

IZA DP No. 698

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January 2003

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Discussion Paper No. 698  
January 2003

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## **ABSTRACT**

### **Product Market Integration, Comparative Advantages and Labour Market Performance\***

In a two-country model with trade driven by comparative advantages, it is considered how imperfectly competitive labour markets are affected by lower frictions in international goods trade. Easier goods trading is equivalent to increased mobility of employment across countries and thus a change in the trade-off between wages and employment faced by wage setters. While the effects of product market integration on the trade-off between wages and employment in general is ambiguous, it is shown that product market integration works like a general improvement in productivity via the specialization it allows through trade. Unambiguously, real wages and employment and welfare improve upon reductions in trade frictions, and therefore workers are better off irrespective of whether the market power of unions is enhanced or muted.

JEL Classification: F15, J30, J50

Keywords: trade frictions, wage formation, employment, welfare gains

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\* Comments and suggestions by participants at seminars at CEBR and Tartu are gratefully acknowledged. We also gratefully acknowledge financial support from the Danish Social Science Research Council.

# 1 Introduction

The globalization process has been most visible in financial market interactions and the growth in trade flows (see e.g. IMF (2002)). However, labour mobility has not been significantly affected so far, and therefore eventual labour market implications have to arise as a response to changes in capital and goods markets. From a European perspective, the indirect labour market consequences are potentially very important given that European product market integration is proceeding fast and labour markets are often asserted to suffer from structural problems. A concern often raised in the debate is that international integration will be detrimental to employment creation due to structural problems in the labour market. Others are concerned that the process will weaken the position of workers by eroding trade union power.

The presence of a link between international integration and labour market performance is suggested by casual evidence on adjustments to specific events, attempts at establishing cross-border cooperation between trade unions, and the stress on European wage norms in wage formation. Empirical analyses do also indicate that a Europeanization of labour markets is taking place (see e.g. Andersen, Haldrup and Sørensen (2000)). However, all this is indirect evidence, and does not really address the mechanisms through which international integration affects labour markets.

In this paper, we set up a two-country general equilibrium model to consider some of the channels through which integration of product markets affect labour markets, even if labour is not internationally mobile. Much of the debate has focused on how product market integration affects the wage elasticity of employment, since this is a key determinant of the effective bargaining power of trade unions (see e.g. Burda (1999)). Integration of product markets may or may not make employment more sensitive to the wage rate, and therefore it is in general ambiguous how the trade-off faced by trade unions is affected. The effect of product market integration on unions bargaining power can thus in general go either way. Still it is shown that real wages and employment unambiguously increase. The reason is that lower product market frictions make it possible to allocate production better according to comparative advantages, and this is like a general productivity increase making it possible to improve both real wages and employment. This shows that there are gains from product market integration, also in economies with imperfectly competitive labour markets. Interesting, although it is ambiguous whether union power effectively increases or decreases, workers are

unambiguously better off. This result may explain why trade unions in most European countries have been in favour of further European integration even though it is uncertain how the market power of trade unions may be affected in the process.

The larger part of the theoretical literature on the labour market consequences of product market integration has focused on the implications of international integration for competitiveness in product markets and how this affects the market power which can be exerted in labour markets. Specifically, it has been analysed how lower trade frictions affect the market power in models of reciprocal dumping, and the basic effects have been worked out in partial equilibrium models (see e.g. Huizinga (1993), Sørensen (1993), Naylor (1998), Andersen and Sørensen (2000))<sup>1</sup>. As is well-known the reciprocal dumping model can explain two-way trade in identical commodities, and the basic reason for trade is product market power causing prices to exceed marginal costs which induces cross-country market entry. While these models yield a number of interesting insights they rely on one particular reason for trade (i.e. reciprocal dumping), which has been contested, and also strategic assumptions (i.e. Cournot competition) which can be called into question (see e.g. Krugman (1995)). Moreover, these models tend to be partial equilibrium models in the sense that they focus on a specific sector, ignoring interdependencies among sectors, and ignoring changes in the range of goods produced.

The aim of this paper is to present a general equilibrium analysis of the labour market implications of product market integration leading to more specialization in production and an increase in international (intra-industrial) trade. Recent empirical evidence indicates not only a strong increase in intra-industrial trade (see e.g. Coppel and Durand (1999)), but also in specialization (see e.g. Midelfart-Knarvik et.al. (2000)). To explain observed trade flows it is necessary to take into account comparative advantages, trade frictions and the presence of non-traded commodities (see e.g. Davis and Weinstein (2001)). It has also been documented that exporting firms tend to have higher productivity than comparable non-exporting firms, and the causality runs from productivity to export, i.e. productive firms become exporters. Export is also associated with exit of less productive firms and

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<sup>1</sup>Driffill and van der Ploeg (1993) present a model with an exogenously given specialized production structure, and shows that wage formation is affected when tariffs are lowered because the responsiveness of prices to wages changes.

reallocation of resources to more efficient firms (see e.g. Bernhard and Jensen (1999a,1999b), and Bernhard, Eaton, Jensen and Kotum (2001)). The model presented here is in accordance with these stylized facts.

The idea underlying the following is that product market integration improves the possibilities of relocation of employment across countries - one basic channel through which this works is via changes in market shares, that is, if foreign market shares in domestic markets increase it amounts to a movement of jobs from domestic to foreign labour markets and vice versa. This effect is present even disregarding mobility of factors of production and if firms are competitive. In the following, therefore, we consider this mechanism in a setting in which factors of production are assumed not to be mobile across countries, and where product markets are competitive in order to focus on the basic mechanisms at stake.

Specifically, the model is an extension of the well-known Dornbusch, Fischer and Samuelson (1977) model of Ricardian trade. Trade frictions modelled as Samuelsons iceberg costs are present, and these trade frictions are taken to be reduced in the process of international product market integration. We introduce market power in labour markets and consider how reductions in trade frictions affect labour market performance. One important finding is that endogenous market shares imply that there is job mobility across countries. Interestingly, the elasticity of labour demand is larger than implied by the underlying structural preference parameter. Exploiting the general equilibrium set-up we are able to evaluate the consequences of reductions in trade frictions both for the equilibrium allocation and for welfare. The general equilibrium effects are not trivial since relocation of jobs also imply relocating income and thus employment. It is an implication that reductions in trade frictions imply more trade (fewer goods are non-traded) and specialization, with productive firms exporting and less productive firms being driven out by cheaper imports. Accordingly, the non-tradeables sector shrinks and production is reallocated to better match differences in efficiency/productivity. This is like a general productivity increase. As a consequence employment as well as real wages increase. These changes all tend to increase welfare.

The following is organized as follows. Section 2 develops a two-country general equilibrium model with trade frictions and differences in comparative advantages. Section 3 considers wage determination and the basic effects of product market integration, while section 4 analyses the general equilibrium effects of reductions in trade frictions. Section 5 offers a few concluding

remarks.

## 2 Product market integration

Consider the following stylized situation. We have two representative (European) countries trading with each other in various products subject to trade frictions. An ongoing integration process reduces frictions in goods trade. Neither real capital (surpassed) nor labour is mobile across countries. Product markets are competitive<sup>2</sup>, but labour is organized in trade unions setting a wage under a right to manage structure. The countries are assumed to be symmetric with respect to technology and the distribution of relative factor supplies (see below).

### Households

Households demand a variety of differentiated goods, and they can acquire goods from either domestic or foreign producers. Each household supplies a specific type of labour matching the labour requirements of one particular production activity (see below). Moreover, households own firms and are entitled to profits. The utility of the representative household type  $h \in [0, 1]$  is assumed to be

$$U_h = c_h - dl_h^\gamma, \quad \gamma > 1. \quad (1)$$

This formulation captures the utility from consumption of the private consumption bundle  $c_h$  (see below), and the disutility of work  $l_h$ . Note that  $d$  normalizes the disutility of work to the utility of consumption. The budget constraint of the household reads

$$Qc_h = I_h + \Pi_h, \quad (2)$$

where  $Q$  is the consumer price index (see below),  $\Pi_h$  denotes nominal profits and  $I_h$  nominal labour income.

The consumption bundle,  $c_h$ , is defined over commodities of different types, produced in different sectors, indexed by  $j$ ,

$$c_h = \left[ \int_0^1 c_{hj}^{\frac{\theta-1}{\theta}} dj \right]^{\frac{\theta}{\theta-1}}, \quad (3)$$

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<sup>2</sup>Note that the same mechanism determining the boundary between exports, imports and non-tradeables is present if firms are in a monopolistically competitive (Bertrand) position, see Andersen (2002).

where  $\theta$  ( $> 1$ ) measures the elasticity of substitution between the different types of goods. The associated price index is given by

$$Q \equiv \left[ \int_0^1 Q_j^{1-\theta} dj \right]^{\frac{1}{1-\theta}}. \quad (4)$$

The demand by household  $h$  of commodities of type  $j$  is given as

$$c_{hj} = \left[ \frac{Q_j}{Q} \right]^{-\theta} c_h. \quad (5)$$

The consumption bundle of goods of type  $j$  is similarly defined over subtypes of products indexed by  $i$ , i.e.

$$c_{hj} = \left[ \int_0^1 c_{hji}^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}}. \quad (6)$$

For simplicity the elasticity of substitution between these subtypes of goods is also assumed to be given by  $\theta$ . The associated price index is

$$Q_j \equiv \left[ \int_0^1 Q_{ji}^{1-\theta} di \right]^{\frac{1}{1-\theta}}, \quad (7)$$

and the demand by household  $h$  of commodity  $i$ , produced in sector  $j$ , is given as

$$c_{hji} = \left[ \frac{Q_{ji}}{Q_j} \right]^{-\theta} c_{hj}. \quad (8)$$

Aggregate demands are found by aggregation of demand by individual households to read

$$c_j = \left[ \frac{Q_j}{Q} \right]^{-\theta} c, \quad (9)$$

$$c_{ji} = \left[ \frac{Q_{ji}}{Q_j} \right]^{-\theta} c_j, \quad (10)$$

where  $c$  is aggregate consumption.

Consumers can acquire the commodities they buy from either domestic or foreign producers of consumption goods. A given variety  $i$  in the goods category  $j$  is offered by domestic producers at a price  $P_{ji}$  and by foreign producers at a price  $P_{ji}^*$ . However, there are frictions involved in international trade (see e.g. Dornbusch, Fischer and Samuelson (1977)) which can be thought of as various non-tariff impediments to trade. These costs can also

be interpreted as information or search costs concerning foreign markets, and they can include both fixed and proportional components. However, since the qualitative results of the paper hold in either case, we chose to work with the more simple case of proportional costs.

Let  $z_{ji}$  denote the gross costs of acquiring one unit from a foreign supplier. Hence,  $z_{ji} \geq 1$  since acquisition of one unit of the commodity may absorb resources to overcome trade frictions ( $z_{ji} = 1$  corresponds to frictionless international trade). It is assumed that the trade friction is a function of an indicator variable  $\tau$ , i.e.  $z_{ji} = z_{ji}(\tau)$ , where  $z_{ji}$  is increasing in  $\tau$ . The parameter  $\tau$  will in the following be varied to capture product market integration arising from a reduction in trade frictions.

Domestic consumers choose a domestic supplier if

$$P_{ji} \leq P_{ji}^* z_{ji}, \quad (11)$$

while a foreign supplier is chosen if

$$P_{ji} > P_{ji}^* z_{ji}. \quad (12)$$

It follows that the consumer price  $Q_{ji} = P_{ji}$  if the final good is acquired from a domestic producer, and  $Q_{ji} = P_{ji}^* z_{ji}$  if it is acquired from a foreign producer.

## Producers

Firms in sector  $j$  produce goods of type  $j$  by use of labour type  $j$ , subject to a linear production technology

$$y_{ji} = A_{ji} l_{ji}, \quad (13)$$

where  $A_{ji}$  is an exogenous productivity parameter. The productivity parameter allows for trade based on differences in comparative advantages (see below).

The relative productivity of domestic labour to foreign labour in producing commodity  $i$  in sector  $j$  is defined as

$$a_{ji} \equiv \frac{A_{ji}}{A_{ji}^*}. \quad (14)$$

The comparative advantage variable  $a_{ji}$  is symmetrically distributed with a density function<sup>3</sup>  $g(a_{ji})$ , where  $a_{ji} \in [\lambda^{-1}, \lambda], \lambda > 1$ .<sup>4</sup> This implies that  $a_{ji} = 1$  for  $i = 1/2$ , that is, for half the goods, the domestic economy has a comparative advantage relative to the foreign country and vice versa. Note that it is an implication that the average skill levels are the same in the two countries. The distribution of comparative advantages can reflect historic specialization in various product varieties (see e.g. Grossman and Helpman (1995)).

The production structure captures that various producers in a certain sector convert similar kinds of inputs into different final consumption goods. There is perfect competition and, hence, the price is

$$P_{ji} = A_{ji}^{-1}W_j. \quad (15)$$

where  $W_j$  is the wage rate in the domestic country in sector  $j$ .

Using this price formula, it is possible to determine which final goods are produced domestically, and which are imported. To this end consider first the condition ensuring that domestic consumers choose a domestic supplier (i.e. (11)) which can be written as

$$A_{ji}^{-1}W_j \leq z_{ji}A_{ji}^{*-1}W_j^*, \quad (16)$$

or

$$w_j \leq z_{ji}a_{ji}, \quad (17)$$

where  $w_j = \frac{W_j}{W_j^*}$  is the relative wage.

Similarly, foreign consumers choose domestic suppliers if

$$w_j \leq z_{ji}^{-1}a_{ji}. \quad (18)$$

We thus have that a specific commodity  $i$  in product group  $j$  is exported provided  $i \in E_j$ , where

$$E_j = \{i \mid w_j < z_{ji}^{-1}a_{ji}\}, \quad (19)$$

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<sup>3</sup>It is assumed that  $g(a_{ji}) < g^*$ , that is, the distribution of comparative advantage does not have too much mass at a single point.

<sup>4</sup>Assume that  $A_{ji}$  is uniformly distributed over the interval  $[1 - x, 1 + x]$  and similarly for  $A_{ji}^*$ . Hence  $\frac{A_{ji}}{A_{ji}^*}$  is distributed over the interval  $\left[\frac{1-x}{1+x}, \frac{1+x}{1-x}\right]$ , with a density function with the property that  $g\left(\frac{1}{y}\right) = g(y)$ .

is a non-traded good provided  $i \in NT_j$ , where

$$NT_j = \{i \mid z_{ji}a_{ji} \geq w_j \geq z_{ji}^{-1}a_{ji}\}, \quad (20)$$

and, finally, that it is imported if  $i \in I_j$ , where

$$I_j = \{i \mid w_j > z_{ji}a_{ji}\}. \quad (21)$$

Whether given commodities are exported, imported or non-traded is determined endogenously depending on relative wages, comparative advantages and trade frictions. Trade can be interpreted as intra-industrial trade since there is trade within industry  $j$  with some product types being exported and other types being imported. It is an implication that trade is related to specialization as export goods are only produced in the home country and vice versa for import goods. The non-traded sector represents varieties being produced in both countries. If lower trade frictions lead to more trade (see below) and a shrinking non-tradeable sector, it follows that this is accompanied by more specialization. Observe that there is never two-way trade of identical commodities ( $ji$ ), but there is export and import of commodities of a given category ( $j$ ).

For later reference, observe that consumer prices are given as

$$Q_{ji} = \begin{cases} P_{ji} = A_{ji}^{-1}W_j & \text{if } i \in E_j \cup NT_j \\ z_{ji}P_{ji}^* = z_{ji}A_{ji}^{*-1}W_j^* & \text{if } i \in I_j \end{cases}, \quad (22)$$

and therefore

$$Q_j = \left[ W_j^{1-\theta} \int_{i \in E_j \cup NT_j} A_{ji}^{\theta-1} di + W_j^{*1-\theta} \left[ \int_{i \in I_j} z_{ji}^{1-\theta} A_{ji}^{*\theta-1} di \right] \right]^{\frac{1}{1-\theta}}. \quad (23)$$

Since all sectors are symmetric this also defines the aggregate price level ( $Q_j = Q$ ).

### Labour demand

The demand for labour of variety  $j$  can now be determined. Although not directly in competition over jobs with foreign workers, the domestic workers are affected by international trade, since the wage rate affects the competitiveness of domestic firms and hence which goods become traded.

Seen from the perspective of the workers, the home market is thus

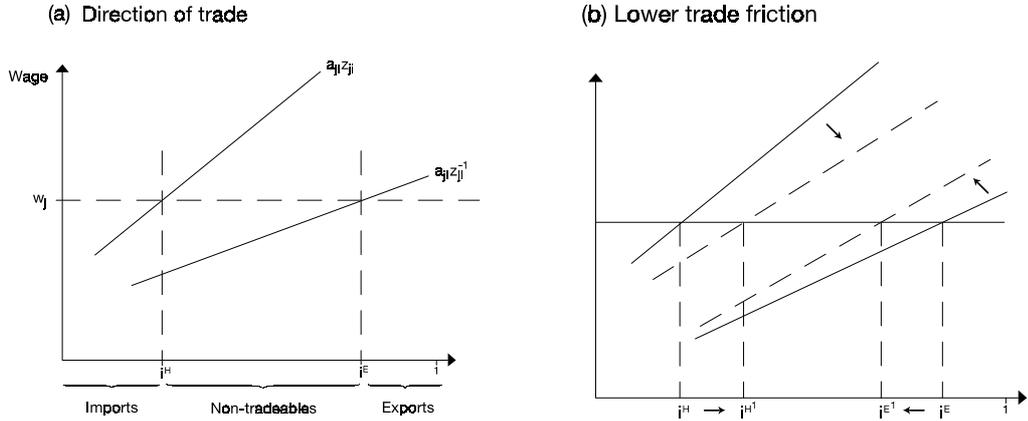
$$H_j = E_j \cup NT_j = \{i \mid w_j \leq z_{ji}a_{ji}\}, \quad (24)$$

and the export market is

$$E_j = \{i \mid w_j < z_{ji}^{-1}a_{ji}\}. \quad (25)$$

We make the monotonicity assumption that both  $a_{ji}$  and  $z_{ji}$  are monotone increasing in  $i$ , where  $\varepsilon_{a_{ji},i} > \varepsilon_{z_{ji},i}$ .<sup>5</sup> It then follows that there exists a critical value of  $i$ - in the following denoted  $i^H$ - with the property that all  $i \geq i^H$  belong to  $H_j$ . Similarly, there is a critical value of  $i$ - in the following denoted  $i^E$ - with the property that all  $i \geq i^E$  belong to  $E_j$ . Note<sup>6</sup> that  $i^E \geq i^H$ . It also follows that  $i^E = i^E(w_j, \tau)$  and  $i^H = i^H(w_j, \tau)$ , where  $\frac{\partial i^E}{\partial w_j} > 0$ , and  $\frac{\partial i^H}{\partial w_j} > 0$ , i.e. an increase in the relative wage of domestic labour increases the range of goods being imported and reduces the range of goods being exported. A reduction of trade frictions leads to an increase in  $i^H$  and a decrease in  $i^E$ , i.e. more imports and exports and the non-tradeables sector shrinks. Figure 1 illustrates the endogenous determination of which goods are traded and the direction of trade as well as how this is affected by a reduction of trade frictions.

Figure 1:



<sup>5</sup>In the following  $\varepsilon_{x,y}$  denotes the elasticity of  $x$  wrt  $y$ .

<sup>6</sup>Since  $z_{ji} \geq 1$ , it follows that  $i \in E_j \Rightarrow i \in H_j$ , while  $i \in H_j \not\Rightarrow i \in E_j$ .

Using the demand and production functions (i.e. (9), (10) and (13)), the total labour demand in sector  $j$  can be written

$$L_j = \int_{i^H}^1 \frac{1}{A_{ji}} \left[ \frac{Q_{ji}}{Q_j} \right]^{-\theta} \left[ \frac{Q_j}{Q} \right]^{-\theta} c di + \int_{i^E}^1 \frac{z_{ji}}{A_{ji}} \left[ \frac{Q_{ji}^*}{Q_j^*} \right]^{-\theta} \left[ \frac{Q_j^*}{Q^*} \right]^{-\theta} c^* di, \quad (26)$$

The first part on the RHS gives the labour demand generated by supplying goods to the domestic market, and the second part is the labour demand generated by supplying to the foreign market. Inserting the relevant consumer prices, we find that

$$L_j = \phi^H \left( \frac{W_j}{W_j^*}, \tau \right) \left[ \frac{W_j}{Q} \right]^{-\theta} c + \phi^E \left( \frac{W_j}{W_j^*}, \tau \right) \left[ \frac{W_j}{Q^*} \right]^{-\theta} c^* \quad (27)$$

where

$$\phi^H \left( \frac{W_j}{W_j^*}, \tau \right) \equiv \int_{i^H}^1 A_{ji}^{\theta-1} di, \quad (28)$$

$$\phi^E \left( \frac{W_j}{W_j^*}, \tau \right) \equiv \int_{i^E}^1 z_{ji}^{1-\theta} A_{ji}^{\theta-1} di. \quad (29)$$

Note that  $\phi^H$  is positively related to the share of production going to the home market, and  $\phi^E$  to the share of production going to the foreign market.

### Equilibrium conditions

By using that there are no profits in equilibrium, it follows from the budget constraint of the households that

$$c = \int_0^1 W_j L_j dj. \quad (30)$$

It is an implication that trade is balanced. Moreover, labour demand (see (27)) equals labour supply (see below), and total demand for a given product variety equals supply, i.e.

$$c_{ji} + c_{ji}^* = y_{ji} \quad \text{for } i \in E_j, \quad (31)$$

$$c_{ji} = y_{ji} \quad \text{for } i \in NT_j, \quad (32)$$

$$c_{ji} + c_{ji}^* = y_{ji}^* \quad \text{for } i \in I_j. \quad (33)$$

Similar relations hold for the foreign country.

### 3 Wage formation

Assume that workers supplying labour used for production in sector  $j$  are organized in a trade union setting the wage under a right to manage structure and taking all aggregate variables as given. The trade union is assumed to be utilitarian, and, since the disutility of work is increasing in employment, trade union members share the employment. That is the wage is chosen so as to solve

$$\text{Max } U_j = \frac{W_j L_j}{Q M} - d \left( \frac{L_j}{M} \right)^\gamma, \quad (34)$$

where  $M$  is the number of trade union members. The wage rate turns out to be

$$\frac{W_j}{Q} = \frac{\varepsilon_{L_j, W_j}}{1 + \varepsilon_{L_j, W_j}} d \gamma \left( \frac{L_j}{M} \right)^{\gamma-1} \quad (35)$$

Equation (35) gives the wage curve as depending on the mark-up parameter, determined in the usual way via the elasticity of labour demand  $\varepsilon_{L_j, W_j}$ , the parameter  $d$  determining the level of disutility of work, and the amount of employment (with an elasticity  $\gamma - 1 > 0$ ).

#### Labour demand elasticity

The wage curve (35) includes the crucial effect linking product market and labour markets, namely, the elasticity  $\varepsilon_{L_j, W_j}$  and, therefore, the trade-off between wages and employment faced by workers. This in turn affects the market power of trade unions.

The labour demand elasticity is found to be:

$$\varepsilon_{L_j, W_j} = -\theta + v \varepsilon_{\phi^H, W_j} + (1 - v) \varepsilon_{\phi^E, W_j}, \quad (36)$$

where  $v$  denotes the share of production going to the home market

$$v \equiv \frac{\phi^H \left( \frac{W_j}{W_j^*}, \tau \right) \left[ \frac{W_j}{Q} \right]^{-\theta} y}{\phi^H \left( \frac{W_j}{W_j^*}, \tau \right) \left[ \frac{W_j}{Q} \right]^{-\theta} y + \phi^E \left( \frac{W_j}{W_j^*}, \tau \right) \left[ \frac{W_j}{Q^*} \right]^{-\theta} y^*}. \quad (37)$$

One important fact concerning the demand elasticity for labour is that its numerical value exceeds the underlying elasticity of consumer demand, i.e. (see Appendix)

$$\varepsilon_{L_j, W_j} < -\theta. \quad (38)$$

The intuition is that there are two dimensions of substitution, namely, between different commodities and between domestic and foreign suppliers. When demands are relocated between domestic and foreign firms, it corresponds to production (employment) becoming more mobile across national borders even though factor mobility is nil. This implies that the labour demand elasticity is higher in an open economy than in a closed economy. However, how further integration affects the labour demand elasticity is in general ambiguous, i.e.

$$\frac{\partial \varepsilon_{L_j, W_j}}{\partial \tau} = \frac{\partial \left[ v \varepsilon_{\phi^H, W_j} + (1 - v) \varepsilon_{\phi^E, W_j} \right]}{\partial \tau} \begin{matrix} \geq \\ \leq \end{matrix} 0. \quad (39)$$

In general it is not possible to conclude whether effective bargaining power of unions decreases or increases. As shown below it is still possible to make inference on how real wages and employment are affected in general equilibrium. This points out that the strong focus in the literature on the effects of product market integration on labour demand elasticities may be potentially misleading, since it overlooks important general equilibrium effects.

## 4 General equilibrium

The global or two-country general equilibrium can fairly easily be worked out exploiting the symmetry conditions made in the model.

### Trade

First consider trade. In the symmetric equilibrium, the home markets in the two countries are of equal size, i.e.

$$i_H = 1 - i_E. \quad (40)$$

Lower trade frictions imply that  $i^H$  increases and  $i^E$  decreases. From (40), it follows that there is an increase in the range of commodities which are exported which is similar to the increase in the range of commodities which are imported. That is, the non-tradeable sector decreases both because more goods are exported and because more goods are imported. It is an implication that production becomes more specialized reflecting that the allocation

of production across countries to a larger extent reflects comparative advantages. Trade is thus driven by productivity, and production becomes more efficiently allocated the lower are the trade frictions.

### Productivity

Aggregate labour productivity for the types of activities in operation domestically can be written

$$\bar{A} \equiv \frac{\int_{i^H}^1 A_{ji} di}{\int_{i^H}^1 di}, \quad (41)$$

from which it follows that

$$\frac{\partial \bar{A}}{\partial i^H} = [\bar{A} - A_{ji^H}] \int_{i^H}^1 di > 0. \quad (42)$$

A lower trade friction ( $\tau$ ) implies that  $i^H$  increases and, therefore, that average productivity goes up<sup>7</sup>. The intuition is that further product market integration implies that less efficient domestic production is squeezed out by more productive foreign production, i.e. production becomes more efficiently allocated across countries according to comparative advantage. As a result aggregate labour productivity goes up and this implies an outward shift in the possibility set of real wages and employment available to the economy.

### Wages and employment

Turning to equilibrium real wages and employment, we find by imposing the conditions for a symmetric equilibrium on (27) that the real wage is determined from the relation

$$1 = [\phi^H(1, \tau) + \phi^E(1, \tau)] \left[\frac{W}{Q}\right]^{1-\theta}. \quad (43)$$

The definitions of  $\phi^H$  and  $\phi^E$  (see (28) and (29)) and (40), imply that

$$\frac{\partial \phi^H(1, \tau)}{\partial \tau} + \frac{\partial \phi^E(1, \tau)}{\partial \tau} > 0. \quad (44)$$

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<sup>7</sup>Note that since production is distributed according to comparative advantage, and the relative productivity of domestic firms is increasing in the index  $i$  it follows that  $\bar{A} > A_{ji^H}$ .

It follows that the real wage is decreasing in the level of trade frictions, by use of (44) and (43), i.e.

$$\frac{\partial \left( \frac{W}{Q} \right)}{\partial \tau} < 0. \quad (45)$$

Lower trade frictions lead to higher real wages for two reasons, namely, the direct effect arising from lower prices of all imported commodities, and the indirect effect arising from better match of production according to comparative advantages. The latter is like a general productivity increase, cf. above. It is noteworthy that the demand elasticity  $\varepsilon_{L_j, W_j}$  does not enter this expression.

It follows straightforwardly (by using (27), (44) and (45)) that employment is also decreasing in the level of trade frictions, i.e.

$$\frac{\partial L}{\partial \tau} < 0. \quad (46)$$

Accordingly, a reduction of trade frictions leads to an increase in both real consumption wages and employment in equilibrium.

### **Welfare**

Finally, consider the welfare effects. The utility of households can in symmetric equilibrium be written

$$U = \frac{W}{Q} \frac{L}{M} - d \left( \frac{L}{M} \right)^\gamma. \quad (47)$$

By using (35), (45) and (46), it follows that

$$\frac{\partial U}{\partial \tau} = \frac{\partial \frac{W}{Q}}{\partial \tau} \frac{L}{M} + \left[ \frac{\varepsilon_{L_j, W_j}}{1 + \varepsilon_{L_j, W_j}} - 1 \right] d\gamma \left( \frac{L}{M} \right)^{\gamma-1} \frac{\partial \frac{L}{M}}{\partial \tau} > 0. \quad (48)$$

A decrease in the trade friction ( $\tau$ ) gives rise to an unambiguous improvement in welfare, and the reason being that there is a gain arising from higher real wages as well as higher employment. There are several reasons for the increasing welfare. The reduction in trade costs saves resources which in turn gives rise to a decrease in consumer prices. Furthermore, since more goods become traded, there is increasing specialization in goods production which also tends to give rise to lower consumer prices. Finally, observe that the higher the market power of unions (the less sensitive employment is to wages) the lower is employment and, therefore, the larger the gains from improvements in employment.

## 5 Concluding remarks

We have analysed the effects of a reduction in international trade frictions in a setting with trade driven by comparative advantages and when labour markets are imperfectly competitive (unionized). One implication of product market integration is further specialization in goods production implying a more efficient exploitation of comparative advantages. This improved possibility for international trade in goods spills over to the labour market. This may be seen as a change in the labour demand elasticity changing the employment and wage trade-off for the trade unions.

Unions may lose power to the extent that employment becomes more sensitive to the wage rate. However, even if unions lose power in this sense, the net result of the decreasing trade costs is an increase in the real wage and an increase in employment. Therefore, trade union members become better off, and total welfare increases.

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## APPENDIX

From (28) and (29) we have

$$\phi^H\left(\frac{W_j}{W_j^*}, \tau\right) = \int_{i^H}^1 A_{ji}^{\theta-1} di, \quad (49)$$

$$\phi^E\left(\frac{W_j}{W_j^*}, \tau\right) = \int_{i^E}^1 z_{ji}^{1-\theta} A_{ji}^{\theta-1} di. \quad (50)$$

First, we notice that  $\phi^H\left(\frac{W_j}{W_j^*}, \tau\right) \geq \phi^E\left(\frac{W_j}{W_j^*}, \tau\right)$ . This follows by observing that  $z_{ji}^{-\theta} \leq 1$  and that  $i^H \leq i^E$ .

Next, we shall prove that  $v\varepsilon_{\phi^H, w_j} + (1-v)\varepsilon_{\phi^E, w_j} \leq 0$ .

Note first that

$$w_j = a_{ji^H} z_{ji^H}, \quad (51)$$

$$w_j = a_{ji^E} z_{ji^E}^{-1}. \quad (52)$$

defines  $i^H$  and  $i^E$  as implicit functions of  $w_j$ , where

$$\frac{\partial i^H}{\partial w_j} > 0, \quad \frac{\partial i^E}{\partial w_j} > 0,$$

since

$$\begin{aligned} \frac{\partial (a_{ji^H} z_{ji^H})}{\partial i} \frac{i}{a_{ji^H} z_{ji^H}} &= \varepsilon_{a_{ji}, i} + \varepsilon_{z_{ji}, i} > 0, \\ \frac{\partial (a_{ji^E} z_{ji^E}^{-1})}{\partial i} \frac{i}{a_{ji^E} z_{ji^E}^{-1}} &= \varepsilon_{a_{ji}, i} - \varepsilon_{z_{ji}, i} > 0, \end{aligned}$$

where the signs follow from the assumptions made on  $a_{ji}$  and  $z_{ji}$ . It follows straightforwardly that

$$\varepsilon_{\phi^H, w_j} = -A_{ji^H}^{\theta-1} \frac{\partial i^H}{\partial w_j} \frac{w_j}{\phi^H} < 0 \quad (53)$$

$$\varepsilon_{\phi^E, w_j} = -A_{ji^E}^{\theta-1} z_{ji^E}^{1-\theta} \frac{\partial i^E}{\partial w_j} \frac{w_j}{\phi^E} < 0 \quad (54)$$

Since  $0 \leq v \leq 1$ , it follows that  $v\varepsilon_{\phi^H, w_j} + (1-v)\varepsilon_{\phi^E, w_j} \leq 0$ .

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