Received 14 January 2023
Revised 17 July 2023
Accepted 30 September 2023

The impact of personal remittance and RMG export income on income inequality in Bangladesh: evidence from an ARDL approach

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Abstract

Purpose – Personal remittance and ready-made garments (RMG) export incomes have emerged as the largest source of foreign income for Bangladesh's economy. The study investigates their impact on income inequality and gross domestic product (GDP) as a control variable, using time-series yearly data from 1983 to 2018.

Design/methodology/approach – It employs the Autoregressive Distributed Lag (ARDL) estimation and the Toda-Yamamoto (T-Y) causality approach. The ARDL estimation outcomes confirm a long-run association among the above variables and validate the autoregressive characteristic of the model.

Findings – Personal remittances positively contribute to reducing the income gap among the people of the society and declining income inequality. In contrast, RMG export income and economic growth contribute to further income inequality. The T-Y causality analysis follows the ARDL estimation outcomes and authenticates their robustness. It reveals a feedback relationship between remittance inflow and the Gini coefficient, unidirectional causalities from RMG export income to income inequality and economic growth to income inequality.

Research limitations/implications – The finding has important policy implications to limit the income gaps between low and high-income groups by channeling incremental income to the lower-income group people. The policymakers may facilitate further international migration to attract further remittances and may upgrade the minimum wage of the RMG workers.

Originality/value – The study is original. As far as the authors' knowledge goes, this is a maiden attempt to investigate the impact of personal remittances and RMG export income on income disparity in the case of Bangladesh.

Keywords Income inequality, Personal remittance, RMG export income, Economic growth, Bangladesh

Paper type Research paper

JEL Classification — D31, F1, F24.

There is nothing to acknowledge.

Funding: No funding is available.

Availability of data and material: The data is available at the following two sources: https://databank.worldbank.org/source/world-development-indicators# https://www.bgmea.com.bd/page/Export_Performance

Competing interests: There is no competing interest.

Authors' contributions: Each author contributes equally.

Review of Economics and Political Science
Vol. 9 No. 2, 2024
pp. 134-150
Emerald Publishing Limited
e-ISSN: 2631-3561
p-ISSN: 2356-9980
DOI 10.1108/REPS-01-2023-0004

1. Introduction

Income inequality refers to an uneven income distribution among different segments of a country's population. While an equal income distribution among the population may be imagined, it is neither practicable nor acceptable to all. Based on differences in education, knowledge and skills, the incomes of different people are different, making natural differences in income. However, a big difference in income among the various groups of people is undesired and detrimental to the economic well-being of a nation. Because the level of income directly determines the quality of life, as it enables access to basic amenities of life. Therefore, reasonably equitable distribution of income among sections of people in a society is highly desirable. A root cause of income inequality in the country stems from Bangladesh's defective and uneven national pay scale (NPS). The NPS produces 20 grades [grade 1 through grade 20], and there is a considerable difference among these grade salaries. For example, according to the 7th NPS, an employee in the 20th grade received only 10.25% of the pay of a grade 1 employee. Similarly, as per the latest 8th NPS, a staff of grade 20 gets only 10.57% of the remuneration of a grade 1 servant. The disparity of income distribution over the years is on a rising trend, which is ethically inconceivable.

Income inequality is measured by the Gini coefficient, which shows the level of inequality in income distribution. In other words, it demonstrates how a country's income distribution diverges from equal distribution. Its value ranges from 0 [absolute equality] to 1 [absolute inequality]. It is also expressed as a ratio ranging from 0 to 100. But in reality, the extreme values never reach. In the case of cross-country comparison, however, the Gini coefficient may lead to misleading conclusions. At the same time, it is free from any confusing indication in the case of country-specific study. For example, two countries, one is highly developed while the other is less developed, may have the same Gini index. Still, they will significantly differ regarding the level of absolute income and life quality. A trend in the Gini coefficient of Bangladesh is sketched in Figure 1, while the variations in the Gini coefficient are outlined in Figure 2.

The remittance inflow has been a significant source of development finance in many developing countries. Its positive impact on economic growth (EG) is acknowledged by many studies, such as Islam (2021a), Ekanayake and Moslares (2020), Meyer and Shera (2017), Imai *et al.* (2014), Islam *et al.* (2012) and Cooray (2012). However, its impact on poverty, particularly income inequality, is not well-researched. Remittance money is believed to reach its end users directly and augment their disposable incomes, enabling them to spend more on family consumption and human capital creation (Islam *et al.*, 2012). Thus, personal remittance is likely to reduce the income disparities across the population's income and reduce the poverty level in society. In 2020, the global remittances amounted to 702 billion US dollars, and

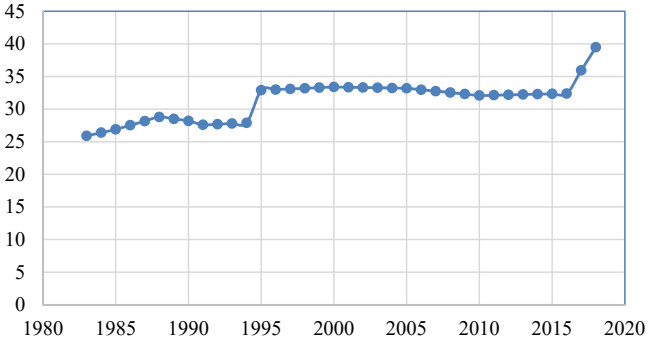

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Figure 1.
Trend in the Gini coefficient

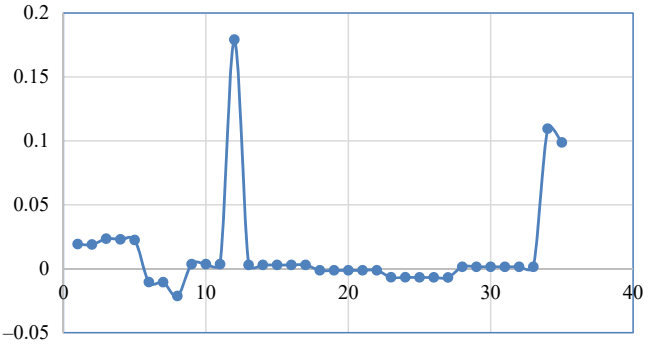

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Figure 2.
Variations in the Gini coefficient

Bangladesh maintained the 7th position with 21.8 billion US dollars of remittance inflow. During 2010–2010, the country's remittance inflow accounted for 5.41%–10.59% of its GDP, with an average of 7.74% (World Bank, 2021). Thus, the contribution of personal remittance to Bangladesh's economy is enormous. Therefore, this study considers investigating its impact on income inequality and drawing policy implications.

The ready-made garments (RMG) sector has become the critical economic performer of Bangladesh's economy in terms of employment, domestic value addition and export income. It directly employs four million rural workers in nearly 5,600 factories among "Bangladesh Garment Manufacturers and Exporters Association (BGMEA)" members and indirectly benefits several other millions (Islam *et al.*, 2016; Islam, 2021b, 2022). The sector contributed 7.98%–19.7% to GDP, with an average of 14.14% during 2010–2020. While during 2010–2019, its contribution to export income amounted from 78.15% to 84.21%, having an average of 81.31% of export income (World Bank, 2021; BGMEA, 2021). Thus, it seemingly significantly impacts the country's socio-economic development and is considered the main driver for sustainable development. It is expected that RMG export income is likely to contribute to downsizing income inequality, as this sector directly benefits millions of families. However, there is considerable concern in Bangladesh about the growing income inequality. The available macro-data suggests that the income distribution is much more unequal, and the Gini coefficient is rising, especially in recent years. Therefore, this study tries to determine the contribution of the RMG export proceeds in reducing income inequality. The contribution of personal remittances and RMG export income as a ratio to GDP is highlighted in Figure 3.

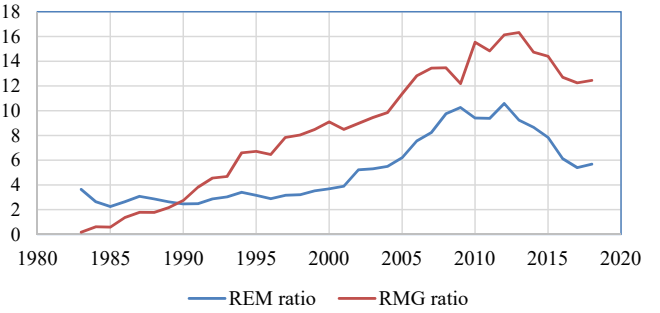

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Figure 3.
Contribution of remittances and RMG export income to GDP

Hence, this study looks at the impact of remittance receipts and RMG export income on income inequality in Bangladesh, including gross domestic product (GDP) as a control variable. Although many studies, such as Islam (2021a) and Islam *et al.* (2012), considered the contribution of remittance earnings to the EG of Bangladesh and South Asia, and several others, including Islam (2021b, 2022), examined the impacts of RMG export earnings on EG in Bangladesh, there is yet any study to uncover their influence on income inequality in Bangladesh. This study is a maiden attempt to investigate the effects of remittances and RMG export income on income disparity in Bangladesh. The rest of the paper is arranged as follows. Section 2 provides some glimpses of the existing literature, section 3 narrates the methodology followed in this study, section 4 depicts the outcome and section 5 concludes the study with some policy recommendations.

2. Literature review

2.1 A theoretical framework

Theoretically, both remittances and export earnings are injections into the national income flow and add to a country's GDP. This study looks into how these two income flows affect the income distribution, considering Bangladesh's economy as an example. Much research is available on the remittance-income inequality nexus. The earlier research includes Taylor *et al.* (2005), Koechlin and León (2006), Acharya and Leon-Gonzalez (2012) and Möllers and Meyer (2014), who looked into how remittances affected income inequality and poverty in several economies. The recent research, including Kóczán and Loyola (2018), Azizi (2019), Arapi-Gjini *et al.* (2020), Azizbek *et al.* (2021), Akçay (2022), Ofori *et al.* (2022) and Tung and Thang (2023) also investigated the influence of remittances on income inequality using different control variables in many parts of the world. Following them, we conceptualize the potential effects of remittance inflow on income distribution in Bangladesh.

In contrast, studies on export income and inequality nexus are only a few, while specific studies on RMG export income and income disparity are rare. Aradhyula *et al.* (2007), Cerdeiro and Komaromi (2017) and Demir *et al.* (2012) considered the impact of trade and trade structure on income distribution. Hazama (2017), Hartmann *et al.* (2017), Le *et al.* (2020), Li *et al.* (2022) and Lee *et al.* (2022) examined the effect of export expansion, its complexity and diversification on income inequality. Zhu *et al.* (2020) examined the impact of export product structure, and Bhuyan and Oh (2021) reviewed the impact of RMG export earnings on income inequality. Following these studies, we consider how RMG export income might affect Bangladesh's income distribution. Moreover, we combine these two separate variables and want to examine their probable consequences on the income disparities in Bangladesh.

2.2 Empirical literature

The literature on the effect of personal remittances and export income on income inequality is not plenty. Separate studies are available on the impact of remittance on poverty and inequality and the influence of exports on poverty and inequality. However, to the author's knowledge, hardly any study considers personal remittances, export income and income inequality nexus together. This study is a maiden effort, and we review available pieces of literature and conclude the present study.

2.3 Personal remittance and inequality

Taylor *et al.* (2005) studied the effect of remittances on income inequality and rural poverty in Mexico using household survey data. They demonstrated that remittances improved income distribution and significantly impacted poverty decline in areas where the share of families with emigrants was large. Koechlin and León (2006), using data on 166 countries from 1970

to 2003, employed cross-section OLS and instrumental variable method and examined the personal remittance and income inequality nexus. They exhibited that initially, remittance inflow increased inequality due to the high cost of migration, while at a later stage, it reduced the latter. They also highlighted that spreading education and financial development could help countries reduce inequality.

Acharya and Leon-Gonzalez (2012) investigated the impact of remittance inflow on poverty and inequality in Nepal using micro-level survey data. They reported that remittance had conditional implications on poverty reduction and inequality; it reduced poverty while increasing overall inequality. However, remittance, mainly from India, decreased inequality with the most significant impact on poverty reduction owing to the more prominent involvement of poor residents in the Nepal–India migration process. Using household survey data, Möllers and Meyer (2014) examined the influence of remittance inflow on poverty reduction and income inequality in Kosovo's rural areas. They found that remittance benefited 40% of households to graduate from poverty, and education helped them reach a higher income level. It did not impact the people in acute poverty and enlarged the income inequality.

Kóczán and Loyola (2018) surveyed the effect of foreign remittances on income inequality in Mexico using household survey data. They found that international remittance became pro-poor over time owing to widespread migration prospects, lowered income inequality and reinforced their insurance effects, alleviating some of the negative influences of shocks on low-income people. Azizi (2019) investigated the impact of personal remittances on poverty and income disparity using panel data on 103 developing nations from 1990 to 2014. The study reported that remittances reduced both poverty and inequality in developing nations.

Arapi-Gjini *et al.* (2020) examined the dynamic impact of remittance inflow on poverty and income distribution in Kosovo using cross-sectional household survey data. They found that remittance inflow reduced relative and absolute poverty levels but increased income inequality marginally. Azizbek *et al.* (2021) investigated the influence of remittances on income inequality in 27 post-communist economies using annual panel data from 1991 to 2014. The study applied the fixed effect and system GMM techniques and revealed an inverse relationship between income disparity and remittances for most countries. They further asserted that income inequality followed a U-shaped pattern.

Akçay (2022) looked into the impact of inbound remittances on income disparity in the Philippines, which depends on remittances. This study revealed an inverse U-shaped relationship between inequality and remittances, indicating that remittances had an income-equalizing effect after reaching a certain threshold validating the presence of a remittance Kuznets Curve. Using the dynamic GMM estimator, Ofori *et al.* (2022) examined how remittances and financial development affected income inequality in 42 African countries. They found that remittances widened the income gap in Africa because the continent's financial system could not channel incoming remittances toward income equality.

Using panel data on the ten largest remittance-receiving nations from 1996 to 2019, Islam and Alhamad (2022) looked into the asymmetric effect of individual remittances on EG. They used the pooled mean group technique to find that remittances had positive but asymmetrical effects on EG. In 18 emerging economies between 1985 and 2019, Tung and Thang (2023) looked at how remittances affected inequality. They showed that remittances, along with foreign direct investment, economic liquidity and trade openness, decreased income inequality. However, it was widened by government spending, inflation and GDP per capita. Golder *et al.* (2023), using data between 1988 and 2020 and the NARDL model, examined the nonlinear impact of financial expansion and remittances on EG in Bangladesh. They documented the positive contribution of remittances on EG. Mamun and Kabir (2023) examined the nexus among remittance, FDI, exports and EG in Bangladesh using data from 1976 to 2019 and the "ARDL bounds test." They reported a positive impact of remittance and export on EG.

2.4 RMG export income and inequality

Only a few studies are available on the export and inequality nexus, but studies on RMG export and income inequality are rare. Aradhyula *et al.* (2007) used panel data on 60 developed and developing countries from 1985 to 1994 and explored the influence of trade on income level and its distribution. Trade increased income inequality in the total sample; more specifically, in the developing countries' sample, trade widened inequality, while in developed countries, it was positive but insignificant. Demir *et al.* (2012) examined the impact of trade structure on income inequality using data on 55 developing nations from 1981 to 2005 and urged that if a larger fraction of the population benefited from exports, it reduced income inequality; otherwise, it deteriorated the latter. Moreover, they stated that if the manufacturing industry's employment share was above a particular threshold, a rise in the manufacturing exports' share lessened income inequality.

Jeppesen *et al.* (2015) examined the impact of export performance on poverty lessening using panel data on 78 developing economies from 1996 to 2010. They employed two kinds of poverty measures, e.g. poverty gap and headcount poverty, applied the system GMM method and demonstrated that export income showed no significant impact on poverty reduction. However, exports coupled with credit facilities produced poverty-decreasing effects. Hazama (2017) examined the impact of export expansion on income inequality by employing 70 low-income and 36 high-income developing economies' panel data from 1971 to 2012. The study used fixed effect estimation and reported that the export ratio influenced income inequality negatively in low-income developing economies. At the same time, its impact was insignificant in high-income developing countries.

Cerdeiro and Komaromi (2017) used cross-country geographic characteristics and employed the Poisson pseudo-maximum likelihood technique to estimate the causal relationship between international trade, income level and income inequality. They concluded that trade openness increased countries' long-term living standards, while no evidence was found in favor of improving overall income distribution due to trade openness. Hartmann *et al.* (2017) studied economic change and income inequality in 150 economies during 1963–2008. They argued that a country's complexity of exports determined the extent of economic equality: The more complex a country's products, the greater income equality. Le *et al.* (2020) employed panel data on 90 countries from 2002 to 2014 and examined the linear association between income disparity and export diversification. They found a long-run association between variables and reported that trade openness had a negative effect on income inequality across the countries. Moreover, they found a reversed U-shaped association between export diversification and income inequality.

Zhu *et al.* (2020) looked at the impact of export structure and export destination structure on inequality, particularly on rural disparities in China, using provincial survey data and secondary regional data from Government entities. They revealed that export promotion contributed to inequality reduction only in urban areas as export activities were concentrated in urban areas. In contrast, inequality remained severe in rural areas as there were barriers in the flow of factor inputs from rural to urban areas. Bhuyan and Oh (2021) examined the impact of textile and garment export earnings on income inequality in Bangladesh using the ARDL approach and employing 25 years of data from 1991 to 2015. They demonstrated that export income contributed to broadening income inequality. However, the study and its results are still unreliable, as only 25 years of data were used. No time-series study can be trusted with fewer than 30 data points.

Using the System GMM, Li *et al.* (2022) studied sectoral export diversification's dynamic impact on income inequality while examining export diversification in 19 Asian countries between 2004 and 2017. The findings indicated that sectoral diversification of exports fueled inequality. They also demonstrated that increased export diversification in high-income Asian countries increased inequality but had little effect on low-income economies. Using

quantile regression and panel data from 90 countries between 2002 and 2014, Lee *et al.* (2022) investigated the non-linear linkage between the diversification of exports and income inequality. They demonstrated that export diversification increased inequality in nations with low and moderate levels of income inequality.

The above-cited literature examined the impact of remittances and export income on poverty and income inequality in discrete frameworks, either in a panel setup or a country-specific study. They employed different methods, and their findings remained inconclusive; some revealed a positive impact of inbound remittance and export income on income inequality, while others demonstrated a negative influence on the latter. Even though several studies, including Islam (2021a) and Islam *et al.* (2012), looked at the contribution of remittance earnings to the EG of Bangladesh and South Asia, and many other studies, including Islam (2021b, 2022), looked at the influence of RMG export earnings on EG in Bangladesh, no study has yet been done to examine their impacts on income inequality in Bangladesh. The current research examines the effects of remittance inflow and RMG export income on income inequality in a single framework incorporating EG as a control variable. To the best of the authors' knowledge, this is a maiden attempt to investigate the impact of personal remittances and RMG export income on income inequality in the case of Bangladesh.

2.5 Formulation of hypotheses

Since this is a maiden study investigating the influence of remittance inflows and RMG export income on income inequality in Bangladesh, we formulate the following hypothesis to be validated.

H0. Neither remittance inflow nor RMG export income affects income inequality.

Ha. Remittance inflow affects income disparity negatively, while RMG export income causes it positively.

As remittance directly reaches the migrants' families, they augment their income and will likely minimize income disparities among income groups. In contrast, RMG export incomes flow to high-income industrialists, increasing the prevailing income inequalities.

3. Methodology

An econometric model is formulated in equation (1) to investigate the impact of incoming remittance, income from RMG export and economic growth on the magnitudes of the Gini coefficient.

$$Gini = f(RMG, REM, GDP) \tag{1}$$

Taking the log on both sides of equation (1), we rewrite equation (2). The variables are specified, and Table 1 lists their descriptive statistics.

Variable	Specification	Mean	Max	Min	Std. dev	Obs
LnGini	Natural logarithm (NL) of Gini coefficient	31.35	39.50	25.90	2.99	36
LnREM	NL of remittance inflow in 2015 US dollars	22.14	23.57	20.71	1.00	36
LnRMG	NL of RMG export income at 2015 US dollars	20.11	21.83	15.80	1.55	36
LnGDP	NL of GDP in 2015 US dollars	25.22	26.21	24.43	0.53	36

Source(s): World Bank (2021), BGMEA (2021), Authors' creation

Table 1.
Descriptive statistics

$$LnGini = f(LnRMG, LnREM, LnGDP) \tag{2}$$

The study is grounded on secondary macroeconomic annual data from 1983 to 2018. The Gini coefficient data is available up to 2018, determining the study's data duration [36 years]. Data on the Gini coefficient, remittance inflow, and GDP are collected from the World Bank (2021) homepage, while data on RMG export income is retrieved from the BGMEA (2021) website. Since we use time-series data, available unit-root tests are conducted to verify the desired properties of each series. Based on the stationary features of the series, we employ the Auto-regressive Distributed Lag (ARDL) method by Pesaran and Shin (1995) and Pesaran *et al.* (2001), which is suitable to estimate both the "long and short-term" variations in the dependent variable influenced by the changes in explanatory variables. Moreover, the model also possesses small sample properties.

Moreover, we employ the bounds-test version of the above model. Usually, critical values by Pesaran *et al.* (2001) are employed to ascertain a long-term association among the variables. However, as we use annual data spanning 36 years, the critical values by Narayan (2005) for the F-bounds statistic are used to confirm the long-term association. A long-run association is established if the estimated value of the *F*-statistic is higher than the critical value. The equation of the usual long-term model is delineated below.

$$LnGini_t = \beta_{01} + \sum_{1}^{j} \beta_{1i} LnGini_{t-1} + \sum_{0}^{k} \beta_{2i} LnREM_{t-1} + \sum_{0}^{l} \beta_{3i} LnRMG_{t-1} + \sum_{0}^{m} \beta_{4i} LnGDP_{t-1} + e_{1t} \tag{3}$$

where j, k, l and m are the optimum lag length for each variable following the Akaike Information Criterion (AIC). An error correction model (ECM) estimates the short-term parameters.

$$\Delta LnGini_t = \alpha_{01} + \sum_{1}^{j} \alpha_{1i} \Delta LnGini_{t-1} + \sum_{1}^{k} \alpha_{2i} \Delta LnREM_{t-1} + \sum_{0}^{l} \alpha_{3i} \Delta LnRMG_{t-1} + \sum_{0}^{m} \alpha_{4i} \Delta LnGDP_{t-1} + \delta ECT_{t-1} + e_{1t} \tag{4}$$

The ECM quantifies the rapidity of error adjustment to stability over the long term despite any short-term deviations and pools the short-term constants with long-term constants without forfeiting long-term information. The coefficient [δ] of ECT is a one-period lag value of the residuals of equation (3) that must be negative and significant to endorse the long-term association among the variables. At the same time, the short-term constants are authenticated by their statistical significance.

Lastly, the Toda-Yamamoto (T-Y) (1995) causality study is applied to observe the causal correlation among the variables. The Vector Autoregressive (VAR) system, outlined in equations (5)-(8), is utilized to find their causality.

$$LnGini_t = \alpha_{10} + \sum_{i=1}^{j+d_{max}} \alpha_{1i} LnGini_{t-i} + \sum_{i=1}^{k+d_{max}} \beta_{1i} LnREM_{t-i} + \sum_{i=1}^{l+d_{max}} \gamma_{1i} LnRMG_{t-i} + \sum_{i=1}^{m+d_{max}} \delta_{1i} LnGDP_{t-i} + e_{1t} \tag{5}$$

$$LnREM_t = \alpha_{20} + \sum_{i=1}^{j+d_{max}} \alpha_{2i} LnGini_{t-i} + \sum_{i=1}^{k+d_{max}} \beta_{2i} LnREM_{t-i} + \sum_{i=1}^{l+d_{max}} \gamma_{2i} LnRMG_{t-i} + \sum_{i=1}^{m+d_{max}} \delta_{2i} LnGDP_{t-i} + e_{2t} \quad (6)$$

$$LnRMG_t = \alpha_{30} + \sum_{i=1}^{j+d_{max}} \alpha_{3i} LnGini_{t-i} + \sum_{i=1}^{k+d_{max}} \beta_{3i} LnREM_{t-i} + \sum_{i=1}^{l+d_{max}} \gamma_{3i} LnRMG_{t-i} + \sum_{i=1}^{m+d_{max}} \delta_{4i} LnGDP_{t-i} + e_{3t} \quad (7)$$

$$LnGDP_t = \alpha_{40} + \sum_{i=1}^{j+d_{max}} \alpha_{4i} LnGini_{t-i} + \sum_{i=1}^{k+d_{max}} \beta_{4i} LnREM_{t-i} + \sum_{i=1}^{l+d_{max}} \gamma_{4i} LnRMG_{t-i} + \sum_{i=1}^{m+d_{max}} \delta_{4i} LnGDP_{t-i} + e_{4t} \quad (8)$$

4. Result and discussion

4.1 Unit-root test result

The outcomes of the unit root tests are exhibited in Table 2. They show that the variables are stationary in a different order, integrated at I(1) and I(0) orders. Notably, the dependent variable LnGINI is stationary at the first difference, which makes us comfortable employing the ARDL approach.

4.2 ARDL estimation outcomes

Since the variables are of different integrating order and the dependent variable is of order I(1), we can directly employ the ARDL cointegrating approach to estimate long-term relationships among them. The model also provides a short-term relationship among variables at the same time. The model ARDL (1, 4, 3, 2) is selected using the Akaike info criterion (AIC) with a maximum of 1 dependent lag and 4 dynamic regressors lags. The

Variable	ADF	ERS	PP	KSSP
LnGINI	−2.0631	−2.1967	−1.8332	0.1336
LnGDP	0.1493	−0.6511	0.8021	0.2195
LnRMG	−5.1308***	−0.9302	−5.6549***	0.2027
LnREM	−2.3515	−1.7042	−2.2771	0.1123*
Δ(LnGINI)	−3.9656**	−4.1145***	−3.9656**	0.1175*
Δ(LnGDP)	−5.7513***	−2.8528**	−5.4979***	0.0673*
Δ(LnRMG)		−1.4704		0.1588
Δ(LnRMG, 2)				0.1028*
Δ(LnREM)	−4.4717***	−3.5909**	−4.4715***	–

Note(s): ***$p < 0.01$, **$p < 0.05$ and *$p < 0.10$
Source(s): Created by authors

Table 2. Outcomes of unit-root test

estimated results of the F-bounds test and the long-term relationship of the model mentioned above, using equation (3), are outlined in Table 3.

The F-bounds test version of the ARDL model generates a value of the *F*-statistic of 7.495, which is higher than the critical values at the 5% level at different order conditions. Thus, a long-run association among the variables is established.

The coefficient of LnGINI is significantly positive, indicating income inequality's repercussive impact on it. The lag values of it cause further disparities in income distribution. This outcome mainly signifies the autoregressive characteristic of the model. The finding has a policy implication to curtail the gap between various income groups to build a balanced society. To this end, policymakers should rationalize the existing uneven NPS system of the country; the existing 20 grades should be reduced to an acceptable level, and the salary gaps among these grades must also be minimized to construct a harmonious and homogenous society.

LnREM and its four lags have produced mixed coefficients; of them, the coefficient LnREM(−4) is negative and significant. It demonstrates that remittance inflow directly influences income distribution and reduces income inequality in the country. Most international out-migrants from the country are from low and middle-income groups, and

F-bounds test result Sample size	Test statistic	Value	Significance (%)	I(0)	I(1)
36◆◆	*F*-statistic	7.495	10	3.800	4.888
	k		5	4.568	5.795
			1	6.380	7.730

Variable	Coefficient	Std. error	*t*-statistic	*P*-value
LnGINI(−1)	0.9145	0.1261	7.2514	0.0000***
LnREM	−0.1066	0.0831	−1.2817	0.2172
LnREM(−1)	0.0604	0.0976	0.6190	0.5441
LnREM(−2)	−0.0409	0.0907	−0.4519	0.6570
LnREM(−3)	0.1266	0.1205	1.0501	0.3084
LnREM(−4)	−0.2766	0.1288	−2.1466	0.0466**
LnRMG	0.1298	0.0542	2.3953	0.0284**
LnRMG(−1)	0.1849	0.1222	1.5120	0.1489
LnRMG(−2)	−0.1572	0.1008	−1.5589	0.1374
LnRMG(−3)	−0.0828	0.0372	−2.2240	0.0400**
LnGDP	−0.5422	0.6769	−0.8010	0.4342
LnGDP(−1)	0.5274	0.8399	0.6278	0.5385
LnGDP(−2)	1.1954	0.5839	2.0473	0.0564*
C	−25.0082	6.8292	−3.6619	0.0019***
@TREND	−0.0397	0.0153	−2.5869	0.0192***
R-squared	0.9378	Durbin–Watson stat	2.4156***	
Adj. *R*-squared	0.8866	*F*-statistic	18.3124***	

Diagnostic test	Test statistic	*P*-value
Jarque-Berra	3.8437	0.1463
Serial Correlation LM Test	4.9578	0.0838
Hetroscedasticity	19.88533	0.1338
Cusum	Stable◆	
Cusum of squares	Stable◆	

Note(s): ***$p < 0.01$, **$p < 0.05$ and *$p < 0.10$; ◆◆ Courtesy of Narayan (2005) for $n = 35$

Table 3.
Long-term ARDL (1, 4, 3, 2) model outcome

their remittances directly go to their families, enhancing their family incomes and consumption. Consequently, they have a direct impact on income inequality to decline. The outcome reinforces the findings of Taylor *et al.* (2005), Koechlin and León (2006), Kóczán and Loyola (2018), Azizi (2019), Azizbek *et al.* (2021), Akçay (2022), Ofori *et al.* (2022) and Tung and Thang (2023), who revealed the mitigating role of remittances on income inequality, while contradicts with Acharya and Leon-Gonzalez (2012), Möllers and Meyer (2014) and Arapi-Gjini *et al.* (2020) who highlighted the contributory impression of remittances on the latter. The finding validates the alternative hypothesis that remittance inflow helps mitigate income disparity and has managerial implications to tap available opportunities abroad and export more workforce to attract more remittances, which may require upgrading the skills of migrating workers and facilitating a friendly environment for them.

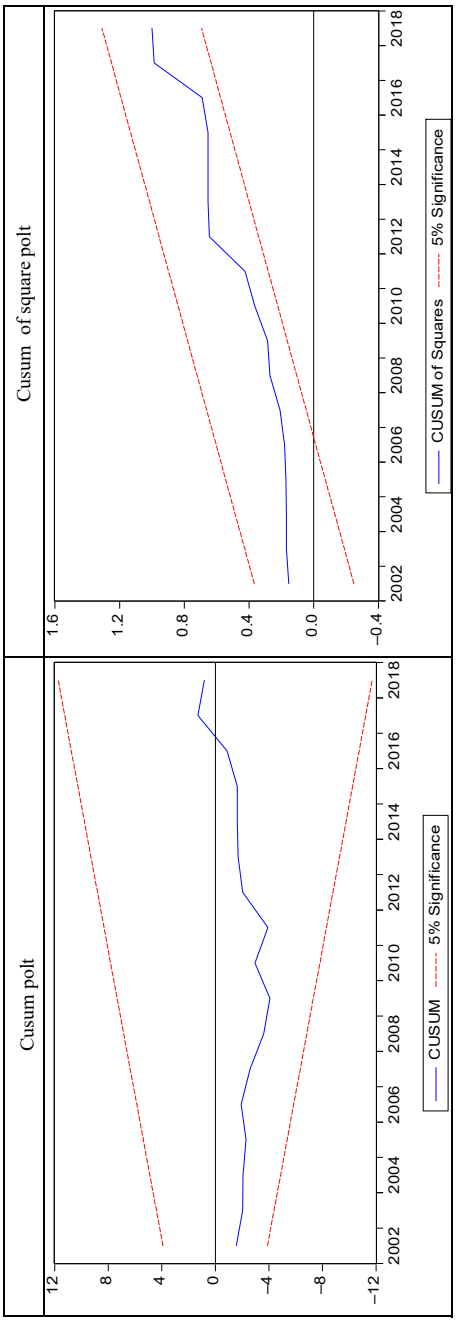
LnRMG and its three lags exhibit mixed coefficients; LnRMG and LnRMG(−3) have documented different and significant coefficients. The resultant magnitude of the two coefficients is positive [0.1298–0.0828 = 0.047], indicating a contributory impact of RMG export income on income inequality. That is, RMG export earnings increase the value of the Gini coefficient, exacerbating income inequality. Despite the handsome amount of RMG export earnings, millions of workers in this sector cannot improve their economic status and remain incapable of meeting their necessities of life owing to the historically low salary in the RMG industry. There has been a historical gap between the actual minimum wage paid and the minimum salary required to meet the basic needs of workers' lives (Kibria, 2018; Moazzem, 2019). Thus, RMG export income contributed to EG and favored the owners of the RMG firms, contributing negatively to uplifting the workers from poverty and economic misery.

The finding authenticates the alternative hypothesis that RMG export earnings augment income inequality and endorses Bhuyan and Oh (2021), who concluded that RMG export income enlarged inequality in Bangladesh. However, this outcome contradicts Aradhyula *et al.* (2007), Hazama (2017), Le *et al.* (2020), Zhu *et al.* (2020), Li *et al.* (2022) and Lee *et al.* (2022), who reported positive contribution of export, trade and export diversification to reducing income inequalities. Moreover, the outcome of this current study also differs from that of Jeppesen *et al.* (2015) and Cerdeiro and Komaromi (2017), who found no significant impact of export income on income inequality. The finding has important policy implications for raising the minimum wage of the RMG workers to enhance their living standard and implement some mechanism to minimize the income differentials.

LnGDP and its two lags put forth mixed coefficients; of them, only the constant of LnGDP(−2) is positive, enormous and significant, indicating a strong positive impact on income inequality; as economic growth occurs, income equality worsens. The outcome aligns with Tung and Thang (2023), who revealed GDP's contributing effect on income disparity. The finding shows that the benefit of EG is not trickling down to lower-income groups but instead going to the pockets of a high-income group of society. Hence, government intervention is imperative to resort to fiscal and administrative measures to channel a share of incremental income to lower-income people.

4.3 Diagnostic test outcomes

The long-term ARDL model must meet some properties, such as its residuals following a normal distribution, no autocorrelation, no heteroscedasticity and be stable. The diagnostic test outcomes are reported in the lower part of Table 3 to assess these properties. The stability test outcomes, i.e. Cusum and Cusum of squares plots, are provided in Figure 4. According to the test outcomes and diagnostic test results, the estimated long-term ARDL model maintains all desirable properties; hence, the variables have long-run relations.



Source(s): Created by authors

Figure 4.
Cusum and Cusum of square plots

4.4 Short-term model estimation

The short-term constants of the ARDL (1, 4, 3, 2) model following the ECM and equation (4) are estimated and exhibited in Table 4.

In the short term, remittance inflow has mixed impacts on the Gini coefficient. Still, its overall effect is positive [(−0.1066 + 0.1910 + 0.1500 + 0.2766) = 0.511], meaning that, unlike long-term, it causes income inequality to rise in the short term.

The stimulus of RMG export income on the Gini coefficient is straightforwardly positive and similar to the long run; it enhances income inequality in the short run.

Economic growth does not influence the Gini coefficient in the short run, though it significantly impacts the latter in the long term.

The coefficient of ECT is negative and significant, confirms the long-run association among the variables and indicates recovery from any short-term deviation to long-term stability at the rate of 8.28% per annum.

4.5 T-Y causality outcomes

The VAR lag order selection principle is applied to determine d_{max} (order of integration). Based on the AIC, the optimum order $d_{max} = 2$ is selected. Moreover, the ideal lag time of the variables is determined as 2, based on the KPSS stationary test outcome reported in Table 2. Eventually, the T-Y causality assessment is conducted concerning equations (5)-(8), using $d_{max} = 2$ and $k = 2$, and the outcomes are demonstrated in Table 5.

The outcomes reveal one feedback and three unidirectional causalities. The feedback relationship exists between remittance inflow and the Gini coefficient [LnREM ↔ LnGINI]. Personal remittances cause the Gini coefficient to hold down, raising the remittance-receiving families' income status, subsequently enabling them to gain further remittances. This indicates a unique migratory feature of Bangladesh's economy: inbound remittance enhances some families' income status and lifts them from poverty; it creates a demonstration effect among the other families in the society. Consequently, others get self-motivated to migrate to earn and change their fate.

The first unidirectional causation prevails from RMG export income to the Gini coefficient [LnRMG → LnGINI], indicating that the inflow of RMG export earnings causes income inequality. Such income directly flows to the firm owners [high-income group], augments

Variable	Coefficient	Std. error	*t*-statistic	*P*-value
C	−25.0082	4.2110	−5.9388	0.0000***
@TREND	−0.0397	0.0068	−5.7996	0.0000***
Δ(LnREM)	−0.1066	0.0519	−2.0522	0.0559*
Δ(LnREM(−1))	0.1910	0.0632	3.0194	0.0077***
Δ(LnREM(−2))	0.1500	0.0630	2.3805	0.0293**
Δ(LnREM(−3))	0.2766	0.0689	4.0116	0.0009***
Δ(LnRMG)	0.1299	0.0614	2.1150	0.0495**
Δ(LnRMG(−1))	0.2399	0.0542	4.4230	0.0004***
Δ(LnRMG(−2))	0.0828	0.0404	2.0500	0.0561*
Δ(LnGDP)	−0.5422	0.8159	−0.6645	0.5153
Δ(LnGDP(−1))	−1.1954	0.8449	−1.4147	0.1752
ECT	−0.0855	0.0144	−5.9390	0.0000***
R-squared	0.7049	Durbin–Watson stat		2.4156***
Adj. *R*-squared	0.5425	*F*-statistic		4.3424***

Table 4.
ECM estimation

Note(s): ***$p < 0.01$, **$p < 0.05$ and *$p < 0.10$
Source(s): Created by authors

Hypotheses	Chi-sq	df	*P*-value	Decision
LnREM does not cause LnGINI	14.93417	4	0.0048***	LnREM ↔ LnGINI
LnGINI does not cause LnREM	8.2993	4	0.0812*	bidirectional
LnRMG does not cause LnGINI	9.1638	4	0.0571*	LnRMG → LnGINI
LnGINI does not cause LnRMG	1.0951	4	0.8951	unidirectional
LnGDP does not cause LnGINI	20.9009	4	0.0003***	LnGDP → LnGINI
LnGINI does not cause LnGDP	0.3616	4	0.9855	unidirectional
LnGDP does not cause LnRMG	9.7621	4	0.0446**	LnGDP → LnRMG
LnRMG does not cause LnGDP	5.0857	4	0.2786	unidirectional

Note(s): ***$p < 0.01$, **$p < 0.05$ and *$p < 0.10$
Source(s): Created by authors

Table 5.
T-Y causality outcomes

their income and workers [low-income group] receive only a meager fraction that is insufficient to maintain their basic life needs to be documented by the RMG industry's low-salary structure. Thus, it widens the income gaps among people, resulting in income inequalities.

The second unidirectional causality exists from economic growth to the Gini coefficient [LnGDP → LnGINI], revealing the influence of economic growth on income inequality. It evidences that growth is not inclusive and sustainable; the benefits of growth are not suitably distributed among the various income groups, favoring the upper section of society and broadening the existing income gaps among people. These above causalities directly verify the ARDL estimation outcomes and substantiate their robustness. The third and last one-way causation occurs from economic growth to RMG export income [LnGDP → LnRMG], demonstrating a growth-led export notion for the economy.

5. Conclusion

The study has explored the impact of personal remittance inflow, RMG export income and economic growth on income equality in Bangladesh using 36 years of annual data from 1983 to 2018. The ARDL approach to cointegration and the T-Y causality check are employed to accomplish the study.

The ARDL estimation outcomes confirm a long-run association among the above variables and validate the autoregressive characteristic of the model. The lag values of the Gini coefficient are found to cause income inequality. Personal remittances have emerged as an essential source of foreign income for the economy of Bangladesh; they directly reach their recipients, enlarge their income, positively contribute to income distribution and consequently help to reduce income inequality in the country. Thus, remittance inflow positively contributes to lowering the income gap among the people of the society and declining income inequality.

RMG export income has been the largest source of foreign income, as evidenced in the preceding analysis. This income is directly channeled to the owners of the RMG firms, who belong to the high-income group; as a result, their incomes are augmented. By contrast, the millions of workers in the RMG industry receive a salary far below their basic needs requirements. Consequently, they merely survive and cannot grow in income, making enough room to diminish the income gap between the low-income and high-income groups, causing ultimate income inequality. Thus, the impact of RMG export income on income disparity is contributory, i.e. it widens economic inequality. The effect of economic growth on income difference has been positive and strong; as income grows, incremental income goes more to high-income groups, deteriorating income equality.

The T-Y causality analysis follows the ARDL estimation outcomes. It reveals a feedback relationship between remittance inflow and the Gini coefficient; remittance inflow causes income inequality to decline, spurs additional migration and attracts further remittances. Similarly, unidirectional causation occurs from RMG export income to income inequality, showing the increasing impact of RMG export earnings on income inequality; i.e. it enhances the income gaps among people, resulting in income inequalities. A one-way causality also happens from economic growth to income inequality, revealing a direct impact of economic growth on income inequality. Thus, economic growth appears to be non-inclusive and unsustainable, as the benefits of growth are not trickled down across society, particularly to the low-income population.

The finding has significant policy ramifications for the policymakers and government of Bangladesh. In the short-term, they should tap existing opportunities abroad and export more workforce to attract further remittances, which might necessitate upgrading migrant workers' skills and creating a welcoming environment for them. The minimum wage of the RMG workers should be raised to enhance their living standard and implement some mechanism to minimize the income differentials.

In the medium and long term, the government should take financial and administrative action to channel a share of incremental income to lower-income people. A more balanced and sustainable society should be materialized by minimizing income gaps between various income groups. This will require the policymakers to rationalize the prevailing bumpy NPS system, reduce the too many employment grades to an acceptable level and minimize the salary gaps among these grades.

5.1 Limitations and future research direction

The country-specific study considers the impact of remittance inflow, RMG export income and economic growth on income equality. Future studies may consider other control variables like trade, foreign direct investment or other econometric methods. Similar studies may be conducted in other countries or groups of economies, even considering panel estimation techniques.

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