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Essays on Globalization and Occupational Wages

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ESSAYS ON GLOBALIZATION AND OCCUPATIONAL WAGES

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To my daughter Mahin
and to the loving memory of my little brother Jumma

Abstract

This thesis evaluates empirically how globalization has affected occupational wages in both developing and developed countries. Three aspects of globalization – openness to trade, openness to capital and offshore-outsourcing – are examined in four self-contained essays. The first two essays evaluate the effects of increased trade liberalization on the wage gaps between skilled and unskilled workers in the Bangladesh manufacturing sector. The third and the fourth essays analyze the effects of globalization on occupational wages in both developing and developed countries.

The first essay is a time series analysis using data from the Bangladesh cotton textile industry covering the 1973-2002 period. A dynamic two-equation model is estimated for real wages of skilled and unskilled workers. The findings suggest that while openness to trade increased both skilled and unskilled real wages, it did not affect them differently, implying that openness *per se* did not contribute to changes in wage inequality.

Essay 2 further investigates the issues in Essay 1, but performs a panel data analysis using data from five manufacturing industries (Jute, Cotton textile, Match, Engineering, and Mustard oil) covering the 1975-2002 period. Several standard models are used to estimate wage equations for skilled and unskilled workers. The results, particularly the estimates from a dynamic fixed effects model, provide some weak evidence that trade liberalization did contribute to a reduction in wage inequality. Consistent with the findings in Essay 1, the results also suggest that it increased wages for both skilled and unskilled workers.

The third essay empirically examines how globalization affects inter-occupational wage inequality within countries. It focuses on two dimensions of globalization, openness to trade and openness to capital, using a relatively new dataset on occupational wages. Estimates from dynamic models for 52 countries over the 1983-2002 period suggest that openness to trade contributes to an increase in occupational wage inequality within developed countries, but that the effect diminishes with an increased level of development. In terms of developing countries, the results show that the effect of openness to trade on wage inequality is insignificant and does not vary with the level of development. The results furthermore suggest that openness to capital does not affect occupational wage inequality in either developed or developing countries.

Offshoring has changed the pattern of international competition; labor in specific occupations rather than in firms and sectors are now facing competition. Accordingly, wages in offshorable occupations are affected in new ways. The fourth essay investigates the effects of offshoring of electronically traded services on relative occupational wages in 13 countries in the 1990-2003 period. The findings suggest that in developing countries, increased exports of IT-related services lead to higher relative wages in offshorable occupations, whereas increased imports of such services reduce relative wages. In the most developed countries, however, relative wages were not significantly affected.

Keywords: *Globalization: openness to trade: openness to capital, foreign direct investment; offshoring; service trade; occupational wage; wage gap; wage inequality; developed countries; developing countries; Bangladesh; time series analysis; panel data; dynamic model*

Preface

First of all, I would like to express my deepest gratitude to my thesis supervisors Professor Arne Bigsten and Associate Professor Dick Durevall for their continuous support and guidance. I am highly indebted to Arne for suggesting the topic of the thesis to me, and for providing intellectual support and encouragement. I am also highly indebted to Dick for excellent guidance – his comments and constructive critique greatly improved the quality of the essays. I truly feel privileged to have worked with them and look forward to working with them in the future.

I also wish to express my gratitude to Associate Professor Måns Söderbom. His helpful comments on my pre-defense seminar and our many intellectual discussions (particularly the e-mail discussions on the 3rd essay when he was at Oxford) helped me a great deal to understand my work. I also want to thank my opponent at the licentiate degree defense, Fredrik Sjöholm, for his valuable comments on the first two essays.

Finishing the PhD work was quite a journey for me considering my complicated pregnancy, giving birth to a wonderful girl, the struggle of two PhD students to raise a child, and lastly the travel back and forth UK-Gothenburg repeatedly for two years. While I during this period no doubt have experienced weariness and frustration, I have nevertheless loved my work. I have enjoyed every second of being a mother and a researcher, and I was always thinking about efficiently allocating my time between the two tasks.

Several people helped me in one way or another to get through the demanding time. I would like to thank Professor Lennart Flood, Professor Lennart Hjalmarsson and Professor Olof Johansson-Stenman for their support and encouragement throughout my

study. I would also like to thank Katarina Nordbolm, Roger Wahlberg and Sven Tengstam, who were always very helpful whenever I turned to them for support. I would also like to thank Heather Congdon Fors for reading my papers and for our stimulating discussions over coffee and lunch. Thanks Maria Risberg for always being there for me – I'll certainly miss you. I cannot thank Eva Jonason and Eva-Lena Neth enough for providing excellent support on administrative and practical matters. The journey would certainly have been much more complicated without their help. Financial support from the Wallander-Hedelius Stiftelse foundation is gratefully acknowledged as well.

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Farzana Munshi

Belfast, February 2008

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Introduction and Summary

1. Introduction

The global economy has become more and more integrated over the past two decades. This globalization is believed to bring long-run benefits to the participating countries via its impact on growth and productivity (McCulloch et al., 2002). Hence, the World Bank and the International Monetary Fund have been prescribing trade liberalization, and more generally increased integration for more than 20 years in order to reduce poverty in developing countries. Still, many countries, both developed and developing, have experienced distributional conflicts, especially widening wage gaps between skilled and unskilled workers, during the same period (OECD, 1997; Goldberg and Pavcnik, 2007).

A large number of studies have tried to identify links between globalization and income distribution, particularly wage inequality, but the findings have been mixed (Slaughter and Swagel, 1997; Goldberg and Pavcnik, 2007). Therefore, the issue is still intensely debated.

This thesis evaluates empirically how globalization has affected occupational wages in both developing and developed countries. Three aspects of globalization – openness to trade, openness to capital, and offshore outsourcing – are examined in four self-contained essays. Before providing a short summary of the essays, a brief review of the existing literature on globalization and wage inequality is called for.

2. Globalization and wage inequality

Globalization may affect wage inequality in several ways. The most direct way is through increased trade, as predicted by the Hecksher-Ohlin-Samuelson (H-O-S) model (Samuelson, 1953). According to the model, unskilled labor-intensive developing countries will tend to specialize in and export unskilled labor-intensive products, while skilled labor-intensive and capital-endowed developed countries will specialize in and export skilled labor-intensive products. Thus, greater openness to trade will shift the structure of production toward more unskilled labor-intensive sectors in developing countries and skilled labor-intensive sectors in developed countries. This should raise the relative price of unskilled labor-intensive goods in developing countries with a consequent increase in the demand for and wages of unskilled labor there. On the other hand, the developed countries should experience an increase in skilled labor-intensive product prices and wages of skilled workers. Hence, the theory predicts decreased wage inequality in developing countries and increased wage inequality in developed countries.

However, the available empirical evidence for developed and developing countries is mixed (Attanasio et al., 2004; Milanovic and Squire, 2005; Bigsten and Durevall, 2006; Goldberg and Pavcnik, 2007). Consider, for example, developing countries: While the East Asian experience in the 1960s and 1970s is in line with the theoretical prediction (Wood, 1997), several Latin American countries have experienced the opposite since the mid-1980s: openness seems to have increased wage inequality (see Attanasio et al., 2004, for Colombia; Galiani and Sanguinetti, 2003, for Argentina; Hanson and Harrison, 1999, for Mexico). Most recent evidence for India (Mishra and Kumar, 2005) and Kenya (Bigsten and Durevall, 2006), however, suggests that openness contributes to a reduction in wage

inequality. The previous studies use different measures of globalization[1] and inequality and cover different time periods, both reasons for finding mixed evidence (for reviews see Goldberg and Pavcnik, 2007).

Globalization has many different dimensions. Openness to trade, openness to capital, outsourcing, and immigration are some of the aspects that have been subject to empirical analysis. Entirely satisfactory measures of these aspects of globalization are hard to find. Wage inequality is measured by the wage gap between skilled and unskilled workers, a term called the skill premium (Goldberg and Pavcnik, 2007). Depending on the source of data, the skill premium is defined on the basis of educational attainment (in the case of available household or labor force survey data) or as a ratio of wages of non-production (white-collar) to production (blue-collar) workers (in the case of plant surveys). Both types of data are used in empirical analyses.

Resource abundance varies across countries. For example, while there is an abundance of natural resources in many Latin American countries, most Asian countries have a relative abundance of unskilled labor. Consequently, the impact of increased trade on wage inequality may differ between Latin American and Asian countries.

The H-O-S model (Samuelson, 1953) is based on some quite restrictive assumptions[2] that are often unable to capture reality. Consider for example the immobility of capital between countries. Trade liberalization is often accompanied by policies aimed to liberalize capital markets. In fact, the increased capital flows that began in the 1990s, along with trade, have played an increasingly important role in the globalization process. While

[1] See McCulloch et al. (2002) for a general review of globalization measures used by different researchers.
[2] See Goldberg and Pavcnik (2007) for a discussion on the shortcomings of the H-O-S model.

increased trade may reduce wage inequality, increased capital flows, particularly foreign direct investment (FDI), may increase inequality in a particular country depending on the nature of the foreign investment and the level of development in the recipient country (see Haddad and Harrison, 1993, for evidence in Morocco; Feenstra and Hanson, 1997, for evidence in Mexico; and Taylor and Driffield, 2000, for evidence in the UK).

Labor market institutions play a major role in determining the impact of openness on wage inequality. Although labor markets in developed countries are relatively more integrated than in developing countries, perfect mobility of labor between sectors, as assumed in the H-O-S model, is not realistic. Labor market rigidities restrict labor reallocation across sectors, which mean that openness affects wage inequality through changes in wages.[3] If wages are not as flexible as the H-O-S model requires, then changes in labor demand may also increase transitional unemployment or increase the size of the informal sector. These potential problems of globalization have gained a lot of media and political attention.[4] Since workers are paid less in the informal sector, an increase in its size may raise wage inequality.

2. Summary of the Thesis

The first two essays evaluate empirically the effects of trade liberalization on the wage gaps between skilled and unskilled workers in the Bangladesh manufacturing sector. Like most developing countries, Bangladesh has implemented gradual trade liberalization in the form of tariff reduction and removal of quantitative restrictions starting in the 1980s. During this

[3] A number of studies have reported slow labor reallocation in developing countries (Currie and Harrison, 1997; Hansson and Harrison, 1999; Attanasio et al., 2004).
[4] See Goldberg and Pavcnik (2003) for a theoretical model and Attanasio et al. (2004) for empirical evidence.

process, income inequality appears to have increased somewhat: the Gini coefficient rose from about 30% during the 1980s to 37% in 1996, but in 2000 it was estimated to have fallen to 31% (WIDER, 2007). Trade reform was mostly concentrated in the manufacturing sector, which by contributing around 70 percent of export revenue is the most important foreign-exchange earner. Given that Bangladesh has a comparative advantage in unskilled labor-intensive production, trade liberalization should have increased unskilled wages more than skilled wages and therefore reduced wage inequality. It hence provides an interesting opportunity to analyze the effect of openness on trade and wage inequality.

The first essay examines the relationship between trade liberalization and skilled-unskilled wage inequality using 1973-2002 time series data from the Bangladesh cotton textile industry. A dynamic two-equation model is estimated for wages of skilled and unskilled workers using the full information maximum likelihood method. Four different openness measures based on price ratios and international trade are used. The main finding is that opening up to international trade increased real wages of both skilled and unskilled workers similarly; i.e., the level of wage inequality was not affected.

Essay 2 is an extension of Essay 1, where panel data from the Bangladesh manufacturing sector is used to further investigate the issue in Essay 1. Panel data analysis produces more precise estimates and takes care of omitted variable biases to a greater extent. The data used is a balanced panel for five major manufacturing industries (Jute, Cotton textile, Match, Engineering, and Mustard oil) with 28 time series observations covering the 1975-2002 period. The industries are mostly unskilled labor-intensive tradable ones that underwent wide-scale reform including tariff reductions and privatization. Four standard models are used in the paper to estimate the wage equations: the ordinary least

square method (OLS), the fixed effects method (FE), the dynamic FE method, and the two-stage least square method (2SLS). The specifications of the estimated equations are similar to those in Essay 1, but the main extension is to allow for human capital. However, unlike Essay 1, we do not control for capital stock and productivity due to lack of data. Consistent with the findings in Essay 1, the results suggest that wages for both skilled and unskilled workers increased. The results also provide some weak evidence that openness to trade reduces wage inequality in Bangladesh.

Essay 3 looks at the impact of globalization on wage inequality by analyzing 1983-2003 data on occupational wages for 52 developed and developing countries. The essay considers two dimensions of globalization: openness to trade and openness to capital. Educational attainment is used as a proxy for skill level, and the ratio of skilled to unskilled wages is used as a measure of occupational wage inequality. This relative wage is explained by openness to trade, openness to capital, and GDP per capita. A non-dynamic and a dynamic model are estimated using the OLS, the FE, the 2SLS, and the generalized methods of moments by Arellano and Bond (1991). The findings suggest that while openness to trade contributes to an increase in occupational wage inequality in developed countries, the effect diminishes with an increased level of development. In terms of developing countries, the effect is insignificant. Our results furthermore suggest that openness to capital does not affect occupational wage inequality in either developed or developing countries.

Based on the findings of the first three essays, there is no strong evidence that globalization, in the form of openness to trade and openness to capital, contributes to a

reduction in wage inequality in developing countries. Nor have we found any evidence that it increases wage inequality in developing countries.

Essay 4 analyzes empirically the impact of offshore outsourcing of electronically traded services (henceforth offshoring) on occupational wages. This latest wave of globalization has attracted a lot of media attention particularly in developed countries due to the fear of job loss and downward pressure on real wages in certain high-skilled occupations, where these countries traditionally have had a comparative advantage (Amiti and Wei, 2005). Many of these jobs have been outsourced to developing countries where the job (task) can be done at much lower cost and delivered electronically at negligible cost. Consequently, wages in offshorable occupations are affected in new ways. It is important to understand both this phenomenon and the potential effects of offshoring on relative wages in offshorable and non-offshorable occupations. This is accomplished in Essay 4 by looking at 13 countries over the 1990-2003 period. To our knowledge, this is the first study that exploits the cross-section variations across countries to try to understand the potential effects of offshoring on relative wages in offshorable and non-offshorable occupations. Our focus is on the link between offshoring and occupational wages; how offshoring affects occupational wages in the short and medium run. Our findings suggest that in developing countries, especially the poorest ones, increased exports of IT-related services lead to higher relative wages in offshorable occupations, whereas increased imports of such services reduce relative wages. However, we fail to find any effect at all in most developed countries. The latter result should be of interest to developed countries, where offshoring as mentioned has created much anxiety regarding downward pressure on wages.

References

Amiti, M. and Wei, S. (2005), Fear of Service Outsourcing: Is it justified? Economic Policy 20, 308-348.

Arellano, M. and Bond, S. (1991), Some tests of specification for panel data: Monte-Carlo evidence and an application to employment equations, Review of Economic Studies 58, pp.277-297.

Attanasio, O., Goldberg, P. K., Pavcnik, N. (2004), Trade Reforms and Wage Inequality in Colombia, Journal of Development Economics 74, pp. 331-366.

Barro, R. J. (2000), Inequality and Growth in a Panel of Countries, Journal of Economic Growth, 5, pp. 5-32.

Bigsten, A. and Durevall, D. (2006), Openness and Wage Inequality in Kenya: 1964-2000, World Development, 34(3), 465-480.

Currie, J. and Harrison, A. (1997), Trade Reform and Labor Market Adjustment in Morocco, Journal of Labor Economics 15, pp. S44-71.

Dollar, D. and Kraay, A (2002), Growth is Good for the Poor, Journal of Economic Growth 7, pp. 195-225.

Edwards, Sebastian (1997), Trade Policy, Growth and Income Distribution, AEA Papers and Proceedings 87(2), pp. 205-210.

Feenstra, R. and Hanson, G. (1997), Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras, Journal of International Economics 42, pp. 371-393.

Galiani, S., and Sanguinetti, P. (2003), The Impact of Trade Liberalization on Wage Inequality: Evidence from Argentina, Journal of Development Economics, 72, 497-513.

Goldberg, P. and Pavcnik, N. (2003), The Response of the Informal Sector to Trade Liberalization, Journal of Development Economics 72, pp. 463-496.

Goldberg, P. and Pavcnik, N. (2007), Distributional Effects of Globalization in Developing Countries, Journal of Economic Literature XLV, pp. 39-82.

Haddad, M and Harrison, A. (1993), Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco, Journal of Development Economics 42, pp. 51- 74.

Hanson, G., and Harrison, A. (1999), Trade Liberalization and Wage Inequality in Mexico, Industrial and Labor Relations Review 52 (2), pp. 271-288.

McCulloch, N., Winters, L. A. and Xavier, C. (2002), Trade Liberalization and Poverty: A Handbook, DFID, UK.

Milanovic, B. and Squire, L. (2005), Does Tariff Liberalization Increase Wage Inequality? Some Empirical Evidence, NBER Working Paper 11046.

Mishra, P. and Kumar, U. (2005), Trade Liberalization and Wage Inequality: Evidence from India, IMF Working Paper No.05/20.

OECD (1997), Trade, earnings and employment: assessing the impact of trade with emerging economies on OECD labour markets, Employment Outlook, OECD.

Samuelson, P.A (1953), Prices of Factors and Goods in General Equilibrium, Review of Economic Studies 21, pp.1-20.

Slaughter, M. J. and Swagel, P. (1997), The Effect of Globalization on Wages in the Advanced Economies, International Monetary Fund Staff Studies for the World Economic Outlook, December 1997.

Taylor, K. and Driffield, N. (2000), Wage dispersion and the role of multinationals: Evidence from UK plant data, Paper presented at the International Economic Association Conference on Globalization and Labor Markets, University of Nottingham.

WIDER (2007), WIDER World Income Inequality Database V 2.0b May. Available online: http://www.wider.unu.edu/wiid/wiid.htm

Wood, A.(1997), Openness and Wage Inequality in Developing Countries: The Latin American Challenge to East Asian Conventional Wisdom, The World Bank Economic Review 11, pp. 33-57.

Essay 1

Trade Liberalization and Wage Inequality: Empirical Evidence from Bangladesh

By

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Abstract

This paper explores the relationship between trade liberalization and skilled-unskilled wage inequality in the Bangladesh cotton textile industry. A dynamic two-equation model is estimated for wages of skilled and unskilled workers over the 1973-2002 period, using four different openness measures. In no case does opening up of trade affect unskilled wages differently than skilled wages, implying that openness *per se* did not contribute to changes in wage inequality. Our findings also suggest that openness is associated with increased real wages for both skilled and unskilled workers.

Key words: Bangladesh, globalization, trade liberalization, wage gap, wage inequality.

JEL codes: F13, F14, F15, O15, O24

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1. Introduction

Several developed and developing countries have experienced a substantial increase in wage inequality following trade liberalization and increased international trade. While this is less of a surprise for developed countries and consistent with the standard Hecksher-Ohlin-Samuelson prediction (Samuelson, 1953), it is a puzzling piece of evidence for developing countries (Williamson, 1997; Arbache et al., 2004; Goldberg and Pavcnik, 2004). As standard trade theory predicts, greater openness to trade should narrow the wage gap between skilled[1] and unskilled workers in developing countries by increasing the relative demand for unskilled workers (Stolper and Samuelson, 1941). The East Asian experience in the 1960s and 1970s is in line with this prediction (Wood, 1997). However, several Latin American countries have experienced the opposite since the mid-1980s; openness seems to have increased wage inequality (see Attanasio et al., 2004, for Columbia; Galiani and Sanguinetti, 2003, for Argentina; Hanson and Harrison, 1999, for Mexico). The conflict of evidence has sparked an intense debate about the impact of trade liberalization on wage inequality.

The purpose of this study is to examine the impact of trade liberalization on skilled-unskilled wage inequality, or more accurately, the wage gap, in Bangladesh. Starting in the mid-1980s, Bangladesh implemented gradual trade liberalization in the form of tariff reduction and removal of quantitative restrictions, with the prime objective to encourage exports by reducing the anti-exports bias (Ahmed and Sattar, 2004). During this process, income inequality appears to have increased somewhat: the Gini coefficient rose from

[1] The definition of skilled labor includes all professional and technical workers, managers, and craftsman who possess advanced education or substantial training or work experience (Wood, 1994).

about 30% during the 1980s to 37% in 1996, but then fell to 31% by 2000 (WIDER, 2007). Nevertheless, given that Bangladesh has a comparative advantage in unskilled labour-intensive production, trade liberalization should have increased unskilled wages more than skilled wages and therefore reduced wage inequality. We investigate whether this is the case in the Bangladesh manufacturing sector by analyzing one of the largest manufacturing sectors, the cotton textile industry, as it is a labour-intensive industry offering many unskilled job opportunities (Nordås, 2004). Data availability is relatively good for this sector compared to others.

To test for the impact of trade liberalization on relative wages, we estimate a dynamic two-equation model for wages of skilled and unskilled workers over the 1973-2002 period. To measure openness, four different openness proxies are used, based on price ratios and international trade. Our major finding is that opening up to international trade has affected skilled and unskilled wages in the same way; there is no change in wage inequality. Moreover, the opening up of trade seems to have increased real wages across the board, possibly because of trade-induced increases in productivity.

The rest of the paper is organized as follows. The next section provides a brief outline of the theory of trade policies and wage inequality and an overview of the existing empirical evidence. Section 3 describes Bangladesh's trade liberalization and labor market reforms. Section 4 outlines the main features of the cotton and textile industry. Section 5 presents the empirical model, the data, and results from tests of the stochastic properties of the variables. Section 6 reports the results from the econometric analysis, and Section 7 concludes the paper.

2. Trade Liberalization and Wage Inequality: Theory and Evidence

The main theory used to explain the effects of trade on wage inequality is that of Heckscher-Ohlin-Samuelson (H-O-S), which asserts that a country's production structure is determined by its relative factor endowments under a liberalized regime of international trade. Accordingly, under certain assumptions, countries should produce and export goods that use their abundant factor intensively, and import goods that use their scarce factor intensively. Given that developing countries have a larger supply of unskilled labor relative to skilled labor compared to developed countries, it is to their benefit to specialize in unskilled labor-intensive goods. For skill-intensive developed countries on the other hand, it is best to specialize in producing skilled labor-intensive goods.

The Stolper-Samuelson theorem considers the relationship between goods prices and factor returns in the H-O-S model. The central insight is that trade reduces wage inequality in unskilled labor-abundant countries and vice versa in skilled labor-abundant countries through changes in relative prices. Consider a simple model with two countries (developed and developing), two factors (skilled and unskilled labor), and two goods (skilled and unskilled labor-intensive products). With given technology, barriers to trade (such as tariffs) may drive wedges between the prices of goods in the two countries, and a reduction in barriers will then result in trade expansion. The developing country, which specializes in unskilled labor-intensive products according to its comparative advantage, will increase its exports of unskilled labor-intensive goods while the developed country, which specializes in skilled labor-intensive production, will increase its exports of skilled labor-intensive products. As a result, the relative price of unskilled labor-intensive goods increases in the developing country, with a consequent increase in unskilled-labor wages,

while increases in the relative price of skill-intensive goods lead to a corresponding increase in skilled-labor wages in the developed country. Hence, opening up of trade reduces wage inequality in developing countries and vice versa in developed countries.

However, the Stolper-Samuelson theorem is based on a number of quite restrictive assumptions. For example, H-O-S assumes perfect flexibility of wages. When this does not hold, shifts in labor demand induced by trade liberalization are accommodated by changes in employment in the short- to medium-run (McCulloch et al., 2002). In addition, openness may affect wage distribution through other channels as well; for example Goldberg and Pavcnik (2004) note that industrial wage premiums account for a significant portion of wage-inequality in poor countries, and when there are labor market rigidities hindering smooth reallocation of labor across sectors, this channel might be important. Sectoral adjustment to tariff changes might then come via changes in wages rather than changes in employment.

Increased openness can also induce technological change, as argued by Acemoglu (2003). There can be productivity growth through scale effects, and increased awareness of best-practice technology and production techniques abroad. When technical change is skill-biased, lower tariffs might lead to higher wage premiums, increasing the relative wages of skilled labor. In fact, Arbacha et al. (2004) show that this happened in Brazil.

Furthermore, it is often argued by critics of globalization that trade liberalization leads to reallocation of employment from the formal to the informal sector where workers are paid lower wages. Goldberg and Pavcnik (2003) present a theoretical model that shows how trade liberalization can expand informal employment, while Attanasio et al. (2004)

find evidence suggesting that trade reform increased the size of the informal sector in Colombia.

Several studies on trade liberalization and wage inequality deal with the East Asian tigers (Hong Kong, Korea, Singapore, and Taiwan) and Latin America. While greater openness to trade in East Asia seems to have reduced the wage gap between skilled and unskilled workers (Wood, 1994; 1997), the Latin American experience provides less support for the H-O-S model, as shown in the review by Goldberg and Pavcnik (2004). Attanasio et al. (2004), for example, find increasing wage inequality in Colombia in the 1980s and 1990s. They identify three main channels through which trade reform contributed to this: increasing returns to education, changes in industry premiums, and increases in the size of the informal sector, although these factors caused only a small part of the increase. In a study on Argentina, Galiani and Sanguinetti (2003) also find that trade reform increased wage inequality, and that it explains a relatively small proportion of the observed increase in wage inequality. On the other hand, Rama (1994) finds a significant impact of trade reform on employment reallocation but almost no impact on wages in Uruguay. Hanson and Harrison (1999) investigate whether the dramatic increase in wage inequality experienced in Mexico in the 1980s was linked to trade reform, and find evidence from plant-level regressions suggesting that foreign direct investment, export orientation, and technical change all played important roles.

There are relatively few studies on African and South Asian countries. In contrast to the Latin American experience, Mishra and Kumar (2005) find that trade liberalization contributed to a decrease in wage inequality in India, while Bigsten and Durevall (2006) get a similar result for Kenya. To our knowledge, there are only two studies addressing the

issue of trade liberalization and wage inequality in Bangladesh. Mujeri and Khondker (2002) examine the sources of increased wage inequality starting in the mid-1980s. Assuming that agriculture is intensive in unskilled labor and located in rural areas and that non-agriculture is intensive in skilled labor and located in urban areas, wage inequality is decomposed using a general equilibrium model for 1985 and 1996. They find that wage inequality did increase and that trade was involved in causing this, but that the impact was small compared to skill-biased technical change and changes in factor endowments. Ahmed and Sattar (2004) do a descriptive analysis for 1991-2002, arguing that the development of real wages in the manufacturing sector was in accordance with the H-O-S theory, raising the wages of unskilled labor more than for skilled labor. Hence, no study actually tests how trade liberalization impacts wage inequality in Bangladesh.

3. Trade and Labor Market Policy in Bangladesh

This section provides an overview of the liberalization process in Bangladesh, focusing on international trade and privatization, and then briefly describes the evolution of labor market policies, since labor market conditions affect the impact of trade liberalization in several ways.

3. 1 *Trade Liberalization and Privatization*

After independence in December 1971, Bangladesh followed an import substitution industrialization strategy for over a decade. Trade policies were based on high tariffs and quantitative restrictions on imports. Liberalization of the trade regime started in the mid-1980s under structural adjustment reforms initiated by the World Bank and the International Monetary Fund. An entire gamut of policies was suggested where trade and

macroeconomic reform were the key elements.[2] The major objective of the trade reform was to encourage exports by reducing the anti-exports bias. The various reform measures included simplification of import procedures, reduction and harmonization of tariff rates on similar products, gradual reduction of non-tariff barriers, removal of restrictions on repatriation of profit and income from foreign investment, and liberalization of the exchange rate. According to World Bank (2000), liberalization happened quickly in Bangladesh compared to its South Asian neighbors. For example, the number of customs duty bands was reduced from 24 in the 1980s to 4 in 2000, the (un-weighted) average customs duty rate was reduced from 100% in 1985 to 57% in 1992, and further down to 17% in 2002 (Ahmed and Sattar, 2004), and the highest customs duty rate was reduced from 350% in 1990 to 37.5% in 2000 (WTO, 2000). Moreover, the number of four digit codes subject to quantitative restrictions was decreased from 550 (26%) in 1987 to 124 (10%) in 2000 (Mujeri and Khondker, 2002). At present, most of the quantitative restrictions are applicable on non-trade grounds such as health, environment, culture, national security etc.

Another important reform was privatization. West Pakistani entrepreneurs owned a majority of the Bangladesh industries before independence. Since most of them moved to West Pakistan during the War of Liberation in 1971, the government formally nationalized most large- and medium-scale industries three months after independence, in the spirit of a socialist strategy of development. Then, after a political change in 1975, the new government abandoned the public sector-led industrialization strategy and launched a

[2] Other measures included fiscal, financial, public resource management and privatization, institutional, and sectoral reforms. For details, see Sobhan (1991), Mujeri et al. (1993), and Hossain and Alauddin (2005).

program to privatize state-owned enterprises. This process of privatization gained speed with the New Industrial Policy of 1982 and the Revised Industrial Policy in 1986, when a major denationalization took place (Bhaskar and Khan, 1995).

3. 2 *Labor Market Policies*

The labor market in Bangladesh comprises formal and informal markets. Like most other developing countries, formal-sector employment is low and the informal sector is dominant; nearly 80% of the employees over 15 years of age are in the informal sector (Mujeri and Khondker, 2002). Formal workers are mainly employed in the manufacturing sector.

The first labor policy of Bangladesh was declared in 1972. Under this policy, public sector wages were determined by the government with the recommendation of the Industrial Worker Wage Commission comprised of representatives of private employers and the government. In 1977 the commission was expanded by including worker representatives. Wages in the formal private sector were determined by collective bargaining, taking government-determined wages as the reference point. In sectors where trade unions did not exist or collective bargaining failed due to weak trade unions, minimum wages were determined based on the recommendation of the Minimum Wage Board, which consulted with both workers and employers (Rashid, 1993).

The current labor policy was declared in 1980 and did not alter public and private sector wage setting or the minimum wage determination mechanism. However, a strong Tri-partite Consultative Committee, comprising the government, workers, and employers, was formed with the objective of giving more rights to workers. The law declared that all

future labor policies would be formulated on the recommendation of the committee and in conformity with International Labor Organization (ILO) conventions. The policy emphasized the role of collective bargaining, where workers were given the right to strike. On the other hand, the employers were given the right to lockout. However, these two instruments could be used only after exhausting all available legal processes.

Although the government makes decisions on public sector wages and allowances unilaterally, political pressures created by trade unions have historically played an important role. Although they represent only 3% to 5% of the labor force and one-third of the formal workers, the trade unions are quite powerful since almost all of them are linked to political parties.

In spite of active unions, however, regulations regarding minimum wages, working hours, occupational safety, etc. are often not enforced. Lack of organizational structure and legislative provisions often results in private sector employees earning below-minimum wages (Nordås, 2004). Hence, although many interventions did take place in the labor market, market forces are likely to have played an important role during a large part of our study period. In our analysis we assume that wages were determined by demand and supply, but still allow for large temporary deviations from equilibrium by employing a dynamic model.

4. The Bangladesh Cotton Textile Industry

The cotton textile industry is one of the most important industries in Bangladesh, contributing 5% of the GDP and 24% of the total manufacturing production (in 2001). Currently, the industry provides 7% of the formal employment and 50% of the total

industrial employment. The cotton textile industry meets 85% of the local demand for cloth and has relatively good access to international markets (WTO, 2000).

The cotton textile industry comprises many composite textile mills, including activities like spinning, weaving, specialized weaving, knitting and hosiery, and dyeing-printing-finishing, or simply all steps needed to transform fiber (the raw material) into fabric (the final product). The process begins with spinning where raw cotton is cleaned and twisted into yarn using spindles. The yarn is transformed into grey using looms in the second step. In the final stage, following the process of dyeing-printing-finishing, the grey is transformed into fabric, which is either sold in the market or used in ready-made garments. Locally produced fabric meets about one-third of local demand and one-tenth of the demand of the export-oriented garments industry.

After independence, the cotton textile companies were organized under the Bangladesh Textile Mills Corporation (BTMC). However, due to an absence of proper supervision, corruption, poor accounting, outdated technology, and low productivity, the BTMC rapidly turned into a loss-making industry. A reversal of the policy began in 1975 when the process of privatization was initiated. This, in combination with import liberalization, led to significant changes in the sector; while the liberalization did provide benefits such as tariff reduction and removal of quantitative restriction, in turn improving access to raw materials and machinery, many enterprises were forced to close due to increased competition (ILO, 1999). For instance, cotton (fiber), which is the basic raw material of the industry, and all types of textile machinery (except spare parts if imported separately) were exempt from duties in the mid-1990s. The effective rate of protection for yarn declined from 68% in 1992-93 to 30.5% in 1999-2000, and that of fabric declined

from 157.7% to 64.5% during the same period (WTO, 2000). Moreover, 100% export-oriented enterprises currently enjoy duty free imports irrespective of rates.

Following this process of liberalization, the volume of trade has increased substantially. Exports of yarn, for example, increased from US$ 19900 million in 1990 to US$ 30800 million in 2002, while imports of yarn grew from US$ 19600 million to US$ 31800 million in the same period. The exports and imports of woven cotton fabrics increased from US$ 11900 million and US$ 13100 million in 1988 to US$ 26500 million and US$ 21700 million in 2003 (WTO, 2000). Hence, the environment in which cotton textile companies are active must have changed substantially as a result of trade liberalization.

5. Empirical Model and Data Description

This section first describes the empirical model, then gives details about the data, and finally reports tests of nonstationarity for the individual variables.

To test for the impact of trade liberalization on relative wages, we estimate wage equations for skilled and unskilled workers. The general empirical model is formulated as

$$Lnrwsk_t = \alpha_0 + \alpha_1 Lnrwsk_{t-1} + \alpha_2 Lnrwusk_{t-1} + \alpha_3 Lnpdy_t + \alpha_4 Lnpdy_{t-1} + \alpha_5 Lncap_t + \alpha_6 Lncap_{t-1} + \alpha_7 Lnrp_t + \alpha_8 Lnrp_{t-1} + \alpha_9 Lnopen_t + \alpha_{10} Lnopen_{t-1} + e_{1t} \quad (1)$$

$$Lnrwusk = \beta_0 + \beta_1 Lnrwsk_{t-1} + \beta_2 Lnrwusk_{t-1} + \beta_3 Lnpdy_t + \beta_4 Lnpdy_{t-1} + \beta_5 Lncap_t + \beta_6 Lncap_{t-1} + \beta_7 Lnrp_t + \beta_8 Lnrp_{t-1} + \beta_9 Lnopen_t + \beta_{10} Lnopen_{t-1} + e_{2t} \quad (2)$$

where *Lnrwsk* is the log of real wages for skilled workers, *Lnrwusk* the log of real wages for unskilled workers, *Lnpdy* the log of productivity, *Lncap* the log of a measure of the capital stock, *Lnrp* the log of relative output price, *Lnopen* the log of a proxy for level of openness, and α_0 and β_0 are catch-all terms for deterministic variables such as intercepts and indicator variables. Finally e_{1t} and e_{2t} are two error terms assumed to be white noise process. Since we use annual data, only one lag of each variable is included to capture dynamics. The choice of variables is based on economic theory as well as data availability: increases in productivity (*Lnpdy),* capital stock (*Lncap),* and relative prices (*Lnrp)* are all expected to lead to higher real wages. We allow lagged wages for skilled workers to affect current wages for unskilled workers, and vice versa, to capture delayed interaction between the two groups. Our hypothesis is that trade liberalization increases real wages for unskilled workers relative to wages for skilled workers, and we test whether the coefficients in the equation for unskilled wages are larger than the ones in the equation for skilled wages. Therefore the coefficients of interest are $\alpha_9, \alpha_{10}, \beta_9$ and β_{10} in the dynamic equations and $(\beta_9 + \beta_{10})/(1-\beta_2)$ and $(\alpha_9 + \alpha_{10})/(1-\alpha_1)$ in the long-run solution.

5. 1 *Data Description*

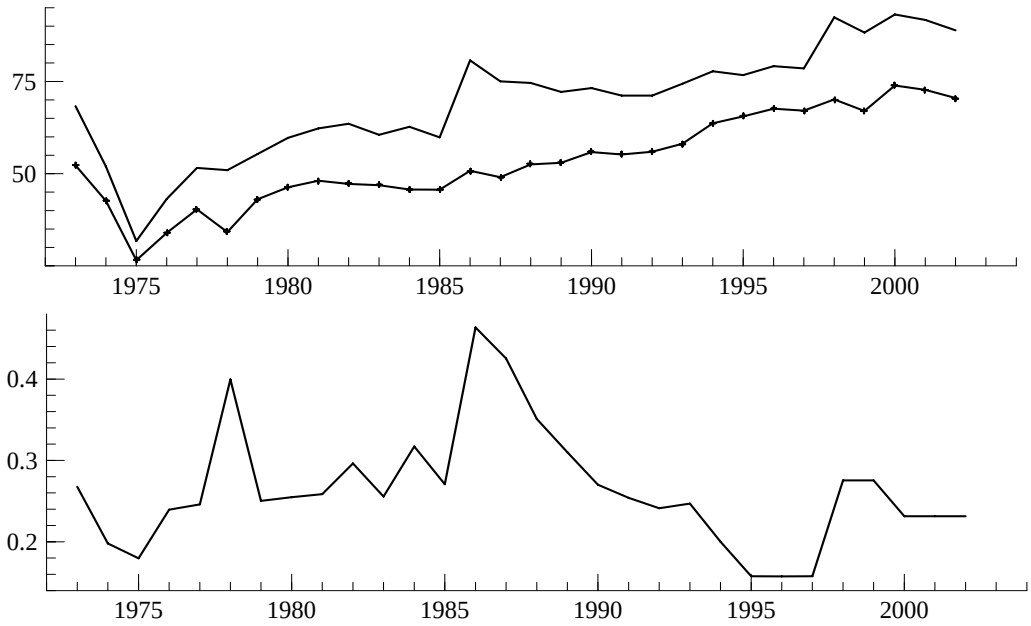
The variables are plotted in Figures 1-5 for the time period of our analysis, 1973 to 2002.[3] Figure 1 shows the evolution of wages of skilled and unskilled workers in the cotton textile

[3] Bangladesh data is usually reported for the fiscal year July-June. We use 1973 to represent 1972-73 and so on.

sector, measured at constant 1996 prices.[4] According to Bangladesh Bureau of Statistics, a skilled worker is a person who possesses professional training and skills received either on-the-job or from any formal or informal training institute, while an unskilled worker is a person who has no professional training or job-specific skill. The upper panel shows that both series exhibit a sharp decline during the first half of the 1970s followed by an upward trend, especially after the beginning of the liberalization process in the mid-1980s. Note that it took about a decade to return to the initial levels attained in 1973, the year after independence. The lower panel highlights the difference between the series, which increases from about 20% in the beginning of the 1970s to over 40% in 1986. Then the trend is reversed, and in 1995 skilled wages are only 16% higher than unskilled wages. In the late 1990s there is once again a small increase in the gap, and in 2002 the difference is 23%.

[4] The GDP deflator is used as the price index when converting series to constant prices, although the consumer price index gives, for all practical purposes, the same results.

Figure 1. Average daily real and relative wages in Bangladesh cotton textile (1973- 2002)



Note: Upper panel: Average daily real wages for skilled (—) and unskilled (—+—+) workers.
Lower panel: log difference between wages for skilled and unskilled workers.
Source: Statistical Yearbook of Bangladesh (various issues).

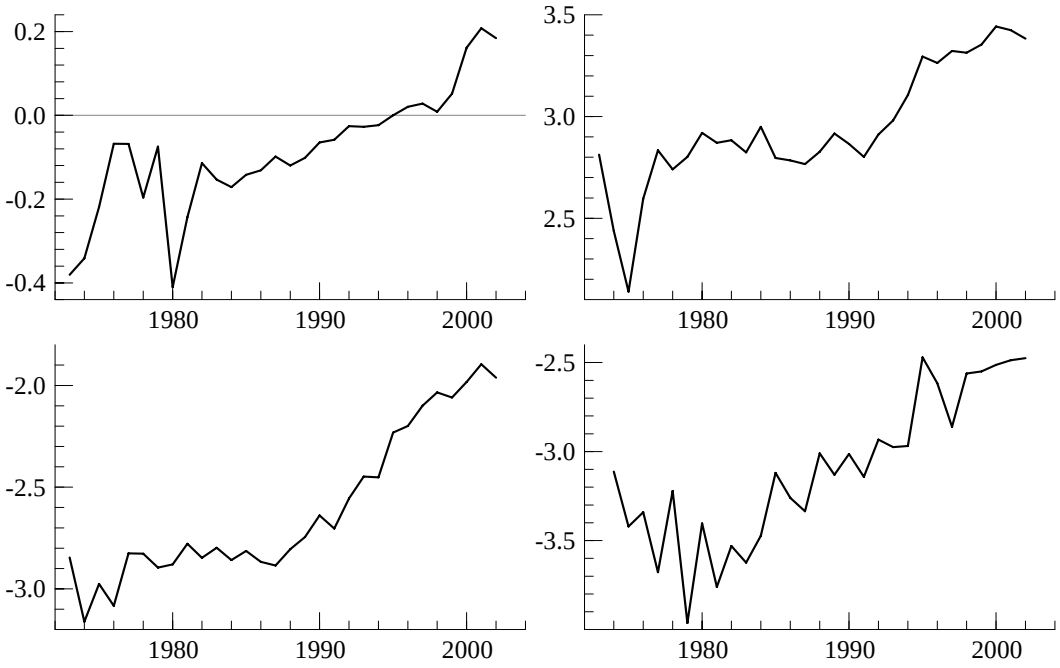
When assessing the impact of liberalization on an economy, one of the problems is measuring the opening-up process. A useful benchmark would be the initiation of the World Bank structural adjustment programs. The World Bank started to support Bangladesh with an annual import credit program in 1973, with the objective to rehabilitate the war-ravaged economy. However, an import credit program was launched in 1982 focusing on trade and industrial policy reform. Therefore, 1982 is often considered to mark the beginning of the opening-up process (Rashid, 2000; Hossain and Alauddin, 2005). Another useful benchmark is that Bangladesh became classified as open in 1996 according to Wacziarg and Welch (2003) who updated the Sachs and Warner openness index (Sachs and Warner, 1995).

Since there is no ideal measure of openness, we use four different proxies for openness, as reported in Figure 2. Although their fluctuations differ somewhat, the similarities of the long-run evolutions are striking. The first measure is denoted *open1*, and is the ratio between the US manufacturing price index (converted to Bangladesh currency using the official exchange rate) and the Bangladesh manufacturing price index. Since the import substitution policy aimed at keeping manufacturing prices high in Bangladesh, reduced protection is expected to result in an increase in the ratio. It would have been more appropriate to compare domestic manufacturing prices with world market prices, but in the absence of such data we use the US manufacturing price index since the US is the major trading partner of Bangladesh. Although the goods covered by the indexes differ and change over time, policy reform seems to be the dominant cause of change in the ratio. A similar measure is used by Athukorala and Rajapatirana (2000) for Sri Lanka and by Bigsten and Durevall (2006) for Kenya. The second measure, *open2*, is the trade dependency ratio, defined as the ratio of exports plus imports to GDP.[5] While this is a widely used measure, it suffers from the weakness of only covering actually traded goods and not all tradable goods. In this sense the measure underestimates the degree of openness in a country. Another potential problem with this measure is that the ratio can vary due to terms of trade changes resulting from exogenous shocks to export and import prices. The third measure, *open3*, is the export orientation ratio, or the ratio of aggregate exports to GDP, which is closely related to the trade dependency ratio. Finally, *open4* is the import

[5] Hossain and Alauddin (2005) use the ratio of the real effective exchange rate for exports and imports as a measure of anti-export bias. As noted by the authors, this measure is highly correlated with *DOP*, which is the same as our *open2* (exports plus imports as a share of GDP). See McCulloch et al. (2002) for a general review of openness measures used by different researchers.

penetration ratio, or the ratio of imports of consumer goods to aggregate consumption. This ratio is expected to increase with reduced protection since imports of consumer goods were the most stringently restricted of all import goods (Andriamananjara and Nash, 1997). It is important to note that all of these measures to some extent capture the outcome of trade liberalization; a truly exogenous measure is not available. However, since we are modeling only one sector, this is likely to be a less serious problem than in studies analyzing the impact on the whole country.

Figure 2. Four different openness measures

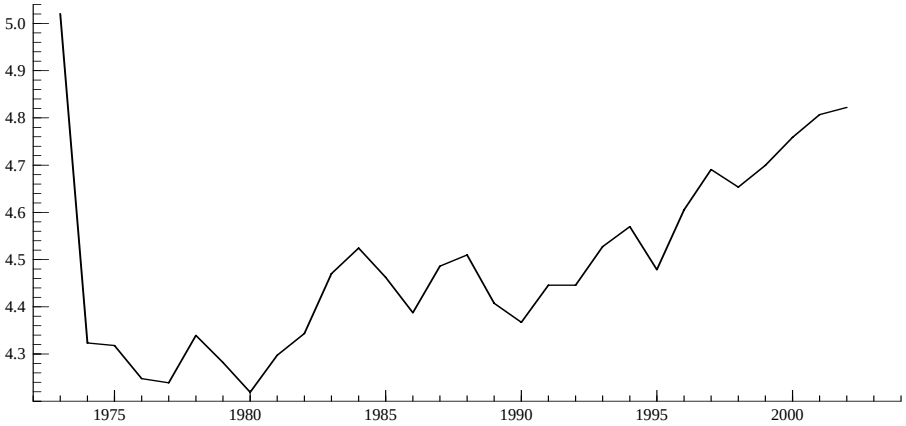


Note: The four openness measures used in this paper are from left to right in the upper panel *Lnopen1* and *Lnopen2,* and in the lower panel from left to right *Lnopen3* and Ln*open4. Lnopen1* is defined as the log of the ratio of US to Bangladesh manufacturing prices, *Lnopen2* is the log of the ratio of exports plus imports to GDP, *Lnopen3* is log of the ratio of aggregate exports to GDP, and *Lnopen4* is the log of the ratio of imports of consumer goods to aggregate consumption. Source: Statistical Yearbook of Bangladesh (various issues) and the IFS database.

As evident from Figure 2, all four proxies convey the same message, which is in line with the general view of the opening-up process described earlier. While they show high variability during the 1970s, partly due to the effects of independence, there are some notable differences relating to trade liberalization during the 1980s. For example, *Lnopen4* exhibits an increasing trend starting in the mid-1980s, while *Lnopen2* begins to increase in 1992 and *Lnopen3* is more or less stable until 1987 when it starts increasing rapidly.

Other variables that might affect real wages directly are productivity, capital stock, and relative input and output prices. Productivity change is denoted *Lnpdy*, and is measured as the ratio of output to an employment index; data on the actual number of employees is not available. As evident from Figure 3, *Lnpdy* declines sharply at independence and then remains stable until the early 1980s when it rises to a new level and stays until about 1992. After that it has a positive trend until 2002.

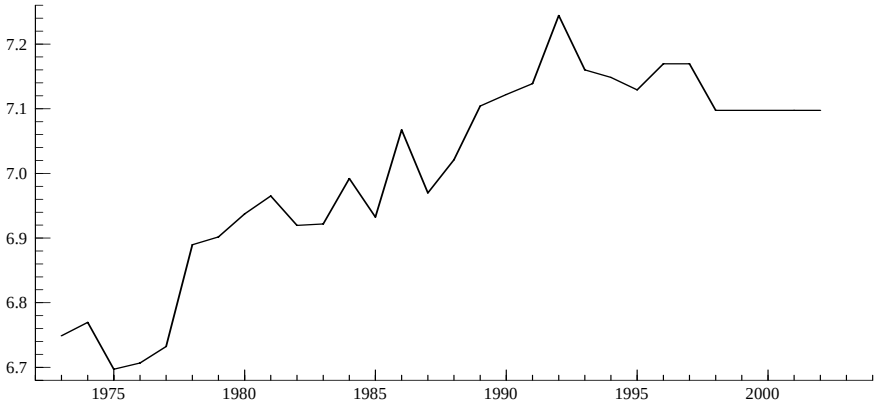
Figure 3. Productivity in Bangladesh cotton textile (1973-2002)



Note: Log of productivity (*Lnpdy).* Productivity is measured as the ratio of output and an employment index.
Source: Statistical Yearbook of Bangladesh (various issues).

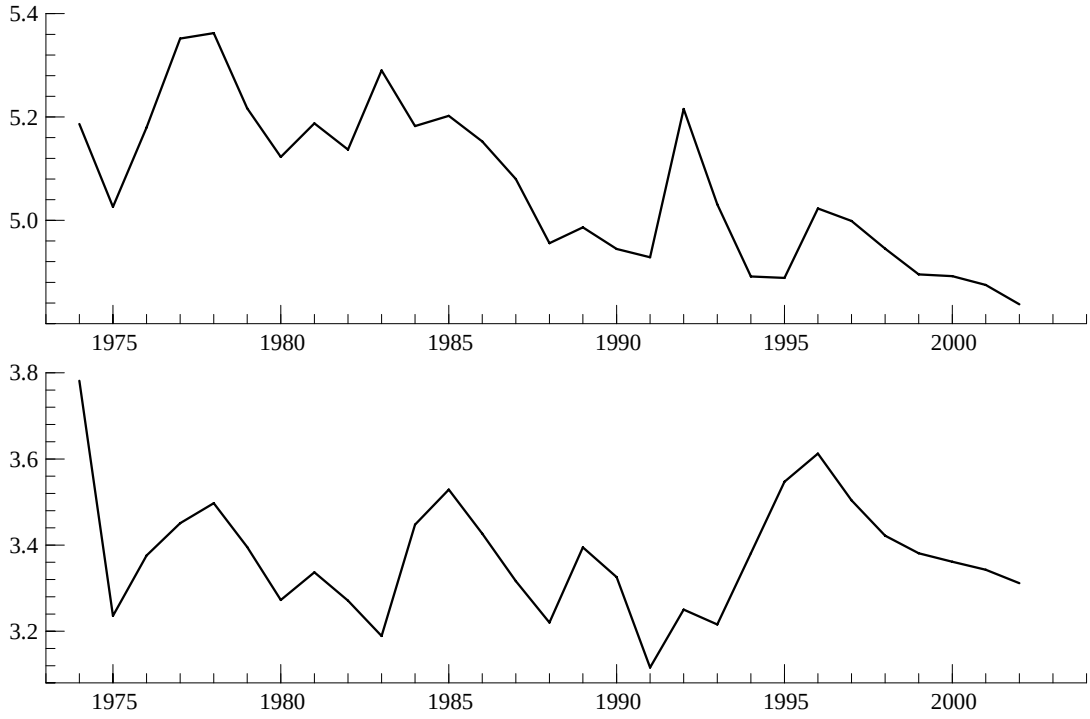
Our measure of the capital stock, *cap,* is depicted in Figure 4 and indicates the number of spindles installed. Spindles are used to make yarn and are, together with looms (for which there is a paucity of data) the most important machines in the industry. It would have been preferable to use the capital-labor ratio instead, and we did test different measures of it constructed with the available employment index. However, no series was significant. As Figure 4 shows, the number of spindles grows rapidly until the beginning of the 1990s when it drops somewhat, and then it stays stable for the rest of the period.

Figure 4. Capital Stock in the Bangladesh cotton textile (1973-2002)



Note: Log of capital stock (*Lncap).*The number of spindles installed is used as a proxy.
Source: Statistical Yearbook of Bangladesh (various issues).

Figure 5. Relative prices for yarn and fabric in Bangladesh cotton textile (1974- 2002)



Note: The relative price is measured as the ratio of price to GDP deflator. The upper panel shows the log of the relative price of yarn (*Lnyrp*) and the lower panel shows the log of relative price of fabric (*Lnfrp*).
Source: Statistical Yearbook of Bangladesh (various issues).

As displayed in Figure 5, we have two series for relative prices, *Lnyrp* and *Lnfrp*, measured as the price of yarn and fabric produced by the industry divided by the GDP deflator. Since the cotton textile industry was a heavily protected sector, these prices are expected to decrease during the opening-up process. However, *Lnyrp* decreases while *Lnfrp* is fairly stable. One difficulty when interpreting the impact of prices on real wages is that yarn is both an intermediate input and final output.

5.2 *Tests of Nonstationarity*

Since almost all variables have trends and several seem to have structural breaks, we begin by investigating their stochastic properties. First we apply the Augmented Dickey-Fuller (ADF) test with an intercept and a deterministic trend. Table 1 reports the test statistics, number of lags used, and the estimated roots. The test statistics for both wage series are significant at the 1% level, rejecting the null hypothesis of a unit root. Since the estimates of their roots also are clearly less than unity, i.e., 0.18 and 0.37 for skilled and unskilled respectively, the two series appear to be stationary around a deterministic trend. The test statistics for the four measures of openness indicate that three of them clearly are stationary around a trend, as also indicated by the roots: the largest is 0.42. The test statistic for the exception variable, *Lnopen3,* is far from significant, and the root is 0.88. Nevertheless, the nonstationarity is probably due to the presence of a break in the late 1980s and not a unit root, as evident from Figure 2 (lower left panel). Note that *Lnopen2* (Figure 2, upper right panel) has a similar pattern, but the sharp 1973-1975 decline probably makes it trend-stationary. The test also fails to reject the null for *Lncap* and *Lnpdy*, although the estimated roots are only 0.72 and 0.56, respectively.

Next we apply the test for unknown structural breaks developed by Perron (1997) to the three variables for which the null hypothesis of a unit root was not rejected (*Lnopen3*, *Lncap,* and *Lnpdy*). In the Perron test, the null hypothesis is that the series has a unit root, possibly with deterministic breaks, and the alternative hypothesis is stationarity, given the structural breaks. As reported in Table 2, allowing for one break in the trend renders all three series trend-stationary. The breaks occur at the end of the 1980s or during the first half of the 1990s. The exact date for *Lnpdy* is uncertain because of the sharp drop in the

series in the beginning of the 1970s (see Figure 3). When the 1973 observation is dropped, the test indicates that the break occurred in 1988 instead of in 1995. To conclude, no series seems to have a unit root so we model the variables in logarithm, allowing the breaks to either cancel out or result in insignificant estimates.

Table 1: ADF test statistics for the unit root tests

Variable	Lags	t-ADF	Estimated root
Lnrwsk	2	-6.145***	0.178
Lnrwusk	1	-7.447***	0.367
Lnopen1	0	-3.863**	0.256
Lnopen2	1	-3.346*	0.419
Lnopen3	1	-1.017	0.879
Lnopen4	0	-5.412***	0.078
Lncap	0	-1.825	0.720
Lnpdy	0	-2.689	0.559
Lnyrp	0	-3.684*	0.307
Lnfrp	0	-5.524***	0.005

Note: The time period is 1973-2002 except for *Lnyrp* and *Lnfrp* for which it is 1974- 2002, including lags. All the regressions contain a constant and deterministic trend. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. The critical values are 1%=-4.32, 5%=-3.58, and 10%=-3.24.

Table 2: Perron test for structural breaks

Variable	Lags	Break date	t-statistic
Lnopen3	0	1989	-5.595***
Lncap	0	1993	-4.629*
Lnpdy	0	1995 (1988)[a]	-8.693***

Note: The test is for a structural break in the trend. ***, **, and * denote statistical significance at the 1%, 5%, and 1% level respectively. The critical values are 1%=-5.45, 5%=-4.83, and 10%=-4.48 for 100 observations.
[a]Break date when the 1973 observation is dropped.

6. Econometric Analysis

In this section we report the results from the econometric analysis. First we estimate a general two-equation model for wages of skilled and unskilled workers, and then we use general-to-specific modeling to obtain a parsimonious model.[6]

The general model is estimated with one lag of each variable and three indicator variables over the 1973-2002 period. The model has measures of openness (*Lnopen1*), capital stock, and productivity as independent variables. Since we do not have observations on prices for the whole sample, we report the regressions with these variables in a separate model. The indicator variables, which have the value of unity in the year indicated and zero elsewhere, capture exceptional events not explained by the other variables. Both real-wage series decline sharply in 1975 due to a rapid increase in inflation, which is captured with the indicator variable *D75*; sticky wages and a rise in inflation from a single-digit level to over 50% due to the oil price shock, among other things, explain the decline.[7] There is also a drop in real wages for unskilled workers in 1978 and a rapid increase for those of skilled workers in 1986 (see Figure 1). These two events are modeled with *D78* and *D86*. The 1978 decline in unskilled real wages is related to loss of income due to industrial disputes which started after the political change in 1975. Strikes due to political reasons almost doubled the number of disputes in 1978 in particular, following the end of martial law (Mondal, 1992). The rapid increase in skilled wages in 1986 is attributed to a government sector wage increase in 1985, which was implemented in 1986 (Hossain et al., 1998).

[6] Ericsson et al. (1990) give an excellent description of the general-to-specific methodology.
[7] The decline took place during the July 1974-June 1975 fiscal year as a result of high inflation in 1974.

The model is estimated using the Full Information Maximum Likelihood (FIML) routine in Oxmetrics 4.2 because of its flexibility and the availability of diagnostic tests, although the Seemingly Unrelated Regression (SURE) gives basically the same result because of the model specification. Table 1A in Appendix reports the estimated coefficients and diagnostic test statistics of the general model. The coefficients of *Lnpdy* and all lagged variables are insignificant, except the lagged endogenous variables. Statistically the model appears well specified; there is no evidence of vector serial correlation (EGE-AR test), vector heteroscedasticity (Vector Hetero test), or vector non-normality (Vector Normality).[8] The reduction of the general model was carried out by removing the longest lag of each variable with low t-values, and then using likelihood ratio tests to check the validity of the simplification. Table 3 reports the parsimonious model. The likelihood ratio test of the reduction from the general to the specific model is not significant, implying that our simplification is statistically valid. Moreover, all the diagnostic tests are satisfactory; the residuals are normally distributed, homoscedastic, and serially uncorrelated.

[8] See Doornik and Hendry (2006) for details on the tests.

Table 3. Wage equations: preferred model

Variable	*Lnrwsk*	*Lnrwusk*
$Lnrwsk_{t-1}$	0.52***	
	(0.05)	
$Lnrwusk_{t-1}$		0.53***
		(0.04)
$Lncap_t$	0.31***	0.33***
	(0.11)	(0.09)
$Lnopen1_t$	0.39***	0.39***
	(0.08)	(0.09)
D75	-0.48***	-0.44***
	(0.04)	(0.03)
D78		-0.18***
		(0.05)
D86	0.21***	
	(0.04)	
Constant	0.10	0.35
	(0.68)	(0.57)
Vector EGE-AR1-2 test	F(8,38)=0.407[0.91]	
Vector Normality test	$\chi^2(4)$=5.998[0.20]	
Vector hetero test	F(33,30)=0.835[0.69]	
Test of model reduction	$\chi^2(12)$=11.16[0.52]	
Estimation method FIML	Time period 1973-2002	

Note: Standard errors in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Apart from the intercepts, all the coefficients in the final model are significant and have the expected signs. The positive coefficients on the *Lnopen1* in both equations imply that openness has increased real wages for both skilled and unskilled workers. More importantly, the coefficients for the openness measure are almost identical in both equations, 0.39, which indicates that openness did not affect skilled wages differently than

unskilled wages. The coefficients in the long-run solution are also very similar: $(\hat{\beta}_9)/(1-\hat{\beta}_2) = 0.81$ and $(\hat{\alpha}_9)/(1-\hat{\alpha}_1) = 0.83$ for skilled and unskilled workers, respectively. As expected, the measure of capital stock, *Lncap,* also has a positive effect on real wages and the coefficient is practically the same in both equations. However, we fail to find a significant effect of our measure of productivity on wages.

We also estimate the model with the prices of yarn and fabric (see Table A2 in Appendix). The coefficient for *Lnfrp* is clearly insignificant while the one for *Lnyrp* is close to being significant although with a negative sign. The negative sign could be due to aggregation; yarn is an input for a large part of the industry. Nevertheless, the impact of openness is not affected by the inclusion of prices. The insignificant test outcomes for the price variables suggest that none of them has an impact on real wages, indicating that openness has not affected wages through changes in prices – a result that is not consistent with the Stolper-Samuelson theorem. This could be due to the fact that we analyze sector data, and that sector-specific price changes may be affected by changes taking place at the national level.

Next the model is estimated with the three other openness measures *Lnopen2*, *Lnopen3,* and *Lnopen4*. The results are similar, as reported in Table A3, A4, and A5 in Appendix. The openness coefficient is somewhat higher for unskilled than for skilled real wages for *Lnopen2*, and a bit lower for *Lnopen3* and *Lnopen4.* However, the standard errors of the estimated coefficients clearly overlap, so there is not a statistically significant difference between the impact of any measure of openness on wages for unskilled and skilled workers.

Since our model is not a complete wage equation, and since it includes explanatory variables that might be affected by trade liberalization, we finally estimate models where openness is the only exogenous variable. Table 4 reports the results for the specifications with *Lnopen1*, a lagged endogenous variable, and with and without indicator variables.

Table 4. Models with only trade liberalization

	Models with indicator variables		Models without indicator variables	
Variable	*Lnrwsk*	*Lnrwusk*	*Lnrwsk*	*Lnrwusk*
$Lnrwsk_{t-1}$	0.59***		0.59***	
	(0.05)		(0.09)	
$Lnrwusk_{t-1}$		0.59***		0.64***
		(0.05)		(0.08)
$Lnopen1_t$	0.53***	0.53***	0.63	0.64***
	(0.09)	(0.08)	(0.39)	(0.16)
D75	-0.53***	-0.50***		
	(0.07)	(0.06)		
D78		-0.18***		
		(0.04)		
D86	0.21***			
	(0.04)			
Constant	1.79***	1.65***	1.80***	1.50***
	(0.22)	(0.18)	(0.39)	(0.33)
Vector EGE-AR1-2 test	F(8,40)=0.878[0.54]		F(8,44)=0.381[0.93]	
Vector Normality test	$\chi^2(4)$=9.346[0.05]		$\chi^2(4)$=33.083 [0.00]	
Vector hetero test	F(27,38)=1.397[0.17]		F(18,51)=0.610[0.88]	
Estimation method FIML, Time period 1973-2002				

Note: Standard errors in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

As before, the openness measure is highly significant and has practically the same impact on wages for skilled and unskilled workers.[9] As also shown in Table 4, our findings do not depend on the inclusion of indicator variables, although the t-values are lower and the model is misspecified without them. Specifications with the other openness measures provide the same message.[10]

7. Summary and Conclusion

Sometime in the 1980s Bangladesh embarked on a trade liberalization process to adopt an export-oriented industrialization strategy. According to the standard trade theoretical prediction, such a reform should decrease wage inequality in a labor-abundant country by reducing the difference between the wages of skilled and unskilled workers. The purpose of this study was to investigate whether this prediction is correct for Bangladesh or whether trade liberalization instead increased wage inequality, as seems to be the case in several Latin American countries. The analysis was carried out on time series data from the cotton textile sector for 1973-2002.

Our major finding is that there is no evidence that trade liberalization changed the relation between the wages of skilled and unskilled workers. Hence, we fail to find that greater openness decreased wage inequality, as predicted by the Stolper-Samuelson theorem. However, we also fail to find that it increased wage inequality. On the other hand, trade liberalization seems to have raised real wages for both skilled and unskilled workers.

[9] Another adjustment to the model would be to add deterministic trends, possibly with breaks. However, this would not be innocuous since there is no economic reason for including trends in the model; as with indicator variables they should be properly motivated. Including trends would reduce the positive impact of trade liberalization on real wages in some of the models but not all, most likely due to the small sample. This issue is addressed in Chapter 2 of this thesis using panel data. Nevertheless, the conclusion about the effect of openness on the wage gaps is unaltered. The results can be obtained from the authors upon request.

[10] The results for the other openness measures are not reported but can be obtained from the authors.

The reason for this is not analyzed, but the result holds for all four measures of the opening-up process, and also when we control for the capital stock and prices. Although this finding should be interpreted with caution, there could be other factors not included affecting both real wages and the openness measures. For example, it is possible that trade liberalization increased technical progress, as in the model by Acemoglu (2003), but that the technical change was skill-neutral in the manufacturing sector. There are pieces of evidence pointing towards a relation between opening up and technical progress in Bangladesh; Mujeri and Khondker (2002) show that wages increased in manufacturing (relative to those in agriculture) as a result of technical change. However, no study looks directly at technical progress or whether it was skill-biased.

One difficulty of evaluating the impact of trade policy on wages is the paucity of data. In this paper we used time series data with few observations but with more sector-specific variables than available for other sectors. This means that we have a small sample size. Despite this fact, our results on wage inequality are quite strong. Yet, the data is limited to the formal sector, and including the informal sector could contribute to changes in wage inequality not captured in our analysis. There is thus ample scope for further research.

References:

Acemoglu, D. (2003), Patterns of Skill Premia, Review of Economic Studies, 70, pp. 199-230.

Arbache, J.S., Dickerson, S. and Green, F. (2004), Trade Liberalization and Wages in Developing Countries, The Economic Journal 114, pp. F73-F96.

Ahmed, S. and Sattar, Z. (2004), Trade Liberalization, Growth and Poverty Reduction: The Case of Bangladesh, World Bank, Washington DC.

Andriamananjara, S. and Nash, J. (1997), Have Trade Policy Reforms Led to Greater Openness in Developing Countries?, Policy Research Working Paper, No. 1730, World Bank, Washington DC.

Athukorala, P-C. and Rajapatirana, S. (2000), Liberalization and Industrial Transformation: Lessons from the Sri Lankan Experience, Economic Development and Cultural Change. 48, pp. 543-72.

Attanasio, O., Goldberg, P. K. and Pavcnik, N. (2004), Trade Reforms and Wage Inequality in Colombia, Journal of Development Economics, 74, pp. 331-366.

Bhaskar, V. and Khan, M. (1995), Privatization and Employment: A Study of the Jute Industry in Bangladesh, American Economic Review 85, pp. 267-273.

Bigsten, A. and Durevall, D. (2006), Openness and Wage Inequality in Kenya: 1964-2000, World Development 34, pp. 465-480.

Doornik J. and Hendry, D. (2006), Modelling Dynamic Systems, PcGive Volume II, OxMetrics 4, Timberlake Consultants, London.

Ericsson, N. R., Campos J. and Tran H., Pc-Give and David Hendry's Econometric Methodology, Revista de Econometria, 10, 1990, pp. 7-117.

Galiani, S. and Sanguinetti, P. (2003), The Impact of Trade Liberalization on Wage Inequality: Evidence from Argentina", Journal of Development Economics 72, pp. 497-513.

Goldberg, P. and Pavcnik, N. (2003), The Response of the Informal Sector to Trade Liberalization, Journal of Development Economics, 72, pp. 463-496.

Goldberg, P. and Pavcnik, N. (2004), Trade, Inequality, and Poverty: What do We Know? Evidence from Recent Trade Liberalization Episodes in Developing Countries, NBER Working Paper, No. 10593.

Hanson, G. and Harrison, A. (1999), Trade Liberalization and Wage Inequality in Mexico, Industrial and Labor Relations Review, 52, pp. 271-288.

Hossain, M, A. and Alauddin, M. (2005), Trade Liberalization in Bangladesh: The Process and its Impact on Macro Variables, Particularly Export Expansion, The Journal of Developing Areas 39, pp. 127-150.

Hossain, M. I., Hye S. A. and Ali, A. M. (1998), Structural Adjustment Policies and Labour Market in Bangladesh, Centre for Integrated Rural Development for Asia and the Pacific, Dhaka.

ILO (1999), Retraining and Redeployment of Workers Affected by Privatization in Bangladesh, International Labor Organization, 1999, Geneva.

McCulloch, N., Winters, L. A. and Xavier, C. (2002), Trade Liberalization and Poverty: A Handbook, DFID, UK.

Mondal, A.H., (1992), Trade Unionism, Wages and Labour Productivity in the Manufacturing Sector of Bangladesh, Bangladesh Institute of Development Studies (BIDS) Research Report, No.133. , Dhaka.

Mishra, P. and Kumar, U. (2005), Trade Liberalization and Wage Inequality: Evidence from India, IMF Working Paper, No. 5.

Mujeri, M., Shahabuddin, Q. and Ahmed, S.(1993), Macroeconomic Performance, Structural Adjustments and Equity: A Framework for Analysis of Macro-Micro Transmission Mechanisms in Bangladesh; In 'Monitoring Adjustment and Poverty in Bangladesh, Report on the Framework Project, Centre for Integrated Rural Development for Asia and the Pacific, Dhaka.

Mujeri, M. and Khondker, B. (2002), Decomposing Wage Inequality Change in Bangladesh: An Application of Double Calibration Technique, DFID, 2002, UK.

Nordås, H. K. (2004), The Global Textile and Clothing Industry Post the Agreement on Textiles and Clothing", WTO Discussion Paper, No. 5, World Trade Organization, Geneva.

Perrron, P. (1997), Further Evidence from Breaking Trend Functions in Macroeconomic Variables, Journal of Econometrics 80, pp. 355-385.

Rama, M., "The Labor Market and Trade Reform in Manufacturing, In Connolly, M. and de Melo, J. (Eds.), The Effects of Protectionism on a Small Country, World Bank Regional and Sectoral Studies, 1994, Washington, DC.

Rashid, M. A. (1993), Bangladesh: Output and Employment Effects of Recent Macroeconomic Policy Reforms, in ILO-ARTEP, Social Dimensions of Economic Reforms in Bangladesh, Proceedings of the National Tripartite Workshop, Dhaka, Bangladesh.

Rashid, M. A.(2000), Impact of Trade Policy Reforms on Industrial Capacity and Employment in Bangladesh, Report prepared for Structural Adjustment Participatory Review Initiative, Dhaka, Bangladesh.

Sachs, J. and Warner, A. (1995), Economic Reform and the Process of Global Integration, Brookings Papers of Economic Activity, pp. 1-118.

Samuelson, P.A. (1953), Prices of Factors and Goods in General Equilibrium, Review of Economic Studies, 21, 1pp. 1-20.

Sobhan, R. (1991), Structural Adjustment Policies in the Third World: Design and Experience, University Press Limited, Dhaka.

Stolper, W. and Samuelson, P. A. (1941), Protection and Real Wages, Review of Economic Studies 9, pp. 51-68.

Wacziarg, R. and Welch, K. H. (2003), Trade Liberalization and Growth: New Evidence, NBER Working Paper No. 10152.

WIDER (2007), WIDER World Income Inequality Database V 2.0b May. Available online: http://www.wider.unu.edu/wiid/wiid.htm

Williamson, J. (1997), Globalization and Inequality, Past and Present, World Bank Research Observer, 12, pp. 117-35.

Wood, A. (1994), North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-driven World, Oxford University Press.

Wood, A.(1997), Openness and Wage Inequality in Developing Countries: The Latin American Challenge to East Asian Conventional Wisdom, The World Bank Economic Review 11, pp. 33-57.

World Bank (2000), Bangladesh Trade Liberalization: It's Pace and Impacts, World Bank, Washington DC.

WTO (2000), Trade Policy Review of Bangladesh, WTO working paper, World Trade Organization, Geneva.

APPENDIX

Table A1: The general model (1973-2002)

Variable	*Lnrwsk*	*Lnrwsk*
$Lnrwsk_{t-1}$	0.393**	-0.127
	(0.17)	(0.14)
$Lnrwusk_{t-1}$	0.089	0.654***
	(0.21)	(0.18)
$Lnpdy_t$	-0.017	-0.113
	(0.18)	(0.15)
$Lnpdy_{t-1}$	-0.054	-0.002
	(0.09)	(0.08)
$Lncap_t$	0.026	0.176
	(0.27)	(0.23)
$Lncap_{t-1}$	0.325	0.148
	(0.27)	(0.23)
$Lnopen1_t$	0.333**	0.351**
	(0.14)	(0.12)
$Lnopen_{t-1}$	0.099	0.155
	(0.15)	(0.13)
D75	-0.504***	-0.443***
	(0.08)	(0.07)
D78	-0.055	-0.231***
	(0.07)	(0.06)
D86	0.264***	0.036
	(0.07)	(0.06)
Constant	0.120	0.212
	(1.37)	(1.18)

Correlation of structural residuals (standard deviations on diagonal)

	Lnrwsk	*Lnrwusk*
Lnrwsk	0.06	0.71
Lnrwusk	0.71	0.05

Vector Portmanteau(4): 7.13

Vector EGE-AR 1-2 test F (8, 26) = 0.44 [0.88]

Vector Normality test χ^2 (4) = 5.13 [0.27]

Vector hetero test χ^2 (57) = 51.80 [0.67]

Note. Standard errors in parentheses. *** and ** denote statistical significance at the 1% and 5% level respectively.

Table A2: The preferred model including the price variables (1974-2002)

Variable	*Lnrwsk*	*Lnrwsk*
$Lnrwsk_{t-1}$	0.478***	0.455***
	(0.07)	(0.07)
$Lncap_t$	0.234*	0.304***
	(0.13)	(0.11)
$Lnopen1_t$	0.305***	0.326***
	(0.11)	(0.09)
D75	-0.541***	-0.471***
	(0.07)	(0.06)
D86	0.221***	-0.174***
	(0.04)	(0.04)
$Lnyrp_t$	-0.214*	-0.213**
	(0.12)	(0.11)
$Lnfrp_t$	-0.031	0.034
	(0.06)	(0.06)
Constant	1.793	1.038
	(1.18)	(1.00)

Correlation of structural residuals (standard deviations on diagonal)

	Lnrwsk	*Lnrwusk*
Lnrwsk	0.06	0.71
Lnrwusk	0.71	0.05

Vector Portmanteau(4): 7.13

Vector EGE-AR 1-2 test F (8, 32) = 0.64 [0.74]

Vector Normality test $\chi^2(4) =$ 9.08 [0.06]

Note. Standard errors in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Table A3: The preferred model with the openness measure *open2* (1973-2002)

Variable	*Lnrwsk*	*Lnrwusk*
$Lnrwsk_{t-1}$	0.404***	0.383***
	(0.05)	(0.04)
$Lncap_t$	0.325***	0.349***
	(0.09)	(0.07)
D75	-0.326***	-0.258***
	(0.06)	(0.05)
D86	0.218***	-0.200***
	(0.04)	(0.03)
$Lnopen2_t$	0.280***	0.305***
	(0.05)	(0.04)
Constant	-0.590	-0.888**
	(0.53)	(0.39)

Note: Standard errors in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Table A4: Preferred model with the openness measure *open3 (1973*-2002)

Variable	*Lnrwsk*	*Lnrwusk*
$Lnrwsk_{t-1}$	0.383***	0.340***
	(0.05)	(0.04)
$Lnopen3_t$	0.206***	0.249***
	(0.04)	(0.03)
$Lncap_t$	0.319***	0.314**’
	(0.10)	(0.06)
D75	-0.489***	-0.437***
	(0.06)	(0.04)
D86	0.206***	-0.225***
	(0.04)	(0.03)
Constant	0.913	1.08**
	(0.77)	(0.47)

Note: Standard errors in parentheses. *** and ** denote statistical significance at the 1% and 5% level respectively.

Table A5: Preferred model with the openness measure *open4* (1974-2002)

Variable	*Lnrwsk*	*Lnrwusk*
$Lnrwsk_{t-1}$	0.521***	0.496***
	(0.08)	(0.09)
$Lncap_t$	0.352**	0.383***
	(0.15)	(0.13)
D75	-0.497***	-0.450***
	(0.08)	(0.07)
D86	0.212***	-0.187***
	(0.04)	(0.03)
$Lnopen4_t$	0.078*	0.094**
	(0.05)	(0.04)
Constant	-0.193	-0.377
	(1.00)	(0.88)

Note: Standard errors in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

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Essay 2

Does openness reduce wage inequality in developing countries? Panel data evidence from Bangladesh

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Abstract

This paper provides panel data evidence on trade liberalization and wage inequality in Bangladesh. Using several standard econometric models, wage equations for skilled and unskilled workers in the formal manufacturing sector are estimated for the 1975-2002 period. The results, particularly the estimates from a dynamic fixed effects model, indicate that openness contributes to a reduction in wage inequality between skilled and unskilled workers. Although the evidence is weak, it is clear that trade liberalization has not increased the wage gap. The results also indicate that real wages of both unskilled and skilled workers increased during the period.

Key words: Bangladesh; openness; wage inequality; panel data, panel unit root; dynamic model

JEL codes: F14, F15, O15, C33

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1. Introduction

The issues of wage inequality and openness to international trade have received considerable attention in recent years. Many developing countries have undergone significant liberalization of international trade since the 1980s. A widening wage gap between skilled[1] and unskilled workers has also been observed in many of these countries (most notably in Latin American countries). A large number of studies have indicated that the greater openness has contributed to this increase (see Williamson, 1997; Arbache et al., 2004; Goldberg and Pavcnik, 2004). These findings have created an intense debate among academics and policy makers, as trade theory predicts that greater openness is instead expected to reduce wage inequality in developing countries.

The standard model used to investigate the effects of trade openness on wage inequality is the Hecksher-Ohlin-Samuelson (H-O-S) model (Samuelson, 1953), which under certain assumptions predicts a reduction in wage inequality in developing countries via the "Stolper-Samuelson effect" (Stolper and Samuelson, 1941). This effect suggests that for a given technology, trade and wages are linked through the changes in relative prices of skilled and unskilled labor-intensive products. Hence, openness to trade leads to a reduction in wage inequality in unskilled labor-intensive developing countries by raising the relative price of unskilled labor-intensive products with a consequent increase in unskilled-labor wages.

Empirical studies regarding the Stolper-Samuelson effect in the context of developing countries, however, exhibit mixed results. While the East Asian experience in

[1] The definition of skilled labor includes all professional and technical workers, managers, and craftsmen with advanced education, substantial training, or work experience (Wood, 1994).

the 1960s and 1970s is in line with this prediction (Wood, 1997), studies on Latin American countries, on the contrary, show that openness contributes to an increase in wage inequality (Beyer et al., 1999, in Chile; Galiani and Sanguinetti, 2003, in Argentina; Attanasio et al., 2004, in Colombia). Most recent evidence for India (Mishra and Kumar, 2005) and Kenya (Bigsten and Durevall, 2006), however, suggests that openness contributes to a reduction in wage inequality.

The divergent findings might be due to several reasons. Firstly, methodology and the studied time period differ among studies. Secondly, the initial levels of inequality and factor abundance, both important factors affecting wage inequality, vary among countries. For example, compared to the natural resource abundance in many Latin American countries, most Asian countries have a relative abundance of unskilled labor. Therefore, the impact of increased trade on wage inequality may differ between countries in Latin America and Asia. Finally, some of the assumptions on which the H-O-S model is based are often too restrictive for developing countries. For example, due to lack of labor reallocation across sectors, trade openness may affect wage inequality through changes in wages. However, if wages are not as flexible as the H-O-S model requires, then changes in labor demand may increase transitional unemployment or increase the size of the informal sector. There is both theoretical (Goldberg and Pavcnik, 2003) and empirical (Attanasio et al., 2004) evidence that greater openness often causes the informal sector, which constitutes a greater share of the labor force in many developing countries, to grow. Since workers are paid less in the informal sector, an increase in the size of this sector may keep real wages down and thus raise the overall wage gap between skilled and unskilled workers.

This paper adds to the literature on openness and wage inequality[2] by presenting an empirical analysis using panel data from the Bangladesh manufacturing sector. Bangladesh has a relative abundance of unskilled workers and has been pursuing trade liberalization since the 1980s. Hence it provides an interesting opportunity to analyze the issue of openness and wage inequality. A few studies on Bangladesh do exist. For example, based on a single industry time series analysis, Durevall and Munshi (2008) find that openness increases real wage for both skilled and unskilled workers while it does not affect skilled and unskilled wages differently.[3] The objective of this paper is to further investigate this issue by using panel data – an approach that produces more precise estimates and to a greater extent takes care of omitted variable biases. In this paper, four standard panel data models are estimated. The results provide some weak evidence that openness to trade reduces wage inequality in Bangladesh. The results also indicate that openness contributes to an increase in both skilled and unskilled wages. These results are robust to both the inclusion of a proxy of human capital and industry-specific prices as additional control variables.

The remainder of the paper is organized as follows. Section 2 provides an overview of Bangladesh trade policy and labor market issues. Section 3 describes the econometric modeling and the data used in the paper. Section 4 presents the empirical analyses and results, and Section 5 concludes the paper.

[2] As in many other studies, wage inequality here refers to the wage gap between skilled and unskilled workers.

[3] Using a general equilibrium approach, Mujeri and Khondker (2002) find increasing wage inequality in Bangladesh; however, they suggest that skill-biased technical change and changes in factor endowments were more important than trade in explaining the wage inequality in their study.

2. Overview of Bangladesh Trade Policy and Labor Market Issues

This section first provides an overview of the trade policy issues in Bangladesh since independence. Then it briefly discusses the issues related to the labor market.

From its first year of independence in 1971, Bangladesh followed an import substitution industrialization strategy for a decade. Trade policies were based on high tariffs and quantitative restrictions on imports, resulting in an anti-export bias. The trade liberalization process started in the mid-1980s, with the primary objective to create a neutral trade regime by reducing and ultimately eliminating the anti-export bias. Liberalization of the import regime was accomplished primarily through the removal of import bans and quantitative restrictions. To increase the competitiveness of domestic industries, customs duty was greatly reduced for raw materials and capital goods used as inputs for manufacturing exports, while it was kept high on final goods. Overall, the customs duty rate was reduced from 350% in 1991 to 37.5% in 2000 (Trade Policy Review, 2000). To increase transparency, the Harmonized System was introduced in July 1988, and the multiple-rate sales tax was replaced by a 15% value-added tax in 1992 (Trade Policy Review, 1992). Following this, the number of four digit codes subject to quantitative restrictions was reduced from 550 (26%) in 1987 to 124 (10%) in 2000.

Export promotion was also one of the main objectives of Bangladesh trade policy reform. Several measures were undertaken in order to encourage exports, including new incentives and facilities for the exporters, duty and tax free imports of inputs for exporters, creation of the Export Processing Zones, and most importantly, improvement of export policy administration. These reforms helped expand the export base mainly by increasing non-traditional exports; the remarkable success of the ready-made garments industry is an

example (Bhattacharya et al., 2002). To increase international competitiveness, a series of other reform measures were undertaken: financial sector reform, privatization, removal of restrictions on foreign direct investment, and exchange rate liberalization, just to name a few.

Like in most developing countries, Bangladesh trade reform was mostly concentrated in the manufacturing sector, which by contributing around 70 percent of export revenue is the most important foreign-exchange earner. Jute, Cotton textile, Match, Engineering, and Mustard oil are the five major industries in the manufacturing sector, and are included in this study. These industries are mostly unskilled labor-intensive, tradable, and dependent on imported raw materials. At the time of independence, they were all in the public sector, but then underwent wide-scale reform including tariff reductions and privatization. Competition has increased in the industries, and the effective rates of protection have been reduced significantly. For example, the rates for Jute declined from 64.40% in 1993 to 26.80% in 2000 (Trade Policy Review, 2000). The rationalization of the tariff structure allowed the industries to import raw materials and capital machineries at low duty rates.

The Bangladesh labor market comprises formal and informal markets. The formal sector workers constitute less than 20% of the total labor force and are mainly employed in the manufacturing sector. Wage setting is regulated by the government and has not changed much since independence. Wages in the public sector are determined and raised periodically by the ad-hoc National Pay Commission. Wages in the formal private sector are determined by collective bargaining, using government-determined wages as a reference point. In sectors where trade unions do not exist or collective bargaining fail due

to weak trade unions, minimum wages are determined based on the recommendation of the Minimum Wage Board. However, lack of organizational structure and legislative provisions are important reasons why many private sector employees are still earning less than minimum wage (Nordås, 2004). There have nevertheless been many interventions in the labor market; market forces are likely to have played an important role in determining the wages during the period of study.

3. Econometric Model and Data

This section first outlines the empirical model, and then describes the data and explains the choice of the explanatory variables used in the analysis. Finally it reports the results of the non-stationarity testing of the variables using a panel unit root test and the Augmented Dickey-Fuller (ADF) test.

To test for the impact of greater openness on the relative wages of skilled and unskilled workers, wage equations for skilled and unskilled workers are estimated separately. The choice of variables is based on economic theory and data availability. The generalized version of the model is as follows, where all the variables are measured in logarithms:

$$ws_{it} = \alpha_0 + \alpha_1 ws_{i,t-1} + \alpha_2 open_t + \alpha_3 rprice_{it} + \alpha_4 humcap_t + D_t + u_{it} \qquad (1)$$

$$wus_{it} = \beta_0 + \beta_1 wus_{i,t-1} + \beta_2 open_t + \beta_3 rprice_{it} + \beta_4 humcap_t + D_t + \eta_{it} \qquad (2)$$

.

In the above equations, ws_{it} represents the wages of skilled workers, wus_{it} the wages of unskilled workers, where i indexes individual industry in a cross section and t indexes time. The variables $ws_{i,t-1}$ and $wus_{i,t-1}$ denote the one period lag of the skilled

and unskilled wages, respectively. In both equations, $open_t$ and $rprice_{it}$ denote the level of openness and the relative price, respectively, and $humcap_t$ denotes a measure of human capital. The variable D_t denotes a time trend, whereas u_{it} and η_{it} are two disturbance terms for both equations. As usual, α_0 and β_0 are intercept terms. To test whether greater openness contributes to a reduction in wage inequality, we test whether openness increases real wages for unskilled workers relative to wages for skilled workers. If it does, one would expect that $\beta_2 - \alpha_2 > 0$. The coefficients of interest are therefore in the short run α_2 and β_2 and in the long run $\alpha_2/(1-\alpha_1)$ and $\beta_2/(1-\beta_1)$.

3.1 Data and Variable Description

The data used in this paper is a balanced panel created on real wages of skilled and unskilled workers[4] of all organized plants[5] in five manufacturing industries (Jute, Cotton textile, Match, Engineering, and Mustard oil) with 28 time series observations covering the 1975-2002 period. Real wages are measured in constant 1996 prices using the GDP deflator. As the choice of variables is often restricted due to a lack of available data, we have openness, industry-specific relative prices, and human capital as explanatory variables in our analysis. Although it would have been desirable to also include measures of productivity and capital labor ratio as explanatory variables, the lack of data availability

[4] Following Wood (1994) and the definition used by Bangladesh Bureau of Statistics, skilled workers are in this paper those who possess both professional training and skills to operate a machine, received either on-the-job or from any formal or informal training institute, and basic knowledge of repair, maintenance, and cleaning of the machine. An unskilled worker, on the other hand, does not have such professional training or skills and works as a helper to skilled workers.

[5] Organized plants are those that employ ten or more workers from the formal sector. Plant-level data, however, was not available.

restricts our ambition to do so. In the absence of long time series data on tariffs and quantitative restrictions, we use a price-based measure of openness, hereafter *open* , to examine the changes in the degree of protection. This measure is defined as the ratio of the US manufacturing price index (converted to Bangladesh currency using the official exchange rate) to the Bangladesh manufacturing price index. Import substitution policy kept manufacturing prices high in Bangladesh for more than a decade, so reduced protection is expected to result in an increase in the ratio. It would have been more appropriate to compare domestic manufacturing prices with world market prices, but in the absence of such data we use the US manufacturing price index since the US is the major trading partner of Bangladesh. A similar measure is used by Athukorala and Rajapatirana (2000) for Sri Lanka, Bigsten and Durevall (2006) for Kenya, and Durevall and Munshi (2008) for Bangladesh.[6]

According to the H-O-S assumption of perfect factor mobility, opening up leads to changes in wage inequality via changes in relative prices,[7] regardless of industries being import-competing or export-competing. However, as the specific factor model suggests, the implication is different for import-competing and export-competing industries, at least in the short run when factors are not mobile. With reduced protection, prices should fall in import-competing industries and rise in export-competing industries. Since the industries in our study are mainly import-competing and likely to have a comparative advantage in

[6] In addition to this price-based measure of openness, Durevall and Munshi (2008) use three other measures of openness: the ratio of export plus import to GDP, the ratio of aggregate export to GDP, and the ratio of imports of consumer goods to aggregate consumption. However, no statistically significant differences among their impacts on skilled and unskilled wages are found.

[7] Beyer et al. (1999) find similar evidence for this in Chile. However, Hanson and Harrison (1999) find only weak correlation between price changes and changes in trade policy for Mexico.

unskilled labor-intensive goods, reduced protection is expected to have a negative impact on prices. The industry-specific relative prices are measured as the price of output produced by each industry divided by the GDP deflator.

Generally, increases in human capital are expected to lead to higher real wages. Depending on the level of education and/or experience, human capital can have different impacts on the relative demand for skilled/unskilled workers. For example, the returns to post-secondary education play an important role compared to primary and secondary education in explaining wage inequality in some studies (see Beyer et al., 1999, for Chile; Attanasio et al., 2004, for Colombia). On the other hand, greater openness increased the demand for unskilled workers with basic general education compared to those with specialized skills in Korea and Taiwan in the 1960s and in Singapore in the 1970s, resulting in reduced wage inequality (Wood, 1997). However, in our dataset, the main distinction between skilled and unskilled workers is the years of on-the-job experience. While the requirement to be an unskilled worker (apprentice, helper) is basic general education, an unskilled worker could be promoted to a skilled worker (junior operator, operator, and senior operator) according to his years of experience. Given that a good proxy for measuring the stock of human capital is not available, we use the secondary school enrolment ratio. This proxy, however, does not capture the years of on-the-job experience, and can therefore only be regarded as a partial measure of human capital. In any case, the inclusion of this variable (human capital) serves as a robustness check of the present analysis of the impact of openness on the wage gap between skilled and unskilled workers.

Table 1 reports the descriptive statistics of the variables used in the analysis. The variables are plotted in Figures 1-4.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev	Min	Max	N
Log of skilled wage	4.2311	.2768	3.3824	5.007	140
Log of unskilled wage	3.9456	.2834	3.2196	4.584	140
Log of relative price	3.6907	.6072	2.4604	4.8728	140
Log of openness	-.0662	.1287	-.4099	.2070	140
Log of human capital	3.2561	.2191	2.8848	3.5698	140

Figure 1 depicts the real wage of skilled and unskilled workers in the five industries. Both series exhibit low growth in all five until the beginning of the liberalization process in the mid-1980s when growth started to increase. As evident in Figure 2, the openness variable too shows little growth until the mid-1980s and an increasing trend thereafter, especially in the late 1990s. The relative prices are displayed in Figure 3; all sectors except Mustard oil show high variability throughout the period. The human capital proxy, depicted in Figure 4, shows an increasing trend starting in 1977.

Figure 1. Real Wages, skilled(sk) and unskilled(usk), in Five Industries (1975-2002)

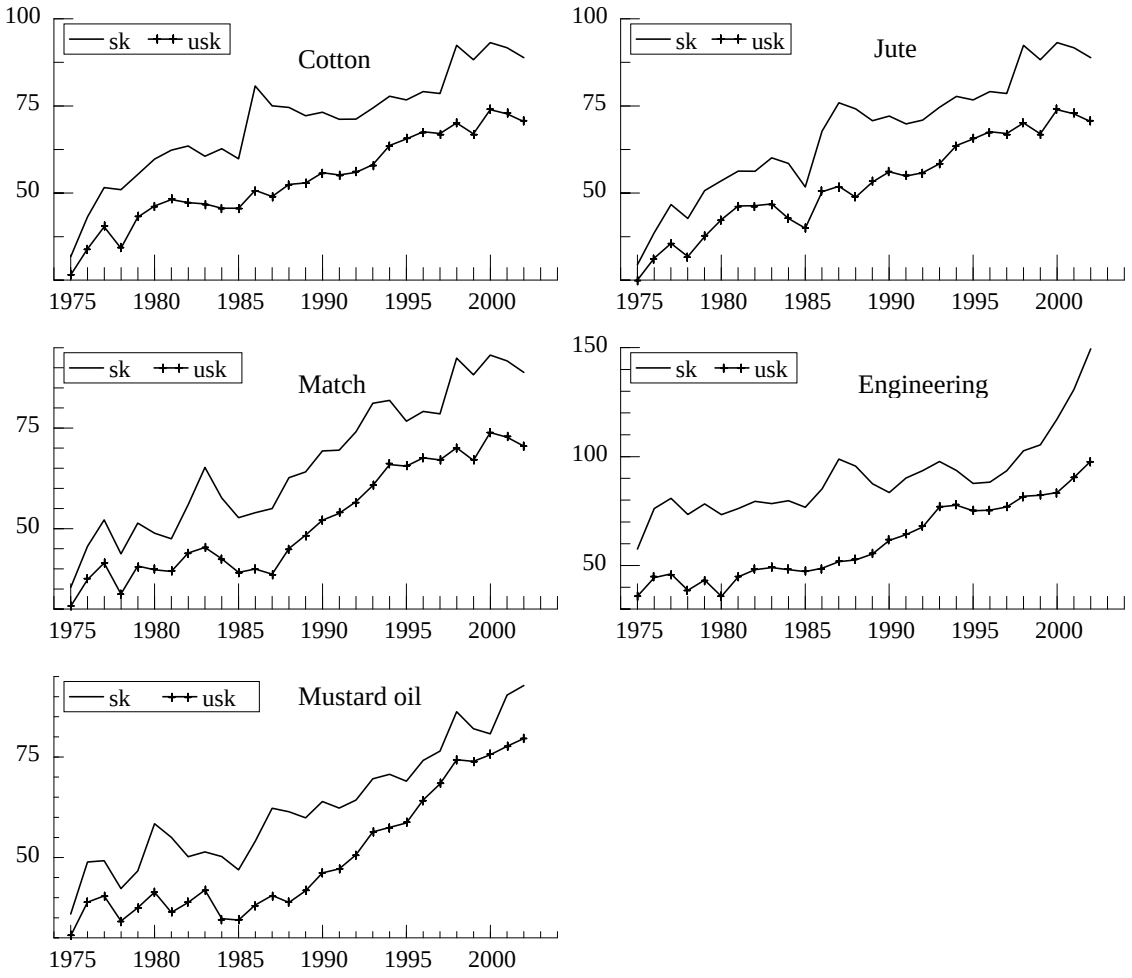


Figure 2. Openness Measure (log)

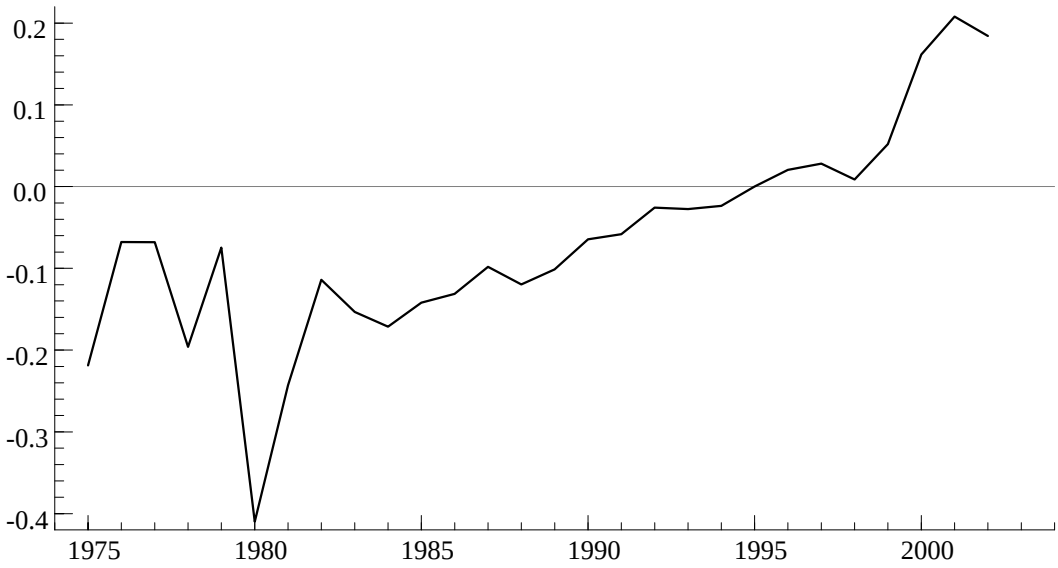


Figure 3. Relative Price (log) Movement in Five Industries

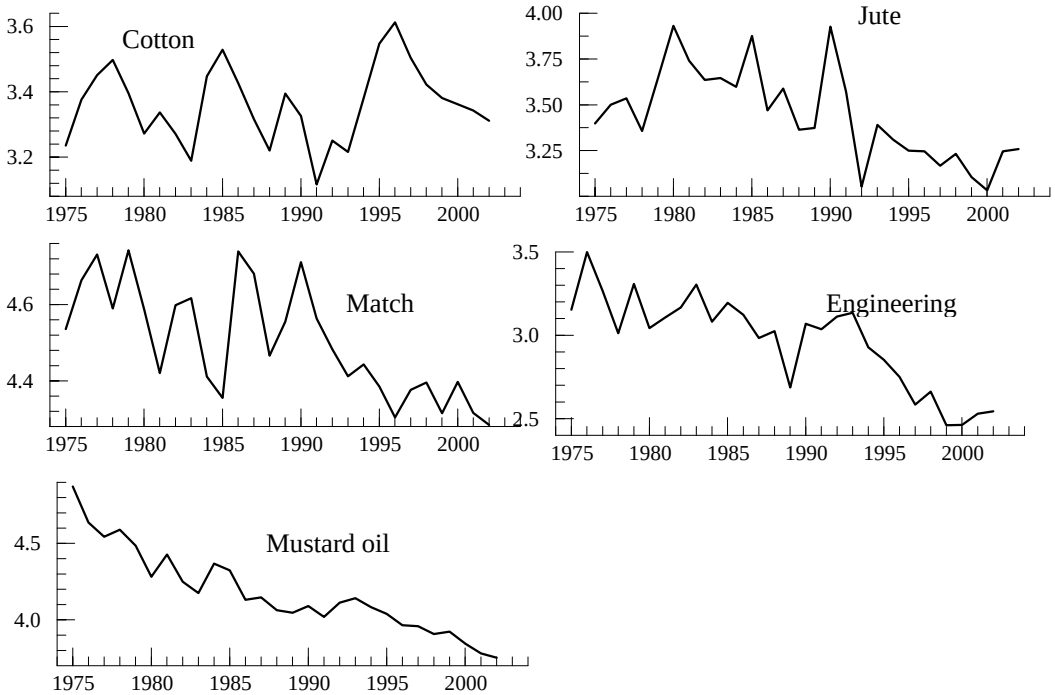
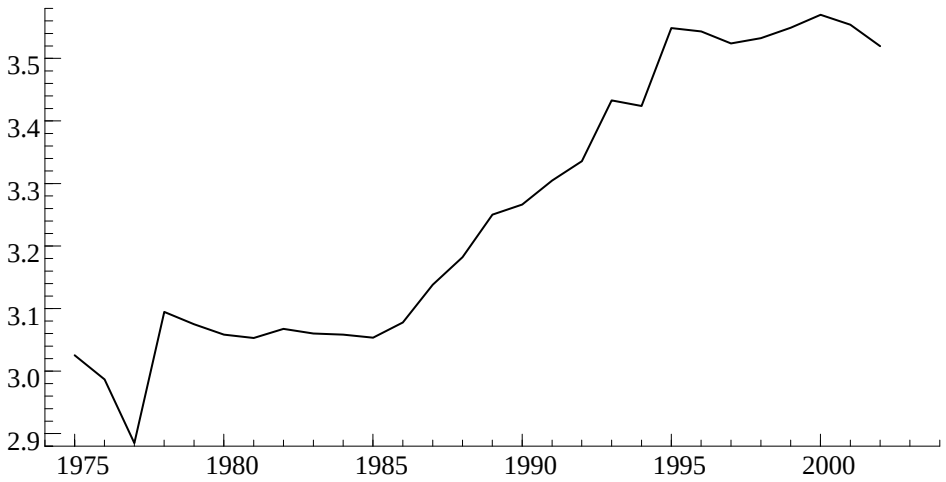


Figure 4. Log of Human Capital (proxy)



3.2 Unit root test

Given that most of the variables described above exhibit trends, we formally test for the presence of unit roots before proceeding with the econometric analysis. The panel unit root test[8] designed by Levin, Lin, and Chu (2002), the Levin-Lin test, is used to test for stationarity of the three panel data series, i.e., log of skilled wage, log of unskilled wage, and log of relative price. For the two variables that lack cross-section observations, i.e., log of openness and log of human capital proxy, the ADF test is used instead. The Levin–Lin test is designed for balanced panels and works very well even in panels with relatively small dimensions, and hence it is appropriate in our case. Furthermore, it allows for individual effects, time effects, and a time trend, and evaluates the null hypothesis that each time series has unit root against the alternative hypothesis that each time series is

[8] The conventional unit root tests such as the Augmented Dickey-Fuller test or Phillips-Peron tests have low power, especially if the sample size is small (Maddala and Kim 1998). Panel data unit root test, on the other hand, is able to increase the power of unit root tests by combining time series with cross-section observations. See for example Breitung and Pesaran (2005) for a review of several methods to test panel unit root.

stationary. To allow for serial correlation, lags of the dependent variable are introduced and hence the model may be viewed as an ADF test. The test statistics for the Levin-Lin panel unit root test are reported in Table 2.

Table 2. Levin-Lin Test Statistics for a Panel Unit Root Test

Variable	Test statistics
Log of skilled wages	-5.923**
Log of unskilled wages	-6.242***
Log of relative price	-7.753***

Notes: The time period is 1975-2002. One period lag is included. All the regressions contain an intercept and a time trend. *** and ** denote statistical significance at the 1% and 5% level respectively.

Out of the three panel variables, the test statistics are significant for two (log of unskilled wages and log of relative price) at the 1% level, rejecting the null hypothesis of unit root. Log of skilled wages is significant at the 5% level. It is therefore evident that all three variables are stationary around a trend. For log of openness and log of human capital, we apply the ADF test with an intercept and a deterministic trend – see Table 3 for results.

Table 3. The ADF Test Statistics for a Unit Root Test

Variable	Lags	t-ADF	Estimated root
Log of openness	0	-4.00**	0.26
Log of human capital	0	-2.331	0.60

Notes: The time period is 1975-2002. All regressions contain an intercept and a time trend.
The superscripts *** and ** denote statistical significance at the 1% and 5% level respectively.

The test statistics indicate that the log of openness series is significant at the 5% level, whereas log of human capital is not significant. However, since the estimated root for the latter is only 0.60, we proceed under the assumption that there is no unit root in any of the series.

4. Empirical Analysis

There are several econometric models for analyzing panel data and, depending on the assumptions about unobserved effects, all have relative advantages and disadvantages. In this paper, four standard models are used to estimate the wage equations: the ordinary least square method (OLS), the fixed effects method (FE), the dynamic FE method and the two-stage least square method (2SLS).

We first estimate a simple non-dynamic specification of equations (1) and (2) with OLS and FE, where log of skilled wages and log of unskilled wages are regressed on only the key explanatory variable openness and on a time trend. We then estimate a simple dynamic specification of both equations with the dynamic FE and 2SLS methods, where a one period lag of the dependent variable is added as an explanatory variable, together with openness and a time trend. The results are reported in Table 4. Finally we estimate the non-

dynamic and the dynamic specifications of both equations by adding two other explanatory variables: log of relative price and log of human capital. The results are reported in Table 5.

Tables 4 and 5 present the pooled OLS, as a baseline model, in Column 2 and Column 6 for skilled and unskilled workers respectively. The coefficients for most of the variables are insignificant, probably due to omitted industry fixed effects. The FE estimator takes care of this problem by eliminating the unobserved heterogeneity across industries provided that the omitted variables are time-invariant.

Tables 4 and 5 report the non-dynamic FE estimates in Column 3 and Column 7 for skilled and unskilled workers respectively. Here openness does not have a significant effect on skilled and unskilled wages in the base specifications (i.e. without additional control variables) (see Table 4). However, when adding relative price and human capital in the model (Table 5), the coefficient for openness in the unskilled wage equation becomes positive and statistically significant (Table 5, Column 7).

Table 4. Estimated Wage Equations for Bangladesh Manufacturing Industries (1)

Dependent Variable	Skilled wages				Unskilled wages			
Regression method	(2) OLS	(3) FE	(4) Dynamic FE	(5) 2SLS	(6) OLS	(7) FE	(8) Dynamic FE	(9) 2SLS
Openness	-0.032	-0.032	0.180**	0.223	0.178	0.178	0.286***	0.482**
	(0.196)	(0.113)	(0.084)	(0.171)	(0.218)	(0.101)	(0.079)	(0.123
Lagged skilled wages			0.456*** (0.065)	0.541*** (0.079)				
Lagged unskilled wages							0.536*** (0.069)	0.573*** (0.074)
R Square	0.63	0.83	0.89		0.85	0.90	0.92	
N	140	140	135	130	140	140	135	130

Notes: All variables are measured in logarithms. A linear time trend and a constant are included in the regressions. Robust standard errors in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Table 5. Estimated Wage Equations for Bangladesh Manufacturing Industries (2)

Dependent Variable	Skilled wages				Unskilled wages			
Regression method	(2) OLS	(3) FE	(4) Dynamic FE	(5) 2SLS	(6) OLS	(7) FE	(8) Dynamic FE	(9) 2SLS
Openness	-0.015	-0.017	0.176**	0.156	0.173	0.172*	0.278***	0.416***
	(0.219)	(0.107)	(0.085)	(0.152)	(0.229)	(0.100)	(0.079)	(0.085)
Relative price	-0.157	0.076	0.007	0.033	-0.082*	0.062	0.015	0.032
	(0.076)	(0.049)	(0.04)	(0.059)	(0.035)	(0.046)	(0..039)	(0.073)
Human capital	-0.511*	-0.468***	-0.142	-0.392***	0.082*	0.178	0.197**	-0.399**
	(0.207)	(0.122)	(0.099)	(0.058)	(0.036)	(0.114)	(0.097)	(0.094)
Lagged skilled wages			0.442***	0.451***				
			(0.066)	(0.076)				
Lagged unskilled wages							0.506***	0.512***
							(0.07)	(0.123)
R Square	0.765				0.876			
N	140	140	135	130	140	140	135	130

Notes: All variables are measured in logarithms. A linear time trend and a constant are included in the regressions. Robust standard errors in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

As current wage levels often depend on past wage levels, one would prefer to estimate a dynamic model by adding a lagged dependent variable as an explanatory variable. In that case the strict exogeneity assumption is violated, and estimating a dynamic FE model may produce biased estimates due to the presence of correlation between the lagged dependent variable and the disturbance term. However, in a panel with a large time series dimension (a large T), as in our case, the bias is likely to be small (see Bond, 2002), and hence we estimate a dynamic FE model after all. Nevertheless, as a robustness check, we use the instrumental variable approach and estimate the model with the 2SLS method to

account for the endogeneity of the lagged dependent variable.[9] It is difficult to find suitable instruments, but we use the lagged dependent variable as an instrument for the differenced dependent variable. The results from the dynamic FE and the 2SLS methods are presented in Tables 4 and 5 (Columns 4 and 5 for skilled workers and Columns 8 and 9 for unskilled workers). As observed, the large standard errors for the openness coefficient from the 2SLS estimation indicate that they are less precise than the dynamic FE estimates. This might be due to using weak instruments. We therefore prefer the dynamic FE estimates and hence focus on those results (Tables 4 and 5, Columns 4 and 8) in the following discussions.

In both the basic and the general specifications, respectively in Table 4 and Table 5, we find that the coefficients for the lagged dependent variables are large and statistically significant (Column 4 and Column 8 for skilled and unskilled workers respectively). This suggests that the dynamics of the equations are important. The coefficients for the openness variable are, as expected, significant and positive for both skilled and unskilled wages in both the basic and the general specifications of the model. Importantly, the increase is larger in magnitude for unskilled workers than for skilled workers; the coefficients are, for instance, 0.278 (Table 5, Column 8) and 0.176 (Table 5, Column 4) for unskilled and skilled wages respectively. The wage increase is even larger when we calculate the same openness coefficients for a steady state of the model: 0.562 and 0.315, respectively. This implies that a 1% increase in openness increases unskilled wages by about 0.3% in the short

[9] The difference GMM by Arellano and Bond (1991) was also used, employing second lag of the dependent variable as an instrument for the differenced dependent variable. The estimator, however, provided less precise estimates and hence the results are not reported here.

run and by about 0.6% in the long run. For skilled workers, the short- and long-run increases are about 0.2% and 0.3%, respectively. However, based on a Z test we can not reject the null hypothesis of equality of the openness coefficients from the dynamic FE specification as reported in Columns 4 and 8 of Table 5 (p-value >0.10), implying that the larger increase in unskilled than skilled wages is not statistically significant at conventional levels.

The coefficients for relative prices are insignificant (Table 5, Columns 4 and 8), which may suggest that openness has increased real wages through channels other than price changes. The coefficient for the human capital proxy is found to be statistically insignificant for skilled wages but significant for unskilled wages. We do not have a good explanation for this. It should be mentioned here that the measure of human capital used in our analysis is partial and does not fully capture the stock of human capital. However, the main results for the openness coefficient remain unchanged with the inclusion of the human capital and relative price variables (Table 5, Columns 4 and 8), which indicates that our main finding regarding the impact of openness on real wage of skilled and unskilled workers is robust.

5. Conclusions

The findings in this paper, based on a panel data analysis, indicate some weak evidence that trade openness contributes to a reduction in wage inequality between skilled and unskilled workers in the Bangladesh manufacturing sector. The results also suggest that wages for both skilled and unskilled workers increase, possibly caused by the overall productivity increase resulting from the liberalization-induced increase in competition. The results are

broadly consistent with previous findings in Asia and Africa (Durevall and Munshi, 2008; Bigsten and Durevall, 2006; Mishra and Kumar, 2005), but different from those in many other developing countries. Regarding the previously mentioned Latin American experience, increased wage inequality was mostly due to an increased demand for skilled labor (Esquivel and Rodriguez-Lopez, 2003; Sanchez-Paramo and Schady, 2003; Attanasio et al., 2004). This is in contrast to the East Asian experience of increased demand for unskilled workers which contributed to a reduction in wage inequality (Wood, 1997). The reduction in wage inequality in the Bangladesh manufacturing sector was possibly due to a similar increased demand for unskilled workers. The increased inflow of foreign direct investments (FDI) in the 1990s may also have influenced the wage gap reduction in our case. However, we could not test this as the inclusion of FDI inflow as an explanatory variable would substantially reduce our estimation sample.

Given their potential role in explaining skilled-unskilled wage inequality, the incorporation of other issues into the analysis, such as informal sector, technological progress, inflow of FDI, and extent of privatization, could provide additional insight. However, lack of data restricts our ambition to analyze their effects. Future research should focus on the above issues, given that more and more countries are pursuing trade liberalization.

References

Arbache, J.S., Dickerson, S., and Green, F. (2004), Trade Liberalization and Wages in Developing Countries, Economic Journal 114, F73-F96.

Arellano, M. and Bond, S. (1991), Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, Review of Economic Studies, 58, 277-297.

Athukorala, P-C. and Rajapatirana, S. (2000), Liberalization and Industrial Transformation: Lessons from the Sri Lankan Experience, Economic Development and Cultural Change, 48(3), 543-72.

Attanasio, O., Goldberg, P. K., Pavcnik, N. (2004), Trade Reforms and Wage Inequality in Colombia, Journal of Development Economics, 74, 331-366

Beyer, H., Rojas, P. and Vergara, R. (1999), Trade Liberalization and Wage Inequality, Journal of Development Economics, 59, 103-123.

Bhattacharya, D., Rahman, M., and Raihan, A. (2002), Contribution of the RMG Sector to the Bangladesh Economy, Paper 50, Centre for Policy Dialogue, Dhaka, October.

Bigsten, A. and Durevall, D. (2006), Openness and Wage Inequality in Kenya: 1964-2000, World Development, 34(3), 465-480.

Breitung, J. and Pesaran, M. (2005), Unit Roots and Cointegration in Panels, Cambridge Working Papers in Economics 0528, Faculty of Economics, University of Cambridge.

Bond, Stephen (2002), Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice, cemmap working paper CWP09/02, The Institute for Fiscal Studies, UCL, UK

Currie, J. and Harrison, A. (1997), Trade Reform and Labor Market Adjustment In Morocco, Journal of Labor economics, 15, S44-71.

Durevall, D. and Munshi, F. (2008), Trade Liberalization and Wage Inequality: Empirical Evidence from Bangladesh, Department of Economics, Göteborg University, Sweden.

Esquivel, G. and Rodriguez-Lopez, J.A. (2003), Technology, trade, and wage inequality in Mexico before and after NAFTA, Journal of Development Economics, 72, 543-565.

Feliciano, Z. (2001), Workers and trade liberalization: The impact of trade reforms in Mexico on wages and employment, Industrial and Labor Relations Review, 55(1), 95-115.

Galiani, S., and Sanguinetti, P. (2003), The Impact of Trade Liberalization on Wage Inequality: Evidence from Argentina, Journal of Development Economics, 72, 497-513.

Goldberg, P., and Pavcnik, N. (2003), The Response of the Informal Sector to Trade Liberalization, Journal of Development Economics, 72, 463-496.

Goldberg, P., and Pavcnik, N. (2004), Trade, Inequality, and Poverty: What Do We Know? Evidence from Recent Trade Liberalization Episodes in Developing Countries, NBER Working Paper, No. 10593.

Hanson, G., and Harrison, A. (1999), Trade Liberalization and Wage Inequality in Mexico, Industrial and Labor Relations Review, 52 (2), 271-288.

Levin, L. A., Lin, C.F., and Chu, C. (2002), Unit root tests in panel data: asymptotic and finite sample properties, Journal of Econometrics, 108, 1-24.

Maddala, G.S. and Kim, I.M. (1998), Unit Roots, Cointegration and Structural Change, Cambridge University Press.

Mishra, P. and Kumar, U. (2005), Trade Liberalization and Wage Inequality: Evidence from India, IMF Working Paper No.05/20.

Mujeri, M. and Khondker, B. (2002), "Decomposing Wage Inequality Change in Bangladesh: An Application of Double Calibration Technique", DFID, UK.

Nordås, H.K. (2004), The Global Textile and Clothing Industry Post the Agreement on Textiles and Clothing, WTO discussion paper, No. 5, 2004, World Trade Organization, Geneva.

Sanchez-Paramo, C. and Schady, N. (2003), Off and Running? Technology, Trade, and the Rising Demand for Skilled Workers in Latin America, World Bank Policy Research Working Paper 3015, Washington, DC, World Bank.

Samuelson, P.A (1953), Prices of Factors and Goods in General Equilibrium, Review of Economic Studies, 21, 1-20.

Stolper, W. and Samuelson, P. A. (1941), Protection and Real Wages, Review of Economic Studies, 9(1), 51-68.

Trade Policy Review of Bangladesh (1992), World Trade Organization, Geneva.

Trade Policy Review of Bangladesh (2000), World Trade Organization, Geneva.

Williamson, J. (1997), Globalization and Inequality, Past and Present, World Bank Research Observer Vol.12, 1997, pp.117-35.

Wood, A. (1994), North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-driven World, Oxford University Press.

Wood, A (1997), Openness and Wage Inequality in Developing Countries: The Latin American Challenge to East Asian Conventional Wisdom, The World Bank Economic Review 11(1), 33-57.

Essay 3

Globalization and Inter-occupational Inequality in a Panel of Countries: 1983-2003

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Abstract

How does globalization affect inter-occupational wage inequality within countries? This paper empirically examines this issue by focusing on two dimensions of globalization, openness to trade and openness to capital, using a relatively new dataset on occupational wages. Estimates from dynamic models for 52 countries for the 1983-2002 period suggest that openness to trade contributes to an increase in occupational wage inequality within developed countries, but that the effect diminishes with an increased level of development. In the context of developing countries, the results suggest that the effect of openness to trade on wage inequality is insignificant and does not vary with the level of development. Our results also suggest that openness to capital does not affect occupational wage inequality in either developed or developing countries.

Key words: openness to trade; openness to capital; foreign direct investment; occupational wage inequality; panel data; dynamic model.

JEL codes: F15, F16, F23, J31, C33

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1. Introduction

Occupational wage inequality has increased in many developed and developing countries in the last two decades. Hence, there has been a growing debate whether globalization has contributed to the increase in wage inequality in these countries (for developed countries see Slaughter and Swagel, 1997, and Schott, 2001; for developing countries see Goldberg and Pavcnik, 2007, and Anderson, 2005; and for both developed and developing countries see Majid, 2004, and Milanovic and Squire, 2005). According to the standard Hecksher-Ohlin-Samuelson (H-O-S) model (Samuelson, 1953), increased trade may increase occupational wage inequality in developed countries but is expected to decrease inequality in developing countries.

Globalization has many different dimensions; outsourcing, immigration, and mobility of goods, services, and capital are some aspects that have been subject to empirical analysis. Analyses of globalization and wage inequality have historically been limited to single-country analysis as there has been no generally accepted comparable data on occupational wages across countries. However, recently the Occupational Wages around the World (OWW) database, which includes both cross-section and time series observations, became available.[1] It is a huge country-occupation-time matrix containing occupational wages for 164 occupations in more than 150 countries during the 1983-2003 period. Few studies analyzing the impact of globalization on wage inequality across

[1] The dataset can be accessed at the National Bureau of Economics Research (NBER) website http://www.nber.com. Another database, the University of Texas Inequality Project (UTIP), provides information on inter-industrial wage differential for 90 countries over the 1975-99 period. The dataset can be accessed at http://utip.gov.utexas.edu/

countries have since obtained evidence contrary to the predictions of the H-O-S theory (Majid, 2004; Milanovic and Squire, 2005).

In this paper, we further explore how increased trade and capital flows affect inter-occupational wage inequality across countries by using OWW data for 52 developed and developing countries covering the entire OWW period, i.e., 1983-2003. Compared to previous studies, we cover a relatively recent period when increased capital flows played an important role in the globalization process. We measure occupational wage inequality (or wage gap) as the ratio of wages of skilled to unskilled workers. Occupations are classified as skilled or unskilled based on educational attainment, which follows the International Standard Classification of Occupations 1988 (ISCO-1988). Given that the standard trade theory (Samuelson, 1953) predicts that increased openness increases wage inequality in developed countries and decreases wage inequality in developing countries, we perform a separate analysis for these two groups of countries by estimating several econometric models of both dynamic and non-dynamic character.

The results support the theoretical predictions regarding developed countries: openness to trade does contribute to an increase in occupational wage inequality by increasing the wage gap. The results also suggest that the increased inequality is more evident in developed countries found at the relatively lower levels of development (e.g., Portugal) and that the increase in wage inequality diminishes with increasing levels of development (e.g., Canada). In the context of developing countries, however, our results suggest that openness has an insignificant impact on wage inequality and that the effect of openness does not vary with the level of development. The results also suggest an

insignificant impact of openness to capital on occupational wage inequality in both developed and developing countries.

The remainder of the paper proceeds as follows. Section 2 presents a review of standard theory and relevant empirical literature on globalization and occupational wage inequality, and Section 3 presents a description of the econometric model and data used in the paper. Section 4 presents the econometric analysis and the results, and Section 5 concludes the paper.

2. Globalization and Occupational Wage Inequality

The standard model used to investigate the effects of openness to trade on wage inequality is the already mentioned H-O-S model (Samuelson, 1953), which is based on some quite restrictive assumptions[2] that are often not able to capture reality. However, the simple prediction of the model is intuitive and widely used in empirical studies to analyze the distributional effects of greater openness to trade. According to the model, unskilled labor-intensive developing countries will tend to specialize and export unskilled labor-intensive products while skilled labor-intensive and capital-endowed developed countries will specialize and export skilled labor-intensive products. Thus, increased trade, via the Stolper-Samuelson effect (Stolper and Samuelson, 1941), should raise the wages of unskilled workers in developing countries and of skilled workers in developed countries. Hence, under certain assumptions, the model predicts a reduction in wage inequality in developing countries and vice versa in developed countries.

[2] See Goldberg and Pavcnik (2007) for a discussion on the shortcomings of the H-O-S model.

One example of the restrictive assumptions of the H-O-S model is the immobility of capital between countries, although trade liberalization is often accompanied by policies targeted to liberalize capital markets. In fact, the increased capital flows that began in the 1990s are along with trade playing an increasingly important role in the globalization process. The empirical evidence so far provides mixed views of the impact of increased trade and capital on wage inequality.[3] While increased trade may reduce wage inequality, increased capital flows, particularly foreign direct investment (FDI), may cause it to increase in a particular country. In a worst case scenario they may actually both increase wage inequality.

Capital is expected to flow to capital-scarce developing countries where the marginal product of capital is high (Mundell, 1957). Feenstra and Hanson (1995) develop a theoretical model to show that a flow of capital from North (a rich country) to South (a poor country) raises the relative wage of skilled workers in both countries. Depending on the nature of foreign investment and the level of development of the recipient country, wage inequality may either increase (see Taylor and Driffield, 2000, for evidence in the UK) or decrease (see Haddad and Harrison, 1993, for evidence in Morocco).[4]

Although labor markets in developed countries are relatively more integrated than in developing countries, perfect mobility of labor between sectors, as is assumed in the H-O-S model, is not realistic. Labor market rigidity causes a lack of labor reallocation between sectors, and greater openness should then affect wage inequality through changes

[3] For developed countries see Slaughter and Swagel (1997) and Schott (2001). For developing countries see Anderson (2005) and Goldberg and Pavcnik (2007).
[4] See Slaughter (2002) for a discussion on several channels through which FDI can stimulate the demand for skilled workers.

in wages.[5] However, if wages are not as flexible as the H-O-S model requires, then changes in labor demand may increase transitional unemployment or increase the size of the informal sector. This potential problem of globalization has gained a lot of media and political attention.[6] Since workers are paid less in the informal sector, an increase in its size may keep real wages down, thus raising wage inequality.

There are several other important channels as well through which globalization may affect occupational wage inequality. A large number of studies have pointed to skilled-biased technological change (SBTC), linked to openness to international trade and capital either directly or indirectly, as one of the most important factors causing wage inequality to rise (Behrman et al., 2000; Esquivel and Rodriguez-Lopez, 2003; Pavcnik, 2003; Attanasio et al., 2004). Another channel through which globalization may affect wage inequality is the recent increase in outsourcing or trade in intermediate goods and services. Feenstra and Hanson (1999) find that in the 1979-1990 period, outsourcing was responsible for 17.5% to 40% of the increase in the relative wages of US non-production workers. In the general equilibrium model by Ekholm and Ulltveit-Moe (2007), the effect of offshoring (outsourcing abroad) depends on the relative influence of two forces: vertical specialization and competition. Greater vertical specialization may increase the skill premium and therefore wage inequality in industrialized countries. On the other hand, increased competition may reduce the wage premium and therefore wage inequality in these same countries. The recent fall in relative wages in US manufacturing was according to Ekholm and Ulltveit-Moe (2007) due to the dominance of the second force.

[5] A number of studies have reported a lack of labor relocation in developing countries. For example, Currie and Harrison (1997), Hansson and Harrison (1999) and Attanasio et al. (2004).
[6] See Goldberg and Pavcnik (2003) for a theoretical model and Attanasio et al. (2004) for empirical evidence.

Although a Gini coefficient is traditionally used to analyze the changes in income inequality (see Edwards, 1997; Barro, 2000; Dollar and Kraay, 2002), its use in cross-country analysis is problematic since the coverage of income sources and taxes tends to differ across countries. To avoid this problem, more recent studies use wage inequality as a measure of income inequality (e.g., Te Velde and Morrisey, 2004; Milanovic and Squire, 2005). In general, wages constitute the major portion of the incomes of individuals, and hence income and wage inequality move in the same direction. Below we discuss the relevant previous studies that used the OWW database to analyze the impacts of globalization on wage inequality in several countries. However, the discussed studies use different methodologies and cover different time period.

Most studies on inter-occupational inequality use a measure of skill differential following Freeman and Oostendorp (2000). Their measure of wage inequality is based on decile earnings in the wage distribution for each country, and on the assumption that relatively high-paid occupations are also relatively high-skilled. More exactly, Freeman and Oostendorp (2000) first order the occupations in each country according to wage level, then divide the ordering into deciles, and finally use the mean wage in each decile to calculate a measure of dispersion as the ratio of the wages in the 90^{th} percentile to the 10^{th} percentile of the wage distribution. The advantage of this measure is that it utilizes a maximum amount of data in the OWW database. However, the problem with this approach, as noted in Freeman and Oostendorp (2000), is that the number of occupations varies across countries and time, which may influence the spread of wages.

To our knowledge, only a few studies use the OWW database to analyze the impact of globalization on wage inequality (Majid, 2004; Te Velde and Morrisey, 2004; Milanovic

and Squire, 2005). Milanovic and Squire (2005) use the Gini coefficient as a measure of inter-occupational wage inequality and obtain weak evidence of reduced levels in rich countries and increased levels in poor countries in the 1984-1999 period. Majid (2004) uses standard deviation of log of wages as a measure of wage dispersion and finds increasing and decreasing wage inequality in developing and developed countries respectively in the 1983-1998 period. Measuring wage inequality as the ratio of skilled to low-skilled wage, Te Velde and Morrisey (2004) find decreasing levels in some, but not all, East Asian countries in the 1985-1998 period .

3. Econometric model and Data

This section outlines the empirical model, describes the data, and finally explains the choices of the explanatory variables used in the analysis.

The general specification of the empirical model is as follows, where the dependent variable, relative wage, is explained by openness to trade, openness to capital, and GDP per capita.

$$LnW_{it} = \alpha_1 LnW_{i,t-1} + \alpha_2 LnTRA_{it} + \alpha_3 LnCAP_{it} + \alpha_4 LnGDP_{it} + \alpha_5 LnTRA_{it} LnGDP_{it} + \alpha_6 LnCAP_{it} LnGDP_{it} + v_{it} + \mu_{it} \quad (1)$$

where LnW_{it} denotes the log of the ratio of skilled to unskilled wages in country *i* at time *t*. This ratio is the measure of inter-occupational wage inequality. The variable $LnW_{i,t-1}$ denotes a one period lag of the dependent variable, while $LnTRA_{it}$ and $LnCAP_{it}$ denote measures of openness to trade and openness to capital respectively. The coefficients of these two variables are expected to have a positive sign for developed countries and a negative sign for developing countries. The variable $LnGDP_{it}$ denotes log of GDP per

capita, used here as a proxy for the level of development. The two interaction variables, $LnTRA_{it}LnGDP_{it}$ and $LnCAP_{it}LnGDP_{it}$, denote the interaction between GDP per capita and openness to trade and the interaction between GDP per capita and openness to capital respectively. Finally, ν_i is the intercept and μ_{it} is a disturbance term where i indexes individual countries in a cross section and t indexes time.

3.1 Inter-occupational wage inequality

The International Labor Organization (ILO) has conducted a survey since 1924 called the "October Inquiry" to collect data on wages by occupation across countries. However, the data lacks comparability across occupations and countries since different countries report wages differently. While some countries report national data, others report data from major cities or urban areas, and while some countries report national averages of earnings, some report minimum wages or collectively bargained wages. Moreover, while some report multiple wage figures, others report only monthly, weekly, or daily wages. In addition, some countries report wages separately for males and females, while others report them together. The number of reported occupations also varies across countries and years.[7]

Fortunately, Freeman and Oostendorp (2000) managed to standardize the ILO October Inquiry data into the previously described OWW, where wages are reported as monthly averages for males in national currencies. The data used in this study is a subset from the OWW including 15 developed and 37 developing countries and covering the 1983-2003 period. It is an unbalanced panel in which there are several missing values. Only

[7] For a detailed description of the heterogeneity in October Inquiry data and the standardized procedure, see Freeman and Oostendorp (2000).

countries with data for at least two occupations in each of the skilled and unskilled categories for at least three consecutive years are included in the analysis.

As suggested by Freeman and Oostendorp (2000), we have used the base calibration with county-specific uniform weighting to get the nominal wages for the occupations. The occupations are found in most countries for most of the time period, and are classified as either skilled (19 occupations) or unskilled (15 occupations) according to the skill levels used in ISCO-88. The ISCO-88 uses education categories with reference to the International Standard Classification of Education 1976 (ISCED 76) to approximate skill levels.[8] Following this, an unskilled worker is at the first ISCO skill level (major group 9: elementary occupations). This corresponds to ISCED category 1 which comprises primary education. Skilled workers are at the fourth ISCO skill level (major group 2: professional) which corresponds to ISCED categories 6 and 7, which comprises a university or post graduate university degree or equivalent. A list of skilled and unskilled occupations with the corresponding ISCO-88 codes used in this paper is reported in Tables 1 and 2 of Appendix 1. Inter-occupational wage inequality is measured by the ratio of wages of skilled to unskilled workers for the same occupations in all countries.[9]

[8] However, in ISC0-88, skills necessary to perform a job can also be acquired by informal training and experience. For instance, the 2nd skill level (e.g., skilled agricultural or fishery workers/plant and machine operator) corresponds to the ISCED categories 2 and 3, which comprise the first and second stages of secondary education. Following ISCO-88, on-the-job training may supplement this education.

[9] Te Velde and Morrisey (2004) use a similar measure of wage inequality for five countries. However, they define relative wage as the ratio of the wages of skilled to low-skilled workers where low-skilled workers corresponds to first and second ISCO skill level.

3.2 Explanatory Variables

As said in the introduction, globalization has many different dimensions; outsourcing, immigration, and mobility of goods, services, and capital are some aspects that have been subject to empirical analysis. In this paper we consider two dimensions of globalization: openness to trade and openness to capital. We separate the sample into developed and developing countries, since globalization, particularly openness to trade, is expected to increase wage inequality in developed countries and reduce it in developing countries.

The pool of developed countries is made up of the 24 high-income OECD nations.[10] However, only 15 of the 24 are used in the analysis. The other nine were excluded due to several reasons. Occupational wages are not reported in the OWW for Switzerland, Greece, and Spain, and data is available for only one year for France and Luxemburg and for only two years for Ireland. No skilled occupational wages are reported for the chosen occupations in this study for Belgium and Iceland, and for Japan there is only one recorded unskilled occupational wage throughout the period.

The beginning developing countries group includes 116 low- and middle-income nations outside Europe and Central Asia and the Middle East. Although the OWW reports occupational wages for 65 of these, only 46 have wages reported for at least three consecutive years. After excluding another nine due to lack of available data on openness measures, we are left with a sample of 37 developing countries.

[10] Countries are classified according to the World Development Indicator (2006). The countries included in this study are reported in Tables 3 and 4 in Appendix, while the low-and middle-income developing countries not included in the OWW are reported in Table 5.

Satisfactory measures of openness to trade and openness to capital are still not available. Hence, while reduced tariff and non-tariff barriers generally indicate reduced trade protection, these policy variables (particularly the non-tariff barriers) are difficult to measure (although obtaining data for them is even more difficult). The most commonly used proxies for measuring the consequences of trade policies are the outcome-based measures exports and imports, or the sum of them as a percentage of GDP. An increase in the ratio over time indicates reduced trade protection. The limitation of these measures is obvious; an increase in the ratio can be influenced by other factors used in the empirical analysis, thus creating an endogeneity problem.

We use "trade as a percentage of GDP" as a proxy to measure openness to trade (Openness 1). The data for this proxy is available for large cross sections of countries and has been used in previous studies (e.g., Dollar and Kraay, 2002, and Te Velde and Morrisey, 2004). As a robustness check of our empirical analysis we also use "imports as a percentage of GDP" as an alternative openness measure (Openness 2).[11]

Previous empirical studies used foreign direct investment (FDI), i.e., either FDI inflows or FDI stock as a percentage of GDP, as a proxy for openness to capital. FDI inflow is the sum of equity capital, reinvested earnings, and intra-company loans whereas FDI stock is the sum of FDI inflows over a period of time. The FDI stock may be considered a better measure to analyze the long-run impact of FDI than the commonly used

[11] The data for two openness measures is obtained from the World Development Indicator (2006).

FDI inflow. Therefore we use FDI stock as a percentage of GDP as a proxy for openness to capital.[12]

Globalization may impact skilled and unskilled wages differently depending on a country's level of development. There are huge differences in GDP per capita (an indicator of level of development) not only between but also within the two groups of countries (developed and developing). Since each openness measure (trade and FDI) most likely interacts with GDP per capita, the empirical analysis includes two interaction variables to capture this differential effect of level of development: openness to trade interacted with GDP per capita and FDI interacted with GDP per capita.[13] Table 1 presents the descriptive statistics of the variables used in the analysis.

Table 1. Descriptive Statistics

	Developing countries(37)			Developed countries(15)		
Variables (in logarithms)	Mean	SD	N	Mean	SD	N
Relative wage (the ratio of skilled to unskilled wage)	1.04	0.550	320	0.59	0.213	207
Real GDP per capita	8.06	0.932	381	9.93	0.286	222
Trade as a percentage of GDP (Openness 1)	4.02	0.534	381	3.98	0.373	222
Imports as a percentage of GDP (Openness 2)	3.40	0.533	381	3.29	0.344	222
Foreign Direct Investment stock as a percentage of GDP (FDI)	2.30	1.094	371	2.24	0.761	222

[12] Te Velde and Morrisey (2004) have used this proxy for openness to capital. The data is available at http://www.unctad.org/fdistatistics.

[13] GDP per capita is in constant 2000 international dollars, which is obtained from the Penn World Table 6.2. The data is available at http://www.nber.com.

4. Econometric Analysis

Several models are estimated to test the impact of openness on occupational wage inequality. Lagged relative wage is added as an explanatory variable since current wage most likely depends on past wage, and a dynamic model is estimated in addition to a non-dynamic model. First a simple specification of equation (1) is estimated using the key variables openness to trade and openness to capital (FDI) as explanatory variables. The results are presented in Table 2 and Table 3 for developed and developing countries respectively. Then the model is re-estimated by adding the interaction variables. The results are reported in Table 4 and Table 5 for developed and developing countries respectively. The robustness of our results is checked by using an alternative measure of openness to trade, the results of which are reported in Tables 6 and 7.

The first two columns (Columns 2 and 3) in Table 2 and Table 3 present the pooled OLS estimates as a baseline. The results show that the coefficients for openness to trade and FDI are small and insignificant, possibly due to omitted country fixed effects. The fixed effects (FE) models are useful to control for unobserved country fixed effects. In particular, the FE estimation takes care of unobservable time-invariant heterogeneity across countries by allowing for country fixed effects. Omitted variables therefore do not pose a problem even if they are correlated with the regressors. Therefore, the FE method provides more robust estimates in the case of an incomplete model specification.[14] The estimation results from the FE specification are presented in Column 4 of Table 2 and Table 3 for developed and developing countries respectively; the openness to trade coefficient is

[14] Under certain circumstances, random effects estimators may provide more efficient estimations. Using a Hausman test (Hausman, 1978), we find that the explanatory variables are correlated with the individual effects, meaning that the random effects model will provide inconsistent estimates in our case.

positive and significant for developed countries but insignificant for developing countries. The coefficient for FDI is significant for developed countries but insignificant for developing countries. This suggests that openness to trade increases occupational wage inequality in developed countries whereas FDI (openness to capital) reduces it. However, both globalization variables have an insignificant impact on wage inequality in developing countries.

Table 2. Occupational Wage Inequality – Developed Countries

Dependent variable	Relative wage					
Regression method	(2) OLS	(3) OLS(dynamic)	(4) FE	(5) FE(dynamic)	(6) 2SLS	(7) GMM
Lagged relative wage		0.90***		0.481***	0.516**	0.460*
		(0.036)		(0.051)	(0.241)	(0.263)
Openness 1	-0.048	-0.016	0.422***	0.290***	0.257	0.179
	(0.089)	(0.026)	(0.080)	(0.069)	(0.153)	(0.225)
FDI	-0.079	-0.003	-0.099***	-0.042	-0.067*	-0.021
	(0.053)	(0.010)	(0.034)	(0.028)	(0.036)	(0.036)
Number of Observations	207	187	207 [15]	187 [15]	170	170[15]
Hansen Test (p value)						0.905
m1 (p value)						0.059
m2 (p value)						0.214

Notes: All variables are in logarithms. Robust standard errors in parentheses. Linear time trend and constant are included in the regressions. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. m1 and m2 are tests for first-order and second-order autocorrelation in the first-differenced residuals. The null hypothesis of the Hansen test is that the overidentifying restrictions are valid.

Table 3. Occupational Wage Inequality – Developing Countries

Dependent variable	Relative wage					
Regression method	(2) OLS	(3) OLS(dynamic)	(4) FE	(5) FE(dynamic)	(6) 2SLS	(7) GMM
Lagged relative wage		0.888***		0.403***	0.466	0.151
		(0.034)		(0.073)	(0.328)	(0.255)
Openness 1	0.017	0.012	0.057	0.109	0.090	0.316*
	(0.165)	(0.026)	(0.112)	(0.134)	(0.227)	(0.168)
FDI	-0.055	-0.004	-0.055	-0.065	0.110	0.021
	(0.066)	(0.011)	(0.048)	(0.060)	(0.072)	(0.044)
No. of Observations	311	247	311	247	190	190
Hansen Test (p value)						0.446
m1 (p value)						0.235
m2 (p value)						0.493

Notes: All variables are in logarithms. Robust standard errors in parentheses. Linear time trend and constant are included in the regression. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. m1 and m2 are tests for first-order and second-order autocorrelation in the first-differenced residuals. The null hypothesis of the Hansen test is that the overidentifying restrictions are valid.

The strict exogeneity assumption is violated in a dynamic model and the FE methods may produce biased estimates due to the correlation between the lagged dependent variable and the disturbance term. Nevertheless, since we have a fairly large T panel, the bias is probably small in our FE estimation (see Bond, 2002).[15] Hence, we estimate the model with dynamic FE and report the results alongside the non-dynamic FE results in Column 5 of Table 2 and Table 3 for developed and developing countries respectively.

As a robustness check of the dynamic FE estimates, we use the instrumental variable approach and estimate the model with the 2SLS method and the difference-GMM by Arellano and Bond (1991). However, it is difficult to find suitable instruments. The

[15] It should be noted here that the missing values make the average T smaller than 21. The size of the bias might therefore actually be greater than it would have been if T had been 21.

second lag of the dependent variable is used as an instrument for the differenced dependent variable. In most of the dynamic specifications, i.e., the dynamic FE, the 2SLS, and the differenced-GMM (Tables 2 and 3, Columns 5, 6, and 7), the lagged dependent variable term is found to be significant, which shows the importance of the dynamics in the system. However, the 2SLS and the differenced-GMM produce less precise estimates compared to FE in our case, as indicated by more than double standard error for most of the coefficients. This might be a result of using weak instruments. The dynamic FE estimation hence continues to be our preferred model, and the following discussion focuses on the results from this estimation (Tables 2 and 3, Column 6).

The coefficient for the openness to trade variable is positive and significant at the 1% level (Table 2, Column 5) for developed countries. The estimated short-run impact of openness to trade on wage inequality in these countries is 0.290, while the long-run impact is 0.559 (0.290/ (1-0.481)) compared to the non-dynamic (long-run) estimate of 0.442. Both of these estimates suggest an increase in occupational wage inequality; in the long run a 1% increase in openness to trade results in a 0.56% increase in wage inequality. In contrast, we do not find any statistically significant effect of openness on occupational wage inequality for developing countries (Table 3, Column 5).

In Table 4 and Table 5 we re-estimate the regressions of Table 2 and Table 3, but add two interaction variables. The coefficient for the interaction term between openness to trade and GDP per capita is found to be negative and significant for developed countries (Table 4, Column 5). This suggests that increased trade increases wage inequality mostly in developed countries with relatively low levels of GDP per capita. When evaluated at the sample mean of log GDP per capita, the partial effect of openness is 0.21 with a standard

error of 0.003, which implies that a 1% increase in openness increases wage inequality by 0.21%. However, this increase in inequality weakens with increased GDP per capita (e.g., higher level of economic development). The coefficient for the interaction term between FDI and the level of development is insignificant for developed countries (Table 4, Column 5), implying that the impact of increased FDI on occupational wage inequality is similar at any level of development within this group of countries. As shown in Table 5, we do not find any statistically significant evidence that the impact of increased openness (either trade or FDI) on occupational wage inequality varies with level of development in developing countries.

Table 4. Occupational Wage Inequality – Developed Countries with Interaction Variables

Dependent variable	Relative wage					
Regression method	(2) OLS	(3) OLS(dynamic)	(4) FE	(5) FE(dynamic)	(6) 2SLS	(7) GMM
Lagged relative wage		0.827*** (0.069)		0.404*** (0.053)	0.342** (0.146)	0.438 (0.295)
Openness 1	8.38*** (1.88)	2.689** (0.956)	3.619** (1.629)	2.238* (1.308)	6.683* (3.406)	13.903* (7.314)
FDI	0.045 (0.966)	0.045 (0.206)	-0.997** (0.485)	-0.433 (0.396)	-0.603 (1.250)	-0.848 (1.90)
GDP per capita	3.09*** (0.812)	1.03** (0.359)	1.020 (0.702)	0.539 (0.555)	2.280 (1.395)	5.751* (3.20)
Openness 1× GDP per capita	-0.842*** (0.184)	-0.269** (0.095)	-0.337** (0.166)	-0.204* (0.133)	-0.654* (0.350)	-1.39* (0.746)
FDI × GDP per capita	-0.010 (0.99)	-0.004 (0.022)	0.091* (0.050)	0.039 (0.041)	0.054 (0.127)	0.081 (0.192)
No. of Observations	207	187	207	187	170	170
Hansen Test (p value)						0.999
m1 (p value)						0.076
m2 (p value)						0.213

Notes: All variables are in logarithms. Robust standard errors in parentheses. Linear time trend and constant are included in the regression. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. m1 and m2 are tests for first-order and second-order autocorrelation in the first-differenced residuals. The null hypothesis of the Hansen test is that the overidentifying restrictions are valid.

Table 5. Occupational Wage inequality – Developing Countries with Interaction Variables

Dependent variable	Relative wage					
Regression method	(2) OLS	(3) OLS(dynamic)	(4) FE	(5) FE(dynamic)	(6) 2SLS	(7) GMM
Lagged relative wage		0.847*** (0.044)		0.399*** (0.073)	0.529 (0.376)	0.111 (0.230)
Openness 1	-3.817*** (1.289)	-0.778** (0.295)	-0.122 (0.937)	0.697 (1.153)	0.889 (1.189)	0.788 (0.824)
FDI	0.766* (0.439)	0.159* (0.085)	-0.025 (0.353)	-0.172 (0.436)	-1.230* (0.630)	-0.735 (0.462)
GDP per capita	-1.892*** (0.517)	-0.377*** (0.131)	-0.070 (0.453)	0.408 (0.575)	-0.367 (0.547)	0.127 (0.462)
Openness 1× GDP per capita	0.461*** (0.144)	0.095*** (0.033)	0.022 (0.114)	-0.073 (0.140)	-0.099 (0.153)	-0.063 (0.105)
FDI × GDP per capita	-0.090* (0.051)	-0.018* (0.009)	-0.003 (0.043)	0.123 (0.054)	0.184* (0.087)	0.109 (0.067)
No. of Observations	311	247	311	247	190	190
Hansen Test (p value)						0.514
m1 (p value)						0.228
m2 (p value)						0.572

Notes: All variables are in logarithms. Robust standard errors in parentheses. Linear time trend and constant are included in the regression. ***, **, and * denote statistical significance at the 1%, 5% and 10% level respectively. m1 and m2 are tests for first-order and second-order autocorrelation in the first-differenced residuals. The null hypothesis of the Hansen test is that the overidentifying restrictions are valid.

The robustness of the results discussed above is checked by using another measure of openness: imports as a percentage of GDP (Openness 2). The results from different specifications, i.e., FE, 2SLS, and GMM, are reported in Columns 2, 3, 4, and 5 in Table 6 and Table 7 for developed and developing countries respectively. Overall, the main results are qualitatively the same in terms of statistical significance. However, the coefficients for openness to trade are smaller for Openness 2 than for Openness 1 for developed countries.

Table 6. Occupational Wage Inequality in Developed Countries: Robustness Check

Dependent variable	Relative wage			
Regression Method	(2) FE	(3) FE(Dynamic)	(4) 2SLS	(5) GMM
Lagged relative wage		0.515***	0.556*	0.669**
		(0.054)	(0.251)	
Openness 2	0.211***	0.084**	-0.023	0.003
	(0.053)	(0.045)	(0.088)	(0.093)
FDI	-0.029	0.011	-0.031	0.004
	(0.034)	(0.026)	(0.041)	(0.034)
No. of Observations	207	187	170	170
Hansen Test (p value)				0.983
m1 (p value)				0.028
m2 (p value)				0.169

Notes: All variables are in logarithms. Robust standard errors in parentheses. Linear time trend and constant are included in the regression. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. m1 and m2 are tests for first-order and second-order autocorrelation in the first-differenced residuals. The null hypothesis of the Hansen test is that the overidentifying restrictions are valid.

Table 7. Occupational Wage Inequality in Developing Countries: Robustness Check

Dependent variable	Relative wage			
Regression Method	(2) FE	(3) FE(Dynamic)	(4) 2SLS	(5) GMM
Lagged relative wage		0.405***	0.475	0.176
		(0.073)	(0.329)	(0.249)
Openness 2	-0.063	0.079	0.027	0.172
	(0.105)	(0.129)	(0.173)	(0.124)
FDI	-0.042	-0.062	0.115	0.034
	(0.048)	(0.059)	(0.071)	(0.041)
No of Observations	311	247	190	190
Hansen Test p value				0.472
m1 (p value)				0.215
m2 (p value)				0.502

Notes: All variables are in logarithms. Robust standard errors in parentheses. Linear time trend and constant are included in the regression. ***, **, and * denote statistical significance at the 1%, 5% and 10% level respectively. m1 and m2 are tests for first-order and second-order autocorrelation in the first-differenced residuals. The null hypothesis of the Hansen test is that the overidentifying restrictions are valid.

5. Conclusions

By analyzing data for 34 occupations across 52 countries over the 1983-2003 period, this article provides fresh empirical evidence on the impact of globalization on inter-occupational wage inequality by using a relatively new database (OWW) and by focusing on openness to trade and openness to capital. Non-dynamic and dynamic models are estimated to investigate the impact of globalization on occupational wage inequality, which is measured by the ratio of skilled to unskilled wages. We perform separate analyses for developed (high-income OECD) and developing (low- and middle-income) countries.

Overall, the effect of openness is smaller in developing countries than in developed countries, where openness to trade contributes to an increase in occupational wage inequality by increasing the wage gap between skilled and unskilled workers. This result is

in line with the theoretical prediction and in contrast to some previous findings (e.g., Majid, 2004; Milanovic and Squire, 2005). Following the H-O-S intuition, these countries specialize in and export skilled labor-intensive products, resulting in a relative increase in the wages of skilled workers, in turn increasing wage inequality. The results also suggest that the increased inequality is more evident in developed countries which are at relatively low levels in their development process, and that the increase in wage inequality diminishes with increasing level of development. This can be interpreted using Tinbergen's (1974) argument that with an increased level of development in a developed country comes an increased supply of educated skilled workers who are able to fill the demand for technology-induced skilled workers. Consequently, an increased level of development may result in diminishing wage inequality. The increased openness to capital, measured by FDI, has insignificant impact on occupational wage inequality at any level of development. This is plausible because the OECD countries have already reached a certain level of development where increasing FDI, most likely due to the investment pattern in those countries, impacts skilled and unskilled wages similarly.

In the context of developing countries, our results suggest that openness to trade and FDI have insignificant impact on wage inequality and that the effect of openness does not vary with level of development. There may be factors not captured in our analysis at work as well, which may offset the effects of globalization. One such factor is resource abundance across countries in the low- and middle-income groups. For example, compared to the abundance of natural resource in many Latin American countries, most Asian countries have a relative abundance of unskilled labor. Consequently, the impact of increased trade on wage inequality may differ between Latin American and Asian

countries. Although most of the countries experienced trade reform more or less at the same time, the time period for capital market reform varies across countries. The amount and characteristics of FDI received vary as well. Again, labor market institutions play a major role in this context. The findings in this paper have important implications for a country's policy towards trade liberalization as well as for attraction of foreign direct investment. More detailed analysis for developing countries is required, which is left for future research.

References

Attanasio, O., Goldberg, P. K., Pavcnik, N. (2004), Trade Reforms and Wage Inequality in Colombia, Journal of Development Economics 74, pp. 331-366

Anderson, E. (2005), Openness and inequality in developing countries: a review of theory and recent evidence, World Development 33 (7), pp. 1045-1063

Arellano, M. and Bond, S. (1991), Some tests of specification for panel data: Monte-Carlo evidence and an application to employment equations, Review of Economic Studies 58, pp.277-297.

Barro, R. J. (2000), Inequality and Growth in a Panel of Countries, Journal of Economic Growth, 5, pp. 5-32.

Behrman, J., Birdsall, N., and Szekely, M. (2003), Economic Policy and Wage Differentials in Latin America, Center for Global Development Working Paper 29. Washington D.C.

Bond, S. (2002), Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice, cemmap working paper CWP09/02, The Institute for Fiscal Studies, UCL, UK.

Currie, J. and Harrison, A. (1997), Trade Reform and Labor Market Adjustment in Morocco, Journal of Labor economics 15, pp. S44-71.

Dollar, D. and Kraay, A (2002), Growth is Good for the Poor, Journal of Economic Growth 7, pp. 195-225.

Edwards, Sebastian (1997), Trade Policy, Growth and Income Distribution, AEA Papers and Proceedings 87(2), pp. 205-210.

Ekholm, K. and Ulltveit-Moe, K. H. (2007), A new look at offshoring and inequality: specialization versus competition, CEPR Discussion Paper 6402.

Esquivel, G. and Rodriguez-Lopez, J.A. (2003), Technology, trade, and wage inequality in Mexico before and after NAFTA, Journal of Development Economics 72, pp. 543-565.

Feenstra, R. C. and Hanson, G. H. (1995), Foreign Investment, Outsourcing and Relative Wages, NBER Working Paper 5121.

Feenstra, R. C. and Hanson, G. H. (1999), The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1990, Quarterly Journal of Economics 114, pp. 907-41.

Freeman, R. B. and Oostendorp, R. H. (2000), Wages Around the World: Pay Across Occupations and Countries, NBER Working Paper 8058.

Goldberg, P. and Pavcnik, N. (2003), The Response of the Informal Sector to Trade Liberalization, Journal of Development Economics 72, pp. 463-496.

Goldberg, P. and Pavcnik, N. (2007), Distributional Effects of Globalization in Developing Countries, Journal of Economic Literature XLV, pp. 39-82.

Haddad, M and Harrison, A. (1993), Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco, Journal of Development Economics 42, pp. 51-74.

Hanson, G., and Harrison, A. (1999), Trade Liberalization and Wage Inequality in Mexico, Industrial and Labor Relations Review 52 (2), pp. 271-288.

Hausman, J. A. (1978), Specification tests in econometrics, Econometrica 46, pp.1251-1271.

Majid, N. (2004), What is the effect of trade openness on wages? Employment Strategy Papers 2004/18, ILO.

Milanovic, B. and Squire, L. (2005), Does Tariff Liberalization Increase Wage Inequality? Some Empirical Evidence, NBER Working Paper 11046.

Mundell, R. A. (1957), International Trade and Factor Mobility, American Economic Review 47, pp.321-335.

Pavcnik, N. (2003), What explains skill upgrading in less developed countries? Journal of Development Economics 71, pp.311-328.

Samuelson, P.A (1953), Prices of Factors and Goods in General Equilibrium, Review of Economic Studies 21, pp.1-20.

Schott, P. (2001), Across-Product versus within-product specialization in international trade, Quarterly Journal of Economics 119, pp.647-678.

Slaughter, M. J. (2002), Skill Upgrading in Developing Countries: Has inward foreign direct investment played a role? Working paper No. 192, OECD Development Centre.

Slaughter, M. J. and Swagel, P. (1997), The Effect of Globalization on Wages in the Advanced Economies, International Monetary Fund Staff Studies for the World Economic Outlook, December 1997.

Stolper, W. and Samuelson, P. A. (1941), Protection and Real Wages, Review of Economic Studies 9(1), pp.51-68.

Taylor, K. and Driffield, N. (2000), Wage dispersion and the role of multinationals: Evidence from UK plant data, Paper presented at the International Economic

Association Conference on Globalization and Labor Markets, University of Nottingham.

Te Velde, D. W. and Morrisey, O. (2004), Foreign Direct Investment, Skills and Wage Inequality in East Asia, Journal of the Asia Pacific Economy 9(3), pp.348-369.

Tinbergen, J. (1974), Substitution of Graduates by Other Labor, Kyklos 27(2), pp. 217-226.

Appendix 1: Occupations and Country Lists

Table 1: Skilled occupations

# from ILO OI	Occupation	ISCO-88 code
11	Coalmining engineer	2147
14	Petroleum and natural gas engineer	2147
44	Journalist	2451
52	Chemical engineer	2146
61	Occupational health nurse	2230
76	Power distribution and transmission engineer	2143
129	Accountant	2411
133	Computer programmer in insurance	2132
138	Computer programmer in public administration	2132
145	Mathematics teacher (third level)	2310
146	Teacher in languages and literature (third level)	2310
147	Teacher in languages and literature (second level)	2320
148	Mathematics teacher (second level)	2320
149	Technical education teacher (second level)	2320
150	First-level education teacher	2331
151	Kindergarten teacher	2331
152	General physician	2221
153	Dentist (general)	2222
154	Professional nurse	2230

Table 2: Unskilled Occupations

# from ILO OI	Occupation	ISCO-88 code
13	Underground helper, loader in coal mining	9311
21	Hand packer	9322
28	Laborer in textiles	9322
51	Laborer in printing, publishing, and allied industries	9322
56	Laborer in manufacturing of industrial chemicals	9322
58	Hand packer in manufacture of other chemical products	9322
59	Laborer in manufacture of other chemical products	9322
70	Laborer in manufacturing in machinery	9322
80	Laborer in electric light and power	9322
90	Laborer in construction	9312/9313
100	Room attendant or chambermaid	9132
104	Railway vehicle loader	9333
117	Dockworker	9333
123	Aircraft loader	9333
144	Refuse collector	9161

Table 3 List of Developing Countries (37)

Algeria	Mali
Argentina	Mauritius
Bangladesh	Mexico
Barbados	Mozambique
Belize	Nicaragua
Bolivia	Niger
Burkina Faso	Peru
Burundi	Philippines
Cambodia	Rwanda
Cameroon	Sri Lanka
Central African Republic	St. Lucia
Chad	St. Vincent and the Grenadines
Chile	Thailand
China	Trinidad and Tobago
Colombia	Tunisia
Honduras	Uruguay
India	Venezuela, RB
Madagascar	Zambia
Malawi	

Table 4. List of Developed Countries (15)

Australia	Norway
Austria	Portugal
Canada	Sweden
Denmark	United Kingdom
Finland	United States
Germany	
Italy	
Korea, Rep.	
Netherlands	
New Zealand	

Table 5. Developing Countries Not Reported in OWW (51 countries)

Afghanistan	Kiribati	Samoa
Bhutan	Korea, Dem. Rep.	Sao Tome and Principe
Comoros	Lao PDR	Solomon Islands
Congo, Dem. Rep.	Lesotho	Somalia
Djibouti	Liberia	South Africa
Dominica	Malaysia	Tanzania
Ecuador	Maldives	Timor-Leste
Egypt, Arab Rep.	Marshall Islands	Tonga
El Salvador	Mauritania	Vanuatu
Eritrea	Mayotte	Vietnam
Ethiopia	Micronesia, Fed. Sts.	Zimbabwe
Gambia, The	Mongolia	
Grenada	Morocco	
Guatemala	Namibia	
Guinea	Nepal	
Guinea-Bissau	Northern Mariana Islands	
Haiti	Pakistan	
Indonesia	Palau	
Jamaica	Panama	
Kenya	Paraguay	

Essay 4

Offshoring and Occupational Wages: Some Empirical Evidence

By

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Abstract

Offshoring has changed the pattern of international competition; labor in specific occupations rather than whole firms and sectors are now facing competition. Accordingly, wages in offshorable occupations are affected in new ways. In this paper we investigate the effects of offshoring of electronically traded services on relative occupational wages in 13 countries in the 1990-2003 period. Our findings suggest that in developing countries, increased exports of IT-related services lead to higher relative wages in offshorable occupations, whereas increased imports of such service reduce relative wages. In the most developed countries, however, relative wages were not significantly affected.

Keywords: offshoring, globalization, occupational wages, service trade.

JEL codes: F15, F16, J31.

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1. Introduction

Offshore outsourcing of electronically traded services from high-wage to low-wage countries began in earnest in the early 1990s. Increased trade and capital mobility together with improvements in information and telecommunication technology have accelerated the process, and more and more IT-related services are being offshored (Amiti and Wei, 2005; Welsum and Vickery, 2005). This new wave of globalization brings new challenges; both high-skilled workers (e.g., software engineers, researchers, and analysts) and low-skilled workers (e.g., call center operators and data entry clerks) in high-wage developed countries now face competition from their counterparts in low-wage developing countries. Competition and specialization increase productivity in general, and therefore, prosperity of the participating countries. But does offshore outsourcing benefit everyone?

One of the reasons behind the apprehension in the public debate and in the media over offshore outsourcing of electronically traded services (henceforth offshoring) in developed countries is the fear of job loss and downward pressure on real wages in certain high-skilled occupations, where these countries have had a comparative advantage for a long time (Amiti and Wei, 2005). Many of these jobs have been outsourced to developing countries where the job (task) can be done at much lower cost and delivered electronically at negligible cost. This has increased the demand for these occupations in developing countries, resulting in increases in their wages.

By offshoring routine tasks to low-wage developing countries, producers in high-wage developed countries can specialize in complex tasks in which they have comparative advantages, and hence expand and create more such jobs. Overall real incomes of the origin (developed) country are likely to increase as a result of cheaper imports from the

destination (developing) country. The idea is similar to the standard gains from trade story; trade (offshoring) reduces cost of labor if the various segments in the production chain are allocated according to comparative advantages. Although some workers will of course suffer from temporary dislocation due to the trade, full employment can be attained in the long run through market adjustments. Therefore, trade brings benefits to all participating countries.

Ireland is a good example in this context. In the early 1990s it attracted a lot of US offshored services, since wages were competitive. However, as wages rose in Ireland, the US and other outsourcing countries started to look for new destinations. For example, China, the Philippines, Malaysia, and India in particular, have become attractive offshoring locations. However, by now wages in some offshored occupations are increasing rapidly in India as well. Interestingly, the search-engine company *Like.com* recently decided to close its Indian center since it was not cost-effective any more; wage levels of software engineers in Bangalore and California had become too similar.[1]

Research on the impact of globalization or market integration on labor markets, factor prices, production patterns, and welfare has mainly been based on models with complete goods produced in one location. With increased offshoring, trade in specific tasks or intermediate goods has come to play a very significant role, which also affects factor price movements. To date little research has been done on the impact of offshoring on income distribution in the participating countries, although some studies analyze the effects of offshoring on labor demand (Ekholm and Hakkala, 2006), on employment (Schöller,

[1] This information is accessed online at http://influencepeddler.blogspot.com

2006), and on relative wages of skilled to unskilled workers (Grossman and Rossi-Hansberg, 2006b).

In this paper we undertake an exploratory analysis of available cross-country data to see if we can identify any systematic effects of the offshoring of IT-related services on relative wages. Since we are not testing a full model we have to be cautious with causal interpretations. However, we still believe that we are able to find some interesting correlations that may inform the debate.

The regression analysis is done on a panel of 13 countries in Europe and Asia for the 1990-2003 period. To our knowledge, this is the first study that exploits the cross-section variations across countries to try to understand the potential effects of offshoring on relative wages in offshorable and non-offshorable occupations. We find that increases in exports of IT-related services are associated with increases in relative wages of offshorable occupations, and that there is a reverse effect for increases in imports. This suggests that increased relative demand for these occupations boosts their relative wages. We find that the effect is largest in the poorest developing countries, while we find no effect at all in the most developed countries. The latter result is of interest to developed countries, where offshoring has created much anxiety of downward pressure on wages.

The remainder of the paper is organized as follows: Section 2 describes offshorable jobs and the countries involved in offshoring, Section 3 discusses some relevant literature on offshoring and the debate around it, Section 4 describes the data and the variables used in the empirical analysis, Section 5 presents the results, and Section 6 concludes the paper.

2. Offshoring

As a background to the analysis in this paper, we begin by briefly describing the characteristics of offshorable jobs and the countries to which these jobs are offshored.

2.1 Offshorable jobs

This paper analyzes the offshoring of Mode 1 services under the General Agreement on Trade in Services (GATS). These services are traded electronically and often over long distances, where no direct face-to-face contact is required. Welsum and Vickery (2005) identify a set of occupations which potentially would be affected by offshoring. According to their classification, offshorable jobs are occupations that embody high explicit information but do not require face-to-face contact (codified knowledge), and most importantly, information and communication technology is intensively used in the process of production as well as in trade of the service. More generally, "routine" tasks (Levy and Murname, 2004) and "codifiable" tasks (Leamer and Storper, 2001) are most suitable for offshoring. Welsum and Vickery (2005) predict that around 20% of total employment in OECD countries is potentially offshorable, while Bardhan and Kroll (2003) predict that about 11% of total US employment is.

Offshoring can involve both high-skill and low-skill jobs. Examples of workers include call center operators (Friedman, 2004), radiologists (Pollak, 2003), software programmers (Thurm, 2004), and people preparing tax forms (Robertson et al., 2005). Non-offshorable occupations are those that require face-to-face personal contact and where the services cannot be delivered electronically. Most personal services are non-offshorable; e.g., taxi drivers, child care workers, nurses, barbers, automobile mechanics, cooks, and

jobs in construction and mining. Hardly any physician jobs, except in radiology, are offshorable, since they require face-to-face personal contact. Some government services may not require face-to-face contact, but are still generally not offshorable for political reasons.

With technological progress, more and more jobs are becoming offshorable. Blinder (2006) and Jensen and Kletzer (2005) predict that the number of offshorable jobs in the US will soon exceed the number of manufacturing jobs. For example, services in wholesale and retail trade are good candidates for offshoring due to the steady increase in Internet retailing. In the health sector, laboratory tests are suitable for offshoring. Jobs in financial services as well as attorneys writing routine contracts can also be offshored. However, most jobs in the tourist sector cannot be, except for reservation clerks. Furthermore, research-related and innovative jobs use substantial information technology but are not offshorable. Leamer and Storper (2001) use the term “double-edged geography of the Internet age” to explain how the Internet is spreading out routine tasks while at the same time concentrating (agglomerating) research and innovative activities in order to specialize in complex tasks.

2.2 Offshoring countries

The Global Services Location Index (GSLI), developed by A.T. Kearney (a leading international management consulting firm), provides a ranking of offshore locations according to their attractiveness to investors. It is created by evaluating 40 countries based

on three criteria: financial attractiveness, skills and availability of people, and business environment.[2]

In the GSLI list, the top six countries are Asian: India, China, Malaysia, the Philippines, Singapore, and Thailand. Central and Eastern Europe is attractive to many non-English speaking high-wage European countries due to language skills and geographical proximity. Skills in European languages other than English are uncommon in low-wage Asian countries.

There is a common view that the US and other English-speaking countries will cope better with the challenges of offshoring than non-English Europe, since English skills are a necessary requirement for delivering services electronically (Blinder, 2005). However, using the data on service imports of accounting and other back-office operations, which are indicators of actual offshoring, Amiti and Wei (2005) point out that four out of five top outsourcers of business services in 2002 were non-English speaking countries: Germany, Japan, the Netherlands, and Italy.

3. Literature Review

The classical models of trade focused on the exchange of finished goods. Since communication costs were high, it was reasonable to assume that splitting-up of production processes was only done in close proximity. Technological improvements and the decline of communication costs have made more and more goods and services tradable, which has led to changes in the pattern of comparative advantages.

[2] Financial attractiveness includes compensation levels, infrastructure, and tax and regulatory costs. People skills and availability is based on remote services sector experiences and quality ratings, labor force availability, education and language, and attrition risk. Business environment includes infrastructure, cultural exposure, and security of intellectual property. For details on these sub-categories and the 40 individual metrics on which they are based, see Appendix of A.T.Kearney (2005).

The splitting up of production processes has made high-wage developed countries outsource various labor-intensive tasks of production to low-wage countries.[3] The produced goods are then delivered from abroad by ships and planes. This phenomenon of outsourcing has received significant attention in the last few decades. It has been found in several empirical studies that outsourcing has increased wage inequality in developed countries (Feenstra and Hanson, 1999; Hijzen, 2007), and it has been argued that it leads to a tendency towards factor price equalization (Deardorff, 2001).

Rapid improvements in telecommunication technology since the 1990s have made the cost of trading services small, which has increased the tradability of services. Blinder (2006) calls this the "Third Industrial Revolution." The concurrent opening-up of large economies like China, India, and Russia has contributed to the speeding up of this process.

There are several reasons why the emergence of offshoring has been a challenge to the standard theoretical predictions of the impact globalization on skilled and unskilled employment and wages.[4] First, offshoring involves both high-skill and low-skill occupations. It is therefore difficult for the traditional comparative advantage theory to identify clear "winners" (skilled workers in developed countries) and "losers" (unskilled workers in developed countries) of globalization in terms of skill-level. Second, in addition to trade in complete goods as in standard trade theory, trade in specific tasks or intermediate goods has come to play an increasingly significant role in international factor price movements.

[3] Outsourcing, however, is also done domestically.

[4] Following the 2X2 Hecksher-Ohlin intuition, integration in commodity markets induces factor price convergence between developed and developing countries through Stolper-Samuelson effects (Stolper and Samuelson, 1941; Samuelson, 1953). An increased wage inequality is consequently predicted in developed countries.

The changing pattern of global trade caused by offshoring demands new theories, and some have begun to emerge regarding both trade in tasks and trade in final goods.[5] Grossman and Rossi-Hansberg (2006a) present a simple analytical framework to analyze the effect of offshoring on domestic factor prices. They decompose the effect into three components: a productivity effect, a relative-price effect, and a labor-supply effect. The productivity effect refers to the reduction in production costs derived from increased offshoring. This means that a firm can obtain inputs more cheaply than before and hence become more profitable, which in turn leads to an increase in the demand for labor in offshored occupations. The relative-price effect refers to the effect of changes in relative goods prices due to offshoring. Reduced prices of goods that use offshorable labor intensively will tend to reduce wages of labor in offshorable occupations in the origin country (the Stolper-Samuelsson prediction). The labor-supply effect is similar to the impact of increased labor supply in an economy, which will generally decrease wages. The effect arises because workers in offshorable occupations are released from their jobs due to offshoring. If the productivity effect dominates the other two, then wages of the workers in offshorable jobs may actually increase. When putting their model to use they find evidence that the combined effect of productivity and labor-supply effects was increased real wages of unskilled US workers in the 1997-2004 period (Grossman and Rossi-Hansberg, 2006b).[6]

To our knowledge, there are no studies investigating the impact of offshoring of IT-related services on relative wages of offshored occupations. However, some studies (Feenstra and Hanson, 1999; Ekholm and Ulltveit-Moe, 2007) analyze the impact of

[5] See Baldwin (2006) for a recent review.
[6] Rodriguez-Clare (2007) uses a similar approach, where the impact of offshoring on average wages is analyzed with three effects: productivity effects, terms of trade effects, and world-efficiency effects.

offshoring on relative wages of skilled workers using the definition of offshoring as import of all intermediate inputs, both material and services. Feenstra and Hanson (1999) find that in the 1979-1990 period, offshoring was responsible for 17.5%-40% of the increase in the relative wages of non-production US workers. Ekholm and Ulltveit-Moe (2007) develop a general equilibrium model of imperfect competition, where the impact of offshoring on relative wages of skilled workers depends on two opposite forces: vertical specialization and competition. Greater vertical specialization may increase the skill premium and therefore wage inequality in industrialized countries. On the other hand, increased competition may reduce the wage premium and therefore wage inequality in these same countries. The recent fall in relative wages in US manufacturing was according to Ekholm and Ulltveit-Moe (2007) due to the dominance of the second force.

Also, some papers study the impact of offshoring on employment. Schöller (2006) finds that offshoring had a negative impact on manufacturing employment in Germany. However, by analyzing data for several OECD countries for the 1995-2003 period, Welsum and Reif (2005) conclude that there was no absolute decline in employment in most countries, although the occupations in question did experience slower employment growth during the period.

4. Data and Variables

This section motivates the choice of variables and describes the data used in the empirical analysis. Table 1 reports the descriptive statistics of the variables used in the analysis.

Welsum and Vickery (2005) identify some occupations that are potentially affected by offshoring in Europe and other countries using the International Standard Classification

of Occupation-1988 (ISCO-88).[7] The Occupational Wages around the World (OWW) database,[8] used in our analysis, also follows the ISCO-88 classification. Using this link we end up with wages of 23 offshorable occupations that match the classification of Welsum and Vickery (2005). In order to evaluate the effects of off-shoring on occupational wages, we compare the wages of each of these occupations with an average of 14 non-offshorable occupations for the 1990-2003 period for several countries. This is different from Feenstra and Hanson (1999), Ekholm and Ulltveit-Moe (2007), and Grossman and Rossi-Hansberg (2006b), where relative wages of skilled workers are analyzed using data from the US manufacturing sector. A list of offshorable and non-offshorable occupations with the corresponding ISCO code is reported in Table A1 and Table A2 in the Appendix.

Table 1. Descriptive Statistics 1990-2003.

Variables	Mean	Standard Deviation	N
Relative wage (the ratio of wages of offshorable to non-offshorable occupations)	1.454	1.019	1606
Growth rate of relative wage	0.013	0.168	1444
Growth rate of exports of business services	0.10	0.326	1458
Growth rate of imports of business services	0.109	0.229	1458
Log (GDP per capita [a] /1000)	2.204	0.837	1650
Index of the attractiveness of a location	5.361	0.625	1650

[a]Real GDP per capita is in thousands of 2000 PPP dollars.

[7] For detailed methodology for selection of occupations, see Welsum and Vickery (2005).

[8] Freeman and Oostendorp (2000) created this database by standardizing the ILO October Inquiry data, which is essentially a large country-occupation-time matrix reporting occupational wages for 164 occupations for more than 150 countries in the respective national currencies.

We focus our analysis on countries ranked by A.T. Kearney's (2005) Global Services Location Index. Twenty-one countries, developed as well as developing, are classified as the most attractive offshore locations in Europe and Asia. However, due to missing data in the OWW database, only 13 can be included in our analysis. These (in order of rank) are India, China, the Philippines, Singapore, Thailand, the Czech Republic, Slovakia, Poland, Hungary, Romania, the UK, Germany, and Portugal.

Our variable of interest is the relative wage in offshorable occupations. We construct this variable as the ratio of each offshorable occupational wage to the average wage level of all non-offshorable occupations. An increase in the ratio implies that the offshorable occupational wages increase relative to those in the non-offshorable occupations.

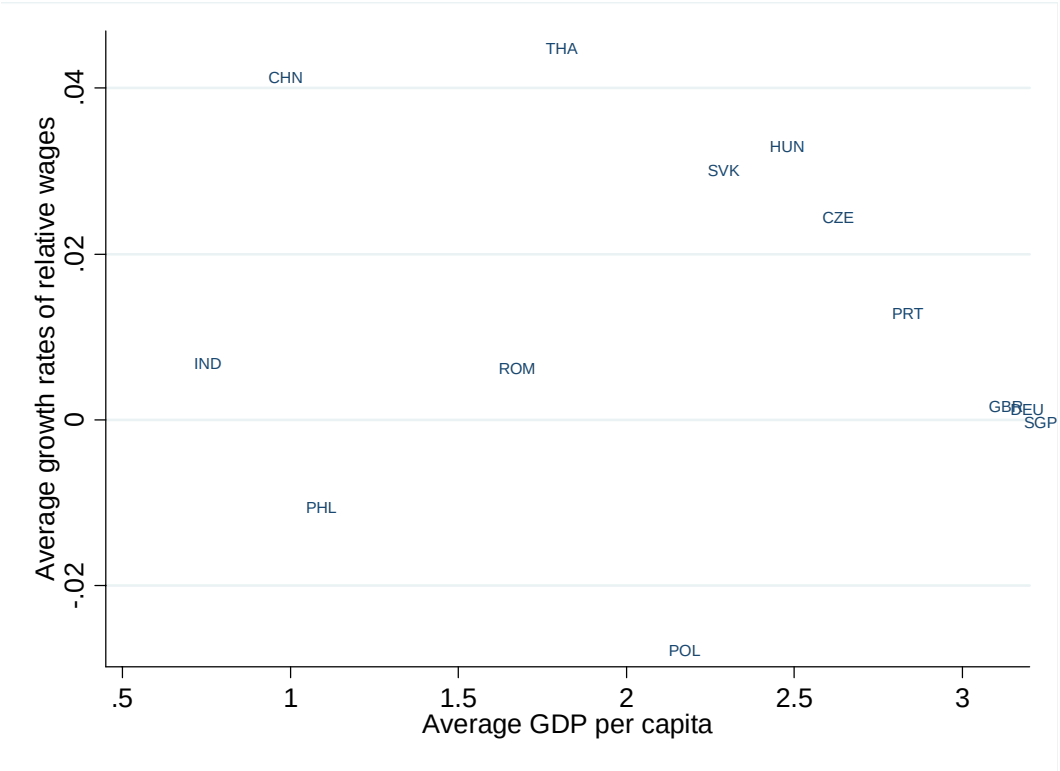
It is difficult to measure the extent of offshoring. Only parts of the production processes are offshored, and they are regarded as inputs to produce the final goods. Hence, indirect measures such as imports of services are sometimes used; particularly "computer and information services" and "other business services" from the IMF Balance of Payments database have been used as proxies for the measures (Amiti and Wei, 2005; Schöller, 2006). Data on "computer and information services" is unfortunately not available for many of the countries for the studied time period. We therefore use information on "other business services" (business services for short) only, measured in US dollars. The business services are traded electronically and include, among others, accounting jobs, management consulting, legal services, research and development, architectural and engineering services, and other back-office operations (United Nations, 2002). The countries in our

sample are both exporters and importers of such services, and hence we use both export and import of business services as measures of offshoring.

It makes little sense to use the variables that measure trade in business services in levels in the analysis, or rescale them by GDP, since business services trade is an indicator of offshoring and its actual values and their relationship to GDP are of little relevance. Hence, we instead use the growth rates of real business services exports and imports as explanatory variables in the model.

The impact of offshoring on wages is likely to vary across occupations and levels of development, and there are large differences in the level of development among the 13 countries in our sample. The current trend of relocation of business services is towards low-wage countries (e.g., India) from high-wage countries (e.g., Germany). This increases the demand for labor involved in outsourcing occupations in India relative to Germany. Moreover, high-wage countries have more integrated labor markets, implying a lower wage differentiation across occupations in those countries. Therefore, we would expect business services exports to increase relative wages the most in countries with relatively low levels of GDP per capita. This is illustrated in Figure 1, which shows the relationship between GDP per capita and the average (over the period of study) growth rates of relative wages. As observed, the high-income countries like Germany and Great Britain have lower relative wage growth than developing countries like India and China.

Figure 1. Average growth rates of relative wages and average GDP per capita



Likewise, imports of business services might also have different impacts on relative wages depending on a country's level of development. High-wage countries are generally increasing the import of business services. If the productivity effect dominates, then increased imports of business services may actually increase relative wages in these countries (see Grossman and Rossi-Hansberg, 2006a; Rodriguez-Clare, 2007), while the effect on relative wages is negative if the relative-price and labor-supply effects dominate.

To control for the level of development and evaluate the differences in impact, we include both the level of real GDP per capita measured in thousands of 2000 PPP dollars and terms where the offshoring variables interact with the level of GDP, in addition to

export and import of business services.[9] Here the log of GDP per capita is used as a proxy for the general level of development.

The attractiveness of a country as an offshoring destination can be defined using the AT Kearney (2005) Global Services National Index. We use this variable (index) as a robustness check of our direct offshoring measure, business services trade. The more attractive locations should export more business services and therefore have higher relative wages than less attractive locations. We would expect this variable to have a positive impact on relative wages in offshorable occupations.

5. Empirical Analysis

To investigate the impact of service offshoring on relative occupational wages, various versions of the following model are estimated.

$$W_{cit} = \alpha_1 + \alpha_2 X_{ct} + \alpha_3 M_{ct} + \alpha_4 L_c + \alpha_5 LnGDP_{ct} + \alpha_6 X_{ct} LnGDP_{ct} + \alpha_7 M_{ct} LnGDP_{ct} + D_t + D_i + D_c + u_{cit} \quad (1)$$

The subscripts *c*, *i*, and *t* are indexes for country, occupation and time, respectively. The dependent variable W_{cit} is the ratio of wages for each offshorable occupation relative to the country average of non-offshorable occupational wages. X_{ct} and M_{ct} represent the growth rates of exports and imports of business services respectively, and L_c is an index of the attractiveness of a location for offshoring. $LnGDP_{ct}$ denotes log of GDP per capita, and $X_{ct} LnGDP_{ct}$ and $M_{ct} LnGDP_{ct}$ are two interaction variables between growth rate of export of business services (*X*) and log of GDP per capita, and between growth rate of

[9] GDP per capita is purchasing power parity adjusted and in constant 2000 international dollars, which is obtained from the Penn World Table 6.2

import of business services (*M*) and log of GDP per capita respectively. D_i and D_c are occupation and country dummy variables, and D_t is a time trend capturing changes in relative wages not due to offshoring. The time trend is included because we expect relatively more rapid productivity growth for offshorable than for non-offshorable occupations, since offshorable occupations are generally assumed to be more high-tech. Finally, α_1 is the intercept and u_{cit} is an error term. The standard errors are corrected for clustering within occupations for each country.

The results from the estimated models are presented in Tables 2-4. We begin by estimating a simple model; the specification includes growth rates of both exports and imports of business services and a time trend as explanatory variables. The results are reported in Table 2, Column (1). The coefficient of business services exports is positive and highly significant, while the coefficient of business services imports is negative and marginally significant. This suggests that increased exports of business services increase relative wages of offshored occupations, whereas increased imports of business services do the opposite. In particular, a 1% increase in exports and imports of business services contributes to a 0.25% increase and a 0.20% decrease in relative wages respectively. The time trend is not significant.

To control for non-observed occupational effects, the specification in Column (2) adds time-invariant occupational dummies to the first specification. Many of the estimated coefficients for the occupation dummies and the time trend are statistically significant. We get similar results as in the previous model for the size and significance of the estimated coefficients of business services exports. However, the coefficient for the business services

imports is not significant. Next we re-estimate the model in Column (2), replacing business services trade with our attractiveness measure. The results are reported in Column (3). The coefficient of the variable (location index) has the predicted sign and is highly statistically significant. This suggests that the most attractive offshoring locations attract the most outsourcing jobs, which results in higher relative wages in offshorable occupations.

Table 3 presents the results from estimations of the model after adding log of GDP per capita and interaction terms for exports and imports of business services, both with and without the occupation dummies. The coefficients of exports and imports of business services are significant and have the expected signs, while the coefficient of the interaction term between exports of business services and the log of GDP per capita is significant and negative and the interaction term for imports is significant and positive (Table 4, Column 2). Evaluated at the sample mean of log GDP per capita, the partial effect of exports is highly significant at 0.071 (s.e. 0.0058); a 1% increase in exports increases relative wages by 0.07%. The effect is higher the lower the log of GDP per capita. This implies that increased exports of business services increase relative wages the most in countries with relatively low levels of GDP per capita (e.g., India). Evaluated at the sample mean of log GDP per capita, the partial effect of imports is -0.0034 but not significant (s.e. 0.0137). Nevertheless, since the individual coefficients are significant, the signs indicate that increased imports of business services reduce relative wages the most in the poorest countries.

Table 2: The effects of offshoring on relative occupational wages: 1990-2003.

Dependent variable	Relative wage		
	(1)	(2)	(3)
Growth rate of exports	0.251[a] (0.049)	0.209[a] (0.049)	
Growth rate of imports	-0.195[c] (0.104)	-0.132 (0.112)	
Location Index			0.725[a] (0.167)
Time trend	-0.019 (0.012)	-0.019[c] (0.010)	0.015[b] (0.006)
Occupation dummies			
D11		0.829[a] (0.175)	0.996[a] (0.206)
D14		0.786[b] (0.185)	1.051[a] (0.217)
D45		0.109 (0.138)	0.068 (0.225)
D46		0.097 (0.091)	-0.025 (0.233)
D52		0.857[a] (0.211)	1.025[a] (0.274)
D76		0.945[a] (0.163)	1.043[a] (0.273)
D77		0.297[b] (0.133)	0.461[a] (0.231)
D91		0.057 (0.163)	0.094 (0.240)
D94		0.068 (0.117)	0.059 (0.239)
D97		-0.058 (0.093)	0.024 (0.206)
D120		1.290 (0.802)	1.270[b] (0.639)
D128		0.196 (0.129)	0.315 (0.235)
D129		1.821[a] (0.542)	1.788[a] (0.457)
D130		0.645[c] (0.379)	0.621[b] (0.282)
D132		0.749 (0.508)	0.790[b] (0.333)
D133		1.322[a] (0.447)	1.314[a] (0.353)
D134		0.907 (0.721)	0.758 (0.502)
D135		0.511 (0.507)	0.414 (0.368)
D136		0.518[b] (0.228)	0.630[a] (0.238)
D138		0.275 (0.181)	0.476[b] (0.194)
D140		-0.062 (0.109)	-0.056 (0.250)
D141		-0.030 (0.119)	0.026 (0.283)
Observations	1426	1426	1606
R-squared	0.006	0.284	0.457

Notes: Standard errors, in parentheses, are corrected for clustering. Superscripts a, b, and c denote statistical significance at the 1%, 5%, and 10% level respectively.

Table 3: The effects of offshoring on relative occupational wages (with interaction variables)

Dependent variable	Relative wage	
	(1)	(2)
Growth rate of exports	0.715[a] (0.241)	0.701[a] (0.203)
Growth rate of imports	-1.519[a] (0.398)	-1.466[a] (0.338)
Ln GDP per capita	-0.474[a] (0.151)	-0.517[a] (0.120)
Growth rate of exports x Ln GDP per capita	-0.271[b] (0.129)	-0.286[a] (0.108)
Growth rate of imports x Ln GDP per capita	0.673[a] (0.170)	0.666[a] (0.150)
Time trend	0.008 (0.008)	0.010 (0.007)
Occupation dummies		
D11		0.877[a] (0.225)
D14		0.814[a] (0.214)
D45		0.039 (0.251)
D46		0.073 (0.251)
D52		0.986[a] (0.338)
D76		0.934[a] (0.268)
D77		0.263 (0.267)
D91		0.005 (0.263)
D94		0.025 (0.269)
D97		0.026 (0.240)
D120		1.298[c] (0.706)
D128		0.260 (0.244)
D129		1.854[a] (0.505)
D130		0.631[c] (0.328)
D132		0.628 (0.417)
D133		1.339[a] (0.407)
D134		0.958[c] (0.569)
D135		0.652[c] (0.365)
D136		0.749[a] (0.285)
D138		0.363 (0.350)
D140		-0.166 (0.263)
D141		-0.023 (0.314)
Observations	1426	1426
R-squared	0.120	0.417

Note: Standard errors, in parentheses, are corrected for clustering. Superscripts a, b, and c denote statistical significance at the 1%, 5%, and 10% level respectively.

Finally, Table 4 reports estimation without and with the interaction variables, but adds dummies also for countries to control for country fixed effects. We find that most of the country dummies are significant. All the other coefficients have the predicted sign except log of GDP per capita (Table 4, Column 2). The latter is not significant, though. Compared to the results in Table 3, the magnitudes of the coefficients of the key variables (the growth rates of exports and imports of business services) are reduced further after introducing country dummies. The partial effect of exports in Column (2) is still highly significant at 0.074 (s.e. 0.0018), as is the partial effect of imports at -0.082 (s.e. 0.0028). In this specification we have put in as many controls as possible, but the impact of outsourcing, as we define it, remains significant.

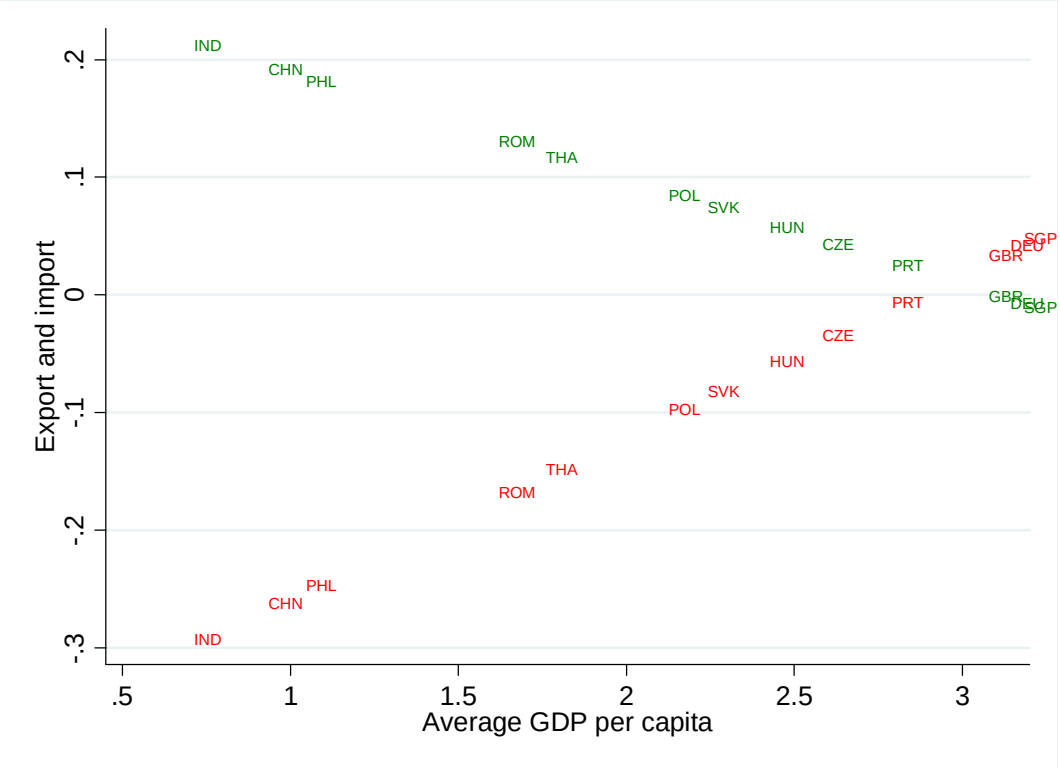
Overall, the main results appear to be fairly stable in all specifications of the model; particularly increased exports of business services contribute to an increase in relative wages of the offshorable occupations at the mean level of log GDP per capita. However, another important result is that the impact varies strongly across country levels of development, as illustrated in Figure 2. In the poorest countries we see that the effects are strong, while there are no effects in the most developed countries in our sample. This is consistent with our initial argument that the impact on relative wages is likely to be higher in thinner and less integrated labor markets than in more developed ones. In sophisticated labor markets, adjustments are smoother, wage gaps across occupations are smaller, and people in different occupations with similar levels of education or skills have more similar wages. Developed countries can hence more easily adjust to a fall in demand for offshorable occupations with significant effects on relative wages.

Table 4: The effects of offshoring on relative occupational wages including country dummies

Dependent variable: Relative wage	(1)	(2)
Growth rate of exports	0.122[a] (0.041)	0.273[b] (0.110)
Growth rate of imports	-0.166[a](0.060)	-0.386[a] (0.132)
Ln GDP per capita		0.317 (0.253)
Growth rate of exports × Ln GDP per capita		-0.090[c] (0.051)
Growth rate of imports × Ln GDP per capita		0.138[b] (0.057)
Time trend	0.015[a] (0.005)	0.002 (0.011)
Occupation dummies		
D11	1.153[a] (0.289)	1.153[a] (0.289)
D14	1.190[a] (0.298)	1.190[a] (0.299)
D45	0.093 (0.349)	0.093 (0.349)
D46	0.099(0.367)	0.100 (0.367)
D52	1.119[a] (0.309)	1.119[a] (0.310)
D76	1.151[a] (0.291)	1.149[a] (0.292)
D77	0.514[c] (0.291)	0.516[c] (0.292)
D91	0.005 (0.342)	0.005 (0.343)
D94	0.084 (0.362)	0.085 (0.362)
D97	0.128 (0.296)	0.127 (0.296)
D120	1.236[b] (0.599)	1.237[b] (0.600)
D128	0.377 (0.277)	0.376 (0.278)
D129	1.851[a] (0.464)	1.852[a] (0.464)
D130	0.655[b] (0.305)	0.655[b] (0.305)
D132	0.651[b] (0.303)	0.651[b](0.304)
D133	1.356[a] (0.370)	1.356[a] (0.371)
D134	0.810[c] (0.475)	0.810[c] (0.476)
D135	0.540 (0.340)	0.541 (0.340)
D136	0.660[b] (0.319)	0.660[b] (0.320)
D138	0.616[b] (0.300)	0.616[b] (0.300)
D140	-0.073 (0.412)	-0.073 (0.412)
D141	-0.019 (0.398)	-0.019 (0.398)
Country dummies		
Germany	-0.287[a] (0.107)	-0.782[b] (0.379)
United Kingdom	0.181 (0.226)	-0.294 (0.396)
Singapore	0.062 (0.167)	-0.464 (0.413)
Portugal	0.867[a] (0.176)	0.513 (0.323)
Czech	0.231[a] (0.088)	-0.065 (0.236)
India	1.865[a] (0.417)	2.128[a] (0.510)
China	0.121 (0.186)	0.335[c] (0.200)
Philippines	0.296[c] (0.170)	0.434[b] (0.206)
Thailand	1.330[a] (0.187)	1.217[a](0.198)
Slovakia	0.136 (0.110)	-0.041(0.163)
Poland	-0.141(0.117)	-0.270[c] (0.141)
Hungary	0.007 (0.125)	-0.224 (0.204)
Observations	1426	1426
R-squared	0.621	0.621

Notes: Standard errors, in parentheses, are corrected for clustering. Superscripts a, b, and c denote statistical significance at the 1%, 5%, and 10% level respectively.

Figure 2. Partial effect of increased exports and imports on relative wages by GDP per capita.



Note: The partial effects of imports and exports are calculated using the regression coefficients and the average log GDP per capita (GDPPC).

The negative demand effect in exporting countries is also counteracted by the productivity effect. By offshoring relatively inefficient production processes, a firm can reduce unit costs and invest in more complex activities where it has a comparative advantage. Several studies find a positive relation between increased offshoring and productivity (Amiti and Wei, 2006; Mann, 2004). Grossman and Rossi-Hansberg (2006a) show theoretically how increased productivity caused by offshoring can have an increasing effect on the real wages of the offshored occupations in the origin country. Rodriguez-Clare (2007) point out that even if developed countries may experience a downward trend in

offshored occupational wages in the short run, positive productivity effects may dominate in the long run, resulting in increased wages.

6. Concluding remarks

Rapid improvements in information and communication technology during the last decade have increased tradability of services. Such trade has received a lot of media and political attention recently, especially in developed countries. Although service outsourcing is still at a relatively low level, it is growing with technological improvements. It is therefore of great interest to understand its impact on wages and income distribution.

The empirical findings in this paper are admittedly tentative – addressing the issues at hand in a more satisfactory fashion requires better data. Still, we do believe that our results indicate that increased exports of IT-related services lead to higher relative wages in related offshorable occupations in developing countries, whereas increased imports have the opposite effect. In the most developed countries, however, relative wages are not significantly affected. This suggests that the fear in developed countries of negative distributional effects is unfounded, at least when it comes to outsourcing of services. Instead of debating whether offshoring is good or bad, the focus should be on how much of the increased national income caused by offshoring should be redistributed for re-training and unemployment insurance for the workers whose jobs have been offshored. The poorer countries, on the other hand, see increasing wage differentials. However, one can hardly deplore the fact that skilled jobs are moving there and increasing their overall income level.

Although the empirical results in this paper are quite strong, the weaknesses of the data must again be acknowledged. The analysis has therefore been forced to use partial

measures of offshoring and a limited number of occupational wage data observations. Still, we do believe that the difference between developing and developed countries with regard to the impact is interesting and significant, and that it should survive a more comprehensive econometric analysis with better data.

References

Amiti, M. and Wei, S. (2005), Fear of Service Outsourcing: Is it justified? Economic Policy 20, 308-348.

Amiti, M. and Wei, S. (2006), Service Offshoring and Productivity: Evidence from the US, NBER working paper 11926.

A.T.Kearney (2005), Building the Optimal Global Footprint, http://www.atkearney.com/.

Baldwin, R. (2006), Globalization: The Great Unbundling(s), Working Paper, Economic Council of Finland.

Bardhan, A.D. and Kroll, C. (2003), The New Wave of Outsourcing, Fisher Center Research Reports, University of California, Berkeley.

Blinder, A. S. (2005), Fear of Offshoring, CEPS working paper no 119.

Blinder, A. S. (2006), Offshoring: The Next Industrial Revolution? Foreign Affairs, 85:2, 113-128.

Deardorff, A. V. (2001), Fragmentation in simple trade models, North American Journal of Economics and Finance 12, pp 121-137.

Ekholm, K. and Hakkala, K. (2006), The Effect of Offshoring on Labour Demand: Evidence from Sweden, CEPR Discussion Paper 5648.

Ekholm, K. and Ulltveit-Moe, K. H. (2007), A new look at offshoring and inequality: specialization versus competition, CEPR Discussion Paper 6402.

Feenstra, R. C. and Hanson, G. H. (1999), The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1990, Quarterly Journal of Economics 114, 907-41.

Freeman, R.B and Oostendorp, R. (2000), Wages around the World: Pay across Occupations and Countries, NBER Working Paper Series 8058.

Friedman, T. (2004), What Goes Around…, The New York Times, Online Edition, February 26.

Grossman, G. M. and Rossi-Hansberg, E. (2006a), Trading Tasks: A Simple Theory of Offshoring, NBER Working Paper Series, 12721.

Grossman, G. M. and Rossi-Hansberg, E. (2006b), The Rise of Offshoring: It's Not Wine for Cloth Anymore, manuscript, Princeton University.

Hijzen, A. (2007), International Outsourcing, Technological Change, and wage Inequality Review of International Economics 15(1), 188-205.

Jensen, J.B. and Kletzer, L.G. (2005), Tradable services: understanding the scope and impact of service offshoring, Institute for International Economics Working Paper 05-9.

Leamer, E. E. and Michael Storper, M. (2001), The Economic Geography of the Internet Age, Journal of International Business Studies, 32:4, 641-665

Levy, F. and Murname, R. (2004), The New Division of Labor, Princeton, NJ: Princeton University Press.

Mann, C. L. (2004), Globalization of IT Services and White Collar Jobs: The Next Wave of Productivity Growth, International Economics Policy Brief, PB03-11.

Pollak, A. (2003), Who's Reading Your X-Ray? The New York Times, Online Edition, November 16,

Robertson, J., Stone, D., Niedewanger, L., Grocki, M., Martin, E., and Smith, Ed (2005), Offshore Outsourcing of Tax-Return Preparation, The CPA Journal, Online Publication of New York State Society of CPA, June.

Rodriguez-Clare, A. (2007), Offshoring in a Ricardian World, NBER working paper 13203.

Samuelson, P.A (1953), Prices of Factors and Goods in General Equilibrium, Review of Economic Studies, 21, 1-20.

Schöller, D. (2006), Service Offshoring: A Challenge for Employment? Evidence from Germany, University of Hohenheim No. 23/2006.

Stolper, W. and Samuelson, P. A. (1941), Protection and Real Wages, Review of Economic Studies, 9(1), 51-68.

Thurm, S. (2004), Tough Shift-Lesson in India: Not Every Job Translates Overseas, The New York Times, Online Edition, March 3.

United Nations (2002), Manual of Statistics of International Trade in Services, Statistical Papers, Series M No.86.

Welsum, D. and Reif, X. (2005), Potential Offshoring: Evidence from Selected OECD Countries, OECD, Paris.

Welsum, V. D., and Vickery, G. (2005), Potential Offshoring of ICT-Intensive Using Occupations, DSTI Information Economy Working Paper, OECD, Paris.

Appendix

Table A1: Offshorable occupations [23].

OWW code	ISCO-88 code	Occupations
11	2147	Coalmining engineer
14	2147	Petroleum and natural gas engineer
46	412/3/4/9	Office clerk
52	2146	Chemical engineer
76	2143	Power distribution and transmission engineer
77	412/3/4/9	Office clerk
45/91/130/134/ 140	4111	Stenographer-typist in different sectors
94	3433	Book-keeper in retail trade
97	4222	Hotel receptionist
120	4221	Airline ground receptionist
128	4223	Telephone switchboard operator
129	2411	Accountant
132	4114	Book-keeping machine operator
133/138	2132	Computer programmer in different sectors
135/141	4113	Card- and tape-punching machine operator in different sectors
136	3412	Insurance agent
142	412/3/4/9	Office clerk

Table A2: Non-offshorable occupations [14].

OWW code	ISCO-88 code	Occupation
13	9311	Underground helper in coalmining
15	3117	Petroleum and natural gas extraction technician
56	9322	Laborer in manufacturing of industrial chemical
61	2230	Occupational health nurse
81	7137	Building electrician
82	7136	Plumber
84	7141	Building painter
85	7122	Bricklayer
98	5122	Cook
99	5123	Waiter
100	9132	Room attendant or chambermaid
111	8323	Motor bus driver
114	3141	Ship’s chief engineer
118	3143	Air transport pilot