Trade Liberalization and Organizational Change*

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Abstract

We embed a simple incomplete-contracts model of organization design in a standard two-country perfectly-competitive trade model to examine how the liberalization of product and factor markets affects the ownership structure of firms. In our model, managers decide whether or not to integrate their firms, trading off the pecuniary benefits of coordinating production decisions with the private benefits of operating in their preferred ways. The price of output is a crucial determinant of this choice, since it affects the size of the pecuniary benefits. Organizational choices also depend on the terms of trade in supplier markets, which affect the division of surplus between managers. We show that, even when firms do not relocate across countries, the price changes triggered by the liberalization of product markets can lead to changes in ownership structures within countries. The removal of barriers to factor mobility can also induce widespread restructuring, which can lead to increases in product prices (or declines in quality), hurting consumers worldwide.

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1 Introduction

Recent decades have witnessed drastic reductions in barriers to commodity trade and factor mobility around the world. Whether the result of liberalization policies — exemplified by the proliferation of regional trade agreements and by successive rounds of multilateral trade negotiations — or falling transport costs, the transformation of economic life has been dramatic. There is ample evidence that the internationalization of product and factor markets has contributed significantly to widespread organizational restructuring, most notably in the large — mergers and outsourcing — but also in the small — changes in reporting structures or compensation schemes.[1] Yet the mechanisms by which changes in the global economy can effect changes in the organization of firms are not well understood. The aim of this paper is to study one such mechanism: liberalization of product and factor markets can alter firms' integration decisions via the induced changes in prices.

As with other papers in the recent literature on organizations in the international economy (e.g., McLaren, 2000; Grossman and Helpman, 2002; Antras, 2003), we depart from the traditional trade framework by opening the "black box" of the neoclassical firm. We start from a simple model of organizational design in which, as in Hart and Holmström (2010), a firm's integration decision governs the trade-off between the managerial "quiet life" and the coordination of its production activities. As shown by Legros and Newman (2009), this choice depends on two key variables: the price at which the firm's product is sold, and the terms of trade prevailing in its supplier market. We embed this model of the firm in a perfectly competitive, specific-factor model of international trade, in which trade between countries results from differences in their factor endowments. The only significant departure from the standard framework is that the factors of production are supplier firms that are run by managers. The model provides a tractable analytical framework in which the effects of falling trade barriers on organization can be grasped by simple demand and supply analysis.

Intuitively, there are good reasons to believe that trade liberalization ought to have an impact on the internal organization of firms. In general, organizational design mediates trade-offs between organizational goals, such as profit, and private, non-contractible ones such as managerial effort or vision. For instance, a downstream firm may vertically integrate with its supplier because this forces better production coordination; this reorganization is not costless, since there may be revenue losses due to inexpert decision-making by non-specialists who take control of

[1]For example, the restructuring of US automakers' relations with their suppliers in the 1980s has been attributed largely to increased competition from Japanese imports and to some extent to the entry of foreign manufacturers into US supplier markets (Dyer, 1996). Various studies have also found that the creation of regional trade agreements lead to organizational restructuring activities within as well as across member countries (e.g., Breinlich (2008) and Guadalupe and Wulf (2010) on the Canada-United States Free Trade Agreement; European Commission (1996) on the EU Single Market; Chudnovsky (2000) on the Mercosur customs union in Latin America). Other studies have stressed the impact of trade liberalization on the reallocation of resources across individual plants and firms (e.g., Pavcnik, 2002; Trefler, 2004) or in work practices (Schmitz, 2005).

the upstream operations. Integration may be most valuable when profitability is too low to attract upstream and downstream managers away from indulging their private interests. Since profits depend on product price, changes in product markets (such as tariff reductions) affect the terms of this trade-off and therefore lead to changes in the degree of integration. Similarly, the amount of profit that needs to be sacrificed by the firm as a whole in order to accommodate the private benefits of its stakeholders will be affected by supplier ; if these change (as when capital is allowed to cross borders), so will organizational structure.

The basic "building block" model of organizational design we use to formalize this intuition is one in which production requires the cooperation of two types of suppliers that can either integrate or deal at arm's length (non-integration). The production technology essentially involves the (non-contractible) adoption of standards: output (or, in an alternate interpretation, the likelihood that the good produced will actually work) is highest when the two suppliers coordinate, i.e., adopt similar decisions about their production standards. However, managers have opposing preferences – derived perhaps from the differing protocols and capabilities of their respective workforces – about the direction those decisions ought to go, and find it costly to accommodate the other's approach.[2] Under non-integration, managers make their decisions separately, and this may lead to inefficient production. Integration solves this problem by delegating the decisions rights to an additional party, called headquarters (HQ), who is motivated solely by monetary concerns. HQ therefore maximizes the enterprise's profit by enforcing common standards between suppliers. However, HQ's will tend to undervalue managerial private benefits. Non-integration is thus associated with high private benefits and low coordination, integration with high coordination and high private costs. Organizational design depends on how much managers value the extra output generated by integration.[3]

In this setting, the price of output is a crucial determinant of firms' organizational choices. In particular, non-integration is chosen at "low" prices: managers do not value the increase in output brought by integration, since they are not compensated sufficiently for the high costs they have to bear. Therefore, integration only occurs at higher prices.

The ownership structure of firms will also be affected by the terms of trade in the supplier markets, which determine the division of surplus between managers. The performance of non-integration depends sensitively on how profits are shared: both managers must receive substantial shares in order to be willing to forgo the "quiet life" in favor of organizational objectives; unequal shares result in low performance. By contrast, integration is more flexible in its ability to

[2]As noted above, the view of the firm follows Hart and Holmström (2010); the model is a multi-sector, multi-country variant of the one in Legros and Newman (2009). These papers are part of a literature pioneered by Grossman and Hart (1986) and Hart and Moore (1990) that identifies a firm's boundaries with the extent of decision rights over assets and/or operations.

[3]Thus our model is consistent with the classic view of integration as the result of a tradeoff between specialization and coordination. But it also reflects the perspective expressed by Grossman and Hart (1986) that integration does not so much remove incentive problems as replace one incentive problem with another. The costs of integration are therefore unlikely to be fixed and will depend instead on prices, the level of output, etc.

distribute surplus between suppliers — since they do not make decisions, the profit shares they receive have no incentive effects — and will therefore tend to be adopted when the supplier market strongly favors one side or the other.

We consider the effects of the successive liberalization of product and factor markets and obtain two main results. First, even when supplier firms do not relocate across countries, freeing trade in goods triggers price changes that can lead to significant changes in ownership structures within countries (waves of mergers and divestitures). Second, following the liberalization of product markets, the removal of barriers to factor mobility can induce further organizational changes, by affecting terms of trade in supplier markets. In Home (the country will the more productive suppliers), restructuring will entail a shift toward integration, while Foreign firms will shift toward outsourcing.[4]

We also show that factor market liberalization can lead to increases in product prices (or decreases in their quality). The intuition for this result is that, by inducing foreign exporting firms to shift toward non-integration — the less efficient ownership structure — factor mobility can lead to a reduction in world supply.[5] Reorganization has thus implications for consumer welfare. In principle, price increases/quality losses may occur in many markets simultaneously, offsetting the normal benefits of factor market liberalization, possibly hurting consumers in all countries.

Our paper contributes to an emerging literature on general equilibrium models with endogenous organizations,[6] and in particular to a recent stream of this literature which has examined firms' organizational choices in a global economy.[7] Most papers have focused on how organizational design can explain the observed patterns of intra-firm trade. Much less attention has been devoted to how firms' boundaries respond to falling trade costs.[8] Nor to our knowledge has the

[4]These predictions of our model about the organizational effects of trade liberalization are consistent with the findings of recent empirical studies (Breinlich, 2008; Alfaro *et al.*, 2010).

[5]This finding is in line with evidence of supply disruptions and quality losses often attributed to firms switching from integration to non-integration. See, for example, the safety problems associated with American-designed toys produced by Chinese contractors and sub-contractors (see "Mattel Recalls 19 Million Toys Sent From China," *New York Times*, August 15, 2007) or customers' frustration with the outsourcing of call centers (see "Please Stay on the Line," *Wall Street Journal*, March 24, 2009).

[6]General equilibrium models of an industry have been used to describe how firms' organizational choices are affected by wealth distributions and relative scarcities of supplier types (Legros and Newman, 1996, 2008) and search costs (McLaren, 2000; Grossman and Helpman, 2002).

[7]Antras (2003) embeds a hold-up model of organization in a two-country international trade model with monopolistic competition, and is mostly concerned with explaining location decisions of multinational firms and the patterns of intra-firm trade; it does not examine organizational responses to the liberalization of product and factor markets, which is our focus. Antras and Helpman (2004) and Grossman and Helpman (2004) study models in which firms choose their modes of organization and the location of their subsidiaries or suppliers; however there is no analysis of either the positive or welfare effects of product and factor market integration. Puga and Trefler (2010) explore the links between contractual incompleteness and product cycles, showing that minor or incremental innovations can be important drivers of growth, particularly in emerging economies.

[8]An exception is Marin and Verdier (2002), which examines how trade integration affects the delegation of authority within monopolistically competitive firms in which managers cannot be given monetary incentives. Ornelas and Turner (2008, 2010) and Antras and Staiger (2008) examine how trade liberalization may mitigate hold-up problems by strengthening a foreign supplier's investment incentives.

previous literature pointed out the potential negative effects that trade liberalization can have on consumer welfare — even absent market power — through its impact on the organization of production.

In the next section, we describe organizational choices in a closed economy. Section 3 extends the model to two countries and examines the effects of the liberalization of the markets of final goods on the ownership decision and on managers' compensation schemes. Section 4 considers the impact of the liberalization of supplier markets and its effects on consumers' welfare. Section 5 concludes with discussion some empirical and policy implications of our analysis.

2 The Model

Our model is similar to a standard specific-factor trade model between two countries, Home and Foreign (Foreign variables are denoted with a "*"), in which trade is the result of differences in the endowments of specific factors. As discussed in Section 2.3 below, the crucial novelty of our model is that production inputs are assets run by managers who trade off the pecuniary benefits of coordinating their decisions with the private benefits of making these decisions in their preferred way.

In what follows, we describe the building blocks of our model in its closed-economy form. The effects of integrating goods and factor markets are studied in the following two sections.

2.1 Setup

In each economy, there are $I+1$ sectors/goods, denoted by 0 and $i = 1, \ldots, I$; good 0 is a numeraire. The representative consumer's utility (which is the same in Home and Foreign) can be written as

$$u(c_0, \ldots, c_I) \equiv c_0 + \sum_{i=1}^{I} u_i(c_i), \tag{1}$$

where c_0 represents the consumption of the numeraire good, and c_i represents consumption of the other goods. The utility functions $u_i(\cdot)$ are twice differentiable, increasing, strictly concave, and satisfy the Inada conditions $\lim_{c_i \to 0} u_i'(c_i) = \infty$ and $\lim_{c_i \to \infty} u_i'(c_i) = 0$. Domestic demand for each good i can then be expressed as a function of its own price alone, $D_i(p_i)$.

Production of good i requires the cooperation of two types of input supplier, denoted A and B_i. B_i suppliers generate no value without being matched with an A; unmatched A suppliers, however, can engage in stand-alone production of the numeraire good 0. Many interpretations of the A and B_i firms are possible. For example, A's may represent light assembly plants or basic inputs, such as energy or business services (e.g., IT, retailing, logistics) that can be used to

produce basic consumer goods or can be combined with other inputs (B_i suppliers) to produce more complex goods.

The *goods markets* operate under conditions of perfect competition: consumers and producers take prices $\{p_i\}$ as given when making their choices. Prices adjust to ensure that each good market clears. Good 0 is always traded freely across the two countries. We choose units so that both the Home and Foreign prices of good 0 are equal to unity, and we assume that aggregate supply of A's in each country is large enough to sustain production of a positive amount of this good.

The *supplier markets,* in which A's and B_i's match to form enterprises that produce the i-goods, are also frictionless and competitive: we model equilibrium in these markets as a *stable match*, a core-like concept, defined below, that has become standard for modeling competition in matching markets.[9]

2.2 Equilibrium in the supplier market

There is a continuum of A suppliers and B_i suppliers. Normalize the measure of A's to unity, and denote by n_i the measure of B_i's. The A's are assumed to be the long side of the market: $\sum_{i=1}^{I} n_i \equiv n_B < 1$. We will consider equilibria with full employment of factors, i.e., all of the A's and B's in the economy will be actively engaged in producing the $I+1$ goods.

All A's are equally productive when matched with one of the B_i's. However, A suppliers have different outside options, depending on their good-0 productivity: a stand-alone A-firm can produce α units of the numeraire good, where α is distributed among the A population according to the continuous distribution $F(\alpha)$.

An equilibrium in the supplier market consists of a stable match, that is a mapping from the set of B_i's to the set of A's, along with a payoff for each A and each B_i, satisfying three conditions:

(1) *Feasibility*: the payoffs accruing to a matched A-B_i pair can be feasibly generated given the price p_i of the good they produce, the production technology, and the set of contracting possibilities available to them; stand-alone B_i's earn zero, while stand-alone A's earn what they can from producing the numeraire good.

(2) *Stability:* no (A, B_i) pair or individual A or B_i on his own could form an enterprise that generates feasible payoffs for each manager that exceed their equilibrium levels.

(3) *Measure consistency*: the measure of matched A's is equal to the measure of matched B_i's.

The derivation of the sets of feasible payoffs is discussed in detail in the next subsection. Stability is a notion that applies to a market without any search frictions, since the implicit

[9] See for instance, Roth and Sotomayor (1990). For an early application of a generalization of this concept (the "f-core") to models of firm formation, see Legros and Newman (1996).

assumption is that at the matching stage, any unsatisfied A or B_i can instantaneously find another partner with whom to to produce. Measure consistency is a technical condition imposed in a continuum economy to rule out one-to-one matches between sets of unequal measure.[10]

Once the match has occurred, each (A, B_i)-pair signs a contract, described below, and is locked in for the duration of the production period.

The supplier market outcome will have a particularly simple characterization. Measure consistency implies that some A's must remain unmatched and produce the numeraire good, since they are the long side of the market. Any two A's that participate in the production of the i-goods must get the same payoff $\hat{\alpha}$, regardless of which industry i they are in: if not, the worse treated A could offer the better treated A's partner slightly more surplus and still gain for herself (she could do so because she is just as productive in making the i-good as the better-treated A), which would violate stability.

Moreover, in equilibrium only the A's with lower opportunity costs (those with $\alpha < \hat{\alpha}$) will be matched with B_i's, while more productive A's ($\alpha > \hat{\alpha}$) will produce the numeraire good. If this were not true, any unmatched A with an opportunity cost below $\hat{\alpha}$ would offer some matched A's partner more than she is currently receiving, again violating stability. Equilibrium surplus of the A's must therefore satisfy the condition[11]

$$F(\hat{\alpha}) = n_B. \tag{2}$$

The equilibrium A payoff $\hat{\alpha}$ acts much like a Walrasian price for A services (but note its properties are derived from the definition of equilibrium, not assumed). As discussed in Section 2.3.3 below, $\hat{\alpha}$ captures the terms of trade prevailing in the supplier market, and will play a crucial role in organizational choices.

2.3 Individual enterprises

Our basic model of the firm shares two key features with the analysis of Hart and Holmström (2010). First, managers in each firm enjoy monetary profits as well as private non-transferable benefits associated with the operations of the firm; different managers view these operations differently and so their private benefits come into conflict. For instance, a standardized production line could be convenient for the sectorally-mobile A suppliers, but may not fit the specific design

[10]For instance, [0,0.1] can be mapped one-to-one onto [0,1], and measure consistency rules this out; measure consistency is trivially satisfied in finite matching models. Conditions guaranteeing the existence of stable matches are fairly weak and are satisfied by our model; further discussion can be found in the references in footnote 9.

[11]This condition requires that all B_i firms obtain a positive surplus after paying $\hat{\alpha}$ to their A suppliers. Appendix A.1 discusses sufficient conditions for full employment in factor markets.

needs of the B_i suppliers.[12] Second, some firm decisions (e.g., choosing production techniques, deciding on marketing campaigns, etc.) cannot be agreed upon contractually; only the right to make them can be transferred through transfers of ownership.

Consider an enterprise composed of an A and a B_i. For each supplier, a non-contractible decision is rendered indicating the way in which production is to be carried out. Denote the A and B_i decisions respectively by $a \in [0,1]$ and $b_i \in [0,1]$. For efficient production, it does not matter which particular decisions are chosen, as long as there is coordination between the two suppliers. More precisely, the enterprise will succeed with probability $1-(a-b_i)^2$, in which case it generates a unit of output; otherwise it fails, yielding 0. Output realizations are independent across firms.

Overseeing each supplier firm is a risk-neutral manager, who bears a private cost of the decision made in his unit. The A manager's utility is $y_A - (1-a)^2$, while the B_i manager's utility is $y_i - b_i^2$, where y_A, y_i are their respective incomes; thus the managers disagree about the direction in which decisions should go. Since the primary function of managers is to implement decisions and convince their units to agree, they continue to bear the cost of decisions even if they don't make them. We also assume limited liability: $y_A, y_i \geq 0$.

While decisions themselves are not contractible, the *right to make them* can be contractually reassigned. Revenues generated by the firm are also contractible, which allows monetary incentives to be created. We assume that the managers have zero cash endowments with which to make side payments, and so are restricted to writing contracts that share revenue contingently on output.

Managers can remain *non-integrated*, in which case they retain control over their respective decisions. Alternatively, they can *integrate* by contractually ceding control over a and b_i to a headquarters (HQ), via a sale of assets. HQ utility is y_H: he is motivated only by monetary considerations, incurring no direct costs or benefits from the decisions a and b_i.

In the supplier market that opens before production, B_i managers match with A managers, at which time they sign contracts specifying a *sharing rule* and an *ownership structure.* The sharing rule is characterized by $s \in [0,1]$, the the share of managerial revenue accruing to manager A, when there is success, with $1-s$ going to B_i. In case of failure, each receives zero. The ownership structure is simply *integration* or *non-integration.*

For each match (A,B_i), total revenue in case of success is given by the product market price, p_i, which is taken as given by firms when they take their decisions and sign their contracts. After contract signing, managers (or HQ) make their production decisions, output is realized, product is sold, and revenue shares are distributed.

[12] Tensions about how a product should be produced could also arise because of the different types of expertise of the suppliers (e.g., engineering and marketing departments). Other papers (e.g., Van den Steen, 2005) have stressed the importance for organization design of conflicting private benefits stemming from different corporate cultures and/or managerial vision.

2.3.1 Integration

As with the other markets in our model, the market for HQ's is competitive. They are elastically supplied at (opportunity) cost $h < \frac{1}{2}$ (the restriction ensures that integration is not too costly to be viable). Since HQ does not care directly about a and b_i, he must receive financial compensation to cover this cost. Recall that the managers have no cash endowments, so this compensation must take the form of a contingent share of the revenue, which we denote η: HQ receives ηp_i in case of success, and 0 in case of failure. HQ's expected payoff is therefore $\eta(1-(a-b_i)^2)p_i$, which he maximizes by setting $a = b_i$. (Thus, in a competitive equilibrium, HQ's share is $\eta = h/p_i$). Among the choices in which $a = b_i$, the Pareto-dominant one is that in which $a = b_i = 1/2$, and we assume HQ implements this choice. The private cost to each supplier manager is then $\frac{1}{4}$, and the payoffs to the A and B managers are

$$u_A^I(s, p_i) = s(1-\eta)p_i - \frac{1}{4} \tag{3}$$

$$u_{B_i}^I(s, p_i) = (1-s)(1-\eta)p_i - \frac{1}{4}. \tag{4}$$

Total managerial ($A + B_i$) welfare under integration is

$$W_i^I(p_i) = p_i - h - \frac{1}{2} \tag{5}$$

and is fully transferable via adjustments in s, because production decisions and therefore profit are unaffected by the managers' shares.

2.3.2 Non-integration

Under non-integration, each manager retains control of his activity. The decisions chosen are the (unique) Nash equilibrium of the game with payoffs $(1-(a-b_i)^2)\,sp_i - (1-a)^2$ for A and $(1-(a-b_i)^2)\,(1-s)p_i - b_i^2$ for B, which are

$$\left(a^N, b_i^N\right) = \left(\frac{1+(1-s)p_i}{1+p_i}, \frac{(1-s)p_i}{1+p_i}\right).$$

The resulting expected output is

$$Q_i^N(p_i) = 1 - \frac{1}{(1+p_i)^2}, \tag{6}$$

which increases with the price: as p_i becomes larger, the revenue motive becomes more important for managers and this pushes them to better coordinate. Indeed, $Q_i^N(0) = 0$, and $Q_i^N(p_i)$ approaches 1 as p_i becomes unbounded.

The equilibrium payoffs under non-integration are given by

$$u_A^N(s,p_i) = Q_i^N(p_i)sp_i - s^2\left(\frac{p_i}{1+p_i}\right)^2 \tag{7}$$

$$u_{B_i}^N(s,p_i) = Q_i^N(p_i)(1-s)p_i - (1-s)^2\left(\frac{p_i}{1+p_i}\right)^2. \tag{8}$$

Observe that each manager's payoff is an increasing function of his share as well as of the product price. Varying s, one obtains the Pareto frontier for non-integration. It is straightforward to verify that this frontier is strictly concave and that the total managerial payoff

$$W_i^N(s,p_i) \equiv Q_i^N(p_i)p_i - (s^2+(1-s)^2)\left(\frac{p_i}{1+p_i}\right)^2 \tag{9}$$

is maximized at $s = 1/2$. It is minimized at $s = 0$ and $s = 1$, where we have

$$W_i^N(0,p_i) = W_i^N(1,p_i) = \frac{p_i^2}{1+p_i}. \tag{10}$$

2.3.3 Choice of organizational form

To determine the choice of organization that the managers make, we must combine the integration and non-integration frontiers to derive their overall Pareto frontier.

The relative positions of the two frontiers depend on the price p_i. When it is low, non-integration dominates integration: to verify this, notice from (3)-(4) and (7)-(8) that when p_i is near zero, integration yields negative payoffs, while non-integration payoffs are bounded below by 0. As p increases to $\underline{p} \equiv \frac{1+2h}{1-2h}$, the two frontiers coincide *at the axes* (i.e. where $s = 0$ or 1: $W^N(0,\underline{p}) = W^I(\underline{p})$), and integration dominates along the axes when $p > \underline{p}$. On the other hand, when $s = 1/2$, non-integration dominates integration at every price, i.e., $W^N(\frac{1}{2},p_i) > W^I(p_i)$ for all p_i. Thus, the two frontiers will "overlap" on an the interval of prices $(\underline{p},\infty]$.

The significance of this overlap, as depicted in Figure 1, which illustrates the frontiers for a price $p_i > \underline{p}$, is that neither integration nor non-integration dominates globally. Rather, the organization that managers choose depend on where they locate along the Pareto frontier, i.e., on the terms of trade in the supplier market (the 45° line corresponds to $s = 1/2$). Thus ownership structure will be the outcome of an interaction between the supplier and product markets.

Recall from Section 2.2 that, for the factor market to be in equilibrium, all A's matched with a B_i must receive a surplus equal to $\hat{\alpha}$. To facilitate the characterization of equilibrium, we make the following restriction on the surplus of A's when matched with a B_i:

Assumption 1 *The distribution $F(\cdot)$ satisfies $\hat{\alpha} \equiv F^{-1}(n_B) \leq \frac{1}{2}W^N\left(\frac{1}{2},\underline{p}\right)$.*

Since $W^N\left(\frac{1}{2},p_i\right)$ is increasing in p_i, this assumption ensures that A's get less than half of

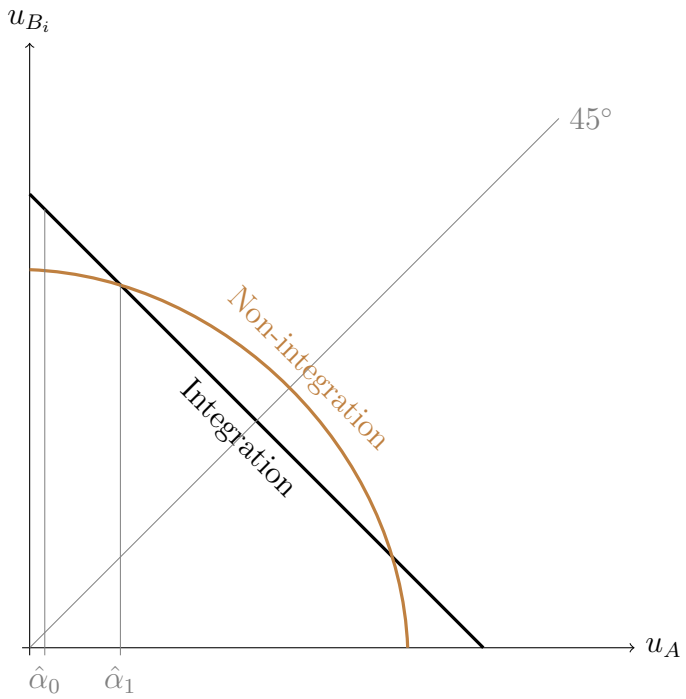

Figure 1: Frontiers

the surplus from producing good i for any price at which integration is not dominated as an organizational choice (i.e., in Figure 1, the surplus allocation will lie above the 45°-line whenever p_i is above some threshold that is less than $\underline{p}$).

From (7), there is a unique value of the output share, $s(\hat{\alpha}, p_i)$ that generates a payoff equal to $\hat{\alpha}$ for A under non-integration; it is easy to verify that $s(\hat{\alpha}, p_i)$ is increasing in $\hat{\alpha}$ and decreasing in p_i. If the payoff that remains for B_i under non-integration ($W^N(s(\hat{\alpha}, p_i), p_i) - \hat{\alpha}$) exceeds the corresponding payoff under integration ($W^I(p_i) - \hat{\alpha}$), managers will choose non-integration. If instead $W^N(s(\hat{\alpha}, p_i), p_i) < W^I(p_i)$, they will choose integration.

It can be shown that under Assumption 1 there is one price, $\underline{p}(\hat{\alpha})$, for which the total surpluses from integration and non-integration are equal. Integration is chosen when $p_i > \underline{p}(\hat{\alpha})$. In Figure 1, B_i is indifferent between the two ownership structures if A gets $\hat{\alpha}_1$, but strictly prefers integration if A gets $\hat{\alpha}_0$. Suppose that the product price p_i was equal to $\underline{p}(\hat{\alpha}_1)$ and $\hat{\alpha}$ was equal to $\hat{\alpha}_1$. If $\hat{\alpha}$ fell to $\hat{\alpha}_0$ while p_i remained unchanged, then $\underline{p}(\hat{\alpha}_0) < p_i$, so integration would now be strictly preferred at p_i. It follows that, for values of $\hat{\alpha}$ that correspond to frontier points above the 45°-line, the set of prices at which integration is preferred increases (in the set inclusion sense) when $\hat{\alpha}$ falls.

The above discussion is summarized by (proof in Appendix):

Lemma 1 *Under Assumption 1,*

(i) There is one solution $\underline{p}(\hat{\alpha})$ *to the equation*

$$W^N(s(\hat{\alpha}, p_i), p_i) = W^I(p_i);$$

Integration is chosen if $p_i > \underline{p}(\hat{\alpha})$ *and non-integration if* $p_i < \underline{p}(\hat{\alpha})$.

(ii) $\underline{p}(\hat{\alpha})$ *is increasing.*

Thus, when A's share is not too large, a fall in $\hat{\alpha}$ becomes a force for integration.[13]

To sum up, managers organizational preferences depend on product prices. At low prices, despite integration's better output performance, revenues are still small enough that managers are more concerned with their private benefits and so remain non-integrated. At higher prices, however, B_i managers know that revenue is large enough that under non-integration they would be tempted to follow the A managers, who obtain little income from the firm and therefore would choose a close to 1 (s is close to zero when the A's share of surplus is small). B_i's therefore bear high private costs under non-integration, and prefer instead the relatively high revenue and moderate cost that they incur under integration.

2.4 Industry equilibrium and the OAS curve

Equilibrium in each industry comprises a general equilibrium of the supplier and product markets. In product market i, the large number of firms implies that with probability one, the supply is equal to the expected value of output given p_i; equilibrium requires that this price adjust so that the demand equals the supply.

To derive industry supply, suppose that a fraction θ_i of firms in industry i are integrated, while the remaining $1 - \theta_i$ non-integrated. Total supply at price p_i is then (recall n_i is the measure of B_i suppliers)

$$S(p_i, \theta_i) = n_i\theta_i + n_i(1 - \theta_i)Q_i^N(p_i). \tag{11}$$

Now θ_i itself is a correspondence that depends on the product price p_i and the terms of trade between suppliers $\hat{\alpha}$. When $p_i < \underline{p}(\hat{\alpha})$, $\theta_i = 0$ and total supply is just the output when all n_i firms choose non-integration, which is increasing in p_i.[14] At $p_i = \underline{p}(\hat{\alpha})$, θ_i can vary between 0 and 1, since managers are indifferent between the two forms of organization. Finally, for all $p_i > \underline{p}(\hat{\alpha})$, $\theta_i = 1$ and output is n_i. Write $S(p_i, \hat{\alpha})$ for the supply correspondence, the Organizationally

[13] Relaxing Assumption 1 would not change the main results of our analysis, but would enrich the set of comparative statics: if $\hat{\alpha}$ were to exceed the critical threshold identified in Assumption 1, declines in $\hat{\alpha}$ would first push toward *non*-integration (starting *below* the 45°-line), then toward integration (once the 45°-line has been crossed).

[14] If p_i is very low, then A's would not be able to obtain $\hat{\alpha}$ in partnership with a B_i; in this case, full employment of the B_i's could not be part of an equilibrium. The demand restrictions discussed in the Appendix rule out the possibility that such low prices would obtain in equilibrium, so we ignore prices in this range in what follows.

Augmented Supply (OAS) curve. The supply curve for a typical industry i is represented in Figure 2. The dotted curve corresponds to what the industry supply would be if no firms were integrated.

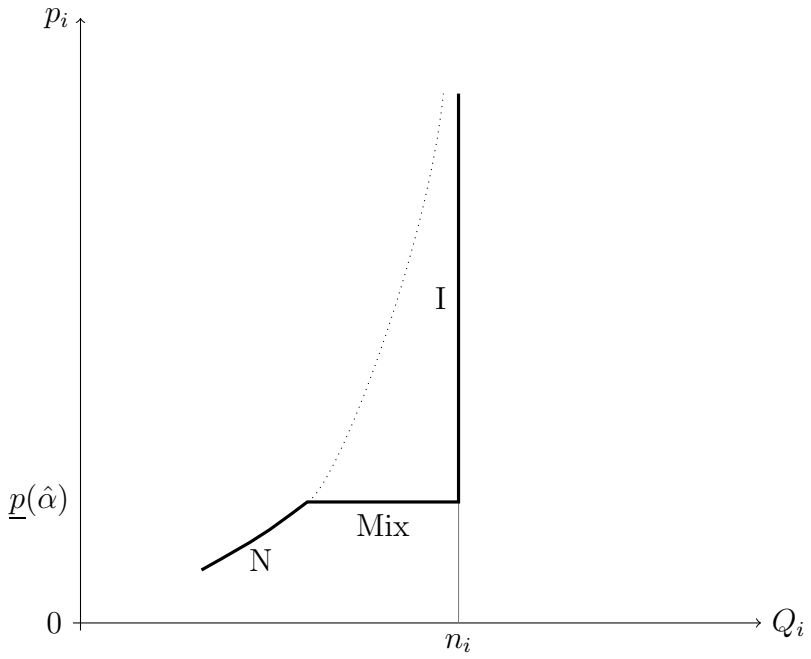

Figure 2: Organizationally Augmented Supply

Given an equilibrium return of A equal to $\hat{\alpha}$, an equilibrium in the product market of good i is a price and a quantity that equate supply and demand: $D_i(p_i) = S(p_i, \hat{\alpha})$. There are three distinct types of industry equilibria, depending on where along the supply curve the equilibrium price occurs: those in which firms integrate (I), the mixed equilibria at the price $\underline{p}(\hat{\alpha})$ in which there is coexistence of integrated and non-integrated firms (M), and a pure non-integration equilibrium (N).

Finally, the economy is in equilibrium when each industry is in equilibrium relative to the (common) A-surplus $\hat{\alpha}$. Our assumptions ensure that such an equilibrium always exists.

There are two comparative statics of the industry supply that are worth noting for our analysis of trade liberalization in the next two sections. First, from Lemma 1, the "integration region" (the vertical segment labeled I in the Figure, consisting of the price range $\left(\underline{p}(\hat{\alpha}), \infty\right)$, expands as $\hat{\alpha}$ falls and contracts as $\hat{\alpha}$ rises. This implies that countries with a lower $\hat{\alpha}$ will also be characterized by a broader integration region. Second, an increase in n_i leads the OAS curve for good i to shift to the right. This implies that if a country has a larger measure of B_i firms, its supply curve in that sector will be positioned to the right of the other country's supply curve.

In the analysis presented in this section, we have focused on equilibria in product and factor markets in a closed economy. This is equivalent to a scenario in which there are prohibitive

barriers to trade in goods and factor mobility between Home and Foreign. In the next two sections, we will examine the impact of the successive removal of barriers to commodity trade and factor mobility on organizational choices. This sequencing will allow us to separate the effects of the liberalization of goods markets from those induced by factor market liberalization; it also reflects the experience of many regional trade agreements, in which policies aimed at improving factor mobility have followed the removal of tariff and non-tariff barriers to commodity trade. An example is provided by the process of European integration: free trade in goods among EU member countries was achieved in 1968, with the the creation of the EEC customs union; free mobility of capital and labor was only introduced in 1992, with the establishment of the Single European Market.[15]

We will focus on the organizational changes triggered by the *full* integration of product and factor markets. Our analysis can be readily extended to the case of positive — but not prohibitive — trade barriers, to examine the effects of incomplete trade liberalization.[16]

3 Liberalization of Product Markets

Let us assume that Home and Foreign have identical demands and identical technologies in the production of all goods $i = 1, \ldots, I$. Trade is the result of endowment differences between the two countries, i.e., differences in the measure of B_i suppliers. In particular, we order the goods so that $n_i < n_i^*$ for $i \in \{1, \ldots, m\}$ and $n_i > n_i^*$ for $i \in \{m+1, \ldots, I\}$. Ours is thus a standard specific-factor trade model, in which A's are the mobile factor and B_i's represent the specific factors. The main difference with the traditional formulation of this model (e.g., Mussa, 1974) is that all factors are supplier firms run by managers, who care about non-pecuniary effects of production decisions.

Under free trade, world markets for goods $i \in \{1, \ldots, m\}$ clear when

$$M_i(p_i^w, \hat{\alpha}) = X_i^*(p_i^w, \hat{\alpha}^*), \tag{12}$$

where p_i^w is the free trade equilibrium price, $M_i(p_i^w, \hat{\alpha}) = D_i(p_i^w) - S(p_i^w, \hat{\alpha})$ denotes Home imports, and $X_i^*(p_i^w, \hat{\alpha}^*) = S^*(p_i^w, \hat{\alpha}^*) - D^*(p_i^w)$ denotes Foreign exports. Symmetrically, the market-clearing condition for goods $i \in \{1+m, \ldots, I\}$ can be written as

$$M_i^*(p_i^w, \hat{\alpha}^*) = X_i(p_i^w, \hat{\alpha}). \tag{13}$$

[15]Similar patterns can be observed at the multilateral level: since the creation of the General Agreement on Tariffs and Trade (GATT) in 1947, successive rounds of multilateral trade negotiation have led to the progressive liberalization of product markets; the removal of barriers to factor mobility has only recently become part of the agenda (e.g., the GATS and TRIMs agreements negotiated during the Uruguay Round).

[16]See Alfaro *et al.* (2010) for an analysis of the effects of tariff changes on ownership structures.

The Home country's trade balance condition requires

$$\sum_{i=1}^{m} p_i^w M_i(p_i^w) - \sum_{i=m+1}^{I} p_i^w X_i(p_i^w) + R_0 = 0, \tag{14}$$

where R_0 denotes the net transfer of the numeraire good to settle the trade balance. A similar condition must hold for the Foreign country.

To isolate the effects of product market liberalization on organizational choices, we shall focus here on trading economies with the same conditions in the supplier markets (i.e., $\hat{\alpha} = \hat{\alpha}^*$). The role of factor market differences is considered in Section 4 below.

Figure 3 depicts the autarky and free trade equilibria in a product markets $i \in \{1, \ldots, m\}$, in which Home imports from Foreign. Consider first the left panel of the figure, which depicts the Home country's market. The intersection between the demand curve, $D_i = D(p_i)$, and the supply curve, $S_i = S(p_i, \hat{\alpha})$, determines the equilibrium autarky price, which is denoted by $\hat{p}_i$. The graph on the right panel of Figure 3 depicts Foreign country's market. Notice that, since Foreign has a larger measure of B_i firms, its supply curve is positioned to the right of that of the Home country. Given the assumption of identical demands, this implies a lower autarky price, i.e., $\hat{p}_i^* < \hat{p}_i$.

In the middle panel of Figure 3, we have drawn export supply and import demand functions in the world market for good i. From condition (12) above, we can derive the equilibrium price under free trade, p_i^w. The move from autarky to free trade results in a price fall from $\hat{p}_i$ to p_i^w in Home, and a price increase from $\hat{p}_i^*$ to p_i^w in Foreign.

Through its effect on product prices, the removal of trade barriers can lead to changes in firms' ownership structures. To see this, consider again Figure 3, which depicts the case of two countries in which terms of trade between suppliers are the same ($\hat{\alpha} = \hat{\alpha}^*$), implying that the range of prices for which managers choose integration is also the same. In this example, the price changes triggered by trade liberalization lead firms in Foreign to vertically integrate: in autarky, the price was too low to make integration appealing ($\hat{p}_i^* < \underline{p}(\hat{\alpha^*})$); the price increase triggered by trade liberalization leads managers to switch to integration ($p_i^w > \underline{p}(\hat{\alpha^*})$). We can thus state the following:

Proposition 1 *Consider two countries with the same terms of trade in supplier markets ($\hat{\alpha} = \hat{\alpha}^*$) moving from autarky to free trade. If $\underline{p}(\hat{\alpha}) = \underline{p}(\hat{\alpha^*}) \in (\hat{p}_i, \hat{p}_i^*)$, the price changes triggered by trade liberalization will induce changes in ownership structures.*

PROOF: $\hat{\alpha} = \hat{\alpha}^*$ implies that in each country managers prefer integration (non-integration) if the domestic product price is above (below) the threshold $\underline{p}(\hat{\alpha}) = \underline{p}(\hat{\alpha^*})$. Following trade liberalization, domestic prices in each industry i will change from their autarky levels ($\hat{p}_i$, $\hat{p}_i^*$) to a common free trade price (p_i^w) in between them. If $\underline{p}(\hat{\alpha}) \in (\hat{p}_i, \hat{p}_i^*)$, movements from autarky to free trade must cause prices to cross $\underline{p}(\hat{\alpha})$ for at least one country, leading to changes in ownership structures. □

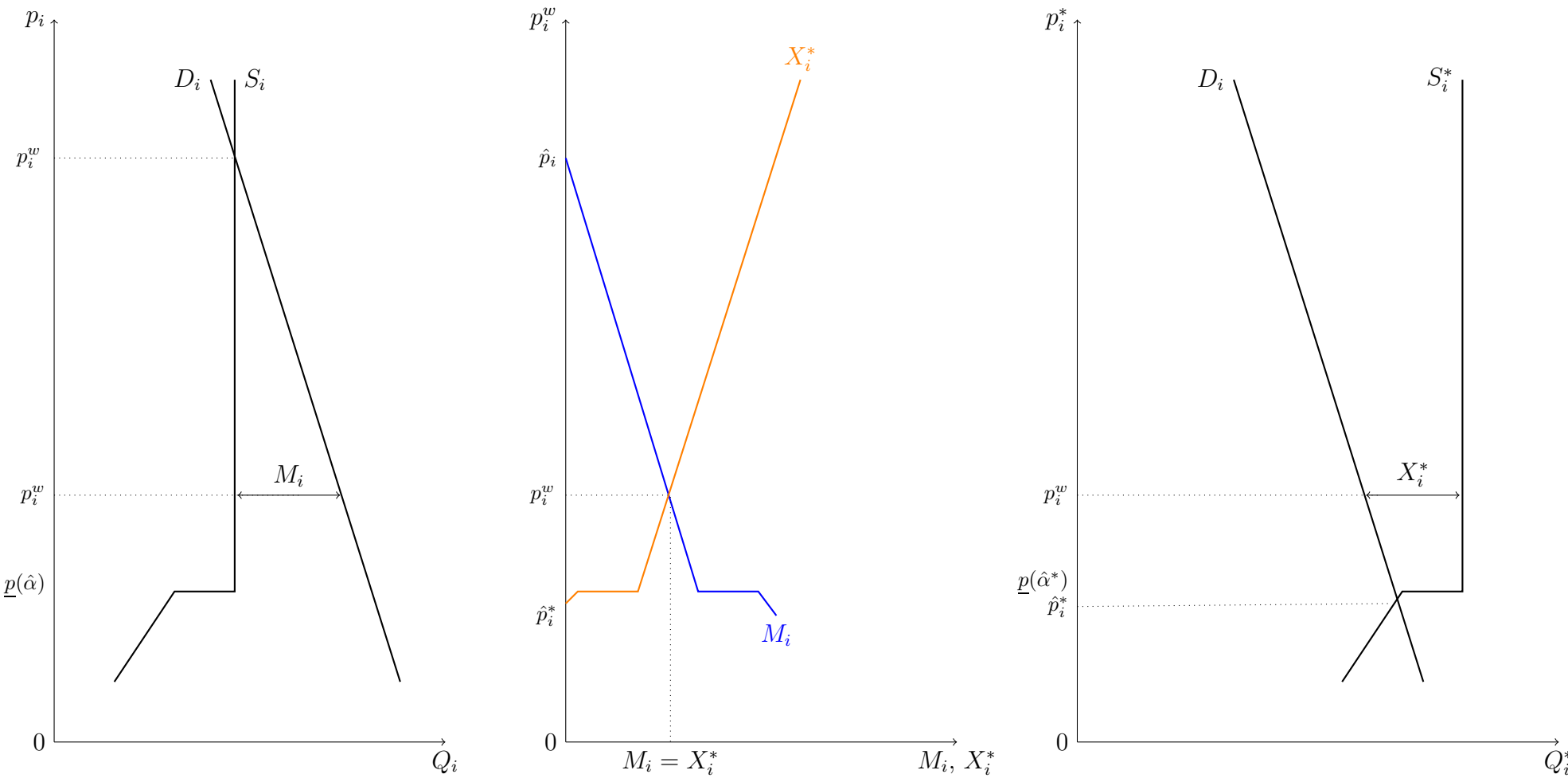

Figure 3: Liberalization of product markets

Proposition 1 states that, even if suppliers do not relocate across countries (no "offshoring"), the removal of trade barriers will lead to mergers or divestitures if autarky prices are "different enough", i.e., do not lie in a region of prices for which the same organization prevails.

If autarky prices are instead very similar, then trade liberalization will not trigger changes in ownership structures. In fact, if both autarky prices lie in the integration range $(\underline{p}(\hat{\alpha}), \infty)$, so will p_i^w and thus there will be no ownership change. The same is true if autarky prices both lie in the non-integration range $(0, \underline{p}(\hat{\alpha}))$. Thus, the condition $\underline{p}(\hat{\alpha}) = \underline{p}(\hat{\alpha^*}) \in (\hat{p}_i, \hat{p}_i^*)$ is sufficient and "almost necessary" for restructuring to occur.[17]

Notice that, even when ownership structures do not change as a result of trade liberalization, we will expect changes in some organizational variables, such as the "power" of compensation schemes (here represented by the size of the profit shares $1-s$ and s), which changes continuously with prices. Indeed, as noted in the discussion leading up to Lemma 1, A's profit share s declines for a non-integrated firm when the industry price rises. In fact, it is easy to show that the same comparative static results holds for integrated firms. Thus, following product market liberalization, if the ownership structure does not change in industry i, the profit shares accruing to B_i managers should increase if i is an export industry and fall if i is an import-competing industry. The reason is that free trade leads prices to rise in the export industries and fall in the import industries. Of course, profit shares will also change when there are changes in ownership structure.

In light of these results, it is instructive to compare the findings in Breinlich (2008) and Guadalupe and Wulf (2010), which study the organizational effects of the Canada-U.S. Free Trade Agreement (CUSFTA). For Canada, which as the smaller member country would be expected to have experienced the largest price changes, Breinlich documents a significant increase in the level of merger activity following CUSFTA; in the U.S., the corresponding effects were much smaller. Guadalupe and Wulf (2010), in their sample of U.S. firms, nevertheless find considerable evidence of reorganizations on a smaller scale, such as changes in reporting structures and in the type of executive compensation schemes. Since the U.S. would have experienced smaller price changes than Canada in the wake of CUSFTA, this is what our model would lead us to expect.[18]

4 Factor Market Liberalization

The analysis carried out in the previous section focused on the organizational responses to price changes triggered by the removal of barriers in product markets, in a setting in which input

[17]The omitted case is when $\underline{p}(\hat{\alpha})$ happens to coincide with one of the autarky prices. In this case, firms in one country will be in "Mix" region in autarky and only some of them will restructure after liberalization.

[18]For example, our model would predict smaller price changes and less dramatic restructuring in Home, if this were endowed with a larger measure of B_i suppliers ($n_B > n_B^*$) and a proportionally larger population.

suppliers did not move across countries. In this section, we assume instead that product markets are fully liberalized (so that product prices are determined by (12)-(13) above) and focus on the organizational effects of factor market liberalization. It is worth noting that "factor mobility" here means only that the A's and/or B_i's are able to move across borders; B_i's remain immobile across sectors.

4.1 Organizational changes

Consider first trading economies with similar factor markets. This is the scenario depicted in Figure 3, in which the range at which integration occurs is the same in the two countries, i.e., $\hat{\alpha} = \hat{\alpha}^*$. This implies that in both countries integration will be the prevailing form of firm organization in industry i if the price exceeds $\underline{p}(\hat{\alpha})$, while non-integration will be chosen at lower prices. Since under free trade $p_i = p_i^* = p_i^w$, in this case, factor market integration will have no impact on organizational choices. Therefore, once product markets are integrated, we should expect factor market liberalization to have little effect on organizational choices in trading economies with similar factor markets (e.g., France and Germany, or the United States and Europe).

Consider next a scenario in which Home and Foreign differ in terms of their factor markets (e.g., West and East Europe, or the United States and China). For simplicity, assume that the total endowment of B firms is the same in the two countries (i.e., $n_B = n_B^*$), but the Home country's productivity distribution of A suppliers in the numeraire sector strictly stochastically dominates the corresponding distribution for the Foreign country, i.e., $F(\alpha) < F^*(\alpha)$, whenever F and F^* are not both 0 or 1.

The equilibrium condition in the integrated supplier market can be written as

$$F(\alpha^w) + F^*(\alpha^w) = n_B + n_B^*, \tag{15}$$

where α^w is the equilibrium return for all A's matched with B's. Hence factor liberalization leads to the *convergence in the terms of trade between suppliers* across countries. In turn, this implies that the range of prices for which integration will be chosen will also be the same for the two countries.

Figure 4 can be used to illustrate factor market equilibria with and without factor mobility. In the no-mobility case, A suppliers in the Home country obtain a higher surplus when matched with B's than do matched A's in the Foreign country, i.e., $\hat{\alpha} > \hat{\alpha}^*$. Following the removal of barriers to factor mobility, the integrated matching market will clear when condition (15) above is satisfied. The equilibrium return to all matched A's will be given by α^w, with $\hat{\alpha}^* < \alpha^w < \hat{\alpha}$.

Notice that convergence in factor prices can be achieved through (i) the relocation of some A suppliers from Foreign to Home, (ii) the relocation of some B suppliers from Home to Foreign, or a combination of both. In Figure 4, channel (i) is captured by the distribution function

$\frac{1}{2}(F(\alpha) + F^*(\alpha))$, while channel (ii) is captured by shifts in n_B and n_B^*.

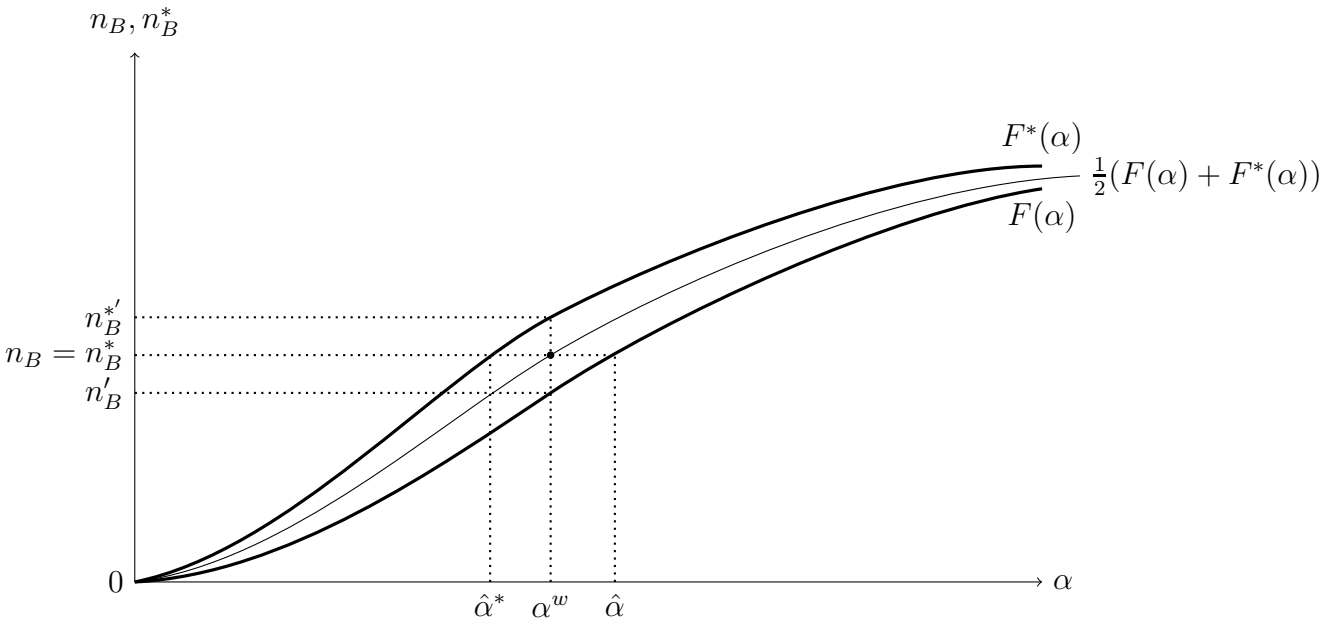

Figure 4: Pre- and post-liberalization equilibria in the factor markets

In Section 2.4, we have shown that an increase in $\hat{\alpha}$ leads to an decrease in the range of prices for which integration is chosen (Lemma 1). It follows that before factor market liberalization, in every sector i, the range of prices for which integration is chosen is smaller in Home country than in Foreign, i.e., $\underline{p}(\hat{\alpha}) > \underline{p}(\hat{\alpha}^*)$.

Figure 5 shows the effects of factor market integration on organizational choices in a sector $i \in \{1, \ldots, m\}$ in which the Home country is an importer. Before liberalization, $\underline{p}(\hat{\alpha}^*) < p_i^w < \underline{p}(\hat{\alpha})$, so firms are non-integrated in Home and integrated in Foreign. Following the removal of barriers to factor mobility, terms of trade in supplier markets converge to α^w, implying that the "integration range" expands in Home and is reduced in Foreign. As a result, world supply contracts and the world price increases from p_i^w to $p_i^{w'}$ (see Proposition 3 in the next subsection). Notice that foreign firms switch from integration to non-integration: before liberalization, they are integrated since $p_i^w > \underline{p}(\hat{\alpha}^*)$; after liberalization, they are non-integrated since $p_i^{w'} < \underline{p}(\alpha^w)$. In this example, no change in ownership structures occurs in Home: since $p_i^w < \underline{p}(\hat{\alpha})$ and $p_i^{w'} < \underline{p}(\alpha^w)$, firms are non-integrated both before and after liberalization.

Proposition 2 *Consider two countries that freely trade with each other, but have different terms of trade in supplier markets ($\hat{\alpha} > \hat{\alpha}^*$). If $p_i^w \in (\underline{p}(\hat{\alpha}^*), \underline{p}(\hat{\alpha}))$, factor market liberalization will induce changes in ownership structures. If the restructuring occurs at Home, it entails a move to integration; if it occurs in Foreign, the move is to non-integration.*

PROOF: $\hat{\alpha} > \hat{\alpha}^*$ implies that $\underline{p}(\hat{\alpha}) > \underline{p}(\hat{\alpha}^*)$. As a result of factor market liberalization, terms of trade in supplier markets converge to α^w in between $\hat{\alpha}$ and $\hat{\alpha}^*$ and the integration range becomes $\left(\underline{p}(\alpha^w), \infty\right)$

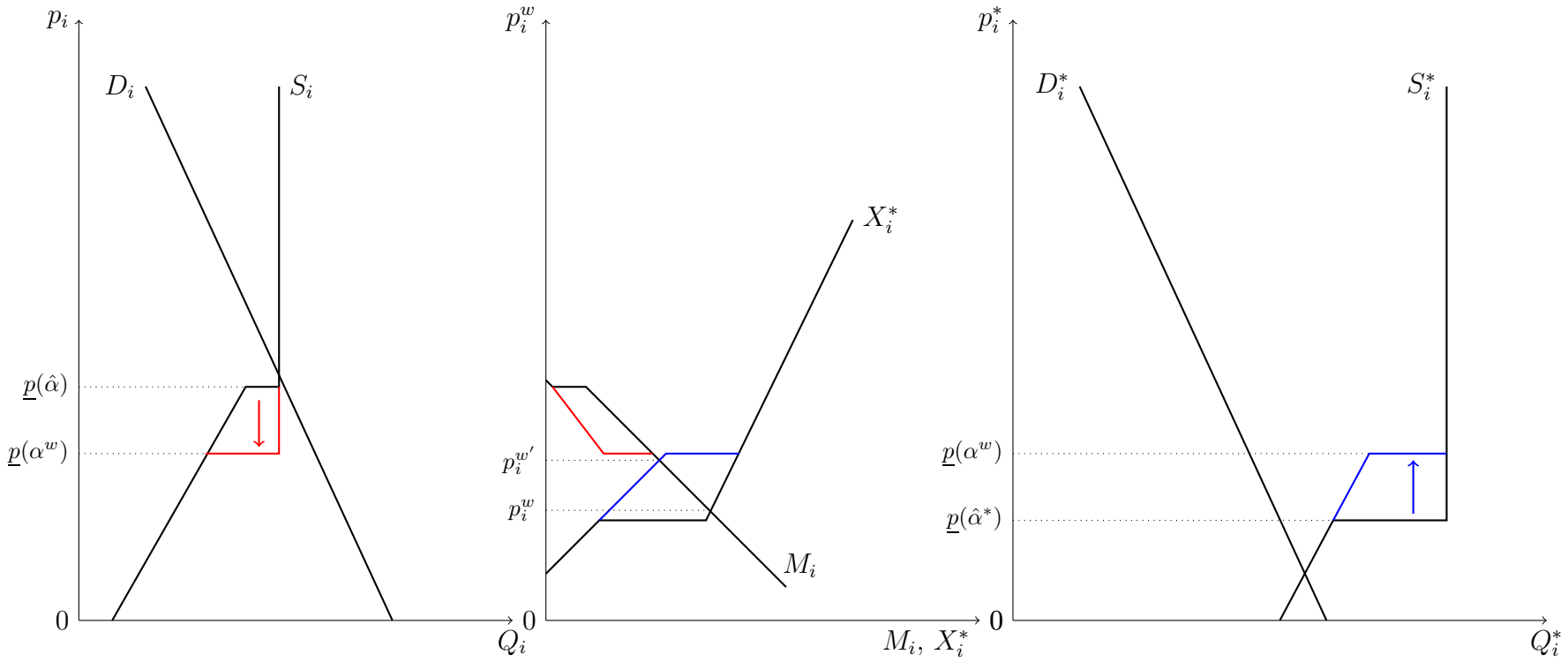

Figure 5: Liberalization of factor markets

in both countries. Since managers face the same product prices and the same terms of trade in both countries, the same organization must prevail in both countries.

If $p_i^w \in (\underline{p}(\hat{\alpha}^*), \underline{p}(\hat{\alpha}))$ firms are initially integrated at Home and non-integrated in Foreign. To converge to a common organization following factor liberalization, ownership structures must thus change in one country. If $p_i^{w'} < \underline{p}(\alpha^w)$, non-integration prevails in both countries, implying divestitures in Foreign. If instead $p_i^{w'} > \underline{p}(\alpha^w)$, integration prevails, implying mergers in Home.

□

Factor market liberalization will not trigger changes in ownership structures if the initial world price is below $\underline{p}(\hat{\alpha}^*)$ or above $\underline{p}(\hat{\alpha})$. Consider first the case in which $p_i^w < \underline{p}(\hat{\alpha}^*)$. Then $p_i^w < \underline{p}(\hat{\alpha})$ as well, and firms in both countries are initially non-integrated. The only way there could be restructuring (i.e., some movement toward integration) is if the post-liberalization price $p_i^{w'}$ were to exceed $\underline{p}(\alpha^w)$ and therefore p_i^w. But this cannot happen: since integration generates more output per firm than non-integration, world supply would then be greater than it was before liberalization, and the we would then have $p_i^{w'} < p_i^w$, a contradiction. The reasoning is similar for the case in which $p_i^w > \underline{p}(\hat{\alpha})$ and firms in both countries are initially integrated. The condition stated in Proposition 2 is thus sufficient and "almost necessary" for restructuring to occur following factor market liberalization.[19]

It should be stressed that, in contrast to the removal of barriers to trade in goods — which generates sector-specific effects on organization by affecting product prices — the removal of barriers between factor markets affects *all* sectors in the economy, by changing the terms of trade in supplier markets. Before liberalization, matched A suppliers obtain a surplus $\underline{p}(\hat{\alpha})$ ($\underline{p}(\hat{\alpha}^*)$) in all sectors in Home (Foreign); after liberalization, their surplus becomes $\underline{p}(\alpha^w)$ in all sectors in both Home and Foreign.

Notice also that the organizational changes triggered by factor market liberalization are *independent* of the specific patterns of factor mobility, i.e., different factor movements have the same impact on the terms of trade prevailing in supplier markets and on organizational choices.[20]

Proposition 2 suggests that countries that have already experienced organizational changes as a result of the elimination of barriers to trade in goods (e.g., EU member countries after the Customs Union formation in 1968) are likely to undergo further restructuring as a result of the removal of barriers to factor mobility (e.g., increased M&A activities across EU members, following the establishment of the Single Market, as documented by the study of the European Commission, 1996). Such *reorganizational* (as distinct from relocational) activities[21] will be

[19] As for the case of product market liberalization, we omit the boundary cases in which p_i^w lies in the "Mix region" for one of the countries (see footnote 17). Also observe that, if $p_i^{w'}$ happens to coincide with the threshold $\underline{p}(\alpha^w)$, the restructuring will only be partial but still in the direction stated in the Proposition.

[20] To verify this, compare the case in which only the sectorally-mobile factor of production (A suppliers) moves across countries with the case in which only the specific factors (B_i suppliers) relocate. In the first case, A firms move from Foreign to Home until all matched A's obtain the same return α^w; in the second case, B_i suppliers move from Home to Foreign, until the surplus they have to pay to A suppliers is equal to α^w in both countries.

[21] There is nothing in the model to prevent "re-partnering" after liberalization: reorganization may involve a

more intense between countries with large productivity differences (e.g., Germany and Romania) rather than among those with similar productivity levels (e.g., Germany and France).

4.2 Product prices and quality

The analysis carried out above shows that factor liberalization can lead to changes in firms' ownership structure, by affecting the division of surplus between managers of different supplier firms. In the remaining of this section, we will examine the consequences of these changes from the point of view of market performance.

Not only do prices affect organization design, but also organizational choices affect prices. This is a simple consequence of the fact that integration generates more output than non-integration at any price level. So a switch toward integration leads to an increase in the quantity supplied, while the opposite is true for a switch to non-integration.

As shown in Figure 5 above, the liberalization of factor markets can trigger changes in ownership structure which lead to a fall in world supply and to a *price increase*. The increase is the result of outsourcing in the Foreign country. This will occur if p_i^w is initially above $\underline{p}(\hat{\alpha}^*)$, but below $\underline{p}(\alpha^w)$; then, following liberalization, Foreign's integration range shrinks, its supply falls as its firms divest; meanwhile, Home firms remain non-integrated since $\underline{p}(\hat{\alpha}) > \underline{p}(\alpha^w)$. Thus in aggregate, supply falls, so p_i^w can no longer be an equilibrium price. The new price, $p_i^{w'}$ must be higher than the initial p_i^w. In other cases, factor liberalization will lead to an increase in world supply and a price decrease, or leave aggregate quantities and prices unchanged.

To sum up, we can state the following:

Proposition 3 *Factor market liberalization leads to a price increase (decrease) if and only if there is a switch toward non-integration (integration) in Foreign (Home).*

PROOF: Factor market liberalization has the following effects on product prices:

A price increase if

$\underline{p}(\hat{\alpha}^*) \leq p_i^w < \underline{p}(\alpha^w)$ (corresponding to a switch to non-integration in Foreign);

A price decrease if

$\underline{p}(\alpha^w) < p_i^w \leq \underline{p}(\hat{\alpha})$ (corresponding to a switch to integration in Home);

No price change if

$p_i^w > \underline{p}(\hat{\alpha})$ (firms in both countries remain integrated);

$p_i^w < \underline{p}(\hat{\alpha}^*)$ (firms in both countries remain non-integrated);

B_i supplier integrating with an A supplier, which may be different from the one it had dealt with at arm's length before; or a B_j spinning off an A to enter into a non-integrated relationship with another, either at home or abroad.

$p_i^w = \underline{p}(\alpha^w)$ (the fraction of firms that are integrated in the world is unchanged).

□

Though systematic evidence corresponding to the effects of organizational changes on product prices does not yet appear to have been assembled, there is at least some indicative evidence of phenomena corresponding the price increases following reorganization that we have discussed. In particular, there are numerous accounts of *falling product quality* resulting (especially) from international outsourcing (see discussion below). Our model can be easily reinterpreted to explain such accounts. One can interpret the "quantity" produced by a firm as quality under money-back guarantees or threat of lost repeat business: the good either delivers the consumer a positive value with probability $Q^N(p_i)$ (under non-integration, else $Q^I(p_i)$) or nothing. Low success probability corresponds to low quality. Thus instead of $Q^N(p_i)n_i$ goods delivered with probability 1, we have n_i goods of quality $Q^N(p_i)$.

Proposition 3 shows that, even in a setting in which firms have no market power, allowing suppliers to relocate freely across countries can negatively affect consumers by inducing inefficient organizational changes that lead to price increases (quality losses). A stronger result can also be derived:[22]

Proposition 4 *Factor market liberalization may reduce consumer welfare in both countries.*

Proof: see Appendix.

□

The intuition for this result is as follows. Factor liberalization leads to a more efficient allocation of A suppliers across countries, resulting in a beneficial increase in aggregate production of the numeraire good: in the Home country, the payoff accruing to A suppliers in the production of i good falls from $\hat{\alpha}$ to α^w, leading some A's to switch to the production of good 0; the opposite happens in the Foreign country. It can easily be shown that the overall effect is an increase in world production of the numeraire good, which is beneficial to consumers in both countries. This is because more efficient A's from Home replace less efficient foreign firms. However, the increase in numeraire production may be quite small (depending on the distribution functions F and F^*), in which case the impact that factor liberalization has on consumer welfare depends mainly on its effects on the prices of the i goods.

4.3 An illustration: the toy industry in China

The type of inefficient outsourcing described above can be illustrated by the safety problems associated with American-designed toys assembled in China. Although some popular accounts

[22]See Legros and Newman (2009) for a more general welfare analysis that, which also takes account of managerial costs.

have attributed these problems to the re-location of production from the US to China, others — and a careful look at the evidence — suggest instead that they were the result of purely *organizational changes* within China: various tasks that were previously performed in factories owned and operated by US companies (particularly Mattel) had been turned over to Chinese contractors and sub-contractors. This calls for identifying the economic forces that led to such apparently inefficient reorganizations, something our model is suited to do.[23]

By the 2000s, China had become the world's leading producer of toys. In 2007, at the time of the product recalls, about 80 percent of the world's toy production, and nearly 80 percent of toys imported into the U.S. were made in China. Mattel was the world's largest toy maker, selling two main types of products: "core products" with highly valued brand names such as Barbie that sell for long periods of time; and "non-core products" that sell for a relatively short term, such as licensed characters associated with newly released movies (Lee *et al.*, 2008). Mattel was a pioneer in manufacturing in Asia. The first Barbie doll, which was introduced in 1959, was produced in Japan. In 2007, 65% of Mattel's production was done in China. The company had five wholly owned factories, responsible for roughly half of its toy production, a higher proportion than that of other large toy makers such as Hasbro and RC2 (Jackson and Xiubao, 2008).

By 2007, however, Mattel was "squeezed between lower prices and higher costs" (Lee *et al.*, 2008). On one hand, it had to continually reduce prices in order to meet the demands of the big retailers such as Wal-Mart and Target. On the other hand, costs were rising: in 2005, Beijing let its currency float, and by 2007 the yuan had appreciated by more than 9 percent against the dollar; fuel and raw materials costs had increased; and labor costs had also been increasing by around 10 percent a year.

In response to these pressures, Mattel partially reorganized its toy production in China. In particular, it started to outsource more of its "non-core" products to third-party suppliers, while continuing to manufacture in wholly-owned factories its most popular toys, such as Barbie dolls and Hot Wheels cars. The effects of this reorganization became apparent in August 2007, when Mattel recalled 19 million Chinese-made toys from the world market because of safety fears relating to lead paint and small magnets that could be swallowed by children.[24] The substandard toys recalled had been produced by Chinese suppliers (e.g., Lee Der Industrial Co. Ltd and Early Light Industrial) rather than in Mattel's wholly-owned factories (Jiangyong *et al.*, 2009). In the days following the recall, Mattel executives announced that they would try to "shift more of their toy production into factories they own and operate — and away from Chinese contractors

[23]Other evidence is provided by Lin and Ma (2008), who find that Korea's experiment with service outsourcing for the period 1985-2001 lead to a decline in productivity.

[24]On August 2, Mattel recalled 1.5 million Fisher-Price toys because of excessively high lead content in their paint. Though the bulk of the affected toys were recalled before they reached consumers, more than 300,000 affected toys had already been sold. Within two weeks, on 14 August, Mattel announced a global recall of another 436,000 toys due to lead paint hazards and recalled another 18.2 million toys with small magnets that could become detached and easily swallowed by children.

and sub-contractors".[25]

The forces identified in our model can be used to interpret Mattel's organizational choices in China and its product recalls. Since China is the world's leading toy exporter, the right-hand panel of Figure 5 can represent its part of the world market for a typical subcategory of toys.[26]

Mattel's experience of falling prices and increasing production costs corresponds to a drop in p_i^w and rise in $\hat{\alpha}^*$. In our model, both types of pressures can lead to a switch from integration to non-integration. A fall in the price of toy manufacturers' output, whether due to changing consumer tastes or growing retailer market power has the same implications for organizational choice, namely a shift toward non-integration. A rise in the opportunity cost $\hat{\alpha}^*$ of the Chinese toy assemblers, whether the result of growing world factor mobility or China's prodigious economic growth (leading to a rightward shift in its productivity distribution $F^*(\cdot)$), has a similar impact. Either way, the effect is to raise the threshold $\underline{p}(\hat{\alpha}^*)$ above which firms prefer to integrate. Finally, integration generates more output than non-integration, so as in Proposition 3 the switch to non-integration leads to an increase in price or, equivalently, to a reduction in quality (success probability), as manifested by Mattel's product recalls.

5 Conclusions

In this paper, we have embedded organizational firms into a standard model of international trade in order to examine the effects of the liberalization of product and factor markets on firm boundaries. Our "building-block" model of the firm is particularly tractable and is based on a simple tradeoff between the organizational objective (profit) and managers' private objectives (doings things in their preferred ways).

In line with recent theoretical work in organizational economics, our paper suggests that market conditions can significantly affect firms' ownership structures. In particular, falling trade barriers and increased factor mobility can affect vertical integration decisions through their impact on product prices and on the terms of trade prevailing in supplier markets. Another implication of our analysis is that that convergence in corporate organization — the tendency of industries to be characterized by the same ownership structure across countries — may result not only from global cultural transmission or technological diffusion, but also from a standard neoclassical market force, the law of one price.

We have studied the organizational changes of trade liberalization using a very stylized model, in which barriers to trade are either prohibitive or non-existent. A follow-up paper by Alfaro *et al.* (2010) extends the analysis by introducing import tariffs. The main prediction of this richer

[25]See the article "Mattel Recalls 19 Million Toys Sent From China," *New York Times*, August 15, 2007.

[26]China had become an exporter of toys as a result of its (partial) liberalization to foreign investors, which has attracted companies like Mattel and Hasbro. In our model, this could be captured by B_i suppliers moving from Home to Foreign due to differences in production costs ($\hat{\alpha}^* < \hat{\alpha}$). Since barriers to factor mobility persist, so does a a cross-country gap in the opportunity costs of A suppliers.

version of the model is that higher tariffs on final goods, by raising product prices, should lead protected firms to become more vertically integrated. Moreover, differences in ownership structures between countries should be smaller in sectors characterized by similar levels of protection and between members of regional trade agreements, especially customs unions. To examine the evidence, Alfaro *et al.* (2010) construct firm-level vertical integration indices for a large set of countries. Their empirical analysis, which exploits both cross-section and time-series variation in import tariffs, supports the predictions of the model.

We conclude by briefly discussing some of the policy implications of our analysis. In the standard competitive trade model, moving to full product and factor market liberalization will maximize consumer welfare. Not so in the present model, which differs from the standard one only by the presence of managers who decide firms' ownership structures and compensation schemes. One implication is that optimal trade policy is likely to differ from the standard one in the presence of organizational firms. For instance, there may be a positive role for production or export subsidies to countervail the effects of inefficient organizational choices. In the post-factor-market liberalization situation depicted in Figure 5, a small subsidy may induce an exporting firm's managers to switch from (inefficient) non-integration to (efficient) integration by effectively raising the price they receive for the goods they produce.

The analysis also suggests that policies that more directly address organizational inefficiencies may complement trade policy. In our model, the managers (together with HQ in the case of integration) are full claimants of enterprise revenue, as in family firms, or other closely-held organizations. The model could easily be adjusted to describe "managerial firms," in which the primary decision makers have low financial stakes. Suppose the managers receive only a small fraction $\lambda < 1$ of the revenues, with the remainder accruing to dispersed shareholders who have little control over major organizational decisions. It is straightforward to show that managers will decide to integrate only when product price exceeds $\underline{p}(\hat{\alpha})/\lambda$, a smaller range of prices than in the case considered so far (for which λ was equal to 1).

The smaller is λ, the more shareholders' interests diverge from those of management, because they value revenue but not managerial private costs (and since they take prices as given, they have no interest in restricting their firm's output). Consumers also benefit from larger values of λ, which imply that high-output integration is chosen more often. Corporate governance policy that offers strong shareholder protection or gives them greater monitoring and/or control over management effectively increases λ, and therefore benefits consumers.

In particular, good corporate governance reduces the likelihood that factor liberalization leads to a price increase and thus to a loss in consumer surplus. Moreover, product market liberalization becomes more effective: the gains from liberalization are larger if organization is chosen to maximize output rather than managerial welfare. It is in this sense that we view governance and trade policies as complementary, and it is not surprising that the European Commission has proposed an Action Plan on corporate governance to "strengthen shareholders'

rights" and to "foster the efficiency and competitiveness of business, with special attention to some specific cross-border issues" (see Commission press release, May 21 2003).

Appendix

A.1 Full Employment Equilibrium

Define $p_0(\alpha)$ to be the lowest price at which an A who accrues all the surplus ($s = 1$) under non-integration can obtain α : $W^N(1, p_0(\alpha)) = \frac{p_0(\alpha)^2}{1+p_0(\alpha)} = \alpha$. Note this equation has a unique solution, increasing in α, and independent of the sector. Consider a generic equilibrium in which matched A suppliers obtain surplus $\hat{\alpha}^G$. It follows from Assumption 1 that $p_0(\alpha^G) < \underline{p}(\alpha^G)$, implying that non-integration prevails at $p_0(\alpha^G)$.

To guarantee that all B_i's are employed, we require that there is excess demand for good i at $p_0(\alpha^G)$, implying that the equilibrium price must exceed $p_0(\alpha^G)$. Let n_i^G be the endowment of B_i's. Then for full employment it is enough that

$$\text{For all } i \in \{1, \ldots, I\},\ u_i^{'}(n_i^G Q^N(p_0(\hat{\alpha}^G))) > p_0(\alpha^G). \tag{16}$$

Since $u_i(\cdot)$ is concave and $p_0(\cdot)$ increasing, this condition is more stringent the larger is α^G and the larger is n_i^G. In the text we make assumptions on the model's fundamentals that guarantee that the Home autarky value $\hat{\alpha}$ is an upper bound for all equilibrium values of matched-A payoffs. The largest endowment to consider is the larger of the Home and Foreign endowments n_i and n_i^*. We can therefore ensure that there is full employment in all scenarios we discuss with

Assumption 2 *Condition 16 holds when $\alpha^G = \hat{\alpha}$ and $n_i^G = max\{n_i, n_i^*\}$.*

A.2 Proofs

Proof of Lemma 1

(i) Consider the function $g(p_i)$ defined as the unique solution to

$$\left(\frac{p_i}{1+p_i}\right)^2 (1 + p_i + g(p_i)) = p_i - \frac{1}{2} - h.$$

Note that $g(p_i)$ is continuous (in fact, differentiable); it is straightforward to verify that it is strictly increasing for $0 \leq h < \frac{1}{2}$, and vanishes at $p_i = \underline{p} \equiv \frac{1+2h}{1-2h}$.

Let $\mathcal{P}^I(\hat{\alpha})$ be the set of prices satisfying $W^N(s, p_i) \leq W^I(p_i)$, that is

$$\left(\frac{p_i}{1+p_i}\right)^2 (1 + p_i + 2s(\alpha, p_i)(1 - s(\alpha, p_i))) \leq p_i - \frac{1}{2} - h$$

where $s(\alpha, p_i)$, the (unique) value of s satisfying $u_A^N(s, p_i) \equiv \left(\frac{p_i}{1+p_i}\right)^2 ((2+p_i)s - s^2) = \alpha$, is the profit share that guarantees A a payoff of α under non-integration: integration is chosen only if $p_i \in \mathcal{P}^I(\hat{\alpha})$. Equivalently, we need

$$2s(\alpha, p_i)(1 - s(\alpha, p_i)) \leq g(p_i). \tag{17}$$

Now, Assumption 1 ensures that $s \in [0, 1/2]$ for any equilibrium $\hat{\alpha}$, and $2s(1-s)$ is increasing on $[0, 1/2]$. From (7), $s(\alpha, p_i)$ is increasing in α and decreasing in p_i.Thus (17) is satisfied if and only if

$$s(\hat{\alpha}, p_i) \leq h(p_i),$$

where $h(\cdot)$ is a continuous, increasing transformation of $g(\cdot)$. Since g is increasing, so is h. Thus if $p_i' > p_i$, and integration is chosen at p_i, we have

$$s(\hat{\alpha}, p_i') < s(\hat{\alpha}, p_i) \leq h(p_i) < h(p_i'),$$

and integration is also chosen at p_i'. Thus, $\mathcal{P}^I(\hat{\alpha})$ can be written as an interval $[\underline{p}(\hat{\alpha}), \infty)$. Note that $p(0) = \underline{p}$.

(ii) Since s increases with $\hat{\alpha}$, and $W^N(s, p_i)$ increases in s on $[0, 1/2]$, $W^N(s, p_i)$ increases in $\hat{\alpha}$. It follows that $\mathcal{P}^I(\hat{\alpha})$ is decreasing (in the sense of set inclusion), i.e., that $\underline{p}(\hat{\alpha})$ is increasing.

Proof of Proposition 4

Proposition 3 shows that, even in a setting in which firms have no market power, allowing suppliers to relocate freely across countries can negatively affect consumers by inducing inefficient organizational changes. However, factor liberalization also leads to a more efficient allocation of A suppliers across countries, resulting in a beneficial increase in aggregate production of the numeraire good 0. In what follows, we derive a sufficient condition for factor market liberalization to hurt consumers in both countries.

Recall that n_i (n_i^*) denotes the measure of B_i firms in Home (Foreign) and that $\sum_{i=1}^I n_i \equiv n_B$ and $\sum_{i=1}^I n_i^* \equiv n_B^*$. Let us assume that $n_B = n_B^* = n$ and that $n_i + n_i^* = 2n/I$, $\forall i$. This guarantees that the world supply is the same across sectors. We also assume that all sectors have the same aggregate demand. Together, these assumptions imply that the price changes and the welfare effects of factor liberalization will be the same in all sectors of the economy. Using the proof of Proposition 3, we can then identify conditions such that the equilibrium world price will strictly increases after factor market integration. Let $L > 0$ be the resulting loss in welfare.

Let $\alpha^w = \frac{1}{2}(\hat{\alpha} + \hat{\alpha}^*)$, where $F(\hat{\alpha}) = F^*(\hat{\alpha}^*) = n$ and $F(\alpha^w) + F^*(\alpha^w) = 2n$. That is, before factor market liberalization A suppliers have outside options $\hat{\alpha}$ and $\hat{\alpha}^*$ in Home and Foreign,

respectively, while they have outside option α^w after the liberalization.

Now, since $\hat{\alpha} > \alpha^w > \hat{\alpha}^*$, some Home A suppliers that before liberalization were employed in the production of I goods will start producing the numeraire good; at the same time, some Foreign A suppliers that were originally producing the numeraire good will start producing the other goods.

The change in numeraire production is then

$$\delta = \int_{\alpha^w}^{\hat{\alpha}} \alpha f(\alpha) d\alpha - \int_{\hat{\alpha}^*}^{\alpha^w} \alpha f^*(\alpha) d\alpha;$$

integrating by parts and using the equilibrium conditions $F(\hat{\alpha}) = n$, $F^*(\hat{\alpha}^*) = n$ and $F(\alpha^w) + F^*(\alpha^w) = 2n$, this becomes

$$\delta = \left[\int_{\hat{\alpha}^*}^{\alpha^w} F^*(\alpha) d\alpha - n\left(\alpha^w - \hat{\alpha}^*\right) \right] + \left[n(\hat{\alpha} - \alpha^w) - \int_{\alpha^w}^{\hat{\alpha}} F(\alpha) d\alpha \right].$$

Note that this is always positive. Since F and F^* are increasing,

$$\delta < \left(F^*(\alpha^w) - n\right)\left(\alpha^w - \hat{\alpha}^*\right) + \left(n - F(\alpha^w)\right)(\hat{\alpha} - \alpha^w) \tag{18}$$

and since $\alpha^w = \frac{1}{2}(\hat{\alpha} + \hat{\alpha}^*)$,

$$\delta \leq \frac{1}{2}(F^*(\alpha^w) - F(\alpha^w))(\hat{\alpha} - \hat{\alpha}^*). \tag{19}$$

Consider two distribution functions $F^*(x;\epsilon), F(x;\epsilon)$ that are linear on the interval $[\hat{\alpha}^*, \hat{\alpha}]$ and that satisfy $F^*(\hat{\alpha};\epsilon) = n + \epsilon$ and $F(\hat{\alpha}^*;\epsilon) = n - \epsilon$. Since there is no restriction on $F(x;\epsilon)$ and on $F^*(x;\epsilon)$ outside the interval $[\hat{\alpha}^*, \hat{\alpha}]$, as ϵ varies it is possible to find 'completions' of these functions such that the overall distributions are indeed distribution functions.

By construction, $F^*(\alpha^w;\epsilon) - F(\alpha^w;\epsilon) = \epsilon$. Therefore, by (18), for all $\epsilon < 2L/(\hat{\alpha} - \hat{\alpha}^*)$, the welfare loss resulting from the increase in the price of all i-goods more than offsets the welfare gain associated with increased consumption of the numeraire good.

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