Intra-Industry Trade Liberalization, Wage Inequality and Trade Policy Preferences

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Abstract
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JEL Codes:  F11, F12
Keywords: Trade and wages; intra-industry trade

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ABSTRACT

This paper presents a simple theoretical model that connects the prevalence of intra-industry trade (IIT) with increased wage inequality from trade liberalization in skilled and unskilled countries. Provided that a country is diversified, skilled workers gain at the expense of unskilled workers from multilateral trade liberalization. Based on this result, we empirically examine whether skilled labor is more supportive of trade liberalization than unskilled labor across 24 countries with different levels of high-tech IIT activity and skill endowments. The empirical results suggest that skilled workers in twenty-two of the twenty-four countries surveyed are more likely than unskilled workers to oppose protection. The marginal effects on opposition to protectionism by skilled labor are the largest in those countries that are most abundant in human capital and that have the largest proportion of high-tech intra-industry trade but still positive in the majority of the least human capital endowed countries. Further, the results from our pooled regressions confirm our prediction that intra-industry trade and exports of high-tech goods have an impact on the trade policy preferences across both skilled and unskilled labour.

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1 INTRODUCTION

The impact of trade policy on the distribution of income among domestic factors of production has received a great deal of attention as the wage gap between skilled and unskilled workers has risen in many countries concurrently with increased trade liberalization. Whether trade liberalization is an important causal factor in the trend toward greater wage inequality has been highly controversial in both public and academic debate.\(^1\)

In recent decades wage inequality between skilled and unskilled labor has been rising within developed countries (Leamer (1996), Wood (1994) and Slaughter (1998)) and across some developing countries (Das (2002), Zhu and Trefler (2001), Wood (1997), Robbins (1996), and Feenstra and Hanson (1996)). While much of the literature concentrates on identifying factors that cause this wage gap, recent work examines the relationship between trade policy preferences and labour market outcomes. Empirical studies by Baldwin and Magee (2000), Scheve and Slaughter (2001a,b) and Beaulieu (2000, 2002a,b)) conclude that skilled labor in the United States and Canada is more likely to oppose protectionism than unskilled labor.

In this paper, we develop a theoretical model that connects the prevalence of intra-industry trade with increased wage inequality from trade liberalization. On the basis of this theoretical outcome, we empirically examine whether skilled labor is more likely to resist protectionism than unskilled labour in countries engaged in intra-industry across twenty-four countries using data from the International Social Survey Programme (ISSP). The motivation for this framework is the observation that much of the recent success in reducing trade barriers has occurred within what can be loosely termed the skill-intensive sector. This within-sector liberalization seems closely associated with the dramatic increase in intra-industry trade.

Our theoretical model builds on Krugman (1995), who incorporates monopolistic competition and intra-industry trade in the standard $2 \times 2 \times 2$ trade model. Given symmetric
intra-industry liberalization within the monopolistically competitive skill-intensive high-tech sector, the results suggest that reciprocal increases in demand for imported skill-intensive products lead to rising wage inequality through conventional Stolper-Samuelson channels that link product and factor prices. The traditional Stolper-Samuelson effect is vindicated, though in a new context; wage inequality rises due to a higher relative price of domestic skill-intensive high-tech goods in all countries. With skilled-labour tending to experience gains from freer trade in diversified countries engaging in intra-industry trade of high-tech goods, it follows that skilled labour will, in general, be more opposed to protectionism.

This theoretical outcome is supported by our empirical findings that skilled labor across a wide variety of countries is systematically less supportive of protectionism and, by extension, more supportive of trade liberalization than unskilled labor. These empirical results are robust to different model specifications. For example, skilled labor is less likely to favour protectionist measures in a variety of pooled regressions with fixed country effects. Further, when the model is estimated for each country separately, highly skilled labor is more likely to oppose import protection than unskilled labour in twenty-two of the twenty-four countries. While the difference between skilled and unskilled workers is greater in some countries than others, skilled labor is more supportive of protectionism only in the Philippines and Bulgaria and the estimated coefficient on skill is only significant for the former.

To our knowledge only two discussion papers, O'Rourke and Sinnott (2001) and Mayda and Rodrik (2001), use the ISSP survey to explore the determinants of trade preferences. These papers focus on non-economic determinants of preferences for trade protection, such as values and identities (i.e. nationalism). In contrast, our analysis focuses primarily on economic determinants such as the role of intra-industry trade and exports of high-tech goods. Mayda and Rodrik (2001) interpret the result that skilled labour in the wealthiest countries oppose
protectionism whereas in the Philippines it is more supportive of protectionism as showing support for the standard theoretical analysis of inter-industry trade liberalization based on Stolper and Samuelson (1941). In the current paper we allow a continued role for this interpretation, but also provide a broader explanation based on intra-industry trade that widens the scope of trade liberalization forces subject to the Stolper-Samuelsom Theorem. The results from our pooled regressions provide strong support for our theoretical findings that intra-industry trade and exports of high-tech goods have an impact on the wage gap between skilled and unskilled labour, and by extension preferences towards protectionism. In this context, it is not only possible for the majority of the countries to experience increasing wage inequality but also for a relatively skill-scarce country such as the Philippines to exhibit diminishing wage inequality. For example, the Philippines may have a reduction in the relative price of those few high-tech goods that it produces because inter-industry trade liberalization rather than intra-industry liberalization could be the dominant force.

The contributions of the current paper can thus be summarized as follows. Firstly, the current paper develops a simple theoretical model of intra-industry trade in final goods where a reduction in trade barriers tends to increase wage inequality and skill formation in favor of skilled labor in diversified countries engaged in intra-industry trade regardless of whether or not they are skilled-labour abundant. The countries most heavily engaged in intra-industry as measured by the proportion of high-tech goods that are exported will typically experience a greater increase in relative competitiveness and thus, wage inequality. Secondly, the current paper is the first to empirically identify intra-industry trade and exports of high-tech goods as factors in explaining the relative preferences of skilled labour against protectionism. Finally, while others have empirically studied whether skilled labour is more supportive of trade liberalization than unskilled labour for Canada or United States, none of these studies examine
the issue across many countries. In contrast, we consider the issue across twenty-four countries that vary widely in skill abundance and per-capita income.

2 A SIMPLE THEORETICAL MODEL

In this section we develop a theoretical trade model that suggests that intra-industry trade liberalization can lead to rising wage gaps between skilled and unskilled labour across a wide range of countries. Most other theoretical models of trade liberalization that seek to explain rising wage inequality focus on elaborating the structure and dynamics of production and markets (Krugman (2000), Dinopoulos and Segerstrom (1999), Feenstra and Hanson (1996), Sachs and Shatz (1998) and Sener (2001)). In contrast, the current framework relies on more appropriate modeling of the features of intra-industry as well as inter-industry trade liberalization. The paper closest to ours is that of Dinopoulos, Syropoulos and Xu (2001) who employ a North-North model. While both models incorporate monopolistic competition, our model uses more standard restrictions on the underlying technology, allows for both intra and inter-industry trade in final goods, and can more readily accommodate North-South differences in technology and factor endowments as well as North-North issues concerning market size. Our explanation of how trade liberalization can cause rising wage inequality in many countries has the virtue of greater simplicity and generality.

As in Krugman (1995) we adapt the conventional 2 × 2 × 2 model by allowing one sector to exhibit monopolistic competition. There are \( m \) countries indexed by \( k \) and each country consists of two-sectors. The high-tech sector, \( j = X \), produces differentiated high-tech products under monopolistic competition, while the traditional sector, \( j = Y \), produces a traditional homogeneous product under perfect competition. The high-tech sector is always relatively intensive in skilled labor, \( i = S \), whereas the traditional sector is intensive in unskilled labor, \( i = U \). Each high-tech firm produces a single variety, the number of varieties and firms adjusts to
drive profits to zero, and countries are diversified so that at least one high-tech variety is produced in each country. The number of varieties produced in country $k$, $n_k$, is endogenous.

2.1 Trade and Protection

The model allows intra-industry trade within the high-tech sector as well as inter-industry trade across sectors. All trade, however, may be subject to protectionism. We let $\tau_{jk} \geq 1$ represent an \textit{ad valorem} “protectionist coefficient” applied to sector $j$ by country $k$. When country $k$ does not apply protectionist measures to sector $j$, $\tau_{jk} = 1$. Country $k$ may apply a uniform most-favoured-nation tariff to all imported varieties of the high-tech good, $\tau_{Xk} > 1$, but international trade law prohibits export subsidies on high-tech goods. Given the situation that prevails in agriculture, we allow for the presence of export subsidies and tariffs in the traditional sector. If country $k$ imports the traditional good, then $\tau_{yk} > 1$ implies that it applies an \textit{ad valorem} tariff to the traditional good, but if it exports, $\tau_{yk} > 1$ indicates an export subsidy. Export subsidies are cast as “protectionist” because they raise the domestic price and thereby protect domestic producers.

For simplicity, we assume that tastes and technologies are identical across countries and symmetric across varieties of high-tech goods. This implies that a common output, $x_k^s$, will be supplied for all varieties produced in country $k$. Further, for all high-tech varieties produced in country $k$ and consumed in country $f$, there will be a uniform quantity demanded, $x_d^{df}$, and a uniform domestic price relative to the traditional good, $p_{df}$. Throughout our discussion, the traditional good is cast as the numeraire such that its domestic price is equal to one in each country. Although each high-tech firm has market power over its own variety, we assume that international price discrimination is precluded by strict anti-dumping rules. If the traditional
good is subject to the same degree of protectionism in countries \( k \) and \( f \), this implies that the relative price of country \( k \)’s varieties differ between the countries only to the extent of country \( f \)’s high-tech protection, \( p_{kf} = \tau_{xf} p_{kk} \). Adjusting for relative differences in protectionism afforded to the traditional good yields:

\[
p_{kf} = \frac{\tau_{yk} \tau_{xf}}{\tau_{yf}} p_{kk}.
\]

The price of country \( k \)’s high-tech products in country \( f \)’s market is lowered when country \( f \) gives an advantage to high-tech consumption by protecting the traditional good but it is increased when country \( k \) disadvantages high tech production by protecting the traditional good.

2.2 \textit{Utility and Demand}

Welfare in country \( f \), is symmetric and additively separable across high-tech varieties as in Krugman (1979). For further simplicity, welfare is assumed to be linear in the traditional good and exhibit a constant elasticity of substitution, \( \sigma > 1 \), between any pair of high-tech varieties:

\[
v_f = \left( \delta_f \right)^{\sigma/\sigma} - \sum_{k=1}^{m} \left( \eta_k \left( x_{kf} \right)^{(\sigma-1)/\sigma} + Y_f^d \right), \quad k = 1, \ldots, m. \tag{2}
\]

In keeping with the notation adopted above, \( x_{kf}^d \) is the quantity demanded of a single high-tech variety produced in country \( k \) by residents of country \( f \), while \( Y_f^d \) is the total consumption of the traditional good in country \( f \). Further, \( \delta_f > 0 \) is a market size parameter for country \( f \).

The quasi-linear property results in the equilibrium conditions for high-tech varieties being independent of income and thus, tariff revenue. Separability implies that the equilibrium condition for each country’s high-tech goods will depend only on its own domestic relative price. A more general “substitutes” formulation would give qualitatively similar results at the cost of greater complexity.
The demand function for any high-tech variety produced in country $k$ by residents of country $f$ is:

$$x_{kf}^d = \delta_k p_{kf}^{-\sigma}, \quad k, f = 1, \ldots, m.$$  

(3)

Given pricing equation (1), the world demand for any variety produced in country $k$ consists of domestic demand and the demands of all foreign countries:

$$x_{kk}^d + \sum_{f \neq k} x_{kf}^d = \left( \delta_k + \sum_{f = 1}^m \delta_f \left( \frac{\tau_{yf}}{\tau_{yk} \tau_{xf}} \right)^\sigma \right) p_{kk}^{-\sigma}, \quad k = 1, \ldots, m.$$  

(4)

Given the simple symmetric utility function described by equation (2), the elasticity of demand perceived by every high-tech firm regardless of its variety or location is equal to the constant elasticity of substitution, $\sigma > 1$.

### 2.3 Costs and the Distribution of Income

The cost functions for producing any high-tech good in country $k$ is assumed to be symmetric and given by:

$$c_{Hk} = b_H(\phi_{Sk}, \phi_{Uk})(x_k^s + \phi), \quad k = 1, \ldots, m$$  

(5)

where $x_k^s$ is the supply of output of any single variety produced by country $k$, and $\phi_{Sk}$ and $\phi_{Uk}$ are wages of skilled and unskilled labor in country $k$. Given quasi-fixed costs of $b_H(\phi_{Sk}, \phi_{Uk})\phi$ as well as variable costs of $b_H(\phi_{Sk}, \phi_{Uk})x_k^s$, the high-tech sector exhibits economies of scale. The cost function for the traditional good is:

$$c_{Tk} = b_T(\phi_{Sk}, \phi_{Uk})Y_k^s, \quad k = 1, \ldots, m,$$  

(6)

where $Y_k^s$ is the total output of the traditional good in country $k$. Unlike the high-tech sector, the traditional sector exhibits constant returns to scale.
In high-tech production the profit-maximization condition equating marginal revenue and marginal cost for any variety yields conventional mark-up pricing:

\[ p_{kk} = \left( \frac{\sigma}{\sigma - 1} \right) b_H(w_{Sk}, w_{Uk}), \quad k = 1, \ldots, m. \]  

(7)

The zero-profit condition associated with open entry and exit equates price and average cost:

\[ p_{kk} = \left( 1 + \frac{\phi}{x_k^s} \right) b_H(w_{Sk}, w_{Uk}), \quad k = 1, \ldots, m. \]  

(8)

The equilibrium output of any variety that corresponds to a tangency point between the average cost and the inverse demand functions, is determined by combining equations (7) and (8):

\[ x_k^s = x^s \equiv (\sigma - 1)\phi, \quad k = 1, \ldots, m. \]  

(9)

In spite of protectionism, there is a common output for each high-tech variety regardless of the country in which it is produced. Tangency between average cost and demand can only occur at a single output when the elasticity of demand is constant and, with symmetry in both costs and utility, this output is uniform across goods.

In the traditional sector, profit maximization serves to equate price and unit cost yielding:

\[ 1 = b_T(w_{Sk}, w_{Uk}), \quad k = 1, \ldots, m, \]  

(10)

since the traditional good is the numeraire. Given that marginal cost is constant and equal to average cost, the profit-maximizing and zero-profit conditions coincide in the traditional sector.

The profit-maximizing conditions for the high-tech and traditional sectors within each country, equations (7) and (10), can be solved for the skilled and unskilled wages:

\[ w_{ik} = W_i(p_{kk}), \quad i = S, U; \quad k = 1, \ldots, m; \]  

(11)

where: \( \frac{p_{kk}}{w_{Sk}} \frac{\partial w_{Sk}}{\partial p_{kk}} > 1, \quad \frac{\partial w_{Sk}}{\partial p_{kk}} < 0. \)
We emphasize that while conventional Stolper-Samuelson relationships always hold (Jones, 1965; Mussa, 1979), international factor price equalization will arise if and only if the relative domestic prices of high-tech products are uniform across countries. The skilled to unskilled relative wage in any country \( k \), \( r_k \equiv w_{Sk} / w_{Uk} \), depends only on the relative domestic price of high-tech varieties:

\[
r_k = R(p_{kk}), \quad \text{where: } \frac{\partial r_k}{\partial p_{kk}} > 0, \quad k = 1, \ldots, m; \quad (12)
\]

Other than the underlying mark-up pricing in the high-tech sector therefore, we have a standard Heckscher-Ohlin-Samuelson analysis of income distribution as in Krugman (1995).

2.4 Equilibrium Specialization and Trade

To determine the equilibrium number of high-tech varieties in country \( k \) and equilibrium output of the traditional good, we use equation (9) and apply Hotelling’s lemma to equations (5) and (6). This yields an economy-wide conditional demand function for factor \( i \) in country \( k \):

\[
\lambda_{ik} = \sigma \phi n_k \frac{\partial b_H(w_{Sk}, w_{Uk})}{\partial w_{ik}} + Y_i^k \frac{\partial b_T(w_{Sk}, w_{Uk})}{\partial w_{ik}}, \quad i = S, U; \quad k = 1, \ldots, m. \quad (13)
\]

where \( \lambda_{ik} \) is the endowment of labour of type \( i \) in country \( k \). Solving for the equilibrium number of high-tech varieties and output of the traditional good in country \( k \) yields:

\[
n_k = N(p_{kk}, \lambda_{Sk}, \lambda_{Uk}), \quad k = 1, \ldots, m; \quad (14)
\]

where:

\[
\frac{\partial N(\cdot)}{\partial p_{kk}} > 0, \quad \frac{\lambda_{Sk}}{N(\cdot)} \frac{\partial N(\cdot)}{\partial \lambda_{Sk}} > 1, \quad \frac{\partial N(\cdot)}{\partial \lambda_{Uk}} < 0.
\]

\[
Y_i^k = Y(p_{kk}, \lambda_{Sk}, \lambda_{Uk}), \quad k = 1, \ldots, m; \quad (15)
\]

where:

\[
\frac{\partial Y(\cdot)}{\partial p_{kk}} < 0, \quad \frac{\lambda_{Sk}}{Y(\cdot)} \frac{\partial Y(\cdot)}{\partial \lambda_{Sk}} < 0, \quad \frac{\lambda_{Uk}}{Y(\cdot)} \frac{\partial Y(\cdot)}{\partial \lambda_{Uk}} > 1.
\]

A rise in the relative price of high-tech varieties in country \( k \) leads to a decrease in the output of the traditional good and an increase in the number of its high-tech varieties. Conventional
Rybczynski effects also hold. For example, an increase in skilled labour leads to a more than proportionate rise in the number of domestic varieties, but reduces output of the traditional good.

World equilibrium requires balance in the consumption and production of all high-tech varieties produced in each country:

\[ x^d_{kk} + \sum_{f\neq k} x^d_{kf} = x^s, \quad k = 1, ..., m. \] (16)

The equilibrium relative price for country \( k \) can be obtained using equations (4) and (9):

\[ p_{kk} = \left[ \left( (\sigma - 1)\sigma \right)^{-1} \delta_k + \sum_{f=1}^{m} \sum_{f\neq k} \delta_f \left( \frac{\tau_{yf}}{\tau_{xf} \tau_{yk}} \right)^{\sigma} \right]^{1/\sigma}, \quad k = 1, ..., m. \] (17)

The relative price of domestic high-tech varieties in country \( k \) and thus, its relative wage, are decreasing functions of foreign measures supporting the high-tech sector and domestic measures supporting the traditional sector given by \( \tau_{xf} \) and \( \tau_{yk} \) respectively. Conversely, the relative price is an increasing function of foreign trade measures supporting the traditional sector, \( \tau_{yf} \).

Provided that a country is diversified, it will export all domestic varieties of high-tech products, import all foreign varieties and, thus, engage in intra-industry trade. The larger is a country’s endowment of skilled labour relative to unskilled labour, then ceteris paribus the larger will be the relative size of its high-tech to traditional sector and the more likely it will be a net exporter of high-tech products. Further, if market size and protectionist coefficients are uniform across countries, a strict Heckscher-Ohlin pattern of inter-industry trade must exist. A group of more skill-abundant developed countries will be importers of the traditional good and net exporters of high-tech goods. Meanwhile, the remaining group of skill-scarce developing countries will be exporters of the traditional good and net importers of high-tech goods.
2.5 *Protectionism Versus Liberalization*

To determine the impact of trade liberalization on the domestic relative price of high-tech goods, wage inequality and, ultimately, trade policy preferences totally differentiate equation (17):

\[
\frac{dp_{kk}}{p_{kk}} = \sum_{f \neq k}^{m} \mu_{kf} \left( \frac{d \tau_{Yf}}{\tau_{Yf}} - \frac{d \tau_{Yf}}{\tau_{Yf}} \right), \quad k = 1, ..., m; \quad \text{where:} \quad \mu_{kf} = x_{kf}^d / x_{k}^d. \quad (17')
\]

If the foreign country, \( f \), raises its tariff on high-tech goods, the relative price of \( k \)’s high-tech products will fall due to the decline in demand from \( f \). In country \( k \), this leads to a reduction in real wages earned by skilled labor and an increase in the real wages of unskilled labor, as shown on Line 1 of Table 1. By contrast, increased protectionism with respect to high-tech goods in country \( k \) reduces the demand for the high-tech varieties of all other countries. While this lowers the prices that other countries obtain for their high-tech products, the tariff-inclusive relative prices rise in country \( k \). As indicated on Line 2, the real wages of skilled and unskilled labor decline in \( k \) when measured relative to imported high-tech varieties.

If country \( k \) increases its protectionist coefficient on the traditional good, domestic wage inequality falls because of the decline in the relative price of its own high-tech varieties. As shown on Line 3, the skilled wage in \( k \) falls relative to the prices of both the traditional good and domestic high-tech varieties. The reverse is true of unskilled wages. If foreign country \( f \) increases its protection on the traditional good, however, \( k \)’s high-tech products become more attractive there and the price of \( k \)’s high-tech goods will be bid up. This leads to an increase in skilled real wages in \( k \) and a decline in unskilled real wages, as indicated on Line 4.

The model generates new results for *intra-industry* trade liberalization across all countries. Mutual reductions (increases) of equal proportions in the high-tech tariff coefficients
of all countries, shown on Line 5, cause increased (reduced) wage inequality in all countries because the relative domestic prices of each country’s high-tech goods rise (fall) in response to rising foreign demand. The real wages of skilled labor rise in each country (decline) when measured in terms of the traditional good or domestic varieties of the high-tech good, but unskilled real wages fall (rise). Simultaneous reductions or increases of equal proportions in the tariffs and export subsidies on traditional goods by all countries cancel each other out exactly in terms of their distributional effects, as reported on Line 6.

This analysis suggests that pure intra-industry trade liberalization is likely to lead to greater wage inequality and thus, skilled workers will have a weaker preference for protectionism across a broad spectrum of countries. Nevertheless, the model does not suggest that the impact on wage inequality or policy preferences will be symmetric. Given that all countries change their protectionist coefficients on high-tech products by the same proportion such that \( \frac{d \tau_{xf}}{\tau_{xf}} = d \frac{\tau}{\tau} \) for all countries indexed by \( f \) and leave their protectionist coefficients on the traditional good unchanged (or change them by the same proportion), equation (17′) reduces to:

\[
\frac{d \rho_k}{\rho_k} = -\theta_k \frac{d \tau}{\tau}, \quad k = 1, \ldots, m; \quad \text{where:} \quad \theta_k = \frac{1}{\sum_{f=1}^{m} x^{d}_{xf}} \sum_{f \neq k} x^{d}_{xf}.
\]  

(17″)

This suggests that the increase in the relative price of domestic varieties resulting from trade liberalization, will be greatest in countries heavily engaged in intra-industry trade where a high proportion of high-tech output is exported so that \( \theta_k \) is large.

The model is also capable of generating standard *inter-industry* trade liberalization results. Consider the case where there is one group of countries indicated by \( k \) that increases their protection to the traditional sector while the remaining countries indicated by \( f \)
simultaneously increase protection to the high-tech sector. Equation (17') indicates that this case mimics the conventional analysis in the $2 \times 2 \times 2$ model and gives the standard result. For group $k$, wage inequality declines, as shown on Line 7, because domestic high-tech products become relatively less expensive in response to slackening foreign demand as well as domestic protection of the traditional sector. Conversely, for simultaneous increases in the protection that the $k$ group gives to the high-tech sector and the $f$ group gives to the traditional sector, wage inequality increases in the $k$ group, as indicated on Line 8. The conventional approach to trade liberalization reverses these results: wage inequality rises in countries that reduce protection to the traditional sector and declines in the countries that decrease protection in the high-tech sector. Since these may be the dominant forces affecting some relatively skill-scarce developing countries, a sound theoretical explanation remains for the standard prediction of reduced wage inequality. Our model, thus, subsumes the conventional results.

The analysis can be broadened to include both elements of intra-industry and inter-industry trade liberalization. If all of the trade-measure coefficients in every country increase by the same proportion, the relative prices of domestic high-tech goods would decline in all countries. This is a direct result of the fact that all countries in our model are engaged in intra-industry trade. Wage inequality, therefore, would decrease in all counties, as reported on Line 9 of Table 1. When measured in terms of the traditional good or domestic high-tech goods, the real wage falls for skilled labour but rises for unskilled labour. Measured relative to the increasing tariff-inclusive price of foreign high-tech varieties, the real wage of skilled labor must fall, but the real wage of unskilled labor could rise or fall. Whenever approximately symmetric increases in all protectionist coefficients are expected to reduce skilled real wages and increase unskilled real wages in all countries regardless of their skill abundance, there are strong grounds for skilled labour in all countries to be more opposed to protectionism. The opposite situation
holds such that wage inequality increases in all countries when trade liberalization leads to all trade measures being reduced by equal proportions.

These results continue to hold even if any existing export subsidies remain unchanged. Traditional good importers, thus, reduce protection on both traditional and high-tech goods, while traditional good exporters only reduce protection on high-tech imports. If country $k$ is a traditional good exporter, equation (17') indicates that all foreign countries lower protection for high-tech goods, but for the subset of other countries that are also traditional exporters, there are canceling effects from traditional good liberalization. Since the full effect of high-tech liberalization remains from all traditional importers, wage inequality rises in each traditional exporting country. If country $k$ is a traditional good importer, its own tariff reduction on traditional goods reinforces the increase in wage inequality.4

In practice, of course, trade liberalization or protectionism is unlikely to be symmetric across countries. Protectionist coefficients will rarely change by the same proportions in all counties and for all goods.5 Consequently, at the empirical level it is an open question whether the analysis of intra-industry trade liberalization is relevant as either an alternative or addition to the standard *inter-industry* analysis. It is to this empirical question we now turn.

3 **Empirical Evidence**

To the extent that economic consequences affect preferences on trade policy, one should observe stronger opposition to protectionism among skilled workers in countries where skilled labour has the most to lose from protectionism or gain from liberalization. The standard Stolper-Samuelson analysis of inter-industry trade liberalization consequently, suggests that skilled labour will be more favourably disposed to protectionism than unskilled labour in countries with relatively low skill endowments, but that this pattern will be reversed in relatively high-skilled countries. Our theoretical analysis suggests that richer results are possible. In the case of pure intra-industry
trade liberalization, our model predicts that, since skilled workers in all countries gain at the expense of unskilled workers, they will resist protection more strongly, and that this result will be more pronounced in countries that are heavily engaged in high-tech intra-industry trade. More generally, our theoretical model suggests that the impact on real wages and wage inequality depends on the details concerning which sectors are subject to reduced trade intervention and to what degree. This implies that an empirical analysis of trade policy preferences may support the importance of either the standard \textit{inter-industry trade liberalization hypothesis}, our new \textit{intra-industry trade liberalization hypothesis}, or both hypotheses. To this end, we investigate the effects of intra-industry trade on trade policy preferences.

3.1 Data

As in Scheve and Slaughter (2001a,b), Beaulieu (2002b) and Balistreri (1997), the unit of analysis in our empirical analysis is the individual. Individual preferences from a generic question on free trade versus protectionism are examined, rather than attitudes toward a specific piece of trade legislation as in Beaulieu (2002b) and Balistreri (1997). An advantage of the generic question approach is that the potential endogeneity of interactions between policy preferences and political institutions is avoided (Scheve and Slaughter (2001a)).

Data on individual trade policy preferences covering 24 countries are obtained from the 1995 International Social Survey Programme (ISSP). Within the survey, respondents were asked whether they supported policies that limit imports from foreign countries and to what extent they agreed or disagreed with the statement that: “(The respondent’s country) should limit the import of foreign products in order to protect its national economy.” The frequency distribution of survey responses to whether a respondent’s country should use import restrictions to protect its national economy are reported in Panel A of Table 2. As shown in the table, fifty-seven percent of the 29,771 respondents from all countries either strongly agree (twenty-four percent) or agree
(thirty-two percent) with the statement. Twenty-one percent neither agree nor disagree and twenty-one percent of the sample either disagree or strongly disagree with the statement.

Panel B of Table 2 presents a contingency table providing non-parametric evidence on whether preferences on import protection are statistically independent of individual skill levels (measured by level of education attained). The row percentages reveal that eighty-three percent of those surveyed with primary education support import protection. Support for protection becomes progressively less pronounced for those with secondary or tertiary education. Seventy-three percent of those with secondary education support protection, whereas sixty percent of those with tertiary education support protectionism. The Pearson $\chi^2$ statistic, reported in the last row of the table, rejects the null hypothesis that trade-policy preferences and educational attainment are statistically independent.

It is important to recognize that the wording of the question may pre-dispose respondents toward supporting import protection for nationalist rather than economic reasons. Evidence of this can be seen by considering that 83 percent of Americans and over 62 percent of Canadians surveyed in the ISSP data support import protection (see Table 3), whereas only 67 percent of Americans support protection in a more neutrally worded question (see Scheve and Slaughter (1999)), and 52 percent of Canadians opposed the Canada-US free trade agreement (see Beaulieu 2002b). Though the framing of the question may have led to higher support for import protection on average, we are interested in the difference between skilled and unskilled workers and therefore the survey remains a useful instrument.

The countries covered in the survey and summary statistics from the sample data are presented in Table 3. The country characteristics that most interest us pertain to intra-industry trade in the high-tech sector and skill endowments. We measure intra-industry trade in the high-tech sector directly and alternatively, consider high-tech exports per capita. Exports of high-
tech goods per capita and the index of high-tech intra-industry trade (IIT) are based on trade in skill-intensive manufacturing industries (Chemicals SITC 5000-5999; Machinery and Equipment SITC 7000-7999; Instruments SITC 8700-8999; and Armored Fighting Vehicles SITC 9510). Two measures of country skill endowment drawn from the United Nation’s 1998 Human Development Report are also, employed: the gross tertiary-education enrollment ratio and GDP per capita. 8 Tertiary education includes universities, colleges, and higher professional schools requiring the completion of secondary education as a minimum condition of admission. A gross enrolment ratio is the number of students enrolled in a level of education — whether or not they belong in the age group normally associated with that level — as a percentage of the population in the pertinent age group. The gross tertiary enrolment ratio however, is only a proxy for a county’s stock of human capital. We consequently, also use 1995 GDP per capita (based on Purchasing Power Parity in current international dollars) as an alternative proxy for skill endowments. As a country’s skill endowment rises, ceteris paribus, its per-capita GDP will rise as well. The problem with using GDP per capita as a proxy for skill endowment is that it may be correlated with other theoretically important differences across countries such as technologies.

Table 3 shows that GDP per capita ranges from $3290 in the Philippines to $27330 in the United States. 9 Although the range of countries in the sample does not include many poor countries, a broad range of countries is represented. The countries in Table 3 are ranked in descending order of their level of high-tech exports per capita. The survey sample spans a range of countries with large levels of high-tech exports per capita such as Ireland, Sweden, the Netherlands, Germany and Canada to countries with low levels of high-tech exports per capita such as the Russian Federation, the Philippines, Poland and Bulgaria. As seen in Table 3 some countries with large (small) levels of high-tech exports per capita are not the richest (poorest) countries or those with the largest (smallest) skill endowments. Australia and New Zealand, for
example, are in the low-high-tech export group but have much greater GDP per capita than other countries in their group. On average however, countries with large levels of high-tech exports per capita have a greater index of high-tech IIT, larger GDP per capita and a higher tertiary enrolment ratio than the medium or low high-tech exporting countries.

Table 3 also reports summary statistics from the survey by country. As observed in the last column of the table, those surveyed from countries with low levels of high-tech exports per capita are on average more supportive of import protection (79 percent), than are those from high and medium high-tech exporting countries (64 and 72 percent respectively).

3.2 Empirical Modeling

In the empirical analysis we first examine individual preferences on trade policy separately for each country. We estimate the following model:

$$\Pr(F_{Tg}=1) = F(\alpha_1 S_g + \beta X_g)$$

(18)

where $F_{Tg}$ is a categorical variable equal to one if the respondent $g$ opposes import protection and zero otherwise; $S_g$ is the skill-level of individual $g$; $X_g$ is a vector of explanatory variables controlling for potential determinants of trade policy preferences that are not of primary interest; and $F(\cdot)$ is the logistic cumulative distribution function.

After considering each country separately, we examine which characteristics of the different countries have a salient effect on the individual preferences of the skilled and less skilled respondents. We estimate variants of the following panel model, which allows for interactions between individual skill variables and subsets of key country variables, such as skill endowments and participation in intra-industry trade:

$$\Pr(F_{Tg}=1) = F(\alpha_1 S_g + \alpha_2 S_g \times C_k + \alpha_3 C_k + \beta X_g).$$

(19)

Here $C_k$ is a country characteristic vector for country $k$. 
3.3 Empirical Results from Separate Country Regressions

Table 4 presents the marginal effects from estimating equation (18) for each country separately. In Table 4 countries are sorted the same as in Table 3, in descending order of their level of high-tech exports per capita. The first two columns of the table represent the country characteristics, high-tech exports per capita and the IIT index. The marginal effects on the education dummy variables are interpreted as the effect on the probability of opposing import protection for a discrete change as the variable changes from 0 to 1. Marginal effects on education, the number of observations, pseudo-R² and the χ² test on the significance of the two education coefficients are reported for each country. In Table 4 the marginal effects reported are generated from estimating equation (18) including other individual characteristics: marital status, gender, age, rural or urban, membership in a labour union, and political party affiliation. The estimates for these other characteristics are suppressed due to space considerations, but the results are discussed below. Country regressions were also conducted excluding union membership and political party affiliation with very similar results.

The results in Table 4 appear to contradict standard inter-industry analysis. Highly skilled workers — those with tertiary versus primary education — are found to be more likely to oppose import protection in 22 out of 24 countries. This result is statistically significant at the 95% level in 19 of the 22 countries, but questionable in Russia, Latvia and Slovakia. The effect of tertiary education on protectionist preferences is only reversed for Bulgaria and the Philippines, with the negative coefficient only being statistically significant for the Philippines. In the case of moderately skilled workers — those with secondary versus primary education — the results are somewhat weaker. Moderately skilled workers are more likely to oppose protectionism in 20 of the 24 countries, with the result statistically significant at the 95% level in 14 countries. In 3 of the 6 countries where the positive coefficient on secondary education is not significant at the
95% level — Canada, Norway and Poland — the tertiary and secondary coefficients are jointly significant at the 99% level. The sign on secondary education is reversed for Australia, Bulgaria, the Philippines and Slovakia, but once again this negative coefficient is only statistically significant for the Philippines.

The effect of individual skill on trade policy preferences, while present in the results reported in Table 4, appears to be moderated by country characteristics. The effect of education on individual trade policy preferences, for example, is generally larger and at a higher level of statistical significance for those in high and medium high-tech exporting countries relative to low high-tech exporting countries. This result also holds when comparing across high and low-IIT countries. Estimated coefficients on tertiary education are positive and statistically significant for all of the high and medium high-tech exporting countries except for Latvia and the Slovak Republics (where they are positive but not statistically significant). The marginal coefficients are also positive and statistically significant at the 95 or 99 percent level in 5 out of eight low high-tech exporting countries. The marginal effects of education are generally smaller, and in some cases negative, in lower high-tech exporting countries, whereas the joint effect of education is positive and statistically significant at the 1 percent level in four of eight low high-tech exporting countries.

Country characteristic effects on the trade policy preferences are examined further in Figure 1. The marginal effects of tertiary versus primary educational attainment for each country are plotted against potentially relevant country characteristics pertaining to national skill endowments as well as participation in high-tech intra-industry trade. Tertiary enrolment ratios and per-capita GDPs are utilized as proxies for national skill endowments in panels (a) and (b) respectively. Per-capita high-tech exports and the high-tech IIT index itself are used as measures of national activity in high-tech intra-industry trade in panels (c) and (d). Fitted lines regressing
the marginal effects on the country characteristics are also included in each panel of the diagram. All the slopes are positive, statistically significant but small. Figure 1 illustrates that highly skilled workers are more supportive of trade liberalization across countries but the difference in preferences is larger in countries with higher tertiary enrolment ratios, per-capita GDPs, per-capita exports of high-tech goods, and high-tech intra-industry trade.

Panels (a) and (b) of Figure 1 point to the possible incompleteness of the standard \textit{inter-industry} trade liberalization hypothesis. Higher national skill endowments are associated with a stronger resistance to protectionism among those with tertiary rather than primary education in accordance with the hypothesis. Nevertheless, there are problems with the horizontal intercepts, which can potentially be explained by the \textit{intra-industry} hypothesis. In panel (a), where national skill endowments are proxied by tertiary enrolment ratios, a highly skilled individual with tertiary education is always expected to resist protectionism more strongly than an individual with primary education regardless of how low the country’s skill endowment. In panel (b), where the national skill endowment are proxied by per-capita GDP, par-capita GDP would have to be below 250 USD before individuals with tertiary education would be expected to be less likely to resist protectionism. Panels (c) and (d) of Figure 1 offer further support for the \textit{intra-industry} trade liberalization hypothesis since those with tertiary education become more likely to resist protectionism in countries that are more highly engaged in intra-industry trade.

There nevertheless, seems to still be an on-going role for the standard \textit{inter-industry} analysis in explaining why the marginal effects of tertiary versus primary education would be reversed at sufficiently low levels of activity in high-tech intra-industry trade. We can investigate the balance of support for the \textit{inter-industry} and \textit{intra-industry} trade liberalization hypotheses more formally using pooled rather than separate country regressions.
3.4 Empirical Results from Pooled Regressions

The results from the separate country regressions suggest that although the marginal effects of individual skill tend to be positive, they are larger for some countries than others, and negative or not statistically significant for other countries. We estimate pooled regressions for individuals from all countries to systematically examine how individual preferences on trade policy are modified by country characteristics. Table 5 reports marginal effects for nine specifications of the model described by equation (19).\(^{10}\) These results are derived from a logistic model that uses two categories for the dependent variable.\(^{11}\) The dependent variable is equal to zero if the respondent agrees or strongly agrees with import protection and equal to one if they disagree or strongly disagree with import protection.\(^{12}\) Given that the individual educational attainment or ‘skill’ variables are categorical, a positive marginal effect for a dummy variable implies that respondents from that category have a higher probability of disagreeing with the statement than those from the omitted category. That is, the marginal effects are interpreted as the increase in the probability of opposing import protection due to acquiring that level of education rather than primary education, the omitted category. The standard errors are White robust standard errors, corrected for heteroskedasticity and clustering on country.

Model 1 provides a benchmark for the remainder of the analysis by focusing exclusively on the direct effects of individual skill as measured by educational attainment. Country fixed-effects are included, but potentially important country characteristics such as skill endowments and high-tech intra-industry trade variables are not. Individuals with secondary education are found to be more likely to oppose protection than individuals with primary education (0.111), and those with tertiary education are even more likely to oppose protection (0.277). These estimated coefficients are statistically significant at the 99 percent level and strongly consistent with the intra-industry trade liberalization hypothesis. From the perspective of the inter-industry
trade liberalization hypothesis, the statistically significant positive coefficients are more problematic because the policy preferences of skilled versus unskilled workers should depend on the country’s skill endowment. Nevertheless, it would be premature to dismiss the standard *inter-industry* analysis, since our sample of countries does not include many low-skill countries and we have omitted country endowment variables thus far.

Models 2 and 3 therefore, introduce interactions between national endowments and individual skill levels. In Model 2 the country skill endowment variable is the tertiary enrolment level, whereas in model 3 it is per-capita GDP. The standard *inter-industry* trade-liberalization hypothesis predicts two results. First, that the interaction terms are positive indicating that as a country’s skill endowments rise, skilled workers become increasingly resistant to protectionism. This *a priori* expectation is strongly validated by Model 3 where the proxy for a country’s skill endowment is per-capita GDP, but not by Model 2 where skill endowments are proxied by tertiary enrolment ratios. While the marginal effects associated with the interaction terms are positive in Model 2, they are small in magnitude and statistically insignificant. The second expectation of the standard *inter-industry* analysis is that the marginal effects on individual educational attainment should be negative implying that skilled individuals in low-skill countries favour protection more than unskilled individuals. There is little support for this *a priori* expectation in either model. The coefficients on both tertiary and secondary education are positive and statistically significant in Model 2. While there is a negative coefficient on secondary education in Model 2, the coefficients on both secondary and tertiary education are statistically insignificant, both individually and jointly.

Models 2 and 3, thus, suggest that the *standard inter-industry* trade-liberalization story is incomplete. In Model 2 neither element of the standard analysis is validated and our model of *intra-industry* trade liberalization within the skill-intensive sector provides a strong alternative
explanation for the results. For Model 3, the analysis of intra-industry trade can be seen as a useful adjunct to the standard analysis. Intra-industry trade considerations can explain why skilled workers are as likely as their unskilled counterparts to resist protection even in countries with extremely low skill endowments, while the standard *inter-industry* analysis can explain why skilled workers in higher-skill countries become increasingly likely to resist protectionism.

Our theoretical model also suggests that country variables relating to intra-industry trade in the skill-intensive sector may be important determinants of trade policy preferences either as an alternative to skill endowment variables or in conjunction with them. We thus, replace the national endowment variables with national high-tech exports per capita and the country’s high-tech IIT index itself in Models 4 and 5, respectively. The individual skill coefficients and the interaction effects are both positive and statistically significant in Model 4 indicating that skilled workers are not only more supportive of trade liberalization but that this effect is even stronger for countries with greater high-tech exports per capita. Likewise, the interaction effects are also positive and statistically significant at the 99 percent level in Model 5 lending strong support to the importance of intra-industry trade in the skill intensive sector. Interestingly, the marginal effects on secondary and tertiary education by themselves, though small in magnitude, are negative and significant at the 95 percent and 90 percent levels respectively. This suggests that in countries with extremely low levels of high-tech IIT, skilled workers will be *less* resistant to protectionism than unskilled workers. A possible rationale for this explanation, of course, is that the standard Stolper-Samuelson analysis of *inter-industry* trade liberalization may be important in conjunction with high-tech intra-industry trade liberalization.

Given the potential role for high-tech intra-industry trade we consequently, consider four models, Models 6-9, that include a role for variables related to both high-tech intra-industry trade and skill endowments. Model 6 allows for interactions between individual skills and both
country high-tech exports per capita and the country tertiary enrolment ratio. The direct effects of personal skills are jointly significant and the coefficients positive. Likewise, the interaction with high-tech exports is positive and individually significant giving strong support to the intra-
industry trade-liberalization hypothesis. Since the interactions with the tertiary enrolment ratio, the proxy for skill endowments, are also positive and jointly significant at the 90 per cent level one cannot rule out a role for the standard inter-industry analysis.

Interactions between individual skills and both national high-tech exports per capita and national GDP per-capita are considered in Model 7. The results suggest that high-tech intra-
industry trade considerations are helpful in explaining the absence of negative and statistically significant direct effects of individual skill, though the interactions with per-capita high-tech exports are not singly or jointly significant. As in Model 3, the standard inter-industry analysis provides an explanation of the statistically significant positive interaction with per-capita GDP, which is the proxy for a country’s skill endowment.

In Model 8 individual skills are interacted with both high-tech IIT and the tertiary enrolment ratio. The results support only the intra-industry trade-liberalization hypothesis. This occurs because the direct effects of personal skills are small and jointly insignificant, and the interactions with national skill endowments, measured by the tertiary enrolment ratios, are individually and jointly insignificant, while the interactions between personal skill and high-tech IIT are positive and highly significant.

Finally, in Model 9 both the inter-industry and intra-industry trade-liberalization hypotheses receive strong support. On the one hand, as predicted by the standard inter-industry analysis the direct effects of personal skill are negative and significant while the interaction with per-capita GDP, which proxy for the national skill level, are positive and significant. On the
other hand, the interaction with high-tech IIT is positive and significant as predicted by the intra-
industry analysis.

It should be noted that in addition to the above highlighted results, we also include control variables such as gender, age, whether the respondent lives in a rural area, employment status, political party affiliation, union membership, unemployment and marital status in our model. Control variables that appear to have salience are gender, rural, membership in a “right political party” and age. Males are found to be more likely than females to oppose protection, and younger respondents are more likely to resist protectionism. To the extent that protection reduces labor market turnover, the age effect is consistent with older workers being less mobile and therefore, more likely to support protection. Rural versus non-rural residents and members of “right of center” parties were more supportive of trade liberalization, while union membership lowered support. Unemployment did not affect preferences.

3.5 Discussion of Results and Diagnostics

As an alternative to the binary models described by equation (18) and (19), we also estimated an ordered logit model where responses to the question about import protection are ordered in the following way: strongly agree, agree, neither, disagree, and strongly disagree. This model corresponds closely with how the data were collected. A problem with the ordered logit approach is that the coefficient estimates are difficult to interpret. On the other hand, the binary dependent variable approach described by equation (19) discards some information. We consequently, estimated the models using both approaches. Given that the results are qualitatively similar whether we use the ordered logit or binary logistic approach, we only report on the binary model both for expositional clarity and due to space constraints.

Results concerning the relationship between skill and preferences reported in Tables 4 and 5 are broadly consistent with the empirical findings of Mayda and Rodrik (2001) and
O’Rourke and Sinnott (2001) who both utilize GDP per capita as the sole “skill” variable. Neither of these papers includes a measure of intra-industry trade or the extent of trade in high-tech goods in their analysis. Rather, both papers consider measures of national pride and though they find that national pride affects trade policy preferences, the skill level of the individual also affects these preferences. This is an extremely salient result when one considers that the survey frames the question toward finding a “nationalist” response: the question asks whether imports should be limited in order to protect the national economy.

Further to the point, Mayda and Rodrik (2003) conclude that their results are consistent with the predictions of the HOS model since the Philippines is the poorest country in the sample. When they then extend their sample of countries beyond the ISSP data set by using the World Value Survey (WVS) however, they find that while in some poor countries, such as Bangladesh, Nigeria, Armenia, and Georgia, more skill is associated with less pro-trade views the opposite is true in Pakistan, India and China. This leads one to believe that there is more to the puzzle than can be explained by the HOS model. Both our theoretical and empirical models provide an explanation for these results based on the degree to which a country is engaged in intra-industry trade and export high-tech goods.

The collective evidence from Models 1-9 strongly supports the relevance of the *intra-industry* trade liberalization hypothesis. The intra-industry analysis is clearly central in all models except for 3 and 7. Even in these models however, the *intra-industry* analysis plays a minor role by helping to explain the ‘loose ends’ left by the *inter-industry* analysis. The empirical analysis also does not rule out a role for the standard *inter-industry* analysis, but this support is mixed. Only Models 3, 7 and 9 suggest a central role for the standard *inter-industry* analysis. More tenuous support is provided in Model 6, with a clear but less central role in Model 5, and little or no support in Models 1, 2, 4 and 8.
4 CONCLUSION

In this paper we consider whether skilled labor will be more resistant to protectionism or, by extension, more supportive of trade liberalization than unskilled labor and whether the existence of intra-industry trade in high-tech goods can shed some light on this issue. Our theoretical model shows the importance of trade liberalization that allows mutual reductions in intra-industry barriers in the skill-intensive sector and reductions in both tariffs and export subsidies in the traditional sector. Symmetric trade liberalization raises wage inequality between skilled and unskilled labor through Stolper-Samuelson channels in all countries. Liberalization in the high-tech sector increases the demand for the high-tech goods in all diversified countries. Demand for skilled labour consequently, will rise in all countries fueling increased wage inequality. In countries that are less competitive in skill-intensive sectors or export a smaller proportion of their skill-intensive output, however, these effects are smaller.

There are two key hypotheses that stem from our theoretical model. First, for most countries, regardless of their relative skill endowments, skilled labor is expected to be more opposed to protectionism than unskilled labor when the country is actively engaged in high-tech intra-industry trade and trade policy is liberalized in this sector. Second, the extent to which a country engages in intra-industry trade in high-tech commodities is expected to be linked with the intensity of opposition to protection by skilled labour. Opposition declines as the extent of high-tech intra-industry trade falls. According to our theoretical model, such preferences would be rational because the gains from freer trade tend to favor skilled relative to unskilled labour but that the advantage from trade liberalization diminishes as a country becomes less involved in intra-industry trade within the high tech sector.

As predicted by our theoretical model, two of the factors found to be significant in our empirical study are intra-industry trade within skill-intensive sectors and the extent of high-tech
exports. Using ISSP data for individuals from twenty-four countries, both the regression results with the countries grouped together and those for the individual countries strongly support the view that skilled workers, almost everywhere, are more likely to oppose import protection. Nevertheless, the opposition to protection by skilled workers declines systematically in countries that are less involved in high-tech intra-industry trade. Both hypotheses stemming from our theoretical model are strongly supported by the data. As the case of the Philippines suggests, however, not all skill-scarce countries are cut from the same mold. Some skill-scarce countries that are less competitive in skill-intensive products may not be diversified, and others may not expect to experience symmetric trade liberalization.
### Table 1: The Impact of Protection

<table>
<thead>
<tr>
<th>Increasing Parameter(s)</th>
<th>Relative Wage</th>
<th>Skilled Labor: Pre-Tax Real Wages</th>
<th>Unskilled Labor: Pre-Tax Real Wages</th>
<th>Number of Varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$w_{sk}/w_{uk}$</td>
<td>$w_{sk}/P_{Tk}$</td>
<td>$w_{sk}/P_{Tk}$</td>
<td>$w_{sk}/P_{Hf}$</td>
</tr>
<tr>
<td>1. $\tau_{Hf}$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. $\tau_{Hk}$</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>3. $\tau_{Tk}$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. $\tau_{Tf}$</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5. $\tau_{Hk}, \tau_{Hf}$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6. $\tau_{Tk}, \tau_{Tf}$</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7. $\tau_{Hf}, \tau_{Tk}$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8. $\tau_{Hk}, \tau_{Tf}$</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>9. All $\tau$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### Table 2  Support for import protection

Panel A: Your country should limit the import of foreign products in order to protect its national economy.

<table>
<thead>
<tr>
<th>Support</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree strongly</td>
<td>7265</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Agree</td>
<td>9651</td>
<td>32</td>
<td>57</td>
</tr>
<tr>
<td>Neither</td>
<td>6396</td>
<td>21</td>
<td>78</td>
</tr>
<tr>
<td>Disagree</td>
<td>4902</td>
<td>16</td>
<td>95</td>
</tr>
<tr>
<td>Disagree strongly</td>
<td>1557</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>29771</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Panel B: Contingency table: support for protection and level of education

<table>
<thead>
<tr>
<th>Education</th>
<th>Support protection</th>
<th>Oppose protection</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>4727</td>
<td>955</td>
<td>5682</td>
</tr>
<tr>
<td>Row (percent)</td>
<td>83.19</td>
<td>16.81</td>
<td>100</td>
</tr>
<tr>
<td>Column (percent)</td>
<td>27.94</td>
<td>14.79</td>
<td>24.31</td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>8849</td>
<td>3233</td>
<td>12082</td>
</tr>
<tr>
<td>Row (percent)</td>
<td>73.24</td>
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<tr>
<td>Column (percent)</td>
<td>52.31</td>
<td>50.05</td>
<td>51.69</td>
</tr>
<tr>
<td>Tertiary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>3340</td>
<td>2271</td>
<td>5611</td>
</tr>
<tr>
<td>Row (percent)</td>
<td>59.53</td>
<td>40.47</td>
<td>100</td>
</tr>
<tr>
<td>Column (percent)</td>
<td>19.74</td>
<td>35.16</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>16916</td>
<td>6459</td>
<td>23375</td>
</tr>
<tr>
<td>Row (percent)</td>
<td>72.37</td>
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<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Pearson Chi2 test for independence:  800.30
### Table 3: Summary of data by country

<table>
<thead>
<tr>
<th>Country</th>
<th>High-tech exports per capita</th>
<th>High-tech Intra-industry trade</th>
<th>Tertiary enrolment</th>
<th>GDP per capita</th>
<th>Frequency</th>
<th>Share of sample with university education %</th>
<th>Support for import protection %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ireland</td>
<td>4.67</td>
<td>0.59</td>
<td>37.0</td>
<td>17490</td>
<td>990</td>
<td>10.40</td>
<td>74.60</td>
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<tr>
<td>Sweden</td>
<td>3.74</td>
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<td>0.45</td>
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<td>2222</td>
<td>22.14</td>
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<td>56249</td>
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</table>

Notes:
1. Separate country data on East and West Germany are not available.

a. The index of intra-industry trade for country j was computed as: 

\[
IIT_k = 1 - 0.5 \sum_{j=1}^{n} \left( \frac{X_{jk}}{X_k} \right) - \left( \frac{M_{jk}}{M_k} \right)
\]

where \(X_{jk}\) and \(M_{jk}\) are country k’s exports and imports of good j, and \(X_k\) and \(M_k\) are country k’s total exports and imports. The IIT index was calculated based on trade in high-technology manufacturing industries (Chemicals SITC 5000-5999; Machinery and Equipment SITC 7000-7999; Instruments SITC 8700-8999; and Armoured Fighting Vehicles SITC 9510).

b. Human capital endowment is measured in two ways. It is measured as the tertiary gross enrollment ratio (percent) in 1995 and as GDP per capita. The enrollment measures of human capital are from the United Nations 1999 Human Development Report. GDP per capita (PPP, current international $) is from World Development Indicators (World Bank).
Table 4: Marginal Effects of Education on preferences for import protection by country (sorted by high-tech exports per capita)

<table>
<thead>
<tr>
<th>Country</th>
<th>High tech exports per capita</th>
<th>Index of IIT</th>
<th>Secondary education</th>
<th>Tertiary education</th>
<th>Observations</th>
<th>Pseudo R2</th>
<th>Joint significance of education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ireland</td>
<td>4.67</td>
<td>0.59</td>
<td>0.046</td>
<td>0.214 **</td>
<td>874</td>
<td>0.08</td>
<td>23.1 **</td>
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<td>Sweden</td>
<td>3.74</td>
<td>0.68</td>
<td>0.224 **</td>
<td>0.477 **</td>
<td>821</td>
<td>0.18</td>
<td>70.9 **</td>
</tr>
<tr>
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<td>3.53</td>
<td>0.79</td>
<td>0.238 **</td>
<td>0.377 **</td>
<td>1364</td>
<td>0.10</td>
<td>108.1 **</td>
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<tr>
<td>Germany, West¹</td>
<td>3.38</td>
<td>0.74</td>
<td>0.303 **</td>
<td>0.434 **</td>
<td>895</td>
<td>0.14</td>
<td>90.1 **</td>
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<tr>
<td>Germany, East¹</td>
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<td>0.74</td>
<td>0.175 **</td>
<td>0.379 **</td>
<td>443</td>
<td>0.15</td>
<td>32.0 **</td>
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<td>0.258 **</td>
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<td>0.108 **</td>
<td>0.556 **</td>
<td>848</td>
<td>0.11</td>
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<td>0.488 **</td>
<td>774</td>
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<td>0.71</td>
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<td>0.379 **</td>
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<td>0.451 **</td>
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<td>0.09</td>
<td>72.3 **</td>
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<td>0.72</td>
<td>-0.051</td>
<td>0.047</td>
<td>1112</td>
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<td>0.039</td>
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<td>0.72</td>
<td>0.112 **</td>
<td>0.147 *</td>
<td>868</td>
<td>0.09</td>
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<td>0.470 **</td>
<td>779</td>
<td>0.10</td>
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<td>0.147 *</td>
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</table>

Notes: Marginal effects are reported for education variables only and are based on the logistic model. The dependent variable equals one if the respondent opposes protection (supports trade liberalization) and is zero otherwise. Therefore a positive marginal effect coefficient implies a higher probability of opposing protection. The estimated coefficients on variables other than education are suppressed for space constraints. The control variables that were included in the regressions (but not reported here) are: marital status, gender, age, union membership, unemployment, affiliation with a political party and rural or urban.

** statistically significant at 99%; * statistically significant at 95%
Table 5: Regression results for all respondents

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<td>0.106 ***</td>
<td>-0.090</td>
<td>0.039 ***</td>
<td>-0.078 **</td>
<td>0.012</td>
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<td>0.249 ***</td>
<td>0.070</td>
<td>0.154 ***</td>
<td>-0.057 *</td>
<td>0.092 ***</td>
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<td>Yes</td>
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<td>Yes</td>
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<td>Yes</td>
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</tr>
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</table>

Notes: The dependent variable in the ordered logistic model is based on responses to the following question: (The respondent’s country) should limit the import of foreign products in order to protect its national economy.” The answers are ordered: Strongly agree; agree; neither; disagree; strongly disagree. Therefore, a positive coefficient is interpreted as that variable increasing the probability of opposing protection.

a. Marginal effects are reported for the logistic model. The dependent variable equals one if the respondent opposes protection and is zero otherwise. Therefore the interpretation of the coefficients is similar to the ordered logistic model: a positive coefficient implies a higher probability of opposing protection.

Omitted categories of dummy variables are for education primary (or less); females; non-rural.

Robust standard errors are reported. ** statistically significant at 99%, * statistically significant at 95%.
FIGURE 1
Marginal effects of tertiary education and country characteristics

Notes: The four panels plot the marginal effects of tertiary education on the probability of supporting trade liberalization against country characteristics: education ratio, number of scientists, intra-industry trade, and GDP per capita. Each scatter plot includes the regression line of the predicted marginal effect on the country characteristic. The fitted lines are as follows: Panel a) \( y = 0.12 + 0.003X \quad R^2 = 0.13 \); Panel b) \( y = 0.08 + 0.059X \quad R^2 = 0.26 \); Panel c) \( y = -0.23 + 0.79X \quad R^2 = 0.33 \); Panel d) \( y = -0.02 + 0.000X \quad R^2 = 0.58 \). The slope coefficients are statistically significant at the 90 percent level for tertiary enrolment, 95 percent level for scientists, and at the 99 percent level for IIT and GDP per capita.
REFERENCES


ENDNOTES

1 See Slaughter (1998) for a review of the literature on trade and wage inequality.

2 The underlying production function is homothetic in contrast with the quasi-homothetic function in Dinopoulos et al. (1999).

3 The cost functions in both sectors are homogeneous of degree one in factor prices, and the conditional factor demand functions, which by Hotelling’s lemma are given by the derivatives with respect to factor prices, are homogeneous of degree zero.

4 The model may help explain the dissimilar experiences of the East Asian countries in the 1960’s and 70’s and Latin American Countries in the 1980’s (Wood (1997)). While an earlier phase of trade liberalization was contemporaneous with reduced wage inequality in East Asia, later liberalization occurred with increased inequality in Latin America. With the rise in intra-industry trade in the 1980’s relative to the 1960’s, Latin American Countries could have experienced a rise in the demand for skilled relative to unskilled labour and an increase in the wage gap. Neither the skill biased technological change, nor the access to new technologies that Wood (1997) conjectured would be needed. The result merely requires that by the 1980s, Latin American countries were diversified and engaging in intra-industry trade in skill intensive goods.

5 Recall that the tariff coefficients are equal to 100% plus the ad valorem tariff rate. If Country A has a 25% tariff rate and Country B 50%, their coefficients are 1.25 and 1.5. An equal proportionate cut of 10% in both tariff coefficients, means Country A’s tariff rate falls to 12.5%, whereas Country B’s falls to 35%. Equal proportionate cuts to tariff coefficients, therefore, do not constitute an attractive liberalization rule unless the initial coefficients are similar.

6 The ISSP survey reports education as a categorical variable with as many as six or as few as four categories in some countries. Some aggregation was thus, necessary for concordance across countries. We focus on three categories: low (primary education), medium (secondary education) and high-skilled (tertiary education) because a larger number obscures the distinction between factors of production. The cost of using more aggregate groupings is the loss of
information and precision in estimation due to additional within group heterogeneity. Similar results are obtained when we use more disaggregated education categories in our empirical tests.

7 Our theoretical model suggests that the appropriate variable to measure the impact of high tech exports is $\theta_k$, the proportion of high tech production that is exported. We however, do not have data on high tech production for all of the countries. Using GDP in the denominator is also not feasible because GDP becomes the dominant factor in the parameter and high-tech exports divided by GDP is highly correlated with GDP per capita. As a proxy for $\theta_k$ we therefore, use high-tech exports per capita.

8 In earlier versions of this paper we also used the number of R&D scientists and technicians per 1000 people between 1990 and 1996 to measure the skill endowment of a country. The results based on this measure are suppressed here due to space constraints but are similar to the results reported for GDP per capita and are available from the authors.

9 East and West Germany have been assigned identical measures of country characteristics because separate country-level data are not available, but separate surveys were conducted in each country.

10 Table 5 was estimated with and without country fixed effects. The results in both cases are similar but only the results based on fixed country effects are reported.

11 In previous versions of the paper we also presented the results from estimating an ordered logistic regression. The results from the ordered logit model are very similar to the results reported here and are available upon request from the authors.

12 The middle category “neither agree nor disagree” caused some difficulty interpreting the results. We treated this middle category three different ways: we drop it from the regressions (as reported here); we code the dependent variable as disagree or strongly disagree versus other; and we code the dependent variable as agree or strongly agree versus other. The different approaches to “neither” do not change our results or conclusions.
Political party affiliation, union membership and unemployment variables are control variables that may be endogenous and were also excluded from the regressions because of their potential endogeneity with respect to skill. Exclusion of these variables does not affect our results with respect to skill and trade preferences.

The results based on the ordered logit model are available from the authors upon request.