

# Globalisation, Vertical Linkages, and 'Relational Contracts'

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## Abstract

This paper analyses the consequences of trade liberalisation on firms' internal organisation, with formal and informal arrangements. We extend the 'relational contract' approach of Baker, Gibbons, and Murphy (2002) in an open economy set-up. We find that liberalising trade in final goods increases the quasi-rents from suppliers' specific investments, leading to an increase in outsourcing. When trade liberalisation focuses more on final goods than on intermediates, a reduction in specific suppliers' opportunism implies a rise in the use of 'relational contracts' between firms. This concurs with an observed rise of hybrid organisational arrangements. We also derive testable implications on productivity dispersion, price-cost margins, and demand elasticities.

JEL-Classification: F23, L22, F12

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# 1 Introduction

This paper investigates the relationship between globalisation and the emergence of informal agreements between and within firms, analysed as 'relational contracts'<sup>1</sup>.

Indeed, the last twenty years have seen the expansion of informal agreements within vertical relationships. On the one hand, 'hybrid' inter-firm arrangements<sup>2</sup> have spread, often relying on unwritten codes of conduct within close long-term relationships. On the other hand, informal agreements within firm boundaries have also developed, as acknowledged by a vast literature<sup>3</sup>. These intra- and inter-firm informal agreements have been expanding as assessed by several case studies and typologies of organisational forms (Ménard, 2004). However, a common cause to the emergence of these diverse business arrangements is yet to be provided.

In the same period, international trade in intermediates has been rising quickly, as a result of a now well-documented process of international fragmentation<sup>4</sup>. Interestingly, fragmentation seems to have taken place both within and outside the boundaries of multinational companies (henceforth MNCs). For instance, Feinberg and Keane (2004) and Borga and Zeile (2004) report a parallel increase in intermediate imports by US MNCs from affiliates and independent suppliers. While intra-firm exports have been found to increase substantially (in the US case, from 8 to 15 % over the 1966-1999 period), abundant case-study evidence illustrates the ubiquity and magnitude of international outsourcing<sup>5</sup>. Prominent examples may be found in a

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<sup>1</sup>Relational contracts may formally be defined as informal, inter-personal, long-term agreements on a predictable way to act according to observed behaviour.

<sup>2</sup>Combining some elements of pure markets and hierarchies, these forms include repeated-order procurement, vertical production networks, franchises, collective trademarks, co-operatives, alliances. For all their apparent diversity, these arrangements share common functionalities : co-ordinating efforts without losing the benefit of decentralised action ; preventing free-riding in the use of joint resources ; and imposing a lighter governance structure that reduces the cost of renegotiation.

<sup>3</sup>Gibbons (2005) provides many examples of both inter-firm informal agreements, including 'implicit contract'-like compensation. Rajan and Wulf (2003) offer recent evidence of 'flatter' hierarchies within US firms, resulting in the direct control of division managers by CEOs with greater reliance on informally agreed, long-term, incentive pay.

<sup>4</sup>See *inter alia* Feenstra and Hanson (1996), Campa and Goldberg (1997), Hummels, Rapoport, and Yi (1998) and the chapters in Jones and Kierzkowski (2001).

<sup>5</sup>Outsourcing is defined in this paper as subcontracting the production of inputs to independent suppliers, at home or abroad (domestic or international outsourcing).

survey by The Economist (11 November 2004 issue), or in industry case studies by the Global Value Chain Initiative, notably in the textile, automobile, pharmaceutical, and electronics industries<sup>6</sup>.

This paper tries to address the phenomena of extensive organisational change and rising input internal and external trade in intermediates in a single analytic framework. Could the dramatic fall in trade and communication costs, identified as a catalyst for fragmentation, have also played a role in the observed rise in relational contracting? Could we explain the coexistence of various organisational forms, in particular hybrid and non-hybrid, within the same sectors? The ambition of this paper is to provide answers to these questions. To that purpose, we build a model of organisational choice in vertical relationships where self-enforcing agreements emerge at the equilibrium of a repeated game between a downstream producer and an upstream supplier. Partners therefore face a four-way sourcing choice, between in-house production or subcontracting, with or without 'relational contracts', with the sustainability of the latter being an instance of the Folk theorem. In the model, organisational forms depend endogenously on prevailing market structure in both sectors, as well as individual firm characteristics. We extend the model to an open-economy, representing both final and intermediate trade liberalisation. We then analyse the incentives for corporate re-organisation offered by trade liberalisation.

An abundant theoretical literature, surveyed by Gattai (2005) and Spencer (2005), explains organisational choice in an open-economy context. These papers provide interesting analytical and complementary treatments of organisational choice, emphasising several determinants of the make-or-buy choice<sup>7</sup>. However, they all focus on contractual arrangements, neglecting the existence of informal agreements.

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<sup>6</sup>For instance, Gereffi (1999) studies the industrial upgrading of textile and apparel commodity chains in Asia. Interestingly, he finds that learning between and within firms played a crucial role in gradually shaping vertical relationships in that sector.

<sup>7</sup>In McLaren (1999, 2000) and Grossman and Helpman (2005), firms' boundaries are determined by the extent of upstream gains from specialisation relative to search and contractual frictions. 'Market thickness' externalities imply multiple firm structure equilibria. Antràs and Helpman (2004) predict organisational and location choices according to the relative intensity of production in head-quarter services or manufactured inputs. Marin and Verdier (2003, 2005) find a non-monotonic relationship between fiercer world market competition and the degree of delegation in organisations. In their general equilibrium model, strategic complementarity between organisational choices leads to multiple equilibria, predicting a convergence of national corporate cultures resulting from globalisation.

In a review of the economics of firm boundaries, Holmström and Roberts (1998) provide three interesting insights related to our question: the allocation of property rights is not relevant to all organisational decisions; it is sensitive to more than marginal incentives to invest; and it may be complemented by repeated interaction in the mediation of vertical relationships. Following this line of research, Baker, Gibbons, and Murphy (2001, 2002), henceforth collectively BGM, integrate hybrid inter-firm and intra-firm relationships in a single model. Vertical partnerships face a four-way choice between integration or outsourcing, with or without informal agreements, the latter being viewed as self-enforced 'relational contracts'. This allows to study the interaction between formal and informal productive arrangements.

McLaren (1999) considers informal agreements (business by 'handshakes') as an alternative to formal vertical agreements, showing the existence of strategic complementarities in the choice between the two alternatives. However, this symmetric model cannot explain the characteristics of firms entering either type of agreement. Nor does it consider formal outsourcing, or give a proper treatment of trade liberalisation. Spencer and Qiu (2001) rationalises the reliance of Japanese exporters on domestic inter-firm keiretsu arrangements in a two-country open economy. However, they do not analyse the formal and informal aspects of organisational choice in a unified framework. Finally, group membership and ethnic ties have been put forward as a determinant of trust in business relationships, stimulating trade<sup>8</sup>. But these authors tend to emphasise 'homogenous' ethnic groups and similarities among group members, rather than identify distinctive characteristics of agents entering such relationships.

The contribution of this paper relative to the above literature is two-fold. First, this paper extends BGM by making the outside option of specific suppliers endogenous. This is achieved by modelling a parallel market for standard inputs (i.e. requiring no specific assets). Second, this paper studies the impact of trade liberalisation in final and intermediate goods on organisational choice. To the best of our knowledge, this is the first attempt at studying the interplay between formal contracts and informal agreements in an open-economy model<sup>9</sup>.

In doing so, we are able to relate the reported twin rise in intra- and inter-

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<sup>8</sup>See Rauch (2001) for a survey.

<sup>9</sup>In a recent paper, ? study how trust-based relationships can complement imperfectly enforced but complete sales contracts between an exporter and a distributor.

firm informal agreements and intermediate trade. We show that larger product market size and exposure to international upstream competition work as driving forces in the rise of hybrid organisations. This interplay also yields original predictions on prevalent organisational forms. In addition, the model relates firms' participation in trust-based relationships to firm characteristics, notably suppliers' productivity in relationship-specific investments.

In the next section, we develop a closed-economy model to derive optimal organisational forms in a population of heterogenous firms. In Section 3, we extend it to several countries to study the effects of trade liberalisation in final and intermediate goods on organisational choice. Section 4 derives empirically testable implications on the effects of trade liberalisation at both the firm and industry levels. Section 5 concludes.

## 2 The Basic Model in a Closed Economy

### 2.1 Downstream sector

We model the final sector as a monopolistically competitive sector with endogenous mark-ups, as in Ottaviano, Tabuchi, and Thisse (2002). Market size affects the size of the quasi-rents from specific vertical relationships, and hence organisational decisions.

Consider a continuum of varieties of mass  $N$ , with preferences given by:

$$U(\{y_i\}, y_0) = y_0 + \alpha \int_0^N y_i di - \frac{\eta}{2} \left[ \int_0^N y_i di \right]^2 - \frac{\beta}{2} \int_0^N [y_i]^2 di \quad (1)$$

where  $\alpha$ ,  $\eta$  and  $\beta$  are all positive<sup>10</sup>. Assume that good 0 is produced competitively with one unit of labour. Taking it as the numeraire implies that wages equal unity. From (1) we can compute inverse demand functions for all varieties, and therefore a residual demand curve for each producer:

$$y_i(p_i, \bar{p}) = \frac{1}{\beta} \left( \alpha - p_i - \frac{\eta N}{\eta N + \beta} (\alpha - \bar{p}) \right) \quad (2)$$

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<sup>10</sup> $\beta$  represents how much consumers value product diversity. A value equal to 0 amounts to the homogenous goods case.

where the average price  $\bar{p}$  is treated as a constant by each single-variety producer, consistent with the continuum-of-firms assumption. Using (2), we compute prices, outputs, and profits for each variety:

$$p_i(c) = \frac{A(\bar{p}, N) + c}{2} \quad (3)$$

$$y_i(c) = \frac{L}{\beta} \left( \frac{A(\bar{p}, N) - c}{2} \right) \quad (4)$$

$$\Pi_i(c) = \frac{L}{\beta} \left( \frac{A(\bar{p}, N) - c}{2} \right)^2 - f \quad (5)$$

where

$$A(\bar{p}, N) = \frac{\alpha\beta + \eta N\bar{p}}{\eta N + \beta} \quad (6)$$

and  $L$  denotes population size, and equals labour income. Denote by  $\bar{c}$  the average variable cost over all existing downstream producers. Computing the average industry price and plugging it into (6) yields a function  $A(\bar{c}, N)$ , increasing in  $\bar{c}$ , and decreasing in  $N$ . It is easily seen that the price elasticity of demand is not constant, and that it increases with the number of firms  $N$ .

We assume free entry in the downstream sector. As we will shortly explain, three technologies are available to downstream firms, allowing them to produce at fixed cost  $f$  and marginal costs  $c_L, c_H$  or  $k$ , with  $c_L < c_H < k$ . The total number of varieties,  $N$ , is then determined by a zero-profit condition on the least efficient producers:

$$\frac{L}{4\beta} [A(\bar{c}, N) - k]^2 - f = 0 \quad (7)$$

Solving for the free-entry equilibrium number of firms yields:

$$N(\bar{c}, L) = 2 \frac{\beta \alpha - k - \sqrt{\frac{4\beta f}{L}}}{\eta k + \sqrt{\frac{4\beta f}{L}} - \bar{c}} \quad (8)$$

Notice that  $N(\bar{c}, L)$  is increasing and concave in  $L$ <sup>11</sup>.

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<sup>11</sup>In both the Krugman (1980) representative firm and the Melitz (2003) heterogeneous

Using (3) and (8), we obtain:

$$A(k, L) \equiv A(\bar{c}, N(\bar{c}, L)) = k + 2\sqrt{\frac{\beta f}{L}} \quad (9)$$

Finally, we may rewrite profits at the free-entry equilibrium as:

$$\Pi_i(c) = \frac{L}{4\beta} \left( k - c + 2\sqrt{\frac{\beta f}{L}} \right)^2 - f = 0 \quad (10)$$

Profit differentials between the most efficient and second-most efficient producers are written as:

$$\Delta\Pi \equiv \Pi(c_L) - \Pi(c_H) = \frac{L}{4\beta} (c_H - c_L) \left( 2k - c_H - c_L + 4\sqrt{\frac{\beta f}{L}} \right) \quad (11)$$

We now endogenise technological differences between firms as consequences of organisational decisions.

## 2.2 Upstream sector

We model the upstream sector as a continuum of potential suppliers of mass equal to  $\gamma^{max} r^{max}$ . To keep things simple, it is assumed that producing one unit of the final good requires one unit of an intermediate good. Accordingly we assume the pool of suppliers to be larger than the pool of buyers, or  $\gamma^{max} r^{max} > N$ . This reduces to a condition on the fixed costs of producing a variety:

$$f \geq \frac{L}{4\beta} \left( \frac{\alpha - k}{1 + \frac{\eta}{2\beta} \gamma^{max} r^{max}} \right)^2 \quad (\text{Assumption 1})$$

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firm monopolistic competition models with CES utility, the price-elasticity of demand remains constant. Consequently, an increase in country size leaves individual prices and (expected) output invariant, simply allowing for a proportional increase in the number of created varieties. By contrast, in this model, the price-elasticity of demand increases with the number of available varieties. Therefore, profits rise in proportion to country size only in the short run, as in (7), while in the long-run the consecutive increased entry depresses profit margins. Thus a given increase in country size causes less-than-proportional increases in the number of firms.

The input supplied by  $U$  may be either specific to  $D$  or standard. A specific input makes  $D$  more efficient but involves relationship-specific investments. In contrast, standard inputs are available through anonymous market transactions, but imply greater downstream production costs (equal to  $k$ ).

### 2.2.1 Specific relationships

Consider a pair of upstream ( $U$ ) and downstream ( $D$ ) producers. As in BGM, we take a property-right view of specific relationships in the context of infinitely-repeated relationships. For simplicity, we consider a single specific asset which may either be owned by the supplier ('Outsourcing') or by the downstream producer ('Employment').

Two types of discrete efforts are available to  $U$ :

- a risky and discrete asset-specific<sup>12</sup> effort  $e_s$ . This effort allows  $D$  to produce at minimal cost  $c_L$  with probability  $q$ , and at cost  $c_H$  with probability  $1 - q$ . Otherwise,  $D$  produces at cost  $c_H$ . This effort involves a fixed cost  $\gamma$  for  $U$ .
- a non-specific effort  $e_{ns}$  making the inputs readily available for the standard market<sup>13</sup>. This costs the upstream party  $\Gamma$ .

Efforts are not observable and not contractible<sup>14</sup>. Outcomes are observable but not contractible. The surplus is shared ex post according to the Nash bargaining solution with equal weights  $\frac{1}{2}$ . The downstream producer's outside option is assumed to be zero<sup>15</sup>. The upstream producer's outside option is assumed to be zero under Employment, and equal to the standard market value of the inputs,  $V$ , under Outsourcing.

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<sup>12</sup>The specific effort may consist in acquiring information necessary to customise input design, training the partner's workforce to use the input, or reduce delivery time.

<sup>13</sup>The non-specific effort may consist in acquiring information on the standard market, certifying the input's quality, or enhancing its compatibility with other buyers' standards.

<sup>14</sup>Note that specific input buyers are more efficient than standard input buyers, even with no efforts made. This could be rationalised by allowing some specific tasks to be contractible, with a corresponding fixed salary. However, these would not affect ex post surplus comparisons across organisational forms and would make the model less tractable.

<sup>15</sup>It may be objected that under Employment residual rights of control would allow  $D$  to produce standard inputs in-house. However,  $D$  would then make zero profits due to free entry. Hence, this assumption is innocuous.

We have described the interaction between  $U$  and  $D$  over one period. As in BGM we consider infinitely-repeated relationships, with the following timing of the game:

1.  $U$  and  $D$  decide on an allocation of property rights (Outsourcing or Employment), on the appropriate upfront payments, and on whether to agree on a relational contract.
2. then the relationship follows a repeated two-stage procedure: in the first stage,  $U$  chooses effort levels. Then the value of  $c$  is observed by both parties. In the second stage,  $D$  either gives  $U$  her informally agreed payment ('relational contract'), or re-negotiates a price ('spot outsourcing'), or seizes the input and pays nothing ('spot employment').

Finally, we assume that all suppliers and buyers are risk-neutral, and that utility is perfectly transferrable between parties through an ex-ante upfront payment.

The formal solution to this game is given in Appendix 1. Intuitively, under 'employment', too little effort is made by  $U$  for fear of hold-up ; under 'outsourcing', too much effort is made from the point of view of the partnership. However, when relational contracts are viable, they provide incentives for the joint-profit maximising effort mix. This is because the potential loss of future gains from cooperation deters opportunism and eliminates the risk of being held-up. Importantly, the initial allocation of property rights determines the viability of these relational contracts.

### **2.2.2 The market for standard inputs**

We assume perfect competition on the market for standard inputs. The market price  $k$  becomes downstream producers' marginal cost. A supplier involved in a specific relationship who has made a non-specific effort may also sell her inputs at market price  $k$ .

We now turn to the determination of optimal efforts according to the chosen organisational form.

## **2.3 The four-way organisational choice for an individual firm**

Each specific vertical partnership is faced with a choice between four alternatives, depending on property rights and informal agreements. 'Outsourcing'

with a relational contract will be termed 'Relational Outsourcing', as opposed to 'Spot Outsourcing'. Similarly, 'Relational Employment' will be opposed to 'Spot Employment'. Besides, non-specific relationships will be termed 'anonymous' transactions.

Organisational choice will be determined by the solution to the infinitely-repeated game between  $U$  and  $D$ . For each firm, this solution will depend on endogenous  $\Delta\Pi$  and  $V$ , and exogenous firm characteristics  $\gamma$  and  $r$ .

In Appendix 1, we give a characterisation of all possible equilibria of this game. Solving the multi-stage game makes it possible to construct a decision rule  $R(\cdot)$  assigning an optimal organisational outcome to a particular fixed cost of exerting the specific effort  $\gamma$ , and the discount rate  $r$ . Threshold values  $\gamma_S$  and  $\gamma_{STD}$  are also defined in the Appendix. This allows us to characterise organisational choice in the closed economy:

**Proposition 1 (Baker, Gibbons, and Murphy, 2002)** *At the subgame-perfect equilibrium, the organisational choice of each vertical pair can be characterised according to the cost of the specific effort and the time preference:*

- If  $\gamma \in [0, \gamma_S]$  then  $R(\gamma, r) = \begin{cases} SO & \text{if } r > \bar{r}_1^{RO}(\gamma) \\ RO & \text{if } r \in [\bar{r}_1^{RE}(\gamma), \bar{r}_1^{RO}(\gamma)] \\ RO \text{ or } RE & \text{if } r < \bar{r}_1^{RE}(\gamma) \end{cases}$
- If  $\gamma \in [\gamma_S, \gamma_{STD}]$  then  $R(\gamma, r) = \begin{cases} SE & \text{if } r > \bar{r}_2^{RO}(\gamma) \\ RO & \text{if } r \in [\bar{r}_2^{RE}(\gamma), \bar{r}_2^{RO}(\gamma)] \\ RO \text{ or } RE & \text{if } r < \bar{r}_2^{RE}(\gamma) \end{cases}$
- If  $\gamma \in [\gamma_{STD}, \gamma^{max}]$  then inputs are supplied through the standardised input market.

**Proof.** See Appendix 1. ■

The model predicts organisational forms according to two partnership-specific parameters, the cost of exerting a specific effort,  $\gamma$ , and the discount rate  $r$ . The lower  $\gamma$ , the more likely Outsourcing will be chosen; the lower  $r$ , the more likely relational contracts will be viable. In some cases, participation constraints are valid for both RO and RE, leaving the exact organisational form sometimes indeterminate. The breakdown of the industry by organisational forms may be illustrated in Figure 1.

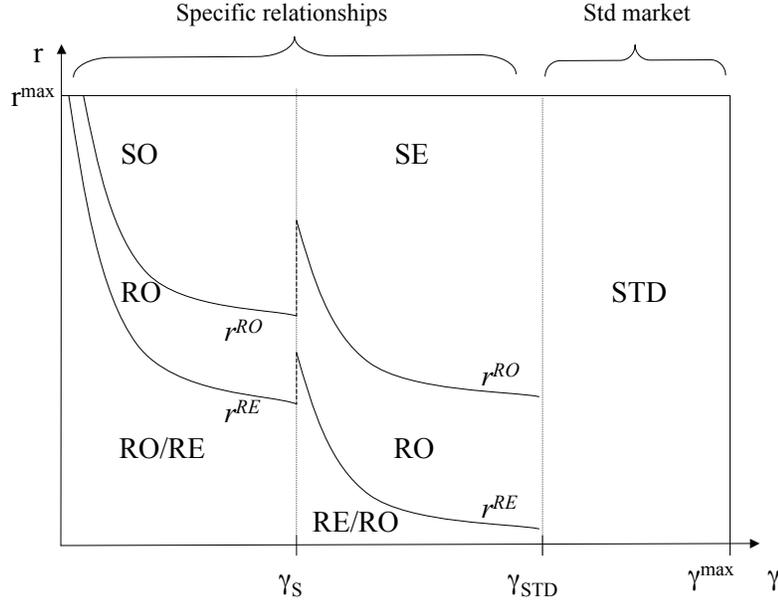


Figure 1: Composition of the upstream sector by organisational arrangement

Notice that for all firms with fixed costs in the range  $[\gamma_S, \gamma_{STD}]$ , the actual organisational form will depend on the viability of relational contracts. When they are viable, outsourcing is found to be optimal, while employment is optimal otherwise. Indeed, outsourcing makes it costlier to renege on the informal agreement for the upstream party. This finding suggests another rationale for outsourcing when vertical relationships are expected to be long-term.

### 3 Organisational choice in the world economy

We now analyse the consequences of trade integration on organisational choice in a  $\mu$ -country version of our model. We consider perfect trade integration in the sense of access to a larger final market and to cheaper standard

inputs, so that  $L^* = \mu L$ <sup>16</sup>. Formally, we denote by  $\lambda$  the ratio between the free trade and autarky prices of these inputs. Hence,  $k^* = \lambda k$  with  $\lambda < 1$  in import-competing countries. We will represent trade liberalisation in final markets by increases in  $\mu$ , and in intermediate markets by decreases in  $\lambda$ . This admittedly simple treatment of trade integration will help us focus on its consequences for corporate organisational choice.

### 3.1 Trade integration between symmetric economies

We start with the simplest trade liberalisation scenario, namely perfect integration between  $\mu$  symmetric economies (with  $\lambda = 1$ ).

On the downstream market, trade liberalisation has a pro-competitive effect. Note that analogues of Equations (3)-(5), (8)-(9) and (11) hold for  $L^* = \mu L$ . We then find that the free-entry number of firms and profit differentials both increase after trade liberalisation. By contrast, price-cost margins decrease.

Trade liberalisation also affects aggregate variables through organisational decisions. Key determinants of organisational choice will be variables  $\Delta\Pi^*$  and  $V^*$ .

$$\Delta\Pi^*(\mu) = \frac{\mu L}{4\beta}(c_H - c_L) \left[ 2k - c_H - c_L + 4\sqrt{\frac{\beta}{\mu L}f} \right] \quad (12)$$

$$V^*(\mu) = k\sqrt{\frac{f}{\beta}\mu L} \left( \frac{N^*(\mu) - q\Delta\Pi^*(\mu)}{1 - q\Delta\Pi^*(\mu)} \right) \quad (13)$$

We will show how globalisation leads to organisational change through a *market size* effect and through a *relational stability* effect. We will try to simplify the exposition by artificially separating these effects, temporarily holding the outside option value of inputs constant while stating the market size effect. We will later see under which conditions the latter relational stability effect reinforces the former market size effect.

#### 3.1.1 Market size effect

An increase in the size of the final market magnifies profit differentials between diversely efficient firms. Quantities increase more than proportionately

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<sup>16</sup>Starred variables will consistently denote world analogues of autarkic variables.

for efficient firms, and so do profits. If specific efforts are necessary to gain access to more efficient technologies, then their marginal product should increase as a result of globalisation. This simple market size effect affects the pattern of organisational choice, as explained in the following Lemma.

**Lemma 1**  *Holding  $U$ 's outside option constant, symmetric trade liberalisation implies:*

- (a)  *a rise in specific vertical relationships;*
- (b)  *a rise in Outsourcing;*
- (c)  *a rise in the propensity to resort to relational contracts.*

**Proof.** See Appendix. ■

Since the costs of specific efforts are left unchanged by globalisation, a rise in profit differentials increases the proportion of firms being able to exert (part a), or effectively exerting these efforts (part b and c). The latter may be induced to do so by the allocation of residual rights of control (part b) or by self-enforcing agreements between trusting partners (part c).

The crucial mechanism at work is the efficiency-enhancing competition effect of trade liberalisation. An increase in final market size results in an increased elasticity of demand for each variety. As more efficient producers set lower prices, market share differences with less efficient rivals are magnified. Because of this intra-sectorial re-allocation, specific investments yields a higher expected return. This leads to organisational change.

In graphical terms, a move towards trade liberalisation - an increase in world market size - shifts all frontiers between organisational forms towards the north-east, and both cutoffs  $\gamma_S$  and  $\gamma_{STD}$  to the right.

### 3.1.2 Relational stability effect

We now consider the impact of trade liberalisation on the stability of relational contracts through the change in specific suppliers' outside options. Symmetric integration has two opposite effects on specific suppliers' outside options. On the one hand, access to a larger world market increases the demand for standard inputs of each individual producer. This '*individual demand effect*' raises upstream firms' outside option. On the other hand,

the free-entry number of producers in the world economy may not increase in proportion to the number of suppliers. In particular, when globalisation leads to significant economies of scale, the number of available varieties increases less than proportionally to the increase in market size. This '*production scale effect*' should cause a decrease of suppliers' outside option.

Hence, we predict a non-monotonic effect of trade liberalisation on this outside option:

**Lemma 2** *Trade liberalisation has a non-monotonic effect on the outside option value of specific inputs. This value decreases at the beginning of the integration process, then increases as the integrated world market reaches a certain scale. Ultimately, this implies a rise in the propensity of Relational Outsourcing at the expense of Spot Outsourcing and Spot Employment.*

**Proof.** See Appendix ■

Symmetric integration implies more competitive pressure on standard input producers. The number of rival suppliers remains the same, while the number of standard input buyers shrinks, reducing each supplier's market share. However, the individual demand of each buyer rises with integration.

When the market share effect offsets the individual demand effect, the value of specific inputs outside the relationship diminishes. In purely formal (Spot) relationships, this value is simply transferred between parties, therefore it does not affect overall efficiency. By contrast, it certainly affects suppliers' temptation to renege on relational contracts, and hence their feasibility. In other words, upstream competition disciplines specific suppliers by deterring opportunistic ex post behavior.

At the beginning of the integration process, the larger number of downstream firms translates into a larger market for standardised inputs. This rise of suppliers' outside option reduces suppliers' payoff from honoring their relational contracts. However, after a certain level of integration, the relational stability effect must be smaller than the market size effect. This implies corporate re-organisation, in the direction of increased outsourcing, particularly with long-term informal agreements.

We may now summarise our findings on the effects of symmetric trade integration in the following Proposition:

**Proposition 2** *Trade integration of symmetric economies provides economic incentives for corporate re-organisation. It should lead to an increase in*

*specific vertical relationships, and an increase in outsourcing relationships. Furthermore, it has non-monotonic effects on the sustainability of long-term informal agreements:*

- *At early stages of globalisation, the relational stability effect may dominate the market size effect, resulting in fewer long-term informal agreements.*
- *When globalisation reaches some critical scale, the market size effect dominates the relational stability effect, resulting in more long-term agreements between firms.*

**Proof.** See Appendix ■

This Proposition states that symmetric trade integration affects organisational choice in a predictable way. On the one hand, due to the market size effect, quasi-rents from specific efforts increase, while costs remain fixed, which implies more outsourcing relationships. On the other hand, the relational stability effect affects the value of the outside option in a non-monotonic way. At the beginning of the integration process, demand for standard inputs and therefore specific suppliers' outside options increase. All else equal, this leads to a reduction in informal agreements, as the temptation to renege on them increases. However, at an advanced stage of trade liberalisation, the production scale effect makes the market for standard inputs tighter, which reduces suppliers' outside options and eventually leads to increased relational contracts.

The overall effect of symmetric trade integration on the composition of the industry by organisational forms is illustrated in Figure 2, for the case of substantial trade integration.

We pause here to comment on this Proposition. First, we have highlighted the importance of global downstream competition in shaping organisations, by affecting the size of quasi-rents accruing from specific investments.

Second, we predict that organisational consequences of trade integration should depend on the scale of the integration process. Small-scale integration should provide new opportunities for specific suppliers to disrupt existing relationships. With large-scale integration, however, the rationalisation of the downstream sector should shrink the standard input market and make upstream competition more stringent, discouraging suppliers' opportunism.

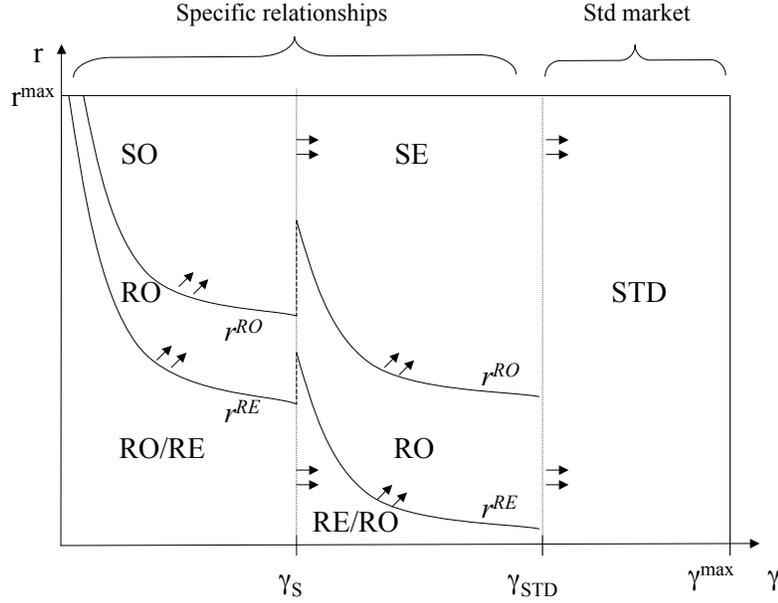


Figure 2: Large-scale symmetric integration and corporate reorganisation in the upstream industry

Third, for a given scale of trade liberalisation, its effect will vary for each country, according to its size. Large countries integrating with similar but smaller countries should first see an increase in intra-firm trade rather than more intensive arms' length trade. In addition, corporate re-organisation following liberalisation should be more intense in smaller economies. Another implication is that multilateral trade integration (between a large number of countries) should lead to convergence in organisational forms.

Finally, we should point at the absence of trade frictions in this simple model. Despite the obvious limitation that the proportion of cross-border relationships is indeterminate, the model still suggests that imported inputs should become less standardised over the course of globalisation. This concurs with previously cited evidence on the growing degree of sophistication in imported inputs. But this also calls for introducing some asymmetry in our model.

## 3.2 Trade integration between asymmetric countries

Symmetric trade liberalisation provides a useful benchmark. Still, we would like to understand how the availability of cheaper imported intermediates affects the pattern of organisation in the home country.

To keep things simple, we restrict country differences to the costs of producing standardised inputs. Denote by  $k^* = \lambda k$  this world price, with  $0 < \lambda < 1$ . We also suppose, without loss of generality<sup>17</sup>, that  $c_H < k^* < k$ .

Because of perfect competition, the world price of standard inputs should equal the most efficient producer's marginal cost. In some countries, freer trade should therefore lead to the exit of some producers. We will denote by  $m$  the number of countries experiencing such exit, with  $m < \mu$ , and from now on will adopt the viewpoint of one of these countries.

The consequences of trade liberalisation for organisational choice will depend on its extent. This will be adequately summarised by parameters  $\mu$ , the ratio of a country's size to the world's size, and  $\lambda$ , the ratio of the autarkic standard input price to the world price. To see this, let us express the profit differential and  $U$ 's outside option as functions<sup>18</sup> of  $\mu$  and  $\lambda$ .

$$\Delta\Pi^*(\lambda, \mu) = \frac{\mu L}{4\beta}(c_H - c_L) \left[ 2\lambda k - c_H - c_L + 4\sqrt{\frac{\beta}{\mu L} f} \right] \quad (14)$$

$$V^*(\lambda, \mu) = \lambda k \underbrace{\sqrt{\frac{f}{\beta} \mu L} \frac{\mu}{\mu - m(\lambda)} \left( \frac{N^*(\lambda, \mu)}{\mu} - q\Delta\Pi^*(\lambda, \mu) \right)}_{s^*(\lambda, \mu)} \quad (15)$$

where  $N^*(\lambda, \mu)$  is the free-entry number of downstream firms on the world market, and  $m(\lambda)$  is the number of countries where the autarky price of standard inputs exceeds the world price.

As in the symmetric model, it is helpful to disentangle a quantity and a relational stability effect.

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<sup>17</sup>If  $k < c_L$  the specific effort of input customisation yields no quasi-rents. If  $k \in [c_L, c_H]$ , specific investments yield risky quasi-rents, potentially negative rents w.r.t standard input production. The (interesting) study of such investment uncertainty goes beyond the scope of this paper.

<sup>18</sup>The expression for the profit differential should look familiar. The expression for the outside option less so, because of the reduction of potential upstream competition due to the exit of home producers.

### 3.2.1 Market size effect

Again, analogues of Equations (3-5), (8-9) and (11) hold for a world market size  $L^*$  and a world standard input price  $k^* < k$ .

It is easily seen from Equation (14) that trade integration has now two conflicting effects on profit differentials. As before, an increase in world market size yields a positive *market size effect*. In addition, cheaper imported intermediates now make standard input buyers more efficient. This results translates into a negative *downstream market share reallocation effect* for specific input users. Which effects dominates on profit differentials depends on the extent of trade liberalisation in intermediates. A modest fall is consistent with rising profit differentials, as shown by the following condition.

**Lemma 3** *The effect of trade liberalisation on profit differentials depends on the world price of standard inputs. Starting from the autarky price, the fall must be low enough, in the sense that*

$$|d\lambda| \leq \frac{2\beta(c_H - c_L)}{\mu k L} \left( \frac{L}{4\beta}(2\lambda k - c_H - c_L) + \sqrt{\frac{L}{\beta}} f \frac{1}{2\sqrt{\mu}} \right) d\mu$$

*for profit differentials to rise after liberalisation. In that case, a result similar to Lemma 1 applies. Otherwise, profit differentials fall.*

**Proof.** See Appendix. ■

Obviously, this condition was automatically met in the symmetric integration case, as it corresponds to the case  $d\lambda = 0$ . When the fall in the standard input price is limited, in the sense that this condition holds, then Lemma 1 still applies: the market size effect raises the proportion of informal and outsourcing relationships. Put another way, we should expect the market size effect to be at work when trade liberalisation is stronger for final goods than for intermediates.

### 3.2.2 Relational stability effect

We now turn to our relational stability effect. Perfect trade integration of the standard input market implies that the world competitive price must equal  $k^* = \lambda k$ . Therefore domestic standard input producers must exit. However, domestic specific input producers could virtually produce, were their specific relationship to break. The outside option of their specific inputs does not

vanish as trade in intermediates is liberalised. Thus imports of standard inputs have interesting implications on the organisational design of specific relationships.

Consider the value of suppliers' outside option after liberalisation by rewriting Equation (15), defining  $s^*(\lambda, \mu)$  as the market share of an active supplier.

$$V^*(\lambda, \mu) = \lambda\sqrt{\mu} \left( k\sqrt{\frac{fL}{\beta}} \right) s^*(\lambda, \mu)$$

Trade liberalisation in final goods (captured by a rise in  $\mu$ ) has the same qualitative effects as in the previous subsection. Besides, trade liberalisation in intermediate goods (captured by a fall in  $\lambda$ ) also has a non-monotonic effect on specific suppliers' outside options.

Notice in the above expression that at a free entry equilibrium, the individual demand for standard inputs will be independent of their price. Therefore, the overall effect of a decrease in  $\lambda$  may be decomposed into a direct effect and an indirect effect. The direct effect comes from a lower price actually paid for each demanded input, proportionally reducing the outside option. The indirect effect comes from an increase in each supplier's market share. To understand the latter effect, we may decompose it further into two effects: a pro-competitive effect of cheaper inputs, raising the number of final producers  $N$ , and hence the potential market for standard inputs; and a depressing effect of cheaper inputs on quasi-rents in specific relationships, raising the proportion of standard input buyers in the downstream sector. Straightforward calculations, using world analogues of Equations (8) and (9), confirm that  $s^*(\lambda, \mu)$  is decreasing in  $\lambda$ .

Summarising, and comparing with the symmetric model, liberalising input trade has two additional effects on the outside option: a *depressing effect on the input price  $k^*$*  itself, and a *positive effect on any supplier's market share  $s^*(\lambda, \mu)$* . Which effect dominates depends on the elasticity of a supplier's market share  $s^*(\lambda, \mu)$  with respect to  $\lambda$  less than unity, as may be seen from:

$$\frac{\partial V^*(\lambda, \mu)}{\partial \lambda} = k\sqrt{\frac{f}{\beta}\mu L} \left[ s^*(\lambda, \mu) + \lambda \frac{\partial s^*(\lambda, \mu)}{\partial \lambda} \right]$$

If this elasticity is lower than one, then the competitive pressure of im-

ported standard inputs should reinforce the effect of large-scale final sector liberalisation on the expansion of relational outsourcing in the home country.

To conclude this discussion, trade liberalisation in the final goods sector and in the intermediate goods sector are likely to have contradictory effects on organisational change. We summarise our findings in the following Proposition:

**Proposition 3** *The policy mix between trade liberalisation in final and intermediate goods matters for the pattern of corporate re-organisation:*

- *if trade liberalisation focuses on the final sector (modest fall in input prices relative to the market size increase), then specific relationships will spread in the industry. Outsourcing, in particular relational outsourcing, will expand.*
- *if trade liberalisation focuses on the intermediate sector (strong fall in input prices relative to the market size increase), then specific relationships, in particular outsourcing will decay in the industry. More transactions will go through the market for standardised inputs. The effect on relational contracts will be indeterminate.*
- *if trade liberalisation does not focus on one particular sector, the pattern of re-organisations will be indeterminate.*

**Proof.** See Appendix 2. ■

This result calls for two comments. First, liberalising trade in each sector is predicted to influence the pattern of corporate re-organisation, a subject on which the literature has been relatively silent<sup>19</sup>. Here we make outside options endogenous, and find that trade liberalisation in intermediates can affect organisational choice through this channel.

Second,  $\lambda$  can also capture differences across trading partners. In this interpretation, trade with low-wage countries selling labor-intensive standard

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<sup>19</sup>To be sure, two papers deal with one instrument or the other. Grossman and Helpman (2004) show that falling intermediate trade costs should favour integration, when outsourcing is performed by high-productivity firms, or outsourcing, when it is performed by low-productivity firms. McLaren (2000) predicts that symmetric integration should 'thicken' upstream markets and create the possibility of an all-outsourcing equilibrium. But most theoretical models discuss organisational choice in an perfectly integrated world economy, possibly for tractability reasons.

inputs would reduce the amount of specific outsourcing and increase the anonymity of input transactions. Interestingly, relational contracts should be on the rise, compared to autarky, despite increased pressure from standard imports competition. This result is reminiscent of Spencer and Qiu (2001), who find that hybrid vertical relationships between home firms can be efficient despite the availability of cheaper foreign inputs. In this paper, as in theirs, imports of cheaper but non-specific inputs cannot match the quasi-rents accruing from specific investments.

## 4 Testable predictions: firm- and industry-level effects of trade liberalisation

In this section we emphasise a number of testable implications of the open-economy model on the effects of trade liberalisation. Two observable variables of interest are the price-cost margin, which we define as  $m(c)$ , and the price-elasticity of demand  $\epsilon(\bar{p}, N)$ :

$$m(c) \equiv p(c) - c = \sqrt{\frac{\beta}{fL}} + \frac{k - c}{2} \quad (16)$$

$$\epsilon(p, \bar{p}, N) \equiv -\frac{p}{\alpha - p + \frac{\eta N}{\eta N + \beta}(\alpha - \bar{p})} \quad (17)$$

We start with price-cost margins.

**Corollary 1 (Price-cost margins)** *Trade liberalisation has heterogeneous effects on price-cost margins according to organisational forms.*

1. *Consider a population of firms resorting to specific suppliers in autarky. Trade liberalisation causes a less severe fall in price-cost margins, on average, to the firms that have switched to outsourcing.*
2. *Among firms that have not re-organised after trade liberalisation, organisational mode should be a determinant of the fall in price-cost margins after trade liberalisation. Among firms that have re-organised, the fall should be smaller on average, and vary across post-liberalisation organisational forms.*

**Proof.** From Lemma 2 and Propositions 2 and 3, producers using specific inputs in autarky and entering outsourcing relationships after trade liberalisation must be switching from SE to SO, or SE to RO. These firms improve their productive efficiency. On average, this implies a more severe fall of price-cost margins in this group. This proves the first part of the corollary.

The price-cost margin  $m(c)$  is decreasing with  $\mu$  and increasing with  $\lambda$ . Besides, firms experiencing no organisational change produce at the same cost  $c$  before and after trade liberalisation. Therefore, trade liberalisation entails a decrease in price-cost margins for these firms. In particular,  $m^*(c) - m(c) = -\frac{(1-\lambda)k}{2} - \sqrt{\frac{\beta L}{f}}(1 - \frac{1}{\sqrt{\mu}})$  which is unambiguously negative. By contrast, firms that experience organisational change after trade liberalisation produce at a smaller variable cost. This implies a lower fall in margins as  $m(c)$  is decreasing in  $c$ . Besides, organisational decisions result in different efficiency gains. This proves the second part of the corollary. ■

This corollary uses a property of the model according to which, due to market power, more efficient firms are able to set lower prices, without passing on to the consumer their whole cost advantage. Hence, they enjoy larger price-cost margins.

Meanwhile, trade liberalisation entails an industry-wide decrease in price-cost margins, due to entry and a larger elasticity of demand<sup>20</sup>. This corollary states that, on average, those firms who have experienced an efficiency gain through corporate re-organisation will suffer from a less severe fall than the others. Provided reliable measures of individual price-cost margins are available, this prediction could be tested directly, leaving aside industry-level effects. With sector-level data on margins, it should still be possible to estimate how much differences in margins over time are explained by re-organisations.

**Corollary 2 (Price-elasticity of demand)** *In a cross-section of industries, the absolute value of the price-elasticity of demand should increase in all tradable sectors, even more so in industries having experienced post-liberalisation organisational change.*

**Proof.** By Equation (17), the price-elasticity of demand faced by each producer is an increasing function of the number of firms and a decreasing function of the industry price. By Corollary 3 we know that the average

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<sup>20</sup>All the corollaries depend on the prediction of fiercer downstream competition after trade liberalisation. This prediction would result from any model of imperfect competition and is supported by empirical evidence, surveyed in Tybout (2003).

cost in industries experiencing organisational change should decrease. Lastly, by Equation (8) the free-entry number of firms is increasing with market size and decreasing with the industry average cost. Therefore, the price-elasticity *function* increases as a result of globalisation. Noting that it is an increasing function of the individual price, (the absolute values of) the observable industry price-elasticities should increase in tradable sectors. The rise should be more dramatic in reorganised industries. ■

Trade liberalisation increases the (absolute value of the) price-elasticity of demand through a competition effect and an efficiency effect reinforcing each other. In a cross-section of industries, the competition effect should work in all tradable sectors ; the efficiency effect should be peculiar to reorganised industries.

## 5 Conclusion

In this paper, we have tried to explain the simultaneous rise of intermediate imports and of hybrid organisational forms. To the best of our knowledge, this paper is the first attempt to do so. We extended the Baker, Gibbons, and Murphy (2002) model of organisational choice with formal and informal (relational contracts) arrangements. By embedding this view of organisations in an open-economy monopolistic competition model, we were able to endogenise the value of quasi-rents from specific investments as well as outside options available to specific suppliers. This allowed us to go beyond property-rights model of the firm (e.g. Antràs and Helpman, 2004), enriching the prediction on the boundaries of the firm by including the stability of relational contracts as a possible determinant.

The model has shed light on two channels by which trade liberalisation can affect organisational choice. First, a larger final market raises quasi-rents from specific investments: this market size effect causes a rise in the propensity of outsourcing and the sustainability of informal agreements both within and between firms. Second, tougher competition on standard input markets reduces opportunism in informally linked independent firms. This relational stability effect goes through the outside option of specific input suppliers. Hence, globalisation, by affecting upstream and downstream market structure, is likely to powerfully affect key variables in organisational choice.

We have found the effects of trade liberalisation to be dependent on its

sectoral structure. When liberalisation only affects the final sector, it has been found to cause a rise in outsourcing, at home and abroad, and a rise in the use of informal agreements to manage vertical relationships. Indeed, both the market size effect, increasing the size of quasi-rents, and the relational stability effect, reducing suppliers' opportunism, are at work. The prediction then concurs with the observed rise in hybrid organisational forms.

When trade liberalisation occurs both in the upstream and downstream sectors, its effect on organisational choice is in principle indeterminate. However, when trade policy puts stronger emphasis on one sector rather than the other, it is possible to predict the direction of organisational change. In particular, when the emphasis is on the final sector, the previous result is left unchanged. Interestingly, the condition for this result to still hold may be interpreted as a limit on the extent of input trade liberalisation, as well as a condition on the characteristics of trade partners. In particular, the previous result would hold with full input trade liberalisation as long as cost advantages between producers in the partner countries are not too different. Therefore, this result could be seen as stressing the importance of the trade policy mix, as much as the identity of the trading partners, for the direction of organisational change.

The model also provides some original testable predictions on some industry characteristics, such as price-cost margins, and demand elasticities. In industries experiencing organisational change, liberalisation should cause a larger decrease in production costs, in price-cost margins, and an absolute increase in the price-elasticity of demand, on average. These implications call for empirical testing on firm-level panel data, the subject of future research.

Finally, the approach taken in this paper has been intentionally oversimplified, and some aspects of organisational decisions have been overlooked: the working of the vertical matching process; the existence of economies of scope with multi-supplier platforms; the existence of specific relationships between foreign partners with different technologies. Last but not least, a general equilibrium analysis would be necessary to assess the welfare consequences of corporate re-organisation following liberalisation. The investigation of these aspects is also left for future research.

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# Appendix 1: Organisational choice in a typical vertical relationship

## Preliminary calculations

Consistent with the continuum-of-firms assumption, upstream producers will treat the industry average cost and number of buyers as constant. Therefore Equation (11) is the relevant profit differential for individual organisational choice. Notice that this expression does only depend on market size and not on the number of active firms.

Denote by  $1_{e_s=1}$  and  $1_{e_{ns}=1}$  the indicator functions that take value one when the specific and non-specific effort are made, respectively. Joint surplus from the bilateral relationship may then be expressed as a function of efforts:

$$S(e_s, e_{ns}) \equiv \Pi(c_H) + (q\Delta\Pi - \gamma) * 1_{e_s=1} - \Gamma * 1_{e_{ns}=1} \quad (18)$$

Recall the timing of the game:

- choice of the allocation of property rights (integration or contracting out) to maximise joint surplus, joint decision to enter a relational contract.
- repeated two-stage procedure: in the first stage,  $U$  chooses efforts  $e_s$  and  $e_{ns}$ . Upon observation of  $c$ , in the second stage,  $D$  compensates  $U$ : either with the informally agreed payment ('relational contract'), or with a negotiated price ('spot outsourcing'), or with nothing, if  $D$  is entitled to seize the input ('spot employment').

We now solve for the subgame-perfect equilibrium of the organisational game.

## A resolution of the game by backward induction

This subsection proves Proposition 1.

### Compensation

Under spot outsourcing,  $U$  will receive the Nash bargaining price equal to  $\frac{\Pi_i + V_j}{2}$  where  $i$  and  $j$  denote observed realisations of the two variables.

These realisations, on average, will depend on the efforts chosen in the previous stage.

Under spot employment,  $U$  will receive nothing.

Under relational contracts,  $U$  will receive a discretionary payment  $b_i$  contingent on the observed value of  $c$ . For relational contracts to be self-enforceable, honouring the relational contract must be the subgame-perfect equilibrium strategy for both parties, in the infinitely repeated procedure game. In other words, the temptations to renege must be lower than the gains from playing equilibrium strategies. Hence the following condition:

$$\begin{aligned} \forall i, b_i + \frac{U^R(1, 0)}{r} &\geq \frac{1}{r} \max \{U^{SO}(1, 1), U^{SE}(0, 0)\} \\ \forall i, \Pi(c_i) - b_i + \frac{D^R(1, 0)}{r} &\geq \Pi(c_i) + \frac{1}{r} \max \{D^{SO}(1, 1), D^{SE}(0, 0)\} \end{aligned}$$

for relational employment and

$$\begin{aligned} \forall i, j, b_i + \frac{U^R(1, 0)}{r} &\geq \frac{\Pi_i + V_j}{2} + \frac{1}{r} \max \{U^{SO}(1, 1), U^{SE}(0, 0)\} \\ \forall i, j, \Pi(c_i) - b_i + \frac{D^R(1, 0)}{r} &\geq \Pi(c_i) - \left( \frac{\Pi_i + V_j}{2} \right) + \frac{1}{r} \max \{D^{SO}(1, 1), D^{SE}(0, 0)\} \end{aligned}$$

for relational outsourcing.

$i$  denotes the realisation of input quality (good,  $G$ , or bad,  $B$ ).  $U(\cdot)$  and  $D(\cdot)$  denote the expected and infinitely discounted surplus as a function of efforts for both parties. Their sum  $S(\cdot)$  is the joint surplus function.  $r$  denotes the probability of exogenous destruction of the bilateral relationship<sup>21</sup>.

For  $U$ , the temptation to renege amounts to an instantaneous payoff (zero under SE or the negotiated price under SO) plus the expected infinitely discounted surplus under SO or SE. By contrast, the gain from honouring the relational contract amounts to an instantaneous (and conditional) bonus payment plus the expected discounted sum of bonuses. For  $D$ , the temptation

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<sup>21</sup>With a (time-invariant) shadow interest rate equal to  $r$ , infinitely discounted gains from time 1 on are indeed equal to  $\frac{1}{r}$  times the constant gain from honoring relational contracts. Yet another interpretation is possible. With a  $1 - r$  probability of survival per period, the sum of future expected gains is indeed equal to  $\frac{1}{r}$  times the constant gain from honoring relational contracts.

to renege amounts to instantaneous minimum profits (minus the negotiated price if SO) plus the expected infinitely discounted surplus under SO or SE. The gain from honouring the agreement equals the expected discounted surplus net of bonus payments.

We may deduce two *sufficient* conditions for the existence of relational contracts, by summing the two inequalities in each case. Denoting by  $\Delta b$  the difference between payments contingent on a low  $c$  and a high  $c$ , respectively, we obtain:

$$|\Delta b| \leq \frac{1}{r} \min\{q\Delta\Pi - \gamma, \Gamma\} \quad (19)$$

$$\left| \Delta b - \frac{\Delta\Pi}{2} \right| + \frac{V}{2} \leq \frac{1}{r} \min\{q\Delta\Pi - \gamma, \Gamma\} \quad (20)$$

This characterises  $U$ 's compensation in the last stage.

### Specific investment choice

We know that for all upstream producers with  $\gamma \leq q\Delta\Pi$ , the joint-surplus-maximising effort combination is  $\{e_s = 1, e_{ns} = 0\}$ . Other suppliers are deemed to offer standard inputs. Denote by  $\gamma_{STD}$  this threshold fixed cost.

To avoid being in the trivial case where first-best efforts are chosen under spot outsourcing, and therefore organisational choice being one-sided, we make the following assumption:

$$V > 2\Gamma \quad (\text{Assumption 2})$$

This assumption ensures there is a multi-tasking problem: the expected reward to non-specific efforts is important enough for  $U$  to engage in socially unproductive efforts. Committing not to engage in non-specific efforts, through relational contracts, strictly raises joint surplus compared to Spot Outsourcing.

$U$  will choose its specific efforts in order to maximise its private surplus function. In all three organisational arrangements, this will amount to solving the following program:

$$\max_{e_s, e_{ns}} \left\{ \frac{1}{2} [\Pi(c_H) + q\Delta\Pi * 1_{e_s=1}] + \frac{1}{2} [V + V * 1_{e_{ns}=1}] - \gamma * 1_{e_s=1} - \Gamma * 1_{e_{ns}=1} \right\}$$

(SO)

$$\max_{e_s, e_{ns}} \{0 - \gamma * 1_{e_s=1} - \Gamma * 1_{e_{ns}=1}\}$$

(SE)

$$\max_{e_s, e_{ns}} \{b_B + (q\Delta b - \gamma) * 1_{e_s=1} - \Gamma * 1_{e_{ns}=1}\}$$

(Relational contracts)

Under Spot Outsourcing, optimal efforts will be equal to  $\{1, 1\}$ , given Assumption 2, if and only if

$$\frac{q\Delta\Pi}{2} \geq \gamma$$

$$q\Delta\Pi - \Gamma \geq \gamma$$

Under Spot employment the chosen effort combination will be  $\{0, 0\}$ . Supplier  $U$  does not make any effort for fear of being held up by  $D$ , since ownership rights allow  $D$  to seize  $U$ 's production in any contingency<sup>22</sup>

Under relational contracts the chosen effort combination will be  $\{1, 0\}$ , provided that:

$$b_B + (q\Delta b - \gamma) \geq 0 \tag{21}$$

This last condition completes the characterisation of relational contracts.

### Individual organisational choice

In the first stage, parties  $U$  and  $D$  choose the allocation of property rights and whether they want to enter an informal agreement. By construction of the model, relational contracts will always be chosen if sustainable. If not, then the costs of exerting the specific effort will be crucial to determine the allocation of property rights.

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<sup>22</sup>Because we rule out contractible efforts, upstream efforts under spot employment, and thus spot employment payments, are simply normalised to zero. Allowing for contractible efforts would make  $U$  exert some additional efforts under employment as well as outsourcing, which would not change organisational choice.

Define  $\gamma_{STD}$  as the threshold fixed cost of investment above which specific efforts are not credible, or simply:

$$\gamma_{STD} = q\Delta\Pi \quad (22)$$

All upstream producers with a fixed cost beyond this threshold may not credibly enter specific relationships with downstream producers, and sell standardised inputs on an anonymous market.

Further define  $\gamma_S$  as the cut-off fixed cost of investment that equates expected joint surplus under SE and SO:

$$\Pi(c_H) + q\Delta\Pi - \gamma - \Gamma = \Pi(c_H) \Leftrightarrow \gamma = \min\left\{\frac{q\Delta\Pi}{2}, q\Delta\Pi - \Gamma\right\} \quad (23)$$

where the right-hand-side is defined as  $\gamma_S$ . All vertical relationships with upstream parties facing fixed costs in excess of  $\gamma_S$  should lead to spot employment instead of spot outsourcing.

Note that these cut-off fixed costs determine the composition of spot (purely formal) specific relationships, as well as relational-contract ones. Indeed, fixed costs affect the payoff from reneging on a relational contract. For example, when the fixed cost exceeds  $\gamma_S$ , 'employment' is the best 'fallback' to the relational contract.

We may now derive conditions under which relational contracts are sustainable. Using Equation (21), we may rearrange Equations (19-20) as, respectively:

$$\begin{aligned} \gamma &\leq \frac{q^2\Delta\Pi}{r+q} \\ \gamma &\leq \frac{q^2\Delta\Pi}{r+q} + \frac{rq(\Delta\Pi - V)}{2(r+q)} \end{aligned}$$

whenever Outsourcing is the best 'fallback' in case one party reneges, and

$$\begin{aligned} \gamma &\leq \frac{q\Gamma}{r} \\ \gamma &\leq \frac{q\Gamma}{r} + q\frac{\Delta\Pi - V}{2} \end{aligned}$$

whenever Employment is the best 'fallback'.

These conditions may be rewritten as conditions on exogenous rates of destruction of existing relational contracts. Since they depend on the jointly optimal organisational choice under spot contracts, their functional form has a discontinuous two-part structure:

$$\bar{r}_{RE}(\gamma) = \begin{cases} \frac{q^2}{\gamma} \Delta\Pi - q & \text{if } \gamma \leq \gamma_S \\ \frac{q\Gamma}{\gamma} & \text{if } \gamma > \gamma_S \end{cases} \quad (24)$$

$$\bar{r}_{RO}(\gamma) = \begin{cases} \frac{q(q\Delta\Pi - \gamma)}{\gamma - q} \frac{\Delta\Pi - V}{2} & \text{if } \gamma \leq \gamma_S \\ \frac{q\Gamma}{\gamma - q} \frac{\Delta\Pi - V}{2} & \text{if } \gamma > \gamma_S \end{cases} \quad (25)$$

This completes the proof of Proposition 1.

To close the model, we must determine the value of  $V$ . This in turns depends on the distribution of suppliers in the  $\gamma$  and  $r$  dimensions. To keep things simple, we assume that these two characteristics are independently and uniformly distributed over  $[0, \gamma^{max}]$  and  $[0, r^{max}]$  respectively. Generalising the model to arbitrary distributions would not affect the qualitative results but it would involve a substantial loss of tractability.

Therefore a specific supplier's outside option under Outsourcing equals:

$$V = k \underbrace{\sqrt{\frac{f}{\beta} \mu L}}_{y(k)} \underbrace{\left( \frac{N - q\Delta\Pi}{1 - q\Delta\Pi} \right)}_{s(k)}$$

where  $y(k)$  denotes the output of a producer using technology  $k$ , and  $s(k)$  denotes the size of the upstream firm's hypothetical customer base on the standard input market. This is equal to downstream firms' demand for standard inputs divided by the mass of suppliers outside a specific relationship.

The distribution of organisational forms across the population of *suppliers* may then be denoted by proportions  $\Phi_{SO}, \Phi_{SE}, \Phi_R, \Phi_{STD}$ , with all proportions summing to unity. It straightforwardly follows from Proposition 1 and the assumption on distributions that:

$$\Phi_{SO} = \frac{1}{r^{max}} \int_{\frac{q\Gamma}{r^{max}} + \frac{q}{2}(\Delta\Pi - V)}^{\gamma_S} [r^{max} - \bar{r}_1^{RO}(\gamma)] d\gamma \quad (26)$$

$$\Phi_{SE} = \frac{1}{r^{max}} \int_{\gamma_S}^{\gamma_{STD}} [r^{max} - \bar{r}_2^{RO}(\gamma)] d\gamma \quad (27)$$

$$\Phi_{STD} = 1 - \gamma_{STD} \quad (28)$$

$$\Phi_R = \gamma_{STD} - \Phi_{SO} - \Phi_{SE} \quad (29)$$

and that

$$\bar{c} = (qc_L + (1 - q)c_H)(\Phi_{SO} + \Phi_R) + c_H\Phi_{SE} + k\Phi_{STD} \quad (30)$$

Finally, we are able to compute the value of specific suppliers' outside option. At the free entry equilibrium, output by firms using standard inputs is simply equal to  $\sqrt{\frac{fL}{\beta}}$ . Since the price at which the input sells is  $k$  and that no additional cost is incurred in case the supplier exerts its outside option,  $V$  simply equals individual expenditure multiplied by each seller's market share  $s(k)$ . Since suppliers are uniformly distributed and that the free entry number of downstream firms under autarky is equal to  $N$ , we have that:

$$s(k) = \frac{\frac{N}{\gamma^{max}} - q\Delta\Pi}{1 - q\Delta\Pi} \quad (31)$$

$$V = k\sqrt{L}\sqrt{\frac{f}{\beta} \frac{\frac{N}{\gamma^{max}} - q\Delta\Pi}{1 - q\Delta\Pi}} \quad (32)$$

## Appendix 2: Organisational choice in the open economy

### Proof of Lemma 1

Evaluating the derivative of the expression in Equation (12) with respect to  $\mu$  yields:

$$\frac{\partial\Delta\Pi^*(\mu)}{\partial\mu} = \frac{(c_H - c_L)L}{4\beta} \left[ 2k - c_H - c_L + 2\sqrt{\frac{\beta}{\mu L}f} \right]$$

which is unambiguously positive.

Using Equations (23) and (22) from the previous Appendix, it is easily seen that both cut-offs increase with trade liberalisation, as profit differentials are higher. This simply proves results (a) and (b).

Lastly, inspection of equations (24) and (25) shows that threshold values of  $r$  for a given  $\gamma$  increase with profit differentials.

## Proof of Lemma 2

This simple proof has three steps. First, by Corollary ??, we know that a fall in  $V$  leads to an increase in Relational Outsourcing, while a rise in  $V$  implies a decrease in Relational Outsourcing.

Second, we may rewrite Equation (13) in the following way:

$$V^*(\mu) = \left( k \sqrt{\frac{f}{\beta} L} \right) \sqrt{\mu} s(\mu)$$

where  $s(\mu)$  represents the market share of a standard input producer as a function of final market size. Straightforward though tedious calculations show that  $N^*(\mu)$  is an increasing function, implying that  $s(\mu)$  is decreasing in  $\mu$ . Rewriting the derivative of  $V^*(\mu)$  with respect to  $\mu$  yields:

$$\frac{\partial V^*(\mu)}{\partial \mu} = \left( k \sqrt{\frac{f}{\beta} L} \right) \left[ \frac{s(\mu)}{2\sqrt{\mu}} + \sqrt{\mu} s'(\mu) \right]$$

The first term in square brackets is positive (the individual demand effect), while the second is negative (the production scale effect). Notice that this derivative has the same sign as  $\frac{s(\mu)}{2} + \mu s'(\mu)$ . Notice further that because  $s(\mu)$  is a market share, it is bounded above by 1, while  $\mu s'(\mu)$  is not. Hence, the derivative must be negative for a large enough  $\mu$ .

Third, inspection of Equations (22)-(25) reveals that other thresholds are left unchanged by the variation of the outside option. This is a consequence of perfect *ex ante* income transferability within specific relationships.

## Proof of Proposition 2

The subgame-perfect equilibrium of the organisational game is found as in the Proof of Proposition 1. However, profit differentials, outside options, and

therefore threshold values of the time preference rate differ. By Equation (11) profit differentials increase. Hence, from Lemma 1, this leads to an increase in  $\gamma_S$  and  $\gamma_{STD}$ .

Furthermore, from Lemma 2, the outside option should decrease for low enough values of  $\mu$ , going against the market size effect. By Equation (25) this implies a larger value of  $\bar{r}_{RO}(\gamma)$ , and fewer firms relying on RO. To the contrary, when trade integration reaches a certain scale (beyond a certain  $\mu$ ), the market size effect must dominate the relational stability effect. By a similar reasoning, this should trigger more relational outsourcing. By continuity, there must exist a threshold value of  $\mu$  such that relational outsourcing rises compared to autarky. This completes the proof.

### Proof of Lemma 3

Using Equation (14), we may compute

$$d\Delta\Pi^*(\lambda, \mu) = \left( \frac{k(c_H - c_L)L}{2\beta} \right) \mu d\lambda + (c_H - c_L) \left( \frac{L}{4\beta} (2\lambda k - c_H - c_L) + \sqrt{\frac{L}{\beta}} f \frac{1}{2\sqrt{\mu}} \right) d\mu$$

from which it straightforwardly follows that a necessary and sufficient condition for  $d\Delta\Pi^*(\lambda, \mu)$  to be positive is:

$$-d\lambda \leq \frac{2\beta(c_H - c_L)}{\mu k L} \left( \frac{L}{4\beta} (2\lambda k - c_H - c_L) + \sqrt{\frac{L}{\beta}} f \frac{1}{2\sqrt{\mu}} \right) d\mu$$

Noting that the term in large brackets is unambiguously positive, for parameter values consistent with positive outputs, we are indeed left with an upper bound on the intensity of trade liberalisation in intermediates.

### Proof of Proposition 3

We may rewrite (22) and (23), as well as (24) and (25) as functions of  $\lambda$  and  $\mu$ , characterising organisational choice according to trade liberalisation. Remark that in all these equations, the only endogenous variables are  $q\Delta\Pi^*$  and  $V^*$ . In particular,  $\gamma_S$  and  $\gamma_{STD}$  increase with  $q\Delta\Pi^*$  but are invariant to changes in  $V$ .  $\bar{r}_1^{ER}(\gamma)$  and  $\bar{r}_2^{ER}(\gamma)$ , whose graphs represent the frontiers of organisational choice in the population of firms, are increasing functions of the *difference* between  $q\Delta\Pi^*$  and  $V$ .

The proof is based on a comparison of several integration scenarios varying by the relative intensity of liberalisation in each sector.

**Integration biased towards the downstream sector** This part of the proof relies on Proposition 2 and a continuity argument.

Recall Figure 2. With symmetric integration, threshold values of the fixed costs  $\gamma_S$  and  $\gamma_{STD}$  shift rightwards while the  $\bar{r}_1^{ER}(\gamma)$  and  $\bar{r}_2^{ER}(\gamma)$  shift to the north-east. The condition in Lemma 3 imposes an upper bound on trade liberalisation in the intermediate sector relative to that in the final sector, such that profit differentials rise. Under this condition, threshold values of the fixed costs still shift rightwards.

Moreover, by continuity, we may find a stronger condition such that the outside option decreases. Given what is needed for an expansion in relational contracting is a growing *difference* in  $\Delta\Pi^* - V^*$ , we end up with a sufficient condition. Indeed, a  $|d\lambda| > 0$  increases  $s^*(\lambda, \mu)$ , as explained in the main text, as well as a decrease in  $\lambda$ . If this condition  $|d\lambda| > 0$  is modest compared to  $d\mu$ , then  $s^*$  will decrease if the pro-competitive effect on  $N$  of integration is more than offset by the market size effect on  $q\Delta\Pi^*$ . Therefore the share of downstream firms relying on standard inputs decreases, and the outside option falls.

To summarise, re-organisations should go in the general direction of more RO, an equal share of SE, and fewer transactions on the anonymous market. While the effect on SO is ambiguous, we know that the share of outsourcing in the industry (SO+RO) should increase.

**Integration biased towards the upstream sector** When the opposite condition as that of Lemma 3 is met, profit differentials decrease with integration. This is because the efficiency gain for standard input users is too strong. Therefore both threshold values of  $\gamma$  decrease, implying more transactions on the anonymous market. Meanwhile, careful inspection of  $s(\lambda, \mu)$  tells us that this market share rises with integration, under the same opposite condition. How the outside option varies should depend on the magnitude of the direct effect of a smaller  $\lambda$  and the indirect effect of a greater  $s(\lambda, \mu)$ . By continuity there exists a sufficiently small  $\lambda$  such that the latter effect dominates the former. A condition on  $|d\lambda|$  may therefore be found that ensures a rise in the outside option. Again, this is a sufficient condition for a decrease in relational contracting.

To summarise, re-organisations should go in the general direction of less RO and RE, substituted by some SO and SE, and some other SE relationships substituted by transactions on the anonymous market.

## Appendix 3: Testable predictions

**Corollary 3 (Technological conditions)** *In industries experiencing organisational change, industry average production costs should decrease by more after liberalisation than in industries knowing no such change.*

**Proof.** The proof follows straightforwardly from the deterministic link between organisational change and efficiency gains, and Propositions 2 and 3. ■

Trade liberalisation offers efficient reorganisation possibilities for some firms. As they take advantage of them, the industry average cost should decrease. Some of this efficiency gain is passed on to the final consumer, as shown below.