STRATEGIC INVESTMENT AND INTERNATIONAL OUTSOURCING IN
UNIONISED OLIGOPOLY

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Abstract:
We consider a unionised oligopoly in which firms choose between vertical integration (VI) and international outsourcing (OS) part of the vertical chain. Domestic labour is unionised while foreign labour is not. Final good production uses an intermediate which can be produced in house or outsourced to a foreign supplier. The intermediate requires an investment in quality. Under OS, the foreign supplier makes a relationship specific investment in developing the intermediate good. We show that if marginal cost are higher under OS, firms’ mode of operation choice involves a trade off between this and the higher fixed cost associated with VI.


Keywords: Outsourcing, Unionisation, Strategic Investment Trade Liberalisation, Oligopoly.

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1. Introduction

Conventional wisdom holds that international outsourcing can be used by firms to weaken trade unions and that strong unions make outsourcing more attractive. However, it is also argued that outsourcing reduces costs. If so, then it ought to enable unions to extract higher wages at the remaining stages of production.

In this paper we examine how the strategic interaction between firms and the relative strength of firms and unions determine the effects of unionisation on the incentive to outsource and the effect of outsourcing on investment and firms’ efficiency.\(^1\)

We build on Leahy and Montagna (2007 and 2009), both of which considered outsourcing in strategic settings, and develop a unionised oligopoly model in which firms choose between vertical integration (VI) and international outsourcing (OS) of part of the vertical production chain.\(^2\) Domestic labour is unionised while foreign labour is not. Final good production requires an intermediate which can either be produced in-house or outsourced to a foreign supplier. The intermediate good requires an investment in quality. The higher its quality, the higher is the productivity of the other inputs used in production. Under OS, the foreign supplier makes a relationship specific investment (RSI) in the quality of the intermediate. In this instance, the downstream firm bargains with the foreign supplier over the price of the intermediate.

Under VI, unionisation reduces the incentive to invest as part of the additional rent generated by the investment is captured by the union. However, we show that an attempt to escape from this problem by outsourcing may not lead to more investment (and hence to a lower marginal production cost): the RSI made by the supplier will typically result in an underinvestment in the quality of the intermediate and hence to an increase in marginal cost for the downstream firm. In addition, upstream outsourcing paradoxically increases the aggressiveness of the domestic unions (which bid up the wage) in the downstream sector. The intuition is that the union knows that the wage it

\(^1\) Lommerud et al (2009) analyse how the incentive to outsource is influenced by unionisation within a partial equilibrium monopolistically competitive framework. Skaksen (2004) studies the implications of the potential of international outsourcing on union wages within a general equilibrium framework in which the decision to outsource occurs after union-firm wage negotiations. Koskela and Schöb (2008) analyse the effects of labour market reforms on the decision to outsource of unionise firms. A related, earlier, literature studies the effects of unionisation on the decision to do FDI: e.g. Zhao (1995), Bughin and Vannini (1995), Bugh

sets has less impact on the labour demanded by the firm as the impact of domestic wages on home marginal cost is relatively less important when the firm outsources part of its production abroad, because reliance on domestic labour is lower. As a result, the per-unit rent for the workers still employed by the firm is higher, even though the total labour rent extracted from this firm may well be lower. This arises from a complementarity between foreign and domestic employment under OS that is due to the complementarity between upstream and downstream activities. The net result of this is that OS is likely to lead to an increase in the marginal production cost of the downstream firm, even if there are substantial underlying cost advantages of the foreign supplier in producing the intermediate. Other things equal, downstream unionisation reduces the incentive of firms to outsource upstream production abroad. If marginal cost are higher under OS, firms’ mode of operation choice involves a trade off between this and the higher fixed cost associated with VI.

We also consider the possibility of outsourcing production of the final good. Outsourcing both upstream and downstream activities allows the firms to escape the negative effects of unionisation on the returns from OS. However, depending on the precise ‘structure’ of OS one source of rent extraction behaviour (i.e. by the union) may be simply replaced by another (i.e. by the foreign downstream producer).

The plan of the remainder of the paper is as follows. Section 2 sets out the model. The game is solved in Section 3 and the equilibrium regimes are discussed in Section 4 and Section 5 concludes.

2. The Model

We consider a market in which there are two final goods firms that sell a homogenous good to an integrated market.\(^3\) We further assume that sales to the final good market do not involve a transport cost. This assumption may reflect the fact that the destination market is located nearby, and/or that it is highly integrated – perhaps in a customs union – with the market where the firms are located, or else both firms may be located and selling in the same countries. The inverse demand is given by:

\[ p = a - y, \]

\(^3\) This market may be the market of one of the firms or a third market. It is easy to show that, provided that the transport cost for the two firms is symmetric, adding a transport cost in selling would not change the results qualitatively. We shall return to this point later.
with \( \bar{p} = y_1 + y_2 \), where \( p \) is the price of the good, \( a \) is a constant parameter, and \( y_1 \) and \( y_2 \) are the quantities produced by firms 1 and 2 respectively.

We assume that the production of the final good requires a specialised component, which is combined in fixed proportions with labour. One unit of this intermediate is required per unit of output. For firm \( i \), let \( l_i = \bar{T} - z_i > 0 \) be the per-unit labour requirement, where \( \bar{T} \) is constant and \( z_i \) captures the ‘usefulness’ of the intermediate: a better intermediate is one that requires to be combined with fewer units of labour in order to produce a unit of output – i.e. a good quality intermediate leads to a higher labour productivity.

The firm can either produce the intermediate in-house (vertical integration) or outsource it to a foreign supplier. Labour markets in the domestic economy are unionised with firm-specific unions bargaining over the wage with firms, while they are perfectly competitive in the foreign country. The foreign country’s wage is therefore exogenous and can be normalised at unity.

If it is outsourced to a foreign intermediate producer, the price of the specialized component input is \( q_i \) while it can be produced in-house at a marginal cost of \( r_i = w_i \hat{r}_i \) where \( \hat{r}_i \) is the per-unit labour requirement. To deliver this input to the home country where it is combined with the composite input, the firm must pay a transport cost of \( t \) per unit of output.\(^4\)

The ‘usefulness’ of the intermediate to the final producer depends on the level of the investment in its quality and in customisation for the final good production. We will assume that \( z = \sqrt[3]{K} \), where \( K \) is investment in design (quality and customisation). Thus, there are diminishing returns to investment. This is a plausible assumption and one that is needed to ensure an interior solution. Using the superscripts \( V \) and \( O \) to denote vertical integration and outsourcing respectively, marginal production cost for firm \( i \) will thus be:

\[
\begin{align*}
  c_i^V &= w_i (\hat{r}_i + \bar{T} - z_i) \\
  c_i^O &= q_i + w_i (\bar{T} - z_i) + t_i
\end{align*}
\]  

(2a)

(2b)

\(^4\) Note that the results would not be materially changed were we to assume instead, that it is the upstream firm that pays the transport cost.
if the firm is vertically integrated.

If firm $i$ is vertically integrated, its profit function is given by:

$$
\pi_i^v = (p - c_i^v)y_i - K_i - G,
$$

(3a)

where $G$ represents the fixed governance cost that a vertically integrated firm is assumed to incur. On the other hand, if the firm chooses to outsource, its profit function will instead be:

$$
\pi_i^o = (p - c_i^o)y_i.
$$

(3b)

When a firm chooses to outsource, it avoids both the investment costs and the governance cost of vertical integration. The investment costs are now borne by an intermediate goods producer who has profits:

$$
\mu_i = (q_i - r_i^m)m_i - K_i - E_i.
$$

(4)

We will also use $i$ to represent the southern upstream firm that has a bilateral outsourcing relationship with the northern downstream firm $i$ (thus the subscript $i=1,2$ refers to an upstream-downstream pair). We let $r_i^m$ be the intermediate producer’s marginal production cost. We assume that the marginal production cost of the intermediate can differ depending on whether it is produced in-house ($r_i$) or by an upstream firm ($r_i^m$). Since one unit of the intermediate is needed in the production of each unit of final output, we can write $m_i = y_i$. The upstream firm must also incur a fixed entry cost $E_i$.

3. The Game

The model is a four-stage game. In stage one, firms decide whether to outsource their intermediate or to produce it in-house at home. If they decide to outsource, they approach a specialised supplier firm, located somewhere in the South, which will produce the intermediate. In stage two, the firms invest in the development of the intermediate. If the downstream firms opts for outsourcing, then the specialised supplier firms undertakes the investment. In stage three, the firms bargain with their firm-specific union over the wage and (if they outsource) they simultaneously bargain

$^5$ $G$ captures the costs – a la Williamson (1975, 1985) – of running a larger and more complex organisation.
with the intermediate supplier over the price of the intermediate.\textsuperscript{6} We assume that the final good producer only has enough time to negotiate with a single supplier. As in Grossman and Helpman (2003), should bargaining breakdown, the producer will not have sufficient time to produce the intermediate itself, and so will exit the market – while the supplier will have wasted its investment. In stage four, firms produce the final output.

As the game is solved by backward induction we begin by discussing the final stage and then working back.

3.1 Stage 4

In the final stage of the game the two firms engage in Cournot competition with outputs determined by maximising operating profits \( \bar{\pi}_i^h = (p - c_i^h) y_i \) since at this stage all fixed and investment costs have been sunk. The first-order conditions given by:

\[
\frac{\partial \bar{\pi}_i^h}{\partial y_i} = p - c_i^h - y_i = 0 ,
\]

where \((h=O,V)\) and \((i=1,2)\). Combining the reaction functions implied by the first order conditions in (5) with the inverse demand function in (1) we obtain the (final-stage) Nash equilibrium in quantities:

\[
y_i = \frac{a - 2c_i^h + c_j^k}{3},
\]

where \((h,k=O,V)\) and \((i,j=1,2)\) with \((i\neq j)\).

Clearly, there are four possible regimes: \((V,V)\), \((V,O)\), \((O,V)\), and \((O,O)\), where the first letter refers to mode of operation selected by firm 1 and the second letter refers to the mode of the second firm.

\textsuperscript{6} We assume that the relationship between upstream and downstream firms is a bilateral one. We ignore the possibility that a large upstream supplier could force the two downstream firms to compete for its output. There are a number of ways in which this possibility can be ruled out. Perhaps the simplest way is to assume that the firms choose different geographical locations in order to outsource the specialized component. Another possibility is that, as a result of customization the, intermediates used by downstream firms are sufficiently different from each other. We also rule out the possibility that more than one upstream firm compete to supply the downstream firm. One could think of there being ex-ante many identical potential intermediate suppliers. However, given that there is only one downstream firm in a particular location, only one firm will enter to supply it in equilibrium since with more than one upstream firms, as a result of Bertrand competition between firms, the intermediate price would be driven to the marginal production cost and the firms will be unable to cover their investment and fixed entry cost. Anticipating this, only one firm will enter to supply a downstream firm.
3.2 Stage 3

In stage three of the game firms will bargain over the wage with the unions and (if they outsource) they will simultaneously bargain with their supplier firm over the price of the intermediate\(^7\). If the firm is vertically integrated, then all the labour employed in its activities (assembly as well intermediate good production) is employed in-house. If it outsources, the firm’s labour demand will only be made up of the workers employed in the production of the final good.

Firm \(i\)'s firm-specific union’s utility function is given by:

\[
U^h_i = (w_i - \bar{w}) L^h_i \quad (h=V,O, i=1,2) \tag{7}
\]

where \(\bar{w}\) is the reservation wage of the union and \(L^h_i = y_i \xi^h_i \) is the total employment of the downstream firm – with \(\xi^O_i = I_i - z_i \) and \(\xi^V_i = \hat{I}_i + I_i - z_i \) are the firm level per-unit employment in the two regimes.\(^8\) We assume that the monopoly union sets the wage maximising equation (7). Recall that all fixed and investment costs are sunk at this stage. Hence, treats \(\xi^h_i\) as a constant and thus sets \(w_i\) such that:

\[
\frac{\partial U^h_i}{\partial w_i} = \xi^h_i \left\{ (w_i - \bar{w}) \frac{\partial y_i}{\partial w_i} + y_i \right\} = 0. \tag{8}
\]

Hence, regardless of the mode of operation chosen by the firm, we can write:

\[
w_i = \bar{w} - \frac{y_i}{\partial y_i / \partial w_i}. \tag{9}
\]

From (2) and (6) we can obtain \(\partial y_i / \partial w_i = -(2/3) \xi^h_i\). This shows that the greater is the per-unit input requirement of unionised labour, the greater is the (negative) impact on the firm’s output and operating profits of an increase in wage. Combining this with (9) we obtain:

\[
w^h_i = \bar{w} + \frac{3}{2} \frac{y_i}{\xi^h_i}. \tag{10}
\]

---

\(^7\) The purchase of intermediate components is sometimes assumed to involve the combination of a fixed lump-sum payment and a price set at marginal cost. As highlighted by Spencer (2005), however, the transfer of rents through lump-sum payments is at odds with stylised facts about domestic and international transactions. Our paper recognizes that outsourcing contracts typically involve strictly positive prices that exceed marginal costs. The distribution of rents between intermediate supplier and final good producer – and hence the return for relationship specific investment – is determined through Nash bargaining over the price after investment is sunk.

\(^8\) We assume that employment and wages have the same weights in the unions’ utility functions. One could easily allow for different weights, but this would not yield many additional insights in this context.
Hence, unions will moderate their wage claims more the greater is the per-unit input requirement of unionised labour. The implication of this is that under outsourcing unions are, other things equal, less restrained in their wage demand. This result goes against conventional wisdom – which contends that outsourcing weakens the rent extraction ability of unions.\(^9\)

Now, using the wage equation in (10), the marginal costs are:

\[ c_i^O = q_i + \bar{w}(I - z_i) + \frac{3}{2} y_i + t_i \]  

(11a)

if the firm outsources its intermediate, and

\[ c_i^V = \bar{w}(\hat{r} + I - z_i) + \frac{3}{2} y_i \]

(11b)

if it is vertically integrated. We assume that if firm \(i\) outsources, then the price \(q_i\) of the intermediate good is set by the intermediate producer.\(^{10}\) The upstream producer chooses \(q_i\) to maximise expression (4) taking the level of investment as given. This yields:

\[ q_i = r_i^m - \frac{y_i}{\partial y_i / \partial q_i} = r_i^m + \frac{3}{2} y_i . \]

(12)

3.3 Stage 2

The firms choose their investment levels simultaneously in stage 2. If the intermediate is produced in-house then \(K_i\) is chosen to maximise \(\pi_i^V = y_i^2 - z_i^2\). Note that \((p - c_i^V)\) has been eliminated using (6) and \(K_i\) has been eliminated using \(K_i = z_i^2\). We can model the firm as choosing the level of cost reduction: \(z_i\). This simplifies the algebra somewhat. The resulting first-order condition is:

\[ 2 \left( y_i \frac{dy_i}{dz_i} - z_i \right) = 0 , \]

(13)

which implies: \(z_i^V = \sqrt{K_i^V} = y_i \frac{dy_i}{dz_i}\). It will prove convenient to write this as:

\[ z_i^V = \sqrt{K_i^V} = \theta^{vk} y_i , \text{ where } k=(V,O). \]

(14)

---

\(^9\) One way to interpret this is that when the firm outsources, the union realises that increasing its wage has less of an impact on the firm and hence becomes more aggressive in its wage setting; for a similar result in a different context, see Skaksen and Sörensen (2001).

\(^{10}\) It is straightforward to assume that, as in Leahy and Montagna (2007 and 2009), the intermediate price is determined by Nash bargaining between the upstream and downstream firms.
The first superscript in $\theta^i_k$ refers to the mode of operation of firm $i$ while the second one refers to the mode of operation of its rival. The expression for $\theta^i_k$ differs depending on the mode of operation choice of the rival firm. As shown in the appendix, $\theta^{IV} = \frac{14}{15} \bar{w}$ and $\theta^{VO} = \frac{10}{11} \bar{w}$. Note that $\theta^{IV} > \theta^{VO}$, so that outsourcing by its rival tends to reduce firm $i$’s investment to output ratio. Thus, outsourcing by one firm ‘softens’ the behaviour of its rival, i.e. it reduces its aggressiveness in investment. This results in a ‘strategic motive’ to outsource which is analogous to that obtained in Leahy and Montagna (2007 and 2009).

If the intermediate is outsourced, then $z_i$ is chosen to maximise $\frac{3}{2} y_i^2 - z_i^2$, where we have made use of the fact that $(q_i - r_i^w) = \frac{3}{2} y_i$ from (12) and we have eliminated $K_i$ using $K_i = z_i^2$. At the optimum: $z_i^O = \sqrt{K_i^O} = (3/2) y_i \frac{dy_i}{dz_i}$. This expression for optimal investment is obviously similar to that in which firm $i$ is vertically integrated. It differs only in that the right-hand side is now multiplied by $3/2$. We can write it in compact form as:

$$z_i^O = \sqrt{K_i^O} = \theta^{ok} y_i,$$ where $k=(V,O)$. (15)

The expression for $\theta^{ok}$ depends on the mode of operation choice of the rival firm. As shown in the appendix, $\theta^{OV} = \frac{7}{12} \bar{w}$ and $\theta^{OO} = \frac{5}{16} \bar{w}$. Note that $\theta^{OV} > \theta^{IV}$ and $\theta^{OO} > \theta^{VO}$, thus the investment-to-output ratio is higher under outsourcing than vertical integration. This arises from the fact that the vertically integrated firm must share the returns from its investment with the unions. Under outsourcing, the upstream firm retains a greater share of the returns from investment than a downstream firm under outsourcing does. The reason for this is that the upstream party in the bilateral relationship – whether it be the upstream supplier or the union – that captures the lion’s share of the return from any investment. This would seem to suggest that marginal costs would be lower under outsourcing, due to a higher input quality. However this is not the end of the story, because under outsourcing the firm is now suffering from the effects of rent extracting behaviour of two parties rather than one: the unions (on the remaining level of employment) and the upstream supplier. Hence, the marginal cost under outsourcing may still be higher than under vertical integration – despite a higher investment-to-output ratio. Comparing this result with those obtained in Leahy and
Montagna (2007 and 2009), it is then clear that the unionisation alters the channels through which outsourcing affects a firm’s cost.

3.4 Stage 1

The firms simultaneously choose their mode of operation in stage 1 of the game. To establish whether a firm will outsource or choose to be vertically integrated, we must compare its profits under the two regimes for a given behaviour of its rival. To this end, it proves useful to obtain expression for the profits in terms of outputs and parameters only. By using the first-order conditions for output in (5) and the expressions for optimal investment (14), in (3a), we can rewrite the profit function under vertical integration as:

\[ \pi_k^{V} = (\theta_k) \left[ 1 - (\theta_k)^2 \right] - G, \quad \text{where} \quad k=(V,O). \]  

(16)

Using (5) in (3b), the profit function under outsourcing can be rewritten similarly as:

\[ \pi_k^{O} = (\theta_k)^2, \quad \text{where} \quad k=(V,O). \]  

(17)

It is immediately obvious from (16) and (17) that a sufficient condition for \( \pi_k^{O} > \pi_k^{V} \) is that \( y_k^{O} \geq y_k^{V} \). The term in square bracket is less than unity and so if outsourcing results in an increase in output then it dominates vertical integration.

3.5 Effects of the mode of operation on wages and union rents

Before proceeding to analyse the mode of operation equilibria in the following section, it is useful to expand on the implications of firms’ mode of operation on equilibrium wages and union rents.

Note that the greater is the firm’s profitability, the higher is the rent extraction ability of the union. If a change in the mode of operation choice increases the downstream firm’s operating profits then this will lead to higher total union rents. It is clear from equation (10) that \((w_i^{h} - \bar{w})\xi^h = \frac{1}{2} y_i^j\) and hence \((w_i^{h} - \bar{w})L_i^h = \frac{1}{2} \tilde{\pi}_i^{h}\) (since: \(\tilde{\pi}_i^{h} = y_i^{h2}\)). Perhaps surprisingly, however, this does not mean that a switch in the mode of operation that raises the downstream firm’s profitability also necessarily raises the union wage. This is because the union rents per unit of labour \((w_i^{h} - \bar{w})\) are proportional to the operating profit per unit of labour employed \(\frac{\tilde{\pi}_i^{h}}{L_i^h} = \frac{y_i^{h}}{\xi^h}\).
4. The Mode of Operation Equilibria

We turn now to a discussion of the mode of operation equilibria. Clearly, there are four possible candidate equilibrium regimes: (V,V), (V,O), (O,V), and (O,O), where the first letter refers to mode of operation selected by firm 1 and the second letter refers to the mode of firm 2.

We begin in subsection 4.1 with what we will call the “base case” in which the firms are ex-ante symmetric and furthermore there is no underlying cost advantage or disadvantage from outsourcing. The lack of an underlying cost advantage from outsourcing implies: \( \rho_i = -\tilde{\omega} r_i^m - t = 0 \) \((i=1,2)\). The parameter \( \rho_i \) reflects the difference in the marginal production cost of the intermediate for the vertically integrated firm and for the upstream supplier. In subsection 4.2, we relax the assumption of \( \rho_i = 0 \) in particular to consider the effects of trade liberalisation. We also wish to consider the effect of cost asymmetries between the firms. This is done in subsection 4.3 where we consider changes in \( \phi = \tilde{w}(\hat{r}_2 - \hat{r}_1) \), where the parameter \( \phi \) can be thought of as the pre-investment cost advantage of firm 1 under vertical integration.

4.1 The base case

When firms are ex-ante symmetric and there is no underlying cost advantage from outsourcing, it can be shown that the marginal cost is higher under outsourcing than under vertical integration. This is despite the higher investment-to-output ratio under outsourcing that we explained in Section 3 and arises from the countervailing effects of the double source of rent-extraction (from both unions and upstream supplier) in the case of outsourcing, as against the single source under vertical integration.

In the base case, it can be shown that the pattern of equilibria depends on the level of governance cost, \( G \). If \( G \) is sufficiently large, then both firms will choose to outsource. While at \( G=0 \) both firms are vertically integrated (V,V) is the unique subgame perfect equilibrium. At intermediate levels of \( G \) there is multiple asymmetric equilibria (V,O) and (O,V).

The emergence of asymmetric equilibria can be explained by the existence of a negative interdependence between the firm’s mode of operation decisions. Here outsourcing is a higher marginal cost (in exchange for lower fixed cost) and hence a lower output strategy. This is because of the greater aggressiveness of domestic unions in the presence of outsourcing plus the additional rent extracting activity of the
upstream firm. The relative incentive to choose vertical integration is larger the larger is one’s expected output. A firm that faces a vertically integrated rival has, ceteris paribus, a lower anticipated market share and hence a lower incentive to vertically integrate itself than a firm that faces an outsourced rival. Hence, over a range of $G$, vertical integration is a best response to a rival’s outsourcing but outsourcing is a best response to a rival’s vertical integration. This result is similar to that obtained in Leahy and Montagna (2009).

4.2 Cost advantages of outsourcing and trade liberalisation

In this subsection we again assume that the downstream firms are ex-ante symmetric and their prospective upstream partners are also ex-ante symmetric but we allow for the upstream and downstream firms to differ in their underlying costs, i.e. $\rho_i \equiv w^m_i - r^m_i - t \neq 0$. Since the downstream firms are assumed to operate in the North and the upstream firms operate in the South this difference could arise from local differences in factor prices. This underlying cost difference may also be affected by changes in trade costs $t$, with $\rho$ increasing as $t$ falls. We maintain the symmetry across firms at the same level in the production chain by assuming that $\rho = \rho_1 = \rho_2$. The ranking of equilibria with respect to the governance costs of vertical integration are the same regardless of $\rho$, the underlying cost advantage of the upstream producers. The resulting mode of operation regimes are illustrated in Figure 1 below.

![Figure 1: Cost advantages of outsourcing and trade liberalisation](image-url)
It is clear from the figure that trade liberalisation increases the range of parameter values over which outsourcing is chosen. In Figure 1 trade liberalisation is captured by a rightwards movement at constant $G$ (see the arrow representing the direction of increasing trade liberalisation in the figure). If $G$ is sufficiently low, trade liberalisation moves us from $(V,V)$ to the region of multiple equilibria $(V,O)$ and $(O,V)$ and then on to the region of $(O,O)$.

4.3 Cost asymmetries

So far we have assumed that the final goods firms are ex ante symmetric but it is interesting to examine the effects of underlying differences in firms for the propensity to outsource.

We find that ceteris paribus, the higher cost firms are the ones that are more likely to choose to outsource. In Figure 2, we have set $\rho = \rho_1 = \rho_2 = 0$ (so that upstream firms have no cost advantage or disadvantage over downstream firms) and have allowed $\phi$ to increase. As $\phi$ increases, the cost advantage of firm 1 over firm 2 gets larger.

![Figure 2: Downstream cost asymmetries](image-url)
As is clear from the figure, the region of \((V,O)\) in which the first firm is vertically integrated while the, now higher cost, second firm outsources gets larger in \(\phi\). These results are consistent with many others obtained in the literature – including those in Leahy and Montagna (2007 and 2009) in an oligopoly setting and those obtained by Antrás and Helpman (2004) in a general equilibrium monopolistic competition setting – and support existing empirical evidence that suggests that foreign outsourcers tend to be less productive than firms that invest abroad (e.g. Tomiura, 2007).

It is straightforward to show that when \(\phi\) is sufficiently large, trade liberalisation will lead to increases in \(\rho\) and eventually move the equilibrium from \((V,V)\) to \((V,O)\) and then, at higher values of \(\rho\), the equilibrium will be \((O,O)\).

5. Concluding Remarks

We have used a unionised oligopoly model to examine how the strategic interaction between firms and between firms and unions determine the effects of unionisation on the incentive to outsource and the effect of outsourcing on investment and firms’ efficiency. We found that, contrary to conventional wisdom, outsourcing can increase the aggressiveness of unions when not all unionised production tasks are outsourced. The reason for this is that the impact of domestic wages on downstream marginal cost is relatively less important when the firm outsources part of its production abroad, because reliance on domestic labour is lower. Consequently firms face a more inelastic labour demand function which can give unions the opportunity to raise wages. Outsourcing can increase the incentive to invest in the quality of the intermediate and, through this channel reduce the marginal production cost. Nevertheless, outsourcing leads to unions becoming more aggressive in their wage demands and it additionally generates a second hold-up problem due to the dependence of the downstream firm on an upstream supplier. The net result of this is that outsourcing is likely to lead to an increase in the marginal production cost of the downstream firm, even if there are substantial underlying cost advantages of the foreign supplier in producing the intermediate. If marginal costs are higher under outsourcing, firms’ mode of operation choice involves a trade-off between this and the higher fixed governance cost associated with VI.

We showed that by reducing the relative cost of foreign outsourcing, trade liberalisation increases the degree of outsourcing. Depending on the level of governance costs, it can shift the equilibrium regime from one in which all firms vertically integrate
to one in which all outsource via asymmetric equilibrium regimes. Since trade liberalisation involves regime shifts, we obtain non-monotonic responses of prices, outputs, wages and investment levels (and thus welfare) to a fall in trade costs – with locally counter-intuitive results.

We also showed that the relatively less productive firms are the ones that are more likely to choose the outsourcing approach and, in line with some earlier research, that outsourcing could be seen as a defensive business strategy.
Appendix

The parameter $\theta$ in the different regimes.

From (14) and (??), it is clear that the optimal $z$ is proportional to output. So, it is possible to write the expression for investment in a general form as:

$$z_i^{hk} = \theta^{hk} y_i^{hk}$$  \hspace{1cm} (A1)

where the first superscript refers to the mode of operation of firm $i$ and the second refers to the mode of operation of its rival. The parameter $\theta$ takes on a different value depending on the mode of operation of the firm and its rival. When firm 1 is vertically integrated we have $\theta^{V_k} = dy_i^{V_k} / dz_i$ for ($k=V,O$). To obtain an expression for $dy_i / dz_i$, differentiate (6) to get:

$$\frac{dy_i^{hk}}{dz_i} = \frac{1}{3} \left( -2 \frac{dc_i^{hk}}{dz_i} + \frac{dc_j^{hk}}{dz_i} \right)  \hspace{1cm} (h=V,O \text{ and } k=V,O)$$  \hspace{1cm} (A2)

**VV case**

In the VV case both firms’ marginal cost takes the form of (11b). Differentiation of (11b) and substitution into (A2) yields:

$$\frac{dy_i^{VV}}{dz_i} = \frac{1}{3} \left( -2w - \frac{3}{2} \frac{dy_j^{VV}}{dz_i} + \frac{3}{2} \frac{dy_j^{VV}}{dz_i} \right) = \frac{2}{3} w - \frac{dy_j^{VV}}{dz_i} + \frac{1}{2} \frac{dy_j^{VV}}{dz_i}$$  \hspace{1cm} (A3)

We also need an expression for $dy_j^{VV} / dz_i$. Adopting an approach analogous to that we used to derive (A3), it is straightforward to show that:

$$\frac{dy_j^{VV}}{dz_i} = -\frac{1}{3} \frac{dy_j^{VV}}{dz_i} + \frac{1}{2} \frac{dy_j^{VV}}{dz_i}$$  \hspace{1cm} (A4)

Combining (A3) and (A4) and substitution into $\theta^{VV} = dy_i^{VV} / dz_i$, yields:

$$\theta^{VV} = \frac{14 w}{45}$$  \hspace{1cm} (A5)

**VO case**

In the VO case both firm 1’s marginal cost takes the form of (11b) and firm 2’s is obtained by combining (11a) and (12) to get:

$$c_i^{O} = r_i^{O} + w(\bar{l} - z_i) + 3y_i + t_i$$  \hspace{1cm} (A6)

Differentiation of (11b) and (A6) and substitution into (A2) yields:
\[
\frac{d y^{iV}_i}{dz_i} = \frac{1}{3} \left\{ -2 \left( -\frac{1}{2} + \frac{3}{2} \frac{d y^{iV}_i}{dz_i} \right) + \frac{3}{2} \frac{d y^{iV}_j}{dz_i} \right\} = \frac{2}{3} \frac{d y^{iV}_i}{dz_i} + \frac{d y^{iV}_j}{dz_i} \quad (A7)
\]

Combine this with:

\[
\frac{d y^{iV}_i}{dz_i} = \frac{1}{3} \frac{d y^{iV}_i}{dz_i} - \frac{2}{3} \frac{d y^{iV}_j}{dz_i} + \frac{1}{2} \frac{d y^{iV}_i}{dz_i} \quad (A8)
\]

and substitute this into \( \theta^{iV} = \frac{d y^{iV}_i}{dz_i} \) to obtain:

\[
\theta^{iV} = \frac{10}{33} \frac{1}{w} \quad (A9)
\]

**OV case**

When firm 1 is outsourcing we have \( \theta^{iV} = \frac{1}{2} (\frac{d y^{iO}_i}{dz_i}) \). To obtain an expression for \( \frac{d y^{iO}_i}{dz_i} \) differentiate (A6) and (11b) and substitute into (A2) to get:

\[
\frac{d y^{iO}_i}{dz_i} = \frac{1}{3} \left\{ -2 \left( -\frac{1}{2} + \frac{3}{2} \frac{d y^{iO}_i}{dz_i} \right) + \frac{3}{2} \frac{d y^{iO}_j}{dz_i} \right\} = \frac{2}{3} \frac{d y^{iO}_i}{dz_i} + \frac{d y^{iO}_j}{dz_i} \quad (A10)
\]

Combine this with:

\[
\frac{d y^{iO}_i}{dz_i} = -\frac{1}{3} \frac{d y^{iO}_i}{dz_i} - \frac{d y^{iO}_j}{dz_i} + \frac{d y^{iO}_i}{dz_i} \quad (A11)
\]

to obtain \( \frac{d y^{iO}_i}{dz_i} = \frac{7}{33} \frac{1}{w} \) and substitute this into \( \theta^{iO} = \frac{1}{2} (\frac{d y^{iO}_i}{dz_i}) \) to obtain:

\[
\theta^{iO} = \frac{7}{22} \frac{1}{w} \quad (A12)
\]

**OO case**

When both firms are outsourcing we have \( \theta^{iO} = \frac{1}{2} (\frac{d y^{iO}_i}{dz_i}) \). To obtain an expression for \( \frac{d y^{iO}_i}{dz_i} \) differentiate (A6) and substitute into (A2) to get:

\[
\frac{d y^{iO}_i}{dz_i} = \frac{1}{3} \left\{ -2 \left( -\frac{1}{2} + \frac{3}{2} \frac{d y^{iO}_i}{dz_i} \right) + \frac{3}{2} \frac{d y^{iO}_j}{dz_i} \right\} = \frac{2}{3} \frac{d y^{iO}_i}{dz_i} + \frac{d y^{iO}_j}{dz_i} \quad (A13)
\]

Combine this with:

\[
\frac{d y^{iO}_i}{dz_i} = -\frac{1}{3} \frac{d y^{iO}_i}{dz_i} - \frac{d y^{iO}_j}{dz_i} + \frac{d y^{iO}_i}{dz_i} \quad (A14)
\]
to obtain $\theta^{\text{OO}} = \frac{5}{16}$ and substitute this into $\theta^{\text{OO}} = \frac{3}{2}(dy^{\text{OO}} / dz)$ to obtain:

$$\theta^{\text{OO}} = \frac{5}{16}$$

(A15)

**Reduced form equilibrium output expressions in the different regimes.**

Combining (5) and (1) the first-order condition for output of a typical firm can be written in general form as:

$$a - c_i^{hk} - 2y_i - y_j = 0$$

(A16)

where $c_i^{hk}$ is the marginal cost for firm $i$ when it chooses mode of operation $h=V,O$ and its rival chooses mode of operation $k=V,O$. From the first order condition for investment in equation (14) and (15), it is clear that the optimal $z$ is proportional to output: $z_i^{hk} = \theta^{hk} y_i^{hk}$ where $h=V,O$ is the mode of operation of firm $i$ and $k=V,O$ is the mode of operation of its rival firm. Also the labour component of firm $i$’s marginal cost $w_i z_i^{hk} = \overline{w} z_i^{hk} + \frac{2}{3} y_i$ and from (12) the intermediate good’s price it must pay under outsourcing $q_i = r_i^m + \frac{2}{3} y_i$ depends on its output. Making use of these relationships we can rewrite the first-order condition for firm $i$ in general form as

$$A_i^{h} - 2y_i - y_j + \eta^{hk} y_i = 0$$

(A17)

where $A_i^{h} = a - \overline{w}(\hat{\bar{f}} + \bar{t})$ and $A_i^{o} = a - (r_i^m + \overline{w}\bar{t} + \bar{t})$ only depend on the firm’s own mode of operation and $\eta^{hk} = \overline{w} \theta^{hk} - \frac{3}{2}$ and $\eta^{ok} = \overline{w} \theta^{ok} - 3$, where the first superscript refers to the mode of operation (V,O) of firm $i$. From the two equations in (A17) we can obtain the reduced form equilibrium output expressions for the two firms:

$$y_i^{hk} = \frac{(2 - \eta^{hk}) A_i^{h} - A_i^{k}}{3 - 2(\eta^{hk} + \eta^{kh}) + \eta^{hk} \eta^{kh}}$$

(A18)
References


