

ECONOMIZING, STRATEGIZING AND THE DECISION TO OUTSOURCE

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Abstract:

We study the *make-or-buy* decision of oligopolistic firms in an industry in which final good production requires specialised inputs. Firms' mode of operation decision depends on both the incentive to economize on costs and on strategic considerations. We explore the strategic incentives to outsource and show that asymmetric equilibria emerge, with firms choosing different modes of operation, even when they are ex-ante identical. With ex-ante asymmetries, higher cost firms are more likely to outsource. We apply our model to a number of different international trading setups.

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1. Introduction

This paper aims to shed light on the organisational and the internationalization strategies of firms in an oligopolistic setting. We develop a model in which downstream firms that outsource¹ enter a bilateral relationship with an upstream firm that must carry out a relationship specific investment. We consider a set up where oligopolistic firms must choose both where to source their intermediates and whether to outsource them or produce them in-house. We use the model to examine how trade policy affects the mode of operation and the internationalization decisions of the firms.

There has been a rapid expansion in outsourcing in recent years, with firms outsourcing activities as diverse as final assembly, R&D and after-sales services. The possibility of outsourcing faces the firm with fundamental decisions with respect to its mode of operation – whether to produce in house or to outsource and whether to outsource to domestic or to foreign suppliers. The growing importance of outsourcing has resulted in the huge increase in interest that this phenomenon has received, both empirically and theoretically, in the academic literature.²

The majority of the theoretical literature on the mode of operation decision of firms hinges on the conventional view that outsourcing is driven by cost considerations. The transaction cost perspective – based on the role of incomplete contracts and asset specificity – places emphasis on the *economising* dimension (e.g. in the work of Oliver Williamson³) of the make-or-buy decision of the firm, which is ultimately based on a total cost comparison of alternative organisational structures. Cost considerations are of course important determinants of outsourcing.⁴ However, the existing empirical evidence is by no means conclusive as to the contribution of outsourcing to cost savings and/or to improvements in the quality of intermediates.⁵ This evidence suggests that

¹ By outsourcing we mean the acquisition of an input or service from an unaffiliated firm whether domestic or foreign. This is the standard terminology. Bhagwati *et al* (2005) uses the term in a much more restricted way to mean the acquisition of services from unaffiliated foreign firms.

² See for instance Abraham and Taylor (1996), Audet (1996), Feenstra (1998), Campa and Goldberg (1997), Hummels *et al* (2001), and Bartel *et al* (2005).

³ See for instance Williamson (1975, 1985).

⁴ For instance, a recent UK survey by Manpower found that the main motivation behind outsourcing of services is cost reduction (<http://www.manpower.co.uk/news/OutsourcingSurvey.pdf>)

⁵ A survey by Software Development Magazine (2004) found that over half of the IT specialists interviewed reported that the quality of outsourced services was inferior to that produced in-house. For example, using firm-level panel data from the German cost structure survey over the period 1992-

cost-savings may not offer an exhaustive explanation of the widespread use of outsourcing. We contend that – to the extent that firms have market power – *strategic* considerations will interact with economising considerations in determining the mode-of-operation choice of firms. Williamson argues that “*most firms lack market power of the kind that is routinely assumed by the strategizing [Industrial Organization] literature*”. However, empirical evidence suggests that the firms that operate internationally (via export, outsourcing and foreign direct investment) tend to be larger than firms that operate only domestically (e.g. Tomiura, 2007). Hence, it is plausible to conjecture that such firms will tend to have higher degrees of market power – and that their mode-of-operation decision will therefore be more affected by considerations of a strategic nature.

The existence of a link between strategy and firms’ mode of operation is not entirely new. Within a Cournot setting, Nickerson and Vanden Bergh (1999) show that organisational choices are affected by strategic considerations in the firm-customer transactions. Shy and Stenbacka (2003) show that competition in the upstream industry affects production efficiency and the choice in the mode of operation of a downstream differentiated Bertrand duopoly when vertical integration involves higher fixed costs but lower marginal costs. Chen *et al* (2004) present a special case of outsourcing where an oligopolistic domestic firm may buy an intermediate from a more efficient firm that is also its competitor on the final goods market. This type of outsourcing, which facilitates collusion, differs substantially from the one we consider in this paper and highlights a different kind of strategic effect. To our knowledge, however, in the existing oligopoly literature on outsourcing issues related to incomplete contracts and relationship specific investment are not taken into account and their role in determining the nature of the trade-offs facing firms when making their mode of operation decisions are therefore disregarded.⁶

2000, Görzig and Stephan (2002) find that firms that outsourced service functions previously provided within the firm experienced a deterioration of return per employee. A negative relationship between outsourcing and firm level profitability is found for smaller firms by Görg and Hanley (2004) for the electronic industry in Ireland.

⁶ Some contributions on the Japanese Keiretsu are more in line with the standard outsourcing literature. For instance, in Spencer and Qui (2001) downstream Cournot oligopolists buy from upstream keiretsu members in a context in which investment contracts cannot be written and upstream firms carry out relationship specific investments. Their paper, however, does not endogenise the outsourcing decision.

In the model we develop, a vertically integrated firm incurs additional governance costs that can be avoided by outsourcing. If the outside supplier is not significantly more efficient at providing the intermediate to the required specifications, however, outsourcing will raise the final goods producer's marginal production costs since, as a result of a hold-up problem arising from contract incompleteness, the supplier will tend to underinvest in the quality of the intermediate. Outsourcing then involves accepting higher marginal costs in exchange for a saving on governance costs.

We find that both strategic vertical integration and strategic outsourcing are possible in equilibrium. Furthermore, unlike most contributions in this literature (for instance those of Grossman, Helpman and Antràs⁷), this model gives rise to the possibility of 'mixed outcomes' in which, even when firms are ex-ante symmetric, they may choose different modes of operation in equilibrium; this is consistent with existing stylised facts whereby not all firms in the same industry and in all countries adopt the same mode of operation strategy. We also show that the incentive to outsource is relatively greater for smaller/higher cost firms and that outsourcing can be characterised as a defensive business strategy. In contrast, vertical integration can be viewed as an aggressive business strategy.

An important reason for the revival of interest in the literature on the boundaries of the firm has been the perceived relationship between outsourcing and globalisation. We apply our model to examine the effect of trade liberalisation and deepening globalisation on the mode of operation of firms. We show that although trade liberalisation will tend to lead to internationalisation of production its affect on outsourcing is less clear cut.

The model is introduced in Section 2. In Section 3 we discuss the mode of operation equilibria of the game focussing on the relatively simple case of ex-ante firm symmetry. In section 4 we explore strategic behaviour and show how it relates to firm asymmetry. In that section, we discuss the idea that outsourcing can often be a defensive business strategy. In Section 5, we examine the effects of trade liberalisation on the outcome of the game and on the welfare of consumers. Section 6 draws some conclusions from the analysis.

⁷ See for instance Grossman and Helpman (2002, 2003, and 2005), and Antràs and Helpman (2004).

2. The Model

Consider two oligopolistic final good firms serving the same market and producing a homogenous product.⁸ We allow for a number of different international trade settings. Thus, the two firms may compete on a home market or a foreign market or an integrated market such as would exist in a customs union. To begin with, we do not need to specify the international trade context. We will be more specific in Section 5, where we analyse the effects of trade liberalization. The inverse demand for the final good is given by:

$$p = a - b(y_1 + y_2), \quad (1)$$

where p is the price of the good, a and b are constants, and y_1 and y_2 are the quantities produced by firm 1 and 2 respectively. We assume that the production of the final good requires a highly specialised component or service, which must be combined in fixed proportions with other inputs. We choose units so that one unit of the customised intermediate is required per unit of output. We allow both firms to decide whether to become vertically integrated or to follow an outsourcing strategy, by purchasing the intermediate good from an upstream supplier. Firm i can make the intermediate in-house at a marginal cost of r_i or buy it from an upstream supplier at the price q_i . In addition, production also requires other inputs. We model these other factors as a composite input and normalise its price at unity. For firm i let $e_i = \bar{e} - z_i > 0$ be the per-unit input requirement for the composite input, where \bar{e} is a constant and z_i captures the ‘usefulness’ of the intermediate: a better intermediate from the point of view of the downstream firm is one that requires to be combined with fewer other inputs in order to produce a unit of output. Using the superscripts V and O to denote vertical integration and outsourcing respectively, marginal production cost for firm $i=1,2$ will thus be:

$$c_i^V = r_i + \bar{e}_i - z_i. \quad (2a)$$

if it produces it in-house and:

$$c_i^O = q_i + \bar{e}_i - z_i \quad (2b)$$

if the firm outsources its intermediate.

⁸ An extension to differentiated products is straightforward but would not yield many additional insights.

Let K be investment in quality and customisation of the intermediate, with $K = \gamma z^2 / 2$. Thus, the usefulness of the intermediate increases in K but at a diminishing rate: $z = \sqrt{2K / \gamma}$. The parameter γ determines the cost of investment in quality.

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

$$\pi_i^V = (p - c_i^V) y_i - K_i - G, \quad (3a)$$

where G represents the fixed governance costs that a vertically integrated firm is assumed to incur. They capture additional costs – *à la* Williamson (1975, 1985) – of running a larger and more complex organisation and they can be thought of as managerial incentive costs of integration. In line with the literature on vertical integration, we assume that governance costs are higher for a vertically integrated firm than for a firm that outsources; without loss of generality, we shall then set the governance cost for the latter to zero.⁹ If the firm chooses to outsource, its profit function will therefore be:

$$\pi_i^O = (p - c_i^O) y_i. \quad (3b)$$

Note that, by outsourcing, a firm avoids both the governance and the investment cost associated with the intermediate. The latter, is now borne by the upstream supplier. This supplier earns operating profit: $(q_i - r_i^u) m_i$, where m_i is output of intermediates and r_i^u is the upstream 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 or by the upstream firm, thus r^u is not necessarily equal to r . Note that we also use i to represent the upstream firm that has a bilateral outsourcing relationship with the downstream firm i (thus the subscript $i=1,2$ refers to a upstream-downstream pair). Making use of the fact that 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 invests $K_i^u = \gamma_i^u z_i^2 / 2$, and must pay a fixed entry cost F . Its total profit is:

$$\mu_i = (q_i - r_i^u) y_i - K_i^u - F. \quad (4)$$

The model is a four stage game. In stage one, the downstream firms decide whether to outsource their intermediate or to produce it in-house. If they decide to

⁹ For a discussion and further references on fixed governance costs see McLaren (2000).

outsource, they approach a specialised supplier firm which will produce the intermediate.¹⁰ In stage two, the firms invest in the development of the intermediate. If the downstream firms choose to outsource, then the upstream supplier firms undertake this investment. In stage three, the firms that outsource bargain with the intermediate supplier over the price of the intermediate. 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, the intermediate is supplied and the final output is produced.¹¹

We are concerned with the subgame perfect equilibria hence the game is solved by backward induction; we thus begin by discussing the final stage and then work back. In the final stage, the two firms engage in Cournot competition with outputs determined by the following first-order conditions:

$$\frac{\partial \pi_i}{\partial y_i} = p - c_i^h - by_i = 0 \quad (5)$$

for $i=1,2$ and where c^h will vary depending on the mode of operation ($h=V,O$) chosen by the firms. The resulting equilibrium output of firm i will then be:

$$y_i = \frac{a - 2c_i^h + c_j^k}{3b}, \quad (6)$$

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

In stage three, recognising that all fixed and investment costs are now sunk, the final goods firms (if they are outsourcing) bargain with an upstream supplier over the price of their intermediate. When both firms outsource, the two upstream and downstream pairs bargain simultaneously. The price q_i of the intermediate good results from the maximisation of the following Nash bargain:

¹⁰ We think of the intermediate input in this model as being highly specialised and thus highly specific to a downstream firm. As a result, we model the relationship between upstream and downstream firms as a bilateral one between a specific firm and a specific supplier – thus ruling out by assumption search and matching processes between final good producers and intermediate suppliers.

¹¹ This set up corresponds to the ‘*informal arrangement*’ described by McLaren (1999), who argues that trade liberalisation works towards less formality in contracting, making informal arrangements more likely.

$$N_i = [(p - c_i^o)y_i]^{\beta_i} [(q_i - r_i^u)y_i]^{1-\beta_i} \quad (7)$$

where β_i and $(1 - \beta_i)$ represent the bargaining power of the typical downstream firm and its upstream partner firms respectively. Note that we have used $m_i = y_i$ to eliminate m_i . Taking the first-order condition for the maximisation of N_i with respect to q_i and rearranging, we obtain:

$$q_i = r_i^u + \frac{3}{2} \left(\frac{1 - \beta_i}{1 + \beta_i} \right) b y_i. \quad (8)$$

The equilibrium mark-up of the intermediate supplier, $q_i - r_i^u$, falls in the downstream firm's bargaining power, but increases in its output y_i . The rent-extracting ability of the intermediate firm will be higher, ceteris paribus, the weaker is the bargaining position of the final good producer and the larger is the latter's output. Although q_i must be larger than r_i^u , it needs not be higher than r_i . Note, however, that even if q_i is lower than r_i^u , it may still be the case that the marginal production cost of the vertically integrated firm is lower than that of a downstream firm that chooses to outsource: as we shall see, in fact, the level of investment may be lower under outsourcing.

The firms choose their investment levels simultaneously in stage 2. We can model the firms as each choosing the level of z_i , as this is directly related to that of investment. A firm that produces the intermediate in-house, will choose z_i to maximise (3a). The corporate governance costs, G , have already been sunk before the firms invest so they play no part in the optimal choice of investment levels. In making this choice, each firm takes account of both the direct cost-reducing effect of its investment on its own profit and also the strategic effect on its rival's output in the final stage. Thus, firm i 's first-order condition is:

$$\frac{d\pi_i}{dz_i} = \frac{\partial \pi_i}{\partial z_i} + \frac{\partial \pi_i}{\partial y_j} \frac{dy_j}{dz_i} = 0, \quad (9)$$

where the first term on the right-hand side, $\partial \pi_i / \partial z_i = -(\partial c_i^v / \partial z_i) y_i - \gamma_i z_i = y_i - \gamma_i z_i$, is the direct effect of z_i on own profits. As regards the second term, $\partial \pi_i / \partial y_j = y_i p' = -b y_i$, but the term dy_j / dz_i depends on the mode of operation of firm j . If the rival firm j is

vertically integrated, then $dy_j/dz_i = (1/3b)(\partial c_i^V/\partial z_i) = -1/3b$. Thus, in this case, the strategic effect $(\partial \pi_1/\partial y_2)(dy_2/dk_1)$ is positive and hence encourages the firm to invest more in the development of the intermediate good. The first-order condition for a firm that is vertically integrated and faces a vertically integrated rival can then be rewritten as:

$$z_i^{VV} = \theta^{VV} \eta_i b y_i^{VV}, \quad \text{where } \theta^{VV} = 4/3, \quad (9a)$$

and where $\eta_i \equiv 1/b\gamma_i$ is a measure of the effectiveness of investment; also note that we adopt the convention that, when there are two superscripts, the first refers to firm i and the second to firm j . If, instead the rival firm j outsources, then even though firm i 's first-order condition takes the same form as in (9), the derivative dy_j/dz_i is different, as z_i now also affects y_j through changes in q_j . Hence, the strategic incentive for firm i 's investment is lessened as a result of the endogenous change in the price of the intermediate because now $dy_j/dz_i = (1/3b)(\partial c_i^V/\partial z_i) - (2/3b)(\partial c_j^O/\partial z_i)$, with the derivative $dc_j^O/dz_i = dq_j/dz_i = (3/2)[(1-\beta_j)/(1+\beta_j)]b dy_j/dz_i$. Rearranging, we get: $dy_j/dz_i = -(1/6b)(1+\beta_j) < 0$, the absolute value of which is less than that in the vertical integration case (where $dy_j/dz_i = -1/3b$) except when $\beta_j = 1$, that is when firm j has maximum bargaining power in its negotiations with the supplier firm. Thus, the first-order condition for a vertically integrated firm facing a rival that outsources can be rewritten as:

$$z_i^{VO} = \theta_i^{VO} \eta_i b y_i^{VO}, \quad \text{where } \theta_i^{VO} = \frac{7+\beta_j}{6}. \quad (9b)$$

A comparison of (9a) and (9b) reveals that a firm's the investment-to-output ratio z_i/y_i ratio is lower when its rival outsources its intermediate than when it chooses to produce it in-house. Thus, outsourcing by one firm 'softens' the behaviour of its rival, i.e. it reduces its aggressiveness in investment. We will return to this issue later when we discuss the strategic motive for outsourcing.

If the intermediate is outsourced, then the investment is carried out by the upstream firm. That firm only receives a share (determined by its bargaining power) of the rent

generated by the investment; as a result, it does not fully appropriate the marginal benefit of its investment and this reduces its incentive to invest. We can use (8) in (4) to obtain:

$$\mu_i = \frac{3(1-\beta_i)}{2(1+\beta_i)}by_i^2 - K_i^u - F. \quad (12)$$

The first order condition for the profit maximising choice of z_i is then:

$$\frac{d\mu_i}{dz_i} = 3\frac{(1-\beta_i)}{(1+\beta_i)}by_i\frac{dy_i}{dz_i} - \gamma_i^u z_i = 0. \quad (13)$$

The expression for dy_i/dz_i differs depending on whether the rival is vertically integrated or outsourcing. Thus, when the rival is vertically integrated it is straightforward to use (2b) and (6) to show that $dy_i/dz_i = -(2/3b)\{(\partial c_i/\partial z_i) + (\partial c_i/\partial q_i)(dq_i/dz_i)\}$ which simplifies to: $dy_i/dz_i = (1+\beta_i)/3b > 0$. We can use this in (13) to obtain:

$$z_i^{OV} = \theta_i^{OV}\eta_i^u by_i^{OV} \quad \text{where } \theta_i^{OV} = (1-\beta_i), \quad (14a)$$

and where $\eta_i^u \equiv 1/b\gamma_i^u$. However, when the rival firm is outsourcing then the effect of z_i on y_i becomes $dy_i/dz_i = (2/3b)(7+\beta_j)(1+\beta_i)/(15+\beta_i+\beta_j-\beta_i\beta_j) > 0$ as shown in the appendix. The use of this in (13) yields:

$$z_i^{OO} = \theta_i^{OO}\eta_i^u by_i^{OO} \quad \text{where } \theta_i^{OO} = \frac{2(7+\beta_j)}{15+\beta_i+\beta_j-\beta_i\beta_j}(1-\beta_i). \quad (14b)$$

Again, outsourcing by one firm ‘softens’ the investment behaviour of its rival in the sense that z_i/y_i is lower when its rival outsources its intermediate than when it chooses to vertically integrate. Furthermore, a comparison of (9) and (14) reveals that, given the mode of operation choice of its rival, firm i ’s investment-to-output ratio is higher when it is vertically integrated than when it outsources – unless the effectiveness of investment when conducted by the upstream firm (η_i^u) is much larger than it is when it is carried out by the downstream firm (η_i). Thus, vertical integration implies a more aggressive investment strategy than outsourcing unless η_i^u is much larger than η_i .

In the first stage of the game, the firms simultaneously choose their mode of operation. To establish whether a firm will choose to outsource or to be vertically integrated, we must compare its profits under the two regimes for a given mode of operation choice of its rival. To facilitate this comparison, it proves helpful to derive an

expression for the profits in terms of outputs and parameters only. By using the first-order conditions in (5) and (9), we can rewrite the profit functions in the two regimes respectively as:

$$\pi_i^{V_k} = \Omega_i^{V_k} b(y_i^{V_k})^2 - G, \quad (15a)$$

and

$$\pi_i^{O_k} = b(y_i^{O_k})^2, \quad (15b)$$

where $k=(V,O)$, $\Omega_i^{VV} = (1 - \frac{8}{9}\eta_i)$ and $\Omega_i^{VO} = (1 - \frac{(7+\beta_i)^2}{72}\eta_i)$. It is immediately obvious from equations (15a) and (15b), that a sufficient condition for outsourcing to yield higher profits is $y_i^{O_k} \geq y_i^{V_k}$. Hence, if outsourcing results in an increase in output (perhaps because the marginal cost of producing the intermediate is so much lower if it is carried out by a specialised upstream producer), then it dominates vertical integration.

3. The Mode of Operation Equilibria

We turn now to a discussion of the mode of operation equilibria. There are four possible candidate equilibrium regimes: **(VV)**, **(VO)**, **(OV)**, and **(OO)**, where the first letter refers to the mode of operation selected by firm 1 and the second letter refers to the mode chosen by firm 2.

Our model is quite rich and there are very many possible asymmetries between firms. To begin with, it proves useful to consider what we will refer to as the *base case*. In this case, the downstream firms are *ex ante* identical – which means that neither firm has an underlying cost advantage; the upstream firms are also *ex ante* identical to each other. Furthermore, we assume the bargaining power parameters to be identical so that $\beta_1 = \beta_2 = \beta$; we also assume that there is no underlying cost advantage or disadvantage from outsourcing – by which we mean that the marginal production cost of the input is the same regardless of whether it is made by the downstream or by the upstream supplier.

Given these symmetry assumptions, the pattern of equilibria depends on the level of governance costs, G . It can be shown (see Appendix) that at $G=0$ both firms choosing vertical integration **(VV)** is the unique subgame perfect equilibrium. If G is sufficiently large, then both firms choosing to outsource **(OO)** is the subgame perfect equilibrium. As shown in the Appendix, there are multiple asymmetric equilibria **(VO)** and **(OV)** for

intermediate levels of G . Hence, for a range of G , there are asymmetric outcomes despite the fact that the firms are fully symmetric *ex ante*.

The underlying reason for the emergence of asymmetric equilibria derives from a negative interdependence between the firm's mode of operation decisions. The intuition for this is that, given our *ex ante* symmetry assumptions, vertical integration entails exchanging high fixed costs for lower marginal costs – and is therefore a higher output strategy. On the other hand, outsourcing – which involves trading off lower fixed costs for higher marginal costs – is a lower output strategy. A firm that faces a rival which is vertically integrated has, *ceteris paribus*, a lower anticipated market share and hence a lower incentive to be vertically integrated 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 that vertically integrates. The profit levels in the different equilibrium regimes are plotted against the governance costs G in Figure 1 for the case of *ex-ante* symmetry. When governance costs are low enough, both firms choose vertical integration and have the same equilibrium profits. As G rises, asymmetric equilibria emerge: the best reply to a firm's vertical integration is outsourcing (and vice-versa). In this region of G , the vertically integrated firm's profits are higher than that of the outsourcing firm.¹² As shown in the figure, the profits of the vertically integrated firm increase when the other firm switches to outsourcing. This is because here outsourcing is less aggressive than vertical integration and results in lower investment and output. At high levels of G , the vertically integrated firm switches to outsourcing and this leads to an increase in the profits of the other firm (which is also outsourcing).

Figure 1 about here

Here we can see both strategising and economising considerations at work; in particular, oligopolistic strategic interaction means that – even when firms are *ex-ante* symmetric – asymmetric equilibria (in which firms choose different mode of operation strategies) can emerge. A better appreciation of how strategic behaviour can be used to soften the behaviour of rivals can be gained by considering underlying asymmetries between firms, to which we now turn.

¹² Nevertheless, in this region of parameter space, the outsourcing firm does not have an incentive to vertically integrate given that its rival is vertically integrated – as then both it and its rival would have lower profits.

4. Aggressive and defensive business strategies

As we saw earlier, a comparison of (9a) and (9b) and a comparison of (14a) and (14b) reveals that outsourcing by one firm softens the investment behaviour of its rival. This results in a ‘strategic motive’ to outsource. In this section, we show how the choice of the mode of operation can be used strategically by firms to affect the oligopoly game between them. To this end, we ask how the make-or-buy decision affects the equilibrium market shares and profit levels. A natural approach to answering this question is to consider the effect of the mode of operation on the firms’ output reaction functions and thus on outputs. The reaction function of firm i that is obtained from the output first-order condition in (5) can be written as $y_i = \psi_i(y_j; c_i)$. Note that the effect of outsourcing on c_i occurs via changes in z_i and q_i . It therefore proves useful, by making appropriate substitutions given the solutions of previous stages of the game, to eliminate z_i and q_i . The resulting functions, which we call *output response functions*,¹³ take account of the indirect effect of outsourcing on outputs through changes in the level of investment and the price of the intermediate good. We will use these functions to illustrate what happens when one of the firms chooses to outsource rather than to vertically integrate. In the absence of outsourcing, these output response functions for firm 1 and firm 2 respectively, are:

$$y_1^{VV} = \frac{A - by_2^{VV}}{bM_1^{VV}}, \quad (16a)$$

and

$$y_2^{VV} = \frac{A - \Phi - by_1^{VV}}{bM_2^{VV}}, \quad (16b)$$

where $M_1^{VV} = (2 - \theta^{VV} \eta_1)$, $M_2^{VV} = (2 - \theta^{VV} \eta_2)$ and $A = (a - \bar{e}_1 - r_1)$. The parameter $\Phi = \bar{e}_2 + r_2 - \bar{e}_1 - r_1$ can be thought of as the underlying (‘pre-investment’) marginal cost disadvantage of firm 2 which can reflect relative productivity differences (of course Φ could be negative giving firm 2 an *ex ante* cost advantage). When firm 2 chooses to

¹³ These are effectively reduced form reaction functions.

outsource but firm 1 remains vertically integrated, the corresponding output response functions are:

$$y_1^{vo} = \frac{A - by_2^{vo}}{bM_1^{vo}} \quad (17a)$$

and

$$y_2^{vo} = \frac{A - \Phi + \rho_2 - by_1^{vo}}{bM_2^{vo}}, \quad (17b)$$

where $M_1^{vo} = (2 - \theta_1^{vo} \eta_1)$ and $M_2^{vo} = \{7 + \beta_2 - 2\eta_2^u(1 - \beta_2^2)\} / \{2(1 + \beta_2)\}$. Note that here we are using the first superscript to refer to firm 1 and the second to firm 2. Thus, y_2^{vo} is the output of firm 2 when firm 1 is vertically integrated and firm 2 is outsourcing. The parameter $\rho_2 = r_2 - r_2^u$ captures the difference between the marginal costs of producing the intermediate incurred by the downstream firm 2 (when it is vertically integrated) and by the upstream intermediate producer partner of firm 2. Thus, when $\rho_2 > 0$, the upstream firm has a cost advantage over the downstream firm in producing the intermediate.

These functions are illustrated in Figure 2. In the figure we assume *ex ante* symmetry between the firms, so that $\Phi = 0$ and $\eta_1 = \eta_2$ but we allow for two cases: one where $\rho_2 = 0$ and one where $\rho_2 > 0$. We will begin by discussing the case in which $\rho_2 = 0$. The curves labelled R_1 and R_2 are the output response functions for firm 1 and 2 respectively when both firms are vertically integrated. The equilibrium is at point E . The curve labelled R_1' is the output response function of firm 1 when firm 2 outsources the intermediate; the curve labelled R_2' is the output response function of firm 2 when it outsources. In this case, the corresponding equilibrium is at point E' . Inspection of equations (16) and (17) reveals that, at $\rho_2 = 0$, a switch to outsourcing by firm 2 does not affect the zero-output intercept of these curves (which depend only on the terms in the numerators). It does however lead to a pivoting inwards of firm 2's output response function about the zero-output point provided that $M_2^{vv} < M_2^{vo}$ (this will be true unless

$\eta_2^u - \eta_2$ is sufficiently large) which is the case illustrated in the figure.¹⁴ The reason why firm 2's output response function pivots inwards is twofold. First, the firm now faces a higher marginal cost of the intermediate, as the upstream firm captures some of the available rents. Second, the investment behaviour is now less aggressive as explained earlier. Firm 1's output response function always pivots inwards when its rival outsources, as $M_1^{vv} < M_1^{vo}$ because $\theta^{vv} > \theta^{vo}$. At the new equilibrium E' , total production is lower.

Figure 2 about here

The effect of outsourcing on firms' market shares will depend on Φ , the extent of the relative cost difference between the two firms. When Φ is small (as in Figure 2), so that the firms have ex-ante very similar efficiencies, outsourcing by firm 2 lowers its market share and raises the market share of firm 1. This does not imply that outsourcing necessarily reduces firm 2's profits. It must be remembered that outsourcing also saves on governance costs and raises the market price. When Φ is large enough, i.e. when firm 2 is sufficiently less efficient, the market share shifting effect of outsourcing is reversed. We show this in Figure 3 in which $\rho_2=0$ and Φ is large. Compared to Figure 2, firm 2's output response functions have moved inward. Inspection of (16) and (17) reveals that firm 1's output response curves are independent of Φ , whilst an increase in Φ shifts firm 2's output response functions inwards in a parallel manner. In Figure 3, outsourcing by firm 2 increases its own market share at the expenses of firm 1. As we have seen, the change in regime between outsourcing and vertical integration causes the output response curves to pivot around the firms' zero output points. Thus, the effect of outsourcing on an output response curve is greater the further away we are from the firm's zero output point. When Φ is high, firm 2's relative market share is small and the negative impact of outsourcing on firm 2's output response curve is locally very small, while the negative effect on the corresponding curve for firm 1 is locally much larger. The net result is that firm 1's output falls and firm 2's output rises. Note that the seemingly paradoxical result

¹⁴ The firm 1's output response function would remain unchanged at $\eta_2^u - \eta_2 = 0$ in the mathematically limiting case of $\beta_2 = 1$, when $q_2 = r_2^u$ and $z_2 = 0$. However we rule out this degenerate case by assumption.

that $y_2^{VO} > y_2^{VV}$ when Φ is very large, despite an inward shift of the output response curve, is due to strategic interaction between firms under oligopoly and would not occur under monopoly. The firm's decision to outsource can raise its own market share when the effect on the strategic aggressiveness of its rival is very strong. This is more likely to be the case the larger the rival's market share in the equilibrium with vertical integration, because the bigger and more powerful is one's competitor, the larger the gain from reducing its aggressiveness.¹⁵ In this sense, outsourcing can be thought of as a defensive business strategy helping a firm to hold on to market share and in some cases to remain in business when it otherwise would not. Because of this strategic effect, outsourcing can sometimes be optimal even when it is unambiguously cost increasing.¹⁶

Figure 3 about here

However, when vertical integration reduces the rival's output it can be seen as an aggressive business strategy. This is the case for firm 2 when Φ is not too large, as in figure 2, when the firm has a strategic incentive to vertically integrate. A comparison of the profits of firm 2 under the two regimes enables us to determine the threshold level of Φ that will induce a switch in the firm's preferred mode of operation.

Figure 4 plots firm 2's *indifference profit locus*, in Φ and G space at $\rho_2 = 0$, i.e. the figure shows the combinations of Φ and G at which $\pi_2^{VO} = \pi_2^{VV}$ (for given values of β_2 and the other parameters). For any given level of Φ , the indifference profit locus gives the critical level of governance costs above which firm 2 will chose to outsource.¹⁷

Figure 4 about here

As is clear from the figure, the critical value of G falls in Φ . The explanation for the negative slope of this locus is that the profits under outsourcing fall less quickly in Φ than the profit under vertical integration. Thus an increase in Φ increases the relative attractiveness of outsourcing for firm 2. The reason for this is twofold. First, an increase

¹⁵ In this analysis we have, for simplicity, focused on the case of $\Phi > 0$. If $\Phi < 0$, firm 1 is small and the returns to firm 2 from reducing its aggressiveness by outsourcing is consequently reduced. Hence, at $\rho_2 = 0$ and $\Phi < 0$, outsourcing could never increase firm 2's output. Therefore, $\Phi < 0$ is qualitatively a special case of Φ small.

¹⁶ In the case shown in Figure 3, even when $G_2 = \rho_2 = 0$, outsourcing increases the profit of firm 2.

¹⁷ Of course, at some parameters values there is no trade-off between outsourcing and vertical integration but, by its very nature, there must be such a trade-off on an indifference locus.

in Φ strengthens firm 2's strategic incentive to outsource in order to reduce the aggressiveness of firm 1. Second, an increase in Φ also reduces the strategic incentives to vertically integrate. To see this, consider that when the firm chooses vertical integration, it trades off higher fixed costs for higher operating profits.¹⁸ The relative gain from vertical integration depends on this improvement in operating profits achieved in exchange for the higher fixed governance costs. However, the difference in the operating profits of firm 2 between the two modes of operation narrows in Φ , as under outsourcing the fall in the input price q_2 works to cushion the fall in operating profits – while no such effect occurs under vertical integration.

Even when $\rho_2=0$ (or even when ρ_2 is slightly negative), the indifference locus falls below zero: hence, outsourcing is always preferred when, due to an underlying cost disadvantage, the firm's market share is small. This is not surprising given that, as we saw above, a sufficient condition for $\pi_2^{VO} > \pi_2^{VV}$ is that $y_2^{VO} \geq y_2^{VV}$. An increase in ρ_2 pushes this locus down making outsourcing more attractive.

Sometimes outsourcing can lead to much lower production costs than in-house production. This is the case when the upstream firm is much more efficient than its downstream partner in producing the intermediate. Thus, we can see in figure 2 that if $\rho_2 > 0$, then firm 2's output response function, in addition to pivoting inward, also shifts outwards in a parallel manner. A comparison of (16) and (17) reveals that whilst firm 2 switching to outsourcing does not affect the numerator in the output response function for firm 1 it will affect that of firm 2 if $\rho_2 > 0$ – i.e. when underlying marginal cost of producing the intermediate is lower under outsourcing than under vertical integration. Note that outsourcing can be an aggressive business strategy that raises foreign output at the expense of firm 1 (as illustrated in Figure 2) even when Φ is zero. For this to happen, however, ρ_2 needs to be positive and very large. In figure 2, the dotted curve labelled R_2'' is the output response function of firm 2 when it outsources and ρ_2 is large enough to cause firm 2's output to rise.

¹⁸ Note that along the locus, because there are fixed governance costs of vertical integration, the marginal cost under vertical integration must be lower than under outsourcing for the profits to be equal in the two regimes.

5. Outsourcing and international trade.

A major reason for the revival of interest in the literature on the boundaries of the firm has been the perceived relationship between outsourcing and globalisation. However, much outsourcing is actually domestic in character, being carried out within national boundaries. Also firms can offshore production of intermediates while keeping them in house through foreign direct investment. Thus how globalisation and trade policy affect outsourcing depends on whether the outsourcing or the vertical integration is domestic or international. In this section, we will apply our model to a number of different trading setups in order to examine how the internationalisation and internalisation strategies of firms interact.

5.1. Trade liberalisation as an intensification of competitive pressure

In this subsection we look at outsourcing as a response to an increase in foreign competition resulting from trade liberalisation. To examine this, we consider the following setup: downstream firm 1 is located in the home country while firm 2 produces its final good in a foreign location. The firms compete on the home market. To focus on the effect of trade liberalisation on the relative incentive to outsource via the intensification of competitive pressure route, we will assume that firms outsource domestic suppliers, i.e. we rule out international outsourcing. The effect of trade liberalisation on the relative cost of foreign outsourcing will be discussed in the next subsection. Clearly one could examine a setup with foreign outsourcing that combines the two effects, but this would yield less transparent results.

The trade costs faced by firm 2 will be parameterized by a per-unit tariff τ . This can be neatly incorporated into the firm's marginal cost by including it in \bar{e}_2 . As a result, the cost difference parameter Φ is now increasing in the tariff. Trade liberalisation will reduce Φ and this will have implications for output, prices and investment under a given regime and under some circumstances it will also lead to a regime shift. We shall begin by examining the effects of trade liberalization within a given regime and then consider its effects on regime outcomes.

Under a given regime, a fall in τ improves the relative competitive position of firm 2 at the expense of firm 1 and this will yield a market share reallocation in favour of the former. Under outsourcing, this market share reallocation results in a fall in the negotiated price of the intermediate good in the home country. This is because trade liberalisation decreases the available rents to be bargained over by the domestic downstream and upstream firms.

Trade liberalisation can also lead to regime shifts as it can affect firms' decision about their mode of operation. A fall in τ (and hence in Φ) will increase the incentive of firm 2 and decrease the incentive of firm 1 to choose vertical integration.¹⁹

In Figure 5, at free-trade firm 2 has an underlying cost advantage. In notational terms, $\Phi < 0$ at $\tau = 0$.²⁰

Figure 5 about here

As can be seen from the figure, at sufficiently low levels of governance costs, and $\Phi > 0$, a fall in τ will eventually lead to a switch from the (V,O) to the (V,V) regime (as firm 1 stays vertically integrated and firm 2 is induced to change regime). At negative values of Φ , further trade liberalisation can result in a switch from (V,V) to (O,V). At sufficiently high levels of governance costs, and $\Phi > 0$, trade liberalisation leads to a move from (V,O) to (O,O), as firm 1 is induced to outsource, whilst firm 2 remains outsourced. When $\Phi < 0$, further trade liberalisation can result in a shift to the (O,V) equilibrium region.

In Figure 5, we see that (V,O) is the typical outcome when τ is high and hence firm 2 has a strong competitive disadvantage, but for low trade costs, (O,V) can emerge as the competitive advantage swings towards firm 2. Also note that the range of G over which multiple equilibria occurs is at its largest when Φ is zero.

¹⁹ Under outsourcing, trade liberalisation increases the profit of the intermediate supplier in the foreign country and reduces the profit of the intermediate supplier in the home country. Clearly, excessive competitive pressure can prevent outsourcing from being supplied, as discussed at the end of Section 3.1.3.

²⁰ Giving firm 2 a cost advantage at free-trade allows us to present cases in which Φ is positive and cases in which it is negative on the same diagram. At high values of t ($\Phi > 0$) firm 1 has a cost advantage, while at low values of t ($\Phi < 0$) firm 2 has a cost advantage. Other constellations of parameters values can be considered but this one is chosen because it captures all the interesting cases.

Finally, we can now briefly explore the implications of the analysis for the effects of trade liberalisation on the consumer in the home country. Here trade liberalisation at a given regime raises output and thus works to increase consumer surplus. This increase in consumer surplus is further enhanced when a threshold is crossed that leads firm 2 to switch to vertical integration. This is because when firm 2 switches to vertical integration, both its own and the industry outputs experience a discrete upward jump. Here a tariff reduction leads to a discrete downward jump in consumer surplus when it results in the crossing of a threshold that brings about a switch to outsourcing by firm 1. This implies that, somewhat counter-intuitively, consumer surplus is not always maximised at free-trade.

5.2. Trade liberalisation and the costs of international outsourcing

Trade liberalisation may also change the relative cost of outsourcing. Suppose that the firms have the possibility of outsourcing abroad. To begin with, we assume that if they are vertically integrated they produce the intermediate in their home country. To disentangle the effect of trade costs on the costs of outsourcing from the effect of trade costs on the competitive pressure faced by firms assume, that the two downstream firms are located in the same country or in a custom's union so that further trade liberalisation does not affect the ex-ante relative cost differences between the firms. We again parameterize trade cost by a per-unit tariff τ . This can be neatly incorporated into the firm's marginal cost by adding it to marginal costs when the firm outsources abroad but not when it produces in-house domestically. To deliver the input to the home country when a firm outsources from abroad, the firm must pay τ per unit of output.²¹ When we adopt this specification the parameter ρ_i , which captures the difference between the marginal costs of producing the intermediate incurred by the downstream firm and its upstream outsourcing partner is decreasing in the tariff.

In Figure 6, in which the two firms are ex-ante symmetric but the upstream firms have lower marginal production costs than the downstream firms, we see the effect of

²¹ Note that the results would not be materially changed were we to assume instead, that it is the upstream firm that pays the tariff. Note too that effectively we are assuming an asymmetry between the trade cost associated with selling the final good and importing the intermediate. This implies that the supplier is located, for instance, in an LDC that is geographically farther away.

trade liberalisation on the mode of operation. Unsurprisingly, it leads to an increase in the range of parameter values at which firms outsource.

Figure 6 about here

We have now seen two routes by which trade liberalisation may encourage outsourcing. However, we will now consider a setup in which, by contrast, trade liberalisation leads to more vertical integration. Suppose that the costs of setting up a fully owned subsidiary in which the intermediate can be developed and produced are not prohibitively high, as we had implicitly assumed by ruling out this mode of operation option. Instead, assume now that foreign vertical integration dominates domestic vertical integration – perhaps because production or investment costs are lower abroad than in the home country. Hence, the relevant trade-off is now between international outsourcing and international vertical integration. We will refer to the latter as FDI. Assume that both under outsourcing and vertical integration the downstream firm must pay a trade cost of τ per unit of output to deliver this input to the home country where it is combined with the composite input. In the interests of clarity, we continue to assume that the firms are ex-ante symmetric. In order to focus on the tradeoff between the different modes of operation, we restrict attention to parameter values that imply a lower ex-post marginal production cost for the final producer under FDI than under outsourcing. Outsourcing however involves a lower fixed cost. This is due to lower investment and governance costs.

We find that trade liberalisation reduces the amount of outsourcing relative to FDI. There are two main reasons for this. First, in exchange for facing higher fixed costs, the firms that choose FDI have a higher scale of output than those that outsource. This means that any fall in per unit trade costs applies to a larger output level under FDI and hence is more beneficial to firms choosing the FDI option. Second, trade liberalisation raises the available rents – but this increases the possibility for rent extraction by the upstream firm under outsourcing. A fall in trade costs thus leads to an increase in the bargained intermediate price and this reduces some of the benefit of trade liberalisation to the downstream firm.

The effect of trade liberalisation on the mode of operation outcomes when the trade-off is between FDI and international outsourcing is illustrated in Figure 7.

Figure 7 about here

6. Concluding remarks

In this paper we have developed a model of endogenous outsourcing in an international oligopoly setting. In line with some other recent theoretical contributions, we have modelled the outsourcing arrangement as one where a final good producer enters a bilateral relationship with an upstream supplier which undertakes a relationship-specific investment. Previous authors who have adopted this approach have done so within a non-strategic monopolistically competitive market structure. We have demonstrated that the oligopolistic setup implies that additional strategic considerations play a role in explaining the choice of mode of operation of firms. In particular, we have shown that both strategic vertical integration and strategic outsourcing are possibilities in our model.

A vertically integrated firm incurs additional governance costs that can be avoided by sourcing components outside the firm. However, outsourcing is beset with problems of contract incompleteness. If the outside supplier is not significantly more efficient at providing the intermediate to the required specifications, however, outsourcing will raise the final goods producer's marginal production costs since the supplier fails to fully internalise the marginal benefit of investment. Outsourcing then involves accepting higher marginal costs in exchange for a saving on fixed (governance) costs. In a Cournot oligopoly setting, this gives rise to an additional strategic incentive to vertically integrate – as the lower marginal costs reduce the rival's output and thus indirectly raises the integrated firm's profits. However, strategic outsourcing is also a possibility even when it results in higher marginal costs. This is because when a firm chooses outsourcing, the rival firm's incentive to invest strategically is reduced. We have shown that when a firm has a sufficiently small market share under vertical integration, it has an incentive to strategically switch to outsourcing so as to increase its own and reduce its rival's investment and output. In our model, the choice of the mode of operation by firms is shown to depend on the combined influence of cost considerations (the incentive to economize) and strategic considerations.

Unlike most contributions in the outsourcing literature (e.g. Grossman and Helpman, 2002), this model gives rise to the possibility of 'mixed outcomes' in which,

even when firms are ex-ante symmetric, they may choose different modes of operation in equilibrium; this is consistent with existing stylised facts whereby not all firms in the same industry adopt the same mode of operation.

We examined the effects of trade liberalisation on the relative incentive to outsource. Trade liberalisation can mean that domestic firms face tougher competition and we have shown that a firm that faces greater competitive pressure has a greater incentive to outsource. Also trade liberalisation can reduce the cost of international outsourcing. If the relevant trade-off is between domestic vertical integration and international outsourcing then trade liberalisation increases the incentive to outsource. However, if international vertical integration in the form of FDI is the viable alternative to outsourcing, then our model suggests that trade liberalisation actually reduces the incentive to outsource.

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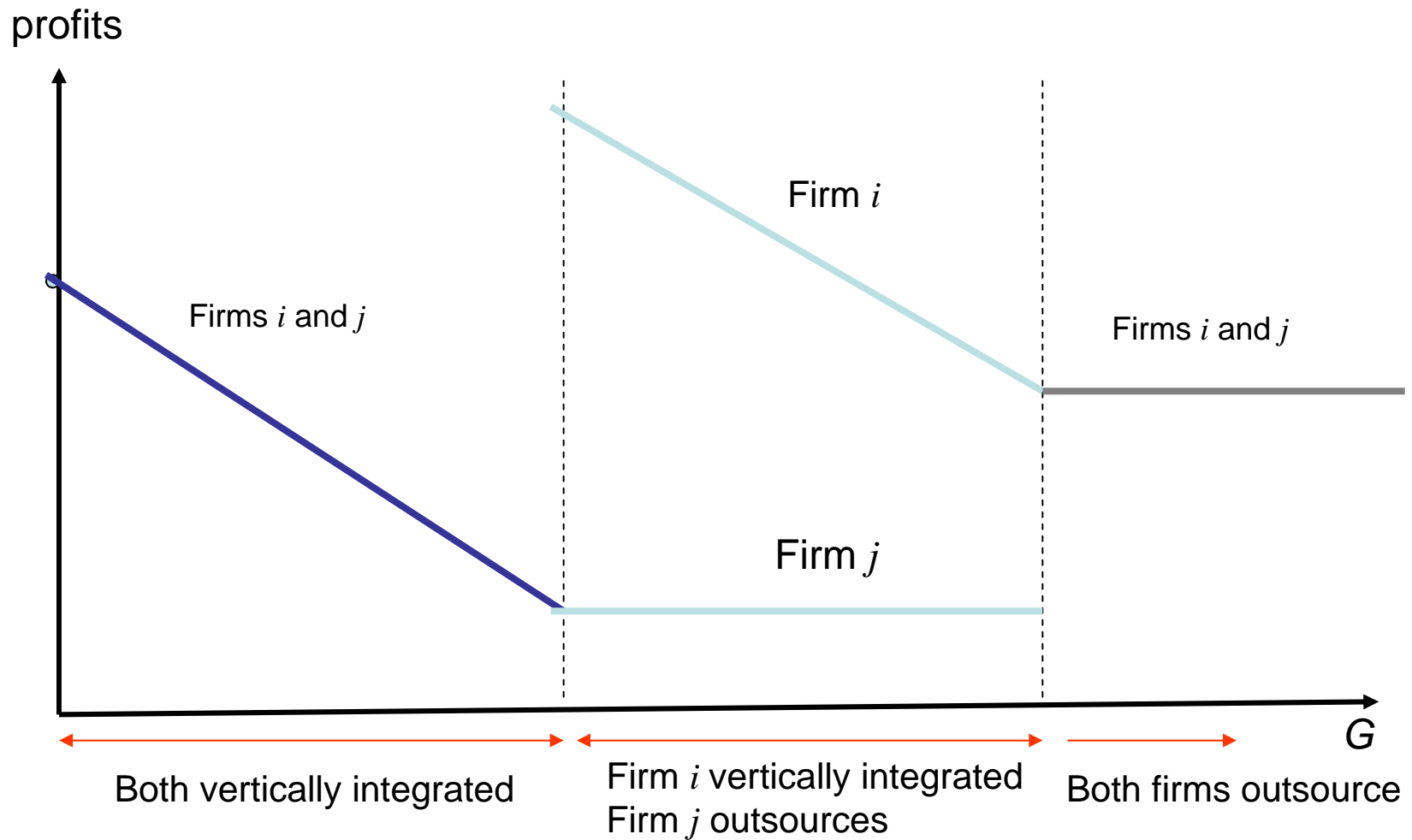


Figure 1. Profit levels of firms under ex-ante symmetry as a function of G .

(In the asymmetric equilibrium region the vertically integrated firm is referred to as firm i and the outsourcing firm as j .)

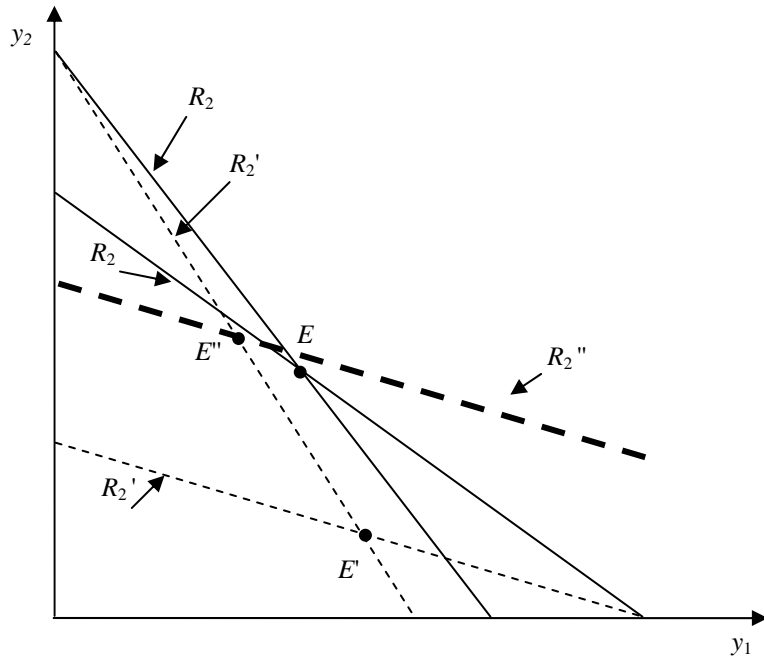


Figure 2. Output response functions ($\Phi=0$)

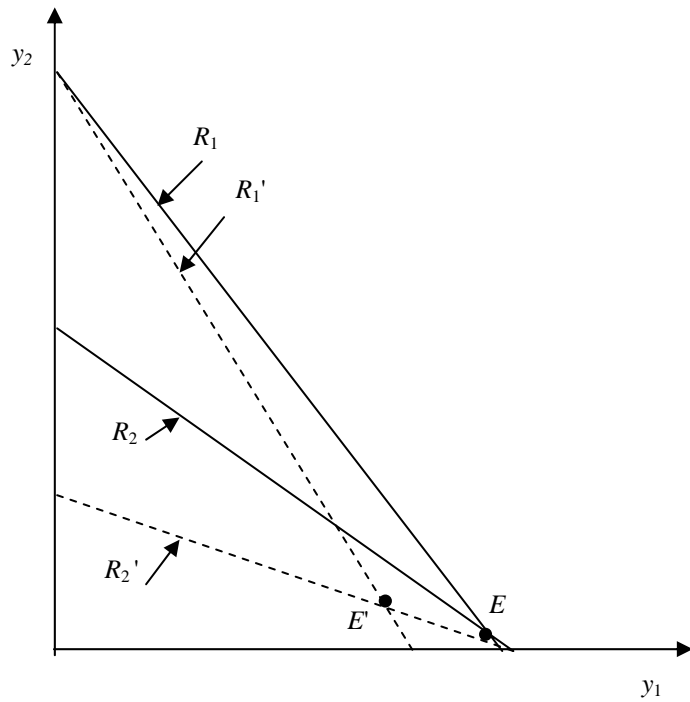
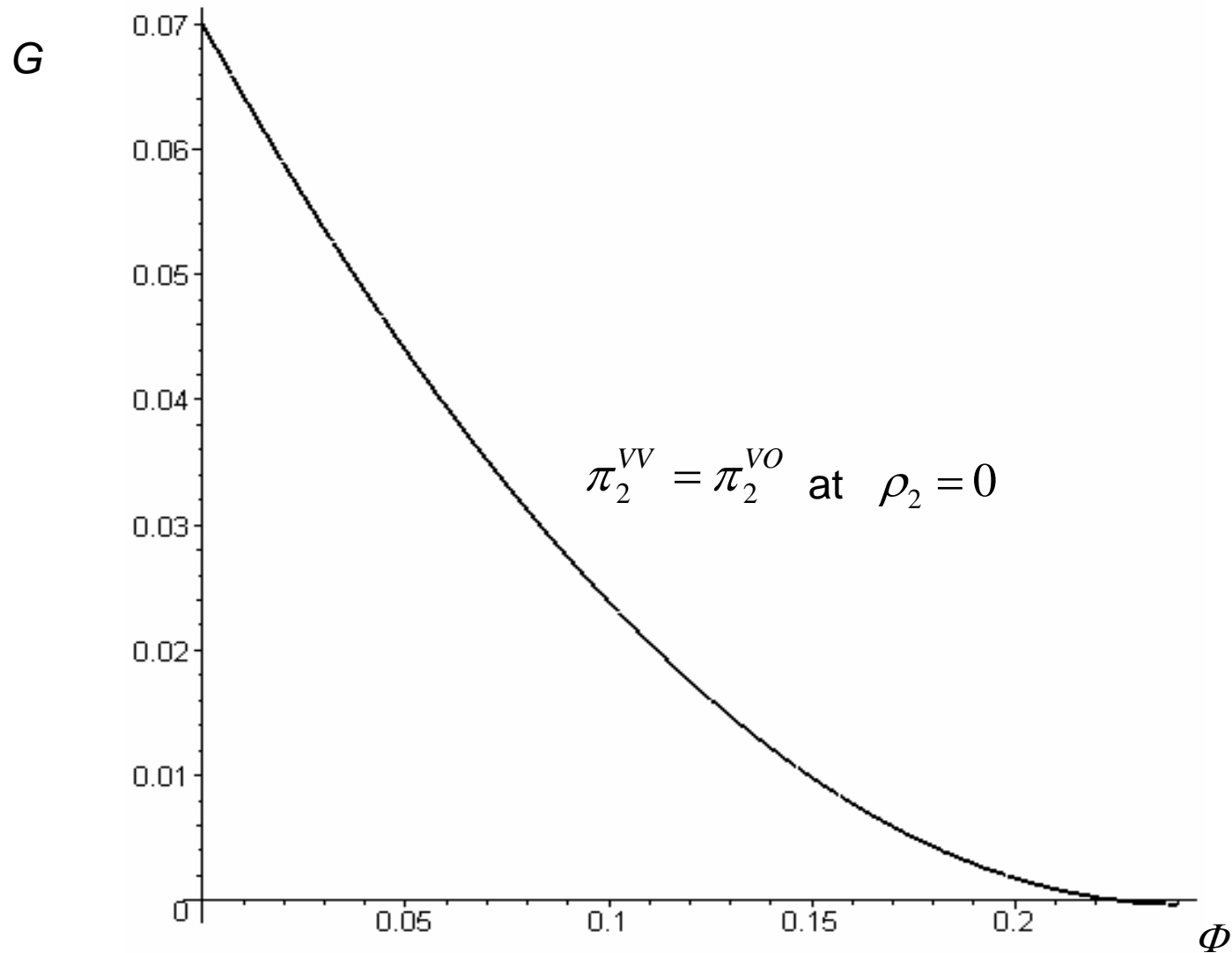


Figure 3. Output response functions (Φ is large and $\rho_2=0$)



**Figure 4. Firm 2's profit indifference locus when firm 1 vertically integrates
(Note in above $A=b=1$, $b=1/2$ and $h=1/2$)**

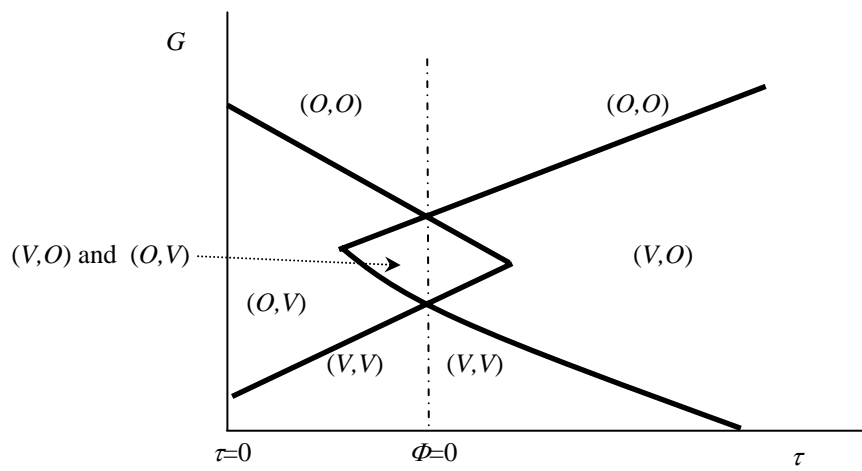


Figure 5. The foreign firm has an underlying cost advantage in the absence of a tariff. The effects of trade liberalisation.

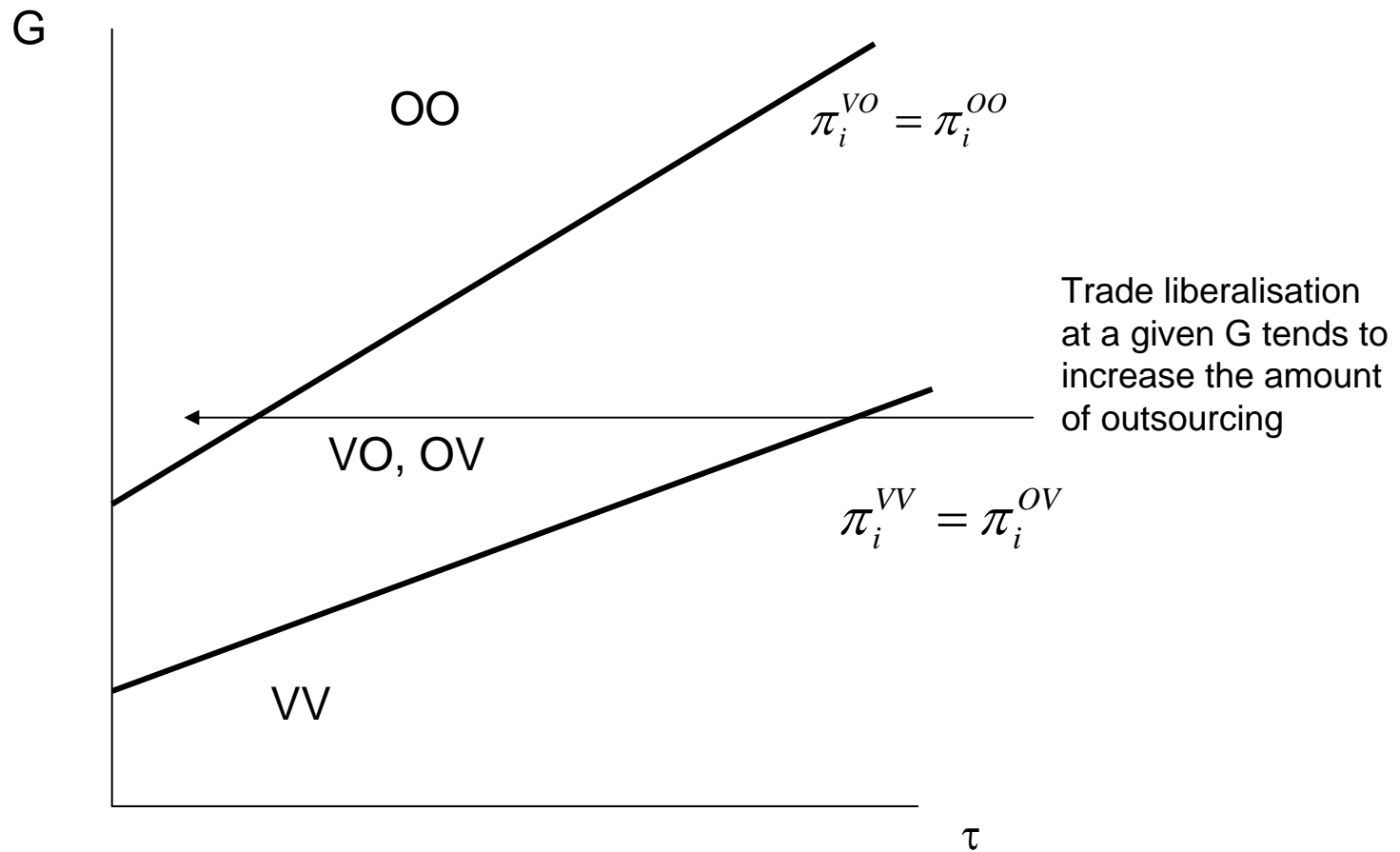


Figure 6. Here the relevant comparison is between domestic vertical integration and international outsourcing. Trade liberalisation increases the parameter range over which firms outsource.

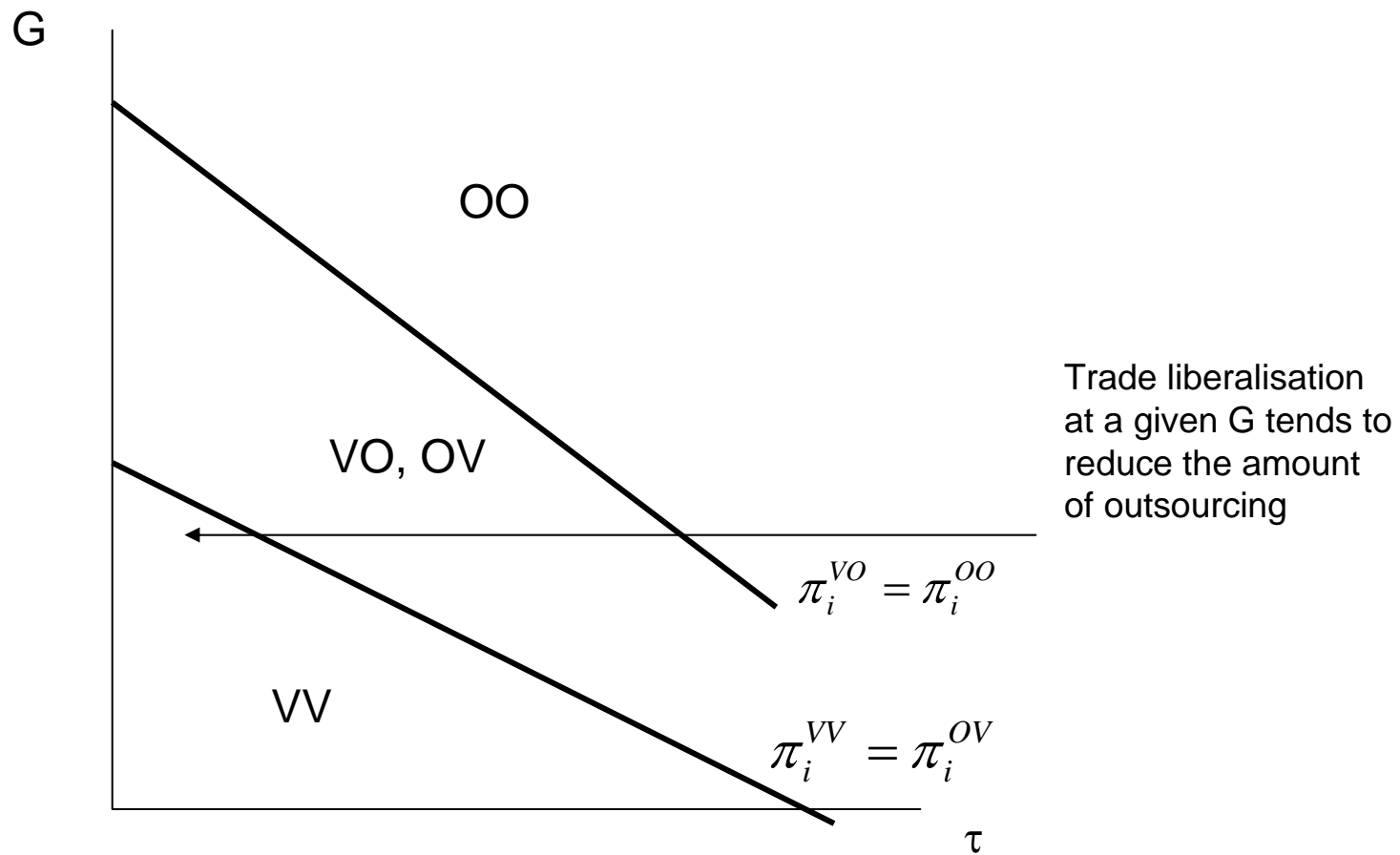


Figure 7. Here the relevant comparison is between FDI (International vertical integration) and international outsourcing. Trade liberalisation favours FDI.