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The poverty alleviation program in A Tsunami impacted area: Models PKH and BPNT Indonesia

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Abstract: This study aims to analyze the overall effectiveness of Program Keluarga Harapan (PKH) and Bantuan Pangan Non-Tunai (BPNT) in reducing poverty in Aceh Province, Indonesia, a province heavily affected by the 2004 tsunami disaster. Using a 23-year time series (2000-2022) dataset and a threshold regression model, the study investigates the effects of such social assistance programs on the alleviation of poverty (per capita income and poverty line). This study highlights some important challenges to improvement in program implementation, such as inefficiencies in the distribution of funds, socio-cultural barriers, and limited alignment with broader economic strategies. The study opens with a discussion of the Indonesian government's Household Welfare Improvement program, a conditional cash transfer program designed to reduce poverty and improve health, nutrition, and education. Based on the evidence obtained, the authors recommend improvements to PKH, including increases in budget allocation, tailored economic empowerment processes, and enhanced program structure in order to maximize the program's long-term poverty reduction impact. The study recommends optimizing food distribution and diversification of food assistance to meet local needs for BPNT. By shedding light on the specific mechanisms driving these effects, these findings add to the existing body of evidence regarding the impact of social welfare policies and provide insights that could inform future programs aimed at improving the effectiveness of assistance to impoverished regions in the aftermath of disasters or natural hazards.

Keywords: *Aceh province, BPNT, Poverty alleviation, PKH, Post-Disaster recovery, Social assistance programs, Threshold regression.*

1. Introduction

The three functions of government that are relevant to state finance are revenue redistribution, provision of public goods and social protection [1]. Social protection is expressed through the distribution of social assistance as part of the government's role through its fiscal policy. The government has imposed the burden of government expenditure as part of efforts to overcome the issue of poverty. Subsidy spending and social assistance play an important role in policies to reduce poverty rates. The role of government subsidies and social assistance can make a significant contribution to efforts to reduce poverty levels. Government subsidies and social assistance can be used to provide better access to necessities, such as food, education, health, and housing. access to basic needs, so that the poor can reduce daily expenses, making it possible to allocate resources to other sectors that can increase productivity and welfare. On the other hand, to increase purchasing power, improving social welfare can help reduce social and economic inequality in society. By providing support to the poor, the government can create a more equitable and inclusive social structure. Investment in human resources:

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Social assistance can be used to improve access and quality of education and health for the poor. This can create more quality and productive human capital [2].

Government expenditure in the welfare sector in the form of government subsidies is a common practice in poverty alleviation. Exclusive subsidies have a significant effect on the income of the poor, but the dilemma is that the increase in the income of the poor is opposite to the decrease in ordinary income. Profit-sharing subsidies have a balancing effect on the income of the poor. Joint subsidies are the best way to increase consumer surpluses and social welfare, but they have little impact on income increases. The selection of social assistance service delivery systems based on evidence - guarantees, insurance, subsidies or a mixture is needed, there is a significant increase in poverty rates in urban slums due to self-incurred expenditures, especially for health [3]. Social assistance and subsidies for the urban poor are forms of policy support aimed at improving welfare and reducing poverty levels in urban environments. This program aims to aid community groups in difficult economic conditions, with a focus on meeting basic needs. The following is a table of the state of social assistance and subsidies in 34 provinces in Indonesia:

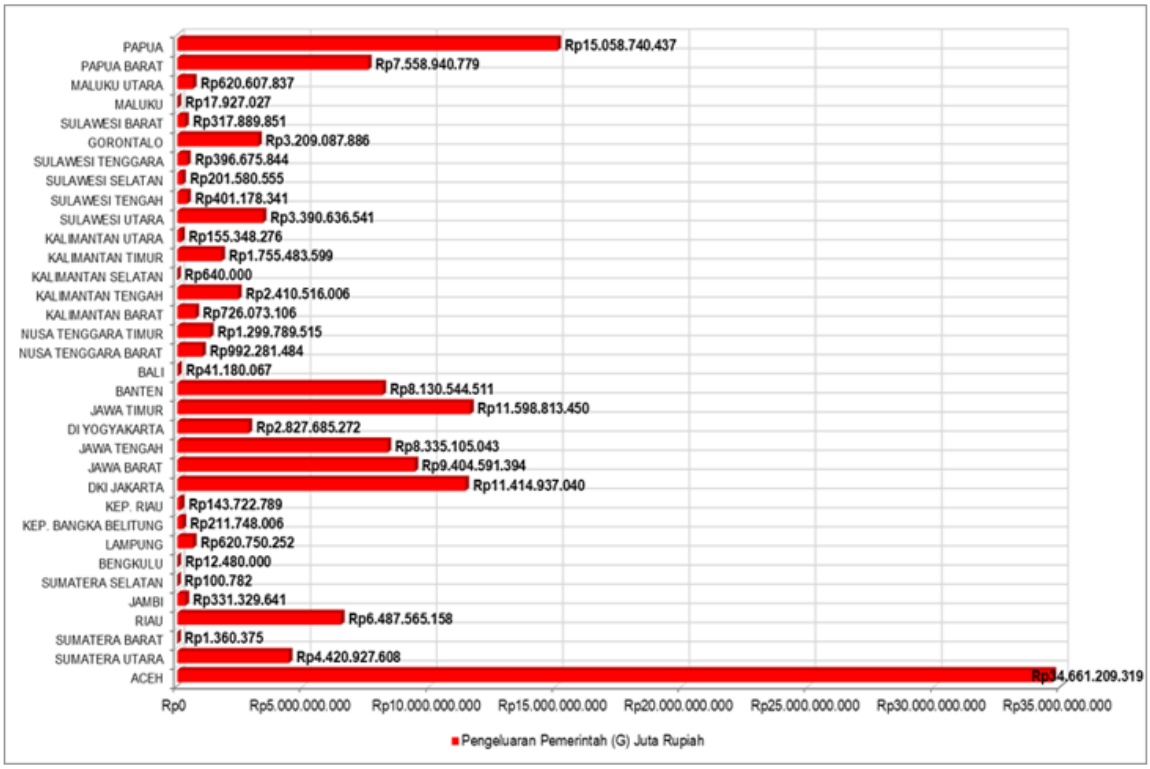

Figure 1.
Average government expenditure (G) in the field of social and welfare of the poor in 34 provinces in Indonesia

Figure 1 explains how the amount of government spending on welfare helping the poor. There are five regions with the highest government expenditure including Aceh, Papua, East Java, DKI Jakarta and West Papua. Aceh Province is the province with the highest government expenditure in the social and welfare sectors of the poor in Indonesia. Based on Figure 1, Aceh with an expenditure figure of IDR 34,661,209,319. Aceh's very high government spending may be due to major programs for poverty alleviation and infrastructure development. Papua, which has a large territory and large geographical challenges, may require significant allocation of funds for development and welfare. Aceh as a province with a recovery territorial from a Tsunami, a large allocation of funds is needed to support various social and infrastructure programs. Aceh as the affected province makes Aceh a large recipient of funds

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to support all sectors needs and welfare programs for its residents. Aceh has also difficult conditions for Aceh because geographical challenges and large development needs can lead to high fund allocations.

Some problems arisen from the poverty reduction program in Aceh might have been compromised by some related issues to the ineffective implementation. Ineffective fund distribution might involve high government spending which does not necessarily translate into effective poverty reduction. Issues such as corruption, mismanagement, and mistargeted allocations may prevent funds from reaching the intended beneficiaries. The first question that tries to be answered by the research is which period within which affects poverty both PKH and BPNT program. Aceh is an interesting territorial to be observed remembering the Tsunami disaster happened before striking the area in 2004. Structural challenges in Aceh's historical conflicts and post-conflict recovery have created unique socio-economic challenges that may impede the success of poverty alleviation programs. These challenges include weak infrastructure, limited economic opportunities, and social disparities. Not to mention the impact, the poor implementation of the program might have diminished the targeted goals.

The design of social assistance programs may not fully align with the specific needs of the poor in Aceh. For instance, the PKH and BPNT programs may not adequately address the root causes of poverty, such as lack of access to quality education, healthcare, and employment opportunities. The issue is worsened by the geographical and cultural Barriers: Aceh's geographical isolation and cultural dynamics may further complicate the distribution and effectiveness of social assistance programs. Remote areas may not receive adequate support due to logistical challenges, while cultural factors may influence the acceptance and utilization of these programs. While social assistance programs aim to provide immediate relief, they may not be sufficiently integrated with broader economic growth strategies. This lack of integration could limit the long-term impact of these programs on poverty reduction. The next question trying to be answered from the result is how does PKH and BPNT program could solve this poverty issue.

The primary purpose of this research is to evaluate the effectiveness of the PKH and BPNT programs in reducing poverty in Aceh, with a focus on identifying the gaps and challenges in their implementation. The primary purpose of this research is to conduct a comprehensive evaluation of the Program Keluarga Harapan (PKH) and Bantuan Pangan Non-Tunai (BPNT) programs in Aceh, with the overarching goal of understanding their effectiveness in reducing poverty and improving the welfare of poor households. Despite significant government expenditure on social welfare programs, Aceh continues to face high poverty rates, indicating potential gaps in the implementation and impact of these programs. This research seeks to address these gaps by achieving some objectives. Firstly, the paper tries assessing the impact of PKH and BPNT on poverty reduction. This research will rigorously analyze the extent to which PKH and BPNT have contributed to improving the welfare of poor households in Aceh, particularly in terms of access to basic needs such as food, education, and healthcare. By evaluating the outcomes of these programs, the study aims to determine whether they have successfully alleviated poverty and improved the quality of life for beneficiaries. This assessment will provide empirical evidence on the effectiveness of these programs in meeting their intended goals. Secondly, the paper tries to identify period to program effectiveness the study will investigate the factors that hinder the successful implementation of PKH and BPNT in Aceh. This includes examining issues related to fund distribution, program design, and socio-cultural dynamics. By identifying these barriers, the research will shed light on why high government spending has not translated into proportional reductions in poverty. This will involve analyzing systemic inefficiencies, potential mismanagement, and the socio-cultural context of Aceh that may affect program delivery and uptake. Finally, the paper provides policy recommendations based on the findings. This research will propose actionable policy recommendations to improve the design, implementation, and targeting of PKH and BPNT programs in Aceh. These recommendations will aim to ensure that the programs are aligned with the needs of the poor and contribute to long-term poverty alleviation. The study will also explore ways to integrate these programs with broader economic growth strategies, ensuring that social assistance is not only a short-term solution but also a catalyst for sustainable development.

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This research is not only relevant for Aceh but also has broader implications for poverty alleviation strategies in Indonesia and other regions facing similar challenges. By providing a detailed analysis of the effectiveness of PKH and BPNT, the study will contribute to the ongoing discourse on social welfare policies and their role in reducing poverty. The findings will be particularly valuable for policymakers, program implementers, and stakeholders involved in poverty alleviation efforts, offering evidence-based insights that can inform future policy decisions.

Ultimately, this research aims to bridge the gap between high government expenditure and persistent poverty in Aceh by identifying timeline that can enhance the effectiveness of social assistance programs. Welfare so, it seeks to contribute to the creation of a more equitable and inclusive society in Aceh, where the benefits of economic growth and social welfare programs are more evenly distributed among all segments of the population.

2. Literature Review

The Food Aid Program (FAP) demonstrates a significant return on investment, particularly for children under two years old, yielding beneficial effects on the economy, health, and nutrition. While substantial efforts target school-age children or adults, the economic and health benefits for these demographics are diminished. FAPs can enhance the incomes of the impoverished, particularly when targeting, food quality, and supplementary activities are refined; nonetheless, their efficacy is contingent upon numerous elements, including timeliness, incentives, and political economy considerations [4].

Poverty and food insecurity in the world would significantly escalate without assistance, particularly in regions receiving minimal aid. Nonetheless, the average beneficial effect of food aid conceals significant variation. Indeed, although aid intensity demonstrably influences poverty alleviation, the effects on food consumption and dietary diversity yield inconclusive outcomes. The findings underscore that the international community cannot provide substantial food help to impoverished households without favorably affecting individuals' financial welfare [5].

3. Research Methodology

3.1. Categories of Data and Sources of Data

This research uses a descriptive quantitative method, with secondary information taken from the Central Bureau of Statistics through observation-based analysis in Aceh Province. The data sources include scholarly articles from https://lampung.bps.go.id/. Other relevant publications are also included. The careful dataset specifically used within this study is structured into a clear time series, representing a sequentially ordered set concerning observations recorded consistently at certain specific time intervals. The time series greatly eases the examination of multiple temporal dynamics along with trends, enabling particularly strict econometric analysis [6]. According Box [7] a time series comprises a collection of observed scores gathered at different time points with the same interval, assuming that the data series is interrelated. Therefore, a time series formulation is a sequential formulation where each observation is interrelated with the others. This study calculates a 23-year time series, covering the period from 2003 to 2022, with a focus on Aceh Province in Indonesia.

3.2. Research Variables

This study discusses some critical variables, including the Poverty Line (GK) and Average Income of the Poor (PPKM) as the main variables, quantified by the ratio of the impoverished population to entire population. These indicators provide an overview of the poverty level in a region and serve as a basis for designing poverty reduction policies. These indicators offer a comprehensive assessment of the poverty level in a region and serve as foundation for formulating poverty alleviation initiatives. The non-threshold variables include Economic Growth (G), quantified by the annual percentage change in Gross Regional Domestic Product (GRDP), Inflation (INF), which marks the overall rise in the prices of products over time; and the Regional Financial Management Index (RFMI), which assesses the quality of regional financial management regarding effectiveness, efficiency, transparency, and

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accountability. Simultaneously, the threshold variables encompass the proportion of beneficiaries of Non-Cash Food Assistance (BPNT) and the quantity of households benefiting from the Conditional Cash Transfer (PKH). These threshold variables exhibit a nonlinear pattern with a specific threshold point, as suggested [8]. Non-threshold variables serve as control variables in the formulation, whereas threshold variables delineate interactions that may not be linear, encompassing minimum, medium, and maximum threshold points.

3.3. Threshold Regression Formulation

This study employs a Threshold Regression Formulation with a 20-year time series from 2003 to 2022 to examine the situation of Aceh Province. Policies are classified into two categories: Group 2, comprising policies that lack a significant influence and hence do not have a threshold score, and Group 1, which includes policies that display a measurable effect and possess a threshold score. This approach utilizes three poverty-related policy variables as threshold variables to indicate the extent of policy influence, while three macroeconomic variables function as control variables to consider wider economic conditions. By deciding the threshold variables as for proxy and the threshold score as c^*, the initial formulation alters the linear equation as follows:

$$\begin{aligned} \text{Pov}_i = {} & (\alpha_1 + \beta_1 G_{it} + \beta_2 INF_{it} + \beta_3 IPKD_{it}) * f(k_i \le c_1^*) \\ & + (\alpha_2 + \beta_1 G_{it} + \beta_2 INF_{it} + \beta_3 IPKD_{it}) * f(k_i > c_2^*) \\ & + \varepsilon_i \qquad (1) \end{aligned}$$

Explanation:

Pov	= Poverty level
G	= Economic growth
INF	= Inflation rate
IPKD	= Regional Financial Management Index
a_1, a_2	= Constant coefficients
$\beta_1 \beta_2 \beta_3$	= Regression coefficients for variables C and G
k_i	= Threshold score for BPNT and PKH
BPNT	= Threshold for the Non-Cash Food Assistance Program (BPNT)
PKH	= Threshold for the Conditional Cash Transfer Program (PKH)
c_1^*	= Bottom level threshold score
c_2^*	= Top level threshold score
ε_i	= Error term

The mathematical formulation converts a linear function into a nonlinear one by applying the natural logarithm to Pov (poverty level) to get stationary data and integrating a proxy for poverty policy variables into the formulation through the threshold constraint $f(k_i \le c_1^*)$. Subsequently, macroeconomic variables G, INF, and IPKD are examined as control variables in conjunction with the threshold poverty variables BPNT and PKH to assess the relevance of the threshold poverty variables influence on poverty (Y). This is done by examining the residuals of the BPNT and PKH equations alongside the standard F-threshold test outcomes. The error term ε_i is assumed to be independently and typically distributed (**i.i.d**) and adheres to a white noise process. The function f (.) is an indicator function, defined such that f (.) = **1** if the specified condition is satisfied, and f (.) = **0** otherwise.

Equation (2) scores a simple two-regime formulation defined by the threshold variables. It shows that the relationship between the explanatory variables and poverty is represented by $\beta_1 = (\alpha_1, \beta_1, \beta_2, \beta_3)$ when k_i (the threshold variable) is less than or equal to the threshold score c_1^* (Regime

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1), but changes to $\beta_2 = (\alpha_2, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8)$ when k_i exceeds the threshold score c_2^* (Regime 2). Equation (2) can only be calculated after rejecting the null hypothesis of a linear formulation.

The threshold formulation progressively transitions from a linear to a nonlinear framework via a mathematical reduction procedure. The threshold equation originates from a basic linear equation, subsequently changing into a non-linear equation for the bottom level and top-level threshold formulations. The subsequent derived equation counts the middle threshold score by identifying the lowest and ideal threshold boundaries. The final equation is as follows:

$$\text{PPKM}_i = (\alpha_1 + \beta_1 G_{it} + \beta_2 INF_{it} + \beta_3 IPKD_{it}) * f(BPNT_i \leq c_1^*) + (\alpha_2 + \beta_4 G_{it} + \beta_5 INF_{it} + \beta_6 IPKD_{it}) * f(c_1^* < BPNT_i \leq c_2^*) + (\alpha_3 + \beta_7 G_{it} + \beta_8 INF_{it} + \beta_9 IPKD_{it}) + * f(BPNT_i > c_2^*) + \varepsilon_i \quad (3)$$

$$\text{GK}_i = (\alpha_1 + \beta_1 G_{it} + \beta_2 INF_{it} + \beta_3 IPKD_{it}) * f(PKH_i \leq c_1^*) + (\alpha_2 + \beta_4 G_{it} + \beta_5 INF_{it} + \beta_6 IPKD_{it}) * f(c_1^* < PKH_i \leq c_2^*) + (\alpha_3 + \beta_7 G_{it} + \beta_8 INF_{it} + \beta_9 IPKD_{it}) + * f(PKH_i > c_2^*) + \varepsilon_i \quad (4)$$

Explanation:

PPKM	=	Poverty Level Income
GK	=	Poverty Line
G	=	Economic Growth
INF	=	Inflation Rate
IPKD	=	Regional Financial Management Index
a_1, a_2, a_3	=	Coefficient
$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9$	=	Regression coefficients for control variables G, INF dan IPKD
k_i	=	Threshold score for BPNT and PKH
BPNT	=	Threshold for the Non-Cash Food Assistance Program
PKH	=	Threshold for the Conditional Cash Transfer Program
c_1^*	=	Minimum threshold score
c_2^*	=	Optimal threshold score
ε_i	=	error term

The threshold formulation equation shows the presence of two regimes as against to three regimes, with the null hypothesis stated as Ho: two regimes opposed three regimes. The test statistic is the same as the F-Statistic in *Eq* (3) with the exception that $\tilde{\sigma}_n^2$ is the residual variance od *Eq* (1) and $\hat{\sigma}_n^2$ is the residual variance of *Eq* (5). Since the threshold level is unknown and the asymptotic F-statistics cannot be derived from the X^2 distribution, a bootstrap procedure is required to test the hypothesis.

4. Results

4.1. Threshold Formulation Outcomes Regarding the Effects of BPNT and PKH Policies

The approach of regression analysis in the threshold model on poverty alleviation policies is to debate whether the existing social assistance, especially BPNT and PKH, gives different benefits to the alleviation of poverty in accordance with the condition. As such, the hypothesis of this formulation suggests that social assistance initiatives are a critical lever in reducing poverty in the long run where the extent and nature of these programs may function above or below some threshold level that maximizes their effectiveness.

It covers data from 2000 to 2022 employing Per Capita Income of the Poor (PPKM) and the Poverty Line (PL) as dependent variables to measure the effectiveness of poverty alleviating policies. BPNT and PKH are the threshold variables in this formulation, which set up the effectiveness threshold for these programs at certain scores. Control variables include economic growth (PE), inflation (INF), and the Regional Financial Management Index (RFMI), which act as macroeconomic variables that impact poverty.

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As the two examples cited, this threshold formulation uses complex statistical frameworks such as the switching formulation derived from the methodology proposed by Hansen and Hill [8] and the smooth transition formulation. These methodologies present wide research of international affairs that the impacts of BPNT and PKH on upper levels under threshold conditions governed by control variables. Results from this specification are expected to show how the effectiveness of social assistance programs at reducing socioeconomic status endowed disparities in poverty varies with different economic environments. This section presents the results of the analysis of the threshold formulation:

Table 1.
Statistical Results of the Optimal Threshold Effect Score of BPNT and PKH

First Formulation with Y Per capita Income of the Poor				
1	**ACEH**	**Threshold Score**	**Regime**	**F-statistic**
BPNT	$f(k_i \leq c^*_1)$	BPNT < 59,19999 -- 3 obs	0 vs. 1 *	21,98810
	$f(c^*_1 < k_i \leq c^*_2)$	59,19999 <= BPNT -- 20 obs	1 vs. 2	3,923277
	$f(k_i > c^*_2)$	-		
		Threshold Score	Regime	F-statistic
PKH	$f(k_i \leq c^*_1)$	PKH < 1,9899 -- 4 obs	0 vs. 1 *	31,19045
	$f(c^*_1 < k_i \leq c^*_2)$	1,989 <= PKH < 2,0699 - 3 obs	1 vs. 2 *	19,13829
	$f(k_i > c^*_2)$	2,0699 <= PKH -- 16 obs		
Second Formulation with Y Poverty Line				
2	ACEH	Threshold Score	Regime	F-statistic
BPNT	$f(k_i \leq c^*_1)$	-	-	-
	$f(c^*_1 < k_i \leq c^*_2)$	-	-	-
	$f(k_i > c^*_2)$	-	-	-
		Threshold Score	Regime	F-statistic
PKH	$f(k_i \leq c^*_1)$	PKH < 2,26999 -- 14 obs	0 vs. 1 *	5,997274
	$f(c^*_1 < k_i \leq c^*_2)$	2,2699 <= PKH < 2,5599 - 3 obs	1 vs. 2 *	12,96548
	$f(k_i > c^*_2)$	2,5599999 <= PKH -- 6 obs		

4.1.1. Formulation (Y) Per Capita Income of the Poor (PPKM)

Referring to the initial formulation, BPNT is the threshold variable, while Y is the per capita income of the poor, where the result of the BPNT threshold score in Aceh Province shows only a significant lower limit. That is considered an improvement according to the following criteria:

1) BPNT < 59.19999 -- 3 observations occurred in the years 2020-2022, during which BPNT presented a substantial lower threshold influence on per capita income.
2) 59.19999 ≤ BPNT -- 20 observations from 2000 to 2019 demonstrate that BPNT exerted a significant median threshold influence on per capita income during this two-decade period.

The PKH threshold variable shows a significant lower and upper limit in the Aceh Province with Y which is the per capita income of the poor. Based on the following standard, this is considered very effective:

1) PKH < 1.9899 -- 4 observations occurred in 2018, 2020, 2021, and 2022, showing that PKH applied a significant lower threshold influence on per capita income.
2) 989 ≤ PKH < 2.0699 -- 3 observations exist in 2001, 2007, and 2014, indicating a significant median threshold effect of PKH on per capita income.
3) 2.0699 ≤ PKH -- 16 observations exist in 2002-2009, 2011-2013, 2015-2017, and 2019, demonstrating that PKH had a substantial top level threshold effect on per capita income, proving that PKH has attained its maximum efficacy.

4.1.2. Formulation (Y) Poverty Line (GK)

In this first formula, in which the threshold variable is BPNT (food assistance) and Y (to describe poverty line), there is no effect that is significantly threshold score of BPNT in Aceh Province even on Y. This means that the BPNT policy has no effect on the poverty line.

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Whereas the PKH threshold variable with Y is the poverty line, shows high and low boundaries in Aceh Province, with quite effective when viewed from certain criteria.

1) PKH < 2.26999 -- 14 observations exist in the years 2000-2004, 2006-2010, 2014, 2018, and 2020-2022, during which PKH had a significant lower threshold effect on the poverty line.
2) 2.2699 ≤ PKH < 2.5599 -- 3 observations exist in 2005, 2015, and 2017, during which PKH had a significant middle threshold effect on the poverty line.
3) 2.5599999 ≤ PKH -- 6 observations exist in 2011-2013, 2015, 2016, and 2019, during which PKH had a significant top threshold effect on the poverty line. This indicates that PKH had reached its peak effectiveness in influencing the poverty line.

4.2. Outcomes of the Regression Threshold Formulation Regarding the Impact of BPNT and PKH Policies on the Per Capita Income of the Impoverished and the Poverty Line

The threshold regression formulation can be illustrated, for example, by the condition that a variable has lower and mid threshold scores, or lower, mid, and upper threshold scores. If we observe the regressions formulation results, it only produced 3 equations which are BPNT on Y which is PPKM (the per capita income of the poor), PKH on Y which is PPKM (the per capita income of the poor), and PKH on Y which is GK (the poverty threshold). This is conditional on the acquiescence of these three formulations, where threshold scores exist. The coefficient score of the regression analysis is useful to see how much influence BPNT and PKH have on per capita income and the poverty line in Aceh Province during 2000-2022 with the threshold level. Mathematical Formulation: *Ordinary Least Squares* (OLS) Threshold Formulation, presenting the outcomes of regression analyses subsequently converted into mathematical notation, incorporating the regression equation scores as follows:

$$\begin{aligned}\text{PPKM}_\text{I} = (\alpha_1 + 0{,}242025\text{PE} - 0{,}025693\text{INF} + 0{,}051625\text{IPKD}) + 0{,}008908\text{BPNT}\\ (2{,}324146)\,(-0{,}459865)\,(3{,}500414)\,(3{,}215995)\\ * f(\text{BPNT} < 59{,}19999) + (\alpha_2 + 0{,}242025\text{PE} - 0{,}025693\text{INF} + 0{,}051625\text{IPKD})\\ + 0{,}056156\text{BPNT} * f(59{,}199999 <= \text{BPNT})\\ (2{,}324146)\,(-0{,}459865)\,(3{,}500414)\,(16{,}01038)\end{aligned}$$

The probability score for each variable obtained from the Threshold Regression Estimation formulation is as follows. This means that the R-squared score is 0.568038 — suggesting that the formula explains ~56% of the variability in the data. R-squared indicates how much of an effect all the independent (predictor) variables have on the dependent (outcome) variable and the threshold variable. Therefore, in this study, the independent variable explains 56% of the total variation in the per capita income of the poor, while the rest 44% is attributed to other variables not contained in the formulation of this research.

Formulation: *Ordinary Least Squares* (OLS) Threshold Formulation, presenting the outcomes of regression computations subsequently converted into mathematical notation, incorporating the regression equation scores as follows:

$$\begin{aligned}\text{PPKM}_\text{I} = (\alpha_1 + 0{,}061856\text{PE} - 0{,}037096\text{INF} + 0{,}068283\text{IPKD}) + 3{,}984851\text{PKH}\\ (1{,}099644)\,(-1{,}306466)\,(9{,}046116)\,(13{,}58402)\\ * f(\text{PKH} < 1{,}9899999) + (\alpha_2 + 0{,}061856\text{PE} - 0{,}037096\text{INF} + 0{,}068283\text{IPKD})\\ + 9{,}272417\text{PKH} * f(1{,}9899999 <= \text{PKH} < 2{,}0699999)\\ (1{,}099644)\,(-1{,}306466)\,(9{,}046116)\,(5{,}817832)\\ +(\alpha_3 + 0{,}061856\text{PE} - 0{,}037096\text{INF} + 0{,}068283\text{IPKD}) + 10{,}001168\text{PKH}\\ * f(2{,}0699999 <= \text{PKH})\\ (1{,}099644)\,(-1{,}306466)\,(9{,}046116)\,(3{,}112703)\end{aligned}$$

For each variable, the Threshold Regression Estimation formulation produces results indicating a probability score. The R-squared score is 0.911481, meaning our formulation explains ~91% of the variance in the data. R-squared judging how many influences are in all the independent variables in the

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dependent variable and threshold variable. Therefore, in this research, 91% of the dependent variables, per capita income of the poor is determined by the independent variables and 9% is influenced by other variables external to this research formulation.

Mathematical Formulation on *Ordinary Least Squares* (OLS) Threshold Formulation, presenting the outcomes of regression analyses subsequently converted into mathematical notation, incorporating the regression equation scores as follows:

$$\begin{aligned} GK_I = {} & (\alpha_1 + \underset{(1{,}761969)}{1{,}831382}PE + \underset{(2{,}648521)}{2{,}015081}INF + \underset{(0{,}594138)}{2{,}015081}IPKD) + \underset{(5{,}334259)}{1{,}199900}PKH \\ & * f(PKH < 2{,}2699999) + (\alpha_2 + \underset{(1{,}761969)}{1{,}831382}PE + \underset{(2{,}648521)}{2{,}015081}INF + \underset{(0{,}594138)}{2{,}015081}IPKD \\ & + \underset{(-4{,}263248)}{24{,}15053}PKH * f(2{,}2699999 <= PKH < 2{,}5599999) \\ & + (\alpha_3 + \underset{(1{,}761969)}{1{,}831382}PE + \underset{(2{,}648521)}{2{,}015081}INF + \underset{(0{,}594138)}{2{,}015081}IPKD + \underset{(6{,}421404)}{10{,}122337}PKH * f(2{,}5599999 <= PKH) \end{aligned}$$

The probability score for every variable can be established by the findings of the Regression Estimation Threshold formulation. The R square 0.874757 cases per month explains ~87% of the variation in the data. R–squared indicates the effect of all independent variables on the dependent variable and the threshold variable, which is that in this study the independent variable contributes as much as 87% to the poverty line. Meanwhile, 13% of the effect is obtained from other variables not included in the research formulation.

5. Discussion

Led by the uncommon level of poverty, these fruitful systems additionally require the substitution of high-poverty neighborhoods (>40%) for low-poverty neighborhoods (<15%) [9]. Influence of informality is two-faced: harmful in middle-income countries and positive in low-income countries. The level of informality in GDP where extreme poverty is between 25% and 37% [10]. Without the economy reaching a certain level, the benefits of globalization on poverty reduction are minimal [11]. Additionally, different strategies have their unique threshold scores required to efficiently alleviate poverty [12]. More general, nonlinear formulations suggest that poverty traps do exist, where sufficient resource allocations will not be used productively, as resource allocation displays a threshold effect: resource allocations below RMB 1,291 per capita are a binding constraint to economic development with resource allocations above RMB 4,469 per capita promoting economic growth [13].

BPNT program alleviates the financial burden on impoverished households by supplying essential food items, such as rice and eggs, thereby enabling them to allocate their income towards other necessities, including education, healthcare, or small business investments. Moreover, BPNT enhances the purchasing power of the impoverished, therefore benefiting the local economy. With effective administration, the program can foster long-term self-sufficiency among disadvantaged families and diminish their need for social assistance. Nonetheless, its influence is significantly contingent upon the efficacy of program execution, equity of allocation, and support in household financial administration.

5.1. The Impact BPNT and PKH On the Income of Impoverished Individuals in Aceh Province

The impact of BPNT against the income of poor people in Aceh Province shows that the BPNT score with a lower threshold is less than 59.19999 with three observations recorded in 2020-2022 at three years of BPNT implementation. It shows a positive coefficient of 0.008908, and the significance level is 0.0317, which is less than 0.05%. All else being equal/ceteris paribus, a 1% increase in BPNT recipients results in an increase in the per capita income of the poor of 0.008%. The presented median threshold score of 59.19999 for this category, BPNT observed over the twenty years period from 2000 to 2019 shows a positive coefficient of 0.056156, with a level of significance 0.0000, which is less level

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than 0.05%. Every percent increase in BPNT recipients results in the poor's per capita income increased by 0.05% (ceteris paribus).

The FAP is highly cost-effective, and during the period under review most of the children we reached were under two years old, meaning they will reap tangible benefits through the economy, health, and nutrition well into their future. But significant initiatives focus on school-age children or adults and the economic and health dividends for these populations are limited. The FAPs can significantly increase the incomes of the poor, especially where targeting, food quality and other interventions are improved; however, their impact depends on a wide variety of factors, including timing, incentives and political economy issues [4].

Poverty and food insecurity would greatly increase in the absence of aid, especially in areas with minimal aid. Yet the average positive impact of food aid hides considerable heterogeneity. Yes, even though aid intensity clearly impacts poverty alleviation, the results on food consumption and dietary diversity are ambiguous. The results highlight that the international community cannot offer significant food aid to poor households without negatively impacting people's economic welfare [5].

The Influence of the Family Hope Program (PKH) on the Per Capita Income of Impoverished Households in Aceh Province indicates disparate effects across all income levels. At the lower criterion (PKH < 1.9899), noted in 2018, 2020, 2021, and 2022, the coefficient is positive, with a significant level of 0.0000 ($p < 0.05\%$). Over these four years, a 1% rise in PKH beneficiaries correlated with a 3.98% increase in the per capita income of the impoverished, assuming other variables remain constant (ceteris paribus). At the intermediate criterion ($1.989 \leq PKH < 2.0699$), noted in 2001, 2007, and 2014, the coefficient persists as positive, with a significance level of 0.0000 ($p < 0.05\%$). Over the course of three years, a 1% rise in PKH recipients leads to a 9.27% increase in the per capita income of impoverished households, provided all other variables remain the same (ceteris paribus). At the top threshold ($1.0699 \leq PKH$), recorded across 16 periods from 2002 to 2009, 2011 to 2013, 2015 to 2017, and 2019, the coefficient is 10.0, with a significance level of 0.0119 ($p < 0.05\%$). A 1% rise in PKH beneficiaries results in a 10.0% increase in per capita income, assuming other variables remain constant (*ceteris paribus*).

Most PKH participants are 39 years old, have completed their primary education, and are homemakers. Before and after the acquisition of PKH, their income ranges in IDR 1,000,000–1,999,999 along with the zakat expenditure. The Family Hope Program is effective, with an average score of 338.26, and dramatically improves the well-being and income of the poorest of the poor [14]. The execution of PKH positively influences wellbeing, with each incremental unit of PKH implementation enhancing welfare by 0.6% [15]. The direct and positive impact of PKH on the welfare of poor households in Indonesia, particularly on income and spending level. Key determinants of economic improvement through PKH include education status, family unit size, and participation in training programs under PKH. To sum up, PKH has proven effective at improving the economic conditions of poor households in Indonesia, and this needs to be strengthened through increased participation and access to better quality training [16]. PKH is also a prime mover in improving household welfare. Policy solutions to this challenge include adjusting the levels of cash transfers so that the poorest recipients receive larger payments than the wealthy. Instead of focusing on the number of beneficiaries, PKH needs to improve its targeting, specifically its targeting for the poorest to benefit more. The Indonesian government may need to develop tailored economic and social assistance programs for the lowest PKH quintile, who tend to have lower education, limited financial means, and largely women [17].

Aceh becomes the province with the highest per capita income for poor families from BPNT and PKH programs. However, PKH is more effective at various income levels. For both the bottom and intermediate thresholds, PKH shows a larger relative increase in income compared to BPNT, having the largest coefficients for both. In conclusion, BPNT has comparatively moderate impact but is still significant especially in long-term and larger beneficiaries while PKH is more effective in improving the welfare of poor households. The programs provide substantial contributions to poverty alleviation by raising income, but PKH has a greater effect on per capita income. This paper provides a description

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of the trends in the development of BPNT and PKH based on the income of poor families in Aceh Province from the year 2000 to 2022.

5.2. The Impact of BPNT and PKH on the Poverty Line in Aceh Province

The BPNT study results regarding (Y) the poverty line in Aceh Province demonstrate that the threshold formulation variable lacks a critical threshold score, indicating it does not significantly affect (Y) the poverty line. During the period from 2000 to 2004, 2006 to 2010, 2014, 2018, and 2020 to 2022, 14 observations were recorded at the lower threshold when PKH is less than 2.26999. Over the course of 14 years, PKH exhibited a positive coefficient of 1.199900, with a significant level of 0.0431 (< 0.05). A 1% rise in PKH grantees results in a 1.19% increase in the poverty line (Y), if all other factors are held constant (ceteris paribus). Within the intermediate range, where 2.2699 ≤ PKH < 2.5599, three observations were recorded in 2005, 2015, and 2017. Over the course of three years, PKH exhibited a positive coefficient of 24.15053 and a significant level of 0.0008 (< 0.05). This signifies that a 1% rise in PKH recipients results in a 24.15% escalation in (Y) the poverty threshold, provided all other variables are held constant. At the upper limit, where 2.5599999 ≤ PKH, six observations were recorded in the years 2011–2013, 2015, 2016, and 2019. Over the course of six years, PKH exhibited a positive coefficient score of 10.122337, with a significant level of 0.0099 (< 0.05). A 1% increase in PKH grantees leads to a 10.12% rise in the poverty line (Y), providing all other factors are held constant.

The Conditional Cash Transfer Program (PKH) has alleviated the financial strain of schooling for recipients by supplying funding for school materials, uniforms, and other educational necessities. This program has significantly influenced the economic circumstances of beneficiary households, with money being utilized as startup capital. Nonetheless, human resources in metropolitan regions encounter difficulties in executing PKH, as they grapple with concerns that diverge from the program's goals. PKH aid typically elevates the expenditures of low-income households, thus influencing the poverty threshold [18]. The PKH program generally aids in poverty alleviation by augmenting household expenditures, hence affecting the poverty line. Nonetheless, there are adverse reactions stemming from the restricted public comprehension of PKH, resulting in perceptions of inequitable distribution. The efficacy of the Family Hope Program's execution is significantly affected by the attributes of the participants, depending on their endorsement or opposition to the program. The efficacy of PKH implementation is significantly reliant on community support and a favorable environment [19].

The Conditional Cash Transfer (CCT) scheme has been extensively executed in numerous nations. In Indonesia, this initiative is referred to as Program Keluarga Harapan (PKH), The Family Hope Program. This cash transfer scheme has been extensively discussed as a poverty alleviation tool. PKH contributes to poverty alleviation and enhances welfare in Indonesia. The program adversely affects poverty while positively influencing welfare, leading to heightened expenditure among low-income households and individuals close to the poverty threshold. Furthermore, research indicates that poverty adversely affects public welfare in Indonesia [20].

Another study related to (PKH) has demonstrated a beneficial effect on poverty alleviation in Bonehau District, Mamuju Regency. Regression study indicates a positive correlation between PKH policies and the decrease in the population of impoverished individuals. The correlation coefficient of 0.462 indicates that this program significantly aids low-income populations by enhancing their expenditures and maybe reducing the poverty threshold. To get the best outcomes, aid management must prioritize targeted utilization, especially in education, facilities for individuals with disabilities, and support for school-age children [21].

Conversely, BPNT (Non-Cash Food Assistance) has not demonstrated a substantial effect on the poverty threshold in Aceh Province, while it has contributed to an increase in per capita income among low-income demographics. Conversely, PKH has shown a considerable impact on poverty alleviation, particularly among medium and higher threshold beneficiaries. At the lower threshold, its effect on the poverty line is very minor yet nonetheless substantial. Nonetheless, at the median and upper criteria, the influence of PKH is significantly amplified, suggesting that the program is more efficacious in alleviating poverty when a bigger percentage of low-income households obtain support. In summary,

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PKH exerts a more significant influence on redefining the poverty threshold than BPNT, particularly affecting recipients at elevated levels. This document provides an overview of the trends in BPNT and PKH development concerning the poverty threshold in Aceh Province from 2000 to 2022.

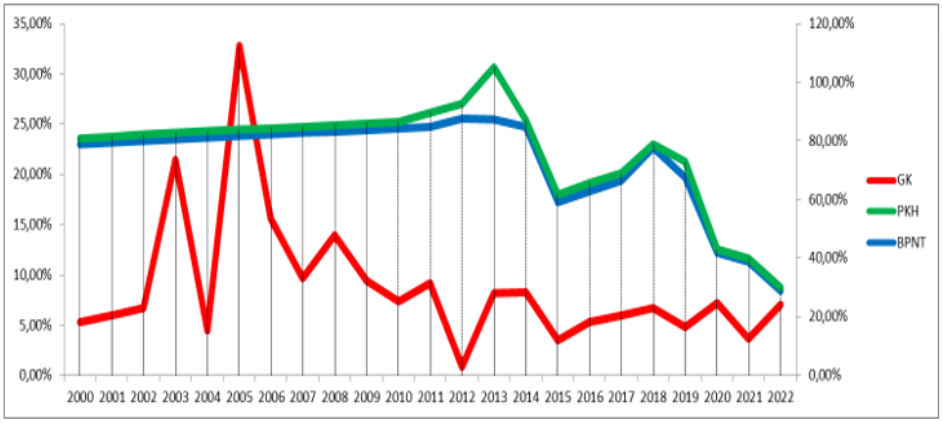

Figure 2.
Trends in the Development of BPNT and PKH on the Conditional Cash Transfer Program (PKH) on the Poverty Line in Aceh Province

As shown in Figure 2, BPNT increased steadily from 78.89% in 2000 to 87.64% in 2012. This increase indicates that the BPNT program expanded its coverage, possibly reducing poverty and helping low-income populations meet their essential nutritional needs. BPNT data series experienced a high decrease, decreasing to 59.22% in 2015, and continued decreasing until 2022 with a result of 28.93%. Such adjustments negatively impacted upon the poverty line (GK) where, because of the decrease in food assistance through non-cash programs, the related financial burden increased, imposing increased pressure on GST welfare, reducing health and wellbeing, particularly upon vulnerable groups. BPNT's augmentation accompanied by a decline in GK when food assistance can facilitate the lower-low-income community to fulfil their primary needs, causing poverty to decrease. A declining BPNT means the poverty line increases with time; this indicates dependency due to programmer's discontents.

Conversely, PKH growth (2012-2014): PKH witnessed significant growth from 2012 to 2014, achieving 17.85% in 2014. It means that during this period PKH received a larger OT, which reduces poverty through social aid to education and health for poor families. PKH's gradually declining impact since 2014: low-income neighborhoods in Indonesia have kept dropping PKH since 2014, and its percentage in 2022 is already below 5% This trend indicates that although PKH contributed to reducing poverty events, its ability to reduce the poverty threshold also decreases over time. From 2012 to 2014, PKH expansion favored the decline of the poverty line. However, the decline in PKH indicates that the poverty line (GK) has risen again because of the reduced distribution of assistance to alleviate poverty in poor households.

6. Conclusions

This study demonstrates that BPNT and PKH significantly enhance the per capita income of low-income areas in Aceh. Nonetheless, PKH demonstrates more efficacy, particularly for lower and middle thresholds, yielding a more substantial revenue boost (up to 10.0%). In summary, PKH possesses superior potential for poverty alleviation; yet, both programs significantly contribute to enhancing the income levels of low-income areas in Aceh Province. BPNT exerts minimal influence on the poverty threshold in Aceh. Although PKH possesses a higher capacity to alleviate poverty, both initiatives are crucial for tackling poverty in Aceh Province.

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7. Suggestion

Strengthening PKH through Integrated Economic Empowerment PKH has proven to be more effective in reducing poverty, especially for poor family groups in the low- and middle-income segments. Hence it also needs to improve the PKH by increasing the budget allocation and target precision. Moreover, the introduction of economic empowerment programs for PKH beneficiaries can support sustainable income improvement. Boosting up mentorship to take skills to another level and reducing the rate of small-scale business development amongst low-income householders will fasten poverty alleviation.

Though it has a limited effect, BPNT is crucial for maintaining food security in lower-income regions. To make BPNT work better, it should be supported by better distribution, better supervision, and more types of food assistance. As described, adjusting aid allocation to be based on consumption habits and needs at the local level will ensure that assistance provided effectively relieves low-income areas of the burden of these actions. Key Policies: Increasing the efficiency and accountability of BPNT systems in place and diversifying the food in-kind modality in accordance with the local need and conducting frequent monitoring and assessment of the BPNT program.

By proposing workable alternatives that can improve the efficacy of social assistance programs, this research ultimately seeks to close the gap between high government spending and Aceh's ongoing poverty. By doing this, it hopes to help Aceh develop a more inclusive and equitable society where the advantages of social welfare initiatives and economic expansion are shared more fairly by all facets of the populace.

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Transparency:

The authors confirm that the manuscript is an honest, accurate and transparent account of the study that no vital features of the study have been omitted and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Competing Interests:

The authors declare that they have no competing interests.

Authors' Contributions:

Conceptualization; UC, A, N and IW.; methodology, UC and A.; software, U.; validation; UC, A, N and IW.; formal analysis, UC and Md. HW.; investigation, UC and N.; resources, UC.; data curation, UC and IW.; writing—original draft preparation, H.W. and U.C.; writing—review and editing, U.C. and I.W.S.; visualization, UC.; supervision, M.D H.W.; project administration, UC.; funding acquisition. All authors have read and agreed to the published version of the manuscript.

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