business unit manager increases firm’s bargaining power. Unlike existing literature, our main result do not rely on the use of strategic transfer pricing, that is, internal prices that deviates from efficient considerations, but on the use of the organization as an strategic device.

To elaborate, we model a situation where, in order to produce the good, the firm requires internal production and acquiring an external input. The input can be obtained from two different sources; from an efficient supplier or from a fringe of standard suppliers. Therefore, the headquarter (HQ from now on) must decide who takes decisions on production and who engages negotiations with the efficient supplier; it is the HQ who bargains with the efficient supplier or delegates those decisions, by means of a decentralized system, to the factory manager.

Regardless of who bargains, the firm and the efficient supplier negotiate a two part tariff contract which allows them to reach efficient production levels. Thus, benefits from delegation do not arise form potential distortions at the production level. By announcing the firm delegates decisions through a transfer price scheme, the firm reduces the rents the supplier can reap in the bargaining stage. The mechanism by which the company reduces those rents are precisely the use of transfer prices. We show that the benefits from decentralizing comes from announcing how the firm is internally organized. In other words, it is the organization which plays an strategic role, not the specifics of the contract, i.e., the transfer price is not strategic. Even if the details of the contract among the different agents of the firm were not known, that is, contracts among participants are secret and therefore it is not credible to set an internal price between divisions different from what maximizes joint rents, decentralizing the firm allows the firm to reduce the average payment bill.

We extend this analysis to two different scenarios. First, we analyze an additional mechanism to divert rents from bargaining: splitting the firm into two new companies. We show that the firm always prefer vertically separating the company rather than centralizing those decisions, but delegating firm’s decisions may be preferred to splitting the firm in two companies. Second, we analyze a case in which an external alternative exists and the firm can shut down the factory and produce the output elsewhere. This reduces greatly the benefits from delegating the factory, but even if the external alternative is better than

²According to several reports, see Ernst and Young (2001), Tax purposes is the main reason for implementing transfer prices schemes, but evaluating management preformance is the second reason for implementing a transfer price scheme

³For instance, centralizing procurement increases firm’s buying power
the internal alternative, we show that the firm may prefer delegating the company to the manager’s factory and do not use the threat of shutting down the company.

Furthermore, we analyze whether the firm prefers not only to announce how the firm is internally organized, but to announce a particular strategic transfer price. In other words, by credibly announcing a particular transfer price, the firm can reduce factory’s profits at discretion. Note, though, that the use of strategic transfer prices may affect the optimal level of production. We show that if the firm can credibly commit to a transfer price, the HQ sets the transfer price artificially lower than the efficient. The reason is still the same but the channel that allows to achieve that improvement is different. By altering the internal price, the HQ can reduce factory’s profits which eventually reduces supplier’s demands at the bargaining stage. However, it is not always in HQ’s interest to use strategic transfer prices. Indeed, when the internal alternative is rather efficient, the use of strategic transfer prices implies a larger payment and receiving lower profits as compared with the case in which transfer prices are set optimal.

Third, we consider a final case where the supplier may behave strategically. We show that, regardless of bargaining power, both the factory and the supplier may find profitable to negotiate an input price different from the efficient one, that is, the one that maximizes firm’s profits. This intended high input price fosters the HQ to set a transfer price different from the efficient one. Eventually, this increases both supplier’s and factory’s profit at the cost of a lower firm’s profit. As a consequence, HQ’s tends to centralize both procurement and production to avoid this undesirable outcome.

Since the seminal paper by Hirshleifer (1956) the literature on transfer pricing has been increasing. A first stream of research has paid attention to taxes and tax shifting incentives (see Baldenius et al. 2004). A second one, relates the incomplete contracting literature and transfer pricing within organizations. In this stream of research, e.g, Edlin and Reichelstein (1995), Che and Hausch (1999) among others, divisions may undertake investment which affects firm’s value. Due to the lack of contractibility and the existence of renegotiation phases, divisions tend to underinvest under a transfer pricing system. A third strand of research, a closer approach to our paper, analyses the choice of a transfer price system that can be used as a commitment device helping the firm to compete better against other rivals (see Baldenius and Reichelstein, 2006, Arya and Mittendorf, 2008, 2010).

As far as we know, there exists almost no papers analyzing firms’ procurement and decentralization through a TP schemes. A worth mentioning exception is the paper by Arya et al (2007). The authors obtain that decentralizing firm’s procurement through the use of TP improves firm’s profits. This improvement is obtained because the firm is able to credibly commit to the use of strategic TP. By doing that, the division in charge of bargaining obtains lower profits and when negotiating with the supplier, the supplier must reduce his demands, thus lowering the linear price that can be imposed to the division. We extend that initial result by finding conditions not only when the TP is strategic but also when the TP is not. Different from Arya et al (2007), we also include a two part tariff rather than a linear when negotiating for the input in order to avoid efficiency issues from the negotiation stage and we do not pay attention to competitive issues.

Our paper is also related to the organizational economics literature and the delegation of decisions. We analyze the decision to procure an input, and how the organization matters

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4 Indeed, the authors call this strategy paper sabotage taking the name from the self sabotage effect introduce by Sappington and Weisman (2005)
to improve bargaining positioning. Anton and Yao (1989) and Inderst (2008) pay attention to the strategic aspects arising in the buyer-seller relationship, but do not relate it to the organizational structure of the firm. Closer in spirit is the paper by Janeba (2000) who analyze firm’s strategy as a mechanism to improve some bargaining positioning in order to reduce taxes payment.

The paper is organized as follows. First, we present the main characteristics of the model the problem to be tackled. Second, we solve the baseline model when transfer prices are set in an optimal way and discuss the main result by allowing two simple extensions. In section 4, we solve the model when transfer prices are strategic and analyze the optimal organization. Finally, in section 5 we analyze the case when the supplier may behave strategically and may collude with the factory’s manager. Finally, Section 6 concludes

2 The model

Costs revenues. Demand for the good is characterized by an inverse linear demand function $P(q) = \frac{P}{q}$ yielding revenues $R(q) = P(q)q$ with $R' \leq 0$. Production costs are given by $C(q)$, with $C' > 0, C'' > 0$. To produce the good the firm must acquire an essential input on a one-to-one basis for each unit of output produced. There is an efficient supplier of this input with marginal costs of production $c_1$. There is an alternative (internal or competitive) source of the input or standard, at a cost $c_2 > c_1$. Profits of the firm are

$$\pi = R(q) - C(q) - T(q)$$

(1)

where $T(q)$ are payments to suppliers. We assume that the parties in the negotiation can use a two-part tariff $T(q) = T + wq$ where $w$ is the marginal wholesale price and $T$ is the fixed component.\(^5\)

The quantity $q^*$ that maximize (1) satisfies the first-order condition $R'(q^*) - C'(q^*) - T'(q^*) = 0$. Define $\pi(q, w) = R(q) - C(q) - wq$, $q(w) = \arg\max_q \pi(q, w)$ and $\Pi(w) = \pi(q(w), w)$. Our assumptions on revenues and cost guarantees the existence of a unique solution $q(w)$ to this maximisation problem, that production is strictly decreasing in the input cost, $q'(w) = \frac{1}{R'' - C''} < 0$; and that the surplus generated is decreasing in the input cost, $\Pi'(w) = -q(w) < 0$.

It is clear that under our technological assumptions any efficient situation should involve the use of the efficient supplier. Assume that the firm and the efficient supplier are indeed one entity. In this case, the firm produces $q(c_1)$ which leads to $\Pi(c_1)$ as the maximum rents that the firm can achieve. If, instead, the firm produces using the competitive source, both the quantity, $q(c_2)$, and the rents generated, $\Pi(c_2)$, are obviously lower than the efficient case. The difference of profits between choosing the efficient supplier or the alternative, $\Pi(c_1) - \Pi(c_2)$, is shared between the firm and the supplier. The aim of this paper is to study how firm organization may affect the way those rents are shared between the firm and the supplier.

\(^5\)One interpretation is that the firm negotiates with a competitive fringe. In this case, the fixed payment vanishes and payments to the suppliers become $T(q) = c_2 q$. An alternative interpretation is that the firm produces the input internally rather than buying it from the market.

Another interpretation of this industry structure is that the firm is in negotiations with a labour union to implement new production methods. The old way of producing the output leads to a marginal cost $c_2$ whereas the introduction of the new method leads to a new marginal cost $c_1$.
Firm organization over production and procurement decisions. There are two basic decisions to be made in this organization: the level of production and who bargains with the efficient supplier. We will pay attention to the following organizational architectures:

Under Centralized procurement, or simply C, HQ of the firm takes both decisions. Hence the HQ will try to maximize firm’s profits, and the utility is (1).

Under Delegated procurement, or simply D, the firm will organise its production activity as a business unit. The HQ set a transfer price \( p \) and the business unit will have profits

\[
\pi_f = pq - C(q) - T(q)
\]

and let us define

\[
q(p, w) = \arg \max_q \pi_f
\]

to be the quantity that the manager produces according to the price of the input and the transfer price. As we know since Hirschleifer (1956), HQ can set a transfer price \( p^* = R(q^*) \) for which the quantity that maximises (2) is the same that maximises firm’s profits (1). In charge of the business unit there will be a manager that must maximise the profits of the factory, that is, his utility is (2). Note that if the firm decentralizes production through a business unit but keeps procurement at the HQ level, it is equivalent to centralize procurement (by Hirschleifer (1956) argument)

Bargaining. Both under centralised and delegated procurement the firm bargains with the efficient supplier a two-part tariff \( T(q) = F + wq \). Along the paper, we will assume that, when bargaining, all agents involved have equal bargaining power. If there is centralised procurement, the alternative for HQ is to achieve profits \( \Pi(c_2) \). In case of agreement the efficient supplier has profits \( \pi_s = T(q) - c_1q \) whereas its outside option is to achieve zero profits. Hence, if there is agreement the joint profits of the firm and the supplier increase from \( JP_C^{off} = \Pi(c_2) \) to \( JP_C = \pi + \pi_s = R(q) - C(q) - c_1q \).

With delegated bargaining, the alternative for the manager of the business unit is to achieve the utility

\[
\pi_f^{off} = \max_q \{pq - C(q) - c_2q\}
\]

In case of agreement the efficient supplier has profits \( \pi_s = T(q) - c_1q \) whereas its outside option is to achieve zero profits. Hence, if there is agreement the joint profits of the firm and the supplier increase from \( JP_D^{off} = \pi_f^{off} \) to \( JP_D = \pi_f + \pi_s = pq - C(q) - c_1q \). Hence, given the assumptions on the bargaining power, the payment will satisfy \( T_i(q) = c_1q + \frac{1}{2}(JP_i - JP_i^{off}) \) where \( i = C, D \) (i.e. it will cover the costs of production \( c_1q \) and

\[\text{6}^{\text{The HQ could introduce a contract that links manager’s utility to firm’s performance and not only to factory’s success. That is, assume that the utility of the manager is}}\]

\[
U = \mu \pi + (1 - \mu) \pi_f,
\]

with weights \( \mu \) chosen by HQ. If \( \mu = 1 \), the manager just tries to maximise firm’s profits; when \( 0 \leq \mu < 1 \), the objective function of the manager is not perfectly aligned with firm’s interests.

\[\text{7}^{\text{There are at least two implication of this assumption. First, most of our results are not sensitive, at least qualitatively, to this assumption as long as parties always retain some bargaining power. This is not always true if one of the parties may make take-or-leave-it offers. Second, we do not presume that the factory is more or less able than the manager when negotiating with the efficient supplier. Results can be extended allowing heterogeneous bargaining power and main results would hold at a qualitative level.}}\]
will assign some of the extra rents $JP - JP^{eff}$ to the supplier which depends on who is actually bargaining with the supplier).

**Timing.** In the first stage, the HQ choose the organizational structure of the firm. This means two different decisions: who is in charge of firm’s procurement, the HQ or the factory’s manager; and who takes decisions over production. In the second stage, once the organization is known, a bargaining stage takes place in which the supplier and the firm negotiate the terms of the contract $T(q)$. Finally, in the third stage, the firm produces according to the organizational structure and the terms of the contract with the supplier.

**Headquarter’s evaluation of organizational architecture.** HQ’s main objective is to choose the most suitable organizational architecture to maximize firm’s profits. First, efficiency over production can be achieved by means of efficient bargaining: using a two-part tariff $T(q) = T + wq$ allows those who negotiate to reach an efficient solution.\(^8\) This means that the optimal quantity to be produced in equilibrium will be $q(c_1)$ and the total industry profits is always $JP^{IND} = R(q(c_1)) - C(q(c_1)) - c_1q(c_1) = \Pi(c_1)$. Second, the HQ shares total industry profits with the efficient supplier. Under centralized or decentralized procurement, the firm obtains $JP^{IND} - T_i(q(c_1))$ where $i = C, D$. Third, since it is always possible to achieve the efficient outcome (since prices are non strategic), the optimal organizational architecture solely depend on the payment to be made to the efficient supplier, that is, the objective is to minimize the payment $T(q(c_1))$. Indeed, since we assume a two part tariff, the marginal wholesale price will be $w = c_1$. Therefore the objective of the headquarters is to minimize the fixed payment $F$.

Under centralized bargaining, it is almost straightforward to see that $q(c_1)$ is the quantity that maximizes $JP_C$. This can be achieved by setting $w = c_1$. Thus, $JP_C = JP^{IND} = \Pi(c_1)$ and the fixed payment is $F^C = \frac{1}{2}(\Pi(c_1) - \Pi(c_2))$. Under delegated bargaining case, the argument is similar since, absent uncertainty, it is always possible to set a transfer price that equates production decisions of the HQ with those of the factory manager. When the HQ announces that the firm will organize production according to a transfer price scheme, it means first that the manager maximizes (2) and, although the definitive price will not be known until negotiations over input are over, it is assumed that the HQ chooses the transfer price $p$ that maximizes firm’s profits given that the marginal cost of the input is $w$, and taking into account the expected behavior of the factory that announces $q(p, w)$.\(^9\)

Note that now we assume that the HQ knows the outcome of the bargaining stage, and hence whether the factory must use the alternative source of the input at marginal cost $w = c_2$, or at the expected price $w^{exp}$ when sourcing comes from the efficient supplier.

Thus, given those assumptions, the HQ can, by means of a transfer price scheme, to produce the optimal quantity $q(w)$. This optimal quantity is obtained by setting a transfer price

$$p^{exp} = R'(q(w^{exp})) \quad (5)$$

which, absent uncertainty, can be obtained as long as the manager communicates the outcome of the bargaining stage.

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\(^8\)Note that this is true as long as prices cannot be used in an strategic manner. Later on, we study the use of strategic prices.

\(^9\)In other words, we assume transfer prices to be renegotiable. That is we assume that it is not credible to set an internal price that do not maximize firm’s proceeds. Later on, we analyze the case where the HQ can credibly commit to a particular transfer price.
Thus, it is now clear that joint profits $JP_D = JP^{IND} = \Pi(c_1)$ are maximized when $w = c_1$ and the fixed payment is then

$$F^D = \frac{1}{2}(JP^*_D - JP^\text{off}_D) = \frac{1}{2}(\Pi^f(c_1) - \Pi^f(c_2))$$

where the last equality is taking into account the optimal transfer prices, that is,

$$JP^\text{off}_D = \pi^\text{off}_D = R'(q(c_2))q(c_2) - C(q(c_2)) - c_2q(c_2) \equiv \Pi^f(c_2)$$

and

$$JP^*_D = R'(q(c_1))q(c_1) - C(q(c_1)) - c_1q(c_1) = \Pi^f(c_1)$$

### 3 Organization as an strategic device

In this section we analyze the strategic role of announcing how the firm organizes its production and procurement activities. Notice that, no matter how the firm is organized, efficient production is obtained; to efficient production $q(c_1)$ in case there is a deal with the efficient supplier, and to the same production $q(c_2)$ in case of no deal with the efficient supplier. Hence, any preference $HQ$ have for one structure or the other must come from a different distribution of the same surplus between the firm and the supplier, in other words, the $HQ$ should choose the organizational structure that minimizes the fixed payment to the supplier.

Thus, it can be shown that, under fairly general conditions, $F^C > F^D$; in other words, the firm gets larger benefits by delegating procurement when divisions are profit centers than keeping that decision in $HQ$’s hands. First, the ability to adjust production depending on the outcome of the negotiation increases firm’s bargaining power. However, delegating procurement to a profit center (in this case, the factory) increases even further the bargaining power. This increase is not obtained because the factory makes different production decisions but because the amount of profits to be bargained are different depending on who is negotiating the terms of the agreement. Delegating procurement happens to be better than keeping centralized whenever the amount of profits to be bargained by the division are lower than the profits of the whole company, $\Pi(w) \geq \Pi^f(w)$. This is true if and only if $R'' < 0$. \textsuperscript{11}

**Proposition 1** Delegated procurement is (weakly) preferred to centralized procurement, that is, if $R'' < 0$, then $F^D < F^C$: Moreover if $R'' = 0$, then $F^D = F^C$ and if $C'' = 0$, then $F^D = 0$.

\textsuperscript{10}Regardless of the firm’s bargaining power, the firm obtains a discount with respect to the price paid to the competitive or internal alternative $c_2$. Indeed, even if the supplier has all bargaining power, $T + c_1q(c_1) = c_2$. To see this, note that if the supplier has all the bargaining power the payment is the largest possible, $T = \Pi(c_1) - \Pi(c_2)$. By revealed preference, $\Pi(c_2) = R(q(c_2)) - c_2q(c_2) - C(q(c_2)) > R(q(c_1)) - c_2q(c_1) - C(q(c_1))$ since $R(q(c_1)) - c_2q(c_1) - C(q(c_1)) = \Pi(c_1) + c_1q(c_1) - c_2q(c_1)$, we can rewrite the inequality as $\Pi(c_2) < \Pi(c_1)$ or, reordering, $\Pi(c_1) - c_1q(c_1) < \Pi(c_2)$ or, reordering, as total payment $T + c_1q(c_1) = \Pi(c_2) - \Pi(c_1) + c_1q(c_1) < c_1q(c_1)$, that is, $T + c_1q(c_1) < c_2$.

\textsuperscript{11}The result also requires costs to be convex. The convexity is required to have divisions a well defined function and being able to obtain a finite quantity to be produced.
Delegation provides always a lower payment to the supplier than the centralized case. The mechanism that reduces the payments are the transfer prices, but the firm cannot reduce the payment to the supplier at discretion since prices are not strategic and therefore it would not be credible to announce any price but only those that maximize firm’s profits. In other words, the firm is somewhat constrained by the cost and revenue structure. Indeed, in industries in which the cost structure is not linear and firm’s revenues are less concave (i.e., the sales division is in a very competitive environment) transfer prices makes the share of profits retained by the factory larger reducing therefore the advantages of delegating procurement. In the limiting case, when firm’s revenues are linear factory’s profit coincide with firm’s profits and therefore there are no advantages in delegating procurement to the factory.

3.1 A couple of examples

We obtain explicit results for two widely used demand functions (linear and constant elasticity of demand) and quadratic costs. The linear demand case is of particular interest because it allows to relate firm’s profit in a linear way.

Example 1. Linear demand Consider \( R(q) = \frac{v - bq}{2} q \), and \( C(q) = m q^2 \). \(^{12}\) The optimal level of production is \( q(w) = \frac{w - m}{b + m} \) where \( w \in \{c_1, c_2\} \) stands for the marginal cost of production and \( c_1 \leq c_2 \leq v \). Thus, given production levels, firm’s profit, net of fixed fees, are \( \Pi(w) = \frac{(v - w)^2}{2(b + m)} \). Note that we can relate both profit functions in a linear way, that is, \( \Pi(c_2) = \phi(c_1, c_2) \Pi(c_1) \) where \( \phi \equiv \left( \frac{v - c_2}{v - c_1} \right)^2 \in (0, 1) \) measures the value of the alternative. Thus, the payment under centralized procurement is

\[
F^C = \frac{1}{2} (\Pi(c_1) - \Pi(c_2)) = \frac{1}{2} (1 - \phi) \Pi(c_1),
\]

that is, the higher \( \phi \), the better the alternative and the lower the payment to the supplier.

Instead, if the firm decentralizes procurement, although production levels are the same, it is the factory who bargains with supplier and the payment becomes \( F^D = \frac{1}{2} (\Pi^f(c_1) - \Pi^f(c_2)) \). Taking optimal transfer prices, that is, \( p = mq(w) + w \), factory’s profit become \( \Pi^f(w) = \frac{m}{2} \left( \frac{v - w}{b + m} \right)^2 \). Note that factory’s profit can be related to the company’s profits of the company a linear way. Indeed, \( \Pi^f(w) = \theta(m, b) \Pi(w) \) where \( \theta(b, m) \equiv \frac{m}{b + m} \in (0, 1) \).

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\(^{12}\) This can be easily extended to \( R(q) = \left( v - \frac{bq^s}{1+s} \right) q \), and \( C(q) = m q^{1+s} \) with \( s > 0 \).
The parameter $\theta(m,b)$ measures precisely the difference of profits obtained by the factory and the firm as a whole. The transfer price is precisely the mechanism by which profits are shared among the two divisions, that is, the large the $\theta$, the larger the share of profits obtained by the factory division. Therefore,

$$F_D = \frac{1}{2}(\Pi'(c_1) - \Pi'(c_2)) = \frac{1}{2}(b,m)(\Pi(c_1) - \Pi(c_2)) = \frac{1}{2}\theta(b,m)(1 - \phi)\Pi(c_1)$$

and clearly $F_C > F_D \iff \theta(b,m) < 1$. As expected, $\theta$ is decreasing in the parameter $b$ and increasing in $m$. (explain...)

**Example 2. Constant elasticity demand.** Consider $R(q) = \frac{1}{1 - \gamma}q^{1-\gamma}$ with $0 < \gamma < 1$ and $C(q) = mq^2$. If the marginal procurement cost is $w$, the optimal quantity is the one that satisfies $R'(q) - w - C'(q) = q^{-\gamma} - w - 2mq = 0$ and $\frac{\partial q(w)}{\partial w} = -\frac{1}{\gamma q^{-(1+\gamma)} + 2m} < 0$. Then $F_C > F_D \iff \int -\frac{\partial R(w)}{\partial w} dw > \int -\frac{\partial q(w)}{\partial w} dw$. Note that $-\frac{\partial R(w)}{\partial w} = q(w)$ and $-\frac{\partial q(w)}{\partial w} = -C''(q(w))q(w)\frac{\partial q(w)}{\partial w} = q(w)\frac{2m}{\gamma q^{-(1+\gamma)} + 2m} q(w) < q(w)$. Since $\frac{2m}{\gamma q^{-(1+\gamma)} + 2m} < 1$, the statement holds.

### 3.2 Discussion of the result

Our main result highlights the strategic effect of announcing the firm is organized in a particular way. Note that we do not require agents know the specifics of the organization, or how internal contracts are designed, in other words, the supplier does not need to know the specific transfer price at which the factory sells internally the good. As long as the supplier understand the firm is organized through business units, firm’s bargaining power is improved. We extend this main result by studying two different extensions. First, we allow the HQ to split company in two different entities as an additional organizational structure, what we call **Vertical Separation**. We show that the firm may benefit from this structure, but it is not an structure that always dominates delegated procurement. The second extension allows the firm to shut down the company and produce the output externally. Although a good external alternative increases the incentive to centralize procurement, the HQ may prefer keeping procurement delegated. In both extensions, we derive explicit results by using a linear demand and a quadratic cost function.

**Vertical Separation**

Under **Vertical Separation**, or simply **VS**, the HQ splits the firm up into two different entities. In this case, HQ of the former company plays no further role and the manager of the factory becomes HQ of the new company, taking over both procurement and production decisions. Although the HQ chooses to create two companies, let’s say the sales division company and the factory company, we assume the HQ cares about total profits of the firm, that is $JPI^{IND} - TVS(q)$ where $TVS(q)$ is the payment to the efficient supplier in the vertical separation case. In other words, it is assumed the HQ obtains a payment that covers exactly the profits of the separated entity.

We use the Shapley Value as a solution concept when three are the players involved in sharing the rents.\(^{13}\) Formally the approach used here to share rents is a cooperative game in which we have $N = 3$ players (the grand coalition) and a characteristic function

\(^{13}\) Similar results could be obtained if instead of the shapley value we use simultaneous negotiations processes.
$v : S \rightarrow \mathcal{R}$ from the set of all possible coalitions of players to a set of payments that satisfies $v(\emptyset) = 0$. The Shapley value gives any player $i$ his (average) contribution to a coalition, where the contribution is taken over all possible coalitions to which a player $i$ might belong. More formally, a player’s $i$’s share of the rents are given by

$$\Pi_i^{SEP} = \sum_{S \subseteq N \setminus \{i\}} \frac{|S|!(n-|S|-1)!}{n!} (v(S \cup \{i\}) - v(S))$$

where $n$ is the total number of players and the sum extends over all subsets $S$ belonging to $N$ not containing player $i$. The formula can be interpreted as follows: imagine the coalition being formed one player at a time, with each player demanding their contribution $v(S \cup \{i\}) - v(S)$ as a compensation, and then for each player take the average of this contribution over the possible different combination in which any coalition can be formed.

In this simple case, three players bargain to share the rents of the grand coalition, that is $\Pi(c_1)$. By applying Shapley Value it is almost direct to see that the fixed payment to the supplier (that is, the rents reaped by the factory) is:

$$F^{VS} = \frac{1}{3} (\Pi(c_1) - \Pi(c_2))$$

Except the competitive source which gets no rents, all agents (the efficient supplier, the factory firm and the sales firm) are equally important to generate the surplus $\Pi(c_1) - \Pi(c_2)$. Under centralized procurement, the firm and the supplier equally share the rents generated, $\Pi(c_1) - \Pi(c_2)$ whereas in the separating case, the supplier needs to agree with two other companies making the supplier less determinant to achieve the extra rents. Therefore,

$$F^{VS}_{SEP} = \frac{1}{3} (\Pi(c_1) - \Pi(c_2)) > F^C = \frac{1}{2} (\Pi(c_1) - \Pi(c_2)).$$

When comparing delegated procurement and vertical separation, we observe that both organizational structures reduce the fixed payment as compared to the centralized procurement case. Under delegated procurement, some rents are transferred out of the negotiation through a transfer price scheme, whereas, under separation, some of the rents are outside the negotiation since the company is split into two different entities. Under delegated procurement the share of factory’s profits with respect the total company’s profit depends on the optimal transfer price. In particular, if marginal costs are constant, $F^D = 0$ whereas $F^D = F^C$ when marginal revenues are constant. Instead, under separation, the share retained by the factory remains constant, that is, regardless of the firm’s cost/revenue structure, the supplier always retains $\frac{1}{3} (\Pi(c_1) - \Pi(c_2))$. Therefore, the firm may obtain more clout at the negotiations if announces the company is organized via profit centers and procurement is delegated rather than splitting the company in two different entities. The preference of a structure over the other depends crucially on the cost/revenue structure.

Therefore, it is left to show when vertical separation is preferred to delegated bargaining. In this example, the fixed fee under vertical separation is

$$F^{VS} = \frac{1}{3} (\Pi(c_1) - \Pi(c_2)) = \frac{1}{3} (1 - \phi) \Pi(c_1).$$

It is easy to see that the preference for one structure depends on $\theta(m)$. In particular if $\theta(m) \leq \frac{2}{3}$, the firm should organize as a profit center and separate vertically the company otherwise.

\[14\]The total size is obviously affected by firm’s cost/revenue structure, but not the way those rents are shared.
Optimal organization when the factory is not essential

In this second extension, we consider a situation where the firm have an additional alternative, or an external alternative. This external alternative, assumed to be less efficient than the efficient supplier, lets the firm shut down the factory and produce the output in another factory achieving $\Pi^{ext}$.\(^\text{15}\)

Since bargaining is still assumed to be efficient, this means that, regardless of the organizational structure, efficient production is obtained. In the centralized case, the HQ disposes now of two different alternatives, the internal and the external. This means that the joint profits under centralization are now, $JP_C = \Pi(c_1) - \hat{\Pi}$ where $\hat{\Pi} = \max\{\Pi^{ext}, \Pi(c_2)\}$ and the fixed payment is just $F^C = \frac{1}{2} (\Pi(c_1) - \hat{\Pi})$. Under delegated bargaining the factory cannot take advantage of this external alternative and therefore the payment is $F^D = \frac{1}{2} (\Pi^f(c_1) - \Pi^f(c_2))$. The deal achieved by the manager of the factory may lead to very low profits, since the manager of the factory has no other alternatives than producing with the efficient supplier. In an extreme case, the firm may prefer to shut down the factory and produce the output using the new alternative rather than the efficient supplier whenever $\Pi^D < \Pi^{ext}$.

Comparing both structures, unlike the previous industry structure, the HQ may prefer to centralize procurement rather than delegating this decision to the manager of the factory. On the one hand, the introduction of the external alternative improves bargaining positioning of the firm as a whole, an alternative that cannot be used by the manager of the factory. This effects calls for centralizing procurement. On the other hand, delegating procurement improves firm’s bargaining position because it allows to reduce the rents to be shared with the efficient supplier. This effects calls for delegating procurement.

This external alternative is less efficient than the efficient supplier, $\Pi^{ext} = \alpha \Pi(c_1)$ where $\alpha \in (0, 1)$. Under centralized procurement, HQ’s alternative is now
\[
\hat{\Pi} \equiv \max\{\Pi^{ext}, \Pi(c_2)\},
\]
therefore, the joint profits that the firm and the efficient supplier bargain become $JP = \Pi(c_1) - \hat{\Pi}$ and the fixed fee paid to the supplier is $F^C = \frac{1}{2} (\Pi(c_1) - \hat{\Pi})$. Therefore, given the assumptions on our profit functions, firm may prefer to opt for the competitive fringe if $\alpha > \phi$ achieving $\Pi^C = \frac{1}{2} (1 + \alpha) \Pi(c_1)$, or threatens to to shut down the factory and use the other alternative if $\alpha < \phi$ achieving $\Pi^C = \frac{1}{2} (1 + \phi) \Pi(c_1)$.

Under delegated procurement, it is the manager of the factory who bargains with the efficient supplier. The fixed fee that shares rents with the supplier is $F^D = \frac{1}{2} (\Pi^f(c_1) - \Pi^f(c_2))$ and given our assumptions, this fixed fee can be rewritten as $F^D = \frac{1}{2} \theta(1 - \phi) \Pi(c_1)$ and firm’s profit under delegation become
\[
\Pi^D = \Pi(c_1) - F^D = \left(1 - \frac{1}{2} \theta(1 + \phi)\right) \Pi(c_1).
\]
The deal achieved by the manager of the factory may lead to very low profits, since the manager of the factory has no other alternatives, besides the internal, than producing with
\(^{15}\)The alternative of the company can be interpreted as a multinational company owning different factories. We consider this alternative to be exogenous and hence we do not model how the firm achieves that level of profits. We do not allow the company to shift production from one factory to the other.
the efficient supplier. In an extreme case, the firm may prefer to shut down the factory and produce the output using the new alternative rather than the efficient supplier whenever $\Pi^D < \Pi^{ext}$. This is the case when the new alternative is efficient enough, that is, if

$$\alpha \geq \overline{\alpha} \equiv 1 - \frac{1}{2} \theta(1 - \phi).$$

Comparing both structures, unlike the previous industry structure, the HQ may prefer to centralize procurement rather than delegating always this decision to the manager of the factory. On the one hand, the introduction of the external alternative improves bargaining positioning of the firm as a whole, but it is an alternative that cannot be used by the manager of the factory. This effects calls for centralizing procurement. On the other hand, delegating procurement improves firm’s bargaining position because it allows to reduce the rents to be shared with the efficient supplier. This effects calls for delegating procurement. Therefore, when the external alternative is good enough, if

$$\alpha > \alpha^*(\theta, \phi) = 1 - \theta(1 - \phi),$$

the firm centralizes procurement, while the firm prefers delegated procurement otherwise, that is, if $\alpha < \alpha^*(\theta, \phi)$. Thus $\alpha^*(\theta, \phi) \in (\phi, \overline{\alpha})$ states when the benefits from the external alternative offset the benefits of delegating through the factory. As expected, this threshold increases with $\phi$ and decreases with $\theta$. An increase in $\phi$ improves the internal alternative (relative to the external) and the firm prefers delegate over procurement decisions to avoid sharing rents with the efficient supplier. In a similar vein, reducing $\theta$ reduces the profits achieved by the factory which reduces the rents to be shared with the efficient supplier as long as procurement decisions are delegated to the manager of the factory.

4 Transfer Price Commitment.

In this section, the firm cannot only commit to a TP structure but to a particular transfer price. There exists situations in which the firm may credibly announce a particular internal price, for instance, when the firm, typically a multinational, wishes to avoid problems with different tax authorities when setting the transfer price policy. Then the firm agrees to follow the arm’s length principle which implies that the firm must announce an internal price that is somehow comparable with a transaction in the market.\(^{16}\) We allow for this case and let the HQ to set transfer prices in a strategic manner. Thus, HQ announces a particular firm’s architecture and in case production is delegated to the factory manager, the HQ publicly announces a particular transfer price at which divisions trade. Afterwards, the HQ decides whether to centralize procurement or not and finally production decisions take place.

When the HQ delegates both procurement and production to the factory, the level of production is chosen optimally according to (??), and the bargaining process leads to an efficient production, $w = c_1$.\(^{17}\) The argument is similar to the nonstrategic situation,

\(^{16}\)See for instance OCDE (2001) for details on such principle.

\(^{17}\)First, note that since transfer prices are already set, we can see that decentralization of procurement to the factory and delegation of quantity decisions to the sales division would be an unmitigated disaster: the factory would be forced to acquire whatever quantity $q^{sd}(p)$ chosen by the sales division, independently of the marginal cost $w$ of the input; hence the supplier could obtain a share $\alpha$ of factory’s profits through a two part tariff with a marginal price $w = c_1$ and a fee $T = \alpha(c_2 - c_1)q^{sd}(t)$. This fee would be larger, for any equilibrium quantity $q^{sd}(p)$, to the fee charged to HQ if they centralize procurement.
and the supplier prefers to reduce the marginal wholesale price to increase the total rents and grab some of those rents through the fixed component, being $F^D, St = \frac{1}{2}(\Pi^f(p, c_1) - \Pi^f(p, c_2))$. Thus, when setting the transfer price, HQ solves,

$$\max_{\{p\}} \Pi(p, c_2, c_1, \alpha) = R(q(p, c_1)) - C(q(p, c_1)) - c_1 q(p, c_1) - \frac{1}{2} \Pi^f(p, c_1) - \Pi^f(p, c_2).$$

And the first order condition can be rewritten (using envelope theorem) in the following way,

$$\frac{\partial \Pi(p, c_2, c_1, \alpha)}{\partial p} = [R'(q(p, c_1)) - p] \frac{\partial q(p, c_1)}{\partial p} - \frac{1}{2} \{q(p, c_1) - q(p, c_2)\} \tag{10}$$

In words, the transfer price that maximizes total surplus is $p = R'(q(p, c_1))$ (corresponding to the direct effect); but a part of the generated surplus goes to the supplier as a higher fee; by setting $p < R'(q(p, c_1))$, the efficiency of the firm is reduced, but the HQ creates a wedge between the profits of the whole organization and the profits of the factory that reduce the fee $F^D, St$ that the supplier can charge to the factory which corresponds to the strategic effect.

**Proposition 2** HQ intentionally set a distorted (too low from the point of view of efficiency) transfer price, $p < R'(q(p, c_1))$.

The previous proposition states that, in case the firm commits to a transfer price, it should optimally distort it. The relevant feature of delegating procurement is that it allows the firm keeping some rents away from the bargaining stage. In the nonstrategic situation, the firm successfully achieves that by organizing the firm through profit centers. The ability of the firm to reduce the rents to be bargained with the supplier are somewhat limited by the firm’s cost/revenue structure. Indeed, there might be cases in which delegation provides no benefit to the firm (i.e. $R'' = 0$). In the strategic situation, there is an additional channel to reduce factory’s profits which consists on distorting the optimal transfer price. By doing that the firm faces two impacts: first, since price is not optimally chosen, there is an impact in the efficient choice of production, and second, by reducing the price, the tariff to be paid might also be reduced. Intuitively, the use of an strategic transfer price only makes sense if the reduction of profits (net of fixed fee) is offset by the reduction of the fixed fee (through an improvement of the factory’s bargaining strenght). In other words, the firm can always reduce the payment to the supplier by committing to a very low transfer price. This can be done, though, at the cost of an inefficient choice of firm’s production and profits.

Indeed, when the alternative is as efficient as the supplier, that is, $c_1 = c_2$ it can be showed that, by marginally increasing the cost of the alternative, setting an strategic price leads to lower profits than not committing to a transfer price.

First, when $c_1 = c_2$, under strategic transfer pricing, the firm chooses the efficient transfer price, $p = R'(q(p, c_1))$ since the strategic effect vanishes, no distortions are created when dealing with the efficient supplier, and the firm gets $\Pi(c_1)$. When transfer prices are nonstrategic, the effect of an increase in the cost of the alternative is (differentiating profits with respect to the alternative),

$$\frac{\partial \Pi}{\partial c_2} = \frac{1}{2} \left( -q(c_2) + R''(q(c_2))q(c_2) \frac{\partial q(c_2)}{\partial c_2} \right) < 0$$
This negative sign can be decomposed into two effects of opposed sign. The first effect, or the direct effect, states that an increase in the cost of the alternative reduces the quantity to be demanded and the profits that can be obtained if negotiations fail. The second effect, or the adjusting effect, states that if the alternative cost increases the HQ does adjust the transfer price to a new one allowing the factory to make better production decisions.

When prices are strategic an increase in the alternative does impact negatively firm’s profits through the direct effect but the firm loses the adjusting effect since the firm commits to a specific transfer price. Let \( p^* \) be the price that solves (10), we obtain (by envelope theorem)

\[
\frac{\partial \Pi^{Str}}{\partial c_2} = -\frac{1}{2} q(p^*, c_2) < 0
\]

In other words, committing to a transfer price does not allow the firm to adapt the transfer price to the real marginal cost reducing profits in the alternative (the HQ loses the adjusting effect). This lack of adaptability increases the fix component that the supplier can charge to the firm.

Second, the fixed fee paid to the supplier is larger when the cost of the alternative is close to \( c_1 \). To see this compare the impact of a marginal increase in the cost of the alternative when the price is nonstrategic and when the price is strategic. Under strategic pricing, an increase in the cost of the alternative is

\[
\frac{\partial F^{Str}}{\partial c_2} = q(p^*, c_2) + (q(p^*, c_1) - q(p^*, c_2)) \frac{\partial p^*}{\partial c_2}
\]

where \( p^* \) solves (10).

Instead, when prices are nonstrategic, an increase in the cost of the alternative is

\[
\frac{\partial F^{D}}{\partial c_2} = q(c_2) - q(c_2) \frac{\partial p^{NS}(c_2)}{\partial c_2}
\]

where \( p^{NS}(c_2) = R'(q(c_2)) \) is the nonstrategic transfer price. First at \( c_1 = c_2 \) the strategic and the nonstrategic transfer prices are identical, and the fees paid to the supplier, as well. Thus,

\[
\left. \frac{\partial F^{Str}}{\partial c_2} \right|_{c_2 = c_1} = q(c_2) > \left. \frac{\partial F^{D}}{\partial c_2} \right|_{c_2 = c_1} = q(c_2) - q(c_2) \frac{\partial p^{NS}(c_2)}{\partial c_2}
\]

since \( \frac{\partial p^{NS}(c_2)}{\partial c_2} = \frac{1}{R'' - C''} < 0 \).

The following proposition states a case in which non commitment is the preferred situation.

**Proposition 3** The firm prefers not to commit to a transfer price when the alternative cost is in a neighbourhood of \( c_1 \). \( \left. \frac{\partial \Pi^{Str}}{\partial c_2} \right|_{c_2 = c_1} > \left. \frac{\partial \Pi^{D}}{\partial c_2} \right|_{c_2 = c_1} \iff R'' < 0 \). Moreover, in this neighbourhood, the fixed payment is larger under strategic pricing, \( \left. \frac{\partial F^{Str}}{\partial c_2} \right|_{c_2 = c_1} > \left. \frac{\partial F^{D}}{\partial c_2} \right|_{c_2 = c_1} \)

Now, let us analyze a situation in which committing to a transfer price may provide larger prices than no committing. We analyze this case by means of an example and we obtain that committing to a price is profitable in cases in which is crucial to gain leverage at the negotiation stage. The demand function analyzed is linear having the form \( R(q) = (1 - \frac{b}{2}) q \), production costs are convex \( C(q) = m q^2 \) being \( m > 0 \), and finally we normalize \( c_1 = 0 \) rename \( c_2 = c \). The following figures compares firm’s profits and fees under the use of nonstrategic transfer price (dashed lines) and under the use of strategic prices (solid line). Note that firm’s profits (weakly) decreases and fees (weakly) increases as the cost of the alternative increase. When the firm commits to a transfer price, it might
be the case that the alternative is so inefficient that it is better not to produce in case the negotiations fail (corresponding to the horizontal segment of the solid line). We consider both cases; in the first two figures the threshold is obtained in the horizontal part whereas in the last figure the threshold is determined in the strictly decreasing part. When looking at fees, the threshold may be obtained at the horizontal part (first figure) or at the interior part (last two figures)

Nevertheless, the use of strategic transfer prices makes sense when the cost of the alternative is high and when firm’s cost/revenue structure makes difficult for the firm to reduce factory’s profits through nonstrategic transfer prices, that is, for \( \theta \) large. In other words, the use of strategic prices matters if allows the firm to gain some leverage. The following figure captures precisely this argument for the linear demand quadratic cost case. The solid line represents the combinations of parameters such that above the solid line the firm prefers using strategic transfer prices, while the dashed line represents the combination of parameters such that the fee paid is the same both under strategic and under nonstrategic transfer price. Therefore three regions are obtained, one in which fees and profits are larger under nonstrategic (below the dashed function), the second in which both fees and profits are larger under strategic transfer price (above the solid function) and finally a third region of parameters in which fees are lower under strategic but the firm gets larger profits under nonstrategic. In this last region the reduction of fees does not offset the distortions generated at the production level.
5 Supplier’s Commitment

Consider the case that, instead of committing to a particular internal price \( p \) or a particular quantity \( q \), it is possible to commit to a particular contract \( \{F, w\} \). The timing is similar to the benchmark case with the exception of the contract commitment, that is, the HQ sets the organizational structure, then either the HQ or the factory bargains with the supplier and commit to a particular contract \( \{F, w\} \), and finally the firm starts production needs. A potential reason for this explanation may arise because the firm is also selling to many other customers and other firms and has to make public the terms of the contract (references).

When the firm is centralized, the supplier improves nothing by committing to a contract different from \( \{F^C, c_1\} \). A marginal wholesale price different from the marginal cost of production, that is setting \( w \neq c_1 \), reduces the quantity to be produced and therefore the rents to bargain with. However, when the supplier enters the negotiation with the factory this is not necessarily the case. By credibly committing to a particular contract \( \{F, w\} \), the supplier may affect not only the quantity that the firm chooses but also can effectively influence the transfer price. Indeed, in this case, it is in not optimal to set the contract \( \{F^D, c_1\} \) obtained in the benchmark case.

For the delegated case, note that at the production stage the HQ selects the transfer price such that the factory chooses the level of production that maximizes firm’s profits (as showed in previous sections). Thus, given the transfer price \( p \) and the input price \( w \) the factory chooses \( q^f(p^f(w), w) \) according to (3) and the HQ can achieve, given \( w \), the optimal production by setting \( p(w) = R'(q^*(p(w), w)) \) (optimality is still conditional on the right expectations over \( w \)).

At the bargaining stage and in case negotiations fail, the input price rises up to \( c_2 \)
and the factory obtains $\Pi^f(p(c_2), c_2)$, i.e., factory’s outside option. When the factory and the supplier bargain over the terms of the contract \{\text{\$F}, w\}, they choose the tariff $T^D(q) = F^D + wq$ that maximize their joint profits. However, they are restricted to set a marginal wholesale price not above $c_2$ since the HQ can always block the agreement and procure the input from the alternative. An input price $w > c_2$ is largely inefficient and total rents generated are even lower than $\Pi(c_2)$. Given said that, the supplier and the factory maximize their joint profits,

$$\begin{align*}
p(w)q^f(p^f(w), w) - qw^f(p^f(w), w) - C(q^f(p^f(w), w)) - F^D + (w - c_1) q^f(p^f(w), w) + F^D
\end{align*}$$

subject to the restriction $w \leq c_2$ which is equivalent to choose the input price $w$ that maximizes rents and use the fix component to split those rents,

$$(p^f(w) - c_1)q^f(p^f(w), w) - C(q^f(p^f(w), w)), \ s.t \ w \leq c_2$$

The first-order condition of this problem can be written (by using envelope theorem) in the following way,

$$\begin{align*}
(w - c_1) \frac{\partial q^f(p^f(w), w)}{\partial w} + \frac{\partial p}{\partial w} q^f(p^f(w), w),
\end{align*}$$

where two different effects arise. The first element, the direct effect, is the effect of the input price on the quantity produced by the factory while the second element, the strategic effect, is the effect that the input price has on the internal price set by the HQ. While the quantity effect is negative since $w \geq c_1$ and $\frac{\partial q^f(p^f(w), w)}{\partial w} < 0$ (as already showed in the baseline case), the internal price effect turns out to be positive

$$\frac{\partial p}{\partial w} = R''(q(p(w), w)) \frac{\partial q^f(p^f(w), w)}{\partial w} > 0$$

if and only if revenues are concave ($R'' < 0$). Indeed, due to the existence of this strategic effect, both the factory and the supplier always agree on an input price $w > c_1$. When this strategic effect was absent setting $w = c_1$ was indeed optimal. Now, in this framework, when $w = c_1$, the first order condition is still positive, $\frac{\partial p}{\partial c_1} q^f(p^f(c_1), c_1) > 0$. Thus, both the supplier and the factory benefit by distorting wholesale prices so as to influence transfer prices even though this comes at the cost of producing inefficiently.

The following result summarizes the contract and the payoffs obtained under a fully delegated situation. It is instructive to define the following threshold $k(c_2) \equiv -R''(q(c_2))q(c_2)$ ($> 0$ if $R''() < 0$),\(^{18}\) since the exact shape of the contract depends on the relative efficiency of the supplier and the competitive fringe. We say that supplier’s efficiency is low (but never lower than the fringe) when $c_1 > c_2 - k(c_2)$ and high when the opposite happens. It is rather intuitive to see that when the supplier’s efficiency is low the wholesale price is set to its maximum level, $w = c_2$, and the firm thus produces at its lowest level of production. Instead, when supplier’s efficiency is high, the wholesale price is $w \in (c_1, c_2)$, but still the production is inefficiently low.

\(^{18}\)For instance, for a linear demand case in which $R(q) = (1 - q)q$ and $C(q) = q^2 F(c_2) = \frac{1-c_2}{2}$
Lemma 1 Take the case where the firm is delegated and both the supplier and the factory can credibly commit to a particular contract \( \{ F, w \} \)

(a) When supplier’s efficiency is low the contract is \( \{ F_D, w \} = \{ -(1-\alpha) (c_2-c_1) q(c_2), c_2 \} \), production \( q = q(c_2) \), and payoffs are \( \Pi = \Pi(c_2) + (1-\alpha) (c_2-c_1) q(c_2) \) and \( \Pi^S = \alpha (c_2-c_1) q(c_2) \)

(b) When supplier’s efficiency is high, the contract is \( \{ F_D, w \} = \{ \alpha [\Pi^F(w) - \Pi^F(c_2)] -(1-\alpha)(w-c_1)q(w), w \} \), \( w \in (c_1, c_2) \), production \( q = q(w) < q(c_1) \), and payoffs \( \Pi = \Pi(w) - F^D \) and \( \Pi^S = (w-c_1)q(w) + F^D \)

It is worth mentioning that the fix component \( F^D \) may take negative values; it is the supplier who pays the firm (the factory, indeed) for accepting the terms of the contract. This possible situation arises when the supplier’s efficiency is low (case (a)) or when the supplier does not have much bargaining power (\( \alpha \) low in case (b)). This can be seen potentially as an slot allowance or even as a bribe. In any case, we assume that the negative fix component is returned to the firm and not kept privately in hands of the factory’s manager. The intuition of this negative fix component may be seen in the following way. Assume that the supplier’s efficiency is low, both the factory and the manager agrees on setting the largest marginal wholesale price possible, \( w = c_2 \). Net of fixed payments, the factory gets exactly \( \Pi^F(p(c_2), c_2) \) (the same amount obtained under the alternative). Since the rents generated under this agreement rises up to \( (c_2-c_1) q(c_2) \), the factory may reap \( (1-\alpha) \) of those rents and that rents can only be satisfied through the fix component.

Given this potential unwanted production levels, the HQ may prefer to centralize procurement activities. Centralizing it raises production up to its efficient level, \( q(c_1) \), and hence profits (net of fixed payment) increases, as well. However, centralizing does reduce firm’s bargaining strenght increasing the fix component and reducing firm’s profits (see Proposition 1). The next proposition compares firm’s profits obtained under the different organizational structures when the supplier may engage in strategic behavior.

Proposition 4 When supplier’s efficiency is low, the headquarter strictly prefers centralization rather than delegation whenever \( \alpha < 1 \) (and indifference when \( \alpha = 1 \)). Instead, when supplier’s efficiency is high, there exists a bargaining power \( \hat{\alpha} \) such that for \( \alpha \geq \hat{\alpha} \) it is optimal to delegate procurement to the factory and centralize procurement otherwise.

In Figure 2a we represent firm’s profits under centralization (blue lines) and under decentralization (red lines) against supplier’s bargaining power \( \alpha \). Solid lines represent a situation where the supplier’s efficiency is low while dashed lines show a case where supplier’s efficiency is high. For the sake of an exposition ease, the difference in those two cases is just an increase in the cost of the alternative \( c_2 \). This implies that the firm gets always lower profits when the cost of the alternative is large (dashed lines) and at \( \alpha = 0 \), the firm gets the same exact profits.

First, consider the case when when supplier’s efficiency is low (solid lines). The firm chooses between producing efficiently \( q(c_1) \) and paying a large amount \( F^C \) and getting \( \Pi(c_1) - \alpha (\Pi(c_1) - \Pi(c_2)) \) or producing an inefficient quantity, \( q(c_2) \) but getting some payment in return \( F \), that is, \( \Pi(c_2) + (1-\alpha)(c_2-c_1)q(c_2) \). In this case, we observe that centralizing (solid blue line) always provides larger profits than delegating procurement (solid red line). This is so since the distortion at the production level is so high that it
does not compensate any improvement at the bargaining stage. Indeed, when the firm has no bargaining power ($\alpha = 1$), the firm is indifferent between delegating procurement or not since the supplier may reap all surplus. Note though that production decisions are not the same and centralizing provides a larger amount of production ($q(c_1)$) than under delegation ($q(c_2)$).

Consider now the case when the supplier’s efficiency is high (dashed lines). In this situation, the distortion at the production level still exists but it is not taken at its corner, that is, $w \in (c_1, c_2)$. The firm faces a similar tradeoff than the previous case, that is, the firm compares an efficient but expensive agreement, providing $\Pi(c_1) - F^C$ against an inefficient but cheaper agreement, providing $\Pi = \Pi(w) - F^D$. Different from the first case, the firm may prefer decentralization. The firm has incentives to delegate procurement when, by doing that, improves significantly his bargaining positioning (even at the cost of producing inefficiently). This requires first that the supplier’s efficiency is very high (the alternative is highly inefficient) and second that the firm has very small bargaining power ($\alpha$ is very high). In figure 2a, we represent graphically this second case and observe that when $\alpha \in (\hat{\alpha}, 1)$, it is better to centralize production. When the cost of the alternative increases the reduction of profits is larger under centralization than under delegation since more firm’s profits can be extracted by the supplier at the bargaining stage (note that $|\frac{\partial \Pi(c_2)}{c_2}| > |\frac{\partial \Pi^f(c_2)}{c_2}|$). Yet, delegation is superior to centralization only when the firm has a small bargaining power $\alpha \in (\hat{\alpha}, 1)$. If the firm has more bargaining power, the firm cares about producing efficiently, creating higher rents and knowing that only a small part of those rents will be captured in the negotiation stage. On the contrary, when $\alpha$ is high, most of those efficient rents go to the supplier unless that decision is delegated to the factory. In that case, rents are lower, but some of those rents are kept away from the negotiation stage.

Finally, we obtain conditions in which the supplier may prefer to bargain with the HQ rather than with the factory (even if they can commit to a contract). This arises when the supplier’s efficiency is low (see part (a) of Lemma 1) and also when the HQ prefers delegation. In the former case, committing to the contract deters delegation but in the latter case, the commitment improves supplier’s profit but it is unable to force the firm to centralize those activities.

**Corollary 1** If the supplier’s efficiency is low, committing to a contract deters delegation of procurement.
Figure 2 (b) illustrates the previous results by solving a linear demand case. Demand and cost functions $P(q) = 1 - q$ and $C(q) = q^2$, $c_1 = 0$, $c_2$ takes values on $[0, 1]$, supplier has bargaining power $\alpha \in [0, 1]$. In a decentralized structure, the supplier can choose the wholesale contract $T(q) = F + wq$ before headquarters set the transfer price $p$. Instead, if the organization is centralized, there is no transfer price and no strategic influence on that choice. There are two optimal organizational structures, depending on the values of the alternative and the bargaining power of the supplier.

Northeast region: Headquarters decentralize procurement, the supplier sets distorted wholesale prices and production is inefficiently low. This situation become optimal when the alternative is highly inefficient and the firm has no bargaining power ($\alpha$ high)

Headquarters centralize procurement, production is efficient but the supplier extracts (for a given bargaining parameter $\alpha$) more rents.

6 Concluding remarks

The main goal of this paper is to understand the benefits of decentralization, through a transfer price scheme, of firm’s procurement. We show conditions under which the delegation of firm’s procurement improves firm’s bargaining against suppliers. The benefits arises as long, by decentralizing, factory’s profits are lower than firm’s profits which improves firm’s bargaining positioning. We show, unlike Arya (2007), the existence of those benefits both under strategic and non-strategic transfer prices. We extend the initial framework by introducing other aspects that may moderate the decision to decentralize firm’s procurement. First, the firm may split the company in two different entities (vertically separation) as a mechanism to reduce supplier’s rents. Second, the firm owns an external
alternative that allows to shut down the factory. In both cases, we obtain situations in which the firm prefers firms’ procurement to be at factory’s hands. Third, we show that the use of strategic transfer prices does not necessarily improve firm’s profits and they may be counterproductive. Fourth, we show that the firm may prefer centralize firm’s procurement when the factory and the supplier privately negotiate the input price.

Finally, there are at least two natural extensions. First, the multiplant case: note that in this case, the firm can use the organizational structure to increase firm’s bargaining positioning, but it can also shift production to increase its positioning. When the firm owns several factories, it may not always be optimal to keep decentralization at the factory level, and the firm partly centralize firm’s procurement by building a new layer, namely, a central purchasing. Second, the introduction of uncertainty at the demand’s side. In that framework, the sales manager knows the true realization of the demand but cannot communicate it to the HQ or to the factory (following Weitzman, 1974). Thus, the problem faced by the HQ is to whom provide authority over quantity; to the sales division and taking advantage of the local information knowledge or to the factory and reinforce the bargaining position against the efficient supplier.

References


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7 Appendix

7.1 Proofs

The following two proofs shows that the optimal contract when procurement is centralized and when it is delegated

**Proof Centralized procurement.** The optimal contract between the supplier and the headquarter is the solution to the following problem

\[
\max_{\{F,w\}} \left[ \Pi(w) - F - \Pi(c_2) \right]^{(1-\alpha)} \left[ F + (w - c_1)q(w) \right]^\alpha
\]

Let us first take logs to convert the program into

\[
\max_{\{F,w\}} (1 - \alpha) \ln \left[ \Pi(w) - F - \Pi(c_2) \right] + \alpha \ln \left[ F + (w - c_1)q(w) \right]
\]
and the first order conditions are
\[
\frac{\partial}{\partial F} = 0 \iff -\frac{(1-\alpha)}{\Pi(w) - F - \Pi(c_2)} + \frac{\alpha}{F + (w - c_1)q(w)} = 0
\]
\[
\frac{\partial}{\partial w} = 0 \iff \frac{(1-\alpha)\frac{\partial \Pi(w)}{\partial w}}{\Pi(w) - F - \Pi(c_2)} + \frac{\alpha \left( (w - c_1)\frac{\partial q(w)}{\partial w} + q(w) \right)}{F + (w - c_1)q(w)} = 0
\]

Note first that from \(\frac{\partial}{\partial F} = 0\) we obtain the fixed component \(F^h q\)
\[
F^h q(\alpha, w) = \alpha [\Pi(w) - \Pi(c_2)] - (1 - \alpha)(w - c_1)q(w)
\]

By plugging \(F^h q(\alpha, w)\) into \(\frac{\partial}{\partial w} = 0\), we obtain
\[
\frac{(1-\alpha)\frac{\partial \Pi(w)}{\partial w}}{(1-\alpha)(\Pi(f(w) - \Pi(f(c_2)) - (w - c_1)q(w))} + \frac{\alpha \left( (w - c_1)\frac{\partial q(w)}{\partial w} + q(w) \right)}{\alpha(\Pi(f(w) - \Pi(f(c_2)) - (w - c_1)q(f(w)))} = 0 \iff
\]
\[
\frac{\partial \Pi(f(w))}{\partial w} + (w - c_1)\frac{\partial q(w)}{\partial w} + q(f(w)) = 0
\]

Note that by applying the envelope theorem \(\frac{\partial \Pi(w)}{\partial w} = -q(w)\) which means that
\[
\frac{\partial}{\partial w} = 0 \iff (w - c_1)\frac{\partial q(w)}{\partial w} = 0
\]

which holds if and only if \(w = c_1\). Thus, take \(w = c_1\) into \(F^h q(\alpha, w)\) and we obtain
\(F^h q(\alpha, c_1) = \alpha [\Pi(c_1) - \Pi(c_2)]\)

Consider \(\alpha = 1\), in which case we have the largest fee \(F^h q = \Pi(c_1) - \Pi(c_2)\). By revealed preference, \(\Pi(c_2) = R(q(c_2)) - c_2q(c_2) - C(q(c_2)) > R(q(c_1)) - c_2q(c_1) - C(q(c_1))\); since \(R(q(c_1)) - c_2q(c_1) - C(q(c_1)) = \Pi(c_1) + c_1q(c_1) - c_2q(c_1)\), we can rewrite the inequality as \(\Pi(c_2) > \Pi(c_1) + c_1q(c_1) - c_2q(c_1)\) or, reordering as total payment, \(c_2q(c_1) > \Pi(c_1) - \Pi(c_2) + c_1q(c_1)\) that is, \(c_2q(c_1) > F + c_1q(c_1) \rightarrow F + c_1q(c_1) < c_2\). QED.

**Proof of Delegated organizational structure.** The optimal contract between the supplier and the factory is the solution to the following problem
\[
\max_{\{F, w\}} [\Pi(f(w) - F - \Pi(f(c_2))^{(1-\alpha)} [F + (w - c_1)q(w)]^\alpha
\]

Let us first take logs to convert the program into
\[
\max_{\{F, w\}} (1-\alpha) \ln [\Pi(f(w) - F - \Pi(f(c_2))] + \alpha \ln [F + (w - c_1)q(w)] \ s.t \ w \leq c_2
\]

and the first order conditions derived from the lagrangian are
\[
\frac{\partial L}{\partial T} = 0 \iff -\frac{(1-\alpha)}{\Pi(w) - T - \Pi(c_2)} + \frac{\alpha}{T + (w - c_1)q(w)} = 0
\]
\[
\iff (1-\alpha) [T + (w - c_1)q(w)] = \alpha [\Pi(f(w) - T - \Pi(f(c_2))]
\]
\[
\frac{\partial L}{\partial w} = 0 \iff \frac{(1-\alpha)\frac{\partial \Pi(w)}{\partial w}}{\Pi(w) - T - \Pi(c_2)} + \frac{\alpha \left( (w - c_1)\frac{\partial q(w)}{\partial w} + q(w) \right)}{T + (w - c_1)q(w)} = 0
\]
Note first that from $\frac{\partial T^f}{\partial T} = 0$ we obtain

$$T^f(\alpha, w) = \alpha \left[ \Pi^f(w) - \Pi^f(c_2) \right] - (1 - \alpha)(w - c_1)q(w)$$

By plugging $T^f(\alpha, w)$ into $\frac{\partial}{\partial w} = 0$, we obtain

$$\frac{(1 - \alpha)\partial \Pi^f(w)}{(1 - \alpha)(\Pi^f(w) - \Pi^f(c_2) - (w - c_1)q(w))} + \frac{\alpha \left( (w - c_1)\frac{\partial q^f(w)}{\partial w} + q^f(w) \right)}{\alpha (\Pi^f(w) - \Pi^f(c_2) - (w - c_1)q^f(w))} = 0 \iff$$

$$\frac{\partial \Pi^f(w)}{\partial w} + (w - c_1)\frac{\partial q^f(w)}{\partial w} + q^f(w) = 0 \iff$$

$$(w - c_1)\frac{\partial q^f(w)}{\partial w} = 0$$

where the last equivalence is obtained by noting that $\frac{\partial \Pi^f(w)}{\partial w} = -q^f(w)$. Finally, since $\frac{\partial q^f(w)}{\partial w} < 0$, $w = c_1$. Finally, plug $w = c_1$ to obtain the payment $T^f = \alpha \left[ \Pi^f(c_1) - \Pi^f(c_2) \right]$. 

**Proof of Proposition 2.** Notice that at $p = R^f(q(p, c_1))$, we have $\frac{\partial \Pi(p, c_2, c_1)}{\partial p} = -\alpha \{q(p, c_1) - q(p, c_2)\} < 0$; hence we obtain the stated result. 

**Proof of Proposition 3.** First, firm’s profits when the transfer price is not strategic are $\Pi = \Pi(c_1) - \frac{1}{2} (\Pi^f(c_1) - \Pi^f(c_2))$ and differentiating (and applying envelope theorem) with respect to $c_2$, we get

$$\frac{\partial \Pi}{\partial c_2} = \frac{1}{2} \left( -q(c_2) + R''(q(c_2))q(c_2)\frac{\partial q(c_2)}{\partial c_2} \right)$$

rearranging and noting that $\frac{\partial q(c_2)}{\partial c_2} = \frac{1}{R''(q(c_2))} < 0$, we obtain

$$\frac{\partial \Pi}{\partial c_2} = \frac{1}{2 R''(q(c_2))} C''(q(c_2)) q(c_2) < 0$$

Second, firm’s profits when the transfer price is strategic are $\Pi^{Str} = \Pi(p^*, c_1) - \frac{1}{2} (\Pi^f(p^*, c_1) - \Pi^f(p^*, c_2))$ where $p^*$ solves 10, and differentiating (and applying envelope theorem) with respect to $c_2$, we get

$$\frac{\partial \Pi^{Str}}{\partial c_2} = -\alpha q(p^*, c_2) < 0$$

Now, note that when $c_2 = c_1 p^* = R'(q(c_1))$, which implies that $q(p^*, c_2) = q(c_1) = q(c_2)$ and therefore $\Pi = \Pi(c_1) = \Pi^{Str}$. Note that $\frac{\partial \Pi}{\partial c_2} \bigg|_{c_2 = c_1} = \alpha \frac{C''(q(c_1))}{R''(q(c_1))} q(c_1)$ while $\frac{\partial \Pi^{Str}}{\partial c_2} = -\alpha q(c_1)$. Since $\frac{C''(q(c_1))}{R''(q(c_1))} < 1 \iff R'' < 0$ the stated result is obtained. 

**Proof of Lemma 1.** The optimal contract between the supplier and the factory is the solution to the following problem

$$\max_{\{T, w\}} \left[ \Pi^f(w) - T - \Pi^f(c_2) \right]^{(1-\alpha)} \left[ T + (w - c_1)q(w) \right]^\alpha \text{ s.t. } w \leq c_2$$

Let us first take logs to convert the program into

$$\max_{\{T, w\}} (1 - \alpha) \ln \left[ \Pi^f(w) - T - \Pi^f(c_2) \right] + \alpha \ln \left[ T + (w - c_1)q(w) \right] \text{ s.t. } w \leq c_2$$
and the first order conditions derived from the lagrangian are

\[
\frac{\partial}{\partial T} = 0 \iff - \frac{(1 - \alpha)}{\Pi'(w) - T - \Pi'(c_2)} + \frac{\alpha}{T + (w - c_1)q^f(w)} = 0
\]

\[
\iff (1 - \alpha) [T + (w - c_1)q(w)] = \alpha [\Pi'(w) - T - \Pi'(c_2)]
\]

\[
\frac{\partial}{\partial w} = 0 \iff \frac{(1 - \alpha) \frac{\partial \Pi'(w)}{\partial w}}{\Pi'(w) - T - \Pi'(c_2)} + \frac{\alpha \left( (w - c_1) \frac{\partial q(w)}{\partial w} + q^f(w) \right)}{T + (w - c_1)q^f(w)} - \lambda = 0
\]

where \(\lambda \geq 0\) is the lagrange multiplier associated to the constraint \(w \leq c_2\). Note first that from \(\frac{\partial}{\partial T} = 0\) we obtain the fixed component \(T^f\)

\[
T^f(\alpha, w) = \alpha \left[ \Pi'(w) - \Pi'(c_2) \right] - (1 - \alpha)(w - c_1)q^f(w)
\]

First, take the case \(\lambda = 0\), which implies that \(w < c_2\). By plugging \(T^f(\alpha, w)\) into \(\frac{\partial}{\partial w} = 0\), we obtain

\[
\frac{(1 - \alpha) \frac{\partial \Pi'(w)}{\partial w}}{(1 - \alpha) \left( \Pi'(w) - \Pi'(c_2) - (w - c_1)q^f(w) \right)} + \frac{\alpha \left( (w - c_1) \frac{\partial q^f(w)}{\partial w} + q^f(w) \right)}{(\Pi'(w) - \Pi'(c_2) - (w - c_1)q^f(w))} = 0 \iff
\]

\[
\frac{\partial \Pi'(w)}{\partial w} + (w - c_1) \frac{\partial q^f(w)}{\partial w} + q^f(w) = 0 \iff
\]

\[
\frac{\partial p^f(w)}{\partial w} q^f(w) + (w - c_1) \frac{\partial q^f(w)}{\partial w} = 0
\]

since \(\frac{\partial \Pi'(w)}{\partial w} = \frac{\partial p^f(w)}{\partial w} - q^f(w) + (p^f(w) - w - C'(q^f(w))q^f(w)) \frac{\partial q^f(w)}{\partial w} = \frac{\partial p^f(w)}{\partial w} - q^f(w)\). Note that \(w = c_1\) cannot be a local optimum and therefore \(w \in (c_1, c_2)\).

Now, take the case \(\lambda = 0\), which implies that \(w = c_2\) and \(T(\alpha, w)\) becomes \(T(\alpha, c_2) = -(1 - \alpha)(c_2 - c_1)q^f(c_2)\). Finally this case takes place whenever \(\frac{\partial p^f(c_2)}{\partial c_2} q^f(w) + (c_2 - c_1) \frac{\partial q^f(c_2)}{\partial c_2} \geq 0\) and can be rewritten \(\frac{\partial q^f(c_2)}{\partial c_2} \left[ R''(q^f(c_2))q^f(c_2) + (c_2 - c_1) \right] \geq 0\) which implies that \(R''(q^f(c_2))q^f(c_2) + (c_2 - c_1) \leq 0\). ■

**Proof.** 4In a centralized organization, there are no distortions on wholesale prices, and the firm achieves profits \(\Pi(c_1) - T = \Pi(c_1) - \alpha[\Pi(c_1) - \Pi(c_2)]\), whereas under decentralization profits are \(\Pi(c_2) + (1 - \alpha)(c_2 - c_1)q(c_2)\). Then

\[
\Pi(c_1) - \alpha[\Pi(c_1) - \Pi(c_2)] > \Pi(c_2) + (1 - \alpha)(c_2 - c_1)q(c_2) \iff
\]

\[
\Pi(c_1) > \Pi(c_2) + (c_2 - c_1)q(c_2) = R(q(c_2)) - C(q(c_2)) - c_1q(c_2),
\]

which is indeed true since \(q(c_2)\) is not the optimal quantity at marginal costs of the input \(c_1\). This proves the first part of the proof.

Assume now that \(c_1 < c_2 - k(c_2)\). Let us first consider the extreme cases, \(\alpha = 0\) and \(\alpha = 1\). When \(\alpha = 1\), under a centralized structure profits are \(\Pi(c_2)\). Under delegation profits are \(\Pi(w) - T^f = \Pi(w) - (\Pi'(w) - \Pi'(c_2))\). Then delegation provides larger profits than centralization if

\[
\Pi(w) - (\Pi'(w) - \Pi'(c_2)) > \Pi(c_2) \iff \Pi(w) - \Pi(c_2) > \Pi'(w) - \Pi'(c_2),
\]

and this is the case for \(w < c_2\) whenever \(R'' < 0\).

If \(\alpha = 0\), under a centralized structure, profits are \(\Pi(c_1)\) while under delegation profits are \(\Pi(w) - T^f = \Pi(w) + (w - c_1)q(w)\). Then,

\[
\Pi(c_1) > \Pi(w) + (w - c_1)q(w) \iff \Pi(c_1) > R(q(w)) - C(q(w)) - c_1q(w)
\]
which is indeed true since \( q(w) \) is not the optimal quantity at marginal costs of the input \( c_1 \).

Finally, take any \( \alpha \in (0, 1) \), and note that both \( \Pi(w) - T^f(\alpha, w) \) and \( \Pi(c_1) - T^{hq}(\alpha) \) are continuous and linear w.r.t \( \alpha \). Finally since at \( \alpha = 0, \Pi^{\text{Cent}} > \Pi^{\text{Del}} \) while the opposite is true for \( \alpha = 1 \), it must be true that there exists \( \tilde{\alpha} \) such that \( \Pi(w) - T^f(\tilde{\alpha}, w) = \Pi(c_1) - T^{hq}(\tilde{\alpha}) \).

**Proof of Corollary 1.** If \( c_1 > c_2 - \bar{k}(c_2) \), the supplier obtains under centralization \( \Pi^S_C = \alpha(\Pi(c_1) - \Pi(c_2)) \) while obtains \( \Pi^S_D = \alpha(c_2 - c_1)q(c_2) \) under delegation. Note that

\[
\Pi^S_C > \Pi^S_D \iff \Pi(c_1) > \Pi(c_2) + (c_2 - c_1)q(c_2)
\]

which is true since \( q(c_2) \) is not the optimal quantity for \( w = c_1 \).

If \( c_1 < c_2 - \bar{k}(c_2) \), one can redefine firm’s profit function in the following way, \( \Pi^{HQ}_C = \Pi(c_1) - \Pi^S_C \) while \( \Pi^{HQ}_D = \Pi(w) + (w - c_1)q(c_2) - \Pi^S_D \). Note that if the HQ delegates procurement, it is true that the supplier would be better off if centralized. This means that

\[
\Pi^{HQ}_D > \Pi^{HQ}_C \iff \Pi(w) + (w - c_1)q(c_2) - \Pi^S_D > \Pi(c_1) - \Pi^S_C \\
\iff \Pi^S_C - \Pi^S_D > \Pi(c_1) - (\Pi(w) + (w - c_1)q(c_2)) > 0 \\
\iff \Pi^S_C > \Pi^S_D
\]

\[\blacksquare\]

### 7.2 An alternative but equivalent organization: HQ bargains with the supplier, production decentralize through a TP scheme

Assume now that the HQ centralizes procurement but delegates production to the divisions. The rest of the timing goes as follows:

1. The HQ bargains with the supplier the input price according to a two part tariff \( \{w, T\} \), that is, we assume total payment takes the form \( T(q) = T + wq \).

2. If an agreement is reached, HQ implements a TP scheme. This means that
   
   (2.1) the HQ chooses the internal price \( p \) and whether it is the factory or the sales division that chooses quantities.
   
   (2.2) Both divisions become profit center and the chosen division decides, given \( p \), how much to produce.

When the HQ announces at the first period that that the firm will organize production according to a transfer price scheme, it means that (1) divisions become profit centers and (2) although the definitive price will not be known until negotiations over input are over, it is known that the HQ chooses the transfer price \( p \) that maximizes firm’s profits given that the marginal cost of the input is \( w \), and taking into account the expected behavior of the division that announces \( q(p, w) \) (later on, we analyze the case where the HQ can not only announce an organization where divisions announces a TP structure but it can credibly commit to a particular transfer price).

Thus, given those assumptions, the HQ wants, by means of a transfer price scheme, to produce the optimal quantity \( q(w) \) (which obviously coincides with the centralization
case). This optimal quantity is the one that satisfies the first order condition \( R'(q(w)) - C'(q(w)) - w = 0 \). Thus, HQ can induce the optimal behavior of the division that chooses quantities, be it the factory or the sales division, through the choice of a particular transfer price \( p \). Since there is no uncertainty at the production stage, it is always possible to achieve such optimal quantity.

For instance, the sales division would choose the quantity

\[
q^{sd}(p) = \arg \max_q R(q) - pq.
\]

The first order condition is \( R'(q^{sd}(p)) - p^{sd} = 0 \) and a transfer price \( p^{sd} = w + C'(q(w^{exp})) \) leads to \( q^{sd}(p) = q(w^{exp}) \). If, instead, it is the factory that chooses quantities, it would choose the quantity

\[
q^{f}(p^{f}, w) = \arg \max_q p^{f} q - wq - C(q).
\]

The first order condition is \( p^{f} - w - C'(q^{f}(p^{f}, w)) = 0 \) and a transfer price \( p^{f} = R'(q(w^{exp})) \) leads to \( q^{f}(p^{f}, w^{exp}) = q(w^{exp}) \) (optimality is conditional on having the right expectation about the unit cost of the input).

Thus, it is then direct to see that the outcome of the bargaining stage will be exactly the same than the highly centralized case, that is, both the firm and supplier jointly maximizes production at \( q(c_1) \) and the fix part tariff is exactly \( T^{hq} = \alpha \{ \Pi(c_1) - \Pi(c_2) \} \). In other words, it is equivalent to organize the firm by delegating or not production as long as bargaining is decided by the HQ. It is also clear that if there exists some degree of uncertainty at the production stage, this equivalence is not necessarily true, anymore.