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Sectoral and regional impacts of trade liberalization on the skilled-unskilled wage-gap in Pakistan

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Abstract: This study explores the impacts of trade liberalization on the skilled-unskilled wage gap (henceforth SUSWG) by using the micro-level data of Pakistan. It is generally believed that when economies are liberalized, the SUSWG increases, especially in poor economies. Our study uses a two-step estimation methodology. We used two measures for SUSWG at sectoral and regional levels. We employed Oaxaca-Blinder decomposition for residual wage-gap, and log-wage-gap. For empirical (i.e., sectoral and regional) analysis, we employed Fixed effects (FE), Random effects (RE) and FE with Driscoll-Kraay Standard Errors (DKSEs), feasible generalized-least-squares (FGLS), and Panel-corrected Standard Errors (PCSE). We used sectoral panel data for sectoral analysis and provincial panel data for regional analysis, using the data from 1990 to 2005. Our study finds that protection rates and SUSWG are associated in Pakistan. Trade liberalization increases the SUSWG. The sectoral and regional analysis reveal similar findings on the impact of liberalization on SUSWG. Moreover, our results are robust and insensitive to various controls, measurement approaches (i.e., the log wage gap and the residual wage gap), and econometric techniques. We also find that lagged tariffs increase the SUSWG. Our findings will provide guidelines for policymakers to make future policies regarding trade liberalization and SUSWG in Pakistan.

Keywords: *Pakistan, Skilled-unskilled wage gap, Trade liberalization.*

1. Introduction

During the 1980s and 1990s, many developing nations reduced tariff and non-tariff barriers, exposing their economies to external competition. As these economies opened up to international trade, they experienced rapid economic growth [1, 2]. However, the trade liberalization had varied effects on wages due to contrasting skill levels (i.e., skilled and unskilled), and this in turn affected wage inequality too [1, 3, 4].

The impact of trade liberalization (TL) on SUSWG has garnered significant interest [5-8]. The SUSWG has been observed to have improved in a number of countries (particularly those in Latin America) since the liberalization of their economies in the 1980s. A large number of empirical studies have shown that openness to trade has contributed to an increase in the wage gap [9-11]. According to existing exploration in labor economics, trade liberalization is found to be a major influencing factor for the labor class. Trade liberalization differently affects the labor force because access to resources as well as activities depends on labor's skill level (i.e., skilled and unskilled) [12].

Trade openness also alters the pattern of income distribution as a result of the varied skills exhibited by labor. Furthermore, it influences the relative prices of goods, which in turn affects incentives and promotes the reallocation of factors of production between the different sectors. As a result, this causes a shift in labor earnings and employment, which eventually affects the SUSWG [13]. It is generally

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anticipated that trade liberalization could contribute to a widening gap between the low-income and high-income sectors of an economy, thereby increasing the SUSWG [14, 15].

Another possible explanation related to this phenomenon is that openness to trade has introduced higher- and advanced-level technology, which requires the use of more skilled workers. The tariffs that the buyer of goods must pay determine the cost of imported goods (capital). Therefore, liberalization of trade may lead to a decrease in import tariffs, which reduces the cost of capital goods and leads to more use of capital goods. As a result, a high level of complementarity exists between the capital and skilled workers, as well as a high level of substitutability between the capital and unskilled labor. Thus, if both categories of labor supply are constant, skilled labor demand would increase and unskilled labor demand would decrease, which would widen the SUSWG [14, 16, 17]. All of these may transform into larger unemployment for the unskilled worker, worsen the income distribution, and eventually worsen poverty [18].

A prominent examination of the impacts of openness to trade is presented by Krueger [19], who argues that openness will commonly compress the SUSWG in developing economies. This reasoning builds on the Hecksher-Ohlin Stolper-Samuelson theorems as the theoretical association between trade liberalization and the wage gap based on Hecksher-Ohlin's (H-O) theory. The model assumes that the factor of production is unskilled and skilled labor in two countries, i.e., developed and under developed, and both are producing skilled and unskilled labor-intensive p products. The extended Stolper-Samuelson (SS) theorem states that trade liberalization will benefit the relatively abundant economy of the country. In developing nations, the relatively abundant factor is unskilled labor. So, the developing nations have a comparative advantage in the production of abundant factors, i.e., unskilled labor. Therefore, trade liberalization will enhance unskilled labor demand and, thereby, its wage [20]. Consequently, this practice narrows the SUSWG as well as income inequality [21].

Our study contributes to existing the literature on Pakistan in the following ways: This study employs the reduction in import tariffs as a proxy for trade liberalization, which is regarded as a more reliable indicator than the previous ones used in existing studies[1] on Pakistan. Khalid [25] and Ullah et al., [26] utilized trade ratios for trade openness to examine the impact of trade openness on the wage gap in Pakistan. Second, to the best of our understanding, our study is the first to employ sectoral and provincial datasets in order to elucidate the effects of trade liberalization on SUSWG within the Pakistani context. Thirdly, for the estimation, we utilized the entire liberalization regime (1990-2005). We employed sectoral panel data for sectoral analysis (i.e., manufacturing sector) and provincial panel data for regional analysis using the data from 1990 to 2005 in Pakistan. Fourthly, in our study, we estimated SUSWG using two methods (i.e., the log wage gap and residual wage gap), neither of which has been implemented yet. We employed Oaxaca-Blinder decomposition for residual wage-gap, and log-wage-gap.

The following portions of the paper are organized in the following manner: section 2 provides the theoretical foundation, while section 3 elaborates on the dataset and methods. The empirical findings are expounded upon in Section 4, while the study is ultimately concluded in Section 5.

2. Theoretical Framework

The standard Heckscher-Ohlin (H-O) theory posits that a country exports goods in which its economy makes intensive use of its abundant factor, while importing goods in which its scarce factor is

[1] In previous studies of Pakistan, Salman and Javed [22] and Yasmin [23] studied the effect of trade liberalization on wage inequality among professional and unskilled people using two labor force surveys (LFS-1996 & LFS-2005) and (LFS 1990-1991 & 2005-2006), and these studies used import penetration ratio, export penetration ratio and comparative price for trade liberalization measures respectively. The following are the drawbacks of previous studies that used different proxies rather than import tariffs. The first drawback of Salman and Javed [22] is that they only used seven industries for the study and used that kind of data which is easily available in government publications. To calculate industry-level trade-related variables, they did not use product-level data. The second shortcoming is that they used exports and imports related measures of liberalization, it is demonstrated that there is the problem of over-invoicing and under-invoicing in exports and imports data of Pakistan specifically. Thirdly, they utilized only two data sets from the labor force survey. According to Goldberg and Pavcnik [24] (imports, export, product prices when data on prices are available, growth of exports and imports, price indices of imports and exports) these measures are extremely arguable because generally these measures used in the empirical literature while using these measures as independent variables in regression models causes simultaneity biases.

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utilized intensively [31, 32]. Although, in two nations, there are two factors (i.e., unskilled and skilled labor), and two product models, trade barriers among nations drive wedges between the two goods prices. The unskilled labor-intensive exportable prices may be low in developing nations and vice versa for developed nations. The change from autarky to free trade can increase unskilled labor-intensive exportable production in the developing nations (poor economies), which in turn increases the unskilled labor demand and decreases the skilled labor demand. Regarding the Stolper-Samuelson (SS) theorem, the wages of unskilled labor will increase in response to trade liberalization [32].

The influence of introducing the non-traded products in the model will depend on the consumption pattern substitution between the non-traded and traded products. If a poor nation produces a non-traded product that intensively utilises unskilled labor, and demand for this product is a close substitute for the highly skill-intensive of the two traded products, thus opening up will decrease the price and enhance the skill-intensive tradable sales. Consequently, reducing the unskilled-labor demand in the production of the non-tradable could be greater than the unskilled labor-intensive demand increase in the tradable sector that is labor-intensive. Thus, it is theoretically possible that there would be a decrease in the wage of unskilled labor.

The production of a land-intensive tradable could potentially offer a comparative advantage to a poor country where land is an abundant factor. The liberalization of the economy would accelerate the production of tradable goods that require considerable land investment. If land for production serves as a complement to skilled labor in a developing nation, this would increase the demand for skilled labor, resulting in an unanticipated increase in relative wages.

In addition, if we included the capital factor in the model, it would be highly sensitive to suppose that it is complementary to the skilled labor. Supposing the developing nation does not have a comparative advantage in the production of skill-intensive goods, this might not affect the wage gap prediction as expected in the above original model. So, we anticipate that the wages of unskilled workers will increase as a result of greater openness.

There is a large amount of evidence that in less-developed economies, exporting sectors are usually less skill-intensive as compared to import-competing sectors [32]. Regarding the above-mentioned and Stolper-Samuelson theorem, the wages of the unskilled should enhance relative to the wages of skilled when opening up the economy. The Stolper-Samuelson theorem's impact is not only possible in one way that can affect wage inequality. Another channel that can also be possible through which openness to trade affects the wage gap is through the variation of the industry wage premiums.

To sum up, as the tariffs were reduced in Pakistan, our study expects the wage gap to be reduced either by Stolper-Samuelson or if lesser tariffs decrease rents in the previously existing protected sector. However, there could be a contrary impact if tariff reductions induced productivity improvements in the previously existing protected sector. As expected, lower tariffs reduced the SUSWG. Finally, the prevailing theoretical theory about openness to trade and SUSWG is ambiguous. Now this calls for empirical analysis to clear up this ambiguity.

3. Data and Methodology

3.1. Pakistan's Trade Policy

Pakistan's trade policy underwent significant development from 1988 to 2005. Significant modifications were implemented in 1988 as part of the Structural Adjustment Program, which was implemented during the administration of Zia Ul Haq. Varying degrees of protection were observed across different sectors. Imports of goods associated with the three most heavily regulated sectors—furniture, wood products, and textiles, handicrafts, and furniture were subject to average tariffs of 94%, 106%, and 96%, respectively. The facilitation of manufacturing sectors has indicated that Pakistan, similar to Brazil and Columbia, encountered similar challenges as a result of its stringent protection of industries that employed relatively unskilled labor [33]. Figure 1 presents a summary of descriptive statistics pertaining to import tariffs over the sample period of 1990-2005. It illustrates the temporal progression

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of the average rate of protection. It indicates that the average rate of protection in manufacturing sectors decreased from 62% in 1990 to 13% in 2005 and from 63.22% in all sectors to 13.76% in 2005.

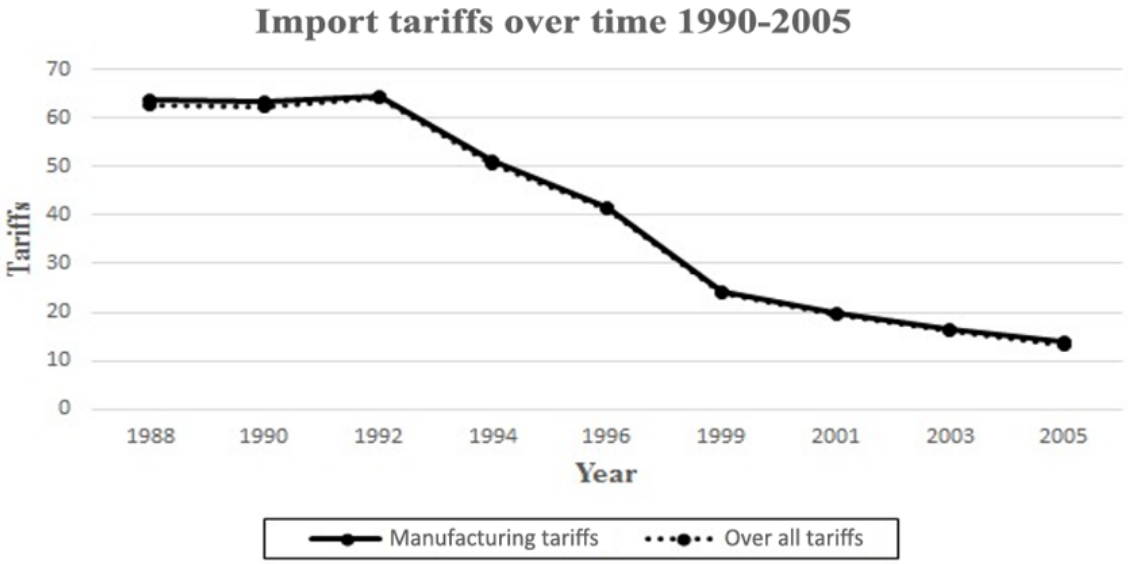

Figure 1.
Borrowed from the study.
Source: Wu, et al. [4].

3.2. Data

To explore the impact of trade liberalization on the SUSWG, our study used two-digit micro-level datasets from 1990 to 2005 (i.e., the trade regime of Pakistan). The data sources of the study are the Labor Force Survey (LFS)[2], the Census of Manufacturing Industries (CMI), Pakistan Custom Tariffs (PCT), and data on tariffs (i.e., sectoral and regional) from the studies by Wu, et al. [4], Ul-Haq, et al. [2], Ul-Haq, et al. [34], and Ul-Haq [35]. The basic features of the dataset are characterized by descriptive statistics. It gives a comprehensive summary of the data. Table 1A and 1B illustrate the descriptive statistics of the variables that are utilized at the manufacturing sector and provincial level, respectively.

Table 1A.
Sectoral descriptive statistics.

Variables	N	Mean	S.D	Min.	Max.
SUSWG1	72	1.083	0.046	1.012	1.246
SUSWG2	72	0.368	0.197	0.002	0.848
Tariffs	72	39.966	22.889	10.18	95.67
LGDP	72	17.671	1.646	14.118	20.613
LGFCF	72	16.641	1.735	12.729	19.943
LX	63	3.27e+07	6.75e+07	34100.1	3.40e+08
LM	63	3.12e+07	3.37e+07	1400000	1.50e+08
IP	72	0.498	0.396	0.038	1.793
XCR	72	0.367	0.402	0.0006	1.611

Note: SUSWG1 for the log wage gap and SUSWG2 for the residual wage gap. S.D stands for standard-deviation

[2] The LFS are used for the years 1990, 1991, 1992, 1993, 1994, 1996, 1997, 1999, 2001, 2003, and 2005, which is conducted by the FBS.

Table 1B.
Provincial descriptive statistics.

Variables	N	Mean	S.D	Min.	Max.
SUSWG1	44	1.095	0.055	1.044	1.299
SUSWG2	44	0.420	0.187	0.223	1.039
PLIB	44	19.193	9.893	4.914	35.044
GDE	44	0.531	0.069	0.434	0.659
SFLF	44	0.085	0.052	0.014	0.223
FLFP/MLFP	44	0.096	0.066	0.014	0.288
Urban	44	0.414	0.042	0.341	0.465

Note: SUSWG1 for the log wage gap and SUSWG2 for the residual wage gap. SFLF for the share of female in the labor force and FLFP/MLFP for the female labor force participation to male labor force participation.

3.3. Methodology

Our study used a two-step estimation methodology, and SUSWG used two approaches. Menon and Van [36] used the residual wage gap and the log wage gap for the wage gap. For the log wage gap, we used the ratio of skilled log wages to unskilled log wages.

Furthermore, the residual wage gap is used regarding Oaxaca-Blinder decomposition. The extent to which the overall wage gap is illustrated by observable characteristics within two groups (i.e., gender, formal-informal, skilled-unskilled) is indicated by the Oaxaca-Blinder decomposition [37, 38]. This process is divided into two parts: the first is explained by product characteristics, and the second is an unexplained part of the residual wage gap, which is usually recognized as a discrimination part in skilled and unskilled groups. The wage gap between the skilled and unskilled groups can be decomposed through a natural log of the real wage (w) for the skilled workers (i=S) and unskilled workers (i=U) as follows:

$$w_i = X_i\beta_i + \varepsilon_i \quad (1)$$

The workers' characteristic set is represented by x, either in the skilled or unskilled group that influences the wage. X utilized the set of dummy variables for age, education, and experienced, and the error term is the ε supposed to be normally distributed with varianceσ^2. Thus we illustrate the SUSWG as:

$$w_S - w_U = (X_S\beta_S - X_U\beta_U) + (\varepsilon_S - \varepsilon_U) \quad (2)$$

If the regression is evaluated on the mean of the log wage then the end term becomes zero. After mathematical operations of subtracting and adding on X_U and β_S we extract (derive) workers' attributes "in terms of skilled workers prices" which gives:

$$w_S - w_U = (x_S - x_U)\beta_S + X_U(\beta_S - \beta_U) + (\varepsilon_S - \varepsilon_U) \quad (3)$$

The total log wage gap in skilled and unskilled groups is revealed by the left-hand side of Equation 3, and on the right-hand side, the first term indicates the explained wage gap portion, and the next term indicates the residual gap in the skilled and unskilled group (the difference in productive characteristics of skilled groups' workers based on market returns). The final term is usually ignored due to decomposition conducted on means, otherwise known as the residual wage gap, the sum of the last two terms [28, 36, 39]. For the wage gap discrimination part in the skilled-unskilled group, we used the proxy of the residual wage gap.

To empirically investigate the association between SUSWG and trade liberalization, we employed both fixed effect (FE) and random effect (RE) models. The Modified Wald and Wooldridge tests are utilized to assess the presence of serial correlation and heteroscedasticity prior to conducting empirical analysis. In addition, the issue of cross-sectional dependence is examined using Pesaran's Cross-Sectional Dependence (CD) test. The results revealed the existence of heteroscedasticity, serial correlation, and cross-sectional dependence. In order to address these issues, the Driscoll-Kraay Standard Errors (DKSEs) [40, 41], as suggested by Hoechle [42], is the preferred model for the manufacturing sector (N=9 and T=8; N is greater than T), whereas the FGLS is the preferred model for the provincial study (N=4 and

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T=11; T is greater than N), as suggested by the Parks-Kmenta method [35, 43-45]. In addition, for robustness checks, the Panel Corrected Standard Errors (PCSEs) and DKSEs are utilized.

3.4. Model

To begin with, the empirical analysis of the central question of this study is based on the evaluation of Equation 4 for the sectoral model and Equation 5 for the provincial model. The variables SUSWG as a regress and trade liberalization as a repressor are in our core model. Following Attanasio, et al. [16] Kumar and Mishra [46], our study measures the variable of skilled-unskilled based on education; people below or equal to middle education are considered unskilled, and those above are considered skilled, and we used the age bracket of 15-64 years. Moreover, the study of Attanasio, et al. [16] used people below or equal to primary education as being considered unskilled and those above primary education as being considered skilled. Kumar and Mishra [46] used people below intermediate considered unskilled and those with equal or above intermediate education considered skilled. To empirically evaluate the impact of trade liberalization on the SUSWG, we used the following empirical models:

$$SUSWG_{jt} = \beta_0 + \beta_1 Tariffs_{jt} + \beta_2 X_{jt} + \varepsilon_{jt} \quad (4)$$

$$SUSWG_{pt} = \beta_0 + \beta_1 PLIB_{pt} + \beta_2 X_{pt} + \varepsilon_{pt} \quad (5)$$

Whereas SUSWG indicates the skilled-unskilled wage gap, which j is for the sector, p is for the province, and t is for time. The coefficient of trade liberalization β_1 captures the change in the SUSWG. The key variable of our study is trade liberalization (i.e., tariffs a sectoral indicator) and PLIB (a provincial indicator)). The vector X_{pt} shows the set of control variables for sectoral level such as import penetration (IP), log of gross domestic product (LGDP), log of gross fixed capital formation (LGFCF), export consumption ratio (XCR), lagged exports*nominal effective exchange rate (LXNEER), and lagged imports*nominal effective exchange rate (LMNEER), and for province-level such as urbanization (urban), gender disparity in education (GDE), and female labor force participation (FLFP). For the FLFP, we used two proxies as a share of females in the labor force (SFLF) and female LFP to male LFP (FLFP/MLFP). ε_{pt} is the error term.

3.4.1. Provincial Liberalization Index

In light of our regional perspective, we use Topalova [47] methodology to create an indicator that measures the impact of trade policy in Pakistan. The PLIB indicator is calculated as a weighted average of tariffs at the industry level on a national scale. The weights assigned to the tariffs reflect the initial employment share of each industry within a specific state, with 1990 serving as the initial year in our study. It is computed as follows:

$$PLIB_{pt} = \frac{\sum_k \left(L_{pk1990} \times Tariff_{kt} \right)}{L_{p1990}}$$

Where p denotes the unit of analysis (Pakistan provinces), k is the sector, and t is time. $Tariff_{kt}$ refers to the tariff in sector k for year t, $L_{pk}1990$ is the workers employed in sector k in 1990 in province p, and L_{p1990} is the total number of workers in a unit of analysis p for the year 1990.

4. Results and Discussion

4.1. Sectoral Analysis

The results of trade liberalization and SUSWG are examined using the log wage gap and residual wage gap methodologies. We regress a panel regression model utilizing the RE, FE, and DKSEs methods to explore the trade liberalization impact on the SUSWG. The coefficient and their standard errors regarding the association between trade liberalization and SUSWG in the manufacturing sector are given in Table 2.

Table 2 shows the relationship between SUSWG and trade liberalization in the manufacturing sector of Pakistan. In columns (1, 4) of Fixed Effect, the core variable of nominal tariffs shows a negative and statistically significant link with the SUSWG. Column (2,5) also reveals the inverse relation between

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trade liberalization and SUSWG and is statistically significant in the Random Effect. Moreover, in columns (3,6) we used our desired DKSEs method. Column (3, 6) also reveals the negative sign for the SUSWG as well as statistical significance. The reduction of tariffs enhanced the SUSWG. The 1 percent reduction in tariffs led towards the 0.08, 0.31; 0.079, 0.33; 0.079, 0.33 percentage point (i.e., 0.0008, 0.0031 (FE); 0.0007, 0.0033 (RE); 0.0007, 0.0033 (DKSEs)) increase in SUSWG. However, our findings are the same when applying the FE, RE, and DKSEs methods. To robustness check our major findings, we include numerous trade-related control variables in the study's main model, such as the IP, XCR, LGDP, LGFCF, LXNEER, and LMNEER. In order to check robustness, our study used the DKSEs method in all models in Table 3.

In Table 3, the key variable of nominal tariffs shows that the relation between the tariffs and SUSWG is negative and significant in columns (1,4). Further, we add the control variables of import penetration and export consumption ratio in columns (2, 5), which also show that the protection rate is negatively associated with SUSWG as well as statistically significant. Using the import penetration and export consumption ratio, the gross domestic product log, the gross fixed capital formation log, the lagged exports*nominal effective exchange rate, and the lagged imports*nominal effective exchange rate in columns (3,6), (4,8), and showing that SUSWG went up because the manufacturing industry's protection rate went down is also shown. However, all robustness models in Table 3 using both approaches give a robust result and do not alter the sign of our major findings as well as their statistical significance.

Table 2.
Trade liberalization and SUSWG.

Variable	Log wage gap			Residual wage gap		
	FE	**RE**	**DKSE**	**FE**	**RE**	**DKSE**
Nominal tariffs	-0.0008*** (0.0001)	-0.0007*** (0.0001)	-0.0007* (0.0004)	-0.003*** (0.0006)	-0.003*** (0.0005)	-0.003** (0.001)
Constant	1.116*** (0.006)	1.115*** (0.009)	1.115*** (0.0268)	0.496*** (0.0278)	0.503*** (0.0322)	0.503*** (0.0634)
F/Wald-statistics	21.70	32.57	3.60	20.98	32.36	9.76
P-value	0.001	0.000	0.090	0.001	0.000	0.014

Note: SUSWG is the dependent variable in Fixed Effect (FE), Random Effect (RE), and Driscoll-Kraay standard errors (DKSEs) models. N is 72 in all models. Columns 1-3 for the log wage gap and columns 4-6 for the residual wage gap. In parenthesis, presents the standard errors. Asterisks denote significance level (i.e. '***' for 1%, '**' for 5%, and '*' for 10%).

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Table 3.
Trade liberalization and SUSWG (Robustness checks).

Log wage gap					**Residual wage gap**			
Variables	**DKSE**	**DKSE**	**DKSE**	**DKSE**	**DKSE**	**DKSE**	**DKSE**	**DKSE**
Nominal Tariffs	-0.0007*	-0.0008*	-0.0008*	-0.0009*	-0.003**	-0.003**	-0.003***	-0.003**
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.0009)	(0.001)
IP		-0.0112	-0.017*			0.013	0.024	
		(0.007)	(0.009)			(0.053)	(0.074)	
XCR		-0.0131*	-0.012*			-0.044	-0.0583	
		(0.006)	(0.006)			(0.036)	(0.0382)	
LGDP			0.002	0.004			0.035**	0.025
			(0.004)	(0.004)			(0.014)	(0.033)
LGFCF			-0.003	-0.001			-0.030	-0.019
			(0.005)	(0.006)			(0.017)	(0.020)
LXNEER				-0				-0*
				(0)				(0)
LMNEER				-0				0
				(0)				(0)
Constant	1.115***	1.126***	1.158***	1.056***	0.503***	0.513***	0.403*	0.381
	(0.026)	(0.029)	(0.065)	(0.031)	(0.063)	(0.075)	(0.204)	(0.295)
F/Wald-statistics	3.60	3.34	26.61	5.64	9.76	3.59	63.99	8.42
P-value	0.091	0.077	0.000	0.016	0.014	0.066	0.000	0.005

Note: SUSWG is dependent in all models. N is 72 in all models except 4 & 8 in which N is 63. Columns 1-4 for log wage gap & columns 5-8 for the residual wage gap. Standard errors in parenthesis.' '***' for 1%, '**' for 5%, '*' for 10%.

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4.1.1. Lagged Analysis

Here, we explore the modification of the SUSWG as a result of tariff reductions that might take time to appear by inspecting the relationship between the lagged tariffs and the SUSWG at the sectoral level by taking both approaches (i.e., the log wage gap and residual wage gap). In both approaches, lagged tariffs are the independent for all models in Table 4.

Table 4.
Lagged trade policy and SUSWG.

Variable	Log wage gap			Residual wage gap		
	FE	RE	DKSE	FE	RE	DKSE
Lagged tariffs	-0.001*** (0.0001)	-0.0009*** (0.0001)	-0.0009* (0.0004)	-0.003*** (0.0009)	-0.003*** (0.0009)	-0.003** (0.001)
Constant	1.129*** (0.005)	1.128*** (0.008)	1.127*** (0.028)	0.513*** (0.042)	0.519*** (0.030)	0.519*** (0.077)
F/Wald-statistics	70.78	74.94	4.59	9.35	11.11	6.44
P-value	0.000	0.000	0.064	0.016	0.000	0.035

Note: SUSWG is dependent variable in FE, RE, & DKSEs models. N is 63 in all models. In parenthesis, presents the standard errors. '***' for 1%, '**' for 5%, and '*' for 10%.

Table 4 reveals the impact of lagged tariffs on the SUSWG in the manufacturing sector. The results are shown in Table 4, which is evaluated similarly to what we evaluated in Table 2, except for the nominal tariffs. There is also an indirect correlation between the lagged trade policy and the wage gap, as shown in Table 4. Such as column (1,4) of FE shows the negative influence of lagged tariffs on the wage gap, which means that lagged trade policy contributes to the increase in SUSWG at the sectoral level of Pakistan. Moreover, columns (2,5) of RE and columns (3,6) of DKSEs reveal that the coefficient is negative and significant on the lagged tariffs. The impact of lagged tariffs is the same on SUSWG. In other words, we can say that the lagged trade policy affected the wage gap in the same way as the nominal tariffs affected SUSWG. To ensure the robustness of our major findings of lagged tariffs and the SUSWG, we incorporate various control variables like IP, XCR, LGDP, LGFCF, LX*NEER, and LX*NEER.

In Table 5, after incorporating these controls, we find that the results are robust and significant for various controls. The addition of these variables does not change the major findings of lagged tariffs and the wage gap in the manufacturing sector. To sum up, in all cases, our findings are negatively associated with trade liberalization and the wage gap is statistically significant.

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Table 5.
Lagged trade policy and SUSWG (Robustness checks).

Methodology	Log wage gap				Residual wage gap			
Variables	**DKSE**	**DKSE**	**DKSE**	**DKSE**	**DKSE**	**DKSE**	**DKSE**	**DKSE**
Lagged tariffs	-0.0009*	-0.0009*	-0.001**	-0.0009*	-0.003**	-0.003**	-0.003**	-0.003*
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
IP		-0.011	-0.035***			0.015	0.010	
		(0.008)	(0.008)			(0.057)	(0.076	
XCR		-0.008	-0.001			-0.039	-0.048	
		(0.007)	(0.005)			(0.040)	(0.037)	
LGDP			-0.001	0.004			0.033	0.025
			(0.005)	(0.005)			(0.019)	(0.035)
LGFCF			-0.005	-0.001			-0.033	-0.021
			(0.006)	(0.006)			(0.022)	(0.021)
LXNEER				-0				-0
				(0)				(0)
LMNEER				-0				0
				(0)				(0)
Constant	1.127***	1.136***	1.275***	1.090***	0.519***	0.525***	0.505**	0.421
	(0.028)	(0.030)	(0.069)	(0.037)	(0.077)	(0.086)	(0.175)	(0.296)
F/Wald-statistics	4.59	2.29	81.65	3.65	6.44	2.30	113.45	8.13
P-value	0.064	0.090	0.000	0.051	0.035	0.091	0.000	0.005

Note: SUSWG is the dependent variable in FE, RE, & DKSEs models. N is 63 in all models. In parenthesis, presents the standard errors. '***' for 1%, '**' for 5%, and '*' for 10%.

Table 6.
Trade Liberalization and SUSWG.

Methodology	Log wage gap				Residual wage gap			
Variables	**FE**	**RE**	**FGLS**	**PCSE**	**FE**	**RE**	**FGLS**	**PCSE**
PLIB	-0.001*	-0.001*	-0.002***	-0.001*	-0.007***	-0.007***	-0.006***	-0.007***
	(0.0006)	(0.0006)	(0.0004)	(0.0007)	(0.002)	(0.002)	(0.001)	(0.001)
Constant	1.127***	1.123***	1.135***	1.123***	0.568***	0.568***	0.535***	0.576***
	(0.018)	(0.018)	(0.0126)	(0.017)	(0.049)	(0.081)	(0.023)	(0.033)
F/Wald-statistics	3.76	3.07	21.98	3.18	11.40	11.66	36.55	17.69
P-value	0.059	0.079	0.000	0.075	0.002	0.000	0.000	0.000

Note: SUSWG is the dependent variable in FE, RE, FGLS, & PCSE models. N is 44 in all models. In parenthesis, presents the standard errors. Asterisks denote significance level (i.e.,'***' for 1%, and '*' for 10%).

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4.2. Regional Analysis

Our study investigates the impact of trade liberalization on the SUSWG, focusing specifically on the provinces of Pakistan. Table 6 presents the findings relating to the provinces of Pakistan. On the basis of the other controls and the key variable of provincial trade liberalization (PLIB), the coefficient and its standard errors are interpreted.

In Table 6, we used the FE, RE, desired FGLS, and PCSE methods to study the link between SUSWG and trade liberalization. The key explanatory variable of the provincial study is provincial trade liberalization (PLIB). The coefficient of provincial tariffs indicates that trade liberalization enhances the SUSWG across provinces in Pakistan. The influence of tariffs on the SUSWG is negative and significant in all models, utilizing all approaches in the above table. The protection rate and SUSWG are inversely associated in Pakistan. The protection rate enhanced the SUSWG. Moreover, we check the robustness of empirical results to ensure that our findings are robust or not. For robustness checks, we include various control variables in our main model. The estimates of our robustness check are presented in Table 7. The variables of urbanization (urban), the share of females in the labor force (SFLF), female labor force participation to male labor force participation (FLFP/MLFP), and gender disparity in education are used in Table 7.

Table 7 shows that across provinces (column 1) of Pakistan, the negative impact of trade liberalization on the SUSWG is statistically significant regarding the use of the liberalization measure, which is PLIB. The results show that after involving the control variables, our results are the same. The inclusion of these controls does not alter the coefficient of PLIB; it remains negative and statistically significant by using both FGLS and PCSEs methods in the log wage gap and the residual wage gap.

4.2.1. Lagged Analysis

We regress the lagged trade policy of SUSWG in Pakistan. We investigated the decline in tariffs that might take time to appear by examining the association between the lagged tariffs and SUSWG. The results are given in Table 8, which is evaluated similarly to Table 6, but except for PLIB.

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Table 7.
Trade liberalization and SUSWG (Robustness checks).

Methodology	**Log wage gap**					
Variables	**FGLS**	**FGLS**	**FGLS**	**FGLS**	**PCSE**	**PCSE**
PLIB	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Urban		-0.289	-0.141	-0.155	-0.167	-0.175
		(0.177)	(0.175)	(0.175)	(0.181)	(0.181)
SFLF			0.414**		0.376**	
			(0.174)		(0.180)	
GDE			-0.0001	-0.014	0.021	0.009
			(0.143)	(0.146)	(0.149)	(0.152)
FLFP/MLFP				0.336**		0.308**
				(0.141)		(0.146)
Constant	1.117***	1.241***	1.144***	1.160***	1.149***	1.160***
	(0.016)	(0.078)	(0.109)	(0.110)	(0.113)	(0.114)
F/Wald-statistics	2.98	5.76	16.59	16.67	15.41	15.61
P-value	0.085	0.056	0.002	0.002	0.004	0.004
Residual wage gap						
PLIB	-0.006***	-0.004***	-0.004***	-0.004***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Urban		0.951***	0.983***	0.992***	1.348*	1.350*
		(0.246)	(0.242)	(0.249)	(0.760)	(0.776)
SFLF			-0.592***		-1.304*	
			(0.160)		(0.681)	
GDE			0.290*	0.290*	0.122	0.106
			(0.164)	(0.166)	(0.527)	(0.537)
FLFP/MLFP				-0.464***		-0.965*
				(0.128)		(0.516)
Constant	0.535***	0.123	-4.26e-06	-0.008	0.059	0.049
	(0.023)	(0.099)	(0.138)	(0.143)	(0.512)	(0.530)
F/Wald-statistics	36.55	30.37	35.17	33.94	26.59	27.31
P-value	0.000	0.000	0.000	0.000	0.000	0.000

Note: SUSWG is dependent variable in FGLS, & PCSE models. N is 44 in all models. In parenthesis, presents the standard errors. Asterisks denote significance level (i.e.,'***' for 1%, '**' for 5%, and '*' for 10%).

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Table 8.
Lagged trade policy and SUSWG.

Methodology	Log wage gap				Residual wage gap			
Variables	**FE**	**RE**	**FGLS**	**PCSE**	**FE**	**RE**	**FGLS**	**PCSE**
Lagged tariffs	-0.001*	-0.001*	-0.001***	-0.001*	-0.008***	-0.008***	-0.005***	-0.008***
	(0.0007)	(0.0008)	(0.0004)	(0.0008)	(0.002)	(0.002)	(0.001)	(0.002)
Constant	1.135***	1.131***	1.131***	1.131***	0.593***	0.592***	0.538***	0.601***
	(0.022)	(0.021)	(0.012)	(0.021)	(0.0591	(0.092)	(0.033)	(0.043)
F/Wald-statistics	3.65	2.93	17.88	3.04	9.57	9.82	16.01	13.68
P-value	0.064	0.087	0.000	0.081	0.004	0.002	0.000	0.000

Note: SUSWG is the dependent variable in FE, RE, FGLS, & PCSE models. N is 40 in all models. In parenthesis, presents the standard errors. Asterisks denote significance level (i.e.,'***' for 1%, and '*' for 10%).

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The coefficient is negative and significant for lagged tariffs. The lagged tariffs effect is the same on SUSWG, as shown in Table 6 on the impact of tariffs on SUSWG. The coefficient on the lagged tariffs is robust after the inclusion of other control variables and suggests a negative relationship between lagged tariffs and SUSWG. The sign with the lagged tariff coefficient is the same as we evaluated in Table 8. To end, we evaluate a significant relationship between trade liberalization and SUSWG in the case of Pakistan, which is that import tariff reduction is negatively related to SUSWG. Overall results are robust after adding the controls, as shown in Table 9.

Table 9.
Lagged trade policy and SUSWG (Robustness checks).

Methodology	**Log wage gap**					
Variables	**FGLS**	**FGLS**	**FGLS**	**FGLS**	**PCSE**	**PCSE**
Lagged tariffs	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Urban		-0.289	-0.141	-0.155	-0.167	-0.175
		(0.177)	(0.175)	(0.175)	(0.181)	(0.181)
SFLF			0.414**		0.376**	
			(0.174)		(0.180)	
GDE			-0.0001	-0.014	0.021	0.009
			(0.143)	(0.146)	(0.149)	(0.152)
FLFP/MLFP				0.336**		0.308**
				(0.141)		(0.146)
Constant	1.117***	1.241***	1.144***	1.160***	1.149***	1.160***
	(0.016)	(0.078)	(0.109)	(0.110)	(0.113)	(0.114)
F/Wald-statistics	2.71	5.06	14.18	14.30	13.83	14.01
P-value	0.091	0.079	0.006	0.006	0.008	0.007
Residual wage gap						
Lagged Tariffs	-0.005***	-0.004***	-0.004***	-0.004***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Urban		1.010***	0.950***	0.962***	1.428*	1.427*
		(0.244)	(0.271)	(0.277)	(0.743)	(0.762)
SFLF			-0.539***		-1.461**	
			(0.201)		(0.717)	
GDE			0.322*	0.317*	0.232	0.210
			(0.173)	(0.176)	(0.540)	(0.551)
FLFP/MLFP				-0.425***		-1.074**
				(0.158)		(0.543)
Constant	0.538***	0.092	-0.009	-0.016	0.002	-0.005
	(0.033)	(0.099)	(0.158)	(0.163)	(0.507)	(0.527)
F/Wald-statistics	16.01	21.64	21.17	20.71	21.93	22.50
P-value	0.000	0.000	0.000	0.000	0.000	0.000

Note: SUSWG is dependent variable in FGLS, & PCSE models. N is 44 in all models. In parenthesis, presents the standard errors. Asterisks denotes significance level (i.e.,'***' for 1%, '**' for 5%, and '*' for 10%).

Additionally, a significant correlation between lagging tariffs and SUSWG is determined. These results remain robust even after the other variables are accounted for. In conclusion, our research demonstrates that trade liberalization has a negative and statistically significant effect on the SUSWG throughout Pakistan's provinces and in the manufacturing sector. Furthermore, in every instance, our

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results remain robust to the inclusion of diverse controls. Furthermore, a lagged trade policy analysis reveals a negative correlation between trade liberalization and SUSWG, which remains robust even after incorporating different controls. Our results are consistent with those of Galiani and Sanguinetti [14], Hanson and Harrison [48], Ghazali [49], Anwar and Sun [50], and Anwar and Sun [50].

5. Conclusion

In the 1990s, Pakistan opened the economy for trading purposes as a part of the SAPs of the International Monetary Fund (IMF); during this period, tariff rates were drastically reduced. The core objective of this study was to empirically investigate the impact of trade liberalization on the SUSWG in the manufacturing sector and across provinces in Pakistan. This study used 2-digit sectoral-level data for the manufacturing sector as well as disaggregated data for province-level data from Pakistan over the period of the trade regime from 1990 to 2005. The key outcome of this study indicates a negative association between trade liberalization and the SUSWG. Our study found that the reduction of protection rates increased the SUSWG in the manufacturing sectors and across provinces of Pakistan and was statistically significant utilizing all approaches. Moreover, after the robustness checks, our results are robust to numerous trade-related controls. Furthermore, we also find that lagged trade policy is negatively associated with SUSWG. Moreover, we also find that lagged trade policy is negatively related to SUSWG as well as robust to numerous controls. This research will offer recommendations for policymakers to make forthcoming policies concerning trade liberalization and the SUSWG in Pakistan.

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The authors declare that they have no competing interests.

Authors' Contributions:

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

References

[1] P. K. Goldberg and N. Pavcnik, "The response of the informal sector to trade liberalization," *Journal of Development Economics*, vol. 72, no. 2, pp. 463-496, 2003. https://doi.org/10.3386/w9443

[2] J. Ul-Haq, S. Khanum, and R. A. Cheema, "The impact of trade liberalization on child labor in Pakistan," *International Review of Applied Economics*, vol. 34, no. 6, pp. 769-784, 2020. https://doi.org/10.1080/02692171.2020.1782853

[3] J. Ul-Haq, S. Khanum, and K. Imran, "Skill-biased impact of trade liberalization on employment in the manufacturing sector of Pakistan," *Global Economics Review*, vol. 6, no. 2, pp. 212-226, 2021. https://doi.org/10.31703/ger.2021(vi-ii).17

[4] M. Wu, J. Ul-Haq, N. U. Zafar, H. Sun, and J. Jiang, "Trade liberalization and informality nexus: Evidence from Pakistan," *The Journal of International Trade & Economic Development*, vol. 28, no. 6, pp. 732-754, 2019. https://doi.org/10.1080/09638199.2019.1593489

[5] E. Anderson, "Openness and inequality in developing countries: A review of theory and recent evidence," *World Development*, vol. 33, no. 7, pp. 1045-1063, 2005. https://doi.org/10.1016/j.worlddev.2005.04.003

[6] T. Desjonqueres, S. Machin, and J. Van Reenen, "Another nail in the coffin? Or can the trade based explanation of changing skill structures be resurrected?," *Scandinavian Journal of Economics*, vol. 101, no. 4, pp. 533-554, 1999. https://doi.org/10.1111/1467-9442.00172

[7] J. Haskel and M. J. Slaughter, "Trade, technology and UK wage inequality," *The Economic Journal*, vol. 111, no. 468, pp. 163-187, 2001. https://doi.org/10.1111/1468-0297.00593

[8] L. F. Katz and K. M. Murphy, "Changes in relative wages, 1963–1987: Supply and demand factors," *The Quarterly Journal of Economics*, vol. 107, no. 1, pp. 35-78, 1992. https://doi.org/10.2307/2118323

[9] J. S. Arbache, A. Dickerson, and F. Green, "Trade liberalisation and wages in developing countries," *The Economic Journal*, vol. 114, no. 493, pp. F73-F96, 2004. https://doi.org/10.2139/ssrn.447141

[10] P. Goldberg and N. Pavcnik, "Trade, inequality, and poverty: What do we know? Evidence from recent trade liberalization episodes in developing countries," NBER Working Paper, (w10593), 2004.

[11] J. G. Williamson, "Globalization and inequality, past and present," *The World Bank Research Observer*, vol. 12, no. 2, pp. 117-135, 1997.

[12] P. Sauré and H. Zoabi, "International trade, the gender wage gap and female labor force participation," *Journal of Development Economics*, vol. 111, pp. 17-33, 2014. https://doi.org/10.1016/j.jdeveco.2014.07.003

[13] E. Aguayo-Tellez, "The impact of trade liberalization policies and FDI on gender inequalities: A literature review. World Bank," Retrieved: https://openknowledge.worldbank.org/handle/10986/4391. [Accessed 2012.

[14] S. Galiani and P. Sanguinetti, "The impact of trade liberalization on wage inequality: Evidence from Argentina," *Journal of Development Economics*, vol. 72, no. 2, pp. 497-513, 2003. https://doi.org/10.1016/s0304-3878(03)00117-2

[15] R. McNabb and R. Said, "Trade openness and wage inequality: Evidence for Malaysia," *The Journal of Development Studies*, vol. 49, no. 8, pp. 1118-1132, 2013. https://doi.org/10.1080/00220388.2013.794263

[16] O. Attanasio, P. K. Goldberg, and N. Pavcnik, "Trade reforms and wage inequality in Colombia," *Journal of Development Economics*, vol. 74, no. 2, pp. 331-366, 2004. https://doi.org/10.1016/j.jdeveco.2003.07.001

[17] S. Li, "The effect of trade liberalization on Chinese rural poverty," *Asian Social Science*, vol. 5, no. 5, pp. 23-33, 2009. https://doi.org/10.5539/ass.v5n5p23

[18] H. Beyer, P. Rojas, and R. Vergara, "Trade liberalization and wage inequality," *Journal of Development Economics*, vol. 59, no. 1, pp. 103-123, 1999.

[19] A. O. Krueger, *Perspectives on trade and development*. Chicago: University of Chicago Press, 1990.

[20] W. F. Stolper and P. A. Samuelson, "Protection and real wages," *The Review of Economic Studies*, vol. 9, no. 1, pp. 58-73, 1941.

[21] E. Meschi and M. Vivarelli, "Trade and income inequality in developing countries," *World Development*, vol. 37, no. 2, pp. 287-302, 2009. https://doi.org/10.1016/j.worlddev.2008.06.002

[22] Z. Salman and M. Javed, "The impact of trade liberalisation on wage inequality: Case of Pakistan," *The Pakistan Development Review*, vol. 50, no. 4, pp. 575-595, 2011. https://doi.org/10.30541/v50i4iipp.575-595

[23] B. Yasmin, "Trade liberalization and the lead role of human capital and job attributes in wage determination: The case of Pakistan's labor market," *Lahore Journal of Economics*, vol. 14, no. 1, pp. 1-37, 2009. https://doi.org/10.35536/lje.2009.v14.i1.a1

[24] P. K. Goldberg and N. Pavcnik, "Trade, wages, and the political economy of trade protection: Evidence from the Colombian trade reforms," *Journal of International Economics*, vol. 66, no. 1, pp. 75-105, 2005. https://doi.org/10.1016/j.jinteco.2004.04.005

[25] U. Khalid, "Impact of trade liberalization on the industry wages in Pakistan (1995 9dash9 2015)," *Global Social Sciences Review*, vol. 4, no. 1, pp. 128-141, 2019. https://doi.org/10.31703/gssr.2019(iv-i).12

[26] I. Ullah, Q. Xuefeng, M. H. Shah, A. Rehman, S. Ali, and Z. Ahmed, "Forecasting wages inequality in response of trade openness in Pakistan: An artificial neural network approach," *The Singapore Economic Review*, pp. 1-16, 2020. https://doi.org/10.1142/s0217590820500058

[27] J. Ul-Haq, N. Nazeer, and N. Rahim, "Does trade liberalization reduce gender wage gap in the manufacturing sector of Pakistan?," *Competitive Social Science Research Journal*, vol. 3, no. 1, pp. 119-130, 2022.

[28] N. Aslam, J. Ul-Haq, A. R. Cheema, and H. Visas, "Does trade liberalization increase the formal-informal wage-gap in Pakistan?," *Edelweiss Applied Science and Technology*, vol. 6, no. 1, pp. 26-42, 2022. https://doi.org/10.55214/25768484.v6i1.303

[29] J. Ul-Haq, M. Arif, Q. M. A. Hye, H. Visas, and A. R. Cheema, "Unleashing the potential: Exploring the relationship between trade liberalization and female labor force participation in Pakistan," *Nurture*, vol. 17, no. 2, pp. 60-68, 2023. https://doi.org/10.55951/nurture.v17i2.193

[30] J. Ul-Haq, I. Ashraf, A. R. H. Cheema, Qazi Muhammad Adnan, and H. Visas, "The relationship between trade liberalization and gender disparity in education: Evidence from Pakistan," *Nurture*, vol. 17, no. 3, pp. 180-193, 2023. https://doi.org/10.55951/nurture.v17i3.291

[31] E. E. Leamer, "A trade economist's view of US wages and globalization," in *Brooking Conference Proceedings*, 1995: Brookings.

[32] A. Wood, "Openness and wage inequality in developing countries: The Latin American challenge to East Asian conventional wisdom," *The World Bank Economic Review*, vol. 11, no. 1, pp. 33-57, 1997. https://doi.org/10.1093/wber/11.1.33

[33] N. Pavcnik, A. Blom, P. Goldberg, and N. Schady, "Trade liberalization and labor market adjustment in Brazil," The World Bank, Policy Research Working Paper No. 2982 World Bank, Washington, DC, 2003.

[34] J. Ul-Haq, N. Nazeer, and S. Khanum, "Trade liberalization and child labour: Empirical evidence from manufacturing sector of Pakistan," *Competitive Social Science Research Journal*, vol. 2, no. 4, pp. 88-98, 2021.

[35] J. Ul-Haq, *Trade liberalization, wages and work environment nexus: Evidences from Pakistan*. Beijing: School of International Trade and Economics, University of International Business and Economics, 2016.

[36] N. Menon and D. M. R. Y. Van, "International trade and the gender wage gap: New evidence from India's manufacturing sector," *World Development*, vol. 37, no. 5, pp. 965-981, 2009.

[37] A. S. Blinder, "Wage discrimination: Reduced form and structural estimates," *Journal of Human Resources*, vol. 8, no. 4, pp. 436-455, 1973. https://doi.org/10.2307/144855

[38] R. Oaxaca, "Male-female wage differentials in urban labor markets," *International Economic Review*, vol. 14, no. 3, pp. 693-709, 1973. https://doi.org/10.2307/2525981

[39] A. R. Cheema, A. Saleem, J. U. Haq, and B. Shehzadi, "Estimating gender wage gap and its decomposition in Pakistan," *Journal of Quantitative Methods*, vol. 6, no. 2, pp. 26-50, 2022.

[40] A. M. Al-Malki, M.-U. Hassan, and J. Ul-Haq, "Nexus between remittance outflows and economic growth in GCC countries: The mediating role of financial development," *Applied Economics*, vol. 55, no. 46, pp. 5451-5463, 2023. https://doi.org/10.1080/00036846.2022.2139812

[41] S. Dou, J. Ul-Haq, H. Visas, B. Aslam, and S. Khanum, "Does export product diversification reduce sulfur dioxide emissions in China? A regional analysis," *International Journal of Environmental Science and Technology*, vol. 20, no. 6, pp. 6247-6258, 2023. https://doi.org/10.1007/s13762-022-04353-y

[42] D. Hoechle, "Robust standard errors for panel regressions with cross-sectional dependence," *The Stata Journal: Promoting Communications on Statistics and Stata*, vol. 7, no. 3, pp. 281-312, 2007. https://doi.org/10.1177/1536867x0700700301

[43] Q. Hye, M. Adnan, J. Ul-Haq, H. Visas, and R. Rehan, "The role of eco-innovation, renewable energy consumption, economic risks, globalization, and economic growth in achieving sustainable environment in emerging market economies," *Environmental Science and Pollution Research*, vol. 30, no. 40, pp. 92469-92481, 2023. https://doi.org/10.1007/s11356-023-28945-4

[44] J. Shi, H. Visas, J. Ul-Haq, S. Abbas, and S. Khanum, "Investigating the impact of export product diversification on environmental degradation: Evidence from Chinese Provinces," *Environment, Development and Sustainability*, vol. 25, no. 10, pp. 11455-11486, 2023. https://doi.org/10.1007/s10668-022-02536-8

[45] H. Visas, R. Rehan, J. Ul-Haq, A. R. Cheema, S. Khanum, and Q. M. A. Hye, "Does tourism increase energy consumption in BRICS countries?," *Journal of Tourism Management Research*, vol. 10, no. 1, pp. 94-106, 2023. https://doi.org/10.18488/31.v10i1.3402

[46] U. Kumar and P. Mishra, "Trade liberalization and wage inequality: Evidence from India," *Review of Development Economics*, vol. 12, no. 2, pp. 291-311, 2008. https://doi.org/10.1111/j.1467-9361.2007.00388.x

[47] P. Topalova, *Trade liberalization, poverty and inequality: Evidence from Indian districts. In: Harrison, A., Ed., Globalization and Poverty*. Chicago, IL: University of Chicago Press, 2007.

[48] G. H. Hanson and A. Harrison, "Trade liberalization and wage inequality in Mexico," *ILR Review*, vol. 52, no. 2, pp. 271-288, 1999. https://doi.org/10.1177/001979399905200207

[49] M. Ghazali, "Trade openness and wage inequality between skilled and unskilled workers in Tunisia," *Économie Internationale*, no. 1, pp. 63-97, 2009. https://doi.org/10.3917/ecoi.117.0063

[50] S. Anwar and S. Sun, "Skilled-unskilled wage gap in China," in *Proceedings of the 39th Australian Conference of Economists*, 2010: Economic Society of Australia Inc., pp. 1-24.