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## Trade Shocks and Labour Adjustment: Evidence from Pakistan's Manufacturing Industries

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The present study is an attempt to explore the impact of trade liberalisation on employment and wages of production and non-production workers in large scale manufacturing industries of Pakistan. We use a sample of 18 industrial establishments with a time series data covering a period 1970-71 to 2005-06. In order to account for endogeneity problem, this study uses the Generalised Method of Moments (GMM). The study comes up with the findings that trade liberalisation has significantly negative impact on employment of both production and non-production workers. On the other hand, trade liberalisation has a significantly positive impact on wages of production workers, but it has no significant impact on wages of non-production workers. The negative impact of trade is attributed to the high protection given to most of the inefficient industries in the post liberalisation period. On the other hand, reduction in non-production worker employment is not unexpected as in case of developing country like Pakistan, trade liberalisation is supposed to displace capital intensive industries that employ most of the non-production (skilled) workers.

*Keywords:* Production Worker, Non-production Workers, Trade, Employment, Wages

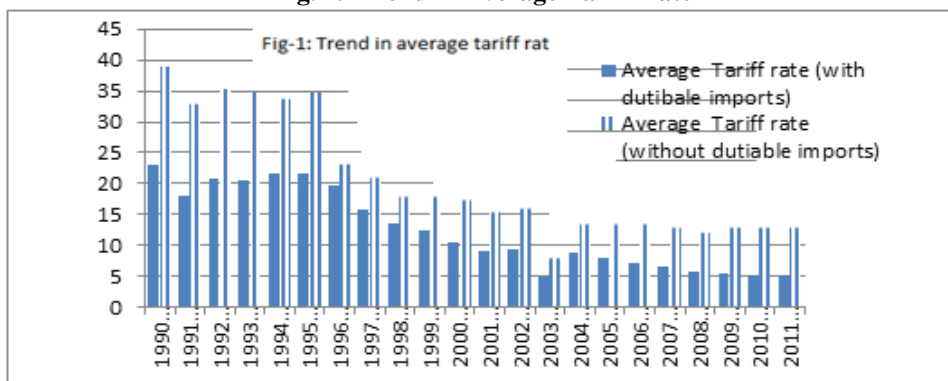
### 1. INTRODUCTION

Pakistan initiated deregulation and liberalisation of the economy in the late 1990s as a result of structural adjustment programme. In the past, the economy of Pakistan subjected to different type of trade restrictions in order to protect the economy from foreign competition and to encourage industrialisation in the country. The restricted trade regime resulted in inefficiency in the manufacturing sector and the economy lagged behind in competitiveness. Pakistan initiated restructuring the economy by moving towards free trade through gradual reduction in import duties and other non-tariff barriers. The Figure 1 indicates the trend in import duties which shows that import duties reduced gradually from 1990 to 1995, whereas after 1995, there has been a smooth decline in import duties till 2011. The government of Pakistan not only relied on reducing import duties, but in most of the cases non-tariff barriers were replaced with tariffs. Besides, the maximum tariff rate was reduced significantly. In 1986-87, the maximum

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tariff rate was 225 percent, which was reduced to 45 percent during 1997-98. Furthermore, to cascade<sup>1</sup> the tariff structure, the earlier surcharges and taxes also known as para tariffs were merged with statutory tariff (national tariffs) regimes. Most of the items that were not importable earlier were made importable, however, there was some exception for goods prohibited because of religious, health as well as security considerations [Khan (1998)].

**Fig. 1. Trend in Average Tariff Rate**



Source: Based on data from Federal Board of Revenue.

Since 2008, Pakistan has taken some cautious steps of trade liberalisation. Its average applied MFN tariff is 14.3 percent in 2014-15, slightly down from 14.8 percent in 2008. All but 45 tariff lines are ad valorem. Since July 2014, Pakistan no longer has duty free tariff lines. The tariff displays a significantly positive escalation. Some 98 percent of tariff lines are bound; the average bound rate is 61.5 percent. Regulatory exemptions and concessions provided for various industries under SRO regimes remain an important source of deviation from MFN rates. Pakistan has bound other duties and charges at zero, but “regulatory import charges” of 5 percent apply on some 284 mostly agricultural products. Since Pakistan’s last Review, the Government has been implementing a programme to modernise customs procedures. In addition to tariffs, imports are subject to sales tax. Despite cautious liberalisation, overall tariff levels remain high, which weakens productivity growth and constitutes an impediment to efficient resource allocation and the integration of Pakistan into global value chains. In addition, the use of ad hoc trade policy instruments under SROs remains common and severely undermines the predictability of the trade regime; it also supports a culture of rent-seeking. The elimination of tariff and tax-related SROs, planned for end-2015, will significantly increase transparency of the trade regime.

If we compare the actual tariff level in Pakistan in the context of WTO rules, Table 1 shows that Pakistan tends to have relatively moderate MFN applied tariffs while it has a relatively high bound tariffs under the WTO. Summing over tariff lines we observe a higher average MFN and higher average bound tariff rates on agricultural commodities. On the other hand, we note a relatively lower MFN on agricultural commodities when averaging the MFN applied tariffs weighted by trade value.

<sup>1</sup>Higer tariff for final goods and lower tariff for inputs.

Table 1

*Summary of Pakistan's MFN and WTO Bound Tariffs*

	Year	All Products	Agriculture	Non-agriculture
Simple Average Final Bound		59.9	95.6	54.6
Simple Average MFN Applied	2010	13.9	17.0	13.4
Trade Weighted MFN Applied Average	2009	9.8	9.1	9.9
Value of Imports in Billion US\$	2009	31.7	4.2	27.5

*Source:* Authors elaboration based on data from the World Trade Organisation.

It is to be noted that we are referring to MFN applied tariffs rather than true paid duties, indicating that it would include exemptions and other taxes. Similarly, from Appendix A1 we also observe that there are many instances where we find that the “MFN applied tariffs is ‘duty free’ although the bulk of agricultural imports enters as tariff lines with duties in the range of 5 percent to 25 percent”. Remarkably, we also observe that most of the non-agricultural commodity imports tends to enter as tariff lines in the range of 0 percent to 10 percent. [Valdes (2013)].

In recent years, Pakistan in line with WTO commitments has been restructuring its tariff structure. It is evidenced by the fact that by July 2014, Pakistan did not have duty free lines. However, again in recent years, a tariff escalation has been noted. For example, 98 percent of tariff lines are bound where is the average bound rate is 61.5 percent. Furthermore, different types of concessions and regulatory exemptions and SROs given industries has been a source of deviation from MFN. Despite cautious liberalisation, overall tariff levels remain high, which is not a good omen in term of productivity and efficiency of resource allocation.

Adjusting to the increasing trade liberalisation requires a considerable reallocation of resources between different sectors of the economy. In particular, increasing trade liberalisation tends to have implication for labour markets of Pakistan. The adjustment may take place in the form of changes both in employment and wages. This study therefore, is an attempt to understand how the adjustment takes place in the economy in term of employment and wages. In particular, how the employment of production<sup>2</sup> (presumably low skilled) workers and non-production workers<sup>3</sup> (skilled) workers behave in the post liberalisation period.

## 2. TREND IN EMPLOYMENT AND WAGES

Table 2 indicates a pattern of production worker's employment and wage both in the pre and post-liberalisation period. It shows that in the pre-liberalisation period, many of the import competing industries experienced an impressive growth (mostly in the double digits) in employment and wages. It included industries like electrical goods,

<sup>2</sup>Production workers means those who are engaged in work directly associated with production like manufacturing, assembling, packing, repairing etc. Working supervisors and persons engaged for repairs and maintenance are also included.

<sup>3</sup>Non-Production workers includes administrative and professional employees, white collar office employees.

industrial chemicals, other chemicals, machinery industry, glass and non-metallic products as well as rubber industry. However, in the post-liberalisation period, when most of the tariffs and other non-tariff barriers were eliminated in the 1990s, many of these industries which had recorded a significant positive growth in term of employment and wages, tumbled down and the growth rate became negative in term of employment and wages of production workers.

Table 2  
*Industry-wise Compound Annual Growth Rate in Employment and Wages of Production Workers (%)*

Industry	Pre-liberalisation Period <sup>4</sup> (1975-76 to 1990-91)		Post-liberalisation Period (1990-91 to 2005-06)	
	Employment	Wages	Employment	Wages
	Food	0.8	1.2	5.7
Beverages	24.6	20.8	-6.9	-9.2
Coal and Petroleum	2.0	2.5	7.8	2.6
Drugs and Medicine Industry	0.5	5.2	0.8	0.1
Electrical Goods	15.2	13.7	-3.6	-1.5
Fabricated Metal Products	8.7	7.8	-1.9	-3.2
Glass and Non-Metallic Products	15.1	16.4	-5.3	-8.4
Industrial Chemicals	4.1	3.8	8.1	-4.6
Iron Bars and Steel Industry	14.3	13.5	-6.7	-5.4
Leather and Foot Wear Industry	-1.9	-1.1	7.8	3.5
Machinery Industry	14.5	8.4	3.9	4.4
Other Chemicals	13.1	12.4	-5.9	-6.1
Paper Printing and Wood	7.2	12.0	13.8	10.2
Rubber Products	14.2	13.5	-3.5	-6.6
Textile	-0.02	-2.8	7.0	5.4
Transport Goods	-4.7	1.1	27.1	13.6

Source: Author's own calculation based on various issues of CMI.

However, this result is not very surprising. Since during the 60s, Pakistan actively pursued the strategy of import substitution. Many of these industries got protected through subsidies, tariffs and other non-tariff measures. For example, Naqvi and Kemal (1991) who conducted a comprehensive survey on the structure of protection in Pakistan came up with the findings that during the 1960, import competing industries got protected heavily while these import competing industries were the most inefficient industries. In

<sup>4</sup>In fact, Pakistan, in the late 80s, under the Structural Adjustmetn Programme, moved toward a more liberalised regime by reducing import duties and eliminating non-tariff barriers. Hence the period before 1990-91 is considered as pre-liberalisation, while the period after 1990-91 is post-liberalisation.

the 1990s, the liberalisation strategy pursued by Pakistan resulted in elimination of subsidies, tariff and non-tariff barriers. As a result, these import competing industries were no more able to withstand foreign competition and production worker's employment and wages experienced a decline.

On the other hand, Table 3 also shows that many of the labour intensive industries like food, leather and footwear, paper printing and wood, transport and textile industry, which experienced a very nominal growth or even a negative growth in production worker's employment and wages in the pre-liberalisation period, recorded a significant positive growth in the post-liberalisation period. This transformation pattern from import competing industries towards export oriented industries is quite interesting and is in accordance with the traditional trade theory.

Table 3  
*Industry-wise Compound Annual Growth Rate in Employment and  
Wages of Non-Production Workers (%)*

Industry	Pre-liberalisation Period (1975-76 to 1990-91)		Post-liberalisation Period (1990-91 to 2005-06)	
	Employment	Wages	Employment	Wages
Food	2.7	2.0	8.4	6.0
Beverages	4.4	-5.0	-13.7	-9.3
Coal and Petroleum	-0.9	2.7	7.1	6.7
Drugs and Medicine Industry	3.3	6.9	4.2	2.6
Electrical Goods	9.0	-0.7	-3.7	-2.8
Fabricated Metal Products	0.6	0.4	2.9	-2.6
Glass and Non-metallic Products	4.7	5.4	-0.5	-2.5
Industrial Chemicals	6.2	5.7	11.2	9.9
Iron Bars and Steel Industry	3.4	2.4	-0.8	-3.3
Leather and Foot Wear Industry	7.8	-4.5	11.1	9.5
Machinery Industry	3.5	3.5	9.5	6.3
Other Chemicals	5.8	3.8	-1.1	-3.1
Paper, Printing and Wood	6.2	10.9	16.6	10.8
Rubber Products	5.3	5.7	0.8	-4.9
Textile	-2.3	-0.6	10.6	6.7
Transport Goods	2.5	-0.8	11.1	7.0

*Source:* Author's own calculation based on various issues of CMI.

Table 3 shows the trend in employment and wages of non-production workers. With the exception of coal and petroleum and textile industry, growth in employment and wages was positive in almost all other industries. Unlike the production workers, growth in employment and wages of non-production workers was not as high in the pre-liberalisation period. However, in the post-liberalisation period, there was a higher growth in employment and wages of non-production workers in the food industry, coal and petroleum, industrial chemicals, leather and footwear industry, machinery industry, paper printing and wood, transport and textile industry.

Many of these industries which experienced a higher growth in term of employment and wages were labour intensive industries. But this finding may not be surprising as it is more likely be the result of the increasing technological change that

takes place with the increasing globalisation and liberalisation. Industries make use of a more modern techniques and technology requiring the use of more skilled workers in order to compete in the face of increasing global competition.

There were some other industries wherein both employment and wages of non-production workers recorded a decline. It included the industries like beverages, electrical goods, glass and non-metallic products, other chemicals as well as iron bars and steel industry.

### 3. EMPIRICAL EVIDENCE

The main theoretical reference on the impact of trade liberalisation on employment and wage differential is the traditional Heckscher-Ohlin-Samuelson theorem. Heckscher-Ohlin theorem of international trade forms the basis for studying the link between trade and employment. According to the H-O theorem, countries allocate their resources towards the production of a commodity with which the country is abundantly endowed. Developing countries being labour abundant, will allocate their resources towards the production of labour-intensive goods, while developed countries will concentrate on the production of capital intensive goods because they use to have more capital. Trade between them will lead to a more efficient use of resources; increase the share of labour in total output in the developing countries and that of capital in the developed countries. Similarly, the Stolper-Samuelson theorem also proves that there is one to one correspondence between the product prices and the factor prices. Since trade liberalisation is likely to increase the demand for labour intensive products in developing countries, so the demand for labour in the developing countries, while for capital in developing countries is expected to increase. The main idea of HOS framework is redistribution of employment from import substituting sector towards export sector.

The Stolper-Samuelson Theorem (SST) implies that protectionism increases the demand for the scarce factor. In developing countries the scarce factor is capital, while capital is skilled biased. Hence, the demand for skilled workers will increase. It follows that liberalisation will stimulate the demand for unskilled workers in developing countries; while in developed countries it will increase the demand for skilled workers [Beaulieu and Dehejia (2005)].

The literature on employment and wages has expanded a great deal in the last decade. Most of the studies have been accomplished in the context of both developed and developing economies. The empirical findings are mixed. Some studies, come up with the findings that trade has a positive impact while other show that trade has either no significant impact or it has no impact on labour demand. [Wood (1997); Revenga (1997); Slaughter (2001); Hasan (2001); Banga (2005)]. Rama, *et al.* (2003) presents an analytical review of literature on trade, globalisation and labour market outcomes. The study points out that empirical results on globalisation and labour demand are sharply divided, and come up with different consequences. However, one of the pattern tends to emerge from these studies, i.e. wages tend to fall with trade and rise with foreign direct investment at least in the short run. In the long run, however, both trade and foreign direct investment tends to have a positive impact on wages. Furthermore, the study indicates that social protection programmes are helpful in reducing inequality while, core labour standards seems to have no significant impact on return to labour.

Hasan, *et al.* (2007) examine the impact of trade liberalisation on labour demand elasticities using industry-level data dis-aggregated by states of India from 1980 to 1997 while decomposing labour demand elasticity into substitution effect and scale effect. The empirical findings show that in the post liberalisation period, these elasticities have increased especially in states subjected to more flexible regulations. Belman and Lee (1996) analysing a review of literature on trade and job displacement in US comes up with the findings that because of downward sticky wages, trade may reallocate and displace workers. This type of adjustment could be costly if it is involuntary as the typical displaced workers are supposed to experience a significant associated losses, including a potentially prolonged period of unemployment and reduced earnings once they get re-employed. Some studies link change in increasing wage inequality with trade, FDI and immigration. The empirical results show that production worker wages tend to rise with exports but decline with increasing FDI and immigration. As far, the employment of production workers is concerned, it tends to increase with increasing productivity and exports as well. On the other hand, FDI and immigration, both have a negative impact on production workers' employment [Yasin (2007)].

Some studies evaluating the validity of assumptions and prediction of traditional trade models show that there are other channels through which trade may affect wages. The study identifies that traditional trade theories presume that the good which is imported is also produced locally. As a result a good imported is likely to displace domestic workers, however, Edwards and Lawrence (2010) show that a country may not necessarily produce the goods imported and therefore, may not displace domestic workers. Hence the predictions of the traditional trade theories may not be held as expected.

Helpman, *et al.* (2012) shows that the role of labour market rigidity is important for labour market outcomes of trade openness. The study concludes that trade tends to result in higher unemployment in sectors where labour market frictions are low. On the other hand, in a sector where labour market frictions are higher trade tends to result in lower unemployment. Some studies show that the impact of trade on employment and wages is dependent on the type of labour market structure. For example, a study by Iqbal *et al.* (2012) examining the impact of trade liberalisation on employment and wages in Pakistan's manufacturing come up with the findings that trade tends to have a positive impact on employment and wages with flexible labour markets, however, with regulated markets are incorporated in the model, the results are still robust and don not change indicating that labour market regulations do not have any significant effect on the labour market. Similarly, Krishna, *et al.* (2012) investigates wage dispersion across heterogeneous worker groups in Brazil in response to trade liberalisation. It shows that higher education workers experience greater increases in wage dispersion relative to low education workers following trade liberalisation.

In a recent study, Iqbal, *et al.* (2014) have examined the impact of trade on employment of production and non-production workers in case of Pakistan, while using the CMI data. The study has reported a negative impact on employment of both production and non-production workers. However, the aforementioned study has not examined the impact of trade on wages of production and non-production workers. Theoretically, it is also possible that the adjustment to trade liberalisation may have taken

place through a decline in employment, but at the same time, trade may have contributed to reducing wage inequality of production and non-production workers.

An important relationship between trade liberalisation and wage inequality tends to instigate from the traditional trade theorem of Stolper Samelosl theorem which postulates that the gap between the wages of production and non-production workers should narrow down in labour abundant countries such as a developing country like Pakistan. However, this empirical evidence has not been supported by most of the studies that have focused on trade and wages related outcomes in developing countries [ Robins (1996); Wood (1997) and Arbache (2001)].

The present study makes a contribution to the existing literature by investigating the Stolper Samuelson theorem in the context of Pakistan which to the best of our knowledge none of the studies have investigated so far. The present study, therefore, attempts to fill this gap by analysing the impact of trade both on employment and wages of production and non-production workers so that we can identify that how labour market adjustment takes place i.e., whether it is through adjustment in employment or wages.

#### 4. ECONOMETRIC MODEL

To estimate the impact of trade liberalisation on wages and employment of production and non-production workers, we follow Milner and Wright (1998), and derive labour demand equation from a profit-maximising model of firm behavior. Now assume a Cobb-Douglas production function of the following form:<sup>5</sup>

$$Y_{it} = A^\gamma K_{it}^\alpha N_{it}^\beta \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (1)$$

$Y$ ,  $A$ ,  $K$  and  $N$  shows output, technological progress, capital stock and units of labour respectively. Whereas,  $\gamma$  is the share of efficiency of production,  $\alpha$  is the share of capital and  $\beta$  shows the share of labour used in the production. The industrial sector is denoted by  $i$  varies from  $i = 1, 2, \dots, N$  and the time period is shown by notation  $t$ , varies from  $t = 1, 2, \dots, T, \dots$

A firm is assumed to choose the level of capital and labour according to its marginal revenue product. We obtain the following expression after eliminating the capital and solving the system simultaneously:

$$Y_{it} = A^\gamma \left( \frac{\alpha N_{it}}{\beta} \times \frac{w_i}{c} \right)^\alpha N_{it}^\beta \dots \dots \dots \dots \dots \dots \dots \quad (2)$$

To take the logarithm and rearrange the Equation (2), the derived demand of the industry can be written as follows:

$$\ln N_{it} = \theta_0 + \theta_1 \ln W_{it} + \theta_2 \ln Y_{it} \dots \dots \dots \dots \quad (3)$$

where

$$\theta_0 = -(\gamma \ln A + \alpha \ln \alpha - \alpha \ln \beta) / (\alpha + \beta), \theta_1 = -\alpha / (\alpha + \beta)$$

<sup>5</sup>This model is heavily based on the study of Milner and Wright (1998).



$$\text{and } \theta_2 = 1/(\alpha + \beta) \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

Just like Greenaway (1995), we also assume  $A$  as technical efficiency, which is correlated with trade, share and evolve over time in the following manner:

$$A_{it} = e^{\delta_0 T_{it}} M_{it}^{\delta_1} X_{it}^{\delta_2}, \quad \delta_0, \delta_1, \delta_2 > 0 \quad \dots \quad \dots \quad \dots \quad (4)$$

Where  $T$  is time trend,  $M$  and  $X$  are imports and exports respectively. To allow for dynamic changes and adjustments in Equation (3), the estimated labour demand equation can be written as follows:

$$\ln N_{it} = \theta_0 + \theta_1 \ln N_{it-1} + \theta_2 \ln W_{it} + \theta_3 \ln Y_{it} + \theta_4 \ln V_{it} + u_{it} \quad \dots \quad \dots \quad (5)$$

Where  $N$ ,  $W$  and  $Y$  denote total employment, average real wages and industry  $i$  output in time  $t$ , where  $t=1, 2, \dots, T$ .  $V$  denote vector of variables which affect labour demand.  $\theta_0$  is intercept, while  $\theta_1, \theta_2, \theta_3$  and  $\theta_4$  are other unknown parameters to be estimated.

Wage equation can be determined as an inverse labour supply function and other factors. To sum up these effects, we estimate a wage equation of the following form:

$$\ln W_{it} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln N_{it} + \beta_3 \ln W_{it-1} + \beta_4 \ln V_{it} + u_{it} \quad \dots \quad \dots \quad (6)$$

where  $W$ ,  $Y$  and  $N$  are defined as above, while,  $\beta_0$  is intercept and  $\beta_1, \beta_2, \beta_3, \beta_4$  are unknown parameters, to be estimated. In the above model,  $V$  represents a vector of variables, affecting labour demand. For the purpose of our study, the key variables are openness, average tariff rate, exports, imports, and time trend used. Equations (5) and (6) paves the basis for estimation of wage and employment equation of production and non-production workers.

Production workers

$$\begin{aligned} \ln PN_{it} = & \theta_0 + \theta_1 \ln PW_{it} + \theta_2 \ln PN_{it-1} + \theta_3 \ln Y_{it} + \theta_4 \ln Z_{it} \\ & + \theta_5 V_{it} + \mu_{it} + \eta_{it} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (7) \end{aligned}$$

$$\begin{aligned} \ln PW_{it} = & \theta_0 + \theta_1 \ln PN_{it} + \theta_2 \ln PW_{it-1} + \theta_3 \ln Y_{it} + \theta_4 \ln Z_{it} \\ & + \theta_5 V_{it} + \mu_{it} + \eta_{it} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (8) \end{aligned}$$

Non-production workers

$$\begin{aligned} \ln NPN_{it} = & \theta_0 + \theta_1 \ln NPW_{it} + \theta_2 \ln NPN_{it-1} + \theta_3 \ln Y_{it} + \theta_4 \ln Z_{it} \\ & + \theta_5 V_{it} + \mu_{it} + \eta_{it} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (9) \end{aligned}$$

$$\begin{aligned} \ln NPW_{it} = & \theta_0 + \theta_1 \ln NPN_{it} + \theta_2 \ln NPW_{it-1} + \theta_3 \ln Y_{it} + \theta_4 \ln Z_{it} \\ & + \theta_5 V_{it} + \mu_{it} + \eta_{it} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (10) \end{aligned}$$

Where  $PN$ ,  $PW$ ,  $NPN$ ,  $NPW$  and  $Y$  represent production worker's employment, production worker's real wages, non-production worker's employment, non-production

worker's real wages and output in industry  $i$  and time  $t$ , wherever  $t=1, 2, \dots, T$ .  $Z$  represents liberalisation i.e. average tariff rate measured as import duties divided by volume of imports.  $V$  denotes vector of variables which affect labour demand such as exports, imports and time trend used as proxy for technology.  $\theta_0$  is intercept, while  $\theta_1, \theta_2, \theta_3, \theta_4, \theta_5, \theta_6$  and  $\theta_7$  are other unknown parameters to be estimated whereas  $\mu_{it}$  and  $\eta_{it}$  represent error terms which pick up random measurement errors in employment and wages respectively.

## 5. ESTIMATION PROCEDURE

In response to shocks such as trade shock, adjustment of employment and wages usually is not contemporary rather there is a time involved in adjustment; we therefore have to include lag of the dependent variable in the model. However, inclusion of dependent variable with lag has a problem that some of the standard estimators such OLS, fixed effects, random effects, and feasible generalised least squares (FGLS) tends to produce estimates that are biased and inconsistent. [Nickell (1981) and Kien and Yoon (2009)].

To deal with this issue, IV and GMM approaches are the most appropriate to date in order to have unbiased and consistent results. Nonetheless, we use GMM approach to deal with heteroskedasticity if it is present, whereas even if there is no heteroskedasticity present, GMM estimator is still better compared to IV approach. Unlike the IV approach, GMM estimator makes use of all available moment conditions and therefore, yields not only consistent but efficient estimates also. [Baum, Schaffer, and Stillman (2003)]. The GMM estimator consists of first-differenced GMM (DIF-GMM) and system GMM (SYS-GMM). The former is developed by Arellano and Bond (1991) and the latter is developed by Blundell and Stephen (1998), both are popular to estimate dynamic panel dataset. However, in both of the estimators, the first-difference GMM is considered to have "poor finite sample properties, in terms of bias and imprecision, when lagged levels of the series are only weakly correlated with subsequent first differences". Besides, when the number of time period available is small, the difference GMM might be subject to a large downward finite-sample bias. For this purpose, the system-GMM is the most suitable one compared to difference GMM. We, therefore, tend to use the Sys-GMM the main method for estimating the employment and wage equations. For the purpose of our study, we estimate the model with both difference GMM and Sys-GMM in order to check robustness of the model. Furthermore, to check consistency of the model, we in this study will use Hansen  $J$  test.

## 6. DATA

This study uses a panel dataset with a sample of 18 large scale manufacturing industries and time series data from 1970-71 to 2005-06.<sup>6</sup> Because of non-availability of time series data on annual basis, this study uses data with a 5 years gap. We use industry data according to Pakistan's Standard Industrial Classification (PSIC) at 3-digit level. The data regarding output, employment and wages of production and non-production

<sup>6</sup>The latest available survey data of CM is upto 2005-06 only. Whereas, the recent structure of the economy has been changed a lot by 2015, so, we must be careful in analysing the result of our study.

workers come from various issues of the Census of Manufacturing Industries (CMI) of Pakistan. Commodity-wise exports and imports data come from various issues of *Statistical Year Book*. To construct variable of trade liberalisation, we divide total import duties over the volume of imports. In order to construct variable of real output, this study deflates nominal output with wholesale manufacturing price index. Similarly, we divide the employment cost by the total number of employees to form a nominal wage variable while to convert it into real wages, we deflate nominal wage with the consumer price index (CPI).

As part of the data analysis, an examination of the correlation between variables is presented in Table 4. This is to get some preliminary view regarding the types of associations which prevail among variables. The correlation results show that production worker's employment is correlated negatively with production worker's wages, the average tariff rate, imports and real output, but it is correlated positively with non-production worker's employment and non-production worker's wages, openness and exports.

Table 4

*Correlation Matrix*

	PN	PW	NPN	NPW	TF	RX	RM	RY
PN	1.00							
PW	-0.71	1.00						
NPN	0.85	0.52	1.00					
NPW	0.77	0.80	-0.69	1.00				
TF	-0.04	-0.03	-0.06	-0.03	1.00			
X	0.07	-0.03	0.08	-0.01	-0.11	1.00		
M	-0.06	-0.11	-0.07	-0.13	0.05	-0.01	1.00	
RY	-0.05	-0.09	-0.03	-0.09	-0.03	0.11	0.11	1.00

Source: Calculated by author.

Note: PN=Production worker's employment, PW= Production worker's wages, NPN=Non-Production worker's employment, NPW= Non-Production worker's wages, TF= Average Tariff rate, X= Exports, M= Imports, Real output.

Production workers' wages are correlated positively with non-production worker's employment and non-production worker's wages and openness, but correlated negatively with average tariff, exports, imports and real output. Non-production worker's employment is correlated positively with openness and exports, but correlated negatively with non-production workers wages, average tariff rate, imports and real output. Finally, non-production worker's wages are correlated negatively with the average tariff rate, exports, imports and real output but correlated positively with openness.

## 7. RESULTS

Estimation<sup>7</sup> results showing the impact of trade liberalisation both on employment and wages of production and non-production workers are presented in Tables 5 and 6.

<sup>7</sup>For estimation purpose this study uses Eviews-5. However, it is a fact that for GMM, the most suitable software is STATA.

Estimation results are based on difference GMM and Sys-GMM. Model-1 and 2 show that trade liberalisation has significantly negative effect on production worker's employment, while it has a significantly positive impact on real wages of production workers. Similarly, the empirical results based on Sys-GMM are reported in model 3 and 4 in Table 5. The results are robust as the Sys-GMM based results show that the impact of trade liberalisation is significantly positive impact on employment while it is significantly negative impact on real wages.

Table 5  
*Regression Results of Production Workers*

Variables	Differenced GMM		System GMM	
	Employment	Wages	Employment	Wages
	Model-1	Model-2	Model-3	Model-4
Real Wages	-2.446 (-2.145)**	-	-0.226 (-3.114)**	-
Employment Lag	0.424 (4.668)**	-	0.228 (4.568)**	-
Employment	-	-0.234 (-2.601)**	-	-0.224 (-1.894)*
Wage Lag	-	0.323 (3.440)**	-	0.353 (4.440)**
Output	0.105 (2.098)**	0.628 (1.976)*	0.257 (3.098)**	0.232 (1.886)*
Liberalisation	0.175 (2.206)**	-0.001 (-2.178)**	0.173 (2.654)**	-0.074 (-1.889)*
Exports	0.124 (2.556)*	0.062 (1.861)*	0.173 (1.994)**	0.074 (1.979)**
Imports	-0.073 (-1.754)	-0.864 (-1.691)	-0.063 (-1.654)	0.174 (1.71)
Time Trend	-0.018 (-1.182)	0.016 (1.472)	-0.048 (-1.162)	0.033 (0.472)
R-squared	0.6449	0.6284	0.7321	0.7284
No. of Observation	144	144	144	144
No. of Industries	18	18	18	18
Hansen J-Test: P-value	0.09341	0.11901	0.24438	0.23312
Wald Test (Joint Significance): p-value	0.0000	0.0000	0.0000	0.0000

Note: \*Significant at 10 percent level, \*\* Significant at 5 percent level. (a) Robust t-statistics are given in parentheses. (b) Standard errors are HAC heteroskedasticity-and autocorrelation-consistent) or Newey-West standard errors.

In the aftermath of trade liberalisation, these inefficient industries were not able to withstand foreign competition. Other independent variables such as output and wages have signs according to theory. Both lag of employment and real wages have significantly positive effect on its current level in almost all model specifications of Table 5.

Exports have significantly positive effect on production workers' employment while it has positive but insignificant effect on production workers' wages indicating that rising export intensity increases labour demand. This can be attributed to the fact

that Pakistan's exports are more labour-intensive than imports. This result has an important implication for Pakistan's labour market. It implies that exports have generated new jobs for Pakistan's abundant labour force, thus reducing its unemployment level.

Hence, an increase in export volume will bring about employment opportunities for Pakistan's abundant labour force. As far as import penetration is concerned, it is interesting to note that its estimated coefficient is positive but statistically insignificant. Table 6 indicate estimation results regarding the impact of trade liberalisation on employment and wages of non-production workers. The empirical results are based on first difference GMM and Sys-GMM as well. Difference-GMM based results show that trade liberalisation measured as average tariff rate has significantly negative impact on employment but it has significantly positive impact on wages of non-production workers. The empirical results obtained with System-GMM show trade liberalisation have significantly negative impact on employment while it has no significant impact on wages of non-production workers.

Table 6  
*Regression Results of Non-Production Workers*

Variables	Differenced GMM		System GMM	
	Employment Eq-1	Wages Eq-2	Employment Eq-3	Wages Eq-4
Real Wages	-1.527 (-2.136)**	-	-1.517 (-2.146)**	-
Employment Lag	0.428 (4.568)**	-	0.328 (2.568)**	-
Employment	-	-0.024 (-2.54)**	-	-0.034 (-2.854)**
Wage Lag	-	0.313 (2.440)**	-	0.353 (4.440)**
Output	0.057 (2.098)**	0.232 (0.286)	0.422 (2.098)**	0.312 (1.896)*
Liberalisation	0.073 (1.754)*	-0.174 (-1.923)*	0.034 (1.685)**	-0.474 (1.869)
Exports	0.446 (1.145)	0.044 (2.114)	0.226 (1.114)	0.628 (1.976)*
Imports	0.024 (2.668)**	0.113 (3.440)*	0.028 (1.868)*	0.064 (1.691)
Time Trend	0.048 (1.862)*	0.161 (2.172)**	0.048 (1.182)	0.114 (0.472)
R-squared	0.6621	0.6558	0.6321	0.7484
No. of Observation	144	144	144	144
No. of Industries	18	18	18	18
Hansen J-Test: P-value	0.2003	0.319	0.2443	0.0912
Wald Test (Joint Significance): p-value	0	0	0	0

Note: \*Significant at 10 percent level, \*\* Significant at 5 percent level. (a) Robust t-statistics are given in parentheses. (b) Standard errors are HAC heteroskedasticity-and autocorrelation-consistent) or Newey-West standard errors

Real wages as well as output have expected signs. Imports have almost positive effect both on employment and wages of non-production (relatively high-skilled) workers. Imports of developing countries are usually assumed to be skill-biased and are expected to have a positive effect on labour demand of non-production workers.

On the other hand, exports have a positive but insignificant effect on employment and wages of non-production workers. However, in case of Sys-GMM, the results show that exports have insignificantly positive impact on employment, but it has a significantly positive impact on the wages of non-production workers. Our empirical results on the impact of trade on employment and wages of production and non-production workers show that they almost confirm the empirical findings of [Revenga (1997)].<sup>8</sup>

## 8. DIAGNOSTICS TESTS

To account for endogeneity problem in estimating employment and wage equations, this paper has used difference-GMM and system-GMM. Almost in all of the analysis, other than the independent variables we have used the first difference, lag of the first difference of dependent variable and second lag of the dependent variable as instruments. In order to check for the validity of over identifying restrictions, we have used Hansen J-test. Under null hypothesis of Hansen J-test, the validity of over-identifying restrictions is supposed to be satisfied if there is no second order correlation of the residuals. However, our results of the Hansen-J test do not allow us to reject the hypothesis of the validity of instruments used in the study. As far as heteroskedasticity and auto correlation are concerned, all estimates are based upon HAC (Heteroskedasticity-Auto-correlation Consistent) robust standard errors.

## 9. CONCLUSION

Trade openness and liberalisation is a key to foster economic growth and development in a developing country like Pakistan. Changes in economic structure in favour of increasing exports' share of manufactured products could be a favourable signal for this process. However, increasing trade liberalisation is also supposed to result in reshuffling of jobs across sectors. This paper aimed to investigate the labour market's response to trade liberalisation. For this purpose, the paper builds on a dynamic labour demand that incorporates average tariff rate, exports and imports. For this purpose, the study uses difference GMM as well as system GMM in order to estimate the model. The study comes up with the findings that trade liberalisation has significantly negative impact on employment of production and non-production workers whereas, trade liberalisation has significantly positive impact on wages of production workers but it has no significant impact on wages of non-production workers with both difference GMM and system-GMM. The negative impact of trade is attributed to the high protection given to most of the inefficient industries in the post liberalisation period. On the other hand, reduction in non-production worker employment is not unexpected as in case of developing country like Pakistan, trade liberalisation is supposed to displace capital intensive industries that employ most of the non-production (skilled) workers.

<sup>8</sup>The major limitation of this study is the use of data upto 2005-06 which is not very updated as CMI 2010-11 is still in process.

## Appendices

## Appendix A1

## Summary of Pakistan MFN Applied Import Duty Ranges

Frequency Distribution		Duty-free	0 ≤ 5	5 ≤ 10	10 ≤ 15	15 ≤ 25	25 ≤ 50	50 ≤ 100	> 100	Non ad valorem
		% of tariff lines or % of import value								
<b>Agricultural Products</b>										
Final Bound		0	3.3	0	0.3	0.1	0.5	90.3	1.8	0.1
MFN Applied	2010	13.9	19.6	15.7	13.8	14.5	20.1	2.4	0	5
Import Value	2009	34.8	4.1	17.4	21.6	19.6	2.2	0.2	0	32.6
<b>Non-agricultural Products</b>										
Final Bound		0	1.9	0	1.8	14.9	18.3	62.3	0	0
MFN Applied	2010	5	38.4	13	6.7	31.6	4.9	0.3	0	0.1
Import Value	2009	36.1	25.3	18.7	3.8	11.8	2.7	1.7	0	0.9

Source: Authors elaboration based on data from the World Trade Organisation.

## Appendix A2

## Average Rate of Import Duty with and without Exemption/Concessions

Year	Average Tariff rate*	Average Tariff Rate**	Year	Average Tariff Rate*	Average Tariff Rate**
1990-91	23.0	39.0	2001-02	9.1	15.1
1991-92	17.9	32.6	2002-03	9.3	15.6
1992-93	20.8	35.3	2003-04	4.8	7.5
1993-94	20.6	34.7	2004-05	8.8	13.3
1994-95	21.6	33.5	2005-06	8.1	13.1
1995-96	21.6	34.6	2006-07	7.1	13.1
1996-97	19.6	22.9	2007-08	6.5	12.7
1997-98	15.7	20.7	2008-09	5.7	11.7
1998-99	13.5	17.7	2009-10	5.7	12.5
1999-00	12.3	17.7	2010-11	5.6	12.7
2000-01	10.5	17.0			

\*With dutiable imports, \*\* Without dutiable imports.

## Appendix A3

## List of Industries Used for Regression Analysis

No. of Industry	Industry	No. of Industry	Industry
1	Food	10	Other Chemicals
2	Tobacco	11	Coal and Petroleum
3	Leather and Foot Wear Industry	12	Rubber Products
4	Textile	13	Glass and Non-metallic Products
5	Wearing Apparel	14	Iron Bars and Steel Industry
6	Beverages	15	Fabricated Metal Products
7	Paper Printing and Wood	16	Machinery Industry
8	Drugs and Medicine Industry	17	Electrical Goods
9	Industrial Chemicals	18	Transport Goods

## Appendix A4

*Variables Codes and Definitions*

Variables	Definition
Employment (N)	Average daily persons engaged in manufacturing includes employees, working proprietaries, unpaid family workers and home workers.
Wages (W)	It includes wages and salaries paid plus cash and non-cash benefits and constructed as employment cost divided by average number of employee spendr industry paid to the workers.
Production Workers (PW)	Production workers means those who are engaged in work directly associated with production like manufacturing, assembling, packing, repairing etc. Working supervisors and persons engaged for repairs and maintenance are also included.
Non-Production Workers (NPN)	Non-Production workers includes administrative and professional employees, white collar office employees, drivers watchmen, peons, sweepers etc.
Value of Production (Y)	It consists of the value of finished products and by-products, receipts for work done for others, receipts for repairs and maintenance, value of sale of semi-finished products and by-products, wastes and used goods, value of electricity sold, value of sales of goods purchased for resale, the net increase in the value of work in the process and the value of fixed assets produced by the establishment for its own use.
Average Tariff Rate (z2)	This is measured by value of import duties divided by volume of imports.

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