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Dundee Discussion Papers in Economics



Economising, Strategising and the Decision to Outsource

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ECONOMISING, STRATEGISING 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.

(86 words)

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1. Introduction

This paper aims to shed light on the organisational and internationalization strategies of firms in oligopolistic industries. We develop a model in which final good production requires the use of a customised intermediate and oligopolistic final good firms decide whether to source this input from a non-affiliated outside supplier or to produce it in-house. Downstream firms that outsource¹ enter a bilateral relationship with an upstream firm that must carry out a relationship specific investment in the quality and customisation of the input. We apply the model to different trading scenarios to examine how trade liberalisation affects the mode of operation and the mode of internationalization decisions of the firms.

There has been a rapid expansion in outsourcing in recent years, with firms subcontracting activities as diverse as final assembly, R&D and after-sales services – both domestically and internationally. The growing importance of outsourcing, particularly across national borders, has resulted in a huge increase in interest in the factors driving the ‘fragmentation of the vertical production chain’ in both the applied² and theoretical academic literature.

As argued by Gibbons (2005, p. 203), “*a theory of the firm must define ‘integration’ (i.e., whether a given transaction is within one firm or between two) and show why it matters (i.e., what trade-offs exist between integration and non-integration, so that the theory predicts integration for some transactions and non-integration for others)*”. In this paper, we contribute to the literature on the theory of the firm by showing how a firm’s make-or-buy trade-offs are affected by its strategic interactions with competitors.

The early theory of the firm discussed the incentives issues surrounding the emergence of the boundaries of the firm within bilateral (e.g. buyer-supplier) settings. Until fairly recently, this firm-pair level focus has to a great extent set this literature apart from strands of the industrial organisation literature concerned with the emergence of market structures, as well as from areas that have developed from advances in microeconomic and industrial economic theory, e.g. ‘modern’ international trade and investment theories. The last decade

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) use the term in a narrower sense to refer to the acquisition of services from unaffiliated foreign firms.

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

has seen the emergence of a number of path-breaking contributions that have succeeded in contextualising the bilateral buyer-supplier relationships within broader market structures that also allow for the incorporation of international interactions.³ One group of papers endogenises the mode-of-operation choice in the presence of a specialised input within the property-right approach: see Antràs (2003, 2005), Antràs and Helpman (2004), Grossman and Helpman (2004), and Feenstra and Hanson (2005). Another set of papers is based on the transaction cost approach and contextualises the bilateral buyer-supplier relationship within a general equilibrium framework that gives rise to ‘market thickness effects’ (McLaren, 2000; Grossman and Helpman, 2002, 2005). In both of these strands of the literature, the decision to outsource is endogenous, contracts are incomplete and the intermediate input is specialised and requires relationship specific investment.⁴ Their fundamental contribution is to embed the mode of operation decision of the firm within general equilibrium frameworks that can account for the role of the standard drivers of international trade specialisation (i.e., differences in factor endowments and/or product differentiation and love of variety).

Given their emphasis on general equilibrium effects, however, these models (that are developed mostly within monopolistically competitive market structures) rule out by assumption the existence of strategic interaction between firms.

Our paper falls very much within this tradition, in that it aims to contextualise the make-or-buy decision of the firm within a broader market structure. In line with the second group of papers discussed above, we choose to adopt a transaction cost approach. Contrary to the aforementioned papers, however, we study the organisational and internationalization strategies of firms within an oligopolistic setting.

The transaction cost approach, as shown by a large body of empirical evidence, performs particularly well in explaining the backward integration decision of firms;⁵ it thus

³ An excellent survey of this literature is offered by Spencer (2005).

⁴ The choice between the use of specialised components and generic inputs is endogenised within partial equilibrium settings in a number of other papers (see Spencer and Qiu, 2001; Qiu and Spencer, 2002; Head et al, 2004; Feenstra and Spencer, 2005).

⁵ The Transaction Costs (TC) and the Property-Right (PR) approaches are often considered to be very similar in their fundamental predictions; however, it has been argued that they can instead be very different (see for instance Whinston, 2003). In particular, the evidence from supplier–manufacturer relationships tends to support the predictions of the TC approach, whilst that on manufacturer–retailer or franchisor–franchisee relationships tends to be much more consistent with the PR approach. In their recent survey of empirical evidence on the boundaries of the firm, Lafontaine and Slade (2007), point out that in the context

appears to be a natural choice for studying the determinants and implications of the process of disintegration (both within and across national borders) of the vertical production chain – which concerns mainly the *backward* integration decision of the firm.

The transaction cost perspective, based on the role of incomplete contracts and asset specificity, places emphasis on the *economising* dimension of the make-or-buy decision of the firm (e.g. Williamson 1975, 1985 and 1991) – which ultimately rests on a total cost comparison of alternative organisational structures. As a result, the majority of the theoretical literature based on this approach reflects the conventional view that outsourcing is primarily driven by cost considerations. Cost considerations are of course important determinants of outsourcing; 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.⁶ This evidence suggests that 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. Given that 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), it is plausible to conjecture that such firms will tend to have market power – and that their mode-of-operation decision will therefore be 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

of buyer-supplier relationships “*there are almost no statistically significant results that contradict TC predictions*” (p. 658).

⁶ There exists survey evidence that outsourcing is greatly motivated by cost reductions (e.g. <http://www.manpower.co.uk/news/OutsourcingSurvey.pdf>), but also that it can lead to lower quality of the outsourced inputs (e.g. see the survey by Software Development Magazine, 2004). Görzig and Stephan (2002), using German firm level panel data, find that outsourcing firms experienced a deterioration of return per employee. A negative relationship between outsourcing and firm level profitability in the electronic industry in Ireland is found for smaller firms by Görg and Hanley (2004). See also Tadelis (2007) for further evidence and discussion of how outsourcing ultimately has translated for many companies into higher total costs than they had originally anticipated.

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, this paper is the first to examine the “make-or-buy” decision in a context in which final goods firms compete on the product market as oligopolists and in which issues related to relationship specific investment and incomplete contracts are also taken into account: in earlier oligopoly papers, the role of these key features of the transaction costs approach to the theory of the firm in determining the nature of the trade-offs facing firms when making their mode of operation decisions is disregarded.⁷

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 under-invest in the quality of the intermediate. Outsourcing then involves accepting higher marginal costs in exchange for a saving on governance costs. A key feature of our model is that we fully endogenise the investment decision – and hence the quality of the intermediate good. This, in turn, translates into an endogenous marginal cost of production for the final good.

We find that both strategic vertical integration and strategic outsourcing are possible in equilibrium. Furthermore, unlike most contributions in this literature⁸, 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 strategy. We also show that the incentive to outsource is relatively greater for smaller/higher

⁷ 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 versus vertical integration decision.

⁸ See for instance Grossman and Helpman (2002, 2003, and 2005), and Antràs and Helpman (2004).

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 on the mode of operation of firms. We show that, although trade liberalisation will tend to increase the internationalisation of production, its effect 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 benchmark case of ex-ante firm symmetry. In section 4, we explore strategic behaviour, show how it relates to inter-firm asymmetries, and discuss the idea that outsourcing can often be a defensive business strategy. In Section 5, we examine the effects of trade liberalisation on equilibrium outcomes and on the welfare of consumers. Section 6 draws some conclusions from the analysis.

2. The Model

Consider two oligopolistic final good firms serving the same market and producing a homogenous product.⁹ To begin with, we shall not need to specify the international trade context. Thus, the two firms may compete on a home market, a foreign market, or an integrated market such as would exist in a customs union. We will be more specific in Section 5, where we shall consider a number of alternative trading setups in order to analyse the effects of trade liberalization.

The inverse demand for the final good is given by:

$$p = a - b(y_1 + y_2), \tag{1}$$

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 non-generic intermediate component or service. The firm can choose a vertical integration strategy in which it invests in the development of and produces this input itself, or an outsourcing strategy in which it sources it from an outside unaffiliated supplier. Due to the specialised nature of the input, if

⁹ An extension to differentiated products is straightforward but would not yield many additional insights.

the firm chooses to outsource, it will not be able to purchase the intermediate from a spot market. Instead it must buy it from a supplier that has made a relationship-specific investment (RSI) in the development of the input.¹⁰

We allow both firms to decide whether to become vertically integrated or to follow an outsourcing strategy. 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 . We assume that the intermediate must be combined in fixed proportions with other factors of production; we model these factors as a composite input whose price is normalised at unity. Units are chosen so that one unit of the customised intermediate is required per unit of output. 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 the intermediate is produced in-house and:

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

if it is outsourced.

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

In line with the literature on vertical integration, we assume that vertically integrated firms incur governance costs – *à la* Williamson (1975, 1985) – that are higher than those of a firm that outsources; without loss of generality, we shall then set the governance cost for the latter to zero.¹¹ If firm i is vertically integrated, its profit function is therefore given by:

¹⁰ The relationship specificity of investment, in the presence of incomplete investment contracts, gives rise to a hold-up problem.

¹¹ For a discussion and further references on fixed governance costs see McLaren (2000).

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

where G_i represents the fixed component of the governance costs of running a larger and more complex organisation.¹² 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 cost associated with vertical integration and the investment cost associated with the intermediate. The latter, is now borne by the upstream supplier. We shall 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 an upstream-downstream pair); therefore, the supplier earns operating profit: $(q_i - r_i^u)m_i$, where r_i^u is the marginal cost it incurs in producing the intermediate and m_i is its output. Note that 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 . Differences between r^u and r can be due to a host of reasons – e.g. higher marginal costs associated with the governance of a vertically integrated firm, factor cost advantages that a supplier might enjoy, technological differences or differences in expertise between the firms. 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_i . Its total profit is:

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

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 outsource, they approach a specialised supplier firm which will produce the input. 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

¹² Clearly, running a larger and more complex organisation can result in higher fixed and/or marginal costs. G captures the fixed aspect of these costs. As we will mention below, our model also allows for the possibility of higher marginal costs associated with the governance issues of vertical integration. For expositional simplicity, we shall refer to G as the governance costs.

outsource bargain with the intermediate supplier over the price of the input. 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.¹³ In stage four, the intermediate is supplied and the final output is produced.¹⁴

We are concerned with the subgame perfect equilibria, hence the game is solved by backward induction. In the final stage, the two firms engage in Cournot competition, with outputs determined by the following first-order conditions:

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

where $i=1,2$ and 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 good 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:

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

¹³ Given that the intermediate component in this model is a non-generic input which is highly specific to the particular downstream firm, we model the relationship between upstream and downstream firms as a bilateral one – between a specific firm and a specific supplier. The supplier cannot sell the intermediate to another firm and the buyer cannot buy it from a firm that has not carried out the relationship specific investment. Only one firm will enter the intermediate market to make this investment; this is because if more than one supplier entered, they would play a Bertrand game with each other, driving the intermediate price to its marginal production cost. In this instance, suppliers would be unable to cover their development and entry costs. Anticipating this, only one supplier firm will enter in equilibrium.

¹⁴ 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.

where β_i and $(1 - \beta_i)$ represent the bargaining power of the typical downstream firm and its upstream partner respectively, with $0 \leq \beta_i \leq 1$. 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 .¹⁵ 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 . Furthermore, even if q_i is lower than r_i , it may still be the case that the marginal production cost of a vertically integrated firm is lower than that of a downstream firm that chooses to outsource. This is because the final good marginal production cost also depends on the quality of the intermediate and thus on the level of investment in its development. As we shall see, in fact, the level of investment may be lower under outsourcing.

In stage 2, the firms choose their investment levels simultaneously. We can model this decision as firms each choosing the level of z_i , since 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_i , 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

¹⁵ 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, with the distribution of rents between intermediate supplier and final good producer – and hence the returns to relationship specific investment – being determined through Nash bargaining over the price after investment is sunk. The resulting 'double marginalisation' is also an important feature of transaction costs economics – indeed, in the words of Williamson, a key distinction between the transaction costs and the Grossman-Hart-Moore property right framework is their assumption of costless bargaining (Williamson, 2000).

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. The second term captures the strategic effect on the investment decision of the firm. Specifically, in the second term, $\partial\pi_i/\partial y_j = y_j p' = -by_j$. The expression for the term dy_j/dz_i differs depending 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 $(\partial\pi_i/\partial y_j)(dy_j/dz_i)$ 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:

$$z_i^{VV} = \theta^{VV} \eta_i b y_i^{VV}, \quad \text{where } \theta^{VV} = 4/3, \quad (10a)$$

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:

$$z_i^{VO} = \theta_i^{VO} \eta_i b y_i^{VO}, \quad \text{where } \theta_i^{VO} = \frac{7 + \beta_j}{6}. \quad (10b)$$

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 which 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:

$$\mu_i = \frac{3(1 - \beta_i)}{2(1 + \beta_i)} b y_i^2 - K_i^u - F_i. \quad (11)$$

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

$$\frac{d\mu_i}{dz_i} = 3 \frac{(1 - \beta_i)}{(1 + \beta_i)} b y_i \frac{dy_i}{dz_i} - \gamma_i^u z_i = 0. \quad (12)$$

The expression for dy_i/dz_i differs depending on whether the rival is vertically integrated or outsourcing. 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 (12) to obtain:

$$z_i^{OV} = \theta_i^{OV} \eta_i^u b y_i^{OV} \quad \text{where } \theta_i^{OV} = (1 - \beta_i), \quad (13a)$$

and where $\eta_i^u \equiv 1/b\gamma_i^u$. However, when the rival firm is outsourcing, then straightforward (if lengthy) calculations show that the effect of z_i on y_i becomes $dy_i/dz_i = (2/3b)(7 + \beta_j)(1 + \beta_i)/(15 + \beta_i + \beta_j - \beta_i\beta_j) > 0$. The use of this in (12) yields:

$$z_i^{OO} = \theta_i^{OO} \eta_i^u b y_i^{OO} \quad \text{where } \theta_i^{OO} = \frac{2(7 + \beta_j)}{15 + \beta_i + \beta_j - \beta_i\beta_j} (1 - \beta_i). \quad (13b)$$

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.

Lemma 1. *The z_i/y_i ratio is lower when the rival firm j outsources its intermediate than it is when firm j is vertically integrated.*

Proof. It follows from inspection of expressions (10a), (10b) (13a) and (13b).

Furthermore, vertical integration implies a more aggressive investment strategy than outsourcing unless η_i^u is much larger than η_i .

Lemma 2: *For a given relative effectiveness of investment ($\eta_i^u = \eta_i$) and given the mode of operation choice of the rival, firm i 's z_i/y_i ratio is higher when it is vertically integrated than when it outsources.*

Proof. It follows from inspection of expressions (10a), (10b), (13a) and (13b).

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 (10), we can rewrite the profit functions in the two regimes respectively as:

$$\pi_i^{Vk} = \Omega_i^{Vk} b(y_i^{Vk})^2 - G_i, \quad (14a)$$

and

$$\pi_i^{Ok} = b(y_i^{Ok})^2, \quad (14b)$$

where $k=(V,O)$, $\Omega_i^{VV} = (1 - \frac{8}{9}\eta_i)$ and $\Omega_i^{VO} = \left(1 - \frac{(7+\beta_i)^2}{72}\eta_i\right)$. It is immediately obvious from equations (14a) and (14b), that a sufficient condition for outsourcing to yield higher profits is $y_i^{Ok} \geq y_i^{Vk}$. 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 that chosen by firm 2.

Our model is quite rich and there are 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, in that neither firm has an underlying cost advantage; the upstream firms are also *ex ante* identical to each other. In addition, we assume the bargaining power parameters to be identical, so that $\beta_1 = \beta_2 = \beta$; we also assume that there is no underlying marginal 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 (i.e. $r_i = r_i^u$). Furthermore, we let $G_1 = G_2 = G$ – that is, take the fixed governance cost of vertical integration to be the same for both firms.

Given these symmetry assumptions, we obtain the following proposition:

Proposition 1: *Under symmetry, the pattern of equilibria depends on the level of governance costs, G : (i) at $G=0$, the subgame perfect equilibrium entails both firms choosing vertical integration (VV); (ii) at sufficiently large levels of G , the subgame perfect equilibrium entails both firms choosing to outsource (OO); (iii) at intermediate levels of G , multiple asymmetric equilibria (VO) and (OV) occur.*

Proof. See Appendix.

Thus, for a range of G , asymmetric outcomes emerge 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 firms' mode of operation decisions. The intuition for this is that, given our *ex ante* symmetry assumptions, vertical integration always 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 is vertically integrated. 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.¹⁶ 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

Both strategising and economising considerations are at work in determining the equilibrium outcomes; 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.

4. A Closer Look at Strategic Behaviour: Aggressive and Defensive Business Strategies

As highlighted in Lemma 1, 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

¹⁶ 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.

resulting functions, which we call *output response functions*,¹⁷ 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 are, respectively:

$$y_1^{VV} = \frac{A - by_2^{VV}}{bM_1^{VV}}, \quad (15a)$$

and

$$y_2^{VV} = \frac{A - \Phi - by_1^{VV}}{bM_2^{VV}}, \quad (15b)$$

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

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

and

$$y_2^{VO} = \frac{A - \Phi + \rho_2 - by_1^{VO}}{bM_2^{VO}}, \quad (16b)$$

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 its upstream intermediate supplier. Thus, when $\rho_2 > 0$, the upstream firm has a cost advantage over the downstream firm in producing the intermediate.

¹⁷ These are effectively reduced form reaction functions.

These functions are illustrated in Figure 2. In the figure, we assume *ex ante* symmetry between the firms, so that $\Phi = 0$ and $\eta_1 = \eta_2$. In the Figure, we allow for both $\rho_2 = 0$ and $\rho_2 > 0$. We begin by discussing the case in which $\rho_2 = 0$ and shall return to consider the case in which $\rho_2 > 0$ later in the section. 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 (15) and (16) 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.¹⁸ 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 $M_1^{VV} < M_1^{VO}$ given that $\theta^{VV} > \theta^{VO}$. 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, however, that outsourcing necessarily reduces firm 2's profits, since it must be remembered that it also saves on governance costs. When Φ is large enough, i.e. when firm 2 is sufficiently less efficient than its competitor, then the market share shifting effect of outsourcing is reversed. We

¹⁸ 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.

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 (15) and (16) 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 expense 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.

The results obtained so far in this section can be summarised by the following proposition:

Proposition 2. *Outsourcing by a firm can never result in an increase in the output of both firms. In addition, when $\rho_1=\rho_2=0$ and $\eta_i=\eta_i^u$ ($i=1,2$), then: (i) at $\Phi=0$, firm i 's output always falls if it outsources; and (ii) there exist values of Φ large enough such that outsourcing by firm 2 increases its output at the expense of firm 1's.*

Proof. See Appendix.

Note that the seemingly paradoxical result that $y_2^{VO} > y_2^{VV}$ when Φ is very large, despite an inward shift of the output response curve, is due to the 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 is the rival's market share in the equilibrium with vertical integration; the reason for this is that the bigger and more powerful is one's competitor, the larger is the gain from reducing its aggressiveness.¹⁹ In this sense, outsourcing can be thought of as a defensive business strategy helping a firm to hold on to its market share and, in some cases, to remain in business when it otherwise

¹⁹ 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 with $\Phi<0$, outsourcing could never increase firm 2's output. Therefore, $\Phi<0$ is qualitatively a special case of Φ small.

would not. Because of this strategic effect, outsourcing can sometimes be optimal even when it is unambiguously cost increasing.

Figure 3 about here

As we saw in the previous section, $y_2^{VO} \geq y_2^{VV}$ is a sufficient condition for $\pi_2^{VO} > \pi_2^{VV}$. Thus, even when $\rho_2=0$ and $\eta_2^U - \eta_2 = 0$ (or even when ρ_2 and/or $\eta_2^U - \eta_2$ are slightly negative), outsourcing is preferred if, due to an underlying cost disadvantage, firm 2's market share is small enough. Thus we have the following corollary to Proposition 2(ii):

Corollary. *Even when $G_2=0$, $\rho_2=0$ and $\eta_2 = \eta_2^u$ ($i=1,2$), there exist values of Φ large enough for firm 2 to prefer outsourcing over vertical integration.*

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.

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 (15) and (16) 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 the 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 its equilibrium output to rise.

Proposition 3. *At $\Phi=0$ and $\eta_i - \eta_i^u = 0$ ($i=1,2$), there always exists a ρ_i large enough such that a switch to outsourcing by firm i raises its output at the expense of the output of firm j .*

Proof. See Appendix.

5. Outsourcing and International Trade

A major reason for the upsurge of interest in the literature on the mode of operation decision of firms has been the perception that there is a positive relationship between outsourcing and trade liberalisation. However, it is noteworthy that 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 the internalisation decision of a firm 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. Specifically, we examine the effect of trade liberalisation, modelled as a fall in trade costs, on the incentives of firms to outsource – and thus on the mode-of-operation equilibria. We will show that changes in trade costs can impact on these incentives by affecting the underlying cost differences between firms. Thus, for instance, if firms are located in different countries, then trade liberalisation can affect their costs of supplying a market asymmetrically. We discuss this case in Section 5.1. Trade liberalisation can also affect firms' costs by making it relatively cheaper to procure inputs from abroad; we discuss this in section Section 5.2. To focus on the impact of changes in trade cost on the game played by the firms we abstract from other asymmetries between firms that derive from underlying differences in the efficiencies of investment, or from differences between downstream firms in their governance costs or in their bargaining power vis à vis upstream firms. Thus, we shall assume throughout this section that $G_1 = G_2$, $\beta_1 = \beta_2$, $\eta_1 = \eta_2$, and $\eta_i = \eta_i''$ ($i=1,2$). (Relaxing this simplifying assumption yields no real additional insights).

5.1. Trade liberalisation as an intensification of competitive pressure

In this subsection we consider how outsourcing can be 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 from 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 consider 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 certain 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.

A fall in trade costs can also lead to regime shifts as it can affect firms' decisions 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.²⁰

In Figure 4, at free-trade, firm 2 has an underlying cost advantage. In notational terms: $\Phi < 0$ at $\tau = 0$. 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.²¹

Figure 4 about here

²⁰ 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 may prevent outsourcing from being supplied.

²¹ Other constellations of parameters values can be considered but this one is chosen because it captures all the interesting cases.

As can be seen from the figure,²² at sufficiently low levels of governance costs, and with $\Phi > 0$, 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 with $\Phi > 0$, 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 reductions in trade costs 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; however, 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.

Finally, it is interesting to briefly explore the implications of the analysis for the effects of trade liberalisation on the consumer in the home country. With this particular trading set up, trade liberalisation at a given regime raises output and thus works to increase consumer surplus. This increase in consumer surplus is further enhanced when the fall in trade cost reaches a threshold level of τ that causes firm 2 to switch to vertical integration. This is because when firm 2 switches to vertical integration, both its own output and that of the industry experience a discrete upward jump. However, a tariff reduction will lead to a discrete downward jump in consumer surplus when it results in the crossing of a threshold τ 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. This is particularly plausible if the firms have the possibility to outsource abroad. To disentangle the effect of trade costs on the costs of outsourcing from the effect of trade costs on the competitive

²² The curves dividing up the parameter space in Figure 4 are the relevant sections of the two firms' *indifference profit loci* in Φ and G space – which give the combinations of Φ and G at which firms are indifferent between outsourcing and vertical integration, *given the mode of operation chosen by their rival*. In the figure, the first superscript in the profit indifference conditions refers to the mode of operation of firm 1 and the second to that of firm 2. So, for instance, $\pi_1^{VV} = \pi_1^{OV}$ refers to the indifference locus of firm 1, given that firm 2 is vertically integrated. Similarly, $\pi_2^{OV} = \pi_2^{OO}$ refers to the indifference locus of firm 2, given that firm 1 is outsourcing.

pressure faced by firms, we shall 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 them. To begin with, we shall focus on the case in which the firm chooses between *domestic* vertical integration and foreign outsourcing – i.e. we shall rule out the possibility of vertical foreign direct investment. We again parameterize trade cost by a per-unit tariff τ . To deliver the input to the home country when a firm outsources from abroad, the firm must pay τ per unit of output.²³ This can be neatly incorporated into the firm's profits by adding it to its marginal costs when the firm outsources abroad, but not when it produces the intermediate in-house domestically. 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.

Figure 5 illustrates the effect of trade liberalisation on the mode of operation when the two firms are ex-ante symmetric but the upstream firms have lower marginal production costs than the downstream firms. Unsurprisingly, a fall in tariff leads to an increase in the range of parameter values at which firms outsource. Interestingly, once again, trade liberalisation does not necessarily have a monotonic effect on consumer surplus if it leads to more outsourcing – since a switch to outsourcing will lead to an upward jump in the price of the good.

Figure 5 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 above 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

²³ 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.

international vertical integration. We will refer to the latter as FDI. Assume that under both 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 trade-off 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 in this case 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 output scale than those that outsource. (This is because they have lower marginal costs under vertical integration. 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 opportunity 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 6.

Figure 6 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, outsourcing will raise the final goods producer's marginal production costs since the supplier fails to fully internalise the marginal benefit of its 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 the paper, we have assumed Cournot competition. It is fairly straightforward to extend our framework to Bertrand competition with heterogeneous goods. In that case, to the extent that outsourcing increases the marginal cost of production, the strategic incentive to outsource that we find as a result of the endogeneity of investment would be reinforced by a standard Bertrand strategic incentive to raise the rival's price.

In our model, the choice of the mode of operation by firms is shown to be more complex than that implied by standard transaction cost theory and to depend on the combined influence of cost considerations (the incentive to economise) and strategic considerations.

Furthermore, 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 a tougher competition and we have

shown that a firm that faces greater competitive pressure has a greater incentive to outsource. Furthermore, trade liberalisation can also 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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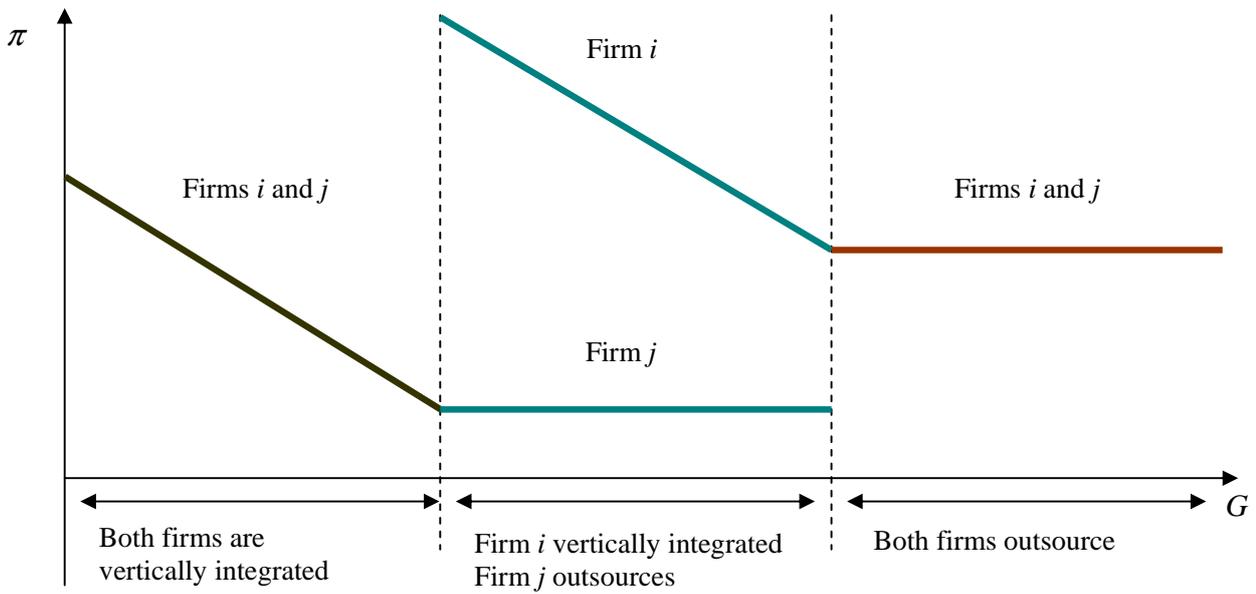


Figure 1. Profit levels of firms as a function of G under ex-ante symmetry

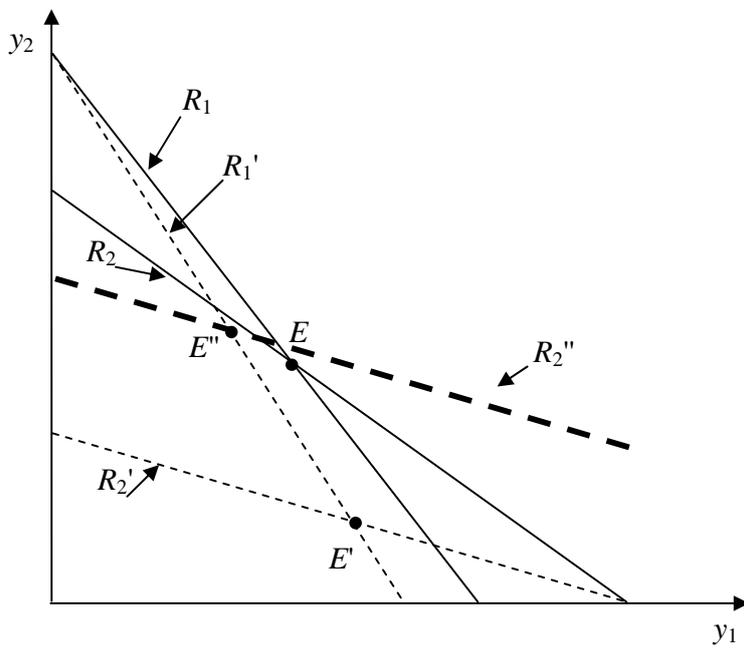


Figure 2. Output response functions ($\Phi=0$)

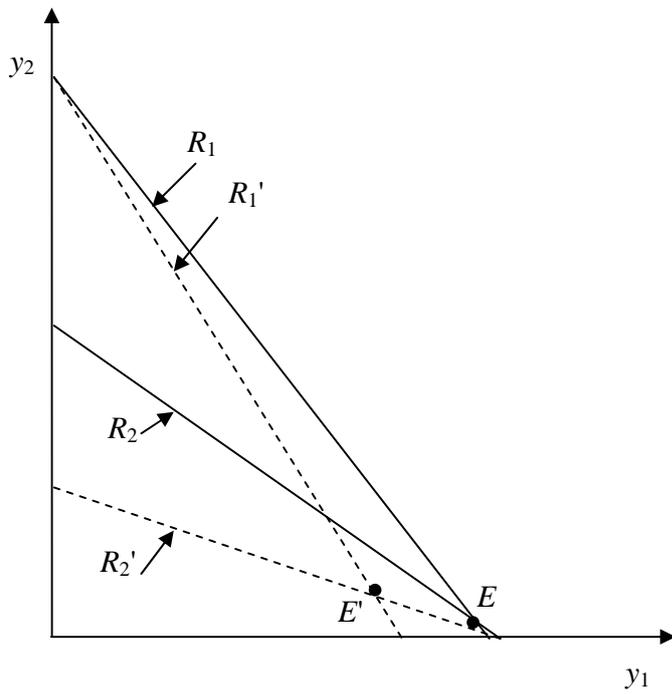


Figure 3. Output response functions (Φ is large and $\rho_2=0$)

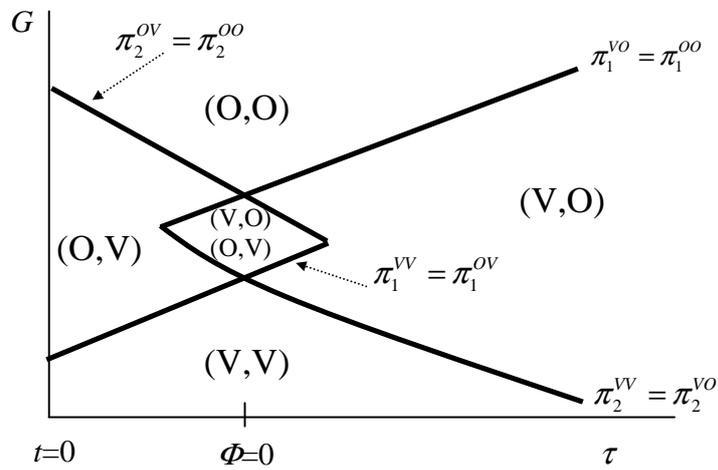


Figure 4. The effects of trade liberalisation when the foreign firm has an underlying cost advantage in the absence of a tariff

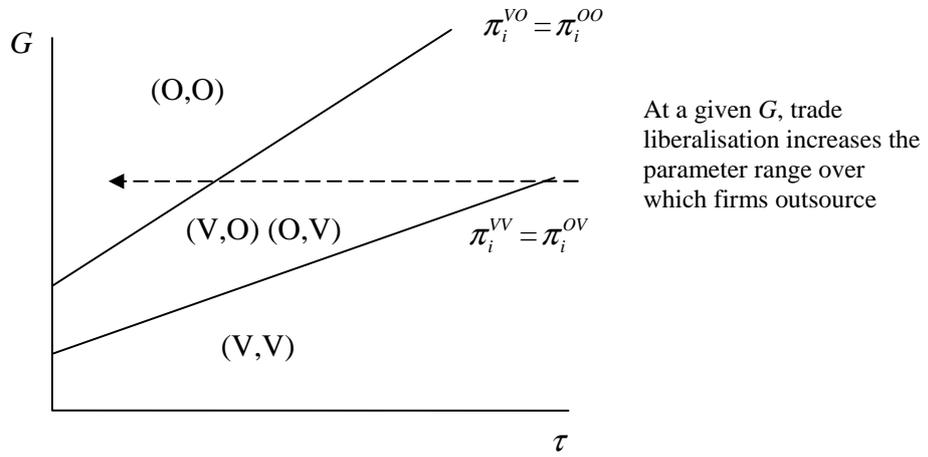


Figure 5. Domestic vertical integration versus international outsourcing: trade liberalisation favours outsourcing

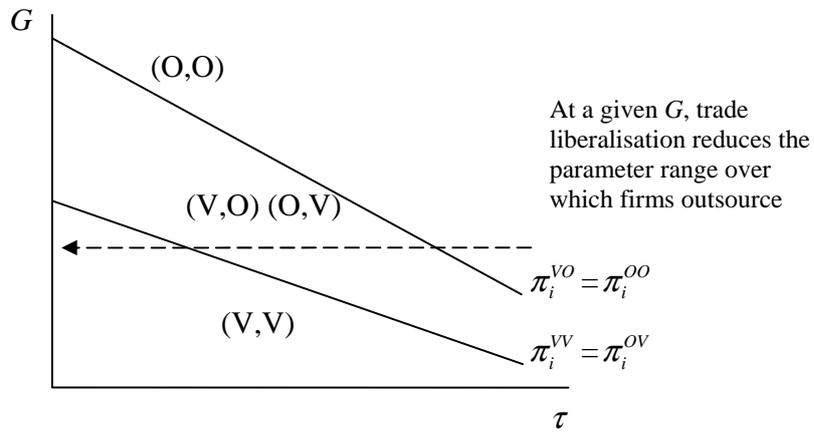


Figure 6. International vertical integration (FDI) versus international outsourcing: trade liberalisation favours FDI

Appendix

Proof of Proposition 1

As a preliminary step to proving this proposition, it is helpful to look at the outputs in the fully symmetric base case. When both firms are vertically integrated, their equilibrium outputs are both:

$$y^{VV} = \frac{A}{b(M^{VV} + 1)}, \text{ where with ex-ante symmetry: } M^{VV} = (2 - \theta^{VV}\eta). \quad (\text{A1})$$

On the other hand, when both downstream firms are outsourcing their intermediate production, their outputs are:

$$y^{OO} = \frac{A}{b(M^{OO} + 1)}, \text{ where } M^{OO} = (2 - \theta^{OO}\eta) + \nu \quad \text{and } \nu = \frac{3}{2} \frac{1-\beta}{1+\beta}. \quad (\text{A2})$$

When one downstream firm is vertically integrated and the other outsources, then the output of the vertically integrated one is:

$$y^{VO} = \frac{A(M^{OV} - 1)}{b(M^{VO}M^{OV} - 1)}, \text{ where } M^{OV} = (2 - \theta^{OV}\eta) + \nu \text{ and } M^{VO} = (2 - \theta^{VO}\eta). \quad (\text{A3})$$

The output of the firm that outsources when its rival is vertically integrated is:

$$y^{OV} = \frac{A(M^{VO} - 1)}{b(M^{VO}M^{OV} - 1)}. \quad (\text{A4})$$

Let \underline{G} be the critical level of G above which a firm will choose to outsource given that its rival is vertically integrated. Thus:

$$\underline{G} \equiv b(\Omega^{VV}(y^{VV})^2 - (y^{OV})^2) = \frac{A^2}{b} \left(\frac{(1 - \frac{8}{9}\eta)}{(3 - \frac{4}{3}\eta)^2} - \frac{(1 - \frac{7+\beta}{6}\eta)^2}{\{(2 - \frac{7+\beta}{6}\eta)(2 + \nu - (1 - \beta)\eta) - 1\}^2} \right), \quad (\text{A5a})$$

where we have made use of expressions (14a), (14b), the definitions of M^{VV} , M^{VO} and M^{OV} above and Ω^{VV} , θ^{VV} , θ^{VO} , and θ^{OV} , in the text.

Similarly, making use of expressions (14a), (14b), the definitions of M^{OO} , M^{VO} and M^{OV} above and Ω^{VO} , θ^{OO} , θ^{VO} , and θ^{OV} , in the text, we obtain:

$$\bar{G} \equiv b(\Omega^{VO}(y^{VO})^2 - (y^{OO})^2) =$$

$$\frac{A^2}{b} \left(\frac{(1 - \frac{(7+\beta)^2}{72}\eta)(1+v - (1-\beta)\eta)^2}{\{(2 - \frac{7+\beta}{6}\eta)(2+v - (1-\beta)\eta) - 1\}^2} - \left[\frac{1}{3+v - \frac{2(7+\beta)(1-\beta)}{15+2\beta-\beta^2}\eta} \right]^2 \right) \quad (\text{A5b})$$

as the level of G above which a firm will outsource when its rival is also outsourcing.

Straightforward, if tedious, calculations show that:

$$\bar{G} > \underline{G} > 0. \quad (\text{A6})$$

Below \underline{G} , vertical integration is a dominant strategy for both firms and hence VV is the unique equilibrium. Above \bar{G} , outsourcing is the dominant strategy for both firms and hence OO is the unique equilibrium. For values of G that lie between \underline{G} and \bar{G} , vertical integration is the best reply to outsourcing but outsourcing is the best reply to vertical integration. Hence when G lies between \underline{G} and \bar{G} , there are two asymmetric equilibria VO and OV.

Proof of Proposition 2

As a preliminary step, we will find it useful to rewrite the output response functions for the different mode-of-operation regimes in compact form:

$$y_1^{hk} = \frac{A + \delta_1 \rho_1 - b y_2^{hk}}{b M_1^{hk}} \quad \text{and} \quad y_2^{hk} = \frac{A + \delta_2 \rho_2 - \Phi - b y_1^{hk}}{b M_2^{hk}}, \quad (\text{A7})$$

where $h=O,V$ is the mode of operation of firm 1 and $k=O,V$ is the mode of operation of firm 2. The parameter δ_j ($j=1,2$) is an indicator variable that is unity if firm j outsources and zero if it is vertically integrated.

Using (A7), we can now show that outsourcing by a firm never results in an increase in the output of both firms. To see this, note that the output of firm i when firm j is vertically integrated is $y_i^{hV} = \frac{\hat{A}_i - b y_j^{hV}}{b M_i^{hV}}$, where ($h=V,O$) and $\hat{A}_i = A + \delta_i \rho_i$ if $i=1$, and $\hat{A}_i = A - \Phi + \delta_i \rho_i$ if $i=2$. A comparison of this with the output of firm i when firm j chooses

outsourcing, $y_i^{hO} = \frac{\hat{A}_i - by_j^{hO}}{bM_i^{hO}}$, gives: $M_i^{hO} y_i^{hO} - M_i^{hV} y_i^{hV} = y_j^{hV} - y_j^{hO}$. Now, since $M_i^{hO} \geq M_i^{hV}$, we have that if $y_i^{hO} \geq y_i^{hV}$ then $y_j^{hV} \geq y_j^{hO}$, and if $y_j^{hV} \leq y_j^{hO}$ then $y_i^{hO} \leq y_i^{hV}$. Thus, the firms' outputs cannot both increase when one of the firms switches to outsourcing.

Proof of Proposition 2(i).

We need to show that: (a) $y_i^{VV} > y_i^{OV}$ and (b) $y_i^{VO} > y_i^{OO}$. Here, the first superscript refers to the mode of operation of firm i and the second to that of its rival. Since $\rho_1 = \rho_2 = 0$, $\eta_i = \eta_i^u$ ($i=1,2$) and $\Phi=0$, we have full ex ante symmetry between firms here, and so we are able to use the M^{hk} values that were given in (A1)-(A3) above for the base case. These can be ranked as follows: $M^{OO} > M^{OV} > M^{VO} > M^{VV}$. For the case of inequality (a) above, using (A1) and (A4), and the ranking of the M^{hk} values, we can see that:

$$y_i^{OV} = \frac{A(M^{VO} - 1)}{b(M^{VO}M^{OV} - 1)} < \frac{A}{b(M^{VO} + 1)} < \frac{A}{b(M^{VV} + 1)} = y_i^{VV}. \quad (\text{A8})$$

In the case of inequality (b):

$$y_i^{OO} = \frac{A}{b(M^{OO} + 1)} < \frac{A}{b(M^{OV} + 1)} < \frac{A(M^{OV} - 1)}{b(M^{VO}M^{OV} - 1)} = y_i^{VO}. \quad (\text{A9})$$

Hence, at $\Phi = \rho_1 = \rho_2 = 0$ and $\eta_i = \eta_i^u$ ($i=1,2$), firm i 's output always falls if it outsources.

Proof of Proposition 2 (ii).

Here we assume $\rho_2 = \eta_2^u - \eta_2 = 0$, so that there is no underlying cost advantage of outsourcing for firm 2. Given that firm 1 chooses mode of operation h (where h can be V or O), then the output of firm 2 when it is vertically integrated is:

$$y_2^{hV} = \frac{A(M_1^{hV} - 1) - M_1^{hV} \Phi}{M_1^{hV} M_2^{hV} - 1} \quad (\text{A10})$$

This falls in Φ and reaches zero at, $\Phi = \tilde{\Phi}^{hV}$, where: $\tilde{\Phi}^{hV} = A \frac{M_1^{hV} - 1}{M_1^{hV}}$. If firm 2 is outsourcing, then its output is:

$$y_2^{hO} = \frac{A(M_1^{hO} - 1) - M_1^{hO}\Phi}{M_1^{hO}M_2^{hO} - 1}, \quad (\text{A11})$$

which is also monotonically falling in Φ . We next need to check if the output of firm 2 is positive at $\Phi = \tilde{\Phi}^{hV}$. To do this, we must substitute $\Phi = \tilde{\Phi}^{hV}$ into (A11). It is then clear that: at $\Phi = \tilde{\Phi}^{hV}$, $y_2^{hO} > 0$ if and only if $M_1^{hO} > M_1^{hV}$. It is straightforward to show that this is the case. By continuity, we can see that for y_2^{hV} close to zero a switch to outsourcing raises the output of firm 2.

Proof of Proposition 3.

The larger is ρ_i , the more firm i 's output response curve shifts outwards. It is clear that if this shift is large enough, then the output of firm i rises. From Proposition 2, this will lead to a fall in the output of firm j .