SOUTH ASIAN JOURNAL OF SOCIAL SCIENCES & HUMANITIES

ISSN: 2582-7065 (Online) SAJSSH, VOL 5, ISSUE 5, PP. 91-113

Financial Development and Income Inequality in Bangladesh: Empirical Evidence from Vector Auto-Regression (VAR) Model

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Received: 18th July 2024 **Accepted:** 13th September 2024 **Published:** 5th October 2024

ABSTRACT

This study investigates the effect of financial development on inequality in Bangladesh. We run a vector autoregressive (VAR) model for the economy of Bangladesh from 1980 to 2020. Using the impulse response functions (IRFs), we find that the disposable income and market income Gini coefficients respond positively to private credit. It suggests that financial development contributes to raising inequality in Bangladesh. We also find that growth has an adverse impact on inequality whereas income inequality has a positive effect on economic growth. However, economic growth has a greater and more pronounced negative effect on inequality than inequality itself, even though these two variables exhibit opposite interaction responses. It indicates that growth lowers inequality in Bangladesh.The forecast error variance decomposition function shows that private credit can explain the variations of disposable income Gini by 8.65 percent; on the other hand, disposable income Gini can explain the variation of private credit by 8.90 percent.

Keywords: financial development, income inequality, private credit, economic growth

JEL Codes: E44, E24, E51, E23

DOI: 10.48165/sajssh.2024.5505

INTRODUCTION

One of the most important concerns facing economists and policymakers in the recent past is the rise in income inequality. Similar to other developing countries, Bangladesh experienced a rise in income disparity (Alvaredo et al., 2018). Scholars typically identify several causes for the rise in inequality, such as institutional changes, globalization, and technological advancement (Jaumotte et al., 2013). A few researchers concentrate their research on the function of financial development. Examining the relationship between financial development and inequality is crucial for the expansion of credit and the growing importance of the financial sector to the economy.

However, the finance-inequality nexus is an ongoing debate. There exist multiple theoretical frameworks regarding the correlation between finance and inequality. On one hand, by encouraging effective capital allocation and easing the financial constraints for the poor, financial sector development could lessen inequality (Galor & Zeira, 1993). On the contrary, credit expansion promotes financial rent and inequality (Rajan & Zingales, 2003). A nonlinear relationship could result from it too depending on the degree of financial development (Greenwood & Jovanovic, 1990). These claims are tested in numerous studies; however, the findings are mixed and conflicting. Financial development has linear positive and negative effects on income inequality (Beck et al., 2007; Jauch & Watzka, 2016) as well as nonlinear U-shaped and inverted U-shaped effects (Brei & Ferri, 2018; Nikoloski, 2013).

This study examines how finance affects income inequality in Bangladesh. It uses the vector autoregression (VAR) model for the period from 1980 to 2020. We contribute to the existing research by investigating the impact of finance on inequality using a longer time dataset. Most of all, we explore how financial development affects the Gini coefficients for market and disposable income. Our findings indicate that Gini coefficient responds positively to private credit, indicating that private credit exacerbates income disparity in Bangladesh. This research implies that income distribution is adversely impacted by the banking sector development.

The rest of the paper is organized as follows: The reasons regarding how financial development could impact income inequality are presented in the next section, which also evaluates relevant theoretical frameworks and empirical research in the field. The econometric approach, model, and data are discussed in section III. Section IV presents our empirical find-

DOI: 10.48165/sajssh.2024.5505

ings of the finance-inequality nexus. Section V recommends some policy proposals and concludes the study.

LITERATURE REVIEWS

What Theories Say

There are three divergent theories on the association between financial development and inequality. First, financial Kuznets curve dynamics are extended by Greenwood and Jovanovic (1990) in a model where the degree of credit market development determines the relationship between finance and income inequality. In an economy, there are two production technologies: one that provides a low-risk and safe return, and the other that offers a higher return on a riskier investment. By collecting and evaluating data on an unsafe and risky investment, financial sector development identifies an aggregate shock to technology and mitigates an idiosyncratic shock through risk diversifications. Both insiders and outsiders can function as agents, where the outsider agents have to bear a larger transaction cost. Therefore, at the early stage, financial intermediation primarily benefits insiders only, which increases inequality. Later the unbanked but potential entrepreneurs can access financial services and borrow money for investments with higher expected returns, which would spur quicker growth. People from the very bottom strata have access to financial services and investment opportunities in the mature stage. After that, income inequality starts to go down.

Second, the investment in human capital is the main topic of the argument of Galor and Zeira (1993). According to their hypothesis, the agent who has inherited more money invests in human capital, turning them into highly trained workers. The agent with less inheritance, however, continues to perform unskilled labor. Thus, intergenerational income disparity is perpetuated as the income inequality eventually converges to a high-income steady state and the poor eventually converge to a low-income steady state. However, credit market expansion makes credit easier for the poor. Therefore, less inherited agents can borrow money and make investments in human capital, which raises their income levels. As a result, over time, inequality has decreased.

Most likely, the model of occupational choice presented by Banerjee and Newman (1993) is contingent on credit availability. An indivisible and high-return investment is only accessible to the wealthy due to borrowing restrictions and imperfections in the capital market. However, the impoverished have easier access to credit in an improved and well-developed credit

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market. They can launch a new company and invest in human resources. This lowers the income gap between the rich and the poor by raising the income of the poor.

Third, Rajan and Zingales (2003) argue that well-established and large industries get benefits from private credit in the early stage of financial access due to their privilege. They suggest an alternative hypothesis from the preceding research. These affluent incumbents block newcomers from obtaining credit even as the financial sector develops because they fear losing their advantage of positioning advantage and borrowing reputation. Banks conduct relationship banking with the current corporate clients. The essence of relationship banking is the capacity to monopolize funding to the customer through a friendly cartel among bankers or a monopoly over firm-specific information. Because of their shared interest in the economies, these industrial incumbents as a whole suppress competition in the banking industry.

Similarly, Demirguc-Kunt and Levine (2009) argue that enhanced financial services for current high-income clients could increase inequality as a result of financial development. More recently, it has been suggested that in financially developed economies, the primary cause of rising income at the top percentile is that the bankers are getting large amounts of payment and the extraction of surplus rent (Stiglitz, 2016).

According to the aforementioned theoretical framework, we believe that, as argued by Rajan and Zingales (2003), private credit raises income inequality in Bangladesh through monopolized and cartel relationship-banking between bankers and existing incumbents' large corporations.

Empirical Studies

Despite the fact that a great deal of empirical research looks at the connection between finance and inequality, the findings on the matter are divided (see Appendix A1). First, using different Gini datasets, Beck et al. (2004) investigated the connection between financial development and the rise of the Gini coefficients. They empirically showed a negative and linear relationship between inequality and private credit. Later their cross-country analysis and GMM estimation validate their earlier findings (Beck et al., 2007).

Following this initial study, several researchers carried out empirical studies spanning a longer period and additional sample countries; however, the results were mixed. According to Clarke et al. (2006), inequality is negatively impacted by financial development in a linear

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fashion. Jauch and Watzka (2016), in contrast, discover that finance has an inverted U-shaped influence on inequality that is both nonlinear and linearly positive. Unlike earlier studies that indicate a linearly negative association between them, more current studies use Gini coefficients from the Standardized World Income Inequality Database (SWIID) by Solt (2020). According to de Haan and Sturm (2017), the banking crisis, financial liberalization, and financial development all contribute to rising inequality. Kim and Lin (2011) present a nonlinear inverted U-shape impact using threshold regressions and the 2SLS. They showed that private credit raises inequality below a threshold value and decreases inequality above the threshold. Nikoloski (2013) showed a nonlinear inverted U-shape relationship between finance and inequality. They use the GMM estimates with five-year panel data from 1962 to 2006.

Conversely, a U-shaped association between financial progress and inequality is reported by Brei et al. (2018). It suggests that while finance increases inequality in financially developed economies, it decreases poverty and inequality in financially poor nations. The system GMM results of Tan and Law (2012)most likely point to a U-shaped relationship between financial development and inequality. The U-shape association is also confirmed by Cuesta-González et al. (2020). A U-shaped effect is also reported by Park and Shin (2015). Their findings imply that nations with better institutions and high educational levels also have lower levels of inequality during financial development.

Numerous researches reported that finance has a conditional impact on inequality. Law et al. (2014), for instance, demonstrate that when institutional quality exceeds a certain threshold, financial development has a negative impact on inequality. Financial development, according to Chen and Kinkyo (2016), raises inequality in the short term but decreases it over time. The negative short-term impact is linked to a lack of good governance. Financial development lowers inequality in financially closed countries but raises it in financially open countries, according to Kuniedaet al. (2014). Furthermore, Benczúr and Kvedaras (2021) find that the difference between the interest rate and economic growth determines the impact of domestic credit on inequality. Bank loans make inequality worse when lending rates are higher than growth rates; on the other hand, if growth exceeds lending rates, inequality is reduced.

Finally, research indicates that when financial development is high, employee income in the financial industry rises. This suggests that inequality and excessive finance are positively correlated. According to Philippon and Reshef (2012), financial sector employees in the US

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economy make significantly more money than those in the private sector with a comparable degree of education. The employees of the financial sector are generally the top earners in the United States, according to Kaplan and Rauh (2010). Boustanifar et al. (2014) reported that there is a significant correlation between general inequality and higher wages in the finance industry.

While there isn't any empirical research on the connection between income inequality and private credit in Bangladesh, there are a few studies that aim to explain the trend in inequality through factors like inflation, public education spending, trade and financial globalization, remittances, economic growth, and remittances. Economic growth has accelerated in Bangladesh, but inequality has gotten worse (Chowdhury & Hossain, 2017). According to Arif and Saeduzzaman (2015), remittances and foreign direct investment lower income inequality, while trade openness does the opposite. According to Karim (2015), funding for public education lowers inequality. Using a vector auto-regression (VAR) model, Nath and Mamun (2007) find that, between 1971 and 2000, wage inequality increased as a result of trade openness. Widening income inequality in rural Bangladesh has been attributed mostly to the remittances from overseas wage earners (Osmani & Sen, 2011). Salahuddin et al. (2014) indicate that financial development contributes to poverty reduction, albeit its impact is nonlinear, using the ARDL model from 1975 to 2011. According to Ferdousi and Dehai (2014), income inequality in Bangladesh has increased due to both general and food inflation. Financial development lowers poverty in two ways: directly by giving the poor more access and savings opportunities, and indirectly by fostering economic growth.

However, the process of reducing poverty in Bangladesh is negatively impacted by financial instability (Abdin, 2016). In Bangladesh, funding on public education lowers income inequality. To the best of our knowledge, no thorough empirical analysis has been done on how private credit affects inequality in Bangladesh. Therefore, we use the Gini coefficients as inequality measures and empirically examine the effect of private credit on inequality in Bangladesh.

METHODOLOGY

Model Specification

Using the vector auto-regression (VAR) model, we examine the interactive dynamic feedback relationship between GDP per capita as a growth measure, the Gini coefficient, and credit

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disbursed by banks to the private sector as a measure for financial sector development. As we know well, the main issue with single-equation estimation is the endogeneity problem. We may assume that rising inequality may be caused by GDP per capita and private credit. There is a problem with reverse causality between financial development and inequality as well as between inequality and growth measures, meaning that any change in an inequality measure could potentially have the opposite effect on growth and financial development. Additionally, the direction of their reactions may alter if there is any feedback response between the variables. This bi-directional causality was not taken into account in earlier inequality research. They employed single equation models and disregarded the endogeneity issue. On the other hand, VAR model dynamic feedback reactions between variables allow it to investigate this reverse causality. It can therefore be used to resolve the endogeneity problem in time series regressions. Moreover, it may readily add time variations in impulse or shocks, account for dynamic heterogeneities; it may consider the relationship of the variable in an unrestricted manner, and capture both static and dynamic inter-dependencies (Canova & Ciccarelli, 2013). An endogenous variable variation can be explained by a variance decomposition matrix.

Furthermore, the VAR estimate is impartial and consistent with a set period, which matches our sample size and time frame. The VAR model has been employed in recent empirical studies on inequality to examine the relationships between macroeconomic variables, including growth, finance, and income disparity (Atems & Jones, 2015; Góes, 2016; Jeong & Kim, 2018). Moreover, we employ a VAR model that is predicated on the subsequent system equation (Abrigo & Love, 2016):

$$Y_t = Y_{t-1}A_1 + Y_{t-2}A_2 + \cdots + Y_{t-p+1}A_{p-1} + Y_{t-p}A_p + X_t\beta + \mathrm{u}_t + e_t \quad (1)$$
$$t \in \{1,2,\ldots, T\}$$

where Y_t is a *(1xk)* vector of dependent variables; X_t is a *(1xl)* vector of exogenous covariates; u_t is a vector of dependent variable-specific fixed effect and e_t is idiosyncratic error-term. The *k x k* matrices A_1, A_2, …, A_{p-1}, A_p and *lxk* matrix *B* are parameters to be estimated. It is worthwhile to discuss about the choice and arrangement of variables in the benchmark model prior to completing the model specifications. Even while the variables we are mainly interested in are financial development and income inequality, we also assume that finance, inequality, and growth metrics are related at the same time. These variables are taken into account in this benchmark model. Income distribution should be impacted by the rate of growth, as indicated by GDP per capita. Similarly, the initial income may also have an impact

DOI: 10.48165/sajssh.2024.5505

on the degree of financial development. The distribution of income and the rate of financial development could be impacted by any changes in economic growth. However, it could take some time for changes in financial development and inequality measures to have an impact on GDP per capita. In light of this, we create the tri-variate model that follows:

The baseline model: X_t=(LNGDPpc, DGINI, PRICREDIT)

This is the baseline model, where the natural log of real GDP per capita (LNGDPpc) is measured in constant US dollars in 2017. It is the proxy of growth measure. DGINI is the disposable income Gini, and PRICREDIT is the private credit of depository money banks and other financial institutions. In some estimates, DGINI is replaced by MGINI (market income Gini) in this model. We assume that the impact of finance may change with globalization and macroeconomic developments. Hence we augment the tri-variate model to a multi-variate augmented model by alternatively adding trade openness, government consumption spending, and inflation (Jeong and Kim, 2018; Kunieda *et al.*, 2014; Lee, 2014):

Augmented Model 2: X_t= (LNGDPpc, TRD, DGINI, LNPRICREDIT)

Data and Variables

First, we employ the disposable and market income Gini coefficients from the most recent SWIID version 9.1 (Solt, 2020). It has a lot of observations and a wider coverage. The Gini coefficient has risen in Bangladesh during the 1980s.

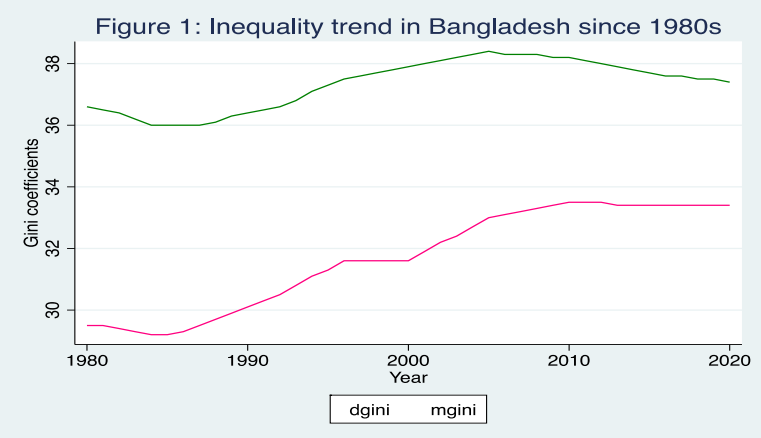

Figure 1: Gini coefficients of both disposable and market incomes in Bangladesh
Source: SWIID (Solt, 2021)

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As a measure of financial development, this study uses private credit provided by deposit money banks and other financial institutions, the most often used measure of financial development. Private data are gathered from the GFDD (WB, 2022). Data on private credit spans the years 1980 to 2020. Figure 2 illustrates the wide range in the degree of financial development. Since 1995, the credit market has grown. The private credit in Bangladesh expanded quickly until 2018, at which point it began to decline.

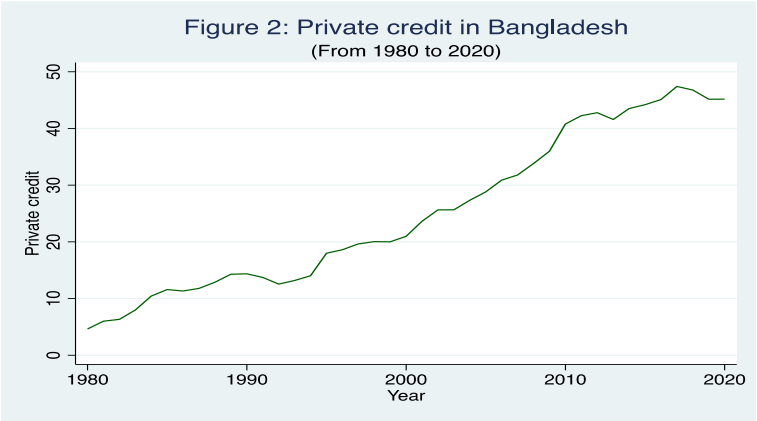


Figure 2: Private credit in Bangladesh.
Source: The GFDD of World Bank (2022)

Moreover, in line with other research (Beck et al., 2007;Čihák & Sahay, 2020; Jauch and Watzka, 2016), additional control variables including trade openness, government consumption spending, and inflation are included to highlight the effects of the macroeconomic environment and international trade. Total export plus import of goods and services divided by GDP is trade openness. Last but not least, all current spending on the acquisition of goods and services is included in government consumption spending. The consumer price index represents inflation. The World Development Indicator is the source of the data for these variables (WB 2022).

An overview of the variables used in this investigation is provided in Table 1. Since financial private credit has a very large standard deviation, we logarithmically converted private credit to lessen the heteroskedasticity of standard errors.

Table 1: *Descriptive statistics*

Variable	Obs	Mean	Std. dev.	Min	Max
Disposable income Gini	41	31.70	1.62	29.20	33.50
Private credit (logarithm)	41	3.05	0.64	1.53	3.86
GDPpc (logarithm)	41	6.56	0.41	6.05	7.37

DOI: 10.48165/sajssh.2024.5505

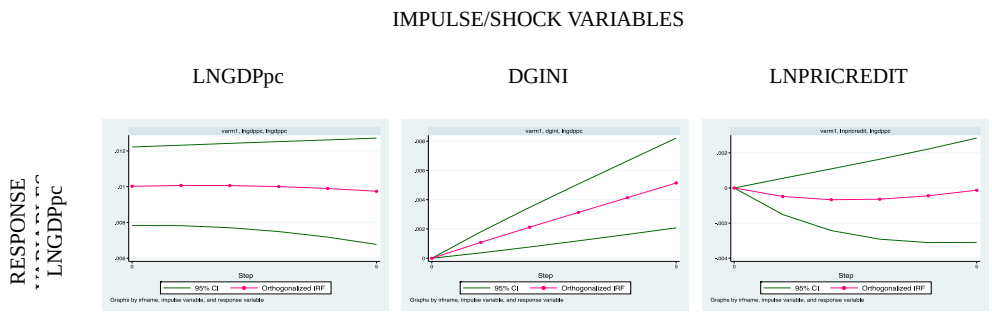
Trade openness	41	23.73	14.59	8.54	48.27
Government consump. spending	41	4.97	0.61	4.03	6.24
Inflation	41	6.98	3.92	0.16	19.14

EMPIRICAL RESULTS

Impulse Response Functions

The impulse response function (IRF) of econometric analysis is reported in this section. First, we report the empirical findings of the IRF in the baseline model; afterward, we describe the response function of the Gini coefficient of market income by replacing disposable income Gini with respect to private credit and growth; finally, we discuss the IRF of inequality to private credit after incorporating trade, government consumption spending and inflation in the augmented VAR model. Since the baseline model contains 40 annual observations, we employ Monte Carlo simulation with 200 repetitions spread across five periods to derive the IRFs. This is done by running VAR regressions. The response function shows how the variables in this study interact with each other. Every variable responds to itself and others to an increase of one standard deviation.

Figure 3 shows impulse responses over 5 years with a 95% confidence interval for the baseline estimate, which contains 40 observations over 1980-2020. The variables used in this study are arranged as follows: LNGDPpc, DGINI, and LNPRICREDIT. It consists of the 3 by 3 interactive matrix. Thus it produces nine dynamic interactive IRFs of a tri-variate model. The impulse variable is represented in each column; while the response variable is reported in each row. For instance, *DGINI in row-2* and *LNPRICREDIT in column-3 in figure-3* represent the IRF line of disposable income Gini to a rise of one standard deviation of private credit. The rest of the IRF graph is described in the same fashion.



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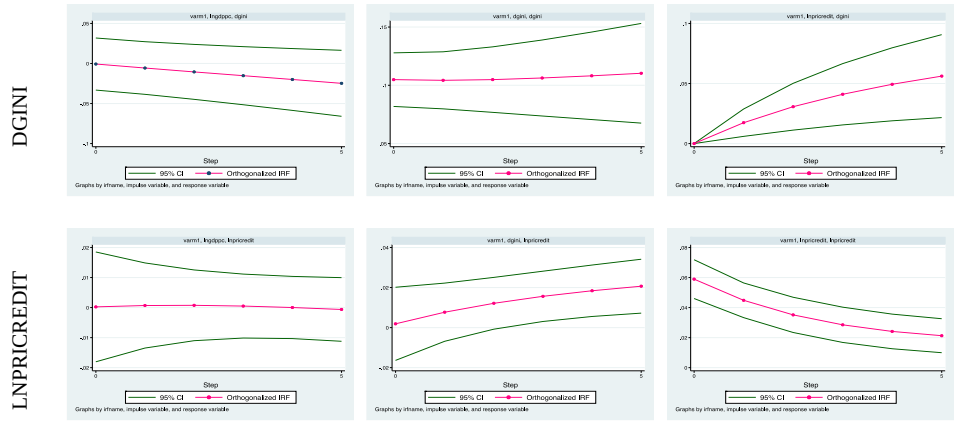

Figure 3: Impulse response functions of the baseline model

Note: *the green line indicates the impulse responses at 95 percent probability bands and the pink line indicates IRFs*

In response to its own impulse *(row-3 column-3),* private credit starts to decline and eventually returns to the zero pathways over time. The Gini coefficient of disposable income responds with respect to the response of private credit *(row 2 and column 3).* It implies that financial development increases inequality in Bangladesh. In response to the impulse of private credit *(at row 1, column 3),* GDP per capita first declines in the first year and continues to be negative till the fourth year; however, it starts to increase in the fifth year and then constantly rises throughout the period. It is also found that the coefficient of GDP per capita is positive, although insignificant, to private credit. These findings indicate that financial sector development increases disposable income Gini (i.e. income inequality) and GDP per capita (i.e. economic growth). The response of private credit to the Gini coefficient indicates that credit expansion is detrimental to income distribution.

Private credit rises significantly and stays constantly positive over time with respect to the response to the impulse of disposable income Gini coefficient *(row 3 and column 2).* If the interactive responses between the Gini coefficient and private credit are compared, the feedback response of the Gini coefficient to private credit is more dominating than that of private credit to the Gini coefficient *(between IRF box 6 and box 8 of Figure 3).* The variance decomposition value of private credit and disposable income Gini shown in Table 2 also confirms our finding. The response of the Gini coefficient is positive to its own shock *(row 2 and column 2 in the IRF box 5 of Figure 3)* and showed positive throughout the duration. With similar a shock from disposable income Gini at the *row 1 column 2 (the IRF box 2 of Figure 3),* GDP per capita increases and depicts continually positive during the remaining

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period. It implies that income inequality is good for the per capita GDP of the Bangladesh economy.

Further, in response to GDPpc, private credit increases and showed almost constantly positive throughout the remaining time *(row 3, column 1 in the IRF box 7 of Figure 3)*. Private credit has a positive effect on growth measure. The response of LNPRICREDIT-to-LNGDPpc is positive; while the inverse IRF is negative to GDP per capita. In other words, private credit has a negative effect on economic growth; on the other hand, GDP per capita has a positive effect on private credit. In addition, the IRF box 4 of Figure shows that GDP per capita at the row 2, column 1 has a negative effect on income inequality. It is found at row 1 column 1 (the IRF box 1 of Figure 3) that GDP per capita steadily declines in response to its own shock. From this finding, we argue that financial development increases income inequality in Bangladesh. These findings are in line with the arguments of Rajan and Zingales (2003) and Demirguc-Kunt and Levine (2009). Bangladesh is a nation in the development stage. The average of private credit is 25.13 percent of GDP with a maximum of 47.41 percent. It indicates that the credit market is at the development stage. Therefore, established large industrial incumbents benefit from the financial sector in Bangladesh. This argument is in line with the theoretical explanation of Rajan and Zingales (2003). Our empirical evidence also supports the findings of Jauch and Watzka (2016) and de Haan and Sturm (2017).

Each variable responds positively to its own shock in the benchmark model, although private credit is on a downward trend. If we compare the interactive response functions between private credit and the Gini coefficient, we find that the IRF of the Gini coefficient to private credit is more positive and greater than the feedback response function of private credit to the Gini coefficient. The feedback response of GDP per capita to private credit is stronger and more positive than the feedback response function of private credit to GDP per capita shock. On the contrary, the feedback response function of GDP per capita to disposable income Gini is higher and more positive, whereas the response of disposable income Gini to GDP per capita shock is lower and negative. The empirical findings suggest that though private credit promotes income inequality, it also slows economic growth in Bangladesh. Likely a rise in GDP per capita leads to a decline in income inequality; on the other hand, an increase in income inequality leads to a rise in growth, meaning that rising income inequality is beneficial for growth in Bangladesh. However, the IRF of economic growth to income inequality dominates the IRF of income inequality to economic growth. Both the Gini

DOI: 10.48165/sajssh.2024.5505

coefficient and private credit have positive feedback IRFs between each other; however, the forecast error analysis and Granger causality test confirm that the impact of private credit on the Gini coefficient is significantly larger and dominating than their inverse effect. We assume that financial development is contemporaneously exogenous to both income inequality and economic growth, therefore we change the combination of the baseline variables [LNPRCREDIT, DGINI, LNGDPpc] in the first ordering; and [DGINI LNGDPpc LNPRICREDIT] in the second ordering. We verify that the dynamic inter-relationship among the baseline variables is not affected by the changing ordering in the baseline model. In other words, we see that income inequality responds positively, while growth responds negatively to financial development in Bangladesh.

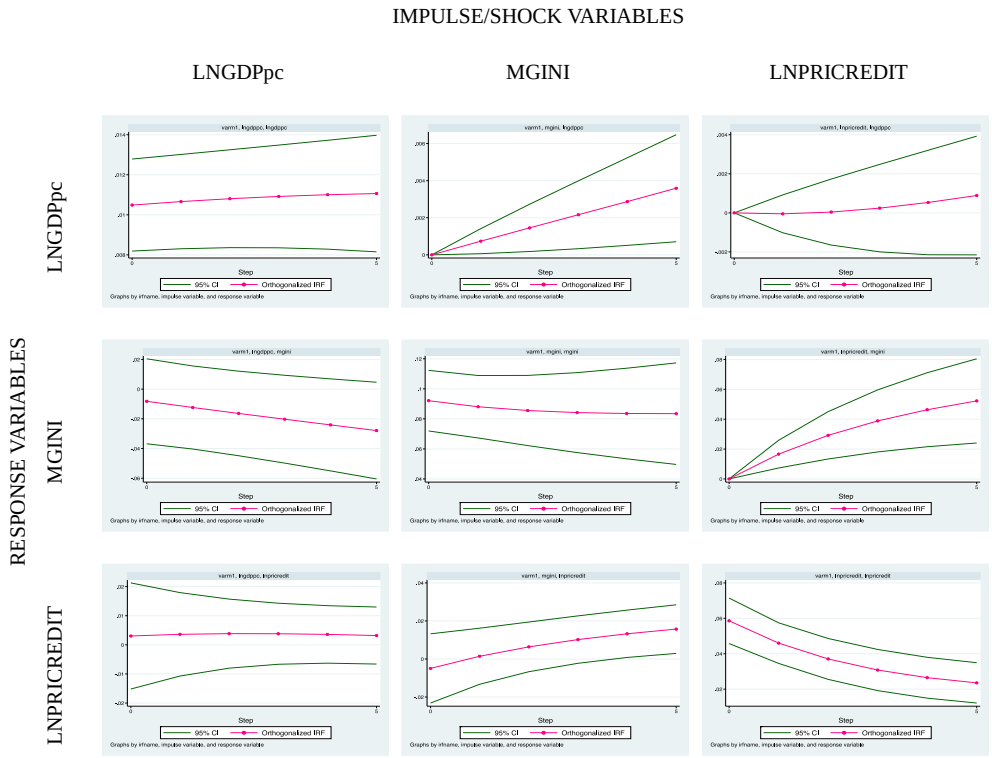

Figure 4: The response function of the baseline model where market income Gini is used as an indicator of income inequality.
Note: the green line indicates the impulse responses at 95 percent probability bands and the pink line indicates IRFs

As we mentioned in the previous section, disposable income Gini (DGINI) is replaced by the market income Gini (MGINI) as a substitute measure of income inequality in the baseline model that includes 40 annual observations over 1980-2020 due to data availability. The response function of the baseline model in Figure 4 demonstrates that similar to disposable income Gini (DGINI), market income Gini (MGINI), in other words, gross income Gini responds positively to the impulse of private credit (row 2, column 3 in the IRF box 8 of

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Figure 4). It indicates that the response function of income inequality in the baseline model is identical with market income Gini too. On the contrary, IRF box at row 3, column 2 shows that private credit increases and grows consistently positive over time. GDP per capita responds negatively and does so consistently for the remainder of the period to the impulse of MGINI in the IRF box 4 at row 1, column 2. It implies that higher inequality is harmful to economic expansion. The IRF in *box 7, at row 3, column 1* demonstrates that private credit rises dramatically in response to the impulse function of GDP per capita and goes constantly positive throughout the period. Further, *at row 3, column 2 in the IRF box 8 of Figure 4*, we see that DGINI responds positively to the LNPRICREDIT. This empirical finding implies that private credit causes income inequality to rise. This testifies to our previous results that financial development, credit market expansion in particular, causes income inequality to increase in Bangladesh when we use the gross income Gini coefficient as an alternative indicator of income inequality. Our estimated results of the VAR model are also consistent with the empirical findings of Jauch and Watzka (2016), de Haan and Sturm (2017), and the theoretical explanation of Rajan and Zingales (2003).

Again, we believe that the impact of private credit on income inequality may be altered when countries become more globalized and macroeconomic developments take place. Therefore, we include trade openness, government consumption spending, and inflation in the augmented regression model to investigate the effects of these macroeconomic control variables on disposable income Gini or net income Gini. The IRF for the augmented model is shown in Figure 5. Instead of reporting the complete 4 by 4 matrix, we present the IRFS of the inequality measure to the LNGDPpc and private credit shocks, together with three control variables in rows 1, 2, and 3. This is because income inequality and private credit are our main variables. Here, we observe that in all three of the alternative extended models *at rows 1, 2, 3, and column 2 of Figure 5*, the response of the DGINI is positive to the impulse of LNPRICREDIT. Disposable income Gini starts to increase with respect to the impulse of government consumption spending, while it reduces to the impulses of both trade openness and inflation *(see rows 1, 2, 3, column-3).* It suggests that international trade and inflation cause to fall in income inequality, while government consumption leads to a rise it in Bangladesh. Additionally, this finding supports the earlier empirical results of Jeong & Kim (2018) and LEE (2014). In the augmented model, on the other hand, the IRF *at row 1 column 1* demonstrates that the disposable income Gini falls precipitously in response to the GDP per capita shock in the first and second years, goes negative in the fourth year, and remains

DOI: 10.48165/sajssh.2024.5505

negative throughout the duration.

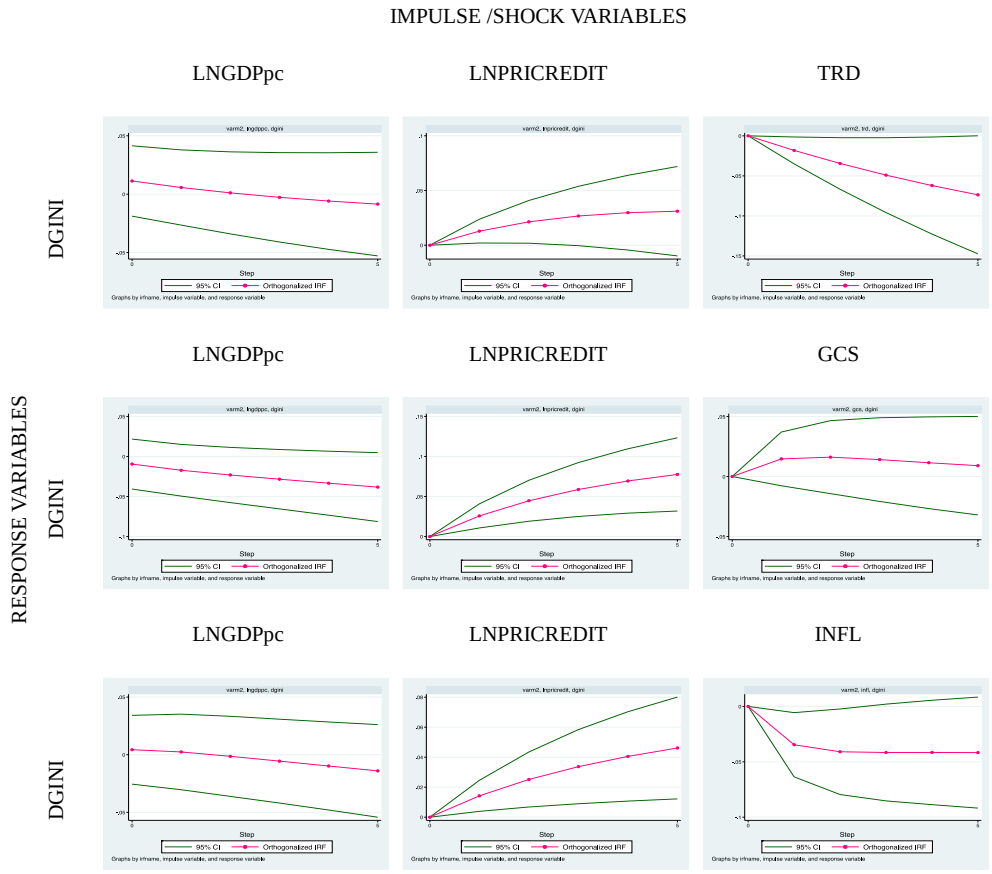

Figure 5: Impulse response functions of the augmented models
Note: the green line indicates the impulse responses at 95 percent probability bands and the pink line indicates IRFs

Forecast error variance decomposition (FEVD) analysis

This section reports the forecast error variance decomposition analysis of the baseline variables of the VAR model. The FEVD matrix explains how much one variable can explain the variation of another variable in the future period. Table 2 demonstrates that the column variable, given as a percentage over the next five years, explains the variance of the row variable. For instance, the variation of LNGDPpc in column 1 explains the variation of itself, DGINI, and LNPRICREDIT by 93.67%, 1.25%, and 0.02% respectively. In contrast, GDP per capita and DGINI explain changes in LNPRICREDIT by 0.02 and 8.90 percent respectively. LNPRICREDIT explains differences in GDP per capita and the DGINI by 0.24 and 8.65 percent, respectively.

DOI: 10.48165/sajssh.2024.5505

Table 2: *Forecast error variance decomposition matrix of the baseline model*

	LNGDPpc	DGINI	LNPRICREDIT
1	2	3	4
LNGDPpc	93.67%	6.09%	0.24%
DGINI	1.25%	90.10%	***8.65%***
LNPRICREDIT	0.02%	***8.90%***	91.08%

The strong impact of LNPRICREDIT on DGINI is confirmed by the FEVD matrix. This suggests that in terms of the private credit variable, inequality, and growth indicators are concurrently exogenous. As is well known, the basic interpretation of this matrix states that the dependent variable is deemed endogenous and the other explanatory variables are exogenous when the dependent variable significantly explains its own variation relative to other explanatory variables. We verify that the variance decomposition value is not significantly and qualitatively altered by rearranging the variables.

Lastly, we carry out some robustness tests. A crucial prerequisite for the VAR model is the stationarity test for each variable. However, as the purpose of VAR analysis is to ascertain the interrelationships among variables rather than to estimate the parameters, it is debatable whether the variables in the VAR model must be stationary. The unit root must lie inside unit circles to pass the stationarity. Our diagnosis verifies that in both the baseline and the extended models, every eigenvalue lies in close to the unit circle. The Granger causality test depicts that inequality vs. growth and private credit vs. disposable income Gini: all have a Granger causality relationship. The FEVD matrix also shows that GDP per capita and the Gini coefficient are exogenous with respect to private credit. The diagnosis test suggests that there is no stationarity problem with our estimation.

CONCLUSIONS

The existing literature explains the rising income inequality by trade globalization, financial integration, technological changes, and institutional factors. Most of the previous studies are conducted at the firms and industry level in the US economy. However, financial sector development is considered by many authors as one substantial determinant of increasing inequality. Several authors argue that the credit market expansion raises income inequality.

This paper empirically examines the role of financial development, private credit in particular, on increasing inequality. Existing theories present complex relationships between these two phenomena. We test these arguments using the VAR estimates and a large sample of

DOI: 10.48165/sajssh.2024.5505

Bangladesh over the 1980-2020 periods. Our findings reveal a positive and statistically significant effect of financial sector development on disposable and market income Gini. These results align with the hypothesis of Rajan and Zingales (2003), that private credit increases income inequality. Private credit can explain approximately 8.65% variations of the disposable income Gini in Bangladesh. It is mentioned that the average of private credit is 25.14 % of GDP for Bangladesh. The relatively lower value of private credit indicates that the financial sector is at the development stage in Bangladesh. Rajan and Zingales (2003) argued that due to the privileged access to financing and strategic advantages, only well-established industrial incumbents get benefit from an underdeveloped financial system. Bankers concurrently seek relationship banking with the industrial incumbent that is currently in place.

We argue that private credit favors the incumbent large industrial corporations. The highly-paid bank employees and their owners are being benefited from the higher monopoly profit. Therefore, one policy implication may be that more state-owned specialized banks and development financial institutions can be established to disburse credit to the lower-income groups to ensure inclusive finance in Bangladesh.

This study has some limitations. It covers only macro-level analysis. However, the empirical examination of this study indicates that the banking sector generates excess profits for large corporations, and aggravates inequality. Further empirical studies may be recommended at the industry level to investigate the detailed scenario of private credit disbursement in Bangladesh.

DOI: 10.48165/sajssh.2024.5505

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Appendix A1**:** Summary of empirical studies of finance-inequality nexus

Empirical studies	**Sample countries (period)** ***[Data structure]***	**Inequality measures**	**F.D. measures**	**Methods**	**Results**
Jauch and Watzka (2016)	138 countries (1960-2008) *[annual and five-year average panel]*	Gross and net Gini	Private credit	FE, GMM	***Linear Positive***
de Haan and Sturm (2017)	121 countries (1975-2005) *[five-year average panel]*	Gross Gini	Domestic credit	RE, G2SLS	
Beck et al. (2004)	52 countries (1960-1999) *[cross-country analysis]*	Growth of Gini index	Private credit	OLS, 2SLS	***Linear Negative***
Beck et al. (2007)	72 countries (1960-2005) *[cross-country and five-year panel]*	Growth of Gini index	Private credit	OLS, GMM	
Clarke et al. (2003)	91 countries (1960-1995) *[five-year average panel]*	Gini index	Private credit	OLS, GMM	
Clarke et al. (2006)	83 countries (1960-1995) *[five-year average panel]*	Gini index	Private credit	OLS, 2SLS RE	
Li et al. (1998)	49 countries (1947-94) *[five-year average panel]*	Gini index	M2/GDP	OLS, IV	
Park and Shin (2015)	162 countries (1960-2011) *[five-year average panel]*	Gross and net Gini; Top income share	Private credit Market Cap.	Pooled OLS, F.E.	***Nonlinear U-Shape***
Brei et al. (2018)	97 countries (1989-2012) *[five-year average panel]*	Gini index	Fin. Dev. index	GMM	
Tan and Law (2012)	35 countries (1980-2000) *[annual panel analysis]*	Gini index	Private credit Market Cap.	GMM	
de la Cuesta-González et al. (2020)	9 OECD countries (2000-2015) *[annual panel analysis]*	Net Gini index	Private credit Market Cap.	Two-stage GLS	
Kim and Lin (2011)	65 countries (1960-2005) *[cross country analysis]*	Growth of Gini index	Private credit Liquid liabilities	OLS, IV	***Nonlinear Inverted U-Shape***
Nikoloski (2012)	52 countries (1962-2006) *[five-year average panel]*	Gini index	Private credit	F.E., GMM	
Chen and Kinkyo (2016)	88 countries (1961-2012) *[annual panel analysis]*	Gini index	Private credit	PMG estimator	***Mixed-Effects***
Čihák and Sahay (2020)	128 countries (1980-2015) *[cross-country and 5-yr av. panel]*	Gross and net Gini	Financial depth Financial inclusion	OLS, GLS, GMM	

Cont'd

DOI: 10.48165/sajssh.2024.5505

Appendix A1: Summary of empirical studies of finance-inequality nexus *[cont'd]*

Empirical studies	**Sample countries (period)** ***[Data structure]***	**Inequality measures**	**F.D. measures**	**Methods**	**Results**
Law et al. (2014)	81 countries (1985-2010) *[cross-country and annual panel]*	Net Gini	Bank credit	OLS, IV, GMM	***Conditional Effects***
Benczúr and Kvedaras (2021)	33 OECD (1960-2010) *[annual panel analysis]*	Gross and net Gini; Top 1 % income share	Domestic bank credit	GMM	
Kunieda et al. (2014)	100 countries (1985-2009) *[Cross-country and annual panel]*	Net Gini	Private credit	GMM	

Note: OLS=ordinary least square, 2SLS= second stage least square, 2SGLS= second stage generalized least square, IV= instrumental variables, FE=fixed effects, RE=random effects, PMG=pooled mean group, GMM=generalized method of moment.

Declarations

Ethical approval:
Ethical approval is not applicable for this manuscript.

Competing interest:
There is no financial, non-financial, professional or personal competing interest among the authors of this manuscript.

Authors' contributions:
All authors equally contributed to draft this manuscript. Both reviewed and finally approved it.

Funding:
This manuscript is a non-funded research work.

Availability of data and materials:
All datasets and materials used in this manuscript can be provided on request.

DOI: 10.48165/sajssh.2024.5505