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TRADE LIBERALIZATION AND ORGANIZATIONAL CHANGE

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Newman

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ABSTRACT

Trade Liberalization and Organizational Change*

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. In particular, non-integration is chosen at "low" and "high" prices, while integration occurs at moderate prices. Organizational choices also depend on the terms of trade in supplier markets, which affect the division of surplus between managers. We obtain three main results. First, even when firms do not relocate across countries, the price changes triggered by liberalization of product markets can lead to significant organizational restructuring within countries. Second, the removal of barriers to factor mobility can lead to inefficient reorganization and adversely affect consumers. Third, "deep integration" - the liberalization of both product and factor markets - leads to the convergence of organizational design across countries.

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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 increased international competition in 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 contribute to that understanding by studying how liberalization of trade in goods as well as factors can affect firms' integration decisions. Our analysis will show that those organizational responses may in turn have significant effects on prices, quantities, and consumer welfare, sometimes in directions opposite to those that would be expected based on traditional trade theory.

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 a firm's decision whether to integrate its production activities turns out to depend on two key variables: the price at which its 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 simple analytical framework in which the effects of falling trade barriers on organization can be grasped by straightforward 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

¹For 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 (see Dyer, 1996). Various studies have also found strong correlations between the creation of regional trade agreements and levels of M&A and other organizational restructuring activities within as well as across member countries (e.g., Breinlich (2008) and Guadalupe and Wulf (2008) 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; Treffer, 2004) or in work practices (Schmitz, 2005).

may be revenue losses due to inexpert decision-making by non-specialists who take control of 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 profit depends on product price, changes in product markets (such as the removal of tariffs) 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 market conditions; 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 adoption of standards: output (or, in an alternate interpretation, the likelihood the good produced will actually work) is highest when the two suppliers coordinate, i.e., take similar decisions. However, managers have opposing preferences 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, integration is also costly, not simply because the decisions HQ imposes will be adversely affect the other two managers, but also because HQ’s relative lack of expertise or its own operating costs will reduce output.³

In this setting, the price of output is a crucial determinant of firms’ organizational choices. In particular, non-integration is chosen at “low” and “high” prices: 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; at very high prices, non-integration performs well because it avoids the costs of HQ, while managers value output so much that they are willing to concede to each in order to achieve coordination. Therefore, integration only occurs at intermediate 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. Relative to non-integration, integration is more flexible in its ability to 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.

²The model is a variant — developed in Legros and Newman (2004) — of the one in Hart and Holmström (2002). Those 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.

³Thus our model is consistent with the view 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.

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 (i.e., there is no “offshoring”), freeing trade in goods triggers price changes that can lead to *major organizational restructuring* within countries. Second, following the liberalization of product markets, the removal of barriers to factor mobility can induce further organizational restructuring that can *adversely affect consumers* by increasing the prices of goods or decreasing their quality.

Depending on initial conditions, these price increases may result from a shift toward integration or a shift away from it. Thus, our findings are consistent with recent evidence of supply disruptions and quality losses resulting from both mergers (Accenture, 2007) or outsourcing (Lin and Ma, 2008). Since we focus on perfectly competitive product and factor markets, the negative impact on consumer welfare arises solely from inefficient organizational choices, rather than from any market power effects.

Our analysis also suggests that the removal of both barriers to commodity trade and factor mobility should lead to international *convergence of organizational choices*, i.e., a tendency of industries to be characterized by the same ownership structure across countries. This convergence in corporate organization has its source not in global cultural transmission or technological diffusion, but in standard neoclassical market forces, namely the law of one price. The trend should therefore be most apparent in trade exposed sectors, and within regional trade agreements such as the EU, in which the integration of the members product and factor markets has been “deeper.”

Our paper contributes to an emerging literature on general equilibrium models with endogenous organizations,⁴ and in particular to a recent stream of this literature which has examined firms’ organizational choices in a global economy. Most papers have focused on how organizational design can explain the observed patterns of intra-firm trade.⁵ Much less attention has been devoted to how firms’ boundaries respond to falling trade costs.⁶ Nor to our knowledge has the 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

⁴General 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; 2008a) and search costs (McLaren, 2000; Grossman and Helpman, 2002).

⁵Antras (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.

⁶An exception is Marin and Verdier (2003), 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) and Antras and Staiger (2008) examine how trade liberalization may mitigate hold-up problems by strengthening foreign suppliers’ investment incentives.

the model to two countries and examines the effects of the liberalization of the markets of final goods on 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 discusses the empirical implications of our theoretical model. Section 6 concludes discussing the 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 (denoted with a “*”), in which trade is the result of differences in the endowments of specific factors. In this section, we describe its building blocks 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 $i = 1, \dots, I$; good 0 is a numeraire. The representative consumer's utility (which is the same in Home and Foreign) can be written as

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

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 $\lim_{c_i \rightarrow 0} u'_i(c_i) = \infty$ and $\lim_{c_i \rightarrow \infty} u'_i(c_i) = 0$. 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 . Many interpretations of the A and B firms are possible. For example, A firms may represent widely used inputs, such as energy or various business services (e.g., IT, retailing, logistics), which can be used to produce basic consumer goods or can be combined with other inputs (B_i suppliers) to produce more complex goods. The crucial feature of the organizational choice model described below is that production inputs are 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.

The A suppliers differ from the B_i suppliers in that they can also engage in stand-alone production of the numeraire good 0. All goods are sold under conditions of perfect competition. Good 0 is always traded freely across the two countries. We choose units so that the international market-clearing and domestic price of good 0 are both equal to unity, and we assume that aggregate supply of A 's is large enough to sustain production of a positive amount of this good.

2.2 Equilibrium in the factor market

In the supplier market, there is a large number of A firms and B firms. Normalize the measure of A firms to unity, and denote by n_i the measure of B_i firms; let $\sum_{i=1}^I n_i \equiv n_B < 1$. We will consider equilibria with full employment of factors, i.e., the sum of A and B firms used in the production of the $I + 1$ goods equals the total endowment of firms in the economy.

An equilibrium in the supplier market consists of matches between each B_i firm and an A firm, along with a surplus allocation among all the managers. Such an allocation must be stable, in the sense that no (A, B_i) pair can form an enterprise that generates payoffs to each manager that exceed their equilibrium levels. By construction, A firms are the long side of the market. This implies that some of the A agents must remain unmatched and produce the numeraire good.

To derive an endogenous solution for the terms of trade in supplier markets, we shall assume the following. 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 $F(\alpha)$.

Any unmatched A with an opportunity cost below that of a matched A would offer the matched A 's partner more than she is currently receiving. Thus, in a stable match, *all matched A 's receive the same equilibrium surplus*, regardless of which industry i they are in. This equilibrium surplus, $\hat{\alpha}$, is the solution to⁷

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

The equilibrium $\hat{\alpha}$ represents the terms of trade in the supplier market, and as shown in Section 2.3.3 below, it plays a crucial role in organizational choices. Notice that in equilibrium *only the A firms with the lowest opportunity cost will be matched* with B_i firms to produce the i -goods, while more productive A firms will produce good 0.

2.3 Individual firms

Our basic model of the firm shares two key features with the analysis of Hart and Holmström (2002): 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.⁸ Second, some firm decisions (e.g.,

⁷This is the relevant equilibrium condition only if A firms are the long side of the market. In turn, this requires that all B_i firms obtain a positive surplus after paying $\hat{\alpha}$ to their A suppliers. The Appendix discusses conditions on consumer preferences that guarantee that this condition is satisfied.

⁸For instance, engineering and market departments may have different views about how a product is or should be developed; or an input design that is convenient for an upstream firm to supply may create problems in final

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 a firm 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 a probability proportional to $1 - (a - b_i)^2$, 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 $y_A, y_i \geq 0$ 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.

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.

Managers can remain *non-integrated*, in which case they retain control over their respective decisions. The success probability in this case is $1 - (a - b_i)^2$. Alternatively, they can *integrate* by engaging a headquarters (HQ), transferring to it the power to decide a and b_i . HQ is motivated only by monetary considerations, and incurs no costs from the decisions a and b_i ; it will therefore wish to maximize the income of the integrated firm. However, involving HQ entails a cost, modeled as a reduction σ in the success probability. For simplicity, we will assume this cost to be the same for all i sectors. We can think of σ as linked to a moral hazard problem: since HQ has control over both suppliers' resources, it may also have opportunities to divert those resources into other activities (including private benefits, other divisions, or pet projects).⁹ Alternatively, the integration cost might arise from direct costs of communication, additional management personnel, or losses from delegating decisions from A and B_i to staff who are not experts.¹⁰

assembly for the a downstream division. 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.

⁹For instance, suppose that after output is realized, there is a probability σ that HQ has a chance to divert whatever output there is to an alternative use valued at δ times its market value, where $\sigma < \delta < 1$. If output is diverted, it does not reach the market, and the verifiable information is the same as if the firm had failed. Managers could prevent diversion by offering a share δ to HQ, leaving $(1 - \delta)$ of the revenue to be shared between the managers, but since $\delta > \sigma$, it is actually better for them to give HQ a zero share of market revenue and let him divert when he is able, so that successfully produced output reaches consumers only $(1 - \sigma)$ of the time.

¹⁰In this case, HQ takes a fraction of the revenue, leaving the residual for the managers to share; this approach would alter the notation slightly but would not affect our results. One can also extend the model to the case in which the HQ's vary in opportunity cost and/or capability, rather than assuming, as we have done here, that there is an elastic supply of HQ's. See Legros and Newman (2008b).

To summarize, each firm's expected output is $(1 - (a - b_i)^2)(1 - \sigma \mathbf{I})$, where \mathbf{I} is the integration indicator function, equal to unity if there is integration, and zero otherwise.

Before production, B_i managers match with A managers, at which time they sign contracts (s, \mathbf{I}) , where $s \in [0, 1]$ is the share of managerial revenue accruing to manager A , with $1 - s$ going to B_i (in case of failure each receives zero).

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.

2.3.1 Integration

With integration, HQ receives an expected surplus proportional to $(1 - (a - b_i)^2)p_i$ and therefore makes decisions for both activities in order to maximize expected revenue of the integrated firm, that is, chooses $a = b_i$. 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 cost to each supplier manager is then $\frac{1}{4}$, and the payoffs to the A and B managers are

$$u_A^I(s, p_i) = (1 - \sigma)sp_i - \frac{1}{4} \quad (3)$$

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

Total managerial welfare under integration is

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

and is fully transferable via adjustments in s .

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

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

The resulting expected output is

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

which is *independent of s* .

Output 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. Thus, as long as $\sigma > 0$, there exists a price \tilde{p}_i at which output supplied to the product market under integration is equal to that supplied under non-integration: \tilde{p}_i is the unique solution to

$$\sigma = \frac{1}{(1 + p_i)^2}, \quad (7)$$

that is, $\tilde{p} = \sqrt{\frac{1}{\sigma}} - 1$. Non-integration output is smaller than integration output for $p_i < \tilde{p}$ and larger for $p_i > \tilde{p}$.

Unlike output, the equilibrium payoffs under non-integration do depend on s and are given by

$$u_A^N(s, p_i) = \left(1 - \frac{1}{(1 + p_i)^2}\right) sp_i - s^2 \left(\frac{p_i}{1 + p_i}\right)^2 \quad (8)$$

$$u_{B_i}^N(s, p_i) = \left(1 - \frac{1}{(1 + p_i)^2}\right) (1 - s)p_i - (1 - s)^2 \left(\frac{p_i}{1 + p_i}\right)^2. \quad (9)$$

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 is $W_i^N(s, p_i) = Q_i^N(p_i)p_i - (s^2 + (1 - s)^2) \left(\frac{p_i}{1 + p_i}\right)^2$ is maximized at $s = 1/2$; it is minimized at $s = 0$ and $s = 1$, where we have

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

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 close to zero, non-integration dominates integration: to verify this, notice from (3)-(4) and (8)-(9) that when $p_i = 0$ integration yields negative payoffs, while non-integration payoffs are bounded below by 0. The same is true for p_i sufficiently large: to see this, it is enough to compare the minimum non-integration surplus, $\frac{p_i^2}{1 + p_i}$, with the integration surplus $p_i(1 - \sigma) - \frac{1}{2}$: for a sufficiently large p_i , the latter is smaller as long as σ is positive. Finally, observe that with $s = 1/2$, $W^N(\frac{1}{2}, p_i) > W^I(p_i)$ for all p_i ; thus integration never dominates non-integration.

Figure 1 depicts the situation for intermediate ranges of prices, in which 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.

Comparison of (5) with (10) reveals that the two frontiers will “overlap” as in Figure 1 on an interval of prices $[\underline{p}, \bar{p}]$.¹¹ In what follows, we will assume that σ is smaller than an upper bound $\bar{\sigma} > 0$ to guarantee that this interval is non-empty.

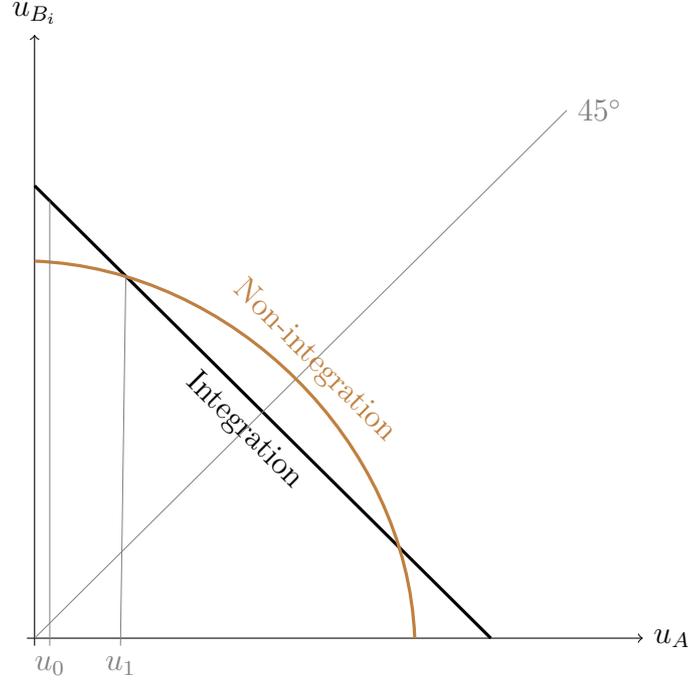


Figure 1: Frontiers

Recall from Section 2.2 that, for the factor market to be in equilibrium, all A firms matched with a B_i firm must receive a surplus equal to $\hat{\alpha}$. Consider an A firm partnered with a B_i firm when the product price is p_i . To facilitate the characterization of equilibrium, we make the following restriction on the surplus of A firms when matched with a B_i firm:

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

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

From (8), 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

¹¹These are the solutions to the (quadratic) equation $W^N(0, p) = W^I(p)$, i.e. $\frac{p^2}{1+p} = p(1 - \sigma) - \frac{1}{2}$.

in p_i . If the payoff that remains for B_i , namely $W^N(s(\hat{\alpha}, p_i), p_i) - \hat{\alpha}$, exceeds $W^I(p_i) - \hat{\alpha}$, the firm chooses non-integration. If instead $W^N(s(\hat{\alpha}, p_i), p_i) < W^I(p_i)$, the firm integrates.

It can be shown that there are at most two solutions to the equation $W^N(s(\hat{\alpha}, p_i), p_i) = W^I(p_i)$ (from Footnote 11 this is clearly true for $\hat{\alpha} = 0$, since $s(0, p_i) = 0$, but it extends to the general case as long as Assumption 1 is satisfied). Call them $\underline{p}(\hat{\alpha})$ and $\bar{p}(\hat{\alpha})$. Integration is chosen when $p_i \in (\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha}))$. In Figure 1, B_i is indifferent between the two ownership structures if A gets u_1 , but strictly prefers integration if A gets u_0 . Thus, if $\hat{\alpha}$ were to be equal to u_1 , the product price prevailing could be $\underline{p}(u_1)$. If $\hat{\alpha}$ were to fall to u_0 , then this price would be in $(\underline{p}(u_0), \bar{p}(u_0))$. 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 is strictly larger (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 exist at most two solutions $\underline{p}(\hat{\alpha})$ and $\bar{p}(\hat{\alpha})$ to the equation $W^N(s(\hat{\alpha}, p_i), p_i) = W^I(p_i)$; (ii) $\underline{p}(\hat{\alpha})$ is increasing, $\bar{p}(\hat{\alpha})$ is decreasing.*

Thus, when A 's share is not too large, a fall in $\hat{\alpha}$ becomes a force for integration: starting at a price just under $\underline{p}(\hat{\alpha})$ (or just over $\bar{p}(\hat{\alpha})$), a decrease in $\hat{\alpha}$ leads the firm to switch from non-integration to integration.

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).

To sum up, there is a non-monotonicity of managers' organizational preference in price. At low prices, despite integration's better output performance, revenue is still small enough that the managers (particularly B_i 's) are more concerned with their private benefits and so remain non-integrated. At high prices, non-integration generates enough revenue that they do not want to incur the cost $p_i\sigma$ of HQ. Only for intermediate prices do managers prefer integration. In this range, the B_i manager knows that revenue is large enough that under non-integration he would be tempted to follow the A manager, who obtains 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 therefore bears high private costs under non-integration, and prefers instead the relatively high revenue and moderate cost that he incurs 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)

$$s(p_i, \theta_i) = n_i \theta_i (1 - \sigma) + n_i (1 - \theta_i) \left(1 - \left(\frac{1}{1 + p_i} \right)^2 \right). \quad (11)$$

Now θ_i itself is a correspondence that depends on the price p_i and $\hat{\alpha}$. 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 .¹² 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. When $\theta_i = 1$ output is $(1 - \sigma)n_i$ and stays at this level for all $p_i \in (\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha}))$. At $p_i = \bar{p}(\hat{\alpha})$, managers are again indifferent between the two ownership structures and θ_i can assume any value from 1 down to 0. Finally for $p_i > \bar{p}(\hat{\alpha})$, all firms remain non-integrated and output again increases with p_i . Of course, when the “integration range” $[\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha})]$ is empty, managers always choose non-integration and $\theta_i \equiv 0$. Write $S(p_i, \hat{\alpha})$ for the supply correspondence, the Organizationally Augmented Supply (OAS) curve.

The supply curve for a typical industry in which $\underline{p}(\hat{\alpha}) < \bar{p}(\hat{\alpha})$ is represented in Figure 2.¹³ The dotted curve corresponds to what the industry supply would be if no firms were integrated.

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 in which some firms integrate and others do not (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 $(\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha}))$), 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

¹²If 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.

¹³We have depicted the typical case of monotonic supply, where $\bar{p} \in [\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha})]$, which obtains when $\hat{\alpha}$ is low enough. Most of our results continue to hold in the alternate case (in which $\bar{p} > \bar{p}(\hat{\alpha})$) – see the remark following the proof of Lemma 1 in the Appendix, at the cost of some expositional complication.

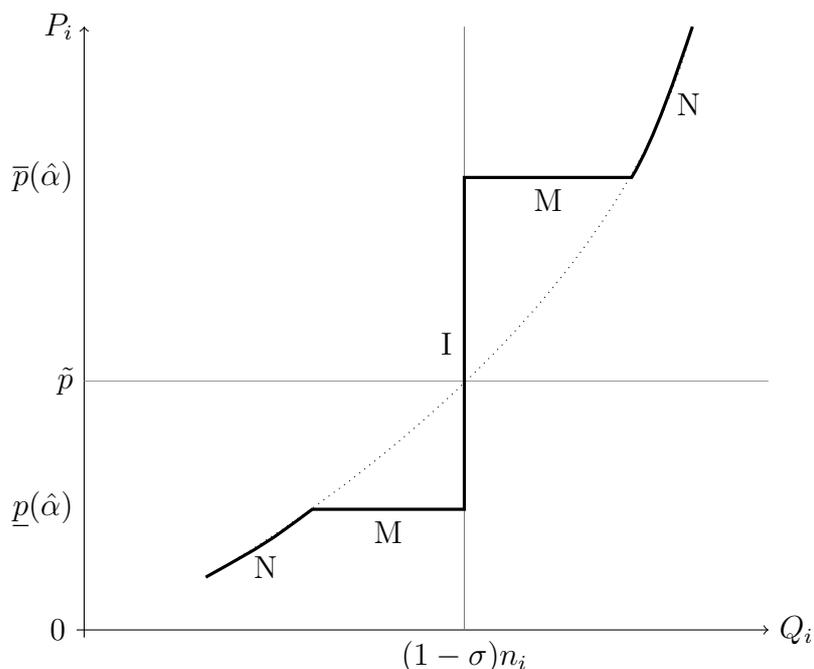


Figure 2: Organizationally Augmented Supply

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.¹⁴

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.

¹⁴Similar 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).

3 Liberalization of Product Markets

Let us assume that Home and Foreign have identical demands and identical technologies in the production of all goods $i = 1, \dots, I$. 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 $i \in \{1, \dots, m\}$ and $n_i > n_i^*$ for $i \in \{m + 1, \dots, I\}$. Ours is thus a standard specific-factor trade model, in which A firms are the mobile factor and B_i firms 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 $i \in \{1, \dots, m\}$ clear when

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

where $M_i(p_i, \hat{\alpha}) = D_i(p_i) - S(p_i, \hat{\alpha})$ denotes Home's imports and $X_i(p_i, \hat{\alpha}) = S(p_i, \hat{\alpha}) - D(p_i)$ denotes Foreign's exports. Symmetrically, the market-clearing condition for goods $i \in \{1 + m, \dots, I\}$ can be written as

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

From the above conditions, we can derive the free trade equilibrium price of each good i , denoted by p_i^w . The Home country's trade balance condition requires

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

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 will shall focus here on trading economies characterized by the same conditions in the supplier markets (i.e., $\hat{\alpha} = \hat{\alpha}^*$). The role of factor market differences is considered in the Section 4 below.

Figure 3 depicts the autarky and free trade equilibria in a product markets $i \in \{1, \dots, m\}$, 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., $\hat{p}_i^* < \hat{p}_i$.

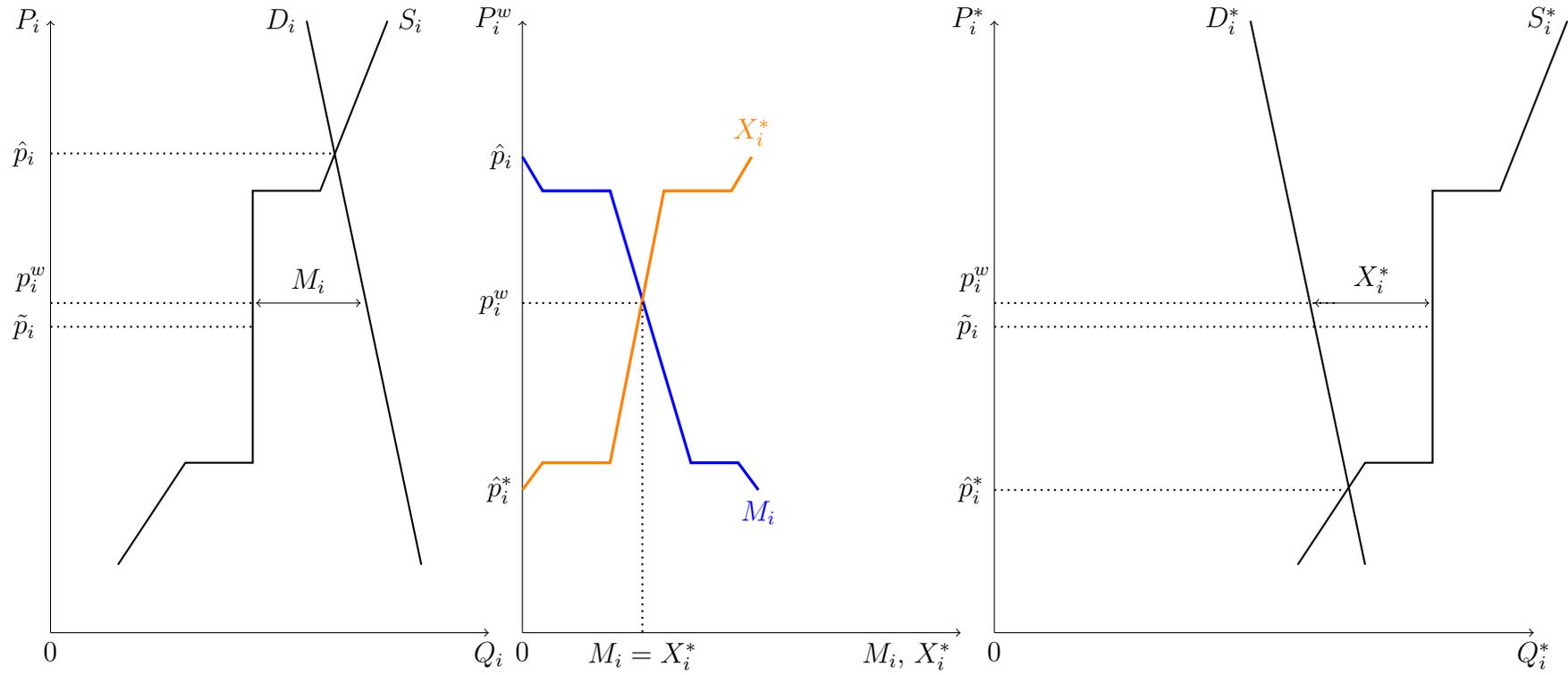


Figure 3: Liberalization of product markets

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.

Free trade leads to price convergence across countries in all sectors. In the case of two countries characterized by the same terms of trade between suppliers ($\hat{\alpha} = \hat{\alpha}^*$), the range of prices for which firms will choose integration or non-integration is the same. This implies that price convergence results in organizational convergence. In the case depicted in Figure 3, both countries move from non-integration to integration.

Insofar as free trade in goods tends to move product prices away from the “extremes” toward the middle, the model predicts a tendency toward widespread reorganizations in favor of integration that may appear as shakeouts and consolidations in the face of increased foreign competition. Such a conclusion comes with caveats, of course, since world prices need not always end up in the integration region, and autarky need not have begun with non-integration.

More generally, our analysis suggests that, through their effect on product prices, tariff cuts can give rise to major organizational restructuring within countries, even when suppliers do not relocate across countries (no “offshoring”). We can thus assert:

Proposition 1 *Even in the absence of factor movements, the removal of trade barriers in sector i can lead to changes in ownership structure within that sector.*

This implies that regional trade agreements such as free trade areas or customs unions — in which member countries remove *all* barriers to trade — should lead to waves of mergers and divestitures across different industries. Piecemeal tariff reductions, however, will lead to re-organizations that are confined to just the affected industries.¹⁵

Major reorganizations such as changes in ownership structure, which are most likely induced by large price changes following a tariff liberalization, are not the only organizational responses predicted by the model. For smaller price changes, it is likely that firms will remain in the price region they started in. But other organizational variables, such as the “power” of compensation schemes (here represented by the size of the profit shares $1 - s$ and s), will change with prices. Indeed, as noted in the discussion leading up to Lemma 1, the A-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 we have

Proposition 2 *Following product market liberalization, if the ownership structure does not change in industry i , the profit shares accruing to B_i managers increase if i is an export industry and fall if i is an import-competing industry.*

¹⁵Obviously, trade liberalization in one sector could trigger organizational changes in other sectors if we relaxed the assumption of separable preferences.

The reason is that with the introduction of free trade, prices rise in the export industries and fall in the import industries. Of course, profit shares will generally change if there are major reorganizations as well.

Propositions 1 and 2 can help us to interpret the results of recent empirical studies of organizational change in the face of the removal of tariff barriers. In particular, it is instructive to compare the findings in Breinlich (2008) with those of Guadalupe and Wulf (2008), which study the effects of the Canada-U.S. Free Trade Agreement (CUFTA), on opposite sides of the border. For Canada, which as the smaller member country would be expected to have experienced the largest price changes, Breinlich documents a considerable level of merger activity following CUFTA. By contrast, Guadalupe and Wulf find little evidence of CUFTA-attributable mergers in their sample of U.S. firms, but do find many 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 CUFTA, this is what our model would lead us to expect.

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 suppliers did not move across countries. In this section, we assume 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 change

Consider first trading economies characterized by 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 when prices are in the range $(\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha}))$, while non-integration will be chosen at all other 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 characterized by similar factor markets (e.g., France and Germany).

Consider next a scenario in which Home and Foreign differ in terms of their factor markets (e.g., West and East Europe). 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

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, with $[\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha})] \subset (\underline{p}(\hat{\alpha}^*), \bar{p}(\hat{\alpha}^*))$.

Figure 5 below shows the effects of the factor market integration on organization choices in a sector $i \in \{m + 1, \dots, I\}$ in which the Home country is an exporter. The removal of barriers to factor mobility implies that the “integration range” expands in Home and is reduced in Foreign, until it coincides with $(\underline{p}(\alpha^w), \bar{p}(\alpha^w))$ in both countries.

Factor mobility can trigger substantial further changes in ownership structure. For example, in the case depicted in Figure 5, prior to factor market liberalization, firms are non-integrated in both Home and Foreign; after liberalization, there is a wave of mergers in the industry as firms in both countries to switch to integration. Notice that this restructuring is associated with a price increase (see discussion in the next subsection).

While factor liberalization leads to mergers in some industries, in others, it may lead to outsourcing (a switch from integration to non-integration). Figure 6 below shows the effects of the liberalization of factor markets in a sector $i \in \{1, \dots, m\}$ in which the Home country is an importer. As in Figure 5, the removal of barriers to factor mobility implies that the integration range expands in the Home country and is reduced in the Foreign country. As a result, supplier firms located in Foreign will move from integration to non-integration.

Notice that, in contrast to the removal of barriers to trade in goods—which generates *sector-specific* effects on organization by affecting product prices—the liberalization of product markets affects *all* sectors in the economy, by changing the equilibrium surplus of matched A suppliers. It follows that

Proposition 3 *Factor market liberalization can induce widespread organizational changes, by changing the terms of trade between suppliers.*

The above analysis 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 *re-organizational* (as distinct from re-locational) activities will be more intense between countries with large productivity differences (e.g., Germany and Portugal) rather than among those with similar productivity levels (e.g., Germany and France).

Increased mobility of different types of suppliers across countries leads to the integration of their matching markets. We obtain the following result:

Proposition 4 *The changes in ownership structure induced by factor market liberalization are independent of the specific patterns of factor mobility.*

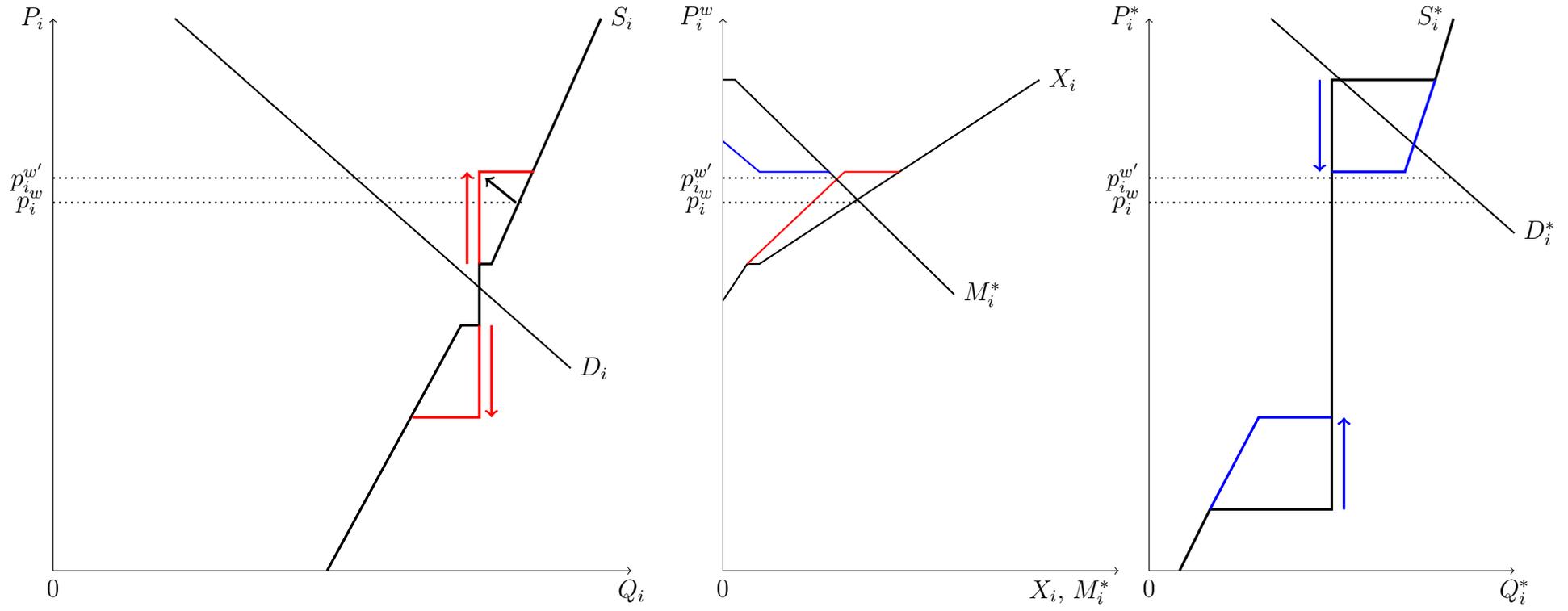


Figure 5: Liberalization of factor markets (a)

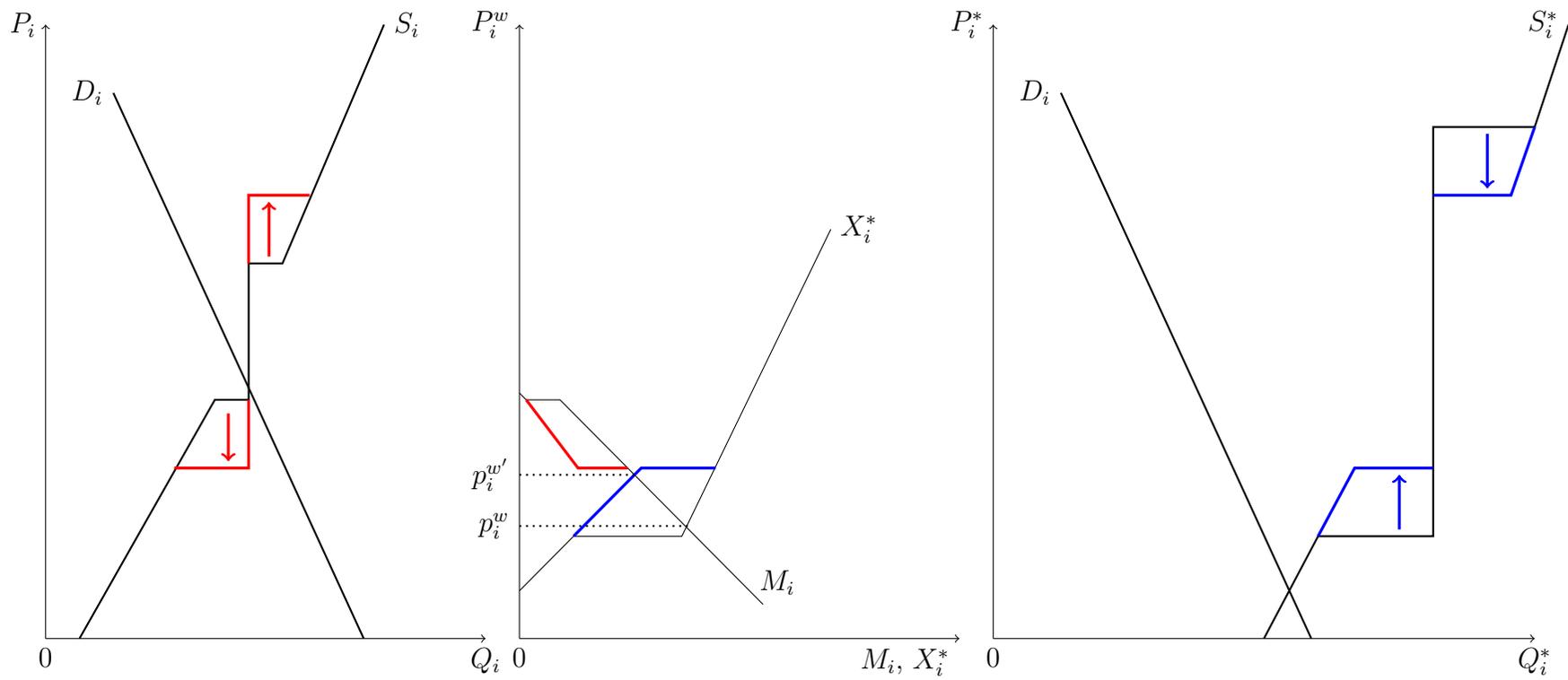


Figure 6: Liberalization of factor markets (b)

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 price they have to pay to A suppliers is equal to α^w in both countries. Thus, different factor movements have the same impact on the terms of trade prevailing in supplier markets and on organizational choices. Notice that there is nothing in the model to prevent “re-partnering” after a liberalization: re-organization may involve a 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.

4.2 Consumer welfare

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 consumers.¹⁶

In our model of organization design, consumers have an interest in firms’ ownership structure. To see this, consider again Figure 2 above and notice that we can distinguish two regions: one of “efficient integration” (the portion of the supply curve comprised between $\underline{p}(\hat{\alpha})$ and \tilde{p} , in which firms that choose to be integrated produce more than what they would by remaining non-integrated; and one of “inefficient integration” (the portion of the supply curve comprised between \tilde{p} and $\bar{p}(\hat{\alpha})$, in which output is smaller under integration than it would be if firms were non-integrated. Thus in our setup changes in organization structure can have an impact on consumer surplus.

We can show that the impact on consumer welfare of the liberalization of factor markets will depend on pre-liberalization product prices. As shown in Figures 5-6 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*. This is indeed the case if factor liberalization leads firms in a Home export sector to switch to inefficient integration (the case depicted in Figure 5). For example, if p_i^w is initially just above $\bar{p}(\hat{\alpha})$, then following liberalization, Home’s integration range expands, its supply falls as its firms merge, and the new equilibrium price must be higher than p_i^w . Alternatively, the price increase could occur when firms in a Foreign export sector move away from efficient integration to outsourcing (the case depicted in Figure 6). For instance, if p_i^w is initially just above $\underline{p}(\hat{\alpha}^*)$, then following liberalization, Foreign’s integration range shrinks, its supply falls as its firms divest, and the new equilibrium price must again be higher than p_i^w .¹⁷

¹⁶See Legros and Newman (2008b) for a more general welfare analysis, which also takes account of managerial costs. The effects on consumer welfare discussed here generally apply as well to such broader welfare measures.

¹⁷As shown in the Appendix (proof of Proposition 5), it is also possible for factor liberalization to trigger

We can state the following:

Proposition 5 *Factor market liberalization can trigger inefficient organizational changes and lead to price increases.*

PROOF: Appendix.

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 *falls in product quality* resulting (especially) from cross-border reorganization (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 $Q^N(p_i)$.

As we have remarked, it is possible that in our model a Home export good produced under efficient non-integration prior to factor market liberalization would be produced, following liberalization, under (inefficient) integration. This is indeed the case depicted in Figure 5. The success probability falls (since aggregate output is falling), corresponding to a fall in quality. This finding is in line with evidence on the inefficiencies of the recent wave of M&A activities (e.g., Langebeer, 2003). For example, a recent survey of American, European, and Japanese executives, 50-60% of respondents admit that mergers were responsible for significant supply disruptions, product launch delays, and quality and service problems (Accenture, 2007).

The case of a move to inefficient outsourcing depicted by Figure 6 could instead be illustrated by the safety problems associated with American-designed toys assembled in China. In August 2007, Mattel recalled 19 million Chinese-made toys from the world market because of safety fears relating to lead paint and small magnets that can be shaken loose and swallowed by children. The cause of these problems has been attributed to the fact that various tasks that were previously performed in factories owned and operated by Mattel had been outsourced to Chinese contractors and sub-contractors (*The New York Times*, August 15, 2007). More systematic 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.

organizational changes that lead to a price *decrease*: this is the case if free factor mobility leads firms in the exporting country to switch to efficient integration, or to move away from inefficient integration. In other cases, factor market liberalization will not trigger any organizational changes, leaving aggregate quantities and *prices unchanged*. As an example, consider a sector i in which, before factor market liberalization, the world market-clearing price p_i^w is within the Home country’s integration price range. Since this range expands after factor market integration, world supply remains unchanged at this price, and thus p_i^w remains the equilibrium price.

Proposition 5 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: in the Home country, the surplus derived by A firms in the production of i good falls from $\hat{\alpha}$ to α^w , leading some A suppliers 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 firms from Home replace less efficient foreign firms. However, the increase in production may be quite small, depending on the distribution functions F and F^* (see Appendix), in which case the impact that factor liberalization has on consumer welfare depends mainly on its effects on the prices of the i goods.

We can then state the following:

Proposition 6 *Factor market liberalization may reduce consumer welfare in both countries.*

PROOF: Appendix.

5 Empirical Implications

In Sections 3 and 4 above, we have examined the organizational responses of firms facing the successive liberalization of product and factor markets. These “waves” of trade liberalization should lead to *waves of organizational restructuring*, where both firm boundaries and contractual relations within firms will change.

Our analysis also suggests that “deep integration” — the full liberalization of product and factor markets — should result in the *convergence of firms’ ownership structure* across countries and within industries. The specific type of ownership structure to which a liberalized industry will converge depends on demand and supply conditions prevailing in that industry, as well as on the terms of trade in supplier markets, which determines the range of prices for which vertical integration is chosen over outsourcing. This result implies, for example, that we should observe convergence of organizational choices within industries across members of the European Union (EU), which have eliminated barriers to both commodity trade and factor mobility.

To assess the validity of this prediction, we have started to explore how the degree of economic integration between countries affects the extent to which these countries have similar ownership structures at the industry level. In particular, we have focused on the comparison between EU members and the United States. To measure the extent of vertical integration in a given industry, we have employed the coefficients constructed by Acemoglu, Johnson and Mitton (2008) using information from WorldBase, a database of public and private companies in more than 200

countries and territories.¹⁸ We have obtained these coefficients for the United States and for 13 EU member countries¹⁹ for 77 BEA-defined industries.

We would expect the degree of integration of product and factor markets to be higher between any pair of EU countries than between a European country and the US, due to both lower transport costs and policy barriers. Our model would thus predict that the difference in the vertical integration measure of a given industry between any two EU countries should be smaller than the corresponding difference between any EU country and the US. We have thus performed the following simple regression: $|v_{ij} - v_{ik}| = \beta_1 D_{US} + \epsilon_{ijk}$, where v_{ij} and v_{ik} are the measures of vertical integration of industry i in countries j and k , and D_{US} is a dummy that equals one if one of the countries in the pair is the United States. We find a positive and significant coefficient for β_1 .²⁰ This provides some preliminary evidence for the hypothesis that countries that are more integrated in goods and factor markets have more similar organizational structures in a given sector, though clearly a more careful analysis is warranted to check the robustness of this result.

6 Conclusions

In this paper, we have embedded organizational firms into a standard model of international trade in order to examine effects of the liberalization of product and factor markets on firm boundaries and other aspects of organization. Falling trade costs will have a significant impact on organizational design, though the direction of change is not generally monotonic. Nor are these changes always efficient: even full liberalization may reduce consumer welfare in the presence of organizational firms. The “building-block” model of the firm in our setup emphasizes one important trade-off influencing organizational choice (coordination vs. specialization), and yields a particularly tractable model. Other building blocks (e.g., partnerships, hold up, or costly communication) could be used. At their broadest level, our results would be unaffected. But details do matter, and investigating the effects of trade liberalization in the presence of these other organizational trade-offs is an important avenue for future research.

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

¹⁸WorldBase reports the four-digit SIC code of the primary Industry in which each firm operates, and for some countries the SIC codes of up to five secondary codes listed in descending order of importance. Acemoglu, Johnson and Mitton (2008) use the 1992 US input-output tables to calculate the opportunity for vertical integration for every pair of industries, by computing the dollar value of one industry required to produce a dollar’s worth of the other industry. They then combine this information with firm data from WorldBase for the year 2002, to construct firm-specific and industry-specific measures of vertical integration.

¹⁹These are all the European countries that were EU members in 2002, excluding France and Greece, for which the vertical integration indexes could not be constructed since there is no information on secondary industries in which firms are active.

²⁰In all regressions, we have included sector fixed effects and robust standard errors clustered by country pair. The estimated coefficient on β_1 was always positive and was significant at the 5% level whenever we excluded industry coefficients constructed with very few firm observations.

maximize consumer welfare. Not so in the present model, which differs from the standard one only by the presence of organizational firms, where managers set the firm’s boundaries and design its 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 6, a small subsidy may induce an exporting firm’s managers to switch from (inefficient) non-integration to (efficient) integration by effectively raising the revenue generated by exporting (in a higher price range, gains from a subsidy could also be made if it encouraged an inefficiently integrated firm to divest).

The analysis also suggests that policies that more directly address organizational inefficiencies may complement trade policy. The model of firms’ organizational design described in the paper is most descriptive of “family firms,” or other closely-held organizations in which the primary decision makers have high financial stakes. The model could easily be adjusted to describe “managerial firms,” in which the primary decision makers have low financial stakes. For instance, suppose the suppliers’ managers receive only a small fraction λ of the revenues, with the remainder accruing to outside shareholders who nevertheless have little control over major organizational decisions. In this setting, it is straightforward to show that managers will decide to integrate when product price lies in $(\underline{p}(\hat{\alpha})/\lambda, \bar{p}(\hat{\alpha})/\lambda)$, a much broader range of product prices than in the case considered above (for which λ was equal to 1). In turn, this will increase the range of prices for which the inefficient forms of integration and non-integration would be chosen by the managers.

Shareholders’ interests will now diverge from those of their managers: typically, they will prefer higher output levels than their managers do. This is because shareholders are unconcerned with the managers’ private costs, but value revenue (and since they are competitive, they have no interest in reducing output). In particular, their interests may be more aligned with those of consumers (who obviously favor high output) than with those of managers.²¹

Consider a corporate governance policy that effectively gives shareholders greater control over organization design decisions (or compare countries with “good corporate governance” or “strong shareholder protection” to those without). It is easy to show that this policy would reduce the likelihood that factor liberalization leads to a price increase and thus to a loss in consumer surplus.²² Moreover, goods market liberalization now becomes more effective: it is clear that such liberalization can only be consumer-welfare enhancing in our model; however, the gains from trade liberalization would be larger still if organization were always chosen to maximize output rather than managerial welfare. Our analysis thus suggests a potential *complementarity* between

²¹However, there are limits to this alliance of interests (see Legros and Newman, 2008b).

²²Compared to the case in which managers with low financial stakes decide on the firms’ ownership structure, integration of supplier markets will now be chosen for some prices below $\underline{p}(\hat{\alpha})/\lambda$ and non-integration for some prices in $(\tilde{p}/\lambda, \bar{p}(\hat{\alpha})/\lambda)$, raising output. Generally, “hostile” takeovers and divestitures will occur at the expense of B_i suppliers (the A ’s must still receive a surplus that satisfies (15)).

trade policy and corporate governance policy. From this point of view, it is not surprising that the European Commission has put forward an Action Plan on corporate governance, which is meant to 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

To ensure existence of a full employment equilibrium for both Home and Foreign (and therefore for the integrated world economy), define $p_0(\hat{\alpha})$ to be the lowest price at which an A can obtain the surplus $\hat{\alpha}$ under non-integration: $W^N(1, p_0(\hat{\alpha})) = \frac{p_0(\hat{\alpha})^2}{1+p_0(\hat{\alpha})} = \hat{\alpha}$. Note this equation has a unique solution, increasing in $\hat{\alpha}$. Thus, $p_0(\hat{\alpha}) > p_0(\hat{\alpha}^*)$. Moreover, the solution is independent of the sector, and it follows from Assumption 1 that $p_0(\hat{\alpha}) < \underline{p}(\hat{\alpha})$, so that Non-integration dominates Integration at $p_0(\hat{\alpha})$. We simply require that there is excess demand for good i at $p_0(\hat{\alpha})$, so that the equilibrium price must exceed $p_0(\hat{\alpha})$ and there is full employment of B_i 's. For this let $V_i = \max\{n_i, n_i^*\}$. We then impose

Assumption 2 For all $i \in \{1, \dots, I\}$, $u'_i(V_i Q^N(p_0(\hat{\alpha}))) > p_0(\hat{\alpha})$.

A.2 Proofs

Proof of Lemma 1

(i) Consider the function $g(p_i) = \left(\frac{1+p_i}{p_i}\right)^2 (p_i(1-\sigma) - \frac{1}{2}) - (1+p_i)$, defined on $[\underline{p}, \bar{p}]$ as the unique solution to

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

It is easily checked that $g(p_i)$ is continuous (in fact, differentiable), strictly concave, vanishes at \underline{p} and \bar{p} , and is therefore single-peaked.

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

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

where s , given by $u_A^N(s, p_i) \equiv \left(\frac{p_i}{1+p_i}\right)^2 ((2+p_i)s - s^2) = \alpha$, 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

$$2s(1-s) \leq g(p_i). \quad (16)$$

Now, Assumption 1 ensures that $s \in [0, 1/2]$ for any equilibrium $\hat{\alpha}$; $2s(1-s)$ is increasing on $[0, 1/2]$; and from (8), s is increasing in A 's payoff. Thus (16) is satisfied if and only if $\hat{\alpha} \leq h(p_i)$, where $h(\cdot)$ is a continuous, increasing transformation of $g(\cdot)$ with $h(\underline{p}) = h(\bar{p})$. Since g is single-peaked, so is h and therefore its upper contour sets are convex. Since $\mathcal{P}^I(\hat{\alpha})$ is the $\hat{\alpha}$ -upper contour set of h , $\mathcal{P}^I(\hat{\alpha})$ can be written as $[\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha})]$.

(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, i.e., that $\underline{p}(\hat{\alpha})$ is increasing and $\bar{p}(\hat{\alpha})$ is decreasing.

Remark. The function $g(p)$ (and therefore $h(p)$) used in the proof achieves a maximum at a unique point \check{p} , which is the (closed-form) solution to a simple cubic equation. Clearly \check{p} is contained in $[\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha})]$ when it is non-empty. For σ small enough to ensure non-emptiness of $[\underline{p}, \bar{p}]$, \check{p} is very nearly equal to $(1/\sigma)^{1/3}$, which is smaller than $(1/\sigma)^{1/2} - 1 = \tilde{p}$. Thus, $\tilde{p} > \underline{p}(\hat{\alpha})$. The condition for $\tilde{p} < \bar{p}(\hat{\alpha})$ is slightly more stringent, but will generally be satisfied if either σ or $\hat{\alpha}$ is not too large.

Proof of Proposition 5

Factor market liberalization has the following effects on product prices:

A price increase if

$$\begin{aligned} \underline{p}(\hat{\alpha}^*) &< p_i^w < \underline{p}(\alpha^w), \quad i \in \{1, \dots, m\}; \\ \text{or } \bar{p}(\hat{\alpha}) &< p_i^w < \bar{p}(\alpha^w), \quad i \in \{m+1, \dots, I\}; \end{aligned}$$

A price decrease if

$$\begin{aligned} \bar{p}(\alpha^w) &< p_i^w < \bar{p}(\hat{\alpha}^*), \quad i \in \{1, \dots, m\}; \\ \text{or } \underline{p}(\alpha^w) &< p_i^w < \underline{p}(\hat{\alpha}), \quad i \in \{m+1, \dots, I\}; \end{aligned}$$

No price change if

$$\begin{aligned} p_i^w &\in (\underline{p}(\hat{\alpha}), \bar{p}(\hat{\alpha})); \\ p_i^w &< \underline{p}(\hat{\alpha}^*); \\ p_i^w &> \bar{p}(\hat{\alpha}^*). \end{aligned}$$

Proof of Proposition 6

Proposition 5 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 the Home (Foreign) country 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 5, we can then identify conditions such that the equilibrium world price will strictly increase 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 the Home and Foreign countries, 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

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

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

$$\delta < (F^*(\alpha^w) - n)(\alpha^w - \hat{\alpha}^*) + (n - F(\alpha^w))(\hat{\alpha} - \alpha^w) \quad (17)$$

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

$$\delta \leq \frac{1}{2}(F^*(\alpha^w) - F(\alpha^w))(\hat{\alpha} - \hat{\alpha}^*). \quad (18)$$

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 (17), 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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