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Trade Liberalization and Gender Wage Inequality: Panel Auto-regressive Distributed Lag Approach for Emerging Economies

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ABSTRACT

This study examines the co-integration and causality direction between trade openness (TO), as a proxy to liberalization, and gender wage gap in the emerging economies. In this study, we applied panel auto-regressive distributed lag (ARDL) model to identify the association between TO and gender inequality in wage and Granger causality test to analyze the causality directions between them for 1994–2014. The results of co-integration and ARDL analyses of the panel dataset indicate that TO and gender wage gap are cointegrated, and fully modified ordinary least squares and pooled mean group estimates results identified a positive association between TO and gender pay inequality in the emerging economies. The results Granger causality analysis specifies a unidirectional causality from TO to gender wage gap in both short-run and long-run which infers that TO significantly raises wage inequality between male and female in the emerging countries.

Keywords: Trade Openness, Gender Wage Gap, Panel Auto-regressive Distributed Lag, Granger Causality, Unidirectional Causality
JEL Classifications: O50, F63, F14

1. INTRODUCTION

Over the recent decades, the value and volume of international trade are increasing in the world economy. Both developed and developing economies are increasingly linked to the international market for goods and services as well as factors of production which leads to growing cross-border flows of capital, goods, technology, and labor. With the remarkable boom of international trade, the participation of women in economic activities is increasing significantly day by day around the world. Consequently, the debate on whether international trade affects wage differential between male and female workers has concerned the international community. This issue has been considered as a crucial research focus in this globalized world especially due to the observed wage disparity over the past decades in the developing countries.

Different trade theories predict the effects of growing international trade on pay differential between genders differently. Heckscher-Ohlin (HO) or more particularly Stolper-Samuelson (SS) theories predict this case from the mainstream background. HO theory assumes that a country should master in producing the good for which it has abundant factors of production. Similarly, as companion theorem of HO model, SS theory suggest that international trade will raise the income of the abundant factor of production which is used to produce the goods exported. Developing countries are endowed with ample unskilled and semi-skilled labor, and they enjoy comparative advantage in producing labor-intensive products. However, female workers share a major portion of unskilled and low-skilled labor force in the developing countries. So based on SS theorem, it seems true that growing export of labor-intensive products will benefit female workers in the developing countries and reduce wage inequality between genders.

On the other hand, neoclassical trade theory prophesies that trade growth eliminates the pay differential among male and female by increasing the utilization of relatively abundant, low-skilled labor even in a situation where there is a change in skill-demand due to increased trade expansion. Becker (2010) theory also supports this prediction of neoclassical trade theory, and it states that long run rising competition eliminates discriminatory behavior in gender wage inequality. However, non-neoclassical theoretical approach overturns the assumption of neoclassical theory. As per this approach, wage inequality is caused not only by the lower skill of female workers but also by worker's bargaining power which comes from types of jobs. In a typical capitalist economy, some groups of employees who have strong bargaining power are employed in a better position while some other groups of employees are in place with little favorable employment due to the atmosphere and low bargaining position. In this case, firms can enjoy the advantageous situation by paying a lower wage to workers with such above disadvantageous position in the organization. As a result, expansion of international trade may create the situation of joblessness by declining or evolving some groups of workers and thus widen wage disparities among workers.

According to offshoring model proposed by Feenstra and Hanson (1995), growing trade results in movement of tasks from skill-rich country to skill-poor country to minimize the cost and it results in higher demand of skill-intensive labor in both skill-rich developed and skill-poor developing countries. Thus, trade increases income gap between skilled and unskilled workforces in those countries. Since employed women constitute a major portion of unskilled labor trade will upturn gender wage gap in the developing countries.

Krugman (1995) and Machin and Van Reenen (1998) found no link between international trade and gender wage inequality. Later on, Krugman (2008) reverses his previous findings by investigating on new sample countries and confirmed that trade increases wage differential between skilled and unskilled labor while Machin and Van Reenen (2007) found little linkage between international trade and wage gap. However, these studies only focused on skill-based wage disparities, not on gender. Several researches studied trade and gender pay gap linkage. Some studies found a affirmative association between trade and gender pay gap for example but not limited to (Artecona and Cunningham, 2002; Bøler et al., 2015; Guimaraes and Silva, 2016; Picchio and Mussida, 2011) whereas others find little or no linkage between them (Dong and Zhang, 2009; Shu and Bian, 2003). Some studies focus on identifying the channels of trade-gender wage gap linkage, and they found different channels of this linkage such as technological change (Allen, 2001; Berman et al., 1994; Brown and Campbell, 2002); productivity and skill differences (Johansson and Katz, 2007; Liu, 2004; Saure and Zoabi, 2014; Zhang and Dong, 2007); bargaining power of female workers (Berik et al., 2002); low-cost female labor force (Rahman, 2014); and labor market institution or trade union (Oostendorp, 2009).

On the contrary, Busse and Spielmann (2006) argued that gender-based pay inequality has a positive association with the comparative advantage in the expansion of labor-intensive sector and countries that experience higher wage inequality between male and female workers enjoy a greater comparative advantage in exporting labor-intensive products. They also suggest that larger wage gap between genders results in the growth of labor-intensive sectors in the developing countries as a significant portion of female workers are unskilled in these countries. However, none of the previous studies focus on identifying long-run and short-run liaison between trade and gender wage inequality and causal direction between them.

This study enhances the literature in this field by empirically examining the link between trade and gender pay gap as well as the direction of causality between them and it applies panel autoregressive distributed lag (PARDL) model and panel co-integration approach developed by Pedroni (1999) to emerging economies. This study has several novelties: (i) This study is the first pioneer one in the trade-inequality nexus literature that applies co-integration procedures to analyze the relationship and identify the direction of casualty between trade and gender wage gap for a long period, 1994–2014; (ii) We employ PARDL method to make clear about the direction of relationship between trade and gender wage gap as well as two different estimators such as pooled mean group (PMG) and fully modified ordinary least squares (FMOLS) to estimate the magnitude of relationship between them; (iii) we identified all types of casualty between trade and gender wage gap such as weak (short-run), long-run, and strong casualty to identify whether trade causes gender wage gap or gender wage gap causes growing trade in the developing countries which will solve the debate of trade gender wage gap linkage; (iv) the study focuses on emerging economies due to their significance and growing contribution in international trade and that's why the study will provide deep insight and significant policy decisions.

The remaining part of the study proceeds as follows. The next section elucidates the econometric theory and methods. Section three reports and analyses the statistical results followed by section four that makes conclusions and provides policy implications.

2. METHODOLOGY

2.1. Data Description

Following the empirical literature (Bildirici, 2014; Ozturk and Acaravci, 2011) the standard functional specification of the association between trade liberalization and gender pay inequality is expressed as follows:

$$y_{it}=\alpha+\beta TO_{it}+\varepsilon_{it} \quad (1)$$

Where y indicates gender wage inequality and trade openness (TO) symbolizes TO of country i at period t; and ε_{it} is error term.

We use TO (share of export and import to gross domestic product [GDP]) as a proxy to trade liberalization which is the most commonly used measure of trade liberalization. Gender-based wage inequality is calculated as follows:

$$\text{Gender Wage Gap} = 1 - \frac{\text{Average Wage of Female}}{\text{Average Wage of Male}}$$

Here, a higher value of wage gap indicates higher gender gap in wage. Due to unavailability of consistent gender-based pay gap data for a long time series, we make the study on 16 emerging countries. The data for TO is assembled from World Bank database, and the data source of gender wage gap is ILO database[1].

2.2. Unit Root Test

The standard methodology to examine the association among a set of variables is a two-step process. First, we should ascertain the type of integration among the variables and then identify whether there exists at least one linear association between the variables. We applied different panel unit root tests to identify the cointegration order of the variables used in the study to make sure whether the variables are stationary at level I (0) or at first difference I (1).

In panel studies, Levin et al. (2002) (LLC); and Im et al. (2003) (IPS) tests are extensively used for unit root test. LLC test uses polled data whereas IPS test is obtained as the average of augmented Dickey-Fuller (ADF) statistics. The basic equation of LLC panel unit root test is as follows:

$$y_{it}=\rho_i y_{i,t-1}+z'_{it}\gamma+u_{it} \qquad i=1,\ldots\ldots, N; \qquad t=1,\ldots\ldots,T \tag{2}$$

Where z'_{it} stands for the deterministic component and u_{it} indicates the stationary process. LLC panel unit root test assumes independently and identically distributed residuals with a mean value of zero and constant variance σ^2 as well as $\rho_i=\rho$ for all values of i. This panel unit root test has a null hypothesis that all variables have a unit root which is constructed as H_o: $\rho_i=1$ against the alternative hypothesis constructed as H_1: $\rho<1$ which indicates that all variables are stationary or do not have a unit root.

Although LLC considers heterogeneity only in intercept terms, IPS unit root test accepts heterogeneity both in intercept and slope. The basic structure of IPs unit root test is as follows:

$$y_{it} = \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \varphi_{i,j} \Delta y_{i,t-j} + z'_{it}\gamma + \varepsilon_{it} \tag{3}$$

IPS unit root test has a null hypothesis that all panel data series have a unit root (H_o: $\rho_i = 1$) against the alternative hypothesis that assumes all panel series as stationary (H_1: $\rho < 1$). This test depends on the average of the individual unit root test statistics. However, the problem of the above-mentioned panel unit root tests known as first generation tests is that they do not consider cross-sectional dependence problems which may arise from uncounted residual dependence; regional and macroeconomic linkages; as well as unobserved externalities. Pesaran (2007) panel unit root test, also known as the second generation unit root test takes cross-sectional dependence problems into account. It is the augmented form of IPS test (CIPS) that considers cross-sectional dependence (Bildirici, 2014; Bildirici and Kayikci, 2013). The CIPS tests for cross section units are estimated using OLS as follows:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + c_i \bar{y}_{i,t-1} + \sum_{j=0}^{k} d_{ij}\Delta\bar{y}_{t-j} + \sum_{j=1}^{k} \beta_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \tag{4}$$

1 Country sample includes: Argentina; Brazil; Bulgaria; Chile; Egypt; Hungary; Kazakhstan; Latvia; Mexico; Peru; Philippines; Poland; Slovakia; Sri Lanka; Ukraine; Venezuela;

The static of CIPS test is the average of individual cross-sectional ADF statistics which is constructed as below:

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} t_i(N,T) \tag{5}$$

Where t_i(N,T) indicates the t-static of the ρ_i estimates.

2.3. Panel Co-integration Test

Among the panel co-integration tests, the Pedroni (2004) test is most popular one. The basic form of Pedroni test is defined as:

$$\Delta y_{it}=\alpha_i+\delta_{it}+\Delta y_{i,t-p}+\varepsilon_{it} \tag{6}$$

In this test Pedroni uses specific parameters to take into account heterogeneity, and the parameters change across individual series. Moreover, it also allows for cross-sectional interdependence with different individual effects. There are seven different statistics proposed by Pedroni panel co-integration test of which the first four are within dimension statistics and other three are between dimension statistics. All test statistics of Pedroni have a null hypothesis of no cointegration. The decision that whether the variables are co-integrated is taken based on the results of the majority of the statistics.

However, Pedroni's test of co-integration only allows for testing the presence of co-integration, but it does not estimate the relationship between the variables in the long-run. Pedroni proposes a FMOLS (Pedroni, 2000) estimator to estimate the long run relationship among variables. According to him, FMOLS method provides better estimates than OLS, and it has a standard as well as asymptotically unbiased distribution. FMOLS also produces consistent t-statistics and standard errors although there exists endogenous regressors in the estimate (Bildirici, 2008; 2014; Parida and Sahoo, 2007). First, Pedroni (1995) cointegration analysis starts with the following OLS regression:

$$y_{it}=\alpha_i+\beta_i TO_{it}+\mu_{it} \tag{7}$$

β_i indicates the slopes of the cointegrated variables. Here, i=1,….., N that specifies cross sections and t indicates time where t=1,…., T points to time period. Suppose, $\varepsilon_{it} = \hat{\mu}_{it}$ and ΔTO_{it} is a stationary vector. We also assume that:

$$\Omega_{it} = \lim_{T\to\infty} E\left[T^{-1}\left(\sum_{t=1}^{T}\varepsilon_{iT}\right)\left(\sum_{t=1}^{T}\varepsilon_{iT}\right)'\right] \tag{8}$$

The long-run covariance of the above vector is decomposed as follows:

$$\Omega_i = \Omega^0_i + \Gamma_i + \Gamma_i'$$

Here, Ω^0_i is the contemporaneous covariance, and Γ_i is the weighted sum of auto co-variances. FMOLS estimators are constructed as follows:

$$\hat{\beta}^*_{GFM} = N^{-1}\sum_{1}^{N}\left(\sum_{t=1}^{T}\left(TO_{it}-\overline{TO_i}\right)^2\right)^{-1}\left(\sum_{t=1}^{T}\left(TO_{it}-\overline{TO_i}\right)y^*_{it}-T\hat{\gamma}_i\right) \tag{9}$$

Where,

$$y_{it}^{*} = \left(y_{it} - \bar{y}_i\right) - \frac{\Omega'_{21i}}{\Omega'_{22i}}\Delta TO_{it} \text{ and } \gamma_{it} = \Gamma'_{21i} + \Omega^6{}_{21i} + \frac{\Omega'_{21i}}{\Omega'_{22i}}\left(\Gamma'_{22i} + \Omega^6{}_{21i}\right) \quad (9.1)$$

$\hat{\beta}*_{GFM} = N^{-1}\sum_{t=1}^{N}\hat{\beta}^{*}_{FM,i}$ is the between-dimensions estimator and $\hat{\beta}^{*}_{FM,i}$ is the FMOLS estimator of i[th] country.

Pedroni test does not consider cross-sectional dependence, and it assumes that in their levels, long-term parameters are equal to short-run parameters for first differenced. These insufficiencies of Pedroni test decrease the power of cointegration based on residuals (Bildirici, 2014). That is why along with Pedroni (1995) cointegration test we also utilize the PARDL model to check both long run and short run co-integration between gender wage gap and TO.

2.4. PARDL test

We applied PARDL approach to the co-integration analysis proposed by Pesaran et al. (1999) for the single equation models. This approach consists of two steps to examine the association between the variables. In the first step, we examine the long-run relationships among the variables. If the test result indicates the existence a long run co-integration, we then estimate the coefficients using the ARDL approach. We computed the coefficients of estimations using PMG method. This approach is the average of unrestricted single country coefficients is considered as a better technique compared to other estimators such as dynamic OLS and FMOLS (Bildirici, 2014). The PARDL model has been applied to several other studies such as (Bildirici, 2014; Bildirici and Kayikci, 2012; 2013; Binder and Offermanns, 2007).

The ARDL (p,q) model for long-run association between TO and gender wage gap can be constructed as follows:

$$\Delta y_{it} = \phi_i + \sum_{k=1}^{p}\Delta y_{i,t-j} + \sum_{k=0}^{q}\Delta TO_{i,t-j} + \delta_{1ij}y_{i,t-1} + \delta_{2ij}TO_{i,t-1} + \varepsilon_{it} \quad (10)$$

Here,

$$\delta_{1i} = -\left(1 - \sum_{j=1}^{q}\lambda_{ij}\right)\delta_{2i} = \sum_{j=0}^{q}\omega_{ij}\ \delta_{ij} = -\sum_{m=j+1}^{p}\lambda_{im}\ \mu_{ij} = -\sum_{m=j+1}^{q}\omega_{im}$$

Where i indicates cross-sections and t represents time periods; ω_{ij} and λ_{it} indicate k x1vector of the explanatory variables; and ϕ accounts for the country-specific intercept. has a the null hypothesis of Equation (10) is that there is no co-integration among the variables (Ho: $\delta_{1i}=\delta_{2i}=0$) whereas the alternative hypothesis states that there exists cointegration (H_1: $\delta_{1i}\neq \delta_{2i}\neq 0$). If long-run co-integration between the variables exist then long-run ARDL model is estimated as below:

$$y_{it} = \phi_i + \sum_{k=1}^{p}\lambda_{ij}y_{i,t-j} + \sum_{k=0}^{q}\omega_{ij}TO_{i,t-j} + \varepsilon_{it} \quad (11)$$

The appropriate lag of ARDL model is selected using Schwarz information criterion (SBC). The short-run dynamic parameters of ARDL can be estimated using error correction (EC) model as specified below:

$$\Delta y_{it} = \alpha_i + \sum_{k=1}^{p}\gamma_{ij}\Delta y_{i,t-j} + \sum_{k=0}^{q}\mu_{ij}\Delta TO_{i,t-j} + \psi_{ij}EC_{t-i} + \varepsilon_{it} \quad (12)$$

Here ε_{it} is the residual which is normally and independently distributed with a mean value of zero and a constant variance; EC_{t-1} indicates the EC term, and ψ specifies the speed of adjustment to the equilibrium point if there is a shock. It infers that how promptly the variables come back to the equilibrium point after any shock in the real world situation. It is expected that ψ should have a negative sign with statistically significant probability value which indicates the existence of long-run cointegration.

2.5. Granger Causality Test

In the final stage of the study, we apply Engle and Granger (1987) causality test to identify the causal relationship between TO and gender wage inequality. We applied vector EC model (VECM) to examine the causality directions between variables and it is determined as follows:

$$\Delta y_{it} = \alpha_0 + \sum_{i=1}^{m}\beta_{ik}\Delta yj,_{t-1} + \sum_{i=1}^{n}\phi_{ik}\Delta TO_{j,t-1} + \psi 1EC_{t-1} + \varepsilon_{lt} \quad (13)$$

$$\Delta TO_{it} = \alpha_0 + \sum_{i=1}^{p}\theta_{ik}\Delta TO_{j,t-1} + \sum_{i=1}^{q}\eta_{ik}\Delta y_{j,t-1} + \psi_2 EC_{t-1} + \varepsilon_{2t} \quad (14)$$

Where ε_t is residual which is supposed to be normally and independently distributed and has mean value of zero and constant variance. EC_{t-1} stands for the EC term. β; θ; ϕ; ψ; and η are the parameters that need to estimate. The parameter ψ indicates the speed of adjustment after any shock. It specifies that how fast the variables come to the equilibrium point if any shock occurs in the real world scenario. We selected the optimal lag based on AIS and SBC criteria. Rejection of null hypothesis indicates that TO does not cause gender pay inequality (y) and gender wage gap (y) does not results in growing trade (TO) respectively.

Using the Equations (13 and 14) Granger causality results can be explained in three different ways (Bildirici, 2014; Lee and Chang, 2008; Ozturk and Acaravci, 2011)

1. Short run (weak) Ganger casualties are determined by testing Ho: $\phi_i = 0$ and H_0: $\eta_i = 0$ for all i and k for Equations (13 and 14) respectively.
2. Long run casualties are detected by testing the hypothesis Ho: $\psi_1 = 0$ and H_0: $\psi_2 = 0$ for Equations (13 and 14) respectively.
3. Strong casualties are ascertained by the hypothesis Ho: $\phi_i = \psi_1 = 0$ and Ho: $\eta_i = \psi_2 = 0$ for all i and k for Equations (13 and 14) respectively.

We apply vector EC model to identify direction of causalities between the variables because it tests both short run and long run causalities through first difference of the explanatory variables and EC term respectively.

3. RESULTS AND ANALYSIS

The summary statistics of gender wage gap and TO for 16 emerging economies are provided in Table 1. The descriptive statics exhibit that average TO of the sample countries is 74.512 that means international trade consists of 74.512% of total GDP of these countries, and it ranges from 185.163 to 15.635. The average gender pay gap is 16.568% with the highest value of 83.704, and the lowest difference is −8.690% which indicates that in some countries women are in more advantageous position than men regarding wage.

3.1. Unit Root Test

We applied both first generation such as LLC, IPS, ADR-fisher and second generation such as Pesaran (2007) panel unit root tests. Although IPS test accepts cross-sectional dependence across units of the panel the Pesaran panel unit root test considers cross-sectional dependence in more general forms (Table 2). According to the majority of panel unit tests results we can conclude that gender wage gap and TO are stationary of their first difference I (1).

3.2. Panel Co-integration Test and FMOLS Estimation

Table 3 reports the statistics of Pedroni's panel cointegration tests. Out of seven panel co-integration tests statistics, six tests rejects of the null hypothesis of no integration at 1% level. The results FMOLS estimates also indicate the presence of significant link between TO and gender wage gap.

Moreover, we have also done Johanson and Fisher cointegration test, and the results are summarised in Table 4. The tests yield 3.97 trace statistics and 69.96 maximum eigenvalue statistics with a P value significant at 1% level, and it supports the cointegration of the variables.

3.3. Panel PMG Estimates

The results of PMG estimates summarized in Table 5 confirmed the positive long-run association between TO and gender pay gap at 1% significance level.

The short-run estimates describe the EC term that corresponds to long-run equilibrium. At equilibrium point, the EC should be zero, and the value of EC except zero implies deviation from long-run equilibrium. The results show a negative sign for EC which is statistically significant whereas all the variables have a statistically insignificant coefficient. This suggests that in case of any sudden shock in the economy, gender wage gap can significantly be resumed to the equilibrium point. The insignificant coefficients of other lagged variables indicate weak exogeneity relative to EC terms and they do not make a significant contribution to adjust to the corresponding association between the variables.

3.4. Granger Causality

The estimations done so far only identify whether there exists any short-run or long-run relationship between TO and gender wage gap but they do not examine the causality directions between the

Table 1: Descriptive statistics

Variable	Mean	Median	Maximum	Minimum	SD	Observations
Trade openness (TO)	74.512	69.125	185.163	15.635	36.477	344
Gender wage gap (y)	16.568	16.871	83.704	−8.690	10.122	344

SD: Standard deviation

Table 2: The panel unit root tests results

Variable	Levin, Lin and Chu		Im, Pesaran, and Shin		ADF-Fisher		Pesaran CD	
	Level	1st difference	Level	1st difference	Level	1st difference	Level	1st difference
y	−5.02*	−17.084*	−5.614*	−15.459*	102.04*	252.88*	−2.88*	−4.159*
TO	−0.5187	−14.367*	1.038	−12.42*	24.12	187.24*	−1.506	−3.916*

*Indicates the significance of probability value at 1% level and rejection of the null hypothesis of a unit root. TO: Trade openness, ADF: Augmented Dickey-Fuller

Table 3: The results of panel co-integration test of Pedroni and FMOLS estimation

Statistics	Within-dimension statistics			Statistics	Between-dimension statistics		
	No deterministic trend	Deterministic intercept and trend	No deterministic intercept or trend		No deterministic trend	Deterministic intercept and trend	No deterministic intercept or trend
Panel v-statistic	1.228984	−0.631305	2.785473*	Group rho-statistic	−2.058487*	−0.556371	−0.746209
Panel rho-statistic	−3.884542*	−3.062336*	−4.858857*	Group PP-statistic	−6.020540*	−5.323240*	−4.478011*
Panel PP-statistic	−5.928707*	−7.003379*	−5.641238*	Group ADF-statistic	−7.244539*	−7.707341*	−4.582680*
Panel ADF-statistic	−6.326616*	−7.340998*	−5.832765*				
FMOLS result: Dependent variable y							
TO: 0.244180*							
R^2: 0.347174							

*Indicates the significance of probability value at 1% level and rejection of the null hypothesis. FMOLS: Fully modified ordinary least squares, ADF: Augmented Dickey-Fuller, TO: Trade openness

Table 4: Johansen and Fisher panel co-integration test results

H0	Fisher Stat§ (from trace test)	Fisher Stat§ (from max-Eigen test)
r=0	83.97*	69.96*
r≤1	65.08*	65.08*

*Indicates the significance of probability value at 1% level and rejection of the null hypothesis. §Probabilities are computed using asymptotic Chi-square distribution

Table 5: Panel ARDL (PMG) test results

Long run: Dependent variable Δy	
TO	0.112475*
Short run	
Error correction term	−0.349509*
C	0.072473
ARDL (2, 2) model	

*Indicates the significance of probability value at 1% level. The appropriate lag selection of ARDL model is based on SBC. ARDL: Auto-regressive distributed lag, PMG: Pooled mean group, TO: Trade openness

Table 6: The results of Granger causality test

Null hypothesis	F-statistics
Weak (short-run) Granger causality	
ΔTO→Δy	6.526212
(Ho: ϕi=0)	(0.0017)
Δy→ΔTO	0.697139
(H0: ηi=0)	(0.4988)
Long-run Granger causality	
EC→Δy	8.150971
(Ho: ψ1=0)	(0.0046)
EC→ΔTO	0.050555
(H0: ψ2=0)	(0.8223)
Strong Granger causality	
EC, ΔTO→Δy	7.013908
(Ho: ϕi=ψ1=0)	(0.0001)
EC, Δy→ΔTO	0.503860
(Ho: ηi=ψ2=0)	(0.6799)

y represents the gender wage gap; TO symbolize for trade openness; and EC is error correction term. Δ indicates the first difference operator. The number of optimal lags is selected based on based on SBC and AIC. *P* values for F-statistics are in given in parenthesis

variables. Finally, we apply Granger causality analysis to ascertain the causal relationship between the variables (Table 6).

The causality test results evidence unidirectional short run, long run as well as strong causality from TO to gender wage gap. It infers that TO significantly increases wage inequality between the genders in the sample emerging economies. Thus, the causality test results are also supported by the estimated coefficients reported by FMOLS and PMG models. The EC term provides evidence for the time required for adjustment to the equilibrium after any unexpected shock in the economy. According to the results, the speed of adjustment is very high, and it requires around three years for the system to come back to its long-run equilibrium level after any shock.

4. CONCLUSION

This study aims at investigating the cointegration and causal relationship between TO and gender wage inequality in the emerging economies. We apply Pedroni and Fisher cointegration analysis and PARDL model to identify the long-run and short-run link between the variables and Granger causality test to identify the causality directions between TO and pay inequality between genders. The study results suggest that growing trade directly increases inequality in wage between male and female in the emerging countries, but gender pay gap does not lead to growing international trade in these countries. This study supports the theoretical view that trade increases wage inequality between male and female in the developing as female labor constitutes a major portion of unskilled labor in these economies. However, it rejects the view that growing international trade is the result of lower wages paid to unskilled female workers in the developing countries.

This study has significant policy implications. The study results solve the policy confusion that trade causes gender pay gap, but growing trade is not the result of wage gap between male and female in the developing countries. As growing trade increases the gender pay gap, the policymakers in the analyzed countries should focus on the issues that reduce gender wage inequality. They can take steps to enhance the skill of the female workers and enact policies that lower the wage inequality between male and female workers. The study has some drawbacks. Due to unavailability of consistent wage gap data for long time series for substantial numbers of emerging countries, we could not include all the emerging economies in our study. The availability of data will make future study robust in this field.

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