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The Impact of Trade Liberalisation on Wage Inequality: Case of Pakistan

ZARA SALMAN and MARIAM JAVED

1. INTRODUCTION

While an increasing number of developing economies are engaging in trade liberalisation, its impact on wage inequality is not quite understood. Trade liberalisation is defined as the removal or reduction of restrictions or barriers on the free exchange of goods between nations. This includes the removal or reduction of both tariff (duties and surcharges) and non-tariff obstacles (like licensing rules, quotas and other requirements) [Investopedia].[1] This phenomenon is seen to impact wages for various skill levels differently and therefore, is likely to have consequences on wage inequality as well. Even though various studies have focused on how economic growth and various demographic factors affect wage inequality, few studies examine the impact on it as a result of policy changes such as, trade liberalisation [Kassa (2003)]. Given Pakistan's slashing reforms towards liberalisation of trade in the 1990s especially after its membership of the WTO in 1995, the impact of this policy on wage inequality is equally important as other determinants.

The Heckscher-Ohlin model and the Stolper-Sameulson Theorem provide the necessary theoretical underpinning to explain how free-trade impacts wages in different sectors of the economy. According to the H-O model, countries specialise in the production of those goods which intensively use the factors of production in which they are abundantly endowed. Consequently, this model predicts that while developed countries specialise in the production of goods that intensively use skilled labour, developing countries like Pakistan, specialise in goods that intensively use unskilled labour [Giliani, *et al.* (2003)]. Under this approach, international competition in developed countries will only increase wages of high-skilled labour, if and only if there is an increase in the relative prices of goods they specialise in. This result is presented by the Stolper-Sameulson Theorem. This theorem, in the developing country context, would imply that trade liberalisation increases the relative prices of industries that employ unskilled labour, and therefore, increasing their wages would consequently reduce wage inequality within the country.

Zara Salman <12020034@lums.edu.pk> and Mariam Javed <mariam.jskhan@live.com> are affiliated with Department of Economics, School of Humanities, Social Sciences and Law, Lahore University of Management Sciences, Lahore.

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[1]http://www.investopedia.com/

In this paper, the effect of trade liberalisation policies on wage inequality in Pakistan in 1990s and early 2000 is investigated. Firstly, the paper aims to investigate whether trade liberalisation played any role in influencing the Pakistani wage structure, during this ten year period after joining the WTO. Secondly, if it did have any impact, it seeks to examine whether it is in accordance with the result expected by the Stolper-Sameulson Theorem. The results demonstrate that an increase in trade liberalisation, measured through import penetration, export penetration and relative prices of each industry, has increased wage inequality for different skill levels; a result contrary to that predicted by the Stolper-Sameulson Theorem.

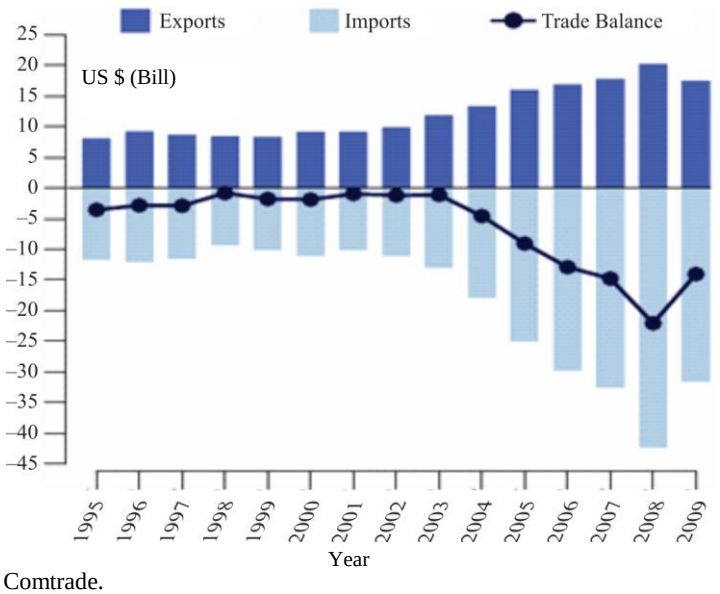
The rest of this section provides a background on Pakistan's trade liberalisation and wage inequality, the consequent objectives of the research and the relevant review of the literature. Section 2 outlines the empirical model while Section 3 describes the data and data sources. Section 4 then presents the estimation results, while Section 5 provides a discussion of these findings in light of other research. Concluding comments and recommendations are in Section 6.

1.2. Background of Pakistan's Trade Liberalisation and Wage Inequality

Trade liberalisation in Pakistan was introduced to strengthen its industrial base. Till the sixties, Pakistan had a very restricted trade policy of import substitution in order to protect its weak manufacturing sector. This was because Pakistan had always focused on its agricultural sector and combined with a lack of well organised infrastructure and political instability, trade policy was characterised with high tariff and non-tariff barriers. However, in the seventies the beginning of an open trade policy was seen. Yet the most substantial change occurred in the late eighties and early nineties when tariff slabs were reduced from 17 to 10 and a uniform tax was introduced instead of a commodity based sales taxes. Moreover, the maximum tariff was decreased from 225 percent in 1986-87 to 70 percent in 1994-95, whereas non-tariff barriers were mostly removed as well. Through various tax holidays and tariff cuts like the decline in average tariff rate from 77 percent to about 17 percent, the government of Pakistan aimed to provide incentives to improve the efficiency of its manufacturing sector. Moreover, measures to encourage exports were introduced, which included the removal of all export duties except for 251 items for which Pakistan has a comparative advantage in the international market. Also included in these measures was entering into Free trade Agreements with mutual agreements on easy access to markets for countries like Malaysia and Sri Lanka [Bashir (2003)]. Pakistan also became member of the World Trade Organisation in 1995 which lead to further openness through steps like signing the Agreement on Textile and Clothing [Industrial Information Network].[2] Moreover, the implementation of a Structural Adjustment and Stabilisation Program led to further trade reforms as they were an integral part of the development process introduced by them [Hyder, *et al.* (2011)]. These measures resulted in a positive effect which was seen in the trade-to-GDP ratio. The ratio increased by 0.4 percentage points per annum in Pakistan since 1990 [Civil Service of Pakistan].[3] The result of these measures can also be seen in the rising trend of exports and imports as depicted by Figure 1.

[2]http://www.iin.com.pk/

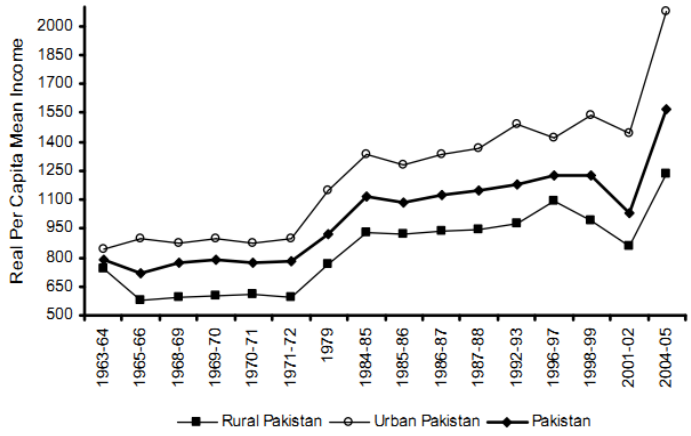
[3]http://www.cssforum.com.pk/



Source: UN Comtrade.

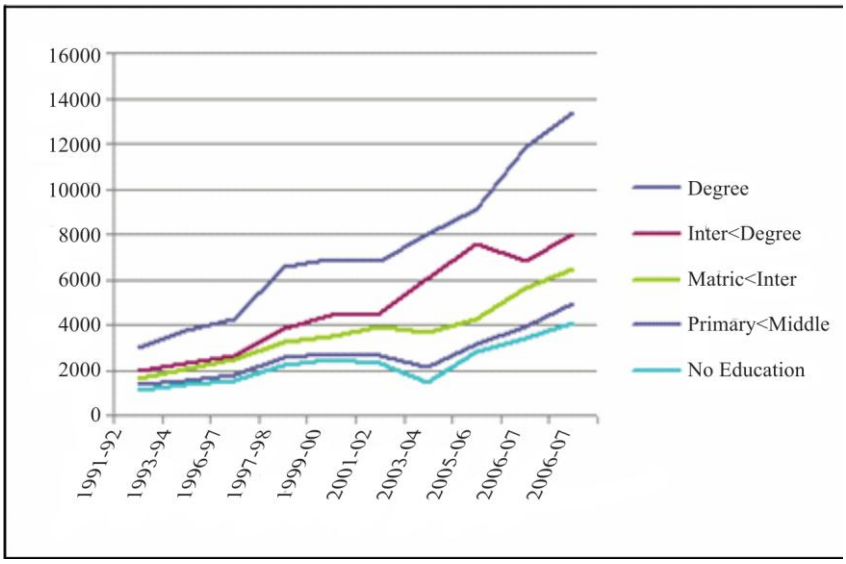
Fig. 1. Total Imports, Exports and Trade Balance

While the volume of trade has increased in Pakistan, the trend for wages has changed as well. Figure 2 shows an upward trend of real per capita mean incomes over time for both rural and urban areas of Pakistan. Furthermore, real and money wages in Pakistan have shown a positive trend from year 1995 till 2005 with a growth rate lower than GDP per capita growth rate in the nineties but higher than GDP per capita from the year 2000 onwards [Irfan (2008)]. Moreover, the trend of wages based on educational categories shows a positive movement over the period 1995-2006 with the greatest improvement seen for workers with higher degrees. This can be seen in Figure 3.



Source: M. Irfan (2008) Pakistan's Wage Structure. PIDE, pp. 15-18.

Fig. 2. Mean Income Trend



Source: M. Irfan (2008) Pakistan's Wage Structure.PIDE, pp. 15-18.

Fig. 3. Wage Trend Based on Educational Category

Moreover, Pakistan's wage data demonstrates the existence of inter-industry wage premiums, as emphasised in Table 1. This elicits that wages for workers with the same degree of skill do not equalise across all industries.

Table 1

Inter-Industry Premiums for Three Skill Groups

	Skilled Premium	Semi-Skilled Premium	Unskilled Premium
Food, Beverage and Tobacco	135.0	59.9	44.2
Textile Wearing Apparel, Leather Industry	153.5	64.8	44.1
Paper, Paper Products, Printing, Publishing	155.4	64.4	48.8
Chemical, Petroleum, Coal, Rubber and Plastic	162.1	93.3	52.7
Basic Metal Industries	145.7	80.1	62.4
Fabricated Metal, Machinery and Equipment	176.5	67.2	49.9
Other Industries	172.6	66.7	50.3

Note: Data for Mean of Yearly Real Wage (1996-97). Real Wages in (000) Rupees.

1.3. Objectives of the Research

The variation in wage premiums across industries for workers with the same skills, paves the way for researching the impact of trade liberalisation on wage inequality. This paper aims to use inter-sector and time variability from years, 1996 to 2005 in trade liberalisation as well as skill premiums to explore the role played by the former in influencing the wage structure of Pakistan in late 1990s and early 2000. Furthermore, it aims to establish the degree to which the Stolper-Sameulson Theorem can explain

Pakistan's wage structure by mid-2000. However, based on the background of trade liberalisation in Pakistan, this paper solely focuses at the effect of the manufacturing sector wages, since the prime objective of trade liberalisation policies has been to improve the industrial sector. Additionally, this research departs from H-O model to a degree. This is because the H-O model enforces perfect inter-sector mobility of labour, assuming wages for workers with the same degree of skill to equalise across all industries, a result inconsistent with the wage data of Pakistan (Table 1).

Since no similar study has been conducted for Pakistan, our paper will serve as an important tool for policy-makers, to draw lessons from existing policy measures which effect the development and growth of the economy. Moreover, the conclusions drawn from this research can also be used as a reference and an evaluation tool for future policy changes as Pakistan enters into new trade relations with various countries.

1.4. Literature Review

Current research indicates that the impact of trade liberalisation on wage inequality is highly debatable. The East Asian countries experienced a positive effect of trade liberalisation i.e., a decline in wage inequality, in accordance to the Stolper-Samuelson theorem. Yet some Latin American countries seem to have experienced the reverse of what the theorem predicted; a liberal trade policy seems to have increased wage inequality. Beyer, *et al.* (1999), while conducting a study on Chile, found that liberalisation had a substantial effect on wage inequality. They provided two reasons for the increase in inequality i.e., transformation in the productive structure of the economy and technological change which was skill biased. These changes resulted in an improvement in wages for skilled labour.

Furthermore, according to Galiani, *et al.* (2003), the trade liberalisation reforms introduced in the nineties in Argentina demonstrate that wage inequality widened in those manufacturing industries where import penetration deepened. In their empirical analysis, the impact of import penetration on college wage premium was studied. By controlling for both individual and industry specific characteristics, it was discovered that there is a positive and significant correlation between both variables. This clearly indicated that while trade liberalisation increases wage inequality in Argentina, it does not completely explain this rise. Therefore other factors must be taken into account as well.

Moreover, some research has led to results that indicate no relation in the empirical analysis of the impact of trade openness on wage inequality. According to Munshi, *et al.* (2006) who studied this relationship for the cotton textile industry of Bangladesh, liberal trade reforms do not increase wage inequality. Four measures were used to estimate this relationship i.e., the ratio of USA to Bangladeshi manufacturing prices, the ratio of exports plus imports to GDP, the ratio of aggregate exports to GDP, and the ratio of imports of consumer goods to aggregate consumption. All measures show an increase in both the wages of skilled and unskilled workers, implying that trade liberalisation has lead to a positive technical change which is skill neutral but that it does not affect wage inequality.

On the other hand, while the above studies go against the predictions of Stolper-Samuelson theorem, those done by Bigsten, *et al.* (2006), Goh, *et al.* (2005) and Kumar, *et al.* (2005) seem to reinforce the predictions of the Stolper-Samuelson theorem. Kumar,

et al. (2005) use tariff reductions to study the impact of trade liberalisation on wage inequality in India, implying that productivity increases are passed on to industry wages. As those manufacturing industries with higher proportion of unskilled labour had greater tariff reductions, the increase in their wages was also greater relative to skilled labour.

2. ECONOMETRIC METHODOLOGY

2.1. Basic Model

In this section, the estimation strategy used in this study is presented. It commences by introducing the basic model that is frequently used in human capital literature in order to determine differences in wages across skill levels, which includes individual, yearly, industrial and regional control variables. This is followed by an introduction of the augmented empirical specifications.

In the basic model, skill dummies are included in order to see the differences in wage premiums between skilled, semi-skilled and unskilled workers across different industries.

$$Wage_i=\alpha_1+\alpha_2 age+\alpha_3 age^2+\delta_1 married+\delta_2 male+\delta_3 urban+\delta_4 training + \delta_5 Y+\gamma P+\lambda I+\varphi_1 S+\varepsilon_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2.1)$$

An OLS model is used to estimate the Equation 2.1. In the above Model 1, *Y* represents the year dummy, *P* represents provinces dummies, *I* represents industry dummies while *S* represents skill dummies. Two variations of Model 1 are run, one for each year, 1996 and 2006 respectively.

Moreover, there is a need to control for clustering in this model since this paper has used aggregate level data for imports, exports and prices at industry level and combined it with micro level data for workers with respect to their industries. If clustering at industry level is not controlled for, the estimated standard errors from OLS estimates on the aggregate data will be too small while their respective *t*-values will be very large, resulting in rejection of the null hypothesis of no significance [Cheah (2009)].

2.2. Introducing Trade Variables

Basing the analysis on Giliani and Sanguinetti's paper (2003), interaction terms between trade and skill variables are introduced in order to evaluate how trade liberalisation impacts wage premiums. Trade liberalisation is measured through import and export penetration ratios and relative prices for each industry.[4] In Model 2, only interactions between skill dummies and import penetration are introduced to see the impact of reduction in tariffs and quotas on the skill premiums. Furthermore, in Model 3, interaction terms between skill dummies and export penetration are added to Model 2, in order to assess the significance of trade liberalisation, encompassing both exports and imports in influencing wages premiums. Then, relative prices are added to Model 3, by including its interactions with the skill dummies of industries in order to decipher how their inclusion further affects the impact of our variables of interest on disparity in wages across varied skill levels. This is done in Model 4.

[4]When we introduce these interactions we remove the skill dummies from the equation.

3. DATA AND CONSTRUCTION OF VARIABLES

3.1. Data Sources

In this section, the data sources used in this study are discussed and the construction of different variables used in the empirical models is highlighted. Furthermore, a brief description of these variables, followed by summary statistics is also provided.

The data used in this study is obtained from a nationally representative cross-sectional data set named as the *Labour Force Survey of Pakistan*. The LFS is an annual survey, carried about by the Federal Bureau of Statistics. The major aim of the survey is to collect a set of comprehensive statistics on the various dimensions of country's civilian labour force. The number of sample households in the survey is 32,778 (99.7 percent of the total sample). Furthermore, it uses a Multi-stage stratified random sample [International Household Survey Network].[5]

The surveys for the year 1996-97 and 2005-06 are obtained and merged in order to carry out the analysis. Since trade liberalisation policies gained tremendous momentum in the early nineties and moreover, Pakistan became a member of the World Trade Organisation at this time, 1996-97 is an ideal time period to be taken as the base period to which trade liberalisation effects of wages can be compared. Secondly, a nine to ten year gap between the two data points is ample time for the trade liberalisation policies to have any effect and thus 2005-06 is taken as the second data point.

Furthermore, since this survey does not provide data on imports, exports or their respective prices, which is necessary for the analysis, this information is obtained from the *Federal Bureau of Statistics Yearbook 2006*, Section 9. Moreover, as this research is interested in evaluating the effects of trade liberalisation on wage inequality in the manufacturing sector, the sample is restricted to the Two Digit Standard Industrial Classification (SIC). The description is given in Table 2.

Table 2

Two Digit (SIC) for Manufacturing Industries

Code	Description
31	Manuf. of Food Beverage and Tobacco
32	Manuf. of Textile Wearing Apparel and Leather Industry
33	Manuf. of Wood or Wood Product or Furniture
34	Manuf. of Paper, Paper Product, Printing, Publishing
35	Manuf. of Chemical Petroleum, Coal Rubber and Plastic Prod.
36	Manuf. Non-metallic Product Except Petroleum and Coal
37	Basic Metal Industries
38	Manuf. Fabricated Metal Products, Machinery and Equipment
39	Other Manuf. Industries and Handicraft

Source: Code Book, Labour Force Survey, 1996-97.

[5]http://surveynetwork.org/

While, the LFS provides data about all industries, the Statistical Yearbook, 2006 is unable to supply us with trade data for Industries 33 and 36. Therefore, as key information on imports and exports is missing for these industries, their respective observations are dropped from the sample.

3.2. Definition and Construction of Variables

Basing our model on Giliani and Sanguinetti's paper, 'The impact of trade liberalisation on wage inequality: evidence from Argentina' (2003), the extent of trade liberalisation is measured through import penetration, export ratio and relative prices. Import penetration is the logarithm of the ratio of imports to the gross value added for each industry in the manufacturing sector, whereas export ratio is defined as the logarithm of the ratio of exports to the gross value added for each industry in the manufacturing sector. These variables have been adjusted for inflation using GDP deflator, where the base year is 2000-01.[6]

To gather data on relative prices for each industry, the production value of each industry was divided by the quantity produced for it, to get market prices. This method was used as no data was available for individual industry prices. Real prices for years 1996-97 and 2005-6 were firstly obtained by dividing each price by the year's Consumer Price Index (CPI)[7] and secondly by the Wholesale Price Index (WPI).[8] However, since these prices were not in the same unit, due to each industry having a different quantity unit, the prices were converted into index numbers by taking 2005-2006 as the base year. These index numbers for relative prices were obtained by dividing the real prices of both 1996-97 and 2005-6 by the real prices of base year, 2005-6. By this method, comparison of the prices of 1996-1997 with 2005-2006 as base year could be undertaken.

Table 3

Periodic Changes in Trade Variables

	Import Penetration		Export Ratio		Relative Prices	
Industries	1996-1997	2005-2006	1996-1997	2005-2006	1996-1997	2005-2006
Food, Beverage and Tobacco	0.81	1.58	0.07	0.07	1.11	0.73
Textile, Wearing, Apparel and Leather	0.04	0.04	3.60	1.29	1.22	0.73
Paper, Paper Products, Printing, Publishing	0.67	0.62	0.00	0.00	1.64	0.73
Chemical, Petroleum, Coal, Rubber and Plastic	3.81	1.90	0.11	0.22	0.88	0.73
Basic Metal Industries	3.23	2.63	0.00	0.00	2.15	0.73
Fabricated Metal, Machinery and Equipment	4.03	6.91	0.17	0.14	2.75	0.73
Other Manufacturing Industries and Handicraft	40.67	53.01	45.93	59.50	4.82	0.73

Source: Federal Bureau of Statistics Yearbook 1996 and 2006.

Furthermore, in order to see the effect of trade liberalisation on wage inequality among labour of different skill levels in the manufacturing sector, variables were defined for wage and the three skill categories. The variable for wage is an annual estimate calculated by translating weekly or monthly earnings (whichever is available for a

[6]GDP Deflator: 1996= 62.04, 2006=147.07.
[7]CPI: 1996=81.11, 2006=131.64 (Base Year 2000-01).
[8]WPI: 1996=81.62, 2006=136.68 (Base Year 2000-01).

particular cross-section), into yearly income. However, since there was still a constraint of missing wages for certain observations (3381 observations) that needed to be addressed, observations from the working sample were used, to estimate by OLS, a typical wage determination (2.1). Parameter estimates from this equation and values of all right hand-side variables for non-workers were used to generate the predicted or fitted wage for the non-workers.

The level of skill premiums were analysed by educational level of workers. Therefore, three skill groups were defined: unskilled (those individuals who have at most attended primary school but have not finished it), semi-skilled (those that have at most attended Intermediate level of schooling but have not finished it) and skilled group (those who have finished a tertiary degree). Dummies are generated for each skill level and are equal to 1, corresponding to the worker's respective skill. The reason why only education and not training is used as proxy for skill is because most workers are trained in the informal sector so the data available for formal training is scarce. Moreover, this data cannot account for the differences in the skills required for white collar jobs and blue collar jobs.

Age and age^2 have been used as a proxy for experience and experience^2 respectively. Mincer's method is not used because it requires completed years of schooling which is missing in our data. The available data fails to differentiate between attended years of schooling and completed years of schooling. Furthermore, the dummies for gender, marital status, training and rural-urban origin are used as right hand side variables for the wage equation. Dummies are also generated for 7 industries and 4 provinces in order to control time-invariant industries and province specific effects. Since, this study is interested in evaluating the impact of trade liberalisation on wage inequality across two periods, a further dummy is generated for year 1996 equal to 1 if year is 1996-97 and year 1996 equal to 0 if year is 2005-06.

Interaction terms are also incorporated in the study. These include interactions between different levels of skill and import penetration, export ratio and relative prices. The variables are defined in Table 4 while summary statistics for all these variables are given in Table 5.

Table 4

Definition of Variables Used in the Regression Analysis

Variables	Description
Wage (I**nwage**)	Yearly wages of all workers in the manufacturing sector excluding industry 33 and 36
Age **(age)**	Age in years
Age^2 **(age2)**	Quadratic term for age
Male (male)	=1if worker is male
Married **(mar)**	=1 if worker is married
Urban **(urban)**	=1 if worker works in an urban area
Year 1996 **(yr1996)**	=1 if year is 1996
Training **(train)**	=1 if worker has training

Continued—

Table 4—(*Continued*)

Punjab **(Punjab)**	=1 if worker is in Punjab
Sindh **(Sindh)**	=1 if worker is in Sindh
KPK **(KPK)**	=1 if worker is in KPK
Balochistan **(Baloch)**	=1 if worker is in Balochistan
Manuf. of food, beverage and tobacco **(in31)**	=1 if worker works in the food, beverage and tobacco industry
Manuf. of textile, wearing, apparel and leather industry **(in32)**	=1 if worker works in the textile, wearing, apparel and leather industry
Manuf. of paper, paper product, printing, publishing **(in34)**	=1 if worker works in the paper, paper product, printing, publishing industry
Manuf of Chemical, petroleum, coal ,rubber and plastic **(in35)**	=1 if worker works in the chemical, petroleum, coal, rubber and plastic industry
Basic metal industries **(in37)**	=1 if worker works in the basic metal industry
Manuf. Fabricated metal, machinery and equipment **(in38)**	=1 if worker works in the fabricated metal, machinery and equipment industry
Other manuf. Industries and handicraft **(in39)**	=1 if worker works in other manufacturing industries and handicrafts
Import Penetration (**inimp)**	Ratio of imports to value added
Export Penetration (**inexp)**	Ratio of exports to value added
Relative Prices **(price)**	Ratio of real prices to Wholesale Price Index
Skilled **(skilled)**	=1 if worker has at most attended primary school but has not finished it
Semi-skilled **(semiskilled)**	=1 if worker has at most attended Intermediate level of schooling but has not finished it
Unskilled **(unskilled)**	=1 if worker has finished a tertiary degree
Skilled Dummy * Import Penetration **(impskilled)**	Interaction term of skilled with import penetration
Semi-skilled Dummy * Import Penetration **(impsemi)**	Interaction term of semi-skilled with import penetration
Unskilled Dummy * Import Penetration **(impunskill)**	Interaction term of unskilled with import penetration
Skilled Dummy * Export Penetration **(expskilled**)	Interaction term of skilled with export penetration
Semi-skilled Dummy * Export Penetration **(expsemi)**	Interaction term of semi-skilled with export penetration
Unskilled Dummy * Export Penetration **(expunskill)**	Interaction term of unskilled with export penetration
Skilled Dummy * Relative Prices **(pskill**)	Interaction term of skilled with relative prices
Semi-skilled Dummy * Relative Prices **(psemi)**	Interaction term of semi-skilled with relative prices
Unskilled Dummy * Relative Prices **(punskill)**	Interaction term of unskilled with relative prices

Table 5

Summary Statistics of the Variables Employed in the Wage Equation

Variables	Mean	Std. Dev.	Min.	Max.
Wage	10.343	1.130	0	13.693
Age	29.901	12.869	10	85
Age^2	1059.707	936.506	100	7225
Male	0.611	0.487	0	1
Female	0.389	0.487	0	1
Married	0.520	0.499	0	1
Unmarried	0.478	0.499	0	1
Urban	0.660	0.474	0	1
Rural	0.312	0.474	0	1
Year 1996	0.312	0.463	0	1
Year 2006	0.688	0.463	0	1
Training	0.078	0.268	0	1
Punjab	0.66	0.482	0	1
Sindh	0.248	0.432	0	1
KPK	0.089	0.285	0	1
Balochistan	0.022	0.145	0	1
Manuf. of Food Beverage and Tobacco	0.107	0.309	0	1
Manuf. of Textile Wearing Apparel and Leather Industry	0.577	0.494	0	1
Manuf. of Paper, Paper Product, Printing, Publishing	0.034	0.182	0	1
Manuf. of Chemical Petroleum, Coal Rubber and Plastic Prod.	0.054	0.227	0	1
Basic Metal Industries	0.021	0.144	0	1
Manuf. Fabricated Metal Products, Machinery and Equipment	0.104	0.305	0	1
Other manuf. Industries and Handicraft	0.102	0.303	0	1
Import Penetration	0.804	1.233	0.026	4.198
Export Penetration	0.998	1.196	0	4.318
Relative Prices	1.160	1.027	0.732	4.819
Skilled	0.059	0.235	0	1
Semi-skilled	0.335	0.472	0	1
Unskilled	0.606	0.489	0	1
Skilled Dummy * Import Penetration	0.056	0.341	0	4.198
Semi-skilled Dummy * Import Penetration	0.267	0.777	0	4.198
Unskilled Dummy * Import Penetration	0.481	1.068	0	4.198
Skilled Dummy * Export Penetration	0.043	0.313	0	4.318
Semi-skilled Dummy * Export Penetration	0.307	0.791	0	4.318
Unskilled Dummy * Export Penetration	0.648	1.089	0	4.318
Skilled Dummy * Relative Prices	0.063	0.319	0	4.819
Semi-skilled Dummy * Relative Prices	0.370	0.751	0	4.819
Unskilled Dummy * Relative Prices	0.727	1.031	0	4.819

4. EMPIRICAL FINDINGS

In this section, the findings of the empirical model will be presented and discussed. This section begins with the basic model, and moves on to the modifications made to the basic model. Furthermore, the effect of the three measures of trade liberalisation on wage inequality in Pakistan is investigated collectively as well as separately.

Table 6 presents a pair of typical estimated coefficients for variables that control for individual characteristics for the year 1996 and 2006 [Equation (2.1)]. The estimated coefficients are close to expected. Wages increase with education and age. Urban workers earn more than rural workers in both years, as is expected. Marital status and Gender are insignificant. Wages do not vary by gender as the females included in this sample are mostly involved in white-collared jobs rather than blue-collared jobs. In 1996, there is no significant difference in wages across provinces; however, in 2006 the wages in Sindh are

Table 6

Individual Control Variables: Estimates for Selected Years

Variables	1996-97	2005-06
Skilled Labour	0.938***	1.062***
	(0.123)	(0.054)
Semi-skilled Labour	0.374***	0.327***
	(0.027)	(0.007)
Age	0.063***	0.045***
	(0.009)	(0.005)
Age2	–0.001***	–0.000***
	(0.009)	(0.000)
Married	0.065	0.033
	(0.049)	(0.038)
Male	0.058	–0.018
	(0.047)	(0.008)
Urban	0.142***	0.133***
	(0.02)	(0.029)
Training	0.036	0.045
	(0.045)	(0.045)
Sindh	0.043	0.049**
	(0.062)	(0.015)
KPK	–0.126	–0.178***
	(0.076)	(0.042)
Balochistan	0.100	0.022
	(0.066)	(0.101)
Food, Beverage and Tobacco	–0.222***	–0.060***
	(0.017)	(0.003)
Textile Wearing Apparel, Leather Industry	–0.143***	–0.164***
	(0.017)	(0.003)
Paper, Paper Products, Printing, Publishing	–0.024	–0.044***
	(0.335)	(0.009)
Chemical, Petroleum, Coal, Rubber and Plastic Products	–0.131**	–0.045***
	(0.052)	(0.012)
Basic Metal Industries	–0.052**	0.189***
	(0.015)	(0.015)
Fabricated Metal Product, Machinery and Equipment	–0.126***	0.019***
	(0.009)	(0.005)
R-squared	0.234	0.146
Number of Observations	3220	7117

Notes: *** and** indicate significance at 1 percent and 5 percent respectively.
Standard errors are written in parenthesis.
The robust standard errors are corrected for clustering at the industry level.

significantly higher than Punjab, while the wages in KPK are significantly lower than Punjab. Furthermore, wages on average have increased in the Food, Chemical, Metal and Fabricated Metal industries (compared to the base category, which is Other Manufacturing Industries and Handicrafts) over the ten year period. However, wages on average declined in the Textile and Paper industry over this period. The skilled premium also increased on average during this period.

Model 2 details the introduction of interaction terms between import penetration and skill levels to the original model, to see the impact of trade liberalisation on wage inequality. The results of the regression are given in Table 7. The estimated impact of import penetration on the wages of skilled workers is positive and highly significant, while its impact on the wages of unskilled workers is negative and also statistically significant. Since, the coefficient for Import Penetration* Semi-skilled is statistically insignificant, we observe no change in the wages of semi-skilled workers with an increase in import penetration. Overall this result implies that as import penetration increases by 1 percent, wage premiums of skilled workers increase by 0.212 percent while the wages of the unskilled workers decrease by 0.199 percent.

Moving on, further interactions are added between export penetration ratio and skill dummies (Model 3), it is observed that some of the earlier coefficients change drastically, as shown in Table 7. The coefficient for the year dummy increases substantially. The industries which had significant coefficients in Model 2, become statistically insignificant in Model 3, and vice versa. This Model also makes the effect of our import penetration interaction insignificant, implying that there is no change in wage premiums as a result of higher import penetration. Furthermore, the interactions between export penetration and skilled dummy, and export penetration and unskilled dummy, are statistically insignificant, there is no impact of higher export penetration on the wage premiums of the skilled and unskilled categories and no substantial effect of wage inequality. However, higher export penetration leads to an increase in wage premiums for the semi-skilled. As export penetration increases by 1 percent, the wage premium for the semi-skilled increases by 0.221 percent.

Proceeding to Model 4, relative prices of industries are now interacted with the skill dummies and added to Model 3. The results of this model, as shown in Table 7, are quite consistent with that of Model 3 and thus quite contradictory to Model 2. All import penetration interactions with skill dummies are still insignificant and there is still no impact of export penetration on skilled wage premium. The interactions with relative prices also come out as insignificant. However, unlike Model 3, Model 4 shows that not only semi-skilled but also unskilled wage premium is increasing with an increase in export penetration. Here a 1 percent increase in export penetration leads to a 0.191 percent and 0.136 percent increase in wage premiums for semi-skilled and unskilled labour respectively. This result shows that while with respect to import penetration and relative prices, there is no impact on wage inequality, wage inequality is decreasing with respect to export penetration.

Table 7

Parameter Estimates for Model 2, 3, 4

Variables	Model 2	Model 3	Model 4
Skilled Dummy * Import Penetration	0.213**	0.276	0.065
	(0.079)	(0.154)	(0.170)
Semi-skilled Dummy * Import Penetration	–0.090	0.054	0.023
	(0.073)	(0.056)	(0.065)
Unskilled Dummy * Import Penetration	–0.199*	0.051	0.092
	(0.092)	(0.124)	(.106)
Skilled Dummy * Export Penetration		0.371	0.218
		(0.267)	(0.226)
Semi-skilled Dummy * Export Penetration		0.221***	0.191***
		(0.062)	(0.047)
Unskilled Dummy * Export Penetration		0.086	0.136***
		(0.060)	(0.035)
Skilled Dummy * Relative Prices			0.456
			(0.250)
Semi-skilled Dummy * Relative Prices			0.106
			(0.058)
Unskilled Dummy * Relative Prices			–0.062
			(0.056)
Age	0.063***	0.061***	0.058***
	(0.008)	(0.004)	(0.004)
Age2	–0.0006***	–0.001***	–0.001***
	(0.000)	(0.000)	(0.000)
Married	0.009	0.015	0.025
	(0.046)	(0.034)	(0.033)
Male	0.002	0.005	0.005
	(0.016)	(0.014)	(0.016)
Urban	0.182***	0.174***	0.165***
	(0.025)	(0.014)	(0.013)
Training	0.081*	0.080*	0.067
	(0.040)	(0.034)	(0.038)
Year 1996	0.479***	0.326***	0.294***
	(0.037)	(0.031)	(0.039)
Sindh	0.112**	0.104**	0.087**
	(0.045)	(0.029)	(0.027)
KPK	–0.162**	–0.158**	–0.171**
	(0.049)	(0.053)	(0.050)
Balochistan	0.034	0.039	0.042
	(0.72)	(0.079)	(0.076)
Food, Beverage and Tobacco	–0.578*	0.613	0.699**
	(0.269)	(0.322)	(0.275)
Textile Wearing Apparel, Leather Industry	–0.750*	0.454	0.532
	(0.330)	(0.366)	(0.308)
Paper, Paper Products, Printing, Publishing	–0.473	0.800*	0.844**
	(0.304)	(0.352)	(0.288)
Chemical, Petroleum, Coal, Rubber and Plastic	–0.394	0.745*	0.819**
	(0.264)	(0.331)	(0.256)
Basic Metal Industries	–0.252	0.897**	0.929***
	(0.235)	(0.302)	(0.243)
Fabricated Metal, Machinery and Equipment	–0.336	0.635**	0.701**
	(0.186)	(0.244)	(0.202)
R-Squared	0.174	0.180	0.188
Number of Observations	10337	10337	10337

Notes: ***,**,* indicate significance at 1 percent,5 percent, 10 percent respectively.
Standard errors are written in parenthesis.
The robust standard errors are corrected for clustering at the industry level.

Since the introductions of these export penetration interactions and price interactions have caused significant changes in our coefficients of Model 2, we expect these to be highly correlated with other variables in the regression. We confirm this assertion by reporting the correlation matrix. Table 8 shows that interaction terms between skill and export penetration are highly correlated with the interaction terms between skill and import penetration, and therefore their inclusion in Model 3 gives divergent results. Furthermore, the interaction terms between skill and relative prices are also highly correlated with interactions between export penetration and skill dummy, as well as with the interactions between import penetration and skill dummy.

Table 8

Correlation Matrix

	Price* Skilled	Price* Semi-skilled	Price* Unskilled	Import* Skilled	Import * Semi-skilled	Import* Unskilled
Import-Penetration* Skilled	**0.78**	–0.08	–0.12	1.00	–0.06	–0.07
Import-Penetration* Semi-skilled	–0.07	**0.75**	–0.24	–0.06	1.00	–0.15
Import-Penetration* Unskilled	–0.09	–0.22	**0.78**	–0.07	–0.15	1.00
Export-Penetration* Skilled	**0.71**	-0.07	–0.10	**0.64**	–0.05	–0.06
Export-Penetration* Semi-skilled	–0.08	**0.75**	–0.27	–0.06	**0.69**	–0.18
Export-Penetration* Unskilled	–0.12	–0.29	**0.78**	–0.10	–0.20	**0.72**

Since, there exists significantly high correlations between our key variables, separate models for each of these set of interactions are run. Table 9 reports their results. Model 2, here only includes the interactions between import penetration and skill dummies. Its results have been interpreted earlier which show that as import penetration increases in different industries, the skilled premium increases, while the unskilled premium decreases; therefore, causing wage inequality to increase substantially.

Model 5 only includes the interactions between export penetration and skill dummies. This estimation elicits that as export penetration increases by 1 percent, the wage premium for the skilled and the semi-skilled increases by 0.48 percent and 0.181 percent respectively. From this model, it can be interpreted that skilled and semi-skilled premiums increase while there is no significant change in wage premium for the unskilled, as export penetration of different industries increases. Therefore, rise in export penetration, similar to import penetration, has resulted in increasing wage inequality in Pakistan.

Model 6, also reiterates previous results that an increase in relative prices of industries is likely to increase wage inequality. As a result of an increase in relative prices, there is no significant change in the wage premium for the unskilled worker. However, the skill and semi-skilled wage premium show a substantial growth with respect to rising relative industry prices. If relative prices in any industry increase by 1 percent, the skilled and semi-skilled wage premium increases by 0.483 percent and 0.086 percent respectively.

Table 9

Parameter Estimates for Model 2, 5, 6

Variables	Model 2	Model 5	Model 6
Skilled Dummy * Import Penetration	0.213**		
	(0.079)		
Semi-skilled Dummy * Import Penetration	–0.090		
	(0.073)		
Unskilled Dummy * Import Penetration	–0.199*		
	(0.092)		
Skilled Dummy * Export Penetration		0.485**	
		(0.136)	
Semi-skilled Dummy * Export Penetration		0.181***	
		(0.045)	
Unskilled Dummy * Export Penetration		0.044	
		(0.041)	
Skilled Dummy * Relative Prices			0.483**
			(0.153)
Semi-skilled Dummy * Relative Prices			0.086*
			(0.036)
Unskilled Dummy * Relative Prices			–0.074
			(0.044)
Age	0.063***	0.061***	0.058***
	(0.008)	(0.004)	(0.005)
Age2	–0.0006***	–0.001***	–0.001***
	(0.000)	(0.000)	(0.000)
Married	0.009	0.015	0.026
	(0.046)	(0.031)	(0.037)
Male	0.002	0.007	0.003
	(0.016)	(0.016)	(0.014)
Urban	0.182***	0.179***	0.167***
	(0.025)	(0.017)	(0.014)
Training	0.081*	0.090	0.074
	(0.040)	(0.048)	(0.046)
Year 1996	0.479***	0.367***	0.445***
	(0.037)	(0.038)	(0.052)
Sindh	0.112**	0.109***	0.089**
	(0.045)	(0.024)	(0.031)
KPK	–0.162**	–0.160**	–0.174***
	(0.049)	(0.054)	(0.047)
Balochistan	0.034	0.036	0.039
	(0.72)	(0.072)	(0.072)
Food, beverage and tobacco	–0.578*	–0.291**	–0.142**
	(0.269)	(0.105)	(0.051)
Textile wearing apparel, leather industry	–0.750*	0.118	–0.208***
	(0.330)	(0.082)	(0.049)
Paper, paper products, printing, publishing	–0.473	0.463***	–0.034
	(0.304)	(0.111)	(0.071)
Chemical, petroleum, coal, rubber & plastic	–0.394	0.500***	0.008
	(0.264)	(0.103)	(0.081)
Basic metal industries	–0.252	0.607***	0.092
	(0.235)	(0.111)	(0.068)
Fabricated metal, machinery & equipment	–0.336	0.387***	–0.054
	(0.186)	(0.102)	(0.050)
R- Squared	0.174	0.177	0.186
Number of Observations	10337	10337	10337

Notes: ***,**,* indicate significance at 1 percent,5 percent, 10 percent respectively.
Standard errors are written in parenthesis.
The robust standard errors are corrected for clustering at the industry level.

To test the validity of Models 2, 5 and 6, an F-test was carried out by comparing each with a restricted model which had no interaction term. The F-test showed that for *H0*: no significant difference between the two models, the null hypothesis was rejected for all three models. Moreover, this test is confirmed by the *p*-values of each model. For Model 2, the *p* value (0.0378) is significant at 5 percent level. For Models 5 and 6, the p values 0.0015 and 0.0031 respectively are significant at 1 percent level. Table 10 shows these results. These results confirm that the three separate models with import penetration, export ratio and relative prices as indicators for trade openness are valid and therefore, more suitable to study the impact on wage inequality than Model 4 which has all three indicators together.

Table 10

F-Test

Import Penetration* Skilled= Import Penetration* Semi-skilled= Import Penetration* Unskilled
F(3,6) = 5.45
Prob > F = 0.0378
Export Penetration* Skilled= Export Penetration* Semi-skilled= Export Penetration* Unskilled
F(3,6) = 20.20
Prob > F = 0.0015
Price*Skilled= Price*Semi-skilled= Price*Unskilled
F(3,6) = 15.50
Prob > F = 0.0031

5. DISCUSSION

In the empirical analysis, as stated earlier, three indicators of trade liberalisation i.e. import penetration, export ratio and relative prices were used together in one model, (Model 4) to study the effect on wage premiums based on skill. However, this model produced insignificant results for the indicators of import penetration and relative prices for all skill types. A significant impact on wage inequality was only seen with respect to export penetration for the semi-skilled and unskilled labour, which showed that wage inequality decreases as the ratio of exports with respect to the value added increases, leading to a rise in wage premiums. If this model was to be considered, then it would signify that the reduction in tariffs and non-tariff barriers, for import competing industries, does not lead to a change in wages for any skill. Neither does the increase in relative prices of each industry. However, if trade openness as indicated by research, has lead to a significant positive change in the composition of production towards manufacturing in Pakistan and also to a reduction in labour force participation inequality based on gender [Hyder, *et al.* (2011)], then the possibility of trade's impact on wage inequality is not far-fetched.

In addition, the interaction terms of the three variables turned out to be correlated with each other, casting doubt on the validity of the results of the first model. Therefore, the effect of the three indicators was investigated separately. When Model 2 was

estimated with only import penetration dummies, the corresponding results regarding increasing wage inequality matched those of Galiani, *et al*. (2003). Their results depicted that an increase in import penetration ratio in the country leads to higher wage premiums of skilled workers relative to other skill based labour. This revealed a significant widening of the wage gap. While the results of Model 2 also show a similar increase in the premium for skilled labour, it also shows significant decrease in skill premium for unskilled labour, significantly widening the wage gap in Pakistan's case as well.

Moreover, results of this paper oppose the findings of Goh, *et al.* (2005), who conducted a study for Poland. They find wage premiums to have increased for unskilled labour, while there being no impact on the skilled premium, with the reduction in tariffs. Their results support the findings of Stolper-Sameulson. The difference from this study's results can be attributed to the fact that Poland carried out trade liberalisation while being in the transitioning stage, and thus the increase in wages for the unskilled is likely to be influenced by greater efficiency that usually follows the transition from a planned to a market economy.

It is also relevant to compare these findings with that of India and Bangladesh, since they are quite similar to Pakistan, in terms of wage structures and trade reforms. According to Mishra (2005), the impact of tariffs and non-tariff barriers on wages in India is such that, sectors with a higher proportion of unskilled labour and higher reductions in protectionist measures will experience an increase in relative wages, relative to those sectors with skilled labour. One reason for the differences between our results could be attributed to the fact that this paper does not look at the skill based impact of trade reforms for each sector. Moreover, the trade reforms in India were much more drastic than those in Pakistan so that might have led to a variation in results.

Furthermore, in model 5 only the effect of export penetration ratios on wages was studied. This model supports the results of Model 2 by also depicting increasing wage inequality. This model predicts increases in the wages for skilled and semi-skilled workers, while there being no significant effect on wages of the unskilled. This result, along with that of the previous model is somewhat similar to the case of Bangladesh. Munshi, *et al*. (2006) use four measures of trade openness. With respect to their results on trade liberalisation through measure of exports and imports, our results are quite consistent. Their coefficient is lower for unskilled and higher for skilled, leading to greater wage inequality. However, with respect to their relative price measure, their results diverge from the results of our model 6, where we find that relative price interaction terms depict a rising wage inequality due to relatively high premiums for skilled and semi-skilled labour. According to Munshi, *et al*. (2006), changes in prices due to openness have an insignificant effect on wages. In their analysis different measures give quite contradictory results on the effect of trade liberalisation on wage inequality. Therefore, in their final analysis, they conclude that due to overlapping standard errors of estimated coefficients, there is no statistically significant difference between the effect of the above measures of liberalisation on wages for unskilled and skilled workers. Though their overall result conflicts with the results of this paper, it must be considered that similar to the case of India, the case of Bangladesh also looks at sector specific data.

6. CONCLUSION

This paper examined the role of trade liberalisation on wage inequality for the period 1996-2005, by combining micro level data from the Labour Force Survey of Pakistan with national data on trade variables from the Federal Bureau of Statistics. Three measures representing the introduction of trade reforms were introduced that is, import penetration, export penetration and relative prices for the manufacturing sector, in order to study the effect on wage premiums based on different levels of skill and by using inter-sector and time variability. The findings indicate that while it is difficult to study the effects of trade liberalisation by using all the measures together, but by analysing them separately, Pakistan's wage premiums for the skilled rise relatively to those for the unskilled. It also predicts that a 10 percent increase in import penetration, increases the wage premiums for the skilled workers by 2.12 percent, while it reduces the wages premiums of the unskilled workers by nearly 2 percent. Furthermore, it can be observed that a 10 percent increase in export penetration increases premiums of the skilled and the semi-skilled workers by 4.8 percent and 1.8 percent respectively, while having no impact on the wages of the unskilled worker. This implies that wage inequality has risen in Pakistan due to the effects of trade openness; a result contrary to the predictions of the Stolper-Samuelson Theorem as well as to the experience of countries like India and Bangladesh.

This contradiction can be explained by the fact that Pakistan aimed to protect non-skill intensive firms in favour of skill intensive firms during its policy of trade liberalisation, similar to the case of Mexico [Robertson (2000)]. This eventually led to the rise in relative prices of skill intensive goods and consequently, the transfer of resources from firms that employed unskilled labour to those that employed skilled labour. This shift not only increased the demand for skilled labour, increasing their wages but also decreased the demand for unskilled labour, causing a fall in their respective wages. Therefore, Pakistan's inconsistent and discriminatory trade liberalisation policy contributed to its widening of the wage differential between the skilled and the unskilled worker, and consequently to the failure of the Stolper-Sameulson Theorem.

However, these results must be considered keeping in mind some shortcomings. Most of the empirical research about the trade liberalisation impacts on wages has been done using Panel data for industries, which is not available in case of Pakistan. This allows researchers to control for sector and time fixed effects and can be used to evaluate how trade liberalisation impacts wages for different skill levels across different industries. Furthermore, the availability of industry specific trade data in case of Pakistan is also a shortcoming, in estimating such a model. Another limitation of our analysis is that, our model considers two surveys for the ten year period, and therefore, more accurate results could have been obtained using yearly surveys for all these ten years.

Despite these shortcomings, the paper enriches the line of studies in the international trade literature that could assist policy makers in developing countries engage in an informed decision-making concerning whether trade liberalisation is best to reduce wage inequality. Empirically, it would further be useful to investigate how trade liberalisation impacts wage inequality for workers at three-digit industry level, to provide a deeper analysis. Furthermore, effects of trade liberalisation on wage inequality across skill levels could be seen controlling for other events like recession, devaluation and oil boom. These may be lines of enquiry for the future research.

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