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Does Trade Liberalization Increase the Labor Demand Elasticities? Evidence from Pakistan

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Abstract

This study measure the linkage of trade liberalization and labor demand elasticities. Using Pakistan firm-level data, spanning the course of trade liberalization, study try to determine whether the trade liberalization increase the own price labor demand elasticities in the manufacturing sector of Pakistan. Elasticities are measure for production workers and non-production workers for major eleven industries at individual level at first and later elasticities are measured by pooling data across the industries at aggregate level. However, in most of the industries, study unable to find any empirical support for the hypothesis of no relationship between trade liberalization and labor demand elasticities in case of Pakistan.

1. Introduction

Historical experience of the most of the developed countries of the world clearly shows that policies that make an economy open to trade with the rest of the world are needed for sustained economic growth. In recent decades no country has achieved economic success, in terms of substantial improvement in living standards for its people, without being open to the rest of the world. The countries that have followed the Import Substitution policies and impose restriction on the trade flows have lagged behind.

In case of Pakistan high protection regimes were followed until 1980s. the process of trade liberalization in trade was started in eighties, when Government of Pakistan liberalize economic policies and deregulate the economy under structural adjustment program (SAP). One of the main objectives was to make industrial sector efficient and competitive by removing import substitution industrialization.

Trade liberalization consequences are important especially for a poor country like Pakistan where one-third population still live below poverty line [Siddique (2001)]. Most of the studies focused on the consequences of trade liberalization on poverty, income distribution, employment, increased inequality, and direct effect on skilled worker and non skilled workers[1]. These studies of Ravenga (1992), Bhagwati (1994), Lawrence (1993), Freeman (1994), and Currie (1997) have generated controversy regarding increased wage inequality in US and in other developing countries. But there is no consensus on the forces behind these changes.

However, Rodrick (1997) re-examined the issue of trade liberalization, labor and wage inequality. He found trade can change labor demand elasticities without changing price of labor. Trade can make labor demand more elastic in by making output market more competitive and by making domestic labor more substitutable with foreign factors and secondly through Hicksian -Marshallian laws of factor demand. Since product market elasticities are likely to rise with the trade liberalization, this implies that with the increase in trade openness, labor demand elasticities will increase as well. It also explains that higher elasticities trigger more volatile responses of wages and employment to any exogenous shock to labor demand and higher elasticities shift bargaining power over rent distribution in firms which enjoys extra normal profit away from labor towards capital.

The main objective of this study is to examine the impact of the trade liberalization on particularly own price labor-demand elasticities of both the production workers and non-production workers in manufacturing sector of Pakistan. The study specifically tests the hypothesis that "trade liberalization have no impact on labor demand elasticities".

The rest of the study is structured as follows: Section 2 is devoted to review of literature and description of trade reforms in Pakistan in section 3. Section 4 explains theoretical model, which will be estimated. In section 5 description of data and estimation procedure is reported and section 6 is about results for both production and non-production workers, and also for overall industries. Lastly, section 7 contains conclusions.

[1] Kemal (2001), Khan (2003), Krishna et al (2001), Roderick(1997) and Currie and Hanson(1997), etc.

2 Review of Literature

The importance of the linkage between international trade (liberalized trade) and labor market firstly was emphasized by Roderick (1997). Study argues that trade makes the demand for labor more elastic which in turn leads to larger employment and wage shocks as a result of given vertical shift in the labor demand curve. This increase in elasticity also leads to the erosion of the bargaining power of the labor.

Roderick (1997) pointed out two channels through which an increase in openness leads to an increase in labor demand elasticities.

1. In first channel study explain that trade reforms allow cheaper imports of intermediate, capital inputs, semi finished goods and unassembled parts for assembly in the importing country. All these imports are substitute for the services of domestic labor. Thus substitution possibilities in production increase with the availability of cheaper and larger variety of inputs.
2. The second channel, works through Hicks Marshallian Law of Factor Demand which can be stated as follow: "*the demand for anything is likely to be more elastic, the more elastic is the demand for further thing which it contributes to produce"*.

However, to date limited empirical literature has not offered strong support for this hypothesis. Slaughter (2001) provides a very systematic empirical investigation of the positive effect of trade on labor demand. By using four-digit industry level data for US for the period of 1961-1991, study found mixed support for this hypothesis. Own price elasticities of the labor demand for production workers have increased overtime while study found no such trend for non-production workers. However, he also found time, by itself, is a better predicator of the elasticities than his trade related variables, which makes explanatory variables weak in the presence of the time dummies or it shows common trend in the case of production and non-production workers.

As empirical evidence, Ramaswami (2003) find a positive impact of trade liberalization on labor demand elasticities in the Indian manufacturing sector by using industry level data disaggregated by states. These elasticities turn out to be negatively related to protection levels that vary across industries and overtime. Furthermore, they found that these elasticities are not only higher for Indian states with more flexible labor regulations; they are also impacted to a larger degree by trade reforms. Finally, they found that after reforms, volatility in productivity and outputs gets translated into larger wage and employment volatility, theoretically a possible consequence of larger labor demand elasticities.

By using Turkish plant level data for major trade liberalization period Karishna *et al.* (2001) tested the effect of trade liberalization on labor demand elasticities. Study found

that "labor demand seems to be unresponsive to openness in Turkey": in the vast majority of the industries they considered separately, and are unable to fine statically and economically significant relationship between these variables.

Empirical literature also has not offered strong support for this hypothesis in multi country case. Fannzylber and Maloney F.M (2005) disregard this hypothesis, by using panel level data for three countries that experienced significant changes in trade regime during the period under analysis. The results showed that labor demand elasticities do change greatly in magnitude overtime and with level of openness to international trade. Moreover, in those countries test of the effect of trade openness on long run labor demand elasticities yield either nonsignificant or mixed results.

Regulation of the market also affects the labor market. With more flexible labor regulation, they impacted to a larger degree by trade reforms. Hasan *et al.* (2003) estimated relationship of the trade reform and labor demand elasticities with the regulation of the labor market. Results of study indicate that labor demand elasticities increase with reduction in protection. Unlike Slaughter (2001), they do not found time to determine their result. Study also found that the response of labor demand elasticities to protection is conditioned by the nature of labor institutions. Study found that the state with more flexible markets see larger increases in the labor demand elasticities in response to reduction in protection.

In case of Pakistan, Yasmin (2005) looked at how trade liberalization has affected the employment and labor demand elasticities in the manufacturing sector of Pakistan. The results indicated that trade liberalization has positively contributed towards employment generation in the manufacturing sector. This study investigated manufacturing sector at aggregate with time series analysis. There is no study found to analysis of trade liberalization and labor demand elasticities for individual industries. This paper adds compareable evidence from Pakistan and used disaggregated data by 11 industries to investigate relationship between trade liberalization and labor demand.

3 Background of Trade Reforms in Pakistan

> "*It is also very clear that the policies of import substitution have been replaced by import liberalization and export led strategy. It is this very strategy which ensured the rapid growth of the most dynamic emerging economies*" [Trade policy 2005-06].

This is well known in theoretical literature that the choice of a trade regime depends partly on the resource endowment of the country. At the time of independence in 1947, Pakistan's industrial base was confined to a few textile mills, some sugar mills and some cement factories, all totaling 34 units. It was considered essential for the country to provide adequate protection to the growing local industry against imports. To protect industry, government of Pakistan emphasized on the import substitution policy and parallel efforts were made to promote exports. For this perspective Pakistan has maintained a complex system of trade policy regime since 1950s. Import bans, quota,

licensing requirements other restrictions imposed to protect the domestic industry, and high tariff have introduced serious distortions. The high tariffs imposed for protecting domestic industries and to raise the revenues have become counterproductive. They have resulted in smuggling and corruption.

During seventies, the nationalization of the large-scale enterprises was eroded the business confidence. Government gave high priority to the economic policies during eighties to the restoration of the business confidence. In particular, the government initiated wide-ranging Structural Adjustment and Stabilization Program (SAP) that aimed at liberalizing and deregulating the economy. The adoption of these programs led to major changes in the industrial and in trade policies in the form of deregulation, privatization and trade liberalization. One of the major objectives was to make industrial sector efficient and competitive by removing import substitution industrialization and nationalization.

In late 1980 and during 1990, Pakistan liberalized imports under SAP[2], in order to enhance the capacity utilization of the domestic industry and competitiveness of the commodity producing sectors. Following SAP government of Pakistan has reduced maximum import duty rate from 250 percent in 1987-88 to 128.6 percent in 1989-90 and further to 110 percent in 1995-1996 (see Appendix A). On the other hand, minimum import duty rate has declined from 13.3 percent in 1987-1988 to 10 percent in 1989-90. Subsequently, it declined to 0.5 percent in 1995-96. As a result, average duty rate (un-weighted) declined from 40.7 percent in 1987-1988 to 25.5 in 1995-96. Excluding sports goods and automobiles the maximum import duty rate was 35 percent in recent compared to 65 percent only three ago. At present, the number of duty slabs has been reduced to 5 with tariff rate 10 percent, 15 percent, 25 percent 35 percent, and 45 percent. A number of items subject to different kinds of restrictions have been reduced from 62 to 47 during 1990-91 to 1993-94 [Kemal (2001)].

Table 1. Import Duty Rates: According to Category

Year	1990-91	1991-92	1992-93	1993-94	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
Consumer Goods (%)	38	37	41	38	43	46	23	26	19	16	17	11
Capital Goods (%)	39	34	32	30	31	36	28	24	22	20	16	11
Total (%)	39	33	35	35	34	35	23	21	18	17	15	9

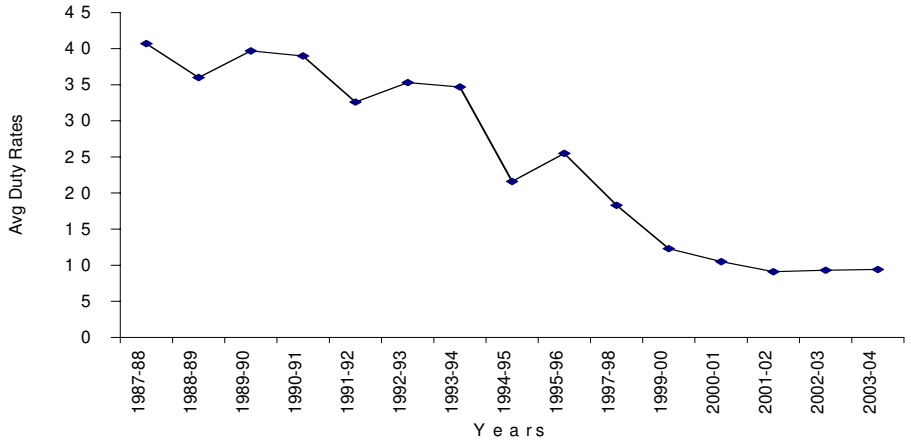
Source: CBR Year Book, 1995-96& various year

[2] Structural Adjustment and Stabilization Programs of the IMF, World Bank and other international financial institutions for Pakistan have called for reduction in the fiscal deficit, rationalization of tax structure, removal of subsidies on consumption and production, etc. with the view fostering higher level of output , price stability ,etc.

Table 1 shows the situation that Pakistan is moving towards liberalizing its imports by gradually declining the rates of duty on import of consumer as well as capital goods. Rate of decline in the duties was more for capital goods than consumer goods. Over all, duty rates had decline by 21 percent during the decade. In 1997, the Government introduced another Tariff Reform Package on March 28, 1997.These reforms were introduced to revitalize the industrial production and export promotion and recommended that maximum tariff should be reduced to 45 percent from previous level of 65 percent with the exception of automobiles; the 10 percent regulatory duty was also abolished.

Duty rates also showed the trend that decline in the duty rate of capital goods are higher than for consumer goods: duty rates on consumer goods have declined by 8 percent while duty rates on capital goods have declined by 11 percent from 1999-00 to 2002-03,

Figure 1: Trends in Average Duty Rates



Source: CBR Year Book, 1995-96& various year.

Overall Import Liberalization in Pakistan has been a gradual process as well as a little bit uneven process, as shown by the downward sloping trend in average import duty in figure 1. In keeping with its obligation under WTO, The government of Pakistan still liberalizing of trade policy and consistent; to move with the international trends; to facilitate trade diplomacy efforts for better market access, to create a level playing field.

4 Theoretical and Estimation Frame-work

It is well known that change in relative prices has significant impact on welfare of the workers. But it is matter of vital importance to investigate the consequences of changing labor-demand elasticities for the economy. Rodrick (1997) explains three fundamental implications of more-elastic factor demands. First, higher elasticities shift the wage

and/or employment incidence of non-wage labor costs (e.g., payroll taxes) towards labor away from employers. Second, higher elasticities trigger more-volatile responses of wages and/or employment to any exogenous shock to labor demand. Third, higher elasticities shift from labor towards capital bargaining power over rent distribution in firms that enjoy extra-normal profits.

Labor-Demand Elasticities

We focus on the profit maximization approach[3], output is not given rather it is determined endogenously, and monopolistic competition is assumed[4]. Therefore a representative firm in an industry is assumed to an inverse demand function.

$$P_{ij} = \theta \bar{P}_j Q_{ij}^{-1/\varepsilon} \quad [1]$$

P_{ij} denotes own price. Here subscript 'i' and 'j' represent firm i in industry j

$\bar{P}_j$ denotes industry average price, θ is scaling factor , Q_{ij} denotes firms output and ϵ denotes the (constant) price elasticity of demand. The production function is assumed to be Cobb-Douglas type and is given by.

$$Q_{ij} = \prod_{k=1}^{n} V_{kij}^{\alpha_k} \quad [2]$$

V_{kij} denotes the *k*th input use here.

For simplicity we consider Cobb-Douglas production function with three inputs capital (K), labor (L), and material (M) used by representative firm.

$$Q = K^{\alpha} L^{\beta} M^{\gamma} \quad [3]$$

Assuming perfect competition in factors market and partially differentiating with respect to *l*th input and equating it to zero, gives the first order conditions

Similarly we can find first order conditions for other inputs

$$w = \theta \overline{P}(1 - 1/\varepsilon)(K^{\alpha} L^{\beta} M^{\gamma})^{1-1/\varepsilon}(\beta L^{-1}) \quad [4]$$

$$r = \theta \overline{P}(1 - 1/\varepsilon)(K^{\alpha} L^{\beta} M^{\gamma})^{1-1/\varepsilon}(\alpha K^{-1}) \quad [5]$$

$$m = \theta \overline{P}(1 - 1/\varepsilon)(K^{\alpha} L^{\beta} M^{\gamma})^{1-1/\varepsilon}(\gamma M^{-1}) \quad [6]$$

In the log form eq (5) can be rewritten as:

[3] For more details on this concept see, Chaudry *et al*. (1999).

[4]This approximates a situation in which there are a large number of varieties and each firm is an infinitesimal player but has some power over the pricing of its product.

$$\ln L = \frac{\ln\theta(1-1/\varepsilon)\beta}{1-\beta(1-1/\varepsilon)} - \frac{1}{1-\beta(1-1/\varepsilon)}\ln\left(\frac{w}{\bar{P}}\right) + \frac{\alpha(1-1/\varepsilon)}{1-\beta(1-1/\varepsilon)}\ln K + \frac{\gamma(1-1/\varepsilon)}{1-\beta(1-1/\varepsilon)}\ln M \quad [7]$$

$$\ln L = \lambda_0 + \lambda_w \ln\left(\frac{w}{\bar{P}}\right) + \lambda_r \ln K + \lambda_m \ln M \quad [8]$$

Where the λ values are each a function of the Є. Substituting the first order conditions for the input material and capital in equation, we get

$$\ln L = \delta_0 + \delta_w \ln\left(\frac{w}{\bar{P}}\right) + \delta_r \ln\left(\frac{r}{\bar{P}}\right) + \delta_m \ln\left(\frac{m}{\bar{P}}\right) \quad [9]$$

This final equation is labor demand function that depends not only on its own price but also on the prices of other inputs and output. All coefficients of the equation are function of the 'Є'.

The own price elasticity of demand for labor (w.r.t industry wage) is given as.

$$\Rightarrow \frac{\partial \ln L}{\partial \ln\left(\frac{w}{\bar{P}}\right)} = \left|\delta_w\right| = \left(\frac{1-(1-1/\varepsilon)(\alpha+\gamma)}{1-(1-1/\varepsilon)(\alpha+\beta+\gamma)}\right) \quad [10]$$

The partial derivative of the absolute value of the own price elasticity of labor demand with respect to product demand elasticity is given as

$$\frac{\partial\left|\delta_w\right|}{\partial\varepsilon} = \left[\frac{\beta}{\varepsilon^2[1-(1-1/\varepsilon)(\alpha+\beta+\gamma)]^2}\right] \succ 0 \quad [11]$$

Finally we focus our attention on the demand for labor (as opposed to that for other factor inputs). The labor demand function is given by

$$l_{ijt} = \delta_0 + \delta_w \ln\left(w_{ijt}\right) + \delta_r \ln\left(r_{ijt}\right) + \delta_m \ln\left(m_{ijt}\right) + \delta_{TP} TP \quad [12]$$

where *l* is the log form of the labor demanded. Thus our final estimating equation is

$$l_{ijt} = \delta_0 + \delta_w \ln\left(w_{ijt}\right) + \delta_r \ln\left(r_{ijt}\right) + \delta_m \ln\left(m_{ijt}\right) + \delta_{TP} TP + e_{ijt} \quad [13]$$

where the error term e_{ijt} allows for random shocks to affect the firm's demand for labor.

5 Data Description and Estimation

Data that have used for estimation are taken from Census of Manufacturing Industries (CMI), which is published by Statistical division, Government of Pakistan. It is only

reliable source of firm level data, which annually surveys all registered manufacturing firms with at least 10 Employees. The annual survey collects firm level information about value of production, value added, total employment cost, average daily employment, material cost, industrial cost, non industrial cost, value of energy inputs, etc. on current prices, which have consumed by firms of different industries.

CMI published for the year 1969-70, 1970-71, and 1975-76 to 1987-88, 1990-91, 1995-96 and 2000-01. Data used in this study is of years 1987-88, 1990-91, 1995-96 and 2000-01. All information covers industries all over Pakistan. Despite all this information, publications of CMI have some limitations like it published irregularly; it doesn't show all existing firms in an industry rather just registered firms.

All of inputs are deflated by the wholesale price index for manufacturing industries to obtain real values. Data on wholesale price index, raw material price index and rate of interest are taken from annual report SBP and Economic survey of the following years 1992-93, 1996-97 and 2001-02. Where as data on tariff rates are taken from *Pakistan Custom Tariff* and from *Yearly Book of CBR.*

Construction of Variables

Determination of Wage Rates

Wage rate (W) is calculated by dividing the total employment cost with the average daily person engaged.

$$W = \left(\frac{TEC}{ADE} \right)$$

Fuel Prices

Fuel prices are calculated by dividing value of fuel with the corresponding quantities. Fuel price index is used for proxy of fuel prices that is calculated by taking average of all types of fuel items.

User Cost of Capital

The calculation of the capital cost and price is a hectic work as admitted by Chaudry *et al*. (1999). The most appropriate price of the capital is the user cost of capital, which is calculated as follows

$$P_k = P_m(\delta + r - \pi_m)$$

Where depreciation rate is calculated by dividing the depreciation charges (*Dep-C*) with value of fixed assets at the beginning of the year (*VFA*)

$$\delta = \left(\frac{Dep - C}{VFA} \right)$$

Where (P_k) is user cost of capital, (P_m) is the price index of capital goods (machinery), r is the rate of the interest, δ is the capital depreciation rate and π_m is the rate of growth in the price index of capital. The data on price index of machinery are taken from *Monthly Statistical Bulletin* and are used as a proxy for the price index of capital. The rate of interest is calculated by taking the average scheduled bank's rate on long-term advances to manufacturing sector.

Estimation Procedure

Equation (13) is our basic estimating equation that is estimated separately for each industry at first, and then for pooled across industries. To take into account within-industry firm heterogeneity, we used fixed effect and random effect model. This strategy based on Karishna (2001). Both 'fixed effects' and 'random effects' models are estimated for each eleven industries in the manufacturing sector of the Pakistan. Trade Reform dummy included to accumulate the effect of the changed trade policy on parameter, which take the value of one for the post liberalization period. Also year specific intercept dummies (in place of the reform intercept dummy) are included to capture year-specific shocks common to all firms in an industry.

6 Results

The outcomes of our estimation of labor demand elasticities and their changes in each of the 11 industries are presented in Table 2. These are estimated under the fixed and random effects. The vast majority of the estimated elasticities (δ_w) lie within the range of −0.15 to −0.75, identified by Hammermesh (1993) as being a reasonable range of values for labor demand elasticities. In all of 11 cases, under both fixed effects and random effects model, the elasticity estimates have weak significance to trade liberalization.

Here, in estimated outcomes, elasticity change is the parameter of particular interest. This parameter corresponding to the wage variable interacted with the liberalization dummy that is one in post reform period. This is shown by the denotation of $\Delta\delta_w$ in Table 2. The elasticities change ($\Delta\delta_w$) is estimated under both fixed and random effects model.

It evident from the results that our estimates of the changes in labor demand elasticities are small in magnitude and largely insignificant. In case of all industries using fixed effects specifications, the null hypothesis that the change in elasticity after the reforms is zero, cannot be rejected at the 5% level of significance as estimated 't-values' of elasticity change are less than two. Our results are very much consistent with available evidence in literature as Krishna *et al*. (2001) in case of Turkey.

Under the random effect model, results are also small in magnitude and insignificant. Eight out of 11 industries cases by using random effect model, the null hypothesis that the change in elasticity after the reforms is zero cannot be rejected at 5% level of significance.

Table 2 Own Price Labor Demand Elasticity Estimates: (Fixed and Random Effects Model)

	Industries	Fixed Effects			Random effects	
Codes		**Δw**	**Δδw**	**R^2**	**Δw**	**Δδw**
311	Food	-0.22	-0.47	0.57	-0.19	-0.41
		(0.16)	(0.970)		(0.148)	(0.934)
320	Textile	-0.17	-0.16	0.72	-0.02	-4.29
		(0.22)	(1.638)		(0.301)	(2.201)*
323	Leather	-0.34	-0.09	0.12	-0.10	0.54
		(0.41)	(3.096)		(0.102)	(1.587)
351	Ind. Chem	-0.12	-0.12	0.73	-0.01	3.04
		(0.16)	(1.797)		(0.083)	(0.809)*
352	Other IC	-0.06	0.03	0.63	0.17	-0.55
		(0.06)	(0.474)		(0.138)	(1.267)
369	Non-metal	0.64	0.86	0.62	0.08	0.60
		(0.33)	(2.355)		(0.182)	(1.781)
371	Iron	-0.18	-0.16	0.77	-0.02	-0.40
	&Steel	(0.24)	(1.781)		(0.129)	(1.614)
381	Fabricated	-0.02	-0.02	0.25	0.14	0.14
		(0.028)	(0.212)		(0.136)	(1.037)
382	Non-elect	-0.35	-0.22	0.77	0.08	-1.5
		(0.451)	(3.047)		(0.057)	(0.794)
383	Electrical	-0.11	-0.04	0.27	-0.02	1.78
		(0.131)	(0.984)		(0.092)	(0.896)*
384	Transport	0.18	-1.05	0.22	0.06	-0.75
		(0.186)	(1.302)		(0.096)	(1.005)

Note: Values in parenthesis denotes S.E.
* Null hypothesis rejected at 5%

The only three industries where the null hypotheses of no elasticity change are rejected. These are Textile (320), Industrial Chemical (352) and Electrical Machinery (383). In these cases the $\Delta\delta_w$ estimate is in absolute terms of the own price labor demand elasticity goes up. Krishna *et al*. (2001) two out of these three industries, namely, Industrial Chemical (352) and Electrical Machinery (383) also found increase in elasticities in post reform period in case of Turkey. Overall then, it appears that in our data industries, labor demand elasticities do not respond to changes in openness as predicted by the theory Rodrick (1997).

Validity of Estimation Framework

Several issues regarding the validity of the estimation framework and the interpretation of the results arise that explained in following steps. These issues are found in empirical literature.

Simultaneity and Correlation problem

- First is the familiar issue of possible simultaneity and correlation between the error term and the right-hand side variables. Since both labor demand and labor supply depend upon the wage, shocks to the labor demand will result in shocks to the wage. To the extent that, say, aggregate demand or productivity shocks

increase product demand and raise labor demand and increase wages (or any other factor prices for that matter) at the same time, the elasticity estimates delivered from (13) would be biased due to a correlation between the error term and the right had side variable. Thus the wage and the disturbance term in our estimating equation may be correlated, thereby raising the possibility of a bias in our estimates. But in a well known contribution, Nickell and Symons (1990) have argued that the identification problem does not really exist anyway since labor supply and labor demand really depend upon two quite different real wages — one deflated by the producer price and one by the consumer price index. Thus using the appropriate real wage implies that simultaneity should not be a real problem.

- The Endogeniety of the wage to changes in labor demand, the identifying assumption here clearly is that labor supplies facing each firm are perfectly elastic, i.e., that shifts in the labor supply curve (resulting in changes in wages) trace out the labor demand schedule and shocks to the labor demand do not affect wages. As Hammermesh (1993) notes, the suitability of this identifying assumption rests on the degree of disaggregation of the data. Since the data we use are firm level, thus quite heavily disaggregated, we do not consider this to be a serious issue here. Since large number of sample of firms, it is improbable that any one buyer of factor inputs will have any market power in these factor markets. Thus, the plausibility of our identifying assumption is certainly greater than in most studies of this nature that use industry level data instead.
- Instrumental variable estimation is perhaps a more satisfactory approach. It proves a little less feasible in each industry context: the using of the lagged variable is problematic due to short length of the data. The number of observation prior to reform is cut by half and overall numbers of observation is down by fourth even when we only use single year lag. One option that presents itself then is the pooling of data across industries to use lagged variables as instruments.

Timing and lagged variables

The second issue that concern of timing and lagged variables responses. It is assumed that in our estimation of equation (13) that firm demand responses to changes in wage rates occurred without lags. As Krishna *et al*. (2001) & Hammermesh (1993) has noted much of the adjustment in firm labor demand takes place within 6 months to 1 year. Thus, given that our data are annual then it is not a serious problem.

Constancy of parameters across firms within industries

Third issue is that of constancy of parameters across and within an industry or alternately of our implicit assumption that firms within an industry have identical wage elasticities. The data indicate that the measured (averaged) wage is quit different across firms within the same industry. We believe that this reflects unobserved differences in (average) worker quality across firms or to a smaller extent due to differences in the number of hours on the job put in by workers in different firms. Given such differences, it would be reasonable to expect that labor demand itself could be somewhat different across firms

within an industry. Of course, to the extent that the differences are simply in levels and are fixed over time — our firm specific intercept should take care of the problem. However, one may expect the slopes to be different across firms within an industry as well. It is, nevertheless, infeasible to estimate firm specific elasticities and their changes for each firm when we only have four observations per firm. In order to address this issue, we experimented with a random coefficients (Hildreth–Houck) specification where the parameter estimates are firm specific but assumed to be drawn from a distribution that is common across firms within a given industry. The results remain the same qualitatively, i.e., the estimated changes in elasticities after the trade liberalization continue to be insignificantly different form zero in all cases.

Labor Demand Elasticities of Non-Production and Production Workers:

To make robustness and interest in the results of labor demand elasticities, we have estimate equation (13) by considering the demand for non-production workers. Elasticities of labor demand for all 11 industries are found under the fixed effect. All elasticities again quit tightly estimated. For non-production workers elasticities are also lie within the range -0.15 to -0.75, but the difference is that, elasticities of most industries are higher in magnitude as compare to production workers. These results are given in the following Table 3.

Table 3 Elasticities of Production and Non-production Workers: (Fixed Effect model)

	Industries	**Production Workers**			**Non-Production Workers**		
Codes		**Δw**	**$\Delta \delta w$**	**R^2**	**Δw**	**$\Delta \delta w$**	**R^2**
311	Food	-0.22	-0.47	0.57	-0.19	-1.36	0.43
		(0.16)	(0.970)		(0.36)	(1.11)	
320	Textile	-0.17	-0.16	0.72	-0.30	-0.58	0.78
		(0.22)	(1.638)		(0.22)	(0.76)	
323	Leather	-0.34	-0.09	0.12	0.67	0.15	0.22
		(0.41)	(3.096)		(0.78)	(0.89)	
351	Ind. Chem	-0.12	-0.12	0.73	-0.07	-0.85	0.65
		(0.16)	(1.797)		(0.25)	(0.79)	
352	Other IC	-0.06	0.03	0.63	-0.03	-0.02	0.82
		(0.06)	(0.474)		(0.04)	(0.12)	
369	Non-metal	0.64	0.86	0.62	-0.37	-1.79	0.2
		(0.33)	(2.355)		(0.42)	(1.39)	
371	Iron	-0.18	-0.16	0.77	-0.36	-1.35	0.55
	&Steel	(0.24)	(1.781)		(0.29)	(1.16)	
381	Fabricated	-0.02	-0.02	0.25	0.22	1.18	0.13
		(0.028)	(0.212)		(0.31)	(0.93)	
382	Non-elect	-0.35	-0.22	0.77	-0.39	-0.99	0.72
		(0.451)	(3.047)		(0.42)	(1.29)	
383	Electrical	-0.11	-0.04	0.27	0.11	-0.46	0.79
		(0.131)	(0.984)		(0.16)	(0.65)	
384	Transport	0.18	-1.05	0.22	-0.36	-0.39	0.25
		(0.186)	(1.302)		(0.56)	(0.34)	

Values in parenthesis are S.E

It is evident from results that our estimated elasticities change of non-production workers is much higher in magnitude as compare to production workers but still it is insignificant for all industries. This situation is consistent with Slaughter (2001) that labor demand elasticities does not increase for non-production but in contrast study finds support for the hypothesis in case of production workers.

Thus even considering disaggregated type of labor (production & Non-production) does not alter the inference that we arrived at earlier that labor demand elasticities seem to be unresponsive to openness of international trade.

Labor Demand Elasticities Overtime

The outcomes of our estimation of labor demand elasticities and their changes overtime in each of the 11 industries are presented in Table 4 under the fixed and random effects model.

Table 4 Over the Time Labor Demand Elasticity Estimates: (Fixed Effect Model)

Major Industries		**Under Fixed Effect**		
Codes		δw	$\Delta\delta w$	R^2
311	Food	0.302	-0.271	0.99
		(0.12)	(0.04)	
320	Textile	0.909	-0.816	0.98
		(0.34)	(0.12)	
323	Leather	1.695	-1.544	0.99
		(0.64)	(0.22)	
351	Indus. Chem	0.655	-0.586	0.99
		(0.24)	(0.08)	
352	Other IC	0.251	-0.234	0.97
		(0.09)	(0.03)	
369	Non-metallic	-0.766	0.697	0.99
		(0.29)	(0.09)	
371	Iron & Steel	0.987	-0.887	0.98
		(0.39)	(0.13)	
381	Fabricated	0.117	-0.106	0.99
		(0.04)	(0.02)	
382	Non-electrical	-1.88	1.699	0.99
		(0.75)	(0.24)	
383	Electrical	0.541	-0.491	0.98
		(0.22)	(0.07)	
384	Transport	0.0166	-0.004	0.97
		(0.02)	(0.01)**	

Values in parentheses are S.E

** Null hypothesis cannot rejected at 5% level of significance.

The purpose of this estimation, either the labor-demand elasticities becomes elastic over the time. In case of ten industries out of eleven industries the labor demand became more

elastic over the time only in industry (384), the hypothesis of no elasticity change cannot be rejected.

Results of Estimation Using Pooled Data across Industries

In previous section, we estimated elasticities for each industry at individual level. These results indicate that the labor demand elasticities are unable to respond trade liberalization. In this section we see, at aggregate level how the labor demand response to openness and to change in protection level. We regress this by using pooled data set across eleven industries. Pooling of the data allow us to use variations in cross industry changes in the protection level and in openness as proxies for the trade reforms dummies. These results are presented in Table 5.

As noted earlier, this was done with the intention of using instrumental variable techniques to control for any remaining simultaneity problem in the framework. We start estimate the equation (13) using pooled data (across industries) and using lagged right-hand side variables as instruments variable. The instrument variables estimates for the pooled sample give us an elasticity estimate that is not as precisely estimated and again we cannot reject the null hypothesis that the trade reforms did not have any effect on the labor demand elasticity.

Table 5 Regressions using pooled data over all industries

Regression A	**Regression B**	**Regression C**
Instrumental variables estimates with the reforms dummy interactions	With Openness measurement (Fixed effect Model)	With actual tariff rates (Fixed effect Model)
δ_w -0.242	δ_w -1.024	δ_w -0.77
(2.45)	(0.67)	(0.42)
$\Delta\delta_w$ -1.076	$\partial\delta_w/\partial(opennes)$	$\partial\delta_w/\partial(t)$ -0.002
(5.53)	0.618 (2.39)	(0.01)
R^2 0.288	R^2 0.662	R^2 0.994

Values in parenthesis are S.E

Regression B uses openness measurement interaction instead of import penetration. Import penetration ratio used in study of et al Krishna *et al.* (2001). The openness measurement is used in place of trade reform dummy. The coefficient of the cross product of openness and the log of wage (deflated by industry price) gives us $\partial\delta_w/\partial(opennes)$, the derivative of the labor demand elasticity with respect to openness [1]. The labor demand elasticity at zero openness δ_w is estimated to be -1.024 and is significant at 10% level of significance. The estimate $\partial\delta_w/\partial(opennes)$ is 0.61 and it is insignificant at 5%. It means that the higher openness is not associated with the higher magnitude of labor demand elasticities.

Regression C uses the actual tariff rates interaction. The tariff rates are used in place of trade reform dummy. The coefficient of the cross product of t and the log of wage (deflated by industry price) gives us $\partial\delta_w/\partial(t)$, the derivative of the labor demand

elasticity with respect to the tariff rate. The labor-demand elasticity at zero tariffs δ_w is estimated to be 0.769 and is significant at the 5% level. The estimate for $\partial\delta_w/\partial(t)$ is -0.0016 and is insignificant at 5% level. Surprisingly, the sign of this co-efficient show that higher tariffs are associated with higher magnitudes of labor demand elasticities.

7 Conclusion

The objective of this study the responsiveness of the labor-demand elasticities under trade liberalization by disaggregated for each eleven industries in the manufacturing sector of Pakistan and responsiveness over the time as well as analyze the behavior of the labor demand elasticities at aggregate level with the openness to international trade, tariff rate and lagged own price of labor.

Labor demand elasticities for each eleven industries are measure by using fixed effect and random effect model. Analyses suggest that the putative linkage between greater trade liberalization and labor demand elasticities (as suggested by theory) may be empirically weak. Under fixed effect model, labor demand elasticities of all eleven industries shows unresponsiveness to trade liberalization how ever under random effect model, in the vast majority we considered separately. We are unable to find significant relationship between these variables for both production and non-production workers. However, labor demand elasticities behave differently over the time. These became more elastic over the time. Hence trade liberalization has neither positive nor negative impact on labor demand in manufacturing sector of Pakistan.

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Appendix A

Table 1

Tariff Structure in Pakitan

	Tariff Rate (%)		
Year	**Minimum**	**Maximum**	**Average Rate**
1987-88	13.3	250.0	40.7
1988-89	16.1	155.2	36.0
1989-90	10.0	128.6	39.7
1990-91	12.6	151.2	39.0
1991-92	12.1	181.0	32.6
1992-93	17.7	270.1	35.3
1993-94	13.4	166.7	34.7
1994-95	0.3	128.6	21.6
1995-96	0.5	110.3	25.5
1997-98	3.3	84.9	18.3
1999-00	0.0	40.0	12.3
2000-01	0.1	111.1	10.5
2001-02	1.8	44.1	9.1
2002-03	0.1	33.0	9.3
2003-04	0.0	32.2	9.4

Source: CBR Year Book, 1995-96& various year.