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The Effect of Household Health and Education Expenditures and Macroeconomic Conditions on Cigarette Consumption: A Panel Data Study of 34 Provinces in Indonesia, 2021–2023

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Abstract: This study aims to analyze the effects of household expenditures on health and education, as well as macroeconomic conditions, on cigarette consumption across 34 provinces in Indonesia during the 2021–2023 period. A quantitative approach is employed using a fixed-effects panel data model to systematically estimate the relationships among the variables. The novelty of this study lies in the integration of both micro-level variables (household expenditure on health and education) and macroeconomic indicators (GRDP growth, open unemployment rate, and poverty depth index) into a unified analytical framework using recent provincial panel data. This approach has rarely been adopted in previous studies, which predominantly relied on cross-sectional household-level data and tended to isolate micro or macro factors. The results indicate that household health expenditures, the poverty depth index, and the unemployment rate have a significant negative effect on cigarette consumption. In contrast, household education expenditures and GRDP growth do not exhibit statistically significant impacts. These findings suggest that increased spending on health may reduce cigarette consumption through a budget reallocation mechanism (crowding-out effect), whereas education-related spending shows no practical short-term influence. The study implies that public policy interventions should prioritize enhancing household investments in health while simultaneously addressing macroeconomic pressures that contribute to smoking behavior. It is recommended that future research extends the observation period, incorporates sociocultural variables, and includes behavioral dimensions to obtain a more comprehensive understanding of household cigarette consumption patterns across regions in Indonesia. These insights are expected to support the development of evidence-based public policies aligned with national health and education agendas.

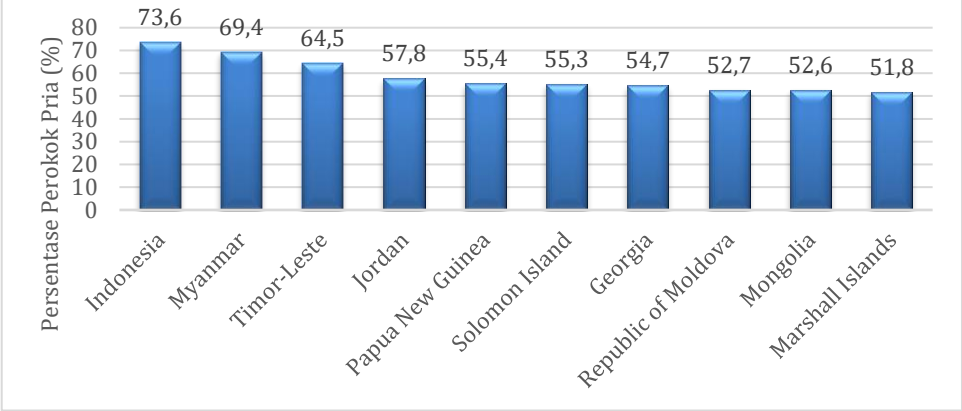
Keywords: Cigarette Consumption Expenditure, Household Health Expenditures, Education Expenditure, Macroeconomic Indicators, Panel Data Analysis.

INTRODUCTION

Indonesia faces a complex and multidimensional tobacco consumption crisis. With the world's highest prevalence of adult male smokers, reaching 73.6% in 2022 (WHO, 2024) and the lowest smoking initiation age in the ASEAN region (an average of 16.8 years according to SEATCA, 2021), the country is in a state of emergency exacerbated by weak tobacco regulations, very affordable cigarette prices (among the cheapest in the Asia Pacific), and social norms that associate smoking with masculinity (WHO, 2020).

Cigarette consumption in Indonesia is not only a health issue but also creates serious social, economic, and structural burdens. From a public health perspective, the risk of diseases such as pulmonary tuberculosis increases significantly with the number of cigarettes consumed (Kakuhes et al., 2020). Economically, cigarettes have a crowding-out effect, with approximately 30% of poor households allocating 15–20% of their income to cigarettes, exceeding their education budget (BPS, 2022). In fact, studies show that every 10% increase in cigarette spending decreases spending on food by 1.75%, education by 0.75%, and health by 0.77% (Ginting & Maulana, 2020). This mechanism is exacerbated by the prioritization of adult consumption at the expense of children's needs (John, 2006), as well as the negative correlation between cigarette spending and spending on staple foods and education (Putri et al., 2020; Amrullah et al., 2022).

Figure 1. 10 Countries with the Highest Percentage of Male Smokers (2022)



Structurally, high cigarette consumption is also driven by exposure to advertising, which influences approximately 70% of adolescents to start smoking (Ministry of Health of the Republic of Indonesia, 2013), and by poverty, which encourages smoking as a means of escape from stress (Bappenas, 2020). Ironically, 80% of smokers are workers, particularly those in the formal sector, which faces high levels of stress (Salsabila et al., 2022; Nizamie & Kautsar, 2021)

However, most existing studies are micro-scale, limited to the household scale and fragmented variable analysis. The lack of a regional macroeconomic approach that integrates factors such as health expenditure, education, economic growth (GRDP), poverty depth, and unemployment limits the comprehensive understanding of the structural determinants of cigarette consumption (Setiyani & Kristiyanto, 2023). However, a cross-provincial panel data approach has significant potential to reveal the disparities in the effectiveness of tobacco control policies in Indonesia.

Cigarette consumption behavior has been extensively studied using various theoretical approaches, particularly from the perspectives of behavioral health and household economics. The Health Belief Model (HBM) states that an individual's decision to smoke or quit is strongly influenced by perceived health risks, perceived benefits of behavior change, and available barriers or incentives (Rosenstock, 1974). When an individual is aware of the health risks of

smoking and perceives the benefits of quitting smoking to outweigh the barriers, they are more likely to reduce their cigarette consumption.

From a behavioral economic perspective, Mental Accounting Theory (Thaler, 1999) explains that households tend to separate expenses based on psychological categories called "mental accounts." In this context, the budget for cigarettes is placed in a separate account from other expenses such as education or health care. This explains why increases in income or education spending do not necessarily reduce cigarette spending, as consumers view cigarettes as a separate need.

Budget Constraint Theory (Biswan, 2022), which states that limited financial resources force households to prioritize expenditures between essential and non essential needs. In practice, tobacco consumption often absorbs budget allocations that should be directed toward basic necessities such as food, healthcare, and education. This imbalance in spending may have long term negative consequences for overall welfare, particularly among younger generations. Nevertheless, among certain segments of society especially working age men, cigarettes are often perceived as a primary need due to social pressure, masculine norms, and their role as a stress-relief mechanism and symbol of social identity (Nichter et al., 2009).

Furthermore, in the context of a developing country like Indonesia, cigarette consumption is not only related to microeconomic aspects but is also influenced by macroeconomic structures such as poverty, unemployment, and weak tobacco regulations. A study by Bappenas (2020) shows that poverty can drive individuals to use cigarettes as an escape from economic and psychological pressures. Furthermore, cigarette advertising and strong cultural norms contribute to maintaining the high prevalence of smoking among adolescents and workers (Ministry of Health of the Republic of Indonesia, 2013; Salsabila et al., 2022).

METHOD

This study uses a quantitative approach, utilizing secondary data from the National Socioeconomic Survey (Susenas) of the Central Statistics Agency (BPS) for the 2021–2023 period. Observations covered 34 Indonesian provinces, resulting in panel data (cross-section and time-series). This approach was chosen to analyze the simultaneous influence of health, education, and macroeconomic variables on cigarette consumption.

All variables were converted to annual units to ensure temporal consistency in the panel data structure, following standard practices in time series and panel data analysis (; Baltagi, 2021). The dependent variable is annual per capita cigarette expenditure, while the independent variables include per capita OOP health expenditure; per capita education expenditure; GRDP growth rate; Poverty Depth Index (P1); and Open Unemployment Rate (TPT).

The estimation model used is panel data regression, with model selection using the Chow, Hausman, and Lagrange Multiplier tests. The best model was selected between the Common Effect Model (CEM), Fixed Effect Model (FEM), or Random Effect Model (REM). Classical assumption tests were performed, limited to heteroscedasticity and multicollinearity, adjusting for panel data characteristics. Partial (t-test) and simultaneous (F-test) analyses were performed to test the significance of the effect. Adjusted R^2 was used to measure the model's ability to explain variations in cigarette expenditure. Based on the conceptual framework developed, the final regression model in this study was formulated as follows:

$$\mathbf{PR_{it}=\beta 0+ \beta_1 PK_{it}+ \beta_2 PP_{it}+ \beta_3 PDRB_{it}+ \beta_4 IKK_{it}+ \beta_5 TPT_{it}+ui+\varepsilon_{it}}$$

PRit = Cigarette expenditure
β1PKit = Health expenditure
β2PPit = Education expenditure
β3PDRBit = Gross Regional Domestic Product (GRDP) growth rate

β5TPTit = Open Unemployment rate
eit = Error term

RESULTS AND DISCUSSION

Model Selection

Chow Test

Table 1. Chow Test

Chow Test	Statistic	d.f.	Prob.
Cross-section F	230.899262	(33,63)	0.0000
Cross-section Chi-square	489.966020	33	0.0000

Source: Eviews 13 output (2025)

Based on the chow test shown in the table above, the significance value of the Cross-section Chi-square and Cross-section F is 0.0000 (less than 5%), so that statistically Ho is accepted and Ha is rejected, then the appropriate estimation model used in panel data regression is the Fixed Effect Model. Because the results of the chow test show that the more appropriate model to use is the Fixed Effect Model, a Hausman test is needed to test the more appropriate model to use between the Fixed Effect Model (FEM) and the Random Effect Model (REM).

Hausman Test

Table 2. Hausman Test

Hausman Test	Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	29.001475	5	0.0000

Source: Eviews 13 output (2025)

Based on the Hausman test shown in the table above, the significance value of the random cross-section is 0.0000 (less than 0.05) so that statistically Ho is accepted and Ha is rejected, so the appropriate estimation model to use in panel data regression is the Fixed Effect Model.

Regression Results Using the Best Estimation Method: Fixed Effects Model (FEM)

Table 3. Regression Estimation Results (Fixed Effects Model - FEM)

Variable	Coefficient	Std. Error	t-Statistic
C	3741415.	267631.1	13.97975
PK	-4.499107	1.340447	-3.356422
PP	0.000667	0.078085	0.008547
PDRB	-4865.970	9761.279	-0.498497
IKK	-205236.0	91340.20	-2.246941
TPT	-139248.9	32636.38	-4.266677

Source: Eviews 13 output (2025)

The results of multiple regression statistical processing produce a regression model equation, namely: Regression Model Equation: PRit = 3741415 – 4.499107 PK + 0.000667 PP - 4865.970 GRDP - 205236 IKK – 139248.9 TPT + Ɛit

F Test

Table 4. F Test

Alpha	F Statistik	Prob
0.05	304.6778	0,000000

Source: Eviews 13 output (2025)

Based on the results of the F test, the F-statistic was obtained at 304,667 with a probability value of 0.0000, which means <0.05, so Ha was accepted and it can be concluded that simultaneously there is a significant influence between the independent variables (Health Expenditure, Education Expenditure, GRDP Growth Rate, Poverty Depth Index and Open Unemployment Rate) on Cigarette Expenditure.

Goodness of Fit Test (R^2)

Table 5. Goodness of Fit Test (R^2)

R^2	**0.994588**
Adj R^2	0.991324

Source: Eviews 13 output (2025)

Based on the regression results with the Fixed Effect Model, it is known that the R-square value is 0.9945. This indicates that the variation of the dependent variable can be simultaneously explained by the independent variables (Health Expenditure, Education Expenditure, GRDP Growth Rate, Poverty Depth Index and Open Unemployment Rate) by 99.45% while the remaining 0.55% is explained by other factors outside the variables studied. Because the R-squared value obtained in this study is close to 1, it means that the ability of the independent variables to explain the dependent variable is significant.

Hypothesis Testing (T-Test)

Table 6. T test

Variable	Variabel Dependen		
	Cigarette expenditure (PR)		
	Coefficient	Prob.	Result
C	3741415.	0.0000	-
PK	-4.499107	0.0013	Significant Negative
PP	0.000667	0.9932	Not Significant
PDRB	-4865.970	0.6199	Not Significant
IKK	-205236.0	0.0282	Significant Negative
TPT	-139248.9	0.0001	Significant Negative

Source: Eviews 13 output (2025)

Based on the t-test results in the table above, the decision-making process is as follows:

1. Based on the equation above, the constant is 3741415. This indicates that if all independent variables (PK, PP, GRDP, IKK, TPT) are equal to 0, then the average PR value is Rp 3,741,415.
2. The coefficient value of PK is -4.4991, which is negative. This indicates that for every Rp 1 increase in the PK variable, the PR value will decrease by Rp 4.499.

3. The coefficient value of PP is 0.00066, which is positive. This indicates that for every Rp 1 increase in PP, PR will increase by Rp 0.000667.
4. The coefficient value of GRDP is -4856.96, which is negative. This indicates that for every 1% increase in GRDP, PR will decrease by Rp 4,865.96.
5. The coefficient value of the IKK is -205236, which is negative. This indicates that for every 1% increase in the IKK variable, the PR value will decrease by Rp 205,236.
6. The coefficient value of the TPT is -139248.9, which is negative. This indicates that for every 1% increase in the TPT variable, the PR value will decrease by Rp 139,248.9.

Discussion

H1: There is an effect of health expenditure on cigarette consumption.

The results of the study indicate that the Health Expenditure variable has a coefficient value of -4.4991 and a significant effect on Average Cigarette Expenditure in 34 Provinces in 2021-2023. This is evidenced by the results of the hypothesis test, with a significant value greater than α (0.0013 < 0.05).

These results align with research by Do & Bautista (2015), which states that tobacco use is negatively associated with household health expenditure in low-middle-income countries (crowding-out effect), because budget allocation for cigarettes reduces the ability to spend on health.

Research conducted by Sari et al. (2017), which used data from 2015, found that health expenditure had a negative and significant effect on cigarette consumption (coefficient -0.016; p-value 0.000). This study confirms that increased health expenditure reduces the allocation of funds for cigarettes in poor households.

Paraje & Araya's (2018) findings in Chile also indicate that tobacco consumption is associated with lower budget allocations for health expenditures, particularly among poor households. A 1% increase in health expenditures is associated with a significant decrease in cigarette expenditures.

In addition to this study, another study by Surjono & Handayani (2013) states that increased cigarette expenditures are inversely related to health expenditures, with poor households spending more on cigarettes than on health.

This finding aligns with the Health Belief Model (HBM), which states that increased health expenditures reflect higher perceived susceptibility (perceived vulnerability to disease) and perceived severity (perceived severity of health impacts) among households. This awareness strengthens the motivation to shift budgets from cigarettes to preventive or curative health services as a rational response to disease threats.

H2: There is an influence of family education expenditure on cigarette consumption.

The results of the study indicate that the Education Expenditure variable has a coefficient value of 0.000667 and does not significantly influence Average Cigarette Expenditure in 34 Provinces from 2021 to 2023. This is evidenced by the results of the hypothesis test, with a significant value greater than the α value (0.9932 > 0.05). These results align with research conducted by Sari et al. (2017) using data from 2010, which stated that education expenditure had no significant effect on cigarette consumption (coefficient -0.009; p-value 0.492).

This finding is consistent with the complex relationship between education and behavior explained in Human Capital Theory (Becker, 1993). Although educational investment is assumed to increase health literacy (such as knowledge about the dangers of smoking), the results confirm that increased education expenditure does not automatically change cigarette consumption preferences in the short term.

This is explained by Mental Accounting Theory (Thaler, 1985), where households tend to separate "mental accounts" for education and cigarette consumption as independent expenditure categories. Allocation of education funds (e.g., tuition fees, books) is mandatory and planned, while cigarettes fall under the "habit account" with high transaction utility. Thus, increasing education spending does not directly reduce cigarette spending because the two items operate within different psychological and functional frameworks. Consequently, policy interventions require a more holistic approach, such as increasing educational materials on the dangers of smoking in education (Nizamie & Kautsar, 2021) to transform knowledge into behavioral change.

H3: There is an influence of GRDP growth rate on cigarette consumption.

The results show that the GRDP growth rate variable has a coefficient value of -4865.970 and does not significantly influence average cigarette expenditure in 34 provinces from 2021 to 2023. This is evidenced by the results of the hypothesis test, which showed a significant value greater than α (0.6199 > 0.05). In other words, provinces with higher economic growth do not have different average cigarette expenditure compared to provinces with lower growth for the period 2021–2023.

These results reflect the complexity of the relationship between prosperity and smoking behavior. Theoretically, there are two opposing influences. First, the income effect, where economic growth increases purchasing power, thus increasing consumption of all goods (including cigarettes). Second, the awareness/structure effect, where long-term economic progress is accompanied by increased education and health awareness, resulting in decreased cigarette consumption. The insignificant effect of GRDP Growth Rate on average cigarette expenditure aligns with research by Marianti & Prayitno (2020), which also found that income (as a proxy for economic well-being) statistically had no significant effect on cigarette consumption in Indonesia. Although the variables are not identical (Individual Income), while in this study it is represented by GRDP Growth Rate, both measure aspects of economic growth/well-being and are equally insignificant in influencing cigarette consumption.

This finding is consistent with the complex relationship between economic growth and consumption behavior described in the literature review. Although Human Capital Theory (Becker, 1993) assumes economic growth will increase investment in health and education, thereby reducing cigarette consumption, the reality in Indonesia shows a more dominant structural factor. As stated by the WHO (2024), deeply entrenched social norms, where smoking is viewed as a symbol of masculinity and a means of social and cultural interaction (cultural resilience), contribute to behavioral changes despite economic growth. This phenomenon is reinforced by the findings of Bappenas (2020) that structural poverty makes smoking a stress-coping mechanism that is difficult to replace by aggregate economic growth.

Furthermore, Mental Accounting Theory (Thaler, 1985) provides a cognitive explanation: increases in household income do not affect the "habit account" (cigarette consumption). Consequently, increases in GRDP do not necessarily shift the allocation of funds to cigarettes because their addictive nature creates psychological budgeting rigidity (maintaining budget allocations into specific items). This aligns with research by Xu et al. (2015) in China, which found a gap between income increases and changes in health behavior. In Indonesia, the relatively low price of cigarettes (WHO, 2020) further weakens the sensitivity of cigarette consumption to macroeconomic fluctuations.

H4: The Poverty Depth Index influences cigarette consumption expenditure.

The results show that the Poverty Depth Index (P1) variable has a coefficient value of -205.236 and significantly influences average cigarette expenditure in 34 provinces from 2021 to 2023. This is evidenced by the results of the hypothesis test, with a significant value less

than α (0.0282 < 0.05). This means that provinces with deeper poverty (poor residents, on average, are further below the poverty line) tend to have lower cigarette expenditure. Intuitively, this is logical because extremely poor families must prioritize basic needs (staple food and shelter), forcing them to sacrifice cigarettes as a "secondary" item. These results are consistent with a study by Salsabila et al. (2022), which stated that 79% of Indonesian smokers come from low-income groups, even though in conditions of extreme poverty, allocations for cigarettes are cut.

The regression findings of this study reinforce the urgency of synergizing poverty alleviation and tobacco control policies. Poverty alleviation programs should include education on financial management for poor households, including the dangers and economic burden of smoking. Research by Sari & Seftarita (2018) supports this, proving that smokers are eight times more likely to become poor if their environment supports smoking.

The significant negative finding between the poverty depth index (P1) and cigarette expenditure reinforces the theoretical framework of budget constraints and the crowding-out effect, as confirmed by research by Supriadi & Rusyiana (2018), Amrullah et al. (2022), and John (2008). At extreme poverty levels (high P1), households face absolute budget constraints that force a strict allocation of resources to basic needs such as food and clothing. This condition creates a crowding-out mechanism, where cigarettes, as nonessential goods, are sacrificed to maintain minimal food consumption, as revealed by research by Supriadi & Rusyiana (2014). This phenomenon is consistent with a study by Paraje & Araya (2017) in Chile, where smoking households allocated 32% less to health, and the findings of Do & Bautista (2015) that the suppressive effect of cigarette consumption is strongest in areas with extreme poverty depth.

Although cigarettes are addictive (Febriyantoro, 2016), these findings demonstrate that in extreme poverty, the law of demand for inferior goods overcomes nicotine dependence. As shown in research by Fadilah et al. (2022), poverty negatively impacts cigarette consumption. This highlights the limits of the addiction trap: when income falls below the survival threshold, households prioritize food over cigarettes, despite facing psychological pressure.

H5: There is an effect of the open unemployment rate on cigarette consumption expenditure.

The results of the study indicate that the Open Unemployment Rate variable has a coefficient value of -139,248.9 and has a significant effect on Average Cigarette Expenditure in 34 Provinces from 2021-2023. This is evidenced by the results of the hypothesis test, with a significant value less than the α value (0.0001 < 0.05). Logically, this is because unemployment means a lack of a steady income, resulting in decreased purchasing power for cigarettes. Unemployed people are likely to reduce consumption of items such as cigarettes due to limited pocket money.

Research by Salsabila et al. (2022) supports this finding, stating that 80% of Indonesian smokers are workers. Causally, being unemployed or unemployed is correlated with decreased cigarette spending due to limited purchasing power. This is supported by research by Nizamie & Kautsar (2021), which shows that individuals working in the formal sector are more likely to be heavy smokers than informal sector workers, and associates this with higher levels of job stress in the formal sector.

The significant negative finding between open unemployment and cigarette expenditure strongly supports Budget Constraint Theory (Biswan, 2022) and Mental Accounting (Thaler, 1985). When income is completely lost due to unemployment, households experience an absolute budget constraint that forces a reallocation of expenditure, with nonessential expenses such as cigarettes being sacrificed to maintain other consumption and basic needs. Within the mental accounting framework, an empty "fixed income" account leaves the "instant pleasure"

account (including cigarettes) untouched, as Thaler (1985) explained regarding the rigidity of allocation between accounts. Although the literature identifies stress as a potential trigger for cigarette consumption (Nizamie & Kautsar, 2021), the results of this study demonstrate that in the context of unemployment, economic constraints overcome psychological factors. The consistency of these findings with the research of Do & Bautista (2015) in LMICs reinforces the urgency of tobacco control as a priority policy to reduce cigarette expenditure.

CONCLUSION

The following conclusions are drawn based on the previous discussion and analysis:

1. Health expenditures have a negative and significant effect on cigarette expenditures. This indicates a crowding-out effect, where the allocation of funds for health displaces the cigarette budget.
2. Education expenditures have a positive but insignificant effect, indicating no practical impact on cigarette consumption. Households separate the "mental accounts" for education (mandatory/planned) and cigarettes. Increases in education spending do not disrupt cigarette allocations because the two items are within different psychological frameworks.
3. The GRDP growth rate has a negative but insignificant effect, implying that economic growth does not automatically change cigarette consumption behavior because cigarettes as a social symbol are difficult to replace even with economic growth (cultural resilience), and the addictive nature of cigarettes creates rigidity in budget allocation (psychological budgeting rigidity).
4. The Poverty Depth Index has a negative and significant effect. In extreme poverty, households prioritize basic needs and sacrifice cigarettes as non-essential items. The addiction trap (nicotine dependence) is overcome by absolute budget constraints.
5. The Open Unemployment Rate (TPT) has a negative and significant impact. Unemployment eliminates fixed income, forcing households to reallocate their budgets at the expense of cigarettes (a non-essential account).

The following conclusions are drawn based on the previous discussion and analysis:

1. Health expenditures have a negative and significant effect on cigarette expenditures. This indicates a crowding-out effect, where the allocation of funds for health displaces the cigarette budget, especially in poor households.
2. Education expenditures have a positive but insignificant effect, indicating no practical impact on cigarette consumption. Households separate the "mental accounts" for education (mandatory/planned) and cigarettes. Increases in education spending do not disrupt cigarette allocations because the two items are within different psychological frameworks.
3. The GRDP growth rate has a negative but insignificant effect, implying that economic growth does not automatically change cigarette consumption behavior because cigarettes as a social symbol are difficult to replace even with economic growth (cultural resilience), and the addictive nature of cigarettes creates rigidity in budget allocation (psychological budgeting rigidity).
4. The Poverty Depth Index has a negative and significant effect. In extreme poverty, households prioritize basic needs and sacrifice cigarettes as non-essential items. The addiction trap (nicotine dependence) is overcome by absolute budget constraints.
5. The Open Unemployment Rate (TPT) has a negative and significant impact. Unemployment eliminates fixed income, forcing households to reallocate their budgets at the expense of cigarettes (a non-essential account).

Suggestion

Policy Recommendations

1. The government needs to integrate smoking cessation programs with primary health care services such as community health centers (Puskesmas) and direct nicotine replacement policies toward poor households.
2. Gradually increase cigarette excise taxes to reduce purchasing power, while simultaneously allocating revenue to health and poverty alleviation programs.
3. Improve the distribution pattern of conditional cash transfer programs, with recipients committing to quitting smoking.
4. Strengthen coordination between the Statistics Indonesia (BPS), the Ministry of Health, and the Ministry of Social Affairs in monitoring the allocation of expenditures by poor households.
5. Develop employment opportunities in the health sector (e.g., anti-smoking counselors) to absorb unemployment while reducing smoking prevalence.

Recommendations for Further Research

Based on the limitations of this study, the authors offer the following suggestions for further research:

1. Add behavioral factors that have not been quantified in the economic model.
2. Expand the research timeframe (e.g., 10 years) to test the consistency of the findings on the crowding-out effect of health and poverty.
3. Examine the insignificant factor of education expenditure through a qualitative approach (in-depth interviews) to understand the mechanism of household budget allocation between education and cigarettes.

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