The Impact of Trade Liberalization upon Inequality in Developing Countries
A Review of Theory and Evidence

Donald J. Robbins

WORKING PAPER NO. 13
The Impact of Trade Liberalization upon Inequality in Developing Countries*

A Review of Theory and Evidence

Working Paper No. 13

Donald J. Robbins

Policy Integration Department
International Policy Group
International Labour Office
Geneva

October 2003

Working papers are preliminary documents circulated to stimulate discussion and obtain comments.
The Impact of Trade Liberalization upon Inequality in Developing Countries
A Review of Theory and Evidence

Working Paper No. 13

Donald J. Robbins

Policy Integration Department
International Policy Group
International Labour Office
Geneva

October 2003

Working papers are preliminary documents circulated to stimulate discussion and obtain comments
The Impact of Trade Liberalization upon Inequality in Developing Countries

**Contents**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>ii</td>
</tr>
<tr>
<td>1. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2. Have trade liberalization and globalization affected distribution in developing countries: theoretical and methodological preliminaries</td>
<td>2</td>
</tr>
<tr>
<td>2.1 Theoretical preliminaries</td>
<td>2</td>
</tr>
<tr>
<td>2.2 Methodological approaches to examining the impact of trade and trade liberalization upon distribution</td>
<td>4</td>
</tr>
<tr>
<td>3. Empirical evidence of the impact of trade upon distribution</td>
<td>7</td>
</tr>
<tr>
<td>3.1 Evidence regarding whether trade reform has affected distribution, by type of study and region</td>
<td>7</td>
</tr>
<tr>
<td>4. Explanations of the observed patterns of the impact of trade on distribution: theoretical and methodological preliminaries</td>
<td>18</td>
</tr>
<tr>
<td>4.1 Trade reform and wages: theories explaining rising relative wages with trade liberalization in the South</td>
<td>18</td>
</tr>
<tr>
<td>4.2 Trade and wages: methodology employed to explain outcomes</td>
<td>22</td>
</tr>
<tr>
<td>5. Explanations of the observed patterns of the impact of trade on distribution: empirical evidence</td>
<td>26</td>
</tr>
<tr>
<td>5.1 Evidence by type of study and region</td>
<td>26</td>
</tr>
<tr>
<td>5.2 Synthesis of empirical research explaining the pattern of wage and employment changes accompanying trade reform</td>
<td>42</td>
</tr>
<tr>
<td>6. Conclusion</td>
<td>45</td>
</tr>
<tr>
<td>References</td>
<td>47</td>
</tr>
</tbody>
</table>
Preface

Within the Policy Integration Department, the International Policy Group (IPG) focuses on developments in the global economy and undertakes analytical work with a view to promoting the ILO’s Decent Work Agenda in the formulation of international economic policy. IPG serves as the technical secretariat to the ILO Governing Body Working Party on the Social Dimension of Globalization.

This working paper is an output of the first phase of a research project funded by the Department for International Development (DFID) of the United Kingdom Government, on the impact of opening to trade and Foreign Direct Investment on employment, income distribution and poverty in developing countries. In this phase of the project the studies are based on international cross-section data. The second phase, currently underway, will consist of country studies.

In his contribution, Donald J. Robbins critically discusses the impact of trade liberalization on income distribution in developing countries. On the basis of a theoretical survey and of a detailed comparison of situations in different regions and countries, the interesting Skill-Enhancing-Trade (“SET”) hypothesis is put forward.

The views expressed are those of the author.*

As an INTEGRATION Working Paper, this document is intended to stimulate further debate on key issues of globalization and its social dimension.

Eddy Lee
Director
International Policy Group

September 2003

Policy Integration Department

* This work was done with the excellent research assistance of Marie Soledad Mosquera and Carlos Julian Ruiz.
The predicament of the poor across the world cannot be reversed by withholding from them the great advantages of contemporary technology, the well-established efficiency of international trade and exchange, and the social as well as economic merits of living in open, rather than closed societies. What is needed is the fair distribution of the fruits of globalization. [Amartya Sen, 2001].

The Impact of Trade Liberalization upon Inequality in Developing Countries

1. Introduction

The examination of the impact of trade reform and globalization is ultimately concerned with two fundamental goals: improving the average level of income per capita and achieving greater equality in the distribution of income. Trade liberalization is a key aspect of the broader topic of “globalization”, but is more clearly defined and more clearly linked to economic theory and policy. This study examines the evidence for developing countries over the last two decades concerning the impact of trade reform upon the distribution of wages. Recent studies of the impact of trade upon distribution emerged as an attempt to understand the rapid growth in the relative wages of more versus less educated workers in the United States beginning in the 1970s that could not be explained by changes in the relative supply of skill. This spawned a large, still expanding empirical and theoretic literature focusing on developed countries that subsequently led to the examination of the same issues in developing countries.

The principal theoretic reference point for the recent literature on trade and distribution is the Hecksher-Ohlin-Samuelson (or Hecksher-Ohlin-Viner, henceforth “HOS/HOV”) model and related Stolper-Samuelson and Rybczinski theorems. The Stolper-Samuelson theorem as applied to production with skilled and unskilled labour leads to opposite predictions for the impact of trade liberalization on distribution for “Northern” countries with a comparative advantage in skilled labour versus “Southern” countries with a comparative advantage in unskilled labour. In the North the Stolper-Samuelson theorem predicts that trade liberalization leads to a rise in relative wages, while leading to a fall in relative wages in the South. Consequently, for unchanging distributions of human capital within countries over time, trade liberalization would worsen the distribution of wages in the North while improving the distribution of wages in the South. This prediction of the Stolper-Samuelson theorem has been invoked by institutions such as the World Bank and the International Monetary Fund to justify trade liberalization in the South, arguing that trade liberalization leads to both greater economic growth and better distribution of wages in the South.

The remainder of this paper is organized in six sections: Sections II and III examine what the impact of trade liberalization and globalization has been. Section II presents the theoretic and methodological basis for studies concerning what the impact of liberalization upon distribution has been, while Section III summarizes and evaluates the empirical evidence. Sections IV and V examine the reasons for the empirical findings in Section III, or why trade liberalization has had the documented impacts upon distribution. Section IV summarizes the theoretic and methodological bases for these studies, while Section V summarizes and evaluates the relevant empirical literature. Section VI concludes. 2. Have trade liberalization and globalization affected distribution in developing countries: theoretical and methodological preliminaries.

1 There is no consensus on this issue. For studies of the impact of trade reform upon growth, see for example Sachs and Warner (1995), Hanson and Harrison (1999b) and Rodrik (2000).
2. Have trade liberalization and globalization affected distribution in developing countries: theoretical and methodological preliminaries

2.1 Theoretical preliminaries

This section summarizes the classical trade theory concerning trade and distribution, the Hecksher-Ohlin-Samuelson (HOS), which is also referred to as Hecksher-Ohlin-Viner (HOV) model and the Stolper-Samuelson (SS) and Rybczinski (RYB) theorems derived from that model. According to HOS/HOV, under certain assumptions the relative returns to factors of production are proportional to the relative prices of skill-intensive versus unskilled-intensive tradable goods and technology. In the absence of trade barriers, if technology is identical over countries, then wage levels and relative wages are equal over countries, the Factor Price Equalization theorem (FPE). Countries may impose tariffs upon goods in which they do not have a comparative advantage. Thus, the skill-rich North might impose tariffs on the imports of shoes while the South, relatively endowed with unskilled labour, imposes tariffs on imports of computers. The Stolper-Samuelson theorem predicts that a fall in tariffs lowers the price of shoes in the North, raising the relative price of computers versus shoes in the domestic market in the North. In the South the opposite occurs, as falling tariffs on computers lower the price of computers, and hence lower the relative price of computers versus shoes in the Southern domestic market. Because relative wages everywhere are proportional to the domestic relative prices of skill-intensive versus unskilled-intensive goods (here computers versus shoes), trade liberalization leads to rising relative wages in the North and falling relative wages in the South.

The Rybczinski theorem is easily understood in this context. With constant tariffs, if the endowments of factors change exogenously in one country, then the relative wages in that country remain unchanged. This is because relative wages are determined by the relative prices of tradable goods in the domestic economy, which are determined by the international relative prices and domestic tariff structure. International relative prices depend upon global supply and demand, and changes in domestic factor supply will not appreciably change global supply. This result is key to the methodology of studying the impact of trade on wages, as discussed below. While changes in domestic relative factor supply do not affect relative factor prices, the domestic sectoral structure of production does shift: output and employment shift towards sectors intensive in the factor that has become more plentiful.

Further arguments related to comparative advantage and Stolper-Samuelson have been put forth to link trade and distribution. Some authors have argued that policies encouraging manufactured exports will lower relative wages in developing countries. The key to this argument is the assumption that the skill content of manufactured exports is lower than for import-competing industries and other exports. Then export-promotion policies that raise the relative prices of exportable goods versus importable or non-tradable goods, particularly the promotion of manufactured exports, may raise the demand for unskilled workers and tend to equalize the distribution of wages [Krueger (1982), Wood (1994)].

---

2 Two countries, each with two goods which each uses two factors. International immobility of factors. Identical or similar technologies, constant returns to scale and consequent competition.
**Trade theory and distribution - the drawbacks of broad distributional measures**

The Heckscher-Ohlin-Samuelson/Viner trade theory described above relates to relative wages or returns to schooling, not to other non-wage sources of income or broader measures of the distribution of wages or income. However, many studies examine the impact of trade and trade liberalization upon measures of income that include non-wage income and broad measures of distribution, principally Gini coefficients. The reason for using such measures appears to be that they are more readily available than measures of relative wages. Whatever the motivation, using these measures to understand the impact of trade policies on wage structure, and ultimately distribution, is highly problematic because those measures typically reflect factors that are likely to be entirely unrelated to trade policies.

The first problem with linking broad distributional measures to trade is that factors other than trade may change the overall distribution even though wage structure might be unaltered. For example, if the dispersion of education or experience (age) rises or falls, the dispersion of wages will rise or fall. This latter effect is referred to as the “composition” effect. Trade theory has had little to say about the determinants of the level or dispersion of human capital. This concern is not merely academic. The distribution of human capital, in particular education and experience in developing countries has often varied rapidly over time, leading to large composition effects. And the changing level of skill is widely documented as affecting relative wages and hence distribution.

The second problem with using broad distributional measures is that, even absent composition effects, they are not precisely linked to relative wages. Of greater concern, though, is the third problem: studies that employ broad distributional measures rarely, if ever, control for the impact of changes in the domestic relative supply of skill upon relative wages. In standard labour market models such relative supply shifts have first order effects upon relative wages – and hence the distribution of wages. Only if the Rybczinski theorem holds can one ignore the impact of relative supply shifts upon wages.

In summary, the link between trade theory and broad measures of distribution is tenuous at best. While broad distributional measures may incorporate the effects of trade on wage structure, they also reflect “composition” effects that are unrelated to trade, and rarely do such studies control for the impact of changes in relative supply upon relative wages, or “wage compression effects”. Relative wages or returns to schooling are a far more appropriate measure for measuring the impact of trade on distribution.

---

3 Returns to schooling are proportional to relative wages. If the wage is exponential in schooling, \( w = \exp(bS) \), then the relative wage of high \( S_1 \) to low educated \( S_2 \) workers is \( W(S_1)/W(S_2) = \exp(bS_1)/\exp(bS_2) \), or \( \exp(b(S_1-S_2)) \). Thus \( \ln(\text{relative wages}) = b(S_1-S_2) \), where \( (S_1-S_2) \) is a constant.

4 Most models simply assume factor endowments to be exogenous. The few trade theories attempting to endogenize human capital have been based upon primitive models of human capital, according to which human capital is a function only of the returns to education or relative wages. Both theoretic and empirical work outside of trade theory have led to major modifications in the modeling of the determinants of human capital, reflecting imperfections in the financial market for financing education that led to household models of consumer, and educational demand. Moreover, these trade theories lead to the empirically unsupported prediction that trade liberalization leads to widening divergence in the human capital between the North and South, because liberalization raises relative wages (returns to schooling) in the North while lowering them in the South [Findlay and Kierzowski (1975), Davis and Reeves (1997)].
The Rybczinski Theorem and Measuring Relative Wages – While relative wages are more clearly linked to trade reform than measures of wage dispersion such as the Gini coefficient, the above discussion of the Rybczinski theorem raises a question concerning the appropriate measure of relative wages when studying the impact of trade. The Rybczinski theorem implies that we should measure relative wages unconditionally – without controlling for relative supply, e.g. Leamer (1998), whereas in standard partial equilibrium labour market models the appropriate measure is the relative wage net of the impact of supply. However, the Rybczinski theorem, and the underlying Heckscher-Ohlin-Samuelson model should not be taken as true without validation. Below I will summarize results contradicting the predictions of the Rybczinski theorem, suggesting that the proper outcome measure is relative wages conditional upon relative supply.

2.2 Methodological approaches to examining the impact of trade and trade liberalization upon distribution

There are two broad groups of studies linking trade policies and distributional outcomes, summarized in Table 1. The first group focuses upon the skill content of exports of LDCs, in particular manufactured exports, and typically investigates the hypothesis that (manufactured) exports are more intensive in unskilled labour than imports or import competing goods, so that policies leading to greater (manufactured) exports will lower the wages of skilled versus unskilled workers, hence tending to contribute to greater wage equality. This argument is sometimes viewed as similar to Stolper-Samuelson effects, where export promotion policies are seen as shifting the relative prices of tradable versus non-tradable goods, or perhaps the relative prices of skilled versus unskilled-intensive tradable goods. Some studies limit themselves to studying the factor content of exports or manufactured exports. Other studies make associations between policy environments or measures such as export shares of output to distributional outcomes. Policy environments are typically not measured quantitatively, and often changes in policy environments within countries over time are not examined. Thus, these studies often do not necessarily present clear experiments. Distribution is typically measured with Gini coefficients, though sometimes information on relative wages is used. However, the impact of relative supply shifts is not explicitly controlled.

The second group of studies examines the impact of trade liberalization on distributional outcomes. Trade liberalization is measured in several ways. Some studies simply examine distributional outcome before and after trade liberalization. Others measure trade liberalization with average tariffs, the relative tariffs of skilled versus unskilled intensive goods or measures of quotas. These causal variables of trade liberalization are related to distributional outcomes, including Gini coefficients, relative wages and relative wages controlling for relative supply, where the most common outcome measure employed is relative wages. The link between distributional outcomes and trade liberalization measures is examined using correlations of the two measures, or regressing distribution outcome measures onto trade liberalization measures. In the latter studies, sometimes other variables are included as controls.

As discussed above, the Rybczinski theorem asserts that shifts in domestic relative supply do not affect domestic relative wages. Some studies examine this possibility by studying the covariation of relative wages and relative supply in times of constant tariffs, via correlations and by regressing relative wages onto relative supply, or in periods of tariff changes by regressing relative wages onto average tariff levels, relative supply and sometimes other factors potentially affecting the relative demand for labour.
Table 1: Variables and methods linking trade policies and distribution

Panel A: Factor content of trade and (manufactured) export promotion policies

Summary:

Theoretical Basis: LDCs have comparative advantage in unskilled labour, reflected in the exports, particularly manufactured exports. Incentives to such exports raise the relative demand for unskilled labour and lower relative wages.

Thus it is argued that exports, particularly manufactured exports, are relatively intensive in unskilled labour. This is sometimes studied in isolation. Given this fact or assumption, it is argued that export promotion policies, particularly policies promoting manufactured exports, lead to greater income equality by lowering the relative demand for skill. Some argue that export promotion policies, by changing relative prices between tradable and non-tradable goods, and between tradable goods more versus less intensive in skill, are theoretically similar to Stolper-Samuelson effects.

Studies vary in the clarity of the experiment contemplated, the rigour of the statistical procedures and the outcome variable used (typically Gini coefficients). The impact of relative supply on relative wages is not controlled for.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Outcomes</th>
<th>How they are linked</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Skill Content of Exports, or Manufactured Exports: lower than for imports or import competing goods</td>
<td>• Gini levels or changes</td>
<td>Given (A) or the assumption of (A), examine the association between (B) or (C) and outcome measures:</td>
</tr>
<tr>
<td>b) Export (manufactured) Promotion Policies</td>
<td>• Relative wages: levels or changes</td>
<td>• typically: Gini coefficient</td>
</tr>
<tr>
<td>c) Openness or Exports/GDP</td>
<td></td>
<td>• method:</td>
</tr>
<tr>
<td>• Openness</td>
<td></td>
<td>• broad association</td>
</tr>
<tr>
<td>• Exports to GDP</td>
<td></td>
<td>• correlation: one country, over time</td>
</tr>
<tr>
<td>• Manufacturing Exports to GDP</td>
<td></td>
<td>• correlation: multiple countries (static or over time)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• regress: outcome onto measures of B or, more typically, C</td>
</tr>
</tbody>
</table>

Panel B: Trade liberalization

Summary:

Often examined in the context of the Stolper-Samuelson theorem.

- Trade liberalization is measured in various ways: in terms of periods, pre- versus post- liberalization; in terms of average tariffs, or relative tariffs, i.e. the tariffs of goods that are more versus less skill intensive; in terms of non-tariff restrictions such as quotas.
- Outcomes are more typically relative wages, or relative wages controlling for relative supply shifts, though sometimes in terms of Gini coefficients.
- Causes and outcomes are examined in various ways: by simple pre-post trade liberalization comparisons of outcome measures; by regressing time series of outcome measures onto dummy variables for pre-post trade liberalization, or onto average tariffs or onto relative tariffs. Such regressions sometimes control for relative supply shifts.
- Estimate relative demand shifts and regress these onto average tariffs and other variables potentially affecting relative demand.

Rybczinski Theorem:
- The hypothesis that domestic relative supply shifts do not affect domestic relative wages is examined by:
  o in periods of stable tariffs: examining the correlations of time series of relative wages and relative supply, or regressing relative wages onto relative supply. Rybczinski predicts no relation between domestic relative supply shifts and relative wages
  o in periods of changing tariffs: including relative supply as a regressor, to examine whether relative supply shifts affected relative wages

<table>
<thead>
<tr>
<th>Cause</th>
<th>Outcomes</th>
<th>How they are linked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade Liberalization;</td>
<td>• Gini; levels or changes</td>
<td>Typically employ relative wages, not Gini coefficients</td>
</tr>
<tr>
<td>- yes/no: pre-post</td>
<td>- Relative wages: levels of changes</td>
<td>• Correlations: Outcomes pre-post, outcomes with average or relative tariffs (uncommon)</td>
</tr>
<tr>
<td>- average tariff levels</td>
<td>Relative wages, controlling for relative supply: levels or changes</td>
<td>• Regressions: Outcomes onto relative wages; outcomes onto relative wages and supply; or estimate relative demand shifts and regress onto average tariffs and other demand shift controls</td>
</tr>
<tr>
<td>- relative tariffs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- quotas, other non-tariff trade barriers (yes/no: pre-post)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data Considerations

Household Surveys versus Firm Surveys for Censuses – The advantage of household surveys is that they permit the examination of wages and employment by detailed educational, experience and gender groups. This permits the construction of wage indices that are comparable over time, controlling for changes in the composition of experience and gender through time. This data may be often disaggregated by industries up to two digits, but not by firms or plants.

The advantage of firm-based data is that it permits study at the firm or plant level and may be sometimes be linked to detailed information on capital, technology and ownership (foreign versus domestic). The principal disadvantage of such data is that data on employment and wages within firms or plants is usually defined in terms of production and non-production workers. Such a division may not reflect the differences in skill that one desires. Non-production workers include both secretarial and low-level administrative workers along with professionals and high-level administrators, thus grouping low and high-skilled workers together. Moreover, the skill composition of workers within the broad non-production and production groups may vary over time, leading to changes in average wages within those groups that do not reflect changes in the relative wages of workers by skill. For example, Burtless (1995) documents that relative wage measures using the production/non-production classification differ very substantially from better measures from household surveys.

It is difficult to measure or control for educational quality. In neither firm nor household data is educational quality measured directly. Some studies employ indirect methods to control for changes in educational quality, by examining wages indices for cohorts within which educational quality does not vary significantly over time.
3. **Empirical evidence of the impact of trade upon distribution**

3.1 **Evidence regarding whether trade reform has affected distribution, by type of study and region**

*Studies measuring outcomes with Gini coefficients or other broad distributional measures*

**Factor content studies**

There are several studies of trade and distribution beginning in the 1980s. Bourguignon and Morrison (1989) examine Taiwan (China), Costa Rica, Malaysia, Malawi, Morocco and Peru, for the 1970s finding that over the cross-section exports of manufactures are associated with lower Gini coefficients. After controlling for primary exports, higher levels of protection are associated with greater income inequality. Using time-series for countries, they find that mineral exports tend to be associated with greater inequality, which they interpret as being due to the higher skill content and concentrated ownership of mineral production. Exports of agricultural products from small and medium-sized farms, however, are associated with lower inequality, apparently due to the lower skill content of agricultural exports and less concentrated ownership of small farms. This interpretation is plausible. However, these results may be questioned to the extent that Gini coefficients reflect various factors other than trade patterns or trade liberalization, as discussed above. Moreover, the pattern of exports is endogenous and its variation does not appear to present a clear experiment.

Wood (1994) examines a wide variety of evidence for the North and the South. He reviews work for the South and provides additional calculations. He posits a tripartite division of skill into uneducated, basic-educated and more educated. Furthermore, developing countries are endowed in unskilled labour and once they achieve a sufficient level of basic education they may, through the combination of comparative advantage and export promotion policies, export manufactures that are intensive in basic-education skills. Higher manufactured exports would then tend to equalize the distribution of wages, though perhaps raising inequality between the uneducated and the basic-educated groups.

Wood suggests that Bourguignon and Morrison’s (1989) cross-sectional results should be regarded cautiously, because of data limitations and because they examine levels, not changes in inequality. To address these shortcomings Wood examines evidence on changes in distribution for seventeen developing countries (p. 222) [the data is largely from Fields (1989, 1990)]. Countries were selected to include data over at least a decade,

---

5 Many of these attempt to relate the pattern of exports or manufactured exports to measures of distribution, though for some cases data on relative wages is available. Papnek and Kyn (1987) find no association between inequality and manufactured exports. Berger and Webb (1988) examine the relation between inequality and foreign exchange restrictions, proxied by the black market premium, finding that tighter restrictions reduce the income share of the riches quintile.
ranging from the early 1960s to the mid-1980s. Inequality was measured with Gini coefficients. He finds a negative but statistically insignificant relationship between inequality and North-bound manufactured exports. After excluding three countries on the suspicion that they contain outliers because of improbably large changes in their Gini coefficients, he finds a statistically negative association. Adding controls, however, led to inconclusive results. He suggests that these results may have been due to data problems, and concludes:

“that cross-country comparisons provide only rather limited support for the proposition that exporting manufactures tends to reduce income inequality (pp. 224-225).”

Wood also analyzes a variety of evidence for four Asian Tigers: Taiwan (China), Korea, Hong Kong (SAR China) and Malaysia. The data is fairly extensive and includes both Gini coefficients and measures of relative wages, though where wage measures are available for these countries, they are typically for production/non-production workers. Here he finds evidence of a negative association between inequality – and sometimes relative wages – with exports of manufactures and export promotion policies. However, relative supply was typically not controlled for. Since relative supply was growing this poses an alternative explanation for falling wage differentials, as Wood notes. Moreover, the conclusion that exports of manufactured exports compressed relative wages and hence distribution may be problematic because trade shares are endogenous, these studies therefore are that they do not present a clear experiment (Leamer, 2000), though there is some controversy in this regard (Deardorf, 2000; Krugman, 2000). Finally, as Wood observes, it is not altogether clear whether these countries should be classified as unskilled LDCs.

Assessing the evidence reviewed by Wood

It appears that for the 1960s and 1970s manufactured exports were often more intensive in unskilled labour than import-competing exports and those exports grew rapidly in several East Asian countries where this growth coincided with often improving income distribution. However, the link between trade and distribution provided by these studies is highly tenuous. Wood is very cautious in his analysis of the data reviewed and emphasized alternative explanations, including increases in the relative supply of skill. This caution seems most warranted. Three problems warrant emphasis. First, on its own terms, the statistical evidence is very weak. Second, the uncontrolled for effects of supply upon wage structure - “compression effects” - and “composition” effects may easily dominate trade’s impact upon wage structure. For example, Robbins (1996a, 1998, 2000a, 2002) and Gindling and Robbins (2000) found that very large declines in relative wages in Costa Rica, Colombia and Malaysia prior to trade liberalization were due to rising relative supply. Composition effects may also be very large and equalizing. For example, in Taiwan (China) in the 1980s relative wages were nearly constant, while Wood documents a fall in the Gini, so that the change in the Gini for Taiwan (China) in this period was due to composition effects [Robbins (2002), Wood (1994)]. Third, the data do not provide a clear experiment, but rather an association between a wide array of trade-promotion and industrial policies, rising manufactured exports and changes in distribution.
Non factor content studies

Spilimbergo, Londoño and Szekely (1999) analyse data on Gini coefficients, factor endowments and a measure of openness for a panel of thirty-four countries over the period 1965-1992. The Gini coefficients employed derive from household surveys and include all sources of income. Their measure of openness derives from Leamer (1988), where openness is the residual from a regression of imports and exports as a share of output regressed onto endowments and other variables.

Their analysis is based upon a model where local and global per capita factor endowments of land, capital and human capital along with openness and ownership structure determine factor returns. They argue that ownership of capital and land may be much more unequal than that of human capital, as the ownership of capital and land are potentially unlimited while ownership of human capital is bounded. They regress Gini coefficients onto per capita factor endowments relative to world average factor endowments and per capita output (to control for potential Kuznets effects) both without and with interactions of factor endowments with openness. They find that relatively higher per capita capital and land are associated with higher Ginis and higher relative human capital is associated with lower Ginis. However, they find the opposite signs on relative per capita factor endowments interacted with openness, i.e. after controlling for the impact of factor endowments on inequality, more openness for countries with higher capital and for higher land lead to lower Ginis, while higher openness for countries with higher than average per capita human capital is associated with higher Ginis. Regionally, they suggest this implies that openness leads to no change in Ginis in industrialized countries and Latin America, while it lowers inequality in Africa, Asia and East Asia.

In assessing this analysis three concerns arise that cast serious doubt on their results linking factor endowments and openness to distribution. First, while their key theoretic assumption relates to the ownership of factors of production, and while they emphasize that ownership patterns vary within countries over time and over countries at a given time, their empirical work assumes ownership to be constant over countries and time. They motivate this assumption on a priori grounds, and assume that ownership of land and capital is relatively concentrated while that of human capital is not. Yet no empirical corroboration for this is provided. Second, their use of Gini coefficients raises profound doubts. As discussed above, changes in Gini coefficients reflect changes in the distribution of human capital, composition effects, along with the impact of change in human capital upon relative wages, wage or compression effects. While it is likely that wage compression and composition effects are correlated with the relative per capita factor endowments they measure, these are not controlled for. Third, while they interpret their results based on a rent model, where rents are higher for protected sectors and especially high for capital and land, they offer no explanation for their result that openness increases inequality when human capital is relatively high. Instead they simply say this is consistent with the empirical literature. However, the empirical literature relates to relative wages, while their model makes no reference to relative wages.

Zhu and Treffler (2001) examine Gini coefficients for 29 developing and newly developing countries (from the Deininger and Squire (1996) inequality database) to illustrate that the predictions of the Stolper-Samuelson theorem are not borne out. They note that of these 29 countries, 16 experienced rising inequality and 12 experienced falling inequality. They cite this dichotomy as illustrating the complexity of Southern inequality. They suggest that a possible answer may be found in the positive correlation between growth in inequality and growth in exports. For the non-East Asia sub-group of countries

---

Their model allows for local endowments to affect wages, unlike in standard HOS/HOV model under the Rybczinski theorem.
the correlation is 0.59 and 0.50 for East Asia. They caution that the data are permeated by measurement errors and that the results may be due to many omitted factors such as levels of openness, co-linearity with trade reforms and differences in domestic re-distributive policies, but note that Stolper-Samuelson predicts a negative relationship. Furthermore, they interpret these results as suggesting that general equilibrium trade linkages over countries may play some role in the “complex evolution of Southern inequality”.

In addition to these reservations should be the aforementioned concerns regarding the use of Gini coefficients. As previously discussed, the Stolper-Samuelson theorem makes predictions about relative wages, not Gini coefficients. Most of these countries have experienced rapidly rising relative supply which, via wage compression effects, would be expected to tend to lower relative wages unless the Rybczinski theorem applies. And composition effects for these countries are not controlled for. If rising exports are positively correlated with increases in the variance of education or experience, then the correlations reported would be biased upwards. Nonetheless, the correlations are thought provoking.

Studies of wages and employment

The majority of studies examining the relation between wages and employment and trade liberalization have been for Latin America, though some have also examined Asia and Africa. In Latin America, the most intensively studied countries have been Chile and, in particular, Mexico.

Latin America

Argentina

Argentina lowered average tariffs from 60 per cent in 1974 to roughly 20 per cent in 1979. Average tariffs remained low until 1984 when they rose to 37 per cent and then fell to below 20 per cent in 1989, after which they rose slightly but averaged below 20 per cent.

Robbins, Gonzalez and Menendez (1997) examine household data for metropolitan Buenos Aires, Argentina over 1974-1994, employing the Katz-Murphy (1992) methodology for constructing constant-demographically-weighted price and relative supply indices and the Welch (1979) and Katz-Murphy (1992) methodology for constructing time series of relative wages and relative supply and estimating relative demand shifts. Relative supply rose continually throughout the period studied, while subsequent to trade liberalization relative wages stopped falling and began to rise, suggesting skill-biased relative demand shifts. Estimated time-series of relative demand showed a marked rise in relative demand after trade liberalization. The positive association of relative wages with trade liberalization exists for both relative wages and relative wages conditional upon supply.

7 A variety of scenarios could generate such correlations: they could be causal, where rising exports are associated with higher growth rates, spurring asymmetric increases in educational attainment and higher variance or coincidental, associated with the shifts in the age structure of the population.
Chile

After decades of import-substitution industrialization policies, Chile's protectionist policies ended abruptly in the mid-1970s, after the 1973 military coup. After 1975 tariffs were suddenly lowered from several hundred per cent in some cases, from an average of 110 per cent to a uniform 10 per cent.\(^8\) Exports as a share of GDP grew from below ten per cent of GDP to about 30 per cent of GDP over the 1970-1992 period. Exports rose rapidly over 1973-1977, fell through 1982 due to overvaluation and international recession, and then resumed rapid growth after 1982 in part due to devaluation.

Robbins (1994a,b,1995) and Gindling and Robbins (2001) employ household data for Greater Santiago, Chile over 1957-1991 to examine the structure of relative wages and relative supply in Chile before and after trade liberalization. Employing the Katz-Murphy (1992) methodology, described above, it was found that relative wages grew very rapidly after trade liberalization, despite a threefold increase in relative supply over 1975-1991. Prior to liberalization relative wages varied inversely with relative supply, but rose 55 per cent between 1975 and 1991. The positive association of relative wages with trade liberalization exists for relative wages conditional upon supply and unconditional relative wages. Gindling and Robbins (2001), employing a modification of the decomposition technique proposed by Juhn-Murphy-Pierce (1993) also found that the relative wage shifts in Chile after liberalization dominated large equalizing educational composition effects associated with educational expansion.

Colombia

Average tariffs rose from 10 to 30 per cent over 1978-1987 in Colombia, and were then reduced to below 10 per cent after 1991. The pesos was strongly depreciated through 1990 and then was revalued in 1990, and remained high through 1997, muting the export performance with trade liberalization.

Robbins (1996a,d; 1998, 2002) employ household data over 1976-1999 for Colombia’s seven principal cities to examine the pattern of relative wages and employment in relation to rising and then falling average tariffs (the periods and metropolitan coverage varies over the respective studies). These studies find that relative wages fell nearly 50 per cent in the period of rising average tariffs and then rose after 1990, despite rising relative supply throughout the period studied.

Costa Rica

Trade reform was gradually implemented in Costa Rica over 1980-1995, particularly after 1985. Gindling and Robbins (2000, 2001) review national household data over 1976-1994 to examine the pattern of relative wages and relative supply before and after trade liberalization. They employ the Katz-Murphy methodology, discussed above. They find that while prior to trade liberalization relative wages fell substantially while relative supply rose, after liberalization though relative supply continued to rise relative wages rose moderately. The decomposition results of Gindling and Robbins (2001) revealed that changes in relative wages in Costa Rica after liberalization were modestly disqualizing as were composition effects, due to rising dispersion of education accompanying educational expansion.

---

\(^8\) Tariffs were raised somewhat after the 1982 depression, but lowered subsequently.
Mexico

Policy - Prior to the 1980s Mexico imposed trade barriers to protect and encourage domestic industries. In 1983 barriers to capital flows were reduced, mostly along Mexico’s borders. Then between 1985 and 1990 average tariffs fell from 23.5 to 12.5 per cent, with maximum tariffs declining from 100 to 20 per cent and import license coverage declining from 92 to 20 per cent of imports. In 1989 controls on foreign capital were also liberalized further. This was followed by Mexico’s entrance into NAFTA in 1992 [e.g. Robertson (2000)].

Findings on wage structure and trade liberalization

Cragg and Epelbaum (1996) employ urban household data over 1987-1993 to examine the impact of trade liberalization upon wage inequality in Mexico. Controlling for occupation and industry variables in estimated earnings functions they find that the predicted change in wages for primary workers over 1987-1993 rose eight per cent while wages of workers with secondary education rose 15 per cent and for those with university education rose 68 per cent. Similarly the estimated changes in skill premia for secondary versus primary educated workers are only 3 per cent while those of post-secondary to primary and post-secondary to secondary are 70 and 67 per cent, respectively.

Revenga (1997 [1994]) employs firm-level data over 1984-1990 for medium to large manufacturing firms at the national level, where wages and employment are disaggregated according to production/non-production workers. From her tables it can be seen that relative wages grew 29 per cent over 1984/1990, rising from 1.895 to 2.45, while relative employment was nearly constant, remaining at about 0.43.

Robbins (1996f) analyses urban household data employing the Katz-Murphy (1992) methodology for constructing comparable relative wage and relative indices over time. He finds that relative wages of workers with university versus primary-complete educations grew 34 per cent over the 1987-1993 period, while relative supply grew 48 per cent. He concludes that relative wages grew coincident with trade liberalization despite potentially very significant downward pressure upon wages from relative supply, going counter to the anticipated Stolper- Samuelson effects. This work has the advantage over firm studies in its use of detailed data on education, experience and gender and the construction of wage and supply indices that correct for changing labour force composition over time.

Hanson and Harrison (1999a,b) examine plant level data over 1984-1990 to examine the pattern and causes of rising relative wages in Mexico after trade liberalization. This data permits desegregation according to production and non-production workers. They find that the relative wages rose 32 per cent, from 1.93 to 2.55 with the SECOFI data. With the industrial census they find that relative wages rose 17.4 per cent, from 1.84 to 2.16. However, they find that relative employment was nearly constant, averaging 0.43.

9 Assuming that the Rybzcinski theorem did not apply, or simply that carefully measured, unconditional relative wages grew dramatically coincident with trade liberalization.
Mexico - Summary

Relative wages rose rapidly in Mexico after trade liberalization, reversing a previous downward trend. This is true whether employing manufacturing surveys in terms of non-production versus production workers or from household surveys, with a more detailed breakdown of skills and the inclusion of all sectors employing a more sophisticated index construction methodology. Overall relative wages rose roughly 30 per cent between 1987 and 1993. It is also clear from the household data that relative supply rose very rapidly, increasing nearly 50 per cent in the 1987-1993 period. We also know that average tariffs and quotas fell sharply. These results appear counter to the usual Stolper-Samuelson predictions for a “Southern” country relatively endowed with unskilled labour. In addition, though, there were major reforms governing foreign investment in Mexico, complicating the identification of rising relative wages with trade reform.

Peru

Mazumdar and Zhou (2000) examine evidence for formal sector firms in Lima, Peru. Peru undertook trade liberalization and structural reforms beginning in 1990. Average tariffs fell from 66 per cent in 1989 to 15 per cent in 1995 and 12 per cent in 1997 and over this period import prohibitions were gradually abandoned. Import licensing was eliminated in 1990 and export restrictions eliminated for most exports in 1991. Using firm level data for metropolitan Lima, the Mazumdar and Zhou document shows that relative wages of production to non-production workers rose 16.5 per cent over the 1991-1997 period. They interpret the rising relative wages coincident with trade liberalization as consistent with findings for other LDCs. However, they do not provide controls for relative supply shifts or other factors, beyond the correlation of trade liberalization with rising relative wage inequality. And there exist the aforementioned concerns about the usefulness of the production/non-production relative wage index.

Uruguay

Uruguay began a modest trade liberalization in the 1970s. During the 1980s the trade policy was stable, but in the beginning of the 1990s a major increase in the trade policy openness was introduced and by 1992 average tariffs were only 5.9 per cent.

Robbins (1996e) examines national household data over 1984-1995, employing the aforementioned Katz-Murphy (1992) methodology. Relative supply grew rapidly throughout the study period, nearly doubling from 0.2 to 0.38. Prior to liberalization relative wages fell with rising relative supply. However, after trade liberalization relative wages rose 25 per cent, 2 to 2.5 over only a five year period.

Asia

Relative supply and relative wages without trade liberalization: Examining the validity of the Rybczinski Theorem.

Malaysia

Though Malaysia pursued export promotion and industrial policies [e.g. Wood (1994), the East Asian Miracle (1993)], it did not undertake trade liberalization in recent decades. Robbins (1994c) examined national household data over 1973-1989 to document and understand the determinants of changes in relative wages. During this period relative supply grew dramatically, rising nearly twenty-fold from 0.01 to 0.19, while relative wages fell equally dramatically, declining more than 50 per cent from 9.2 to 4.3. These results
bear both upon the validity of the Rybczinski theorem and the usefulness of the Gini coefficient studies discussed above. Given the relative constancy of tariffs over this period the Rybczinski theorem would have predicted at most modest changes in relative wages, in response to changing international relative tradeables’ prices. The results go strongly counter to that prediction of the Rybczinski theorem. Moreover, the findings suggest first order wage compression effects due to the remarkable increase in university educational attainment. These alone would have likely dominated changes in Gini coefficients for Malaysia for this period, and support the previous argument that no conclusions regarding the relation between trade (and export promotion policies) and relative wages or broader measures of distribution can be drawn from examining the Gini coefficients.

The Philippines

The Philippines had modest trade liberalization in the mid-1980s. Robbins (1994d) examines national household data for the Philippines over 1978-1988, employing the previously discussed Katz-Murphy (1992) methodology to examine the behaviour and causes of relative wages during trade liberalization. Relative wages were nearly constant over 1978-1982, a period of very modest increases in relative supply (relative wages fell three per cent while relative supply rose 14 per cent). After 1982, however, both relative wages and relative supply rose significantly; despite a 50 per cent increase in relative supply, relative wages grew 25 per cent by 1986 from 2.8 to 3.6, though declining somewhat to 3.15 in 1988. These findings were evaluated as inconclusive.

Taiwan (China)

Taiwan (China) underwent major trade liberalization over 1978-1990, with average tariffs declining from 45 to 9 per cent. Robbins (2002) employs national household data over 1978-1992 to examine the patterns of relative wages and their causes. Relative supply grew sharply over this period, more than doubling from 0.11 to 0.25. Over this period relative wages were nearly constant with little trend, averaging 1.65. These results were interpreted as inconsistent with the Stolper-Samuelson theorem and HOS/HOV model. Under the Stolper-Samuelson and Rybczinski theorems the large fall in average tariffs should have led to large changes in relative wages. In a heterodox framework, if Rybczinski were incorrect while Stolper-Samuelson was valid and Taiwan was relatively endowed in unskilled labour we would expect a large fall in relative wages. However, were Rybczinski incorrect and Taiwan was relatively skill intensive, then rising supply could have counteracted the rising relative demand for skill.

Africa

Morocco

Over 1984-1990 Morocco undertook trade reform. Maximum tariffs were lowered from 165 to 45 per cent while the per cent of goods subject to quotas fell from 41 to 11 per cent.

Currie and Harrison (1997) examine evidence for manufacturing plants in Morocco for production and non-production workers. Counter to the usual expectation for the South, they found that prior to reforms textiles and clothing were highly protected.
Multi-country studies


Liberalization and relative wages

These studies also found in country-level and pooled estimates that both relative wages and relative wages conditional upon relative supply were strongly, positively correlated with average tariffs. If the Rybczinski theorem is correct, then according to the traditional interpretation of the Stolper-Samuelson for the South it predicts a positive relationship between relative wages and average tariffs. However, the correlations of relative wages and average tariffs were strongly negative and statistically significant, ranging from -0.25 to -0.58, and averaging -0.49.

This work next explored the validity of the Rybczinski theorem, emphasized by Leamer (1998), by examining whether relative supply affected relative wages in periods of constant tariffs. In such periods HOS/HOV predicts that domestic relative wages should only change slowly in accordance with changes in the international relative price of tradeables. During the periods studied relative supply shifts were dramatic. Relative supply rose from 0.2 to 0.55, 0.1 to 0.36, 0.2 to 0.39, 0.12 to 0.28, 0.01 to 0.19, 0.25 to 0.37, 0.29 to 0.48, 0.11 to 0.25, 0.24 to 0.38, for Argentina, Chile, Colombia, Costa Rica, Malaysia, Mexico, the Philippines, Taiwan (China), and Uruguay, respectively. In periods of constant tariffs the correlation of relative supply and relative wages ranged from -0.5 to -0.99, averaging -0.78. Similarly, regressing log relative wages onto log relative supply, in both country level and pooled regressions in periods of constant tariffs yielded highly statistically significant negative coefficients, averaging -0.59. These results were robust in instrumenting the 14 relative supply variable. These results were interpreted as strongly supporting the conclusion that shifts in domestic relative supply exert first-order, downward, pressure upon relative wages even in small, open economies, contrary to the Rybczinski theorem.

This work next explored whether the Stolper-Samuelson theorem held in a heterodox framework where domestic relative supply affected relative wages. In pooled and country level regressions, regressing relative wages onto relative supply and dummy variables for periods posterior to trade liberalization continued to yield strongly negative, statistically significant coefficients on relative supply and statistically significant, positive coefficients on the dummy variables, indicating rising relative wages associated with trade reform, controlling for the impact of relative supply. These results were robust to inclusion of time-trends and instrumenting relative supply. Similarly, regressing estimates of relative demand shifts [see Section IV(b) for how relative demand was estimated] onto average tariffs yielded negative coefficients on the tariff variable. These results were also robust to controls for educational quality changes, controls for minimum wages, and changes in labour market legislation (discussed further in Section V.)

These findings were interpreted as showing that, regardless of the validity of the Rybczinski theorem, trade liberalization was associated with rising relative wages. Furthermore, the evidence strongly suggests that the Rybczinski theorem did not apply to these small, open economies. In itself, this raises doubts about the HOS/HOV model and
associated Stolper-Samuelson theorem. And because relative wages conditional upon relative supply also grew rapidly with trade liberalization, these studies conclude that the evidence finds that trade liberalization in the countries studied is associated with rising relative wages and that the evidence is at odds with the standard Stolper-Samuelson predictions for the South.

Evaluation of evidence concerning the impact of trade reform on distribution

The evidence relating trade policies and outcomes to wage structure that is based upon broad distributional measures, including Gini coefficients, is of questionable validity for three reasons. First, while trade theory relates to relative wages, changes in such distributional measures reflect many other factors, notably the level of human capital, or relative supply, and its effect upon relative wages (“wage” or “compression effects”) and the distribution of education and experience (“composition effects”). Even were the Rybczinski theorem valid and wage effects absent, composition effects may easily dominate the impact of trade upon relative wages, leading to false inferences of causality linking trade, trade policies and relative wages. Second, as Wood (1994,1997) emphasizes, the statistical evidence linking trade policies and export patterns is very weak. Third, the negative statistical correlation between Gini coefficients and manufactured exports that Wood (1994) reports, once several countries are excluded, goes counter to the positive correlation presented by Zhu and Treffler (2001).

The evidence from factor content of trade studies for the 1960s and 1970s show that for the countries studied exports were typically less skill-intensive than imports. However the empirical evidence linking export promotion policies and export performance to relative wages is tenuous, even where wage structure was examined directly. The evidence for the East Asian Tigers sometimes examines wages and employment directly, instead of broad distributional measures. However, the improving relative wages occurred in periods of rapid increases in relative supply, which, as Wood (1994,1997) emphasizes, could offer an alternative explanation.10

The evidence from studies examining relative wages and employment and trade liberalization appears more reliable, though subject to a number of important reservations. This evidence suggests that trade liberalization has been associated with rising relative wages, both with and without controls for relative supply shifts. While these studies measure the appropriate outcome variable, other factors correlated with the trade liberalization episodes, such as labour market reforms, other structural adjustment policies, or technological diffusion from the North could be responsible for rising relative wages. Many of these studies attempt to control for or analyze the potential influence of such other factors, discussed in greater detail in Section V. Thus, we have a prima facie case that trade liberalization in recent decades in several, largely Latin American, developing countries led to rising relative wages.

Latin American versus East Asian dichotomy?

In our evaluation the weakness of the East Asian data undermines the credibility of a marked dichotomy between the experience of East Asia, in particular the East Asian Tigers, and Latin America, though we will summarize hypotheses proposed to explain such a potential dichotomy.

---

10 “..this evidence, reviewed more in detail in Wood (1994:228-43), is by no means as clear cut as commonly supposed. The data on relative wages contains gaps and deficiencies. In addition, few analyses have attempted to control for internal influences on the movement of relative wages.” (Wood 1997).
The evidence reviewed presents a strong case against the validity of the Rybczinski theorem. This suggests that one needs to control for the impact of shifts in relative supply upon relative wages in order to identify the impact of trade reform upon relative wages. If correct, this conclusion also raises challenges to the HOS/HOV framework that underlies the Stolper-Samuelson theorem.

Section 4 begins the analysis of why the aforementioned empirical regularities were encountered. That section discusses the theories and methodologies employed, followed by the synthesis of empirical results in Section 5.
4 Explanations of the observed patterns of the impact of trade on distribution: theoretical and methodological preliminaries

4.1 Trade reform and wages: theories explaining rising relative wages with trade liberalization in the South

The focus of this section is on theories explaining why the expected Stolper-Samuelson effects have sometimes not been found in the South. First I discuss variants upon the HOS/HOV model and Stolper-Samuelson theorem and then I turn to models that offer a significant departure from the HOS/HOV framework.

**HOS/HOV based explanations**

**Tariff Structure**

One explanation of rising relative wages with trade liberalization in the South is that prior to reforms tariff structure protected unskilled intensive goods, rather than skill intensive goods. Then trade liberalization would lead to rising relative domestic prices of tradeables and rising relative wages, according to the Stolper-Samuelson theorem. The puzzle would be why countries would protect unskilled-intensive goods in which they purportedly have a comparative advantage.

**Southern?**

Another explanation is that we have miscategorized countries, mistaking them as relatively endowed in unskilled labour when in fact they are rich in skill.

**Compared to Whom?**

Yet another explanation [e.g. Davis (1996), Leamer (1998)] is that the world is divided into various strata of competing economies, or cones of diversification, so that the Stolper-Samuelson theorem holds within the respective cone of diversification. Thus, the classification of the world into North and South is inadequate and what matters is whether a country is “locally” Northern or Southern, i.e. whether a country is relatively endowed with skilled or unskilled labour within its cone of diversification.

**Too soon to tell?**

Another argument is that Stolper-Samuelson requires inter-sectoral shifts of output and employment that take time. If labour is inter-sectorially immobile in the short run then Stolper-Samuelson effects would not be felt immediately.
Rising global relative tradeables’ prices

If the relative price of tradeables was rising this could lead to rising relative wages in the South. It was widely noted [e.g. Wood (1997), Figure 5] that in the mid-1980s the world supply of unskilled labour likely increased because of the greater trade openness of Bangladesh, China, India, Indonesia and Pakistan.

Nature Resources

The introduction of a third factor into the HOS/HOV model, such as land, could potentially explain widening relative wages with opening. If trade opening raised exports for natural-resource intensive products that employed principally skilled labour this could raise relative demand [e.g. Wood (1997)].

Trade Policy Instruments

The use of export-promotion subsidies instead of trade liberalization, though in theory equivalent, may differ in their effects because of differing sectoral structures [Wood (1997)].

Technological change within the HOS/HOV framework

Skill-biased technological change has been widely embraced as explaining rising relative wages in the United States and Europe in recent decades. Nonetheless until recently it was widely believed by trade theorists that in a globally integrated economy complies with the HOS/HOV assumptions only sector-biased technological change could affect relative wages [Leamer (1998)]. However, a series of recent theoretic investigations have clarified the conditions under which factor or sector-biased technological change may affect relative wages. Within the HOS/HOV framework, under most scenarios both types of technological change will affect relative factor prices. Factor bias will not affect relative wages when the prices of tradeable goods remain unaffected. Thus, factor-biased technological change should have no effect when this occurs in a small, open economy because it does not affect the prices of tradeable goods. Sector bias will not affect relative factor prices only when technical progress is global and identical in an integrated global economy with Cobb-Douglas preferences. [See Davis (1998), Findlay and Jones (2000), Jones (2000), Krugman (2000), Xu (2001)].

Technology diffusion and capital deepening via trade

While for the US skill-biased technological change has been put-forth as an alternative to trade as an explanation of rising relative wages, for developing countries it has been postulated that technological change has been fomented by trade reforms. Many of these models seek to explain the observed simultaneous rise in relative wages in the North and the South.

Robbins (1994a,b; 1995, 1996b,c) suggested the Skill-Enhancing-Trade (‘‘SET’’) hypothesis to explain rising relative wages with trade liberalization in Chile and other developing countries. Trade liberalization could raise relative wages in the South by inducing capital deepening and skill-biased technological change. Trade liberalization increased competitive pressures upon domestic producers, inducing them to modernize in order to survive. Furthermore, to the extent that liberalization increases exports, this would make possible the importation of machinery from the North. This would both lead to capital deepening and rising relative demand for skill due to capital-skill complementarity.
[Griliches (1969)], not requiring skill-biased technological change. In addition rising imports of physical capital would likely lead to skill-biased technological diffusion, as widespread evidence suggests that new equipment in the North has been increasingly skill-biased [e.g. Coe and Helpman (1995) for evidence on technological diffusion]. Furthermore, as trade liberalization is often coupled with exchange rate devaluation, following the Marshalian-Jcurve literature, this would permit greater exports that would permit greater capital imports, which due to the increased competitive pressures would be directed towards investment, not consumption [see Pisarides (1996) for a formalization of parts of the SET hypothesis]. See Autor, Katz and Krueger (1998) and Acemoglu (1998) who argue that technological change is skill-biased; Acemoglu (1998) argues that if technological progress diffuses from the North to the South through trade, skill-biased technological progress in the North increases the demand for skill in the North and the South. Bernard (1995) and Acemoglu (1999) present formal models where after trade liberalization firms, in order to compete in the international market, invest in technology.

Stokey (1994) presents a similar argument, whereby capital flows to the South accelerate with trade liberalization because liberalization frees up capital movements from the low-interest rate North to the high-interest rate South. Given capital-skill complementarity this raises the demand for skill in the South.

Acemoglu (1998) also develops a model postulating that increases in the relative supply of skill increase the market size for skill-intensive goods and lead to skill-intensive technological innovations.

**Other Non-HOS/HOV Explanations**

**Natural Resources**

Wood (1997) suggests that a model with three factors, including natural resources may lead to different patterns of exports with different factor contents and hence different effects upon relative wages. He also argues that it is important to distinguish between trade liberalization and trade promotion policies and the periods in which reforms are undertaken.

**Imperfect Competition**

Imperfectly competitive product and labour markets where protection can lead to rents and rent-sharing with workers, whose intensity may be due partly to union strength. Trade liberalization lowers rents and rent-sharing in sectors where tariffs decline. If sectors differ by factor intensity then this can alter average wage levels across sectors and if this covaries systematically with sectoral skill-intensity this can alter economy-wide relative wages. For example, if tariffs decline in sectors intensive in unskilled labour, rents and wages in the unskilled sectors fall, leading to rising relative wages. While this theory has been seen as strictly outside the HOS/HOV model, because of its assumptions of imperfect competition, it may be compatible with modifications of that framework. Its effects appear likely to magnify Stolper- Samuelson effects.

**Outsourcing**

Feenstra and Hanson (1996) present a three factor model where unskilled labour, skilled labour and capital produce a continuum of goods. Trade liberalization may induce movement of production of some products from the North to the South, decreasing the range of goods produced in the North and decreasing the range of goods produced in the South. The factories that move may be relatively unskilled in the North, but may involve higher than average levels of skill than existing factories in the South, raising relative
wages in both the North and South. Zhu and Treffler (2001) present a similar model of technological catch-up by the South leading to rising relative wages in both the North and South.

Jones and Marjit (2001) develop a four-factor, three-sector linear neighbourhood model in which small developing countries produce agricultural goods with land and unskilled labour and two manufacturing goods with both types of labour and capital, a mobile factor. Trade opening in the agricultural sector leads to skill-biased demand shifts in the manufacturing sector.

Xu (2001) employs the Ricardian and Heckscher–Ohlin model of Dornbusch, Fisher, and Samuelson (1977,1988) for a continuum of goods. From the Ricardian model he finds that trade liberalization may affect the range of goods imported and exported, inducing two offsetting effects on the South’s relative skill demand; the net effect determines the change in its wage inequality.

**Summary**

A broad range of potential explanations for rising relative wages with trade liberalization in the South have emerged. These may be summarized in terms of eight groups:

1. Stolper-Samuelson is correct, but tariff patterns depart from the expected.

2. Countries are misclassified as Southern when they are relatively skilled.

3. HOS/HOV is correct and the international relative price of tradeable goods rose with the greater openness of Bangladesh, China, India, Indonesia, and Pakistan in the mid-1980s.

4. Stolper-Samuelson is correct within cones of diversification, challenging standard classifications of countries into North versus South.

5. Protection may generate rents and rent-sharing, and liberalization dissipates rents and lowers wages in some sectors, which may alter relative wages.

6. Trade liberalization leads to diffusion of skill or sector-biased technological change or physical capital from the North to the South.

7. A version of “run-away factories”, where liberalization leads to the movement of factories from the North to the South, lowering relative demand in the North but raising it in the South because of higher average skill intensities in the North.

8. Natural resource endowments may lead to unskilled-intensive manufactured exports from the South that lower relative demand.
4.2 Trade and wages: methodology employed to explain outcomes

Factor content of trade

These studies examine the skill-intensity of trade flows to link changes in trade flows to changes in wage structure or distribution. Some examine the factor content of trade by types of goods and then informally relate these changes to changes in relative wages or, more typically, broad distributional measures. Other studies, particularly for the United States [e.g. Borjas, Freeman and Katz (1991)] calculate the factor content of changes in net trade flows to calculate the impact of trade flows upon distribution. These studies were initially highly criticized by trade economists, though recent research suggests that examination of the factor content of net trade flows may indeed be useful [see Deardorf (2000), Leamer (2000) and Krugman (2000)].

Studies employing Gini coefficients

Many of these studies combine the examination of factor intensities by types of products and informally relate changes in the structure of exports to those intensities and changes in Gini coefficients. These studies are problematic because of the lack of a clear experimental framework and because of the severe drawbacks of using distributional measures such as Gini coefficients.

Studies employing firm data

Wage and employment levels

These studies relate changes in average firm, plant or industry wages to changes in tariffs or goods prices. By relating changes in tariffs or prices to skill-densities they examine whether trade liberalization led to inter-sectoral shifts in output and employment that shifted the relative demand for skill and hence relative wages.

Relative wages and employment

These studies regress relative wages or employment onto industry level trade protection measures – tariffs and quotas – and other variables reflecting technology investments and ownership structure (foreign versus domestic).

Sometimes these data are used to decompose employment shifts into within and between sector shifts, though these are limited by the inherent data limitations and simple techniques employed [see footnote 15].

The advantage of these studies is to examine data at the firm or plant level and to examine often rich data sets on ownership and technology. These studies typically ignore the impact of shifting relative supply. They are also limited to measuring skill in terms of non-production versus production workers. Another limitation is that these data typically encompass only urban manufacturing firms.
Tradables’ prices

Both the Stolper-Samuelson theorem and the rent-sharing arguments postulate a link between tariffs, domestic tradeables’ prices and domestic relative wages. These theories required shifts in the relative prices of skilled versus unskilled-intensive tradeable goods. Evidence for this has been carefully explored for the U.S, but less frequently for developing countries.

Studies employing household data sets

Disaggregated and Time-Series Methods

Several of these studies employ the Katz-Murphy (1992) methodology for constructing inter-temporally comparable relative wage, employment and supply indices.\textsuperscript{11} These indices are more reliable than those possible from firm data or simpler indices from household data. The analyses based upon these indices consist of two broad types: time-series of relative wages, employment and supply and the examination of disaggregated indices of these.

Several disaggregated analyses based on these wage and quantity matrices are then performed. First, the inner-product of disaggregated wage and employment shifts by demographic cells is calculated to determine whether supply shifts dominated wages shifts. Second, employment shifts are decomposed into between and within-sectoral shifts.\textsuperscript{12} Along with the pattern of relative wage changes, this is employed to examine whether there were between-sector employment shifts consistent with the Stolper-Samuelson theorem and whether there was factor biased technological change. If the relative employment of skill rose within industries while relative wages rose, this is often interpreted as reflecting skill-biased technological change.

\textsuperscript{11} To construct these indices the respective population – employees and broader measures of supply including unemployed and, potentially, inactive adults – is divided into demographic sub-groups by gender, experience and education. Normalized wage and quantity matrices are constructed. Each matrix consists of vectors whose elements are demographic cells. The normalized quantity matrices consist of vectors for each cross-sectional sample whose elements are the per cent of the respective population in the demographic cell. From these the average distribution over demographic cells for all periods is calculated. Normalized wage matrices are constructed by first calculating average, or median, wages by demographic cell for each year. Then the average wage for each period is calculated, using the average distribution of the population by cells as weights. Dividing mean (median) wages in each demographic cell in a given period by the average wage for that period yields a normalized wage matrix. The average population distribution over demographic cells is then used when aggregating across cells to ensure constantly-demographically weighted indices.

\textsuperscript{12} The between-sector change in demand for group k measured relative to base year employment of group k in efficiency units, $E_k$ is:

\begin{equation}
X_{ijt} = D_{ik}/E_k = 3 \left( E_{ik}/E_i \right) \left( E_j/E_j \right) = 3 j k E_j/E_k,
\end{equation}

for the jth sector. Here $E_j$ is the labor input in the jth sector in efficiency units, $jk = (Ejk/Ej)$ is group k’s share of total employment in efficiency units in the jth sector in the base year, which I normalize into an index of relative demand shifts using employment measures so total employment in efficiency units sums to one in each year. This formula is used to calculate the three groups of demand shifts: the overall demand shifts (by letting ”j” vary over both industries and occupations) and between demand shifts (letting ”j” vary only over industries) and then calculating the within-industry shift as the residual.
Time-series of relative wages and supply are constructed from the disaggregated wage and quantity matrices. Relative wages of university to primary-complete workers are calculated using aggregating average demographic weights across all years. Relative supply is calculated as the ratio of university to primary-complete equivalents, using the methodology suggested by Welch [see Welch (1979), Katz-Murphy (1992)].

Five groups of analyses are performed with the time-series data on relative wages and supply. A first analysis, that assumes the validity of the Rybczinski theorem, regresses relative wages onto relative tariffs alone. For the South the standard Stolper-Samuelson prediction is that relative wages are positively correlated with average tariffs. A second analysis calculates relative demand shifts imputed by estimating bounds on the elasticity of substitution from regressions of relative wages on relative supply. Then the time-series of relative demand is calculated varying the elasticity of substitution. In a heterodox formulation where Rybczinski is invalid but Stolper-Samuelson is valid, relative demand should fall with trade liberalization. Thus relative demand is regressed onto tariffs, or its trend pre- and post-trade liberalization is examined. A third approach regresses relative wages onto relative supply and tariffs. A forth variant regresses relative wages onto relative supply and tariffs, average tariffs and other variables potentially affecting relative demand, such as imported capital equipment and foreign direct investment. Finally, a fifth variant is to regress other variables potentially affecting relative demand in a onto average tariffs.

Two approaches to examining the validity of the Rybczinski theorem are employed. The inner-product calculations are examined to see if relative supply shifts lead to opposite relative wage shifts, in contrast to the Rybczinski predictions. Second, regressing relative wages onto relative supply in periods of constant tariffs. These results are relevant for two reasons. By testing the Rybczinski theorem the validity of the Stolper-Samuelson theorem is indirectly tested. Second, this is done to clarify whether Stolper-Samuelson should be tested by examining the relation of tariff changes to unconditional relative wages (following Rybczinski), or relative wages conditional upon relative supply as in autarky models of the labour market.

**Inter-industry Wage Differentials**

Some studies estimate inter-industry wage differentials. One reason is to study the possibility of inter-sectoral immobility of labour, by examining whether the variance of such differentials grew with liberalization. The other motivation is to test for industry rents, by examining whether differentials fell in sectors where tariffs fell.

---

13The approach employed builds upon Freeman (1975, 1979, 1980) and follows KM92. For a simple CES production function we may write relative wage shifts as a function of relative demand and supply shifts, and the elasticity of substitution between more (1) and less (2) skilled workers:

\[
\log(W_{1,t}/W_{2,t}) = (1/F) [d_t - \log(s_{1,t}/s_{2,t})],
\]

\[
\log(W_{1,t}) = (1/F) [d_t - s_t]
\]

where \(W_{i,t}\) and \(s_{i,t}\) are, respectively, wages and supplies of group \(i\) in time \(t\); and where \(w_{i,t}, s_{i,t}\) and \(d_t\) are relative wages, supplies and demand shifts at \(t\), and \(F\) is the elasticity of substitution between type one and two workers. The elasticity of substitution is estimated using time trends to proxy relative demand shifts. Then \(d(t)\) is calculated directly varying values of the elasticity of substitution around the estimated values.
Household versus firm data

One advantage of household data is that it typically permits more precise measurement of human capital than the production/non-production worker distinction that typifies firm data. Another advantage is its broader coverage, including other sectors than manufacturing. Firm data sometimes provides much more detail as to the nature of changes within, as well as across, industries. It also sometimes includes detailed information on ownership, capital, technology and worker non-wage benefits.

Educational Quality

Among the limitations of both firm and household data is the absence of information on educational quality. One approach to control indirectly for changes in educational quality is to examine the pattern of relative wages over time for given adult cohorts, for whom the composition of educational quality is nearly constant.
5. **Explanations of the observed patterns of the impact of trade on distribution: empirical evidence**

5.1 **Evidence by type of study and region**

Zhu and Treffler (2001) extend the model of Feenstra and Hanson (1996) and Berman and Machin (2000) regarding innovations and the hypothesis that outsourcing may raise relative wages in both the North and South and present a preliminary empirical examination of the hypothesis. They examine data over 1978-1990 for nineteen developing countries with per capita GDP less than 60 per cent of the US level in 1978. They construct a measure of technological catch-up for each of these countries, which represents the rate at which the LDC’s unit production costs decrease relative to the North, a dual of the Solow technology residual. Regressing changes in skill intensities of production to non-production workers, or “skill-upgrading”, onto changes in capital deepening, changes in the domestic potential relative labour supply and measures of technological catch-up, they find that greater technological catch-up leads to increases in skill upgrading. They interpret this result as consistent with their model that technological catch-up by the South would be consistent with skill upgrading and rising relative wages there.

**Studies of wages and employment**

**Latin America**

**Argentina**

Robbins, Gonzalez and Menendez (1997) examine household data for metropolitan Buenos Aires, Argentina over 1974-1994, employing the Katz-Murphy (1992). The analysis of the Argentine trade liberalization was interpreted as not supporting HOS/HOV. Stolper-Samuelson should lower relative demand and hence relative wages, by inducing between-sector shifts towards sectors intensive in unskilled labour. For Argentina relative supply rose continually throughout the period studied, while subsequent to trade liberalization relative wages stopped falling and began to rise, suggesting skill-biased relative demand shifts. Estimated time-series of relative demand showed a marked rise in relative demand after trade liberalization. This appears to have been driven largely by product and employment shifts towards skilled sectors, contrary to the standard Stolper-Samuelson prediction. Analysis of the correlates of relative demand shifts found that imports of manufactures are associated with lower relative demand while exports, particularly exports of manufactures, were associated with rising relative demand. However, growth and imported capital stock appear more important determinants of relative labour demand.

**Chile**

As summarized above, Robbins (1994a,b,1995) and Gindling and Robbins (2001) employ household data for Greater Santiago, Chile, over 1957-1991 to examine the structure of relative wages and relative supply in Chile before and after trade liberalization. Both relative wages and relative wages conditional upon relative supply grew rapidly with trade liberalization. Several analyses stemming from the Katz-Murphy (1992)
methodology were undertaken to explore the causes of rising wage inequality with trade liberalization. Inner products of relative wage and supply shifts were found negative prior to trade reform, but became positive after liberalization, suggesting that the Rybczynski theorem did not apply and that after liberalization relative demand shifts dominated supply shifts. The decomposition results found that both between- and particularly within-industry shifts were strongly positive after trade liberalization, coincident with rising relative wages. This was interpreted as consistent with skill-biased technical change.

To explore the aforementioned Skill-Enhancing-Trade ("SET") hypothesis relative wages were regressed onto tariffs and imported capital equipment, along with other controls including minimum wages. Estimated coefficients on both variables were positive and significant, while imported capital stock as a percentage of GDP grew from 2 to 12 per cent after liberalization. These results were interpreted as consistent with the SET hypothesis. These results were robust to analysis of changes in labour market legislation and educational quality [see Gindling and Robbins (2001)].

Pavcnik (2000) extends with firm data the research by Robbins (1994,1995,1996) for Chile that found significant within-industry skill upgrading with household data, and that hypothesized and interpreted that as skill-biased technological change wage. She examines whether investment and adoption of skill-biased technology have contributed to increased relative wages via within-industry skill upgrading using plant-level data for Chile. She uses Manufacturing Census data on 4547 plants with more than ten workers from 1979 to 1986, with relative wage and employment measures at the production/non-production level. She estimates the determinants of the share of wages of skilled workers and relative employment of production/non-production workers, under a variety of specifications. While other work identifies skill-upgrading via differences in imported materials, patented technology or foreign technical assistance across industries, she identifies skill upgrading by differences in these variables between firms within an industry. She finds that over 1976-1986 the average share of skilled workers increased 16 per cent, and their share of the wage bill grew by 15 per cent and that the skilled-unskilled wage premium rose 10.6 per cent. Furthermore, she finds that 87 per cent of the shift in the share of skilled workers in total manufacturing employment occurred within industries, and that 64 per cent of the shift occurred within industries when decomposing the wage-bill share of skilled workers. She finds that changes in imported materials, foreign technical assistance and patented technology all have statistically significant, positive effects upon skill upgrading.

These results seem robust. The production/non-production aggregation is not ideal but is still informative. And while it does not appear that the estimates control directly for the rising relative supply of labour on skill-upgrading, the fact that within plants relative wages grew along with relative skill clearly indicates that skill-upgrading was a demand driven phenomenon that was closely related to within-sector skill-biased technological change.

Summary

The evidence for Chile strongly supports the conclusion that relative wages grew after trade liberalization due to skill-biased technological change that was induced by trade liberalization, consistent with the SET hypothesis.
Colombia

Robbins (1996a,d; 1998, 2002) employ household data over 1976-1999 for Colombia’s seven principal cities to examine the pattern of relative wages and employment in relation to rising and then falling average tariffs (the periods and metropolitan coverage varies over the respective studies). These studies find that relative wages fell nearly 50 per cent in the period of rising average tariffs and then rose after 1990, despite rising relative supply throughout the period studied.

Tariff reductions were associated with rising wage dispersion, counter to standard Stolper-Samuelson predictions. Increases in domestic relative supply had large, negative effects on relative wages, in apparent contradiction to the Ryczinski theorem. In the HOS framework changes in the exchange rate leave the relative domestic price of tradeables and hence relative wages unchanged. However, real devaluation, rather than leaving relative wages unaffected, appears to have contributed to raising relative wages. Large within-sector effects were found, associated with trade liberalization and real devaluation. Examining inter-industry wage differentials found no support for sector specificity of labour even in the short-run. Consistent with the SET hypothesis, trade liberalization and devaluation were associated with rising imports of machinery. However, alone they do not fully explain the findings. The HOS/HOV models require that tradeable goods are produced with both skilled and unskilled labour. Examining exported goods suggests that these are typically produced with both skilled and unskilled labour. Controlling for the minimum wage did not affect the conclusions. These conclusions were supported in subsequent work [Robbins (2001b, 2002d)].

Costa Rica

Gindling and Robbins (2000,2001) employed the Katz-Murphy (1992) and other techniques to examine why relative wages rose after trade liberalization in Costa Rica. Relative supply rose continually throughout the period studied, while subsequent to trade liberalization relative wages stopped falling and began to rise, suggesting skill-biased relative demand shifts. Estimated time series of relative demand showed a marked rise in relative demand after trade liberalization. This appears to have been driven largely by product and employment shifts towards skilled sectors, contrary to the standard Stolper-Samuelson predictions. Analysis of the correlates of relative demand shifts suggests a somewhat heterodox interpretation. Imports of manufactures are associated with lower relative demand, while exports and particularly exports of manufactured products are associated with rising relative demand. Growth and imported capital stock appear more important in determining relative labour demand. Economic growth, associated with trade liberalization, and rising stock of imported machinery may be important causes of the skill-biased relative demand shifts after trade liberalization. These results were interpreted as going counter to standard Stolper-Samuelson predictions, and as offering some support for the Skill-Enhancing-Trade hypothesis.

14 Recent work on the employment impact of the minimum wage leads to mixed conclusions. Bell (1997) concludes that the minimum had negative employment impacts, while Robbins (2002c,d) finds that once non-stationarity of the data or additional controls are accounted for the minimum did not have statistically significant employment effects in urban Colombia over 1976-1999.
Mexican trade liberalization is by far the most studied case among developing countries, explaining the extensive discussion that follows.

Cragg and Epelbaum (1996) find that urban wages became more dispersed both within and across education and age groups, and that the return to occupation explains nearly half of the growing wage dispersion. They interpret this as reflecting skill-biased demand shifts. They find that industry effects had little explanatory power, and interpret this as indicating that reform-induced industry rent dissipation is a less important source of changes in wages than skill-biased technological change. They interpret their findings as consistent with the notion that trade liberalization induced skill-biased technological change.

Aitken, Harrison and Lipsey (1996) examine the relation between wages and foreign direct investment in Mexico, Venezuela and the United States (for the periods 1984-1990, 1977-1989 and 1987, respectively). They estimate separate equations for the wages of skilled and unskilled workers as functions of foreign direct investment, capital stock, royalties, output prices, with dummies for industry, region and year for Mexico and Venezuela. For Mexico and Venezuela they find that for both skilled and unskilled workers the share of foreign ownership raises wages, and that royalties are positively correlated with wages, where they interpret royalties as reflecting the acquisition of technology. This work is relevant to subsequent studies where it is argued that trade reform raises the share of foreign owned firms, which on average pay higher wages.

Feliciano (1996) employs national household data for workers in manufacturing firms for 1986, 1988, and 1990 to examine the pattern of inter-industry wage differentials in relation to trade openness. First she estimates inter-industry wage differentials from earnings functions for each year and then regresses those differentials onto industry tariffs, industry licensing measures, industry producer prices and import penetration, controlling for regional and time dummies.

While interpreted as consistent with a Specific Factors trade model, where labour immobility would lead to sector-specific changes in average wage levels as sector-specific protection varies, this does not seem convincing for two reasons. First, we would expect that protection should work via producer prices, but the corresponding coefficients are typically statistically insignificant. Second, we would expect that tariff levels should affect inter-industry wage differentials, but they apparently do not in general; and in the only case where the coefficients tariffs are statistically significant, the sign is opposite of what one would expect.

Robbins (1996f) employs the Katz-Murphy (1992) methodology for national, urban household data over 1987-1993, documenting rising relative wages and supply subsequent to trade liberalization. The inner-product of disaggregated wage and supply were negative over 1987-1989 but strongly positive thereafter through 1993. Decomposition of employment shifts shows large, positive between-sector shifts, and smaller, negative within-sector shifts. These findings differ from those of others for Mexico, due to differences in methodology and the use of household versus firm data (discussed below).

Revenga (1997 [1994]) employs firm-level data over 1984-1990 for medium to large manufacturing firms at the national level, where wages and employment are disaggregated according to production/non-production workers, though most of the analysis examines average wages and total employment. She measures trade protection in terms of average and industry-level tariffs, quotas and licensing. She proposes a rent-dissipation hypothesis, consisting of a chain of causality where at the firm and industry level trade protection – tariffs and quotas - leads to higher product prices, firm rents and rent-sharing with workers,
where the degree of rent-sharing varies over firms and industries. Citing previous work, she notes that higher tariffs were associated with low-skill-intensive industries prior to the trade reforms, hypothesizing that as trade protections fell, rents and hence average wages fell in unskilled-intensive sectors, leading to an increase in relative wages. This explanation is typically characterized as outside the Stolper-Samuelson framework because it requires imperfect competition, though it seems broadly consistent with Stolper-Samuelson forces, where the presence of rents would potentially magnify the impact of trade reform on relative wages.

Revenga documents that changes in protection and tariffs were consistent with the rent dissipation hypothesis: goods prices fell most in sectors where tariffs fell the most. Then she examines components of the aforementioned causal links in a series of regressions. She regresses average wages and total employment onto protection and other controls. She estimates these at the industry and firm level, with and without fixed effects, using OLS and Two-Stage-Least-Squares, to control for the endogeneity of sales. In the firm level wage equations, controls for average industry and regional wages are included.

The focus is upon the fixed effects regressions, where the results are driven by within industry changes. At the industry level she finds that higher tariffs are associated with higher average wages, as hypothesized. However, the estimated impact of tariffs on employment levels is negative. The estimated impact of licensing on wages is negative or zero and on employment is zero.

The firm level regressions control for average industry and regional wages, so estimated coefficients on protection variables are conditional impacts, after their impact on industry level wages. As before, the estimated impact of tariffs upon average wages is positive and significant. It is argued that the combined impact of tariffs on industry wages and upon firm wages conditional upon industry wages suggests that in industries experiencing the largest tariff reductions average wages may have declined up to 8-10 per cent due to falling tariffs. No statistically significant impact of tariffs upon quasi-rents is found. This is interpreted as possibly due to noise in the quasi-rent variable. Similarly, quotas are not found to affect average firm wages. The asymmetry between tariffs’ impact on wages and the absence of an impact of quotas on wages is seen as suggesting that rents from tariffs may be more visible to workers than rents from quotas. Finally, quasi-rents have a positive, statistically significant impact on wages.

These findings are interpreted as consistent with the rent-dissipation hypothesis. Because trade liberalization was strongest for industries intensive in unskilled labour, liberalization lowered average wages most in unskilled-intensive sectors, leading to an increase in relative wages. When trade liberalization dissipated rents unions bargained wage adjustments, reducing employment adjustments. However, when quota reductions lowered rents, the weaker rent-sharing associated with quotas implied that there was less room for wage concessions, so employment adjusted instead.

**Assessment**

This analysis provides a significant support for the rent dissipation hypothesis, though there are important weaknesses in the findings, particularly the absence of a link between tariffs and quasi-rents. And the lack of controls for within-sector and within-firm changes raise the possibility of an alternative interpretation. The argument postulates that higher tariffs or quotas raise domestic tradeable goods prices above their competitive levels leading to firm rents and rent sharing with workers in the form of higher wages and, typically, employment. Not all the links in this line of causality were explored, and for some of the links examined the results are inconsistent with the rent-dissipation hypothesis. The link between prices and tariffs is briefly noted, while the impact of prices upon wages is not reported. The impact of quasi-rents upon employment is also not examined. And while the hypothesis depends crucially upon a causal link between tariffs and quasi-rents,
no statistically significant impact is found for the impact of tariffs on quasi-rents.\textsuperscript{15} Another concern is that this is a between-industry and a between-firm explanation and analysis without controls for changes in relative employment or relative wages within industries or firms. The dependant variables are average industry wages and total industry employment. Changes in average industry or firm wages could have been due to changing relative employment or wages.\textsuperscript{16} A final reservation concerns potential biases due to non-stationarity; results in first-differences or related examinations were not reported.

Feenstra and Hanson (1997) put forth a theory and supporting evidence relating relative wages to the pattern of outsourcing of production from the North to the South that has received a great deal of attention. They present firm-level by states for Mexico over 1975-1988, examining the hypothesis that rising relative wages in Mexico after 1985 were related to the outsourcing of production (foreign direct investment, FDI) from the US to Mexico, consisting of shifting production from the US to Mexico. They hypothesize that plants that were relatively intensive in unskilled labour in the US would be relatively skilled in Mexico, because of the lower average educational levels in Mexico. Thus, this shift would raise relative wages in both the US and Mexico. They examine three principal dependant variables: the share of wages of production workers of all wages, the relative wages of those workers, and the relative employment of production to non-production workers. These variables are regressed onto a proxy for FDI, the number of maquiladoras per state, and other controls. They find that higher levels of maquiladoras per state are associated with higher wages shares and higher relative wages.

Four questions arise in evaluating this work. First, there is the previously discussed concern about relative wage and employment indices based on the production/non-production aggregations. Second, the proxy of FDI using the number of maquiladoras per state neither controls for differing sizes of maquiladoras nor measures other types of FDI not tied to maquiladoras. Third, while it is likely that Mexico experienced major migratory movements over regions during this period that may have changed the state-level relative supply of skill and hence relative wages, this factor is not controlled for. Finally, though one would expect that wages in Mexico along the US border would be highly affected by wages in the US via the high volume of cross-border migration, this is not controlled for. The close integration of the Mexico border labour markets to the US labour market has been documented in Robertson (2000). Thus, an alternative interpretation of the data is that the rising relative wages in the US led to rising relative wages in Mexico.

\textsuperscript{15} As suggested, this may be due to noise in the quasi-rent variable. However, this explanation seems inconsistent with the statistically significant coefficients on some licensing variables in the quasi-rent equation and the statistically significant coefficient on the quasi-rent variable in the wage equations.

\textsuperscript{16} For example, the large decreases in average industry wages in the traditionally protected and more unskilled intensive industries could have arisen from a fall in relative employment in these industries. This potentially serious criticism, however, may not be consistent with the macro-level results in some studies of stable relative employment. If relative employment fell in unskilled-intensive industries, then relative employment would have needed to rise in skilled-intensive industries. One possible explanation for such a pattern might be skilled-biased technological change that was also sector-biased, i.e. more skilled-intensive industries experienced higher skilled-biased change, associated with trade liberalization. For example, if trade liberalization encouraged foreign direct investment towards more skilled-intensive industries that led to skill-biased change there, then overall relative wages might have risen, while relative employment rose in skilled-biased industries and fell in unskilled-intensive industries. Relative employment would rise in skilled-intensive industries because of skill-biased technological change there, while in the unskilled intensive industries the aggregate rise in relative wages would induce substitution from skilled to unskilled labour.
Hanson and Harrison (1999a,b or HH99a,b) both present similar results reviewing plant level manufacturing data to examine the causes of rising relative wages in Mexico after trade liberalization. Employing a simple decomposition technique HH99a decompose employment shifts into between- and within-sector shifts, finding that both are positive and within-sector shifts are much larger.17

HH99a and HH99b also estimate reduced form estimates in levels for relative wages and relative employment as functions of an extensive list of potential exogenous variables, with essentially identical results for regressions at both the industry and plant level. Their plant level estimates control for industry and regional dummies. These results may be divided into the effects of trade liberalization variables measured by tariffs and quotas, trade openness variables reflected by firm exports and foreign ownership and technology variables measured by royalties, capital/labour ratios, imported machinery, total factor productivity, etc.

They report relative wage and employment regressions in levels, and in some cases first differences. For relative wages in levels the estimated coefficient on quotas is negative and statistically significant, while the coefficient on tariffs is positive and statistically significant, though in first differences both coefficients are statistically insignificant. For relative employment the estimated coefficient on quotas is statistically insignificant while for tariffs it is positive and statistically significant, though the estimates in first differences are nearly zero.

For their estimates in levels including both trade reform variables and other variables they find no statistically significant impact of trade reform variables, tariffs and quotas, upon relative wages. They find that "trade openness", reflecting foreign ownership and exports, affected relative wages and relative employment.18 Results for technology variables were mixed, but they tended to have positive, statistically significant effects on relative wages and employment.19

They interpret their results as supporting the conclusion that “openness” matters to relative wages and employment, based on their estimates and on the observation that over the post-trade liberalization or post capital-market reform period, both foreign direct investment and exports grew. They suggest that technological change contributed to widening wage differentials in Mexico after trade liberalization. And they find their results as consistent with, but not providing clear support for, Stolper-Samuelson.

17 They calculate the change in skilled employment, dEsk, as:
\[
dEsk = 3j S(j)de(j) + 3j dS(j)e(j),
\]
where S(j) is the jth industry’s share of total employment and e(j) is the skill intensity of industry j, and where the first term on the right hand side reflects within-industry shifts due to shifts in relative employment within industries and the second term reflects between industry effects, reflecting shifting employment shares over industries, holding the within-industry employment composition constant.

18 Measures of exports and foreign ownership (export share and a dummy variable for foreign ownership) were positively associated with relative wages, though their foreign share variable was negatively correlated with relative wages. Similarly, dummy variables for firms that export and for foreign ownership were positively associated with relative employment, though the firm exports as a share of total manufacturing firm exports was negatively associated with relative employment.

19 Royalties and capital intensity were positively associated with relative wages, while imported machinery, investment in equipment and total-factor-productivity were not associated with relative wages. Royalties and capital intensity were also positively associated with relative employment, as was imported machinery, while total factor productivity was uncorrelated with relative employment.
Assessment

The positive within-sector decomposition results are probably overstated or only true for the more stable manufacturing firms. These results differ from those of Robbins (1996) and Robertson (2000). Robertson finds that within- and between-effects are positive and of similar magnitudes. Robbins (1996) employs national household data and the Katz-Murphy (1992) explained above, finding positive, large between-sector effects but negative and relatively small within-sector effects.20

Interpretation of their regression results is encumbered by the estimation in levels controlling for industry, but not plant, dummy variables. They did not estimate in first differences for the most part, explaining that the explanatory variables tended not to change over time. By including industry but not firm dummies in the regressions in levels, the results may reflect either changes in variables within firms over time or changes across firms in the cross-section. Because the authors emphasize that the regressors did not change significantly over time, the appropriate interpretation of their results is in terms of between-plant comparisons, not a dynamic within-plant interpretation. The results presented have bearing upon hypotheses of between-plant and between-industry shifts, not within-industry changes induced by trade liberalization.

As the authors point out, in Stolper-Samuelson general equilibrium we would not necessarily expect an association between observed plant or industry relative wages or employment or relative wages with tariffs or quotas.21 Thus, the evidence appears uninformative regarding Stolper-Samuelson effects.

20 Robertson (2000) employs similar data and technique, but with data that includes new entrants and data on firms that exit the sample, whereas HH99a employ a balanced sample of firms excluding entry or exit. The Katz-Murphy (1992) technique measures education within occupations, rather than assuming the correspondence between education and the broad non-production and production worker categories, and permits the distribution of both occupations within industries and education within occupations to change, offering a more satisfactory decomposition strategy. The Robbins (1996) results may also reflect the broader coverage, including all sectors, not just manufacturing sectors and potentially both small and large firms, whereas the decompositions of HH99a examine only medium to larger firms.

21 We might not expect that Stolper-Samuelson effects would lead to a correlation between industry tariffs and industry relative wages and employment. Assume, as documented by Feliciano (1994), Revenga (1997), HH99a-b, that relative tariffs – the ratio of tariffs on skill-intensive versus unskilled-intensive goods – rose with liberalization. Then Stolper-Samuelson would predict that as tariffs on unskilled-intensive goods fell, the prices of those goods in the domestic market fell, lowering employment and output in those unskilled-intensive sectors. This would not alter the relative wages in those sectors directly, but would at the economy-wide level imply an increase in the demand of skilled versus unskilled workers, leading to an economy-wide rise in relative wages. Thus, we would not anticipate that industry tariff levels would be associated with industry or firm level relative wages. Nor would we anticipate that industry tariffs or quotas would be associated with industry level relative employment. The shift in relative employment would be the residual consequence of the economy-wide increase in relative wages, and would be observed across all industries and firms. The findings that industry and firm relative wages were uncorrelated with industry quotas and tariffs fit the above prediction. The findings that the impact of quotas and tariffs on relative employment was very small or zero also broadly fit the above explanation. The difference in the signs of these effects may be due to the explanation posited by Revenga (1994), that workers bargained wage premia deriving from the more visible tariffs than quotas and that as tariffs fell workers negotiated wage reductions that muted employment adjustments. The small but negative and statistically significant impact of tariffs on relative employment could also be due to internal labour markets and the hoarding of skilled labour in unskilled-intensive sectors experiencing falls in sales and overall employment.
The interpretation that greater “trade openness”, reflected in rising exports and foreign ownership, caused rising relative wages seems plausible. However, the evidence apparently reflects between-firm effects, not changes within firms over time.

Another difficulty in interpreting the regression results concerns potential co-linearity of regressors. Tariff and quota reductions may have affected relative wages and employment directly and indirectly through other factors, such as their trade openness and technology variables. Thus, when including other controls with tariffs and quotas the coefficients on tariffs and quotas could be biased. The regressions with only tariffs and quotas partly address this. In levels the effects of tariffs and quotas are larger than in the levels regressions with additional controls, but in first differences the estimate coefficients are zero for the relative wage equation and very small for relative employment.22

The conclusion that skill-intensive technology shifts occurred is not supported by the results presented, because the findings apparently reflect associations between levels of technology variables and levels of relative wages and employment by plant, not changes in plants over time. The data is consistent with the interpretation that a rising share of exporting and foreign firms would have generated a shift in employment to higher relative wage and higher relative employment firms, without technological change. The data do not seem to shed clear light upon the question of skill-biased technological change within firms. The authors’ findings of positive within-firm effects may suggest skill-biased technological change, though these findings are subject to the aforementioned reservations.

Their findings that higher capital intensity raises relative wages do not necessarily reflect technological change. The association of capital intensity with both higher relative wages and employment may reflect complementarity between physical capital and human capital [Griliches (1969)] for a given technology, not necessarily technological change. And such capital deepening without technological change could explain rising relative wages. The finding that total factor productivity did not have statistically significant effects is sensible, as factor and sector neutral technological change should not alter relative wages. If changes in total factor productivity were asymmetric over sectors, constituting sector biased technological change, we could expect an aggregate rise in relative wages, but the evidence is not clear on this point.

**Summary**

The results of HH99a,b establish a correspondence between higher relative wages and employment with export orientation, foreign ownership and investments in technology. The evidence is supportive of an explanation where rising relative wages in Mexico were due in part to between-sector shifts of demand. Trade liberalization and relaxation of controls on foreign direct investment may have shifted output and employment towards sectors and firms with higher foreign participation, greater export propensities and firms investing more in technology. However, direct documentation of those shifts is not provided. Because of the firm-level estimation with industry dummies but without firm fixed effects and because the authors say the regressors changed little over time, it is unclear whether there was sector or skill-biased technological change. And as the authors

---

22 More information is required to accurately interpret and extend these findings. Though regressions in first differences were not always viable, perhaps plant level regressions with plant level fixed effects would help isolate within plant changes from between plant effects. Further, regressions of other regressors, such as export propensity, foreign ownership and technology variables onto tariffs and quotas at the plant level with plant fixed effects could help reveal the effects of trade opening as well as regressions for single cross-sections that highlight the between-plant versus within-plant effects and would be useful in disentangling these different effects.
make clear, the evidence does not reveal whether it was trade reform or relaxation in rules
on foreign investments that may have altered the distribution of firms over time. It is also
unclear whether the significant capital deepening led to higher relative wages. As
emphasized by the authors, the evidence for Stolper-Samuelson effects is inconclusive.
The only estimation in first differences finds zero or very small effects of trade reform on
relative wages and employment.

Robertson (2000) presents a variety of evidence to explain rising relative wages in
Mexico after trade liberalization. He begins by presenting a decomposition of employment
changes into between- and within-industry shifts, using the Mexican Monthly Industrial
Survey (Encuesta Industrial Mensual, EIM) for changes in 1987 and 1994 and 1995. The
decomposition results suggest that this increase was nearly evenly divided into within and
between increases. This is inconsistent with standard Stolper-Samuelson prediction where
between-sector shifts move in the opposite direction to within-sector shifts and the
standard expectation of negative between-sector shifts with trade liberalization in the
South. However, as noted in early work [e.g. Revenga (1997)], he argues that Mexico’s
protection differed from the expected structure for a Southern country, where tariffs are
highest on skill-intensive goods. To document this he examines the correlations between
tariffs and skill-intensity prior to reforms, measured in terms of production/non-production
workers, finding a negative correlation suggesting that less skill-intensive industries had
higher protection. He also reports a positive correlation between changes in tariffs and skill
intensity of industries after liberalization, arguing that larger decreases occurred in less-
skill-intensive industries. Following the work of previous authors he examines whether
rising relative tariffs on skilled versus unskilled-intensive tradeable goods led to Stolper-
Samuelson effects by examining relative prices of skilled versus unskilled-intensive
tradeable goods which rose with liberalization. He reports that both relative prices and
relative wages rose together over the 1987-1994 period.

He provides support for Revenga’s (1997) rent dissipation hypothesis, finding that
estimated inter-industry wage differentials over 1987-1994 often fell in many unskilled-
intensive industries.

Finally, citing empirical and theoretic literature [Bernard (1995), Acemoglu
(1998,1999), Autor, Katz and Krueger (1998), Hanson and Harrison (1999a,b), Aw and
Hwang (1995), Aw, Chen and Roberts (1997) and Tan and Batra (1997)], he explores the
hypothesis that liberalization increased incentives to export, requiring firms to invest in
technology which is skill biased, hence raising relative demand and wages. Evidence is
presented for 1991 and 1995 that firms that export invested more in new technology and
trained workers more, and is interpreted as supporting the aforementioned hypothesis.

Assessment

Regarding the decomposition of employment changes, the finding that relative
employment rose agrees with Robbins (1996) but differs from the findings of other authors
using similar data sources [Hanson and Harrison (1999a)]. The difference between
Robertson (2000) and HH99a,b apparently reflects differences in samples. Hanson and
Harrison employ a balanced panel of larger firms, excluding entry and exit, while
Robertson employs three sources including entry and exit. These results differ from
Robbins (1996) because that work uses national household data reflecting employment in
all sectors and a different technique. Robbins (1996) finds positive between but small,
negative within effects. While the Katz-Murphy (1992) technique is preferred, all three
decompositions may be valid for their respective samples. They all coincide in finding
large, positive between sector shifts, while differing in their findings for within sector
shifts.
While the analysis of tradeables’ prices is consistent with Revenga (1997) and others, two reservations arise. The first concerns the use of the production/non-production worker distinction to measure skill. The second reservation concerns outliers, as both the graphs of the levels of tariffs and skill intensity in 1985 and the changes in tariffs and skill-intensity over 1985-1991 suggest that the strength of the reported correlations may be driven substantially by outliers (in particular: soaps and cosmetics, drugs, paints, petroleum refinement).

While the finding of rising relative prices for tradeables and relative wages over 1987-1995 may be consistent with Stolper-Samuelson effects, the results suggest an alternative interpretation. Trade liberalization occurred over the 1985-1990 period. To the extent that relative domestic tradeables’ prices were determined by international prices and tariffs, we would not expect a continued rapid rise in relative prices after 1990, unless the international relative price of tradeables was rising in that fashion or there were long lags in the adjustment of domestic tradeables’ prices, for which no support is provided. Thus, this data suggests that while increases in relative tradeables’ prices may have raised relative wages, this increase may have been due to factors unrelated to trade liberalization.

Only circumstantial evidence is provided regarding the hypothesis that trade liberalization leads firms to export more and invest in skill-intensive technology, and some of this evidence goes counter to the hypothesis. The findings show a static difference between non-exporting and exporting firms in terms of investment and technology and training, rather than documenting an increase in the number of exporters and a consequent increase in technology investments. Evidence showing a shift to exports and a consequent increase in technology investment is not provided. Moreover, careful examination of the data shows a dramatic decrease in technology investment over 1991-1995, which appears inconsistent with the hypothesis positing rising technology investments with liberalization.

Summary

Consistent with other studies, this work finds that between-sector employment shifts were positive. It also reinforces the arguments that trade protection favoured unskilled-intensive industries and that falling protection lowered wages and perhaps rents in those industries. The work documents rising relative tradeables’ prices during and well after liberalization, casting doubt on the link between trade reform and those prices, though finding a correlation between those prices and relative wages. While the hypothesis that trade reform stimulated exports and technology investments is appealing, the large fall in technology investments over 1991-1995 casts doubt upon this.

Synthesis of Mexican results

A wealth of excellent studies exist on the Mexican experience. Mexican trade liberalization did not lead to falling relative tariffs on skilled versus unskilled-intensive tradeable goods as has often been assumed for liberalizing Southern countries. Instead it appears that unskilled goods were most protected prior to liberalization and that liberalization raised relative tariffs. This has led to the hypothesis that Stolper-Samuelson

23 The data presented show a fall in new tools acquisition for domestic firms acquiring new tools over 1991-1995 from 64.5 to 43 and for exporting firms from 77 to 64, and for investments in high-technology equipment from 36.3 to 24 and 46 to 42, respectively.

24 It is conceivable that trade reform was anticipated and technology investments occurred prior to liberalization, subsiding afterwards.
effects contributed to rising relative wages in Mexico, instead of the traditional Stolper-
Samuelson prediction of falling relative wages in the South. The evidence supporting the
rent dissipation hypothesis is strong but not entirely convincing, as no connection between
tariffs and quasi-rents was found and the link between tariffs and average wages could
have been due to changing relative employment within industries or firms, while domestic
tradeable goods prices appear correlated with tariffs, consistent with Stolper-Samuelson.
While relative tradeable goods prices rose during liberalization, their continued rise well
after liberalization casts doubt on the Stolper-Samuelson interpretation, suggesting that
perhaps other forces were at work raising relative prices. Consistent with several
explanations including Stolper-Samuelson effects, sector-biased technological change and
rent dissipation, between-sector employment effects were positive. Estimated within-sector
effects varied over samples and techniques. It may be that within-sector shifts were
positive for manufacturing firms, but negative overall. Such a pattern could be consistent
with several explanations, including sector-factor-biased technological change that led to
skill upgrading in manufacturing firms and rising relative wages, which in turn induced
skill-down-grading in non-manufacturing firms. The evidence for changes in the
composition of firms in terms of foreign ownership, export orientation or technology,
however, is weak. Most of the work appears to refer to static between-firm comparisons
rather than within-firm or within-industry shifts. The possibility that outsourcing of
production from the North to Mexico raised relative wages in Mexico and in the United
States is attractive, though the principal evidence consists of a rise in maquiladora
production along the US border, raising the possibility that rising wages there were due to
the proximity to the US market and its rising relative wages. In conclusion, while great
progress has been made concerning the causes of rising relative wages in Mexico after
trade liberalization, solid conclusions appear somewhat elusive. Future research
emphasizing changes in variables and the sequencing of those changes may permit us to
better test the different theories proposed.

**Peru**

Mazumdar and Zhou (2000) present preliminary findings regarding the determinants
of those relative wage changes using firm-level panel data for metropolitan Lima, Peru
over 1994-1997, finding that firms that exported more, paid higher relative wages. This
result was robust to controls for union density and foreign direct investment. They interpret
their findings as consistent with the hypothesis that the process of exporting is skill
intensive. These plausible and interesting findings are subject to various reservations,
including the absence of labour supply controls, the use of production/non-production
relative wage measures and the absence of other controls for changes in labour market
regulations and factors shifting the structure of firm demand in addition to firm exports.

**Uruguay**

Robbins (1996e) examines national household data over 1984-1995, employing the
Katz- Murphy (1992) methodology, documenting and analyzing rising relative wages after
trade liberalization. Prior to liberalization inner-products were negative, but were positive
after liberalization, both results apparently counter to the predictions of Stolper-Samuelson
and Rybczinski. Similarly, the time-series of relative demand fell prior to liberalization and
rose thereafter. Between industry employment shifts were negative for males and positive
for females after liberalization, while within-industry shifts were positive for males and
negative for females after liberalization. Because male employment dominated, the overall
pattern was one of negative between- and positive within-industry shifts, apparently
counter to Stolper-Samuelson predictions. Given the rising relative wages with positive
within-industry shifts, this was interpreted as consistent with skill-biased technological change and the SET hypothesis. The minimum wage could not be the cause of rising relative wages, as it rose continually after liberalization in 1990. These results were robust within cohort groups, suggesting that changes in educational quality cannot explain the findings.

Asia

Malaysia

Robbins (1994c) examined national household data over 1973-1989 employing the Katz-Murphy (1992) framework to examine the pattern and causes of changes in relative wages. As there was no trade liberalization in this period, though Malaysia did pursue export-promotion policies, the focus was on whether the data supported the Rybczinski theorem. Both disaggregated and time-series data suggest the contrary. Inner-products were strongly negative throughout the study period. While between-sector shifts were positive, and within-sector shifts roughly zero, relative wages fell dramatically in a period when relative supply rose 19 fold, from 0.01 to 0.19.

The Philippines

Robbins (1994d) examines national household data over 1978-1992 employing the Katz-Murphy (1992) methodology. In the 1980s the Philippines pursued gradual trade liberalization and devaluation. Relative supply grew rapidly over this period, rising from 0.3 to nearly 0.5. Relative wages were nearly constant over 1978-1982 and then rose sharply from 2.8 to 3.55 over 1982-1986. However, relative wages fell again to 3.1 by 1988. The 1982-1986 period also corresponds to a sharp depression. The decomposition of employment changes does not yield clear insights into the nature of those relative demand shifts, either over the cycle, or on average over the period. While there may have been an association of gradual trade liberalization with rising relative wages, the period studied also includes a major depression which could also explain the rise and then fall of relative wages over 1982-1988.

Taiwan (China)

As reviewed earlier, Robbins (2002) found that over the 1978-1992 period in Taiwan (China), relative wages were constant while tariffs fell sharply and relative supply rose. These results were interpreted as inconsistent with Stolper-Samuelson on two grounds. If the Rybczinski theorem were correct, then the large fall in average tariffs, if associated with changes in relative tariffs on more versus less-skilled-intensive goods, would have led to large changes in relative wages. If the Rybczinski theorem were invalid and relative supply affected relative wages, then this would have put downward pressure on relative wages. If Taiwan (China) were relatively endowed with unskilled labour, then Stolper-Samuelson pressures would have complemented this effect, leading to a large decrease in relative wages. In such a heterodox context where we consider the possibility that the Rybczinski theorem is invalid while the Stolper-Samuelson theorem is valid, the interpretation is complicated by the possibility that Taiwan (China) was relatively endowed with skill (relative to global factor supplies or to the skill endowments of its trading competitors in a “local” cone). If Taiwan (China) were relatively endowed with skill, then Stolper-Samuelson effects would have tended to raise relative wages, so that these effects would have tended to cancel each other. These results appear, therefore, inconsistent with HOS/HOV and its attendant Stolper-Samuelson and Rybczinski theorems. However, if we
admit the possibility of a heterodox theory where the Rybczinski theorem does not apply while the Stolper-Samuelson does, we cannot clearly interpret the results unless we can determine that Taiwan (China) was globally or locally Southern. Taiwanese wages were low in dollar terms at current exchange rates in the early part of this period: primary complete workers earned 66 cents per hour, secondary-complete workers earned 74 cents per hour and university workers received 1.27 dollars per hour. Wages remained low through 1987 or 1988, but afterwards rose nearly five times, due to exchange rate appreciation and likely to rising productivity. Thus, for most of the period it would seem that Taiwan (China) was characterized by very low wages and that the evidence, even rejecting Rybczinski, appears counter to the standard Stolper-Samuelson predictions for the South. This argument would be more convincing if disaggregated data on relative tariff rates were found to show falling relative tariffs as well as falling average tariffs, over this period.

Africa

As discussed above, Currie and Harrison (1997) examined evidence for manufacturing firms over 1984-1990 and found small wage and employment effects of trade liberalization. They also concluded that wages and the sectoral distribution of employment were relatively unresponsive to trade reforms, with textiles and beverages being the exception. In those sectors a 21 per cent fall in tariffs was associated with a six per cent decline in employment. While labour market regulations on hiring and firing were nominally restrictive they found the Moroccan labour market to be flexible and suggest these laws may have not been enforced. They concluded that employment was responsive to output changes, but that trade reform did not lead to significant output changes. They suggest that increases in the minimum wage may have dampened the wage response to trade reform by firms. Their principal explanation of the small wage and employment responses to trade reform, however, is that firms absorbed the increased competition through lower profit margins and increasing productivity.

Multi-country studies

Robbins (1996b,c; 2000a; 2001) examine evidence on the pattern and determinants of relative wages before and after trade liberalization. These studies examine household surveys for Argentina, Chile, Colombia, Costa Rica, Malaysia, Mexico, the Philippines, Uruguay and Taiwan (China) over (1974-1994, 1957-1991, 1976-1994, 1973-1989, 1987-1993, 1978-1988, 1984-1995, 1978-1992, respectively), employing the Katz-Murphy (1992) methodology and extensions. Stolper-Samuelson predicts shifts of output and employment between sectors from sectors formerly protected. For the South the expectation is that the distribution of employment would shift towards sectors intensive in unskilled labour. However, after trade liberalization the distribution of employment across sectors was relatively constant25 for Chile, Colombia, Costa Rica, Mexico, the Philippines and Uruguay (correlations between the distribution of employment by industry before and after averaged 0.94, 0.99, 0.90, 0.95, 0.90, and 0.93, respectively). Inner-products of wage and employment changes, though negative prior to liberalization were zero or positive afterwards for Chile, Colombia, Costa Rica and Uruguay, suggesting that relative supply shifts were dominated by relative demand shifts after liberalization. Decomposition of employment into between- and within-shifts yielded positive between- and within-shifts in Chile. Between shifts were also positive during liberalization for Argentina, the Philippines

25 This analysis was performed for a disaggregation into seventeen sectors. Finer disaggregation was not viable due to sample sizes.
and Taiwan (China), while within shifts were weak or negative in Costa Rica, Colombia, the Philippines and Taiwan (China).

**Factor-diversified tradeables**

The HOS/HOV model requires that a country produces more than one tradeable good employing both skilled and unskilled labour, though this production need not dominate economy-wide production. Export data revealed that for the countries studied, non-resource based manufactured exports constituted a large and rising share of exports. For example, in Argentina such non-resource-based exports were 18 per cent of total exports in 1975 and 1993, though falling somewhat in the interim. For Costa Rica these exports were 20 per cent of total exports in 1976, rising to 24 per cent in 1989 and then falling to 21 per cent in 1992. For Colombia the figures are nine per cent in 1975 and 17 per cent in 1993. As exports are only part of tradeable production, this suggests that this condition of HOS/HOV was satisfied.

**Cones of diversification**

The Rybczinski theorem should apply to countries whether there is integrated unicon competition or whether countries compete within local cones of specialization. The results from these studies discussed in section III that prior to liberalization the time-series and inner-products of wage and employment changes were negative, strongly suggest that the Rybczinski theorem did not apply, suggesting that the explanation based on local cones of specialization was incorrect. Furthermore, if there were cones of diversification within which Stolper-Samuelson held, it is likely that the Latin American countries studied lie with a single cone. In this case trade liberalization ought to reduce the variance of relative and real wages (controlling for human capital) across countries. However, no reduction in these variances was observed.

**Sectoral immobility of labour and sectoral employment shifts**

Stolper-Samuelson requires that labour be mobile across sectors. Robbins (2001) examines the pattern of inter-industry wage differentials and employment variance to explore whether labour was immobile across sectors in the response to output shifts. If labour specificity is to explain the failure of the Stolper-Samuelson theorem, the standard deviation of inter-industry wage differentials must have risen significantly with trade liberalization. Inter-industry wage differentials were estimated using functions for each cross-section with industry dummies, from which normalized standard deviations were calculated. Because the dispersion of inter-industry wage differentials fell with trade liberalization in Argentina and Chile, labour specificity does not seem to be the key to rising relative demand and wages in those countries. In Uruguay the standard deviation was nearly constant. And because in Taiwan (China) wage dispersion was nearly constant, labour specificity with trade liberalization does not appear to have been important there. In Colombia and Costa Rica the standard deviation of inter-industry wage differentials grew with liberalization but these were the continuation of trends pre-dating liberalization.
The Stolper-Samuelson theorem assumes that changes in tariffs that alter the domestic relative price of tradeable goods will engender a shift of employment across sectors, along with the change in relative factor prices, discussed above. If labour is immobile then we expect a large initial rise in the variance of wages with changes in tariffs, followed by a temporary rise in the Lilien measure of employment variance [Lilien (1982)]. The evidence appears inconsistent with the Stolper-Samuelson theorem and the hypothesis of sectoral immobility of labour.26

**Time-series evidence and the SET hypothesis**

The Skill-Enhancing-Trade hypothesis predicts that trade liberalization and devaluation, accelerates the flows of physical capital and/or technology to the South. Consistent with this prediction, after liberalization machinery imports grew rapidly as a percentage of GDP in most of the countries studied. In Chile, for example, machinery imports rose from 2 per cent of GDP prior to liberalization to 12 per cent of GDP afterwards. Both for single countries and pooled data, regressing relative wages onto relative supply, average tariffs and the stock of imported machinery as a percentage of GDP and other controls yielded large, positive and statistically significant coefficients on the imported capital stock variable. Similar results were obtained from regressions of relative demand shifts onto average tariffs and the stock of imported machinery as a percentage of GDP and other controls.

**Factor (sector) biased technological change**

The latter results are consistent with the interpretation that skill-biased technological change was an important contributor to rising relative wages after trade liberalization. However, how do we reconcile these results with the finding that within-sector shifts were not always positive? One possible interpretation is that technological change was both factor and sector biased, so that some sectors experienced skill-biased change while others did not. Then we would expect rising relative employment in some sectors, potentially leading to overall increases in relative wages, which then induced substitution away from skill in other sectors. Then the overall within-sector shifts might be roughly zero. Further research is required to verify this possibility.

**Summary**

Instead of trade liberalization compressing relative wages in LDCs, liberalization may sometimes widen wage dispersion. This is probably related, indirectly, to a higher degree of insulation from FPE of the domestic labour market than expected from HOS based models. The source of this insulation remains unclear. It does not appear to be due to violation of basic HOS conditions. While the high natural resource content of Latin exports

---

26 In Colombia the Lilien employment variance measure is quite constant over time, and does not appear to respond to changing tariffs. In Costa Rica the employment variance measure is quite volatile but uncorrelated to trade liberalization. The employment variance measure jumps with cyclic factors prior to trade liberalization, but is relatively constant and low after trade liberalization. Finally, in Uruguay there is a jump in the employment variance measure after 1990 that could have been caused by trade liberalization, and a subsequent slight upward trend that, again, could be related to trade liberalization but which appears to be the continuation of a trend prior to trade liberalization. However, the pattern in Uruguay is not consistent with the labour specificity hypothesis, because the variance of inter-industry wages falls in the period where the variance of employment rises, rather than exhibiting a rise in wages with liberalization accompanied by or followed by a rise in the employment variance measure.
might contribute to this partial insulation in the absence of FPE, FPE appears both technically valid and empirically supported by the absence of significant rises in inter-industry wage differentials with trade liberalization. The evidence is consistent with the Skill-Enhancing Trade (SET) hypothesis, where trade liberalization permits or encourages the acceleration of the ratio of the imported physical capital stock to GDP in a sector-biased pattern. The attendant capital-skill complementarities and bundled technology would then raise the relative demand for skilled workers. This explanation is also compatible with trade patterns following comparative advantage in unskilled-intensive products and a greater degree of indirect skill inputs for exports required for marketing and distribution.

5.2 Synthesis of empirical research explaining the pattern of wage and employment changes accompanying trade reform

The evidence linking trade reform or trade openness and improvement in the distribution of wages for East Asia is unconvincing. The statistical link between export performance and Gini coefficients is very frail. Moreover, the use of the Gini coefficients likely leads to spurious results. This is especially true given the rapid increases in educational attainment in most of the developing world in recent decades, and in particular for East Asia. Such increases likely exerted strong equalizing pressure upon relative wages and Gini coefficients while also likely were being accompanied by large changes in the dispersion of education and experience that would have affected Gini coefficients via composition effects. Gini coefficients have been used principally for their availability. Future work should avoid the use of these or other broad distributional measures because they do not permit to isolate the impact of trade on distribution.

The conventional wisdom that hypothesized that distribution in developing countries tends to improve with openness, via the factor content of exports versus import competing goods, does not have strong empirical support. While there is substantial evidence that manufactured exports in the 1960s and 1970s were relatively intensive in unskilled labour compared to production of import competing goods, the link between exports and improving distribution is tenuous. Much of this evidence depends, unreliably, upon Gini coefficients, while other evidence lacks controls for the equalizing impact of rising relative supply and other potential factors upon relative wages. Further doubt is cast upon both the use of Gini coefficients and the hypothesis that rising exports lead to greater equality by Zhu and Treffler (2001) finding of a positive correlation between Gini coefficients and exports shares.

More reliable evidence is available for a small, largely Latin American group of developing countries. There is a strong prima facie case that trade liberalization was associated with rising relative wages and relative wages conditional upon relative supply. This conclusion appears robust to controls for changing labour market laws and shifting educational quality. Because of the limited geographic coverage of such results it is unclear whether these results generalize to poorer, less skill-endowed, less resource-rich developing countries.

While a growing number of potential explanations have been proposed to explain rising relative wages with trade liberalization, the empirical evidence is more suggestive than conclusive. Rather than necessarily denying the validity of the HOS/HOV framework and Stolper-Samuelson theorem, evidence for Mexico and perhaps Chile and Colombia suggests that counter to the traditional assumption, unskilled-intensive products were often more protected and experienced the largest falls in tariffs. Thus, the Stolper-Samuelson theorem may be valid, where relative tariffs on skilled versus unskilled goods increased
rather then fell with liberalization. Such a pattern of protection could reflect comparative advantage in skilled goods in a unified global economy, though it would appear more likely that these countries had comparative advantage within local cones of diversification. Little research has been carried out to understand how typical of developing countries this pattern may have been and why tariffs may have been higher for unskilled-intensive goods. It is unclear whether high tariffs on unskilled-intensive goods reflected global or local comparative advantage in skill, whether they reflected the political economy of protection where organized labour pressured for tariff on unskilled intensive goods despite a comparative advantage in those goods, or whether they reflected other causes.

The findings that domestic relative supply shifts had large negative effects on relative wages have both methodological and theoretic implications. Methodologically, this suggests the practice labour economists developed for partial-equilibrium or autarkic models, who have netted-out the impact of relative supply shifts on relative wages to examine relative demand shifts. Theoretically, the results go counter to the standard HOS/HOV two product model, potentially implicating the Stolper-Samuelson theorem as well. However, related models with many goods shifts in domestic relative supply could affect relative wages, though the open-economy relative demand curve would be less steep than the autarkic relative demand curve. This issue merits further research to better understand the theoretic implications of the strong, negative impact of domestic relative supply upon relative wages and to determine how best to incorporate such information into identifying how trade affects relative wages.

Few studies examine the pattern of domestic relative tradeables’ prices, through which the Stolper-Samuelson theorem should work. For Mexico the evidence is ambiguous as relative prices rose with and well after liberalization. The continued rise in relative prices well after liberalization casts doubt upon the hypothesis that changing tariffs drove those price changes.

The possibility that the international relative price of tradeables rose with the entry of Bangladesh, China, India, Indonesia and Pakistan into global commerce in the mid-1980s and led to the observed increases in relative wages is plausible but not entirely persuasive, though it has not been carefully explored. The largest increase in international relative prices occurred abruptly in the mid-1980s, with only moderate changes before and afterwards [e.g. Wood (1997), Figure 5]. However, in many cases the increase in relative wages with trade liberalization did not coincide with this rise in relative prices.

There is evidence for Mexico for the rent-dissipation hypothesis, whereby protection engendered rents and rent-sharing so that liberalization changed industry rents and relative wages, though the absence of evidence linking tariffs and rents is a major weakness. Similarly, the celebrated hypothesis that outsourcing of production from the North to the South led to rising relative wages in both North and South is plausible, though the principal evidence is that Mexican maquiladora production and relative wages rose along the United States border, which is subject to alternative interpretations.

Technological change is the dominant explanation for rising relative wages in the United States and has figured prominently among explanations of rising relative wages in the South. As technology tends to originate in the North, Southern technological change involves diffusion of technology from North to South. Several variants of the “skill-enhancing trade” hypothesis, whereby trade reform accelerates technological diffusion, have been put forth. And recent theoretic advances have shown that skill-biased, sector-biased and sector-skill biased technological change are all potentially capable of raising relative wages in the South. Compelling evidence of technological change and technology diffusion associated with trade liberalization and leading to rising relative demand exists for Chile, where the evidence suggests skilled or sector-skilled technological bias. For Mexico the evidence is consistent with both sector-biased and skill-biased technological change, although most of the evidence consists of static comparisons across firms, not
changes within firms or in the distribution of firms over time. Thus, while the broad hypothesis of skill-enhancing-trade is quite plausible, more research is required to confirm that hypothesis and identify the specific variants of that hypothesis which have been important.

The hypothesis that in natural resource rich countries – particularly in Latin America - trade opening may have spurred natural resource exports intensive in skill and thereby raised relative wages appears unlikely, as emphasized by Wood (1997). While Latin America is rich in natural resources and natural resource exports remain important, the explanation is unlikely because of the small amount of labour inputs. However, this line of enquiry deserves greater attention, as emphasized by Jones and Marjit (2001) in whose model trade opening in the agricultural sector leads to skill-biased demand shifts in the manufacturing sector.

The increasingly complex combination of factors potentially determining relative wages makes econometric identification of the appropriate model or models quite challenging. Trade reform may affect relative tariffs and prices and could directly affect relative wages via Stolper-Samuelson effects while at the same time affecting other variables, such as foreign direct investment, technology or capital deepening which also affect wage structure. At the same time, foreign investment, technology and capital deepening may change coincident with, but not because of, trade reform. Moreover, other policy reforms - exchange rate, anti-trust, labour market – often occur along with trade reform. And while in the simple world of the simplest HOS/HOV model shifts in relative supply do not affect relative wages, in practice relative supply shifts appear to have first-order effects on wages and potentially the inter- and intra-sectoral reallocation of labour. More research is required to organize the theoretic possibilities and their predictions to permit us to distinguish econometrically between different, often simultaneous explanations. And empirical research that examines the precise sequencing of policy changes and outcomes may permit better identification of causes. Alternatively, it may be possible to exploit natural experiments where sudden, exogenous shifts in an explanatory variable may permit the testing of a particular theory or group of theories. Furthermore, it will be important to expand the regional diversity of studies to economies with different endowments and economic structures in order to explore the generality of outcomes and theories, while avoiding the temptation to use widely available but inadequate outcome measures. The availability of household and firm data sets for developing countries has occurred mostly in the last quarter century and has enormously expanded the supply of useful information. Continued improvement in those data sources will be crucial to future research. More detailed data on worker characteristics in firm data, beyond the broad non-production/production groups, would enormously expand our ability to understand the change patterns and causes of demand for skill within and across firms. And in household data sets, more information on the firms in which workers are employed and the nature and quality of their educations would expand the reliability and breadth of studies employing those data sets. And the ability to merge data across firm and household data sets may become increasingly viable, further expanding the breadth and depth of possible studies.
6. Conclusion

Until the recent research summarized in this article was carried out it was thought that trade liberalization would contribute to greater equality in income by removing distortions that encouraged skill-intensive activities and discouraged production of unskilled-intensive goods. Trade reform via the Stolper-Samuelson theorem would lead to lower relative wages. Trade liberalization promised to be a “win-win” opportunity that would improve economic efficiency, potentially accelerate economic growth and lead to greater equality in the distribution of income. Recent research, though geographically limited, suggests this may often be untrue.

An extensive list of hypotheses has emerged to explain rising relative wages in developing as well as developed countries. While important theoretic and empirical progress has been made, the causes of rising relative wages with trade liberalization are only partially understood. Initially the finding of rising relative wages with trade liberalization was often taken as a rejection of the Stolper-Samuelson theorem. However, while the structure of protection is not documented for most developing countries, we now know that the traditional assumption that skill-intensive industries were most protected prior to liberalization was sometimes incorrect, though the causes and implications of such protection patterns are not well understood. Consequently, increasing relative wages may have been due to Stolper-Samuelson effects, where relative tariffs rose with liberalization, though this has not been directly confirmed. At the same time, the finding that increases in domestic relative supply had large, negative impacts upon relative wages goes counter to the Rybczinski theorem and the underlying HOS/HOV model upon which Stolper-Samuelson is also based. Research is required to clarify whether the rejection of the Rybczinski theorem implies that the HOV/HOS framework is inadequate or simply requires modification, such as the possibility of multiple goods and a continuum of cones of diversification.

Several alternative explanations competing with or complementing the Stolper-Samuelson story have been put forth. In developing countries where product markets tend to be imperfect protection may have led to rents and rent-sharing, so the reductions in protection may have shifted the wage structure across industries through rent dissipation. Where relative tariffs rose, this may have reduced rents in sectors intensive in unskilled labour and raised relative wages, perhaps magnifying Stolper-Samuelson effects. Trade liberalization may have induced or been accompanied by technological diffusion from North to South leading to biased technological change that raised relative wages. Liberalization may also have induced capital deepening which, through capital-skill complementarity, raised the relative demand for skill. Liberalization may also have encouraged or been accompanied by greater foreign direct investment, which under the “outsourcing” hypothesis could explain rising relative wages in both the North and the South.

There is significant empirical support for these alternative hypotheses, though the evidence is not conclusive. In general these hypotheses are potentially consistent with the modified Stolper-Samuelson theorem where relative tariffs rose with trade liberalization, making it difficult to identify the precise causes of rising relative wages. Further theoretical and empirical work is required to clarify empirical predictions that will sometimes permit us to distinguish between different causes. Trade liberalization may engender Stolper-Samuelson effects while causing or being accompanied by: between-industry shifts in rents, sector-biased, skill-biased or sector-skill biased technological and increasing relative supply. Most analyses analyze these factors separately, while empirical analyses must face the possibility of all these factors changing simultaneously. In particular, the simultaneous impact of growing relative supply has not been carefully addressed.
While trade liberalization may sometimes contribute to greater inequality of income through rising relative wages, this does not mean that protectionist policies are preferred. The work reviewed in this article emphasizes the likelihood that trade liberalization has accelerated technological diffusion to the South. As Amartya Sen emphasizes,

“The predicament of the poor across the world cannot be reversed by withholding from them the great advantages of contemporary technology, the well-established efficiency of international trade and exchange, and the social as well as economic merits of living in open, rather than closed, societies.” [Los Angeles Times Syndicate, 2001].

This view suggests that globalization and trade liberalization should tend to increase economic growth. If globalization and greater economic integration leads to higher growth then even when relative wages increase, real wages may be rising for all workers. Such a Pareto improving outcome would need to be weighed against rising income inequality. It is important to reiterate that there is controversy as to the impact of liberalization and openness upon growth.

Rising relative wages and increasing economic growth with trade liberalization are likely to lead to effects that mitigate or reverse rising wage dispersion. Rising relative wages constitute an increase in the returns to education which encourage higher educational attainment that would lower relative wages. If trade liberalization accelerates growth, this can also engender higher educational attainment by absorbing women into the labour force and accelerating demographic transition with falling family size and rising educational investment per child [e.g. Robbins (1998b, 2000b, 2002c)].

Policies that encourage such educational attainment, particularly for low and middle income groups, would be of enormous benefit. The economic growth literature suggests that higher education may permit or foment higher economic growth and real wages. To the extent that relative wages rise because of accelerated technology diffusion to the South requiring higher levels of skill, investing in education should lead to still higher rates of economic growth. Higher educational attainment will also lower relative wages. At the same time it is crucial that such educational investment, subsidies and incentives be designed to generate greater equality in the distribution of educational attainment, so rising educational attainment improves the distribution of income both through wage compression and composition effects. Complementing trade liberalization with these educational policies will help countries reap greater benefits from liberalization in terms of economic growth while moderating or reversing rising wage inequality.
References


Alvarez, Roberto; Robertson, Raymond, 2001. “Exposure to foreign Markets and Firm-Level Innovation: Evidence from Chile and Mexico, Mimeo, Macalester University.


Berman, Eli; Machin, Stephen, 2000. “Skill-Biased Technology Transfer: Evidence of Factor Biased Technological Change in Developing Countries”, Mimeo, Boston University.


Davis, Donald; Bloom, David; Evans, Carolyn, 1996. “Economics of Labour in a Global Economy ”, Mimeo, Harvard University.


Marjit, Sugata; Acharyya, R., forthcoming, *Trade and Inequality: A Developing Country Perspective*.


Ocampo, José Antonio; Sánchez, Fabio, 2000. “Cambio Estructural, Mercado Laboural y Distribución del Ingreso en la Década de los Noventa”.

Ocampo, José Antonio; Sánchez, Fabio; Tovar, Camilo, 2000. *Cambio Estructural y Deterioro Laboural: Colombia en la Década de los Noventa*, Universidad de los Andes, Documento CEDE 2000-06.


List of Policy Integration Department working papers

No. 1  ILO Activities on the Social Dimension of Globalization: Synthesis Report

No. 2  Measuring Decent Work with Statistical Indicators
       By Richard Anker, Igor Chernyshev, Philippe Egger, Farhad Mehran
       and Joseph Ritter

No. 3  Globalization and Decent Work: Options for Panama
       by Philippe Egger

No. 4  Globalización y Trabajo Decente: Opciones para Panamá
       by Philippe Egger

No. 5  Indicators of Social Dialogue: Concepts and Measurements
       by Lane Kenworthy and Bernhard Kittel

No. 6  Assessing the impact of the attacks of 11 September 2001 on women’s
       employment in the United States by Gertrude Schaffner Goldberg and
       Helen Lachs Ginsburg

No. 7  Decent Work and the informal economy in Central America
       by Juan Diego Trejos Solórzano and Miguel Del Cid

No. 8  Poverty Initiatives in the ILO: A review of past and present approaches
       by Pat Holden and Dagmar Walter

No. 9  Whither the International Standard Classification of Occupations (ISCO-88)?
       by Debbie Budlender

No. 10 Improving occupational classifications as tools for describing labour markets:
       A summary of recent national experiences by Debbie Budlender

No. 11 Recent Developments in China’s Labour Economy by Thomas G. Rawski

No. 12 The Impact of Economic Liberalization on Employment and Wages in India
       by Sonia Bhalotra

No. 13 The Impact of Trade Liberalization upon Inequality in Developing Countries
       by Donald J. Robbins

No. 14 The impact of liberalization and globalization on income inequality in
       developing and transitional economies by Giovanni Andrea Cornia

No. 15 The Impact of technology transfer on employment and income distribution in
       developing countries: A survey of theoretical models and empirical studies
       by Maria Cristina Piva