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The impact of foreign direct investment on income inequality in developing countries: The Bayesian approach

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Abstract: Inequality in general and income inequality in particular have existed for a long time and tend to increase daily. Foreign direct investment (FDI) is expected to be an important factor contributing to mitigating that situation. However, the results of previous empirical studies on the impact of FDI on income inequality have not reached a consistent conclusion. Therefore, this study evaluated the impact of foreign direct investment on income inequality in developing economies. The study has provided evidence that the relationship is nonlinear through data from a sample of 36 developing countries between 2008 and 2020 and the Monte-Carlo algorithm according to the Bayesian approach. We document a U-shaped effect of FDI on income inequality. Besides, other factors, including trade openness and migration, obviously impact income inequality. Different results were found when FDI interacted with trade or migration, representing important channels through which inequality is affected. With these results, we suggest that policymakers in developing countries should develop appropriate policies on FDI attraction encourage trade openness and migration to reduce income inequality.

Keywords: Foreign Direct Investment; Income Inequality; Developing Countries; Bayesian

JEL Classification: E22; D6; C11

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Introduction

Aiming to achieve the Sustainable Development Goals (Sustainable Development Goals – including 17 goals of the 2030 Agenda, officially adopted on 25 September, 2015 at the United Nations Summit with the participation of 193 member countries (*THE 17 GOALS | Sustainable Development*, n.d.), one of the urgent requirements is to reduce inequality within and between countries (Reduced inequalities), which includes income inequality . Because it not only causes social instability but also has a negative effect on economic growth. It has been confirmed by the Organization for Economic Co-operation and Development (OECD): the growing trend of income inequality in a country can hold back its economic growth. Specifically, according to the OECD, "an increase in income inequality over the past two decades would drag down economic growth by an average of 0.35 percentage points per year for 25 years, a cumulated loss in GDP at the end of the period of 8.5 percent" (OECD research, 2014). Moreover, as economic inequality increases, the next generation will not enjoy equal opportunities such as access to information, thereby increasing

economic inequality, creating a loop over and over. Christian Aid also argues that high-income inequality can prevent children from low-income families from having the same opportunity to reach their full potential as children from higher income-status families. Thus, income inequality at one point is both an outcome and a cause of the degree to which economic status is passed down through generations (Corak, 2016). Economic inequality has thus become a core social concern in all countries.

International investment (especially in the form of foreign direct investment) is an important factor in achieving poverty reduction goals. Because when capital is available, countries receiving investment can increase production productivity, more exported goods, contributing to a trade balance surplus, thereby boosting GDP growth (Klein et al., 2001). In addition to the direct impact, FDI also has spillover effects on the host countries, which is creating opportunities for countries to access more advanced technology, easier technology transfer, promoting the process of disseminating knowledge, improving management skills and labor qualifications. This contributes to increasing the productivity of domestic enterprises, creating more jobs and incomes for workers and ultimately contributing to economic growth in general (Zhang & Felmingham, 2002). However, besides the positive effects, FDI is also considered as one of the factors causing income inequality. Because foreign investors tend to invest directly in high-profit industries to take advantage of investment incentives, which will affect the income gap across disciplines (Iammarino, 2018). In addition, areas that receive a lot of FDI will have increased production and business opportunities, attracting more workers from that region and other areas, causing income disparities in the labor market in the FDI sector and others (Wei et al., 2009). Employees in enterprises are also facilitated with additional training, which divides workers into two parts. The trained department has higher labor productivity and work efficiency so that they will receive additional benefits, have better job opportunities and income than the others (Lipsey, 2002). This means that countries may have to trade off income inequality to achieve economic growth and eliminate poverty. It seems that developing countries which are expected to be difficult to achieve simultaneously the goals of rapid development, sustainable development and ensuring equity, will be the countries that can bear many impacts of foreign direct investment on income inequality than developed countries (Aust et al., 2020). This prompts further studies on the impact of FDI on income distribution disparities in developing countries.

There have been numerous studies on the relationship between FDI and income inequality, but surprisingly there is no consensus on this issue. Opinions about the impact of FDI on income inequality can be as follows: FDI has no impact on income inequality (SYLWESTER, 2005); FDI has a positive effect on income inequality (Basu & Guariglia, 2007; Choi, 2006; Pan-Long, 1995) ; FDI has a negative impact on income inequality (Chintrakarn et al., 2012; Jensen & Rosas, 2007; Mugeni, 2015). In addition, Kuznets (1955) argued that income inequality increases with economic growth at low-income levels and then begins to decline, meaning that there exists an inverted U-shaped relationship between economic development levels and income inequality. Thus, if economic development arises from FDI, the relationship between FDI and income inequality may also follow an inverted U-curve, that is, the increase in foreign capital at the beginning of the development process will exacerbate income inequality, but it is expected to decrease

when the optimal foreign direct investment stage is reached. Some empirical studies have had results supporting Kuznets' view (Figini & Go¨rg, 2011; Herzer et al., 2014; Nguyen, 2021).

Previous studies also tried to clarify the impact of FDI on income inequality when considering the role of other variables, for example trade openness (Phan, 2022), institutions (Nguyen, 2021), absorptive capacity (Wu & Hsu, 2012), human capital (Mallick et al., 2020); or research in groups of countries with different levels of development such as developed/developing countries (Nguyen, 2021; Nguyen & Darsono, 2022); or study in a specific country with different stages (Chintrakarn et al., 2012; Jensen & Rosas, 2007). However, most of those studies are done by the traditional frequency approach, which assumes that the regression coefficients in the model are unknown and fixed, which are calculated through an infinite number of identical and repeated experiments. Such an assumption will lead to the interpretation of statistical results that is no longer appropriate in many situations in the field of social sciences (Briggs & Nguyen, 2019). For effects taking place in the social environment cannot be experiments repeated over many years under the same conditions as in the field of the natural sciences. Meanwhile, the Bayesian method does not need to be based on the assumption that the observed patterns must repeat continuously, the regression coefficients in the Bayesian model are a random quantity, the fluctuations of these coefficients will be affected by confounding factors, for example in this model, confounding factors will be specific to developing countries. In addition, the Bayesian method also overcomes model defects such as autocorrelation, variable variance and endogeneity (Ramírez Hassan & Montoya Blandón, 2019; Startz, 2012). Therefore, in this study, the author also considers the effects of independent variables including trade openness, migration, inflation, public spending, institutions, unemployment, labor force, financial development, infrastructure, economic freedom index, etc. on income inequality, using the Bayesian method instead of the frequency approach. This is a new contribution compared to the previous literature.

With the above analyses, this study uses the Bayesian method to explore the impact of FDI and other independent variables on income inequality in developing countries, including 36 countries during the period 2008 – 2020. The study also examines the threshold effect between foreign direct investment and income inequality (Kuznets curve) and finds the turning point of FDI in developing countries. The results show that in developing countries, FDI positively affects income inequality. However, when FDI reaches 99% of GDP, FDI will have a negative effect on income inequality. In addition, when an increase in FDI coincides with an increase in trade openness or with an increase in migration, income inequality will also be reduced.

This article is divided into four parts. Section 2 presents the research method, including model, data and method. Section 3 reports the experimental results and provides discussion. Finally, section 4 gives the conclusion and implication.

Research Method

Model

Based on the research theories, to achieve the set objectives, the author builds a panel regression model of this study as follows:

$$GINI_{it} = \beta_0 + \beta_1 * FDI_{it} + \beta_2 * FDI2_{it} + \beta_x * X_{it} + e_{it} \quad (1)$$

Where i = 1, 2,.., N; t = 1, 2, …, T (i is the country and t is the time observed in the model); independently distributed errors $e_{it} \approx$ iid (0, $б_e^2$). X are the control variables.

Table 1 Description of variables in the research model

Variable name	Symbol	Measure	Source	Expected	Inheritance Research
Dependent variable					
Income inequality	GINI	GINI coefficient	WDI, SWIID		(Khan & Nawaz, 2019; Nguyen, 2021)
Independent variables					
Foreign Direct Investment	FDI	Net FDI (of GDP)	WDI	+	(Mallick et al., 2020; Zulfiu Alili & Adnett, 2018)
Control variables					
Trade openness	TRD	Trade (of GDP)	WDI WITS	+	(Kim, 2022; Rezk et al., 2022; Zulfiu Alili & Adnett, 2018)
Migration	MIG	Net Migration (of Total Population)	WDI	+	(Matallah, 2019; Phan, 2022)
The Governance Index	GI	Set of 6 indicators of WGI (six dimensions of governance, including control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, voice and accountability)	WGI	-	(Kim, 2022; Matallah, 2019; Nguyen, 2021)
Labor force	LAB	Labor force participation rate (of total population aged 15 and over)	WDI	+	(Calderón & Chong, 2001)
Inflation	INF	Inflation, GDP deflator (annual %)	WDI	+	(Kim, 2022; Rezk et al., 2022)
Private credit	PRVT	Domestic credit to the private sector (of GDP)	WDI	-	(Rezk et al., 2022)
Digitalization	NET	Individuals using the Internet (of total population)	WDI	-	(Mohd Daud et al., 2021)
Unemployment	UNE	Unemployment (of Total Labor Force (modeled ILO estimate))	WDI	+	(Josifidis et al., 2020; Zulfiu Alili & Adnett, 2018)
Remittances	REM	Personal remittances, received (of GDP)	WDI	-	(Mallick et al., 2020)

Table 1 Description of variables in the research model (cont')

Variable name	Symbol	Measure	Source	Expected	Inheritance Research
Remittances	REM	Personal remittances, received (of GDP)	WDI	-	(Mallick et al., 2020)
Economic freedom	IEF	Index of economic freedom	The Heritage Foundation	+	(Zulfiu Alili & Adnett, 2018)
Infrastructure	TEL	Fixed telephone subscriptions (of Population, total)	WDI	-	(Kim, 2022; Mallick et al., 2020)
Government spending	GEG	government final consumption expenditures (of GDP)	WDI	-	(Kim, 2022; Mallick et al., 2020)
Financial development	FD	Financial Development Index: (1) size of financial institutions and markets (financial depth), (2) degree to which individuals and firms can and do use financial services (access), (3) efficiency of financial intermediaries and markets in intermediating resources and (4) facilitating financial transactions (efficiency), and stability of financial institutions and markets (stability)	IMF, based on research by Cihak et al. (2012)	+	(Jauch & Watzka, 2016)

Data

The study uses annual data for the period 2008-2020 from 36 developing countries. The period and countries are selected depending on the availability of income inequality statistics. Most data is collected from World Development Indicators available from the World Bank (2022). For the missing data, the author has added from other sources including The Standardized World Income Inequality Database (SWIID) and The World Integrated Trade Solution (WITS). The Governance Index data is collected from Worldwide Governance Indicators (WGI), and Index of economic freedom is from The Heritage Foundation.

Method

According to the analysis in part 1, with the advantages of the Bayesian method over the frequency method, the author chooses the Bayesian approach when studying the impact of FDI on income inequality in developing countries.

Bayesian analysis is set up according to the conditional distribution rule:

$$p(B) = \frac{p(A,B)}{p(B)} \quad (2)$$

Bayes theorem is set up as follows:

$$p(A) = \frac{p(A|B)p(B)}{p(A)} \quad (3)$$

Where A and B are two random vectors.

Assuming the data vector y is a sample from a model with the unknown parameter vector θ, the model will be rewritten via the rational function:

$$L(\theta;y) = f(y;\theta) = \prod_{i-1}^{n} f(y_i|\theta), \quad (4)$$

Where: $f(y_i;\theta)$ is the probability density function of y given θ given. With the available data, based on Bayesian rule, we can deduce the properties of θ with the model parameters θ as random.

The Bayesian analysis will begin by defining a posterior model, which is a combination of collected research data and prior information to describe the distribution probabilities of the parameters. Thus, the posterior distribution consists of two components: the rational function containing information about the model parameters based on the observed data and the a priori distribution containing the available information about the parameters in the model.

Posterior Distribution $\propto$ *Rational Function x A priori information*

With the traditional frequency method, the method that tests the statistical results is through the null hypothesis. For example, in this study, if we use the frequency method, we will hypothesize that H0: FDI reduces income inequality. We then compute the p-value, which is the conditional probability. Next, we interpret the p-value as the probability of the observed occurrence that FDI reduces income inequality under the hypothetical condition H0 is correct. After calculating the p-value, we will reject hypothesis H0 and conclude that FDI increases income inequality (if the p-value is less than 1%, 5% or 10%). However, with this method, we cannot calculate the percentage probability that FDI increases income inequality. Meanwhile, the Bayesian method can help calculate the probabilities of trends occurring by testing the Bayesian posterior interval. This is considered the outstanding advantage of the Bayesian method over the frequency method.

Result and Discussion

Bayesian analysis is simulated through a Markov chain Monte Carlo (MCMC). Therefore, to ensure the stability of the Bayesian regression, the MCMC series must converge, which means that the MCMC series must ensure stationarity. Nikolay Balov (2017, 2020) proposed that the MCMC series convergence test can be performed through the convergence diagnostic graph.

According to Nikolay Balov (2017, 2020), Trace Plot helps to track the historical display of a parameter value across iterations of a series, if the trace plot fluctuates around the mean, then the series MCMC is stationary, that is, the convergence condition is met.

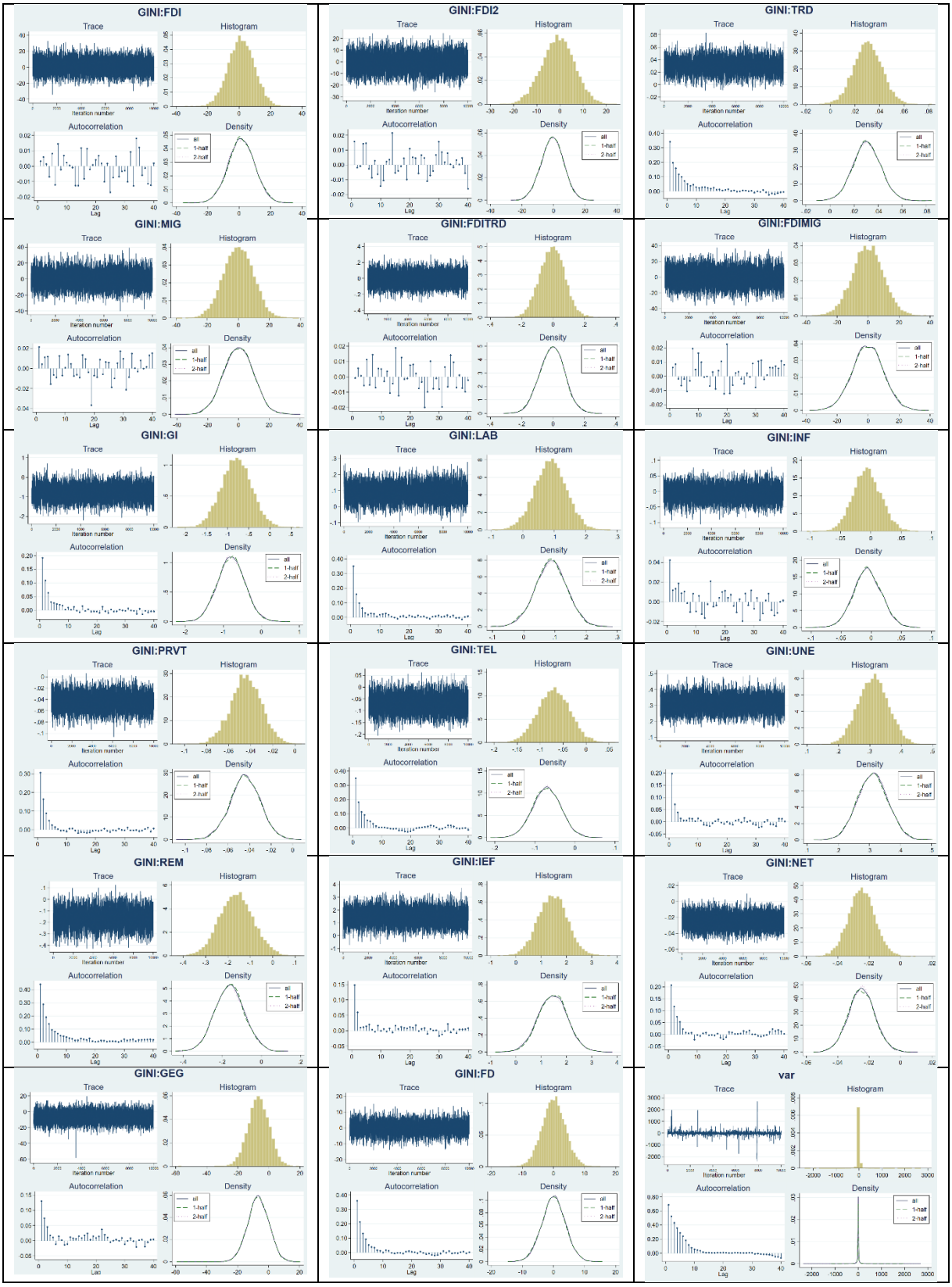

Figure 1 Convergence diagnostic graph

Besides, the autocorrelation histogram fluctuates around the level below 0.02, which shows a good agreement with the distribution simulation density and reflects all the lags within the effective limit. The posterior distribution histogram and the density estimate show the simulation of the shape of the normal distribution of the parameters. The histogram shape is uniform, it can be concluded that Bayesian inference is steady. As the results from Figure 1 shows, all the graphs of the parameters in the model of the MCMC series meet all the convergence conditions as mentioned.

Table 2 Bayes simulation results

	Mean	Std. Dev.	MCSE	Median	Equal-tailed [95% Cred. Interval]	
FDI	1.517975	8.288082	.082881	1.476104	-14,76494	17.84562
FDI2	-.7664863	7,017.492	.071272	-.7271101	-14.75283	12.87148
TRD	.0305945	.0114971	.000219	.0304217	.0079375	.0533933
MIG	.0719294	9,684,076	.09889	.1326932	-19.04042	18.68148
FDI.TRD	-.0057	.0793898	.000794	-.0045646	-.1607689	.1491763
FDI.MIG	-.2142193	1.004,576	.100458	-.2290034	-20.10254	19.35098
GI	-.7921811	.3594288	.00503	-.7932792	-1.486691	-.0824242
LAB	.088191	.0505104	.000805	.0884552	-.0120826	.1862471
INF	-.0062735	.023213	.000251	-.0066326	-.0514429	.039982
PRVT	-.044164	.0140466	.000213	-.044191	-.0723697	-.0166887
TEL	-.0698573	.0350441	.000583	-.0697366	-.1381564	-.0001138
UNE	.3114192	.0483143	.000619	.3116566	.2184855	.4055636
REM	-.1624159	.0754662	.001548	-.1625108	-.3093256	-.013258
IEF	1.455471	.5784555	.007154	1.457726	.3207913	2.591633
NET	-.0247299	.0084312	.000118	-.0247465	-.0414499	-.0080583
GEG	-6.609215	6.778836	.084697	-6.648576	-20.03613	6.245514
FD	.0591398	3.765205	.064125	.0712897	-7.360831	7.501619
_cons	2.404001	4.963765	.095206	2.404406	14.37214	33.81945
var	.2914311	1.239979	331.022	-.1916272	-110.8852	113.5332
CID						
U0:sigma2	88.90248	23.57768	.328646	85.21133	53.76993	
e.GINI						
sigma2	3.704676	.2644856	.002645	3.689151	3.232573	
Acceptance rate	.7138					
Efficiency: min	.1403					

In addition to diagnosing convergence by graph, Nikolay Balov, (2017, 2020) also proposes to test the average minimum efficiency through the acceptance rate. From Table 2, it can be seen that the acceptance rate of the model reached 0.7138, and the minimum efficiency (Efficiency: min) was 0.1403 exceeding the allowable level of 0.01, so the model met the requirements. Bayesian regression also provides a Bayesian confidence interval (Equal-tailed 95% Cred.Interval), which provides a series for a parameter, and the probability that the parameter is in this series is 95%. Bayesian approach through Metropolis-Hastings (MH) algorithm, the regression model is simulated 10,000 times, each time we get a regression coefficient, so the regression results table will show the mean (Mean). In addition, Bayes also provides the standard error (Std.Dev) for the regression coefficient, and the standard error Monte-Carlo. The Monte-Carlo Standard

Error (MCSE) of all parameters is very small. According to Flegal et al., (2008), the closer the MCSE is to zero, the stronger the MCMC series are. These authors also think that MCSE values less than 6.5% of the standard deviation are acceptable and smaller than 5% of the standard deviation is optimal. For example, with the variable FDI, the MCSE value of 0.082881 is less than 5% of the standard deviation (5% x 8.288082 = 0.4144041 > 0.082881). Thus, the MCSE value of the FDI regression coefficient reaches the optimal level. The results in Table 2 show that the MCSE values of the remaining regression coefficients satisfy the optimal level.

The regression coefficients in Table 2 show the change of the dependent variable GINI when each independent variable's average change is in the model. Specifically:

$GINI_{it}$ = 2.404001 + 1.517975*FDI_{it} - 0.7664863*$FDI2_{it}$ + 0.0305945*TRD_{it} + 0.0719294*MIG_{it} -0.0057*$FDI.TRD_{it}$ - 0.2142193*$FDI.MIG_{it}$ - 0.7921811*GI_{it} + 0.088191*LAB_{it} - 0.0062735*INF_{it} - 0.044164 *$PRVT_{it}$ - 0.0698573*TEL_{it} + 0.3114192*UNE_{it} - 0.1624159*REM_{it} + 1,455,471*IEF_{it} - 0.0247299*NET_{it} – 6.609215*GEG_{it} + 0.0591398*FD_{it} + e_{it} (5)

Thus, variables FDI, TRD, MIG, LAB, UNE, IEF and FD will positively impact GINI, while variables FDI.TRD, FDI.MIG, GI, INF, PRVT, TEL, REM, NET, GEG will have the opposite effect to GINI. The regression coefficient of the FDI2 variable has a negative sign, which means that there exists a point at which GINI reaches its maximum.

The author applies the theory of FDI threshold to answer the question of what is the threshold of FDI. Derive the regression equation (1) with respect to the variable FDI and give the derivative zero to find the turning point FDI at which the marginal effect of FDI on income inequality reverses, equal to of $\beta_1/2\ \beta_2$, specifically as follows:

$GINI'_{it}$= - 2*0 .7664863 * FDI_{it}+ 1.517975 = 0, we have : - $\beta_1/2\ \beta_2$ = 99%.

Thus, the FDI threshold of developing countries in the sample is 99% of GDP. Below this threshold, FDI will have a positive effect on GINI, but above this threshold, FDI will have a negative effect on GINI.

To know the probability of the effects of FDI and independent variables on income inequality, we test the Bayesian posterior interval.

Table 3 Bayesian posterior interval test

	Mean	Std. dev.	MCSE
{ GINI:FDI} > 0	.5791	0.49373	.0050082
{ GINI: FDI2 } < 0	.5493	0.49759	.0049759
{ GINI:TRD} > 0	.9954	0.06767	.0007218
{ GINI:MIG}> 0	.506	0.49999	.0049999
{ GINI:FDI.TRD} < 0	.5389	0.49851	.005064
{ GINI:FDI.MIG} < 0	.4962	0.5001	.0048408
{ GINI: GI } < 0	.9861	0.11708	.0012555
{ GINI:LAB} > 0	.9604	0.19503	.0022984

Table 3 Bayesian posterior interval test (cont')

	Mean	Std. dev.	MCSE
{ GINI:INF} <0	.6008	0.48976	.0048976
{ GINI:PRVT}< 0	.9987	0.03603	.0003603
{ GINI: TEL }< 0	.9786	0.14472	.0015962
{ GINI:UNE} > 0	1	0.00000	0
{ GINI:REM} < 0	.985	0.12156	.0013574
{ GINI:IEF} > 0	.9951	0.06983	.000747
{ GINI:NET} < 0	.9974	0.05093	.0005093
{ GINI:GEG} < 0	.8296	0.37600	.0042713
{ GINI:FD} > 0	.5044	0.5001	.0078804

Trade openness (TRD) is also an important factor affecting income distribution inequality, whereby the positive probability for the TRD variable is 99.54%. This result is in contrast to the Stolper–Samuelson theorem, which is derived from the Hecksher–Ohlin (HO) model, according to which the expansion of foreign trade improves income distribution in developing countries as it will increase the wages of unskilled workers while it will decrease the wages of skilled workers. However, some other studies are consistent with the result of this study, such as Dorn et al., (2022) who argue that Trade Openness increases income inequality in developing and emerging countries. The reason is that the transition countries from Eastern Europe and China have experienced a rapid process of opening up to trade, but the welfare regimes and labor market institutions in these countries have not developed commensurately agreement with the process of trade opening, resulting in income distribution inequality.

Migration (MIG) has a positive effect on GINI with a probability of 50.6%, meaning that migration can push income inequality higher and vice versa. Migration takes place only when there is a benefit to migrants, if this benefit is economical, then migrants tend to move to places where they are likely to have a higher income. According to Jestl et al., (2018), developing countries often have an abundant unskilled labor force, if migrants are a highly skilled labor force, it will lead to competition for the labor force in the country, leading to a decrease in the income of native workers. The negative wage impact is exacerbated if non-member migrants are willing to work for lower wages, which reduces the wages of native members of the same skill set. This will lead to a wider gap in the income distribution.

Although when considering each factor TRD and MIG separately, it will increase income inequality, but the interaction variable FDI.TRD and FDI.MIG has a negative effect on GINI in developing countries with probability times 53.89% and 49.62% respectively. This means that FDI will decrease GINI as trade openness or migration increases. However, this probability is quite low, only approximately 50%, showing that the possibility of this opposite effect is not high.

The Governance Index (GI) with a probability of 98.61% has the opposite effect with GINI, meaning that a good governance environment could improve income inequality. This is consistent with the views of Kim (2022); Matallah (2019); Rezk et al. (2022) who argue that improving the effectiveness of the Government in planning and building,

implementing policies related to economic growth, development in order to eliminate hunger and reduce poverty, and properly distribute the benefits of economic growth in society can reduce income inequality.

The variable Labour (LAB) has the effect of increasing GINI with a very high probability of 96.04 %. According to the Law of supply and demand, if the supply of labor increases while its demand decreases or remains the same, the price of labor expressed in wages will decrease (Stockhammer, 2013). Furthermore, ILO statistical data (OECD, 2019) indicates that the informal economy accounts for about 70% of all employment in developing and emerging countries. Informal sector workers often lack access to many or all aspects of the social protection system and labor regulations, resulting in serious loss of income. Thus, an increase in the labor force in developing countries will increase income inequality. This is similar to the results of Gopinath & Chen (2003).

The variable Unemployment (UNE) increases GINI with an absolute probability of 100%. Similar results were seen in several previous studies. A typical example is Zulfiu Alili & Adnett (2018), who argue that rising unemployment increases income inequality because unemployment benefits are often lower than previous wages. The contribution of unemployment to wage inequality would be greater if unemployment growth were more concentrated in the lower part of the income distribution.

The Index of economic freedom (IEF) has a positive effect on GINI with a probability of 60.08%. This result is similar to the study by Zulfiu Alili & Adnett (2018) which shows that higher values of the index of economic freedom mean less intervention in the market, that is, the influence of unions and the unclear minimum wage law leads to increased wage inequality.

Technology infrastructure is represented by the number of Fixed telephone subscriptions (TEL) and digitization expressed in the number of Internet users (NET) have a negative impact on income inequality with the probability of 97.86% and 99.74%, demonstrating that enhanced technology infrastructure can address income inequality. This is also demonstrated in many previous research results (Calderón & Chong, 2001; Mallick et al., 2020)

Remittances (REM) also reduce income inequality with a 98.5% probability. This is explained by the amount of remittances that have improved households' welfare, leading to a reduction in income inequality (Song et al., 2021). In addition, there is evidence that economies where remittances from abroad as a result of the increasing inflow of migrants have helped promote economic growth and tackle poverty, thereby reducing inequality in their country of origin (Akobeng, 2016)

Contrary to initial expectations, Inflation (INF) has a 60.08% probability of a negative GINI effect, meaning that higher inflation will reduce income inequality. This is consistent with the Phillip curve, when unemployment is high and inflation is low, inflation has a negative effect on income inequality. In addition, some studies have suggested that the inflation-income inequality relationship is U-shaped nonlinear. This is, for low inflation, more

inflation correlates with a decrease in income inequality and for high inflation, more inflation means increased income inequality (Galli & Van der Hoeven, 2002; Siami-Namini & Hudson, 2019). Monnin (2014) estimated the turning point of the inflation rate to be 13.3%. Below this threshold, income inequality goes down as inflation increases; above that, income inequality goes up as inflation rises further. Data on average inflation in developing countries during the survey period collected by the author are shown in the following chart:

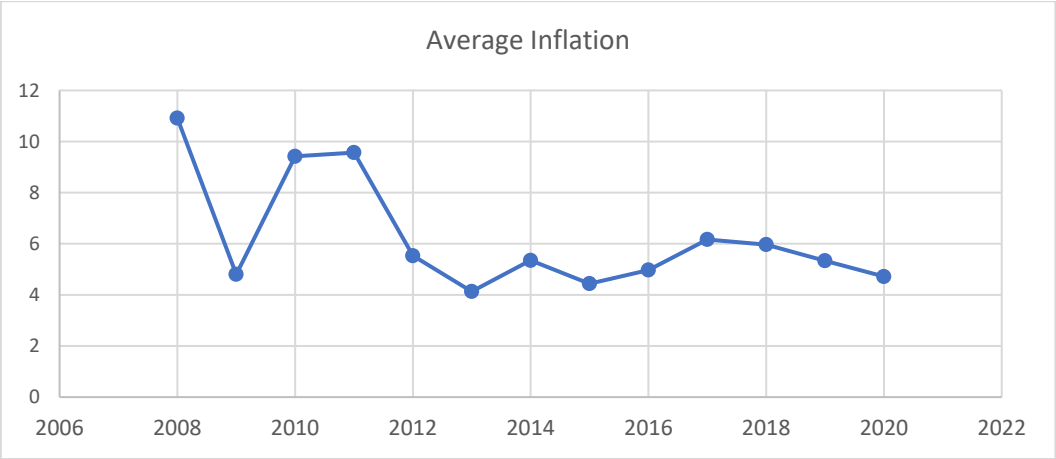

Figure 2 Average inflation of developing countries in the period 2008 - 2020

In Figure 2, we can see that the average inflation of developing countries in the period 2008 - 2020 is always less than 12% , so if based on the threshold point calculated by Monnin (2014) , inflation in developing countries growth in the sample increases will reduce income inequality and vice versa.

Personal credit (PRVT) has a negative effect on GINI with a probability of 99.87%. Personal credit is expected to creep into different income classes to provide capital and financial services, thereby improving the quality of life, increasing income, and narrowing the gap between rich and poor. Thereby, credit directly overcomes the financial exclusion in the low-income individual sector - the main cause of income inequality. Where there is an expansion of personal credit, income inequality is expected to decrease (Aslan et al., 2017).

The relationship between government final consumption expenditures (GEG) and income inequality is negative, meaning that more government spending reduces income inequality and vice versa. The probability of this relationship is quite high 82.96%. This is explained as public spending affects income inequality in two ways: Directly, according to the compensation thesis, the government will expand welfare expenditures to compensate those who suffer more disadvantaged in the process of globalization, making the income gap narrower (Tridico, 2018); Indirectly, government spending on infrastructure, health, education, etc., are driving factors in reduction of income inequality (Mallick et al., 2020).

An increase in FD increases the gap between rich and poor in developing economies with a probability of 50.44%. With a developed financial system, it can efficiently allocate financial resources to the productive sector or it can increase human capital by investing in education. However, financial development can lead to unequal growth, creating income inequality. This may be the case when access to finance is limited to certain groups of people based on their income level, location of residence and ability to provide collateral for loans (Sethi et al., 2021).

Conclusion

Although there are many empirical studies on the effects of FDI on income inequality, most of those studies have been conducted using the traditional frequency approach, which many researchers argue is the interpretation of statistical results is no longer appropriate in many situations in the social domain. Therefore, the author used the Bayesian method to study the impact of FDI on income inequality in developing countries in the period 2008-2020. Besides, the author also tested the threshold effect between foreign direct investment and income inequality (Kuznets curve) and found the turning point of FDI in developing countries.

The estimated results show that FDI has a non-linear effect on income inequality. That means FDI will increase income inequality but when FDI reaches 99% of GDP, income inequality will tend to follow a downward direction. This result provides evidence that there is an optimal FDI threshold in developing countries, or in other words, the relationship between FDI and income inequality has the shape of an inverted U-curve. This finding may be due to the fact that FDI inflows may be concentrated in a particular region or sector. Therefore, FDI inflows are increasing income inequality in developing economies. However, if FDI is to flow across regions and sectors, they will help reduce income inequality in developing economies. In addition, the variables of trade openness and migration also have a positive effect on income inequality. The findings in this study challenge the notion that globalization (as demonstrated by FDI flows, trade openness, and migration) necessarily leads to a more favorable income distribution.

Based on these findings, we urge policymakers and government officials of these developing economies to use FDI inflows more efficiently, distributing FDI across the regions as well as industries for economic development. However, one point to note in the results of this study is that although an increase in FDI, trade openness and immigration will exacerbate income inequality, FDI increases with increased trade openness and increased immigration could help close the gap in income distribution. This needs to be studied more closely in future studies.

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Appendix

Appendix: List of 36 developing countries

No	Country name	Country code	No	Country name	Country code	No	Country name	Country code
1	Albania	ALB	13	Egypt, Arab Rep.	EGY	25	North Macedonia	MKD
2	Argentina	ARG	14	El Salvador	SLV	26	Pakistan	PAK
3	Armenia	ARM	15	Georgia	GEO	27	Peru	PER
4	Bolivia	BOL	16	Honduras	HND	28	Poland	POL
5	Brazil	BRA	17	Hungary	HUN	29	Romania	ROU
6	Bulgaria	BGR	18	India	IND	30	Russian Federation	RUS
7	Chile	CHL	19	Indonesia	IDN	31	Serbia	SRB
8	China	CHN	20	Kazakhstan	KAZ	32	South Africa	ZAF
9	Colombia	COL	21	Kyrgyz Republic	KGZ	33	Thailand	THA
10	Croatia	HRV	22	Mali	MLI	34	Turkiye	TUR
11	Dominican Rep	DOM	23	Mexico	MEX	35	Ukraine	UKR
12	Ecuador	ECU	24	Mongolia	MONG	36	Vietnam	VNM