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Trade Liberalization and Labor Demand Elasticities: A Firm-Level Analysis of Pakistan's Manufacturing Sector

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ABSTRACT

The study investigates the linkage of trade liberalization and labor demand elasticities in Pakistan. The panel data are used by selecting 13 industries in Pakistan's manufacturing sector for the years 1995-1996, 2000-2001, and 2005-2006. The Pooled OLS technique is applied to get the estimates at an aggregated level and disaggregated levels. Overall findings support the positive relationship between trade liberalization and labor demand elasticity in production workers but in the case of non-production workers, the findings show the weak relationship between trade liberalization and labor demand elasticity. The study is also furnished with some policy recommendations.

1. Introduction

It is essential to step into international trade and earn the surplus to develop the country. To enhance international trade, a country has to devise such trade policies which may facilitate the exporters and importers. It has been observed that developed countries formulate and apply open trade policies to earn substantial profit and sustain economic growth. Without trade liberalization, no country can improve the living standard of its people and if countries impose the tariff and other restrictions on international trade, they cannot stand in the queue of developed countries (Edward, 1993, Akhter and Ali, 2007).

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Trade liberalization is considered an issue of less developed countries because they have to face cut-throat competition from developed countries. This competition creates failure in newly developed industries or infant industries of developing countries as they have to rely on developed countries for high standard materials and technology. On the other hand, when there is free trade environment, developing countries may lose competitiveness along with the decrease in government revenues in the form of tariffs and other duties. So, developing nations do not take the risk to liberalize their trade for protecting their domestic markets (Akhter and Ali, 2007).

Trade liberalization performs a significant role in the utilization of labor and creating the demand for labor in the south countries. As these countries are labor abundant countries, so through trade liberalization, these countries can take benefits from capital-abundant countries. According to the H.O theory, when labor-abundant countries enter the foreign trade market, they gain through labor-intensive commodities and labor demand also increases due to which wages and employment levels also go up (Yasmin, 2011).

The linkage of the trade liberalization and labor market has received more attention in developing countries. Rodrik (1997) was the first who introduced the benefit of labor demand by increasing trade liberalization. Owing to this, the employment level and wages also increase, and consequently the output or GDP rises of a nation (Yasmin, 2011). Rodrik also emphasized that labor demand elasticity goes up by opening trade and it also increases the output level and made the domestic market more competitive. Through trade between the south and the north countries, laborers can become a substitute for capital products. The demand elasticity of the product market can be increased by free trade. This phenomenon shows a positive impact on labor demand elasticity due to increasing trade liberalization. Bargaining power over rent gets higher in the firms and they can bargain for capital from labor by enjoying extra profit (Akhter and Ali, 2007).

Pakistan has adopted different trade policies to increase the size of the trade-in GDP. The government of Pakistan has introduced the Export Bonus scheme in 1959 in which a voucher is given to the exporter that allows them to import raw material and machinery that enhance the percentage of exports but this policy was abolished in 1972. In 1962, Exports Credit Guarantee Scheme was introduced and it remained till 1980. This scheme was held by Pakistan Insurance Corporation to ensure exporters' payments from abroad and commercial banks to repay loans that exporters borrow. Maximum trade was observed from the period of 1960-1969 and the minimum trade percentage of GDP was in 1969. In 1978, Exporters Finance Scheme was launched in which loans were given to exporters with zero interest rates. In the 1980s, Pakistan introduced policies to liberalize the economy. In 1988, Pakistan established the Structural Adjustment Program (SAP) with the help of IMF in which subsidies and tariff rates are reduced to fall the protection level and abolished in 1994. Strategic Trade Policy Framework (STPF) was used from 2012-2015 that raised the share of trade in GDP in

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2013. Trade liberalization shifts the concept of capital-intensive production to labor-intensive production in developing countries because exporters in LDCs depend on laborers. Due to the exports of labor-intensive commodities, the wage rate has also increased which makes the labor market more competitive.

The study provides the impact of trade liberalization on labor demand elasticity in Pakistan. Many researchers have investigated the impact of trade liberalization on different variables like growth, output and wage rate. Still, only one study has estimated the linkage of trade liberalization and labor demand elasticity in Pakistan except for Akhter and Ali (2007) and (Yasmin, 2011) in which they examined the relationship of trade liberalization and labor demand elasticity by taking a few industries. But we have taken thirteen industries of the manufacturing sector of Pakistan. Moreover, the results of these studies are inconclusive as it is unable to find the exact impact of trade liberalization. We have taken the data of the latest years from CMI. Our study has used the trade liberalization formula (X+M/GDP) but Akhter and Ali (2007) used a dummy variable for trade liberalization. Furthermore, after 2011, no study has been conducted on the same topic.

The paper is structured as: Section 2 shows the literature review on the studies of trade liberalization and labor demand elasticity. Section 3 specifies the model, data and methodology. Section 4 exhibits the results of labor demand elasticities in aggregated and disaggregated forms. Section 5 is about conclusions and policy recommendations.

2.   Review of Literature

This section presents the empirical findings of those studies that have explored the relationship between trade liberalization and labor demand.

Maloney and Fajnzylber (1999) explained the effect of trade liberalization on labor demand elasticity in three countries. Trade liberalization and own-wage elasticity revealed a negative relationship in the import competitive market but it showed a positive and significant effect in the imperfectly competitive market, export industries and non-tradable markets. The author also found the mixed effects of trade liberalization in the skilled and unskilled labor markets. Akhter and Ali (2000) investigated the relationship between trade liberalization and labor demand elasticity by using firm-level data in Pakistan. The results were insignificant as labor demand behaved differently over time. Jean (2000) focused on the effect of trade liberalization on the price elasticity of labor demand under perfect competition model. The author pointed out how trade Liberalization affects the employment cost by changing the real wage of unqualified workers in France. The study found that there was a positive relation between unskilled labor and trade liberalization. Krishna et al. (2000) demonstrated that trade liberalization enhanced the labor demand elasticity in Turkey. Slaughter (2001) examined the relationship between own-price labor demand elasticity and trade liberalization in the US. The demand for production workers increased in the manufacturing industry and

five out of eight industries showed a positive relationship between international trade and labor demand but the demand for non-production workers displayed a negative relationship in the manufacturing sector. Driffield and Kambhampati (2003) investigated the impact of trade liberalization and domestic competition on firm-level efficiency in India. Five out of six sectors exhibited a positive effect of trade liberalization on firm efficiency level. Middle-aged firms revealed more significant results instead of high-efficiency markets. Hasan et al. (2003) pointed out the relationship between trade liberalization and labor demand elasticity in the Indian manufacturing sector. The results indicated that when protection decreased, labor demand elasticity increased. Bruno et.al (2004) explained the impact of trade liberalization on labor demand elasticity in European countries, the US, and Japan. Trade liberalization increased the labor demand elasticity in the UK. The positive effects were found in Italy and less significant effects appeared in Spain and France. Wacziarg and Wallack (2004) explored the effect of trade liberalization on the shifting of labor across the sectors. Trade liberalization showed a positive impact on structural changes as a whole but it exhibited opposite effects by disaggregating the structural changes. Michaels (2006) highlighted the effect of trade liberalization on the demand for skilled workers in manufacturing industries by using the Heckscher-Ohlin model. The result showed a positive impact on skilled workers. The author proved that where the skill of abundant factors was more, the demand showed a positive result comparatively where the skill was short or imperfect. Yasmin (2011) presented the nexus between trade liberalization and labor demand elasticity in Pakistan. The results pointed out insignificant effects of trade liberalization on labor demand elasticity. After using the time trend, the most significant results appeared. trade openness enhanced the productivity of labor in long run and consequently, skilled workers' demand increased. For advanced technology, skilled labors performed well but in Pakistan, minor positive effects appeared regarding skilled labors. Paz (2012) analyzed the relationship of trade liberalization and labor demand elasticity in Brazil. The results predicted that when there was a tariff cut on domestic imports, it influenced the informal workers positively and negatively depending on labor market. Mahomedy (2013) examined the relationship between international trade and labor demand elasticity in South Africa and found it positive and highly significant. Liyanaarachchi et al. (2016) investigated the nexus between trade liberalization, income distribution, and poverty in Sri Lanka. Trade liberalization showed positive effects on macroeconomic outcomes in long run rather than in the short run. Njikam (2016) examined the impact of trade liberalization on unskilled, skilled, and total labor demand in Cameroon. The relationship between trade liberalization and unskilled labor was positive. The author pointed out that trade liberalization raised international relations and built new job opportunities for unskilled workers. Erten et al. (2019) examined the effect of tariff reduction in South Africa. Tariff reduction affected the formal and informal employment sector and show a reduction in the same magnitude. Dobbelaere and Wiersma (2020) exhibited the effect

of trade liberalization on the firm's product and labor market. The study pointed out that there was a positive relationship on the firm's product market (power price-cost markup) due to a reduction in tariff in intermediate inputs but there is a negative relationship in the firm's labor market power (wage markdowns).

The above-mentioned studies demonstrate the relationship of trade liberalization with labor demand elasticity. These studies point out the different results in developed and developing countries. Most developed countries represent positive results while developing countries exhibit mix or negative results.

3.   Model, Data, and Methodology

3.1   Model Specification

The main objective of the firm is profit maximization. We have to determine the output function of the firm by assuming that the firm is in a monopolistic competition environment[1]. The inverse demand function of the representative firm is given:

$$P_{mn} = \eta P_n^* O_{mn}^{-\frac{1}{b}} \tag{1}$$

Where:

subscripts *m* and *n* represent the firm *m* in industry *n*

P_{mn} =Own Price

P_n^* = Average price in the industry

η = Scaling factor

b= Constant price elasticity of demand

Q_{mn}= *m*[th] firm output in industry *n*.

Using the Cobb Douglas Production Function (CDPF):

$$O_{mn} = \overset{z}{\underset{o=1}{Z}} W_{omn}^{a_0} \tag{2}$$

Where W_{omn} denotes o[th] vector of inputs. We consider three inputs: Capital (C), Labor(L) and Material (R) in CDPF:

$$O = C^{\lambda} L^{\mu} R^{\gamma} \tag{3}$$

Firstly, by taking the partial derivative with respect to labor and equating it to zero, we get the following first-order condition:

$$MP_L = w = \eta P^* \left(-\frac{1}{b} \right) \left[C^{\lambda} L^{\mu} R^{\gamma} \right]^{\left(-\frac{1}{b} -1 \right)} \left[C^{\lambda} R^{\gamma} \right] \left[\mu L^{\mu-1} \right] \tag{4}$$

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[1] See Chaudry, 1999 and Akhter and Ali, 2007 and Yasmin,2011 for more details.

$$MP_L = w = \eta P^* \left(-\frac{1}{b}\right)\left[C^\lambda L^\mu R^\gamma\right]^{\left(-\frac{1}{b}-1\right)}\left[C^\lambda L^\mu R^\gamma\right]\left[\mu L^{-1}\right] \tag{5}$$

$$MP_L = w = \eta P^* \left(1-\frac{1}{b}\right)\left[C^\lambda L^\mu R^\gamma\right]^{\left(1-\frac{1}{b}\right)}\left[\mu L^{-1}\right] \tag{6}$$

Correspondingly, we can write the first order conditions for capital and raw material:

$$MP_C = i = \eta P^* \left(1-\frac{1}{b}\right)(C^\lambda L^\mu R^\gamma)^{1-\frac{1}{b}}[\lambda C^{-1}] \tag{7}$$

$$MP_R = r = \eta P^* (1-\frac{1}{b})(C^\lambda L^\mu R^\gamma)^{1-\frac{1}{b}}[\gamma R^{-1}] \tag{8}$$

We can write equation (6) in natural log form:

$$\ln L = \frac{\ln \eta \left(1-\frac{1}{b}\right)\mu}{1-\mu\left(1-\frac{1}{b}\right)} - \left\{\frac{1}{1-\mu\left(1-\frac{1}{b}\right)}\right\}\ln\left(\frac{w}{p}\right) + \left\{\frac{\lambda\left(1-\frac{1}{b}\right)}{1-\mu\left(1-\frac{1}{b}\right)}\right\}\ln C + \left\{\frac{\gamma\left(1-\frac{1}{b}\right)}{1-\mu\left(1-\frac{1}{b}\right)}\right\}\ln R \tag{9}$$

Equation (9) can also be written as:

$$\ln L = \beta_0 + \beta_1 \ln\left(\frac{w}{\bar{P}}\right) + \beta_2 \ln C + \beta_3 \ln R \tag{10}$$

Where: $\beta_s = f(b)$

By plugging in first-order condition of capital and material in equation (10), we get:

$$\ln L = \phi_0 + \phi_1 \ln\left(\frac{w}{P^*}\right) + \phi_2 \ln\left(\frac{i}{P^*}\right) + \phi_3 \ln\left(\frac{r}{P^*}\right) \tag{11}$$

The own price elasticity of demand for labor w.r.t industry wage

$$\frac{\partial \ln L}{\partial \ln(\frac{w}{P^*})} = \left[\frac{1-(1-\frac{1}{b})(\lambda+\gamma)}{1-(1-\frac{1}{b})(\lambda+\mu+\gamma)}\right] = \phi_1 \tag{12}$$

The partial derivative of the absolute value of own-price elasticity of labor demand (ϕ_1) w.r.t demand elasticity of the product.

$$\frac{\partial(\phi_1)}{\partial b} = \left[\frac{\mu}{b^2\left\{1-\left(1-\frac{1}{b}\right)(\lambda+\mu+\gamma)\right\}^2}\right] > 0 \tag{13}$$

The labor demand function from equation (11) depends on input prices and output therefore it becomes:

$$L_{mnt} = \phi_0 + \phi_1 \ln(w_{mnt}^*) + \phi_2 \ln(i_{mnt}^*) + \phi_3 \ln(r_{mnt}^*) + \phi_4 O_{mnt}^* \tag{14}$$

Where: $w_{mnt}^* = \dfrac{W}{P^*}$, $i_{mnt}^* = \dfrac{i}{P^*}$, $r_{mnt}^* = \dfrac{r}{P^*}$, $O_{mnt}^* = \dfrac{O}{P^*}$

So,

$$L_{mnt} = \phi_0 + \phi_1 \ln(w_{mnt}^*) + \phi_2 \ln(i_{mnt}^*) + \phi_3 \ln(i_{mnt}^*) + \phi_4 Q_{mnt}^* + \phi_5 TRADE + \varepsilon_{mnt} \tag{15}$$

Thus, our final estimating equation is

$$\ln L_{ijt} = \phi_0 + \phi_1 \ln(W_{ijt}^*) + \phi_2 \ln(R_{ijt}^*) + \phi_3 \ln(M_{ijt}^*) + \phi_4(Q_{ijt}^*) + \phi_5 TRADE + \varepsilon_{ijt} \tag{16}$$

Where L is total employees, W is the price of labor, R is the price of capital, M is the price of raw material, Q is total output and TRADE is trade liberalization.

3.2   Data and Methodology

We have used the data of 13 industries of Pakistan's manufacturing sector in different years e.g. 1995-1996, 2000-2001, and 2005-2006[2]. The data are taken from the Census of Manufacturing Industries (CMI) which is a reliable source of data in Pakistan. The main objective of CMI is the measurement of structural and production changes in the large-scale manufacturing industries over time. CMI collects annual-based survey data in which information of employment cost, values of inputs and outputs, contribution to GDP, stocks, fixed assets, value-added, industrial taxes, and material cost are included. CMI publishes the information only to those firms that are registered and not all the existing firms. GDP and trade liberalization data are taken from World Development Indicators. Pooled OLS technique is used in the study to estimate the results.

4.   Results and Discussions

We have done two types of analyses: aggregated analysis and disaggregated analysis. In aggregate analysis, we are taking all workers as a whole of 13 industries that show the combined results but in disaggregated analysis, we divide the workers into production workers and non-production workers. So, first, we explain the results of aggregated analysis followed by disaggregated analysis.

4.1   Labor Demand Elasticities: An Aggregated Analysis

Now we are discussing the results of the aggregated analysis in which we take the log of total employees that are equal to production workers and non-production workers. The results of own and cross-price labor demand elasticities are given in Table 1. In this table, the dependent variable is the log of total employees and independent

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[2] CMI provides the data for selected years so we have taken the latest data available at CMI.

variables are price of labor, price of capital, price of other materials, output, and trade liberalization. Now we discuss the results according to one-by-one industry.

Textile Industry

Textile industry exhibits the negative own-price elasticity of labor demand indicating that the price of labor or wages is negatively related to labor demand according to the classical theory of employment or output (Dutta, 2014). The coefficient of interest rate shows cross-price elasticity of labor demand in terms of interest rate or price of capital is negative and significant. According to labor demand theory, when the price of capital increases, the demand for capital decreases but the demand for labor increases due to the substitution effect. So, the relationship between labor demand and prices of capital is positive. In the textile industry, the relationship between labor demand and interest rate is negative due to the complementary effect because in the textile industry, capital is more important and there is no or less substitute for capital. The parameter of cross-price elasticity of labor demand in terms of raw material is negative and significant. It means that when prices of raw material increase, the cost of production also increases so the output decrease, and the demand for labor also decreases. The coefficient of output elasticity of labor demand in the textile industry is positive and significant. When the output increases, the industry hires more laborers to increase their production, so the labor demand increases with the increase in output. Trade liberalization elasticity of labor demand has appeared with a positive sign suggesting that when trade liberalization increases, industries hire more labor to increase their production. The value of R^2 in the textile industry is 0.44.

Apparel and Wearing Industry

The parameter of own-price elasticity of labor demand in apparel and wearing industry is negative and significant. The cross-price elasticity of labor demand corresponding to the interest rate is significant and negative due to the complementary effect. The cross-price elasticity of labor demand with respect to raw material is positive and insignificant. The reason is that when the prices of raw material increase, the production cost also increases but the demand for labor also increases due to the complementary effect in the production process. Output and trade liberalization elasticities of labor demand have a significant and positive bearing on labor demand. The R^2 value in this industry is 0.52.

Ginning Industry

In ginning industry, own-price elasticity of labor demand is negative and insignificant. Cross-price elasticities of labor demand with respect to interest rate and raw material are negative and insignificant. Output and trade liberalization elasticities of labor demand have positive association with labor demand in ginning industry and both parameters are significant. The value of R^2 is 0.70 in Ginning industry.

Leather Industry

In the leather industry, own-price elasticity of labor demand shows a negative sign but it is insignificant. The relationship between labor demand and the interest rate is negative due to the complementary effect. The raw material, output, and trade liberalization elasticities of labor demand have a positive and significant effect on labor demand. The value of R^2 in this industry is 0.42.

Food Industry

The parameter of own-price elasticity of labor demand in the food industry is negative and insignificant. The parameters of both cross-price elasticities of labor demand are positive and significant. The cost of capital is positive due to the substitution effect. Output and trade liberalization elasticities of labor demand are positive in the food industry. The value of R^2 is 0.54.

Electrical Industry

In the electrical industry, the parameters of own-price elasticity and cross-price elasticities of labor demand are negative and significant. The sign of output elasticity of labor demand is positive and insignificant. There is a positive link between trade liberalization and labor demand but it is insignificant. The R^2 of the electrical industry is 0.55.

Iron & Steel Industry

In the Iron and Steel industry, own-price elasticity and cross-price elasticities of labor demand have a negative association with labor demand. The link between output and labor demand is positive and significant. The coefficient of trade liberalization elasticity of labor demand is positive but insignificant. The value of R^2 in this industry is 0.60.

Transport Industry

The parameter of own-price elasticity of labor demand is negative and insignificant in the transport industry. Cross-price elasticities of labor demand with respect to interest rate and raw material are negative and significant but the sign of raw material elasticity of labor demand is negative and insignificant. The output elasticity parameter of labor demand is positive but insignificant. The relationship between trade liberalization and labor demand is positive and significant. The value of R^2 in the transport industry is 0.82.

Paper and Paper Products Industry

In the paper and paper products industry, own-price elasticity of labor demand and both cross-price elasticities of labor demand are negative and significant. The coefficient of output elasticity of labor demand is positive and significant but trade liberalization elasticity of labor demand has a positive but insignificant effect in the paper and paper products industry. The value of R^2 is 0.32.

Tobacco Industry

The tobacco industry exhibits the negative own-price elasticity of labor demand. The coefficients of cross-price elasticity of labor demand with respect to interest rate and raw material are negative and highly significant. Output and trade liberalization elasticities of labor demand show a positive link with labor demand. The R^2 value in Tobacco is 0.51.

Table 1: Estimates of Own and Cross Price Labor Demand Elasticities

Dependent Variable: $Ln(L_{ijt})$							
Industries	Intercept	Ln $(W_{ijt}*)$	Ln $(R_{ijt}*)$	Ln $(M_{ijt}*)$	Ln $(Q_{jt}*)$	Ln $(Trade_t)$	R^2
Textile	0.4332 (0.025)	-0.4737 (0.045)	-0.4153 (0.055)	-0.6673 (0.058)	0.3863 (0.093)	0.8472 (0.041)	0.44
Apparel & Wearing	0.6828 (0.010)	-0.0800 (0.015)	-0.4611 (0.088)	0.9011 (0.405)	0.8093 (0.039)	0.6625 (0.074)	0.52
Ginning	0.8027 (0.070)	-0.3937 (0.060)	-0.1544 (0.201)	-0.0061 (0.182)	0.2388 (0.079)	0.9286 (0.042)	0.70
Leather	0.7177 (0.017)	-0.6900 (0.128)	-0.0820 (0.053)	0.0024 (0.076)	0.2926 (0.099)	0.8187 (0.092)	0.42
Food	0.7976 (0.987)	-0.6820 (0.235)	-0.4889 (0.074)	-0.6424 (0.088)	0.3032 (0.249)	0.5871 (0.075)	0.54
Electrical	0.2132 (0.031)	-0.1196 (0.056)	-0.4409 (0.014)	-0.8208 (0.075)	0.8049 (0.881)	0.1092 (0.104)	0.55
Iron & Steel	0.8404 (0.300)	-0.9843 (0.065)	-0.1182 (0.042)	-0.7014 (0.088)	0.5339 (0.009)	0.0454 (0.813)	0.60
Transport	0.3819 (0.098)	-0.2592 (0.209)	-0.2987 (0.050)	-0.7271 (0.170)	0.3044 (0.106)	0.0225 (0.078)	0.82
Paper & Paper Products	0.6163 (0.590)	-0.9479 (0.022)	-0.7709 (0.069)	-0.1170 (0.086)	0.0521 (0.036)	0.1748 (0.540)	0.32
Tobacco	0.5224 (0.012)	-0.9431 (0.068)	-0.5802 (0.000)	-0.3189 (0.204)	0.5010 (0.000)	0.7608 (0.651)	0.51
Drugs & Pharmaceutical	0.3638 (0.107)	-0.5564 (0.054)	-0.1028 (0.571)	-0.9587 (0.077)	0.2159 (0.102)	0.2461 (0.105)	0.65
Chemical	0.4522 (0.018)	-0.7614 (0.539)	0.9879 (0.053)	-0.9002 (0.083)	0.1256 (0.051)	0.1947 (0.032)	0.70
Beverages	-0.2545 (0.043)	-0.3584 (0.037)	0.0711 (0.065)	-0.6009 (0.092)	0.1179 (0.032)	0.5408 (0.069)	0.67

Drugs and Pharmaceutical Industry

In the pharmaceutical industry, own price elasticity of labor demand and both cross price elasticities of labor demand are negative. Output and trade liberalization elasticities of labor demand are positive but both are insignificant. The value of R^2 is 0.65 in this industry.

Chemical Industry-

The coefficient of own-price elasticity of labor demand and cross-price elasticity of labor demand with respect to raw material is negative while interest rate elasticity of labor demand is positive. The parameter of output and trade liberalization elasticities of labor demand is positive and significant. The R^2 value of the chemical industry is 0.70.

Beverages Industry

Beverages is the last industry shown in Table 1. Own-price elasticity of labor demand and cross-price elasticity of labor demand with respect to raw material has a negative sign. Interest rate elasticity of labor demand has a positive sign. The output and trade liberalization elasticities of labor demand show positive and significant influence. The value of R^2 in the beverages industry is 0.67.

In Table 1, the minimum value of wages elasticity labor demand in thirteen industries is -0.98 (iron & steel industry) and the maximum value of wages elasticity labor demand is -0.08 (apparel & wearing industry). In the case of cross-price elasticity i.e., interest elasticity labor demand, the minimum value is -0.77 (paper & paper product industry) and the maximum value is 0.98 (chemical industry). Another cross-price elasticity i.e., raw material elasticity labor demand, the minimum value of cross-price elasticity is -0.95 (drugs & pharmaceutical industry) and the maximum value is 0.90 (apparel and wearing industry). The minimum value of output elasticity labor demand in thirteen industries is 0.05 (paper & papers product industry) and the maximum value is 0.80 (apparel and wearing industry). The minimum value of trade liberalization elasticity labor demand is 0.02 (transport industry) and the maximum value of trade liberalization elasticity labor demand is 0.92 (ginning industry). The minimum value of R^2 is 0.32 (paper & papers product industry) and the maximum value of R^2 is 0.82 (transport industry).

4.2   Labor Demand Elasticities: A Disaggregated Analysis

Now, we are turning to the disaggregated analysis in which workers are fragmented into production workers and non-production workers. In Tables 2 and 3, estimates of production workers and non-production workers demand elasticities with respect to wages, interest rate, raw material, output, and trade liberalization in thirteen industries.

The dependent variables in Tables 2 and 3 are the log of production workers and log of non-production workers respectively and independent variables are the price of labor, price of capital, price of other materials, output, and trade liberalization.

In Table 2, the parameters of wage elasticity of production workers' demand and interest elasticity of production workers' demand are negative in all industries. Raw material elasticity of production workers' demand shows mixed findings as the negative sign has appeared in nine industries while there is a positive sign in four industries. Output and trade liberalization elasticities of production workers' demand are positive in all industries.

Table 2: Estimates of Own and Cross Price Demand Elasticities of Production Workers

Dependent Variable: Ln (L_{ijt}) Production Workers							
Industries	**Intercept**	**Ln ($W_{ijt}*$)**	**Ln ($R_{ijt}*$)**	**Ln ($M_{ijt}*$)**	**Ln ($Q_{jt}*$)**	**Ln ($Trade_t$)**	**R^2**
Textile	0.7946 (0.092)	-0.0415 (0.095)	-0.9356 (0.066)	0.0627 (0.161)	0.2815 (0.071)	0.2948 (0.057)	0.52
Apparel & Wearing	0.5783 (0.051)	-0.4644 (0.098)	-0.1693 (0.010)	-0.5436 (0.011)	0.1362 (0.058)	0.7092 (0.67)	0.74
Ginning	0.0023 (0.091)	-0.2508 (0.054)	-0.4648 (0.068)	-0.5210 (0.081)	0.0148 (0.009)	0.2264 (0.073)	0.68
Leather	0.5925 (0.033)	-0.4563 (0.092)	-0.5638 (0.093)	-0.2196 (0.002)	0.5130 (0.035)	0.3108 (0.023)	0.77
Food	0.1982 (0.082)	-0.3353 (0.084)	-0.2602 (0.033)	0.9259 (0.009)	0.1502 (0.055)	0.4834 (0.070)	0.85
Electrical	0.9241 (0.009)	-0.9372 (0.066)	-0.9637 0.058)	-0.4323 (0.084)	0.8842 (0.072)	0.2915 (0.085)	0.44
Iron & Steal	0.2878 (0.091)	-0.1310 (0.022)	-0.2945 (0.033)	0.4011 (0.073)	0.8779 (0.074)	0.3885 (0.042)	0.51
Transport	0.8709 (0.053)	-0.4572 (0.000)	-0.7101 (0.051)	-0.4646 (0.055)	0.3175 (0.075)	0.0970 (0.057)	0.34
Paper & Paper Products	0.0948 (0.027)	-0.6548 (0.059)	-0.7158 (0.055)	-0.5247 (0.085)	0.4991 (0.030)	0.6731 (0.022)	0.41
Tobacco	0.1845 (0.029)	-0.0708 (0.097)	-0.1766 (0.018)	-0.8823 (0.002)	0.6146 (0.092)	0.5382 (0.009)	0.65
Drugs & Pharmaceutical	0.5455 (0.018)	-0.5595 (0.410)	-0.8367 (0.200)	0.7893 (0.097)	0.2978 (0.010)	0.6267 (0.000)	0.67
Chemical	0.3408 (0.077)	-0.7434 (0.076)	-0.8333 (0.052)	-0.8936 (0.094)	0.5738 (0.201)	0.6729 (0.073)	0.23
Beverages	0.1873 (0.065)	-0.2820 (0.085)	-0.6660 (0.051)	-0.4497 (0.071)	0.9959 (0.805)	0.7211 (0.077)	0.76

In Table 3, wage elasticity of non-production workers' demand has mixed findings as the sign of own-price elasticity is negative in ten industries while in three industries, the sign is positive. Both the cross-price elasticities of non-production workers' demand are negative in all industries. Output and trade liberalization elasticities of non-production workers' demand are positive in all industries.

In Tables 2 and 3, the minimum value of wage elasticity is -0.93 and the maximum value is -0.04 in production workers but in non-production workers, the minimum value of wage elasticity is -0.78 and the maximum value is 0.62. In interest elasticity, the minimum value in production workers is -0.96 and the maximum value in production workers is -0.16 but the minimum value of interest elasticity in non-production workers is -0.86 and the maximum value is -0.02. The minimum value of the price of raw material elasticity in production workers is -0.89 and the maximum

value of elasticity is 0.92. In non-production workers, -0.90 is the minimum value and the maximum value -0.02.

Table 3: Estimates of Own and Cross Price Demand Elasticities of Non-Production Workers

Industries	Intercept	Ln $(W_{ijt}*)$	Ln $(R_{ijt}*)$	Ln $(M_{ijt}*)$	Ln $(Q_{jt}*)$	Ln $(Trade_t)$	R^2
Dependent Variable: Ln (L_{ijt}) Non-Production Workers							
Textile	0.6071 (0.074)	-0.7045 (0.085)	-0.0650 (0.057)	-0.0661 (0.036)	0.6403 (0.084)	0.1761 (0.021)	0.34
Apparel & wearing	0.1241 (0.076)	-0.2819 (0.088)	-0.1766 (0.006)	-0.0206 (0.080)	0.7489 (0.091)	0.4887 (0.098)	0.45
Ginning	0.5045 (0.083)	-0.4131 (0.083)	-0.1212 (0.014)	-0.3134 (0.065)	0.5489 (0.045)	0.2774 (0.956)	0.56
Leather	0.4652 (0.072)	-0.2757 (0.072)	-0.4106 (0.009)	-0.5775 (0.006)	0.0482 (0.075)	0.5523 (0.012)	0.72
Food	0.0108 (0.097)	0.5584 (0.028)	-0.3219 (0.078)	-0.8819 (0.055)	0.7314 (0.004)	0.0425 (0.809)	0.67
Electrical	0.2102 (0.002)	-0.6759 (0.003)	-0.3013 (0.019)	-0.1108 (0.033)	0.7463 (0.015)	0.6660 (0.035)	0.56
Iron & Steel	0.4563 (0.004)	0.6001 (0.023)	-0.6366 (0.020)	-0.5273 (0.318)	0.0080 (0.034)	0.8843 (0.914)	0.78
Transport	0.9577 (0.098)	-0.4196 (0.052)	-0.6723 (0.085)	-0.8915 (0.000)	0.5613 (0.903)	0.9195 (0.358)	0.42
Paper & Paper Products	0.2736 (0.090)	-0.0727 (0.064)	-0.7662 (0.031)	-0.9061 (0.109)	0.1033 (0.047)	0.1207 (0.001)	0.67
Tobacco	0.4584 (0.082)	0.6289 (0.13)	-0.3977 (0.037)	-0.6742 (0.066)	0.7002 (0.006)	0.0210 (0.330)	0.61
Drugs & Pharmaceutical	0.0050 (0.096)	-0.2074 (0.003)	-0.8580 (0.005)	-0.4120 (0.078)	0.7546 (0.083)	0.6426 (0.032)	0.71
Chemical	0.8270 (0.071)	-0.6208 (0.085)	-0.8669 (0.047)	-0.4373 (0.038)	0.3008 (0.064)	0.1757 (0.050)	0.74
Beverages	0.9826 (0.022)	-0.7801 (0.058)	-0.0232 (0.011)	-0.3776 (0.022)	0.1165 (0.009)	0.0663 (0.017)	0.72

The output elasticity of production workers has a minimum value of 0.01 and the maximum value is 0.99 but the minimum value of 0.008 in non-production workers and the maximum value is 0.75. The minimum value of trade liberalization elasticity of production workers is 0.09 and the maximum value of 0.72. In non-production workers, the minimum value of trade liberalization elasticity is 0.021and the maximum value of trade liberalization elasticity is 0.91. The minimum values of R^2 are 0.23 and 0.34 in production and non-production workers respectively while the maximum value of R^2 in production workers is 0.85 and 0.78 in non-production workers.

5.   Conclusions and Policy Recommendations

The study probes the effects of trade liberalization on the labor demand elasticity in thirteen industries of Pakistan's manufacturing sector. We have executed two types

of analyses: aggregated and disaggregated. In aggregate analysis, we have taken all workers and in disaggregated analysis, we have separated the workers into production workers and non-production workers. The panel data are taken from CMI for the years 1995-1996, 2000-2001, and 2005-2006 and pooled least square method has been applied to estimate the effects of wage, interest rate, price of raw material, output, and trade liberalization on labor demand.

At the aggregated and disaggregated levels, the findings show that trade liberalization has a significant positive effect on labor demand in these industries. The positive relationship between trade liberalization and labor demand is because Pakistan is a labor-abundant country. When trade liberalization increases, it positively influences the labor demand due to an increase in more output in these industries. So, labor is a substitute for capital in these industries.

Following policies are suggested to increase the labor demand in Pakistan:

- The government may not intervene in the labor market by announcing minimum wages so that the unemployment rate may be decreased. In Pakistan, the unemployment level is high and firms can hire more labors at a low wage rate.
- The policymakers may help industries by decreasing the cost of raw material and capital. The government may provide loans at low interest rates. Moreover, raw material costs can also be minimized.
- The government may reduce the tariff on capital goods to establish industries and enhance the level of output that has a positive impact on labor demand.

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