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Islamic Philanthropy and Education: The Role of ZIS Funds in Improving Quality Education (SDG 4) in Indonesia

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Abstract

Purpose – This paper examines whether zakat, infaq, and shadaqah (ZIS) funds allocated to education contribute to improving provincial education quality in Indonesia, measured through the Education Index (EI). It addresses the research gap concerning the macro-level role of Islamic social finance in supporting SDG 4 (Quality Education).

Design/methodology/approach – The study applies an explanatory quantitative approach using provincial panel data from 34 provinces (2020–2024). A Fixed Effects Model (FEM) is employed to estimate the effect of educational ZIS funds on the Education Index, with teacher–student ratio, school availability, and poverty rate as control variables. Classical assumption tests confirm that the model is free from heteroskedasticity and autocorrelation.

Findings – Educational ZIS funds show a positive but statistically insignificant effect on the Education Index. School availability has a significant positive influence, while poverty shows a significant negative effect on education quality. The teacher–student ratio has a negative but marginal influence. Jointly, all variables significantly explain variations in provincial educational outcomes.

Research limitations/implications – The study is limited by the short observation period and the use of aggregated educational ZIS data sourced only from BAZNAS, without disaggregated program-level or Zakat Management Organizations (LAZ)data. These limitations restrict deeper evaluation of ZIS effectiveness.

Practical implications – Findings highlight the potential of educational ZIS as complementary financing for human capital development. Improving targeting, governance, and coordination between zakat institutions and local governments could enhance impact.

Originality/value – This paper offers one of the first macro-level empirical assessments of educational ZIS and its relationship with Indonesia's Education Index, providing evidence-based insights for strengthening Islamic Social Finance in advancing SDG 4.

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A. INTRODUCTION

Education serves as a fundamental pillar of sustainable development and is universally recognized as a basic human right (Barugahara & McDowall-Emefiele, 2025; Zwane et al., 2025). Within the framework of the Sustainable Development Goals (SDGs), quality education (SDG 4) is a key driver of inclusive and equitable growth. In Indonesia, disparities in educational quality across provinces remain evident, particularly among vulnerable groups and low-income communities. Although government expenditures through the national and regional budgets (APBN and APBD) have contributed to improving educational outcomes, these inequalities have not been fully resolved (World Bank, 2020). This condition has prompted the emergence of alternative financing mechanisms from non-governmental sectors, including Islamic philanthropy through *zakat*, *infaq*, and *shadaqah* (ZIS), which are believed to complement public resources in supporting educational development.

However, without a systematic evaluation of how Islamic philanthropy instruments contribute to measurable educational outcomes, the growing ZIS sector risks remaining programmatic rather than strategic. Given the continuing disparities in educational quality between provinces in Indonesia, the urgency lies not only in mobilizing additional funds, but also in understanding whether and how ZIS allocations can structurally support SDG 4 targets (Sudirman et al., 2026). A similar point is made in the research by Palasenda & Salikurrahman (2024) and Hassan et al (2023) that Islamic social finance not only reduces poverty-related barriers to education, but also ensures ethical and interest-free financing that complements public spending to achieve SDG 4 targets. Macro-level evaluation is therefore crucial to ensure that Islamic social finance evolves from a charitable supplement to an integrated component of the national education financing strategy.

From the perspective of Islamic economics, Zakat, Infaq, and Shadaqah (ZIS) serve not only as redistributive mechanisms to alleviate poverty but also as forms of social investment aimed at enhancing the quality of human capital (Nasim et al., 2025; Sari et al., 2025). This aligns with the Human Capital Theory (Becker, 1993), which posits that education is a long-term investment that improves individual and societal productivity. Furthermore, the Capability Approach (Sen, 1999) emphasizes that education constitutes a fundamental capability that broadens individuals' freedom to pursue meaningful lives. Consequently, allocating ZIS funds to the education sector can

be regarded as an effort to expand learning opportunities for underprivileged groups who continue to face structural barriers (Juliana et al., 2024).

In the Indonesian context, *zakat* holds a central position within ZIS, which explains why most empirical studies tend to focus predominantly on *zakat* rather than other philanthropic instruments (Saidam et al., 2026; Widiastuti et al., 2025; Nuraeni & Anggara, 2026). Nevertheless, empirical research has largely concentrated on the impact of one component of ZIS—namely *zakat*—on poverty reduction or income inequality, with relatively limited attention given to its contribution to education (Choiriyah et al., 2020). This research gap underscores the need for a more targeted quantitative analysis to assess the extent to which *zakat*, particularly *educational zakat*, influences educational outcomes in Indonesia.

To date, studies have presented mixed evidence regarding the relationship between Islamic social finance and educational outcomes. Yussof (2011), for instance, found a positive correlation between *zakat* distribution and school participation rates in Malaysia, suggesting that Islamic philanthropy can serve as an effective instrument for expanding educational access among low-income groups. In this context, *zakat* functions not only as a redistributive tool but also as a form of social investment aimed at enhancing human capital.

However, other studies highlight the limitations of *zakat*'s role, arguing that its impact remains relatively small compared to structural factors such as government expenditure allocation, the quality of educational infrastructure, and regional economic development levels (Fajri, 2025). This perspective implies that the influence of *zakat* on education is not automatic but is highly contingent upon the effectiveness of management institutions and the strategic direction of its utilization.

In the Indonesian context, the role of ZIS funds in human development has become increasingly significant alongside the institutional strengthening of the national zakat system through the National Amil Zakat Agency (BAZNAS) and major Zakat Management Organizations (LAZ). The enhancement of managerial capacity and institutional transparency has opened opportunities for ZIS educational funds to complement public spending in the education sector. Then, from a governance perspective, empirical evidence on the effectiveness of ZIS allocation in education is crucial to strengthen institutional accountability and results-based management in the National Zakat Agency (BAZNAS) and other zakat institutions. Evidence-based findings

can support the transition to a performance-based distribution model, promote better alignment between ZIS programs and provincial education needs, and strengthen synergies between Islamic philanthropic institutions and public fiscal authorities. In turn, this can also help achieve Sustainable Development Goal (SDG) 4. Therefore, it is essential to empirically examine whether the distribution of educational ZIS funds genuinely contributes to education index as a component of the Human Development Index (HDI). Such analysis not only enriches the literature on Islamic Social Finance but also provides a policy basis for optimizing the role of zakat in achieving Sustainable Development Goal (SDG) 4: Quality Education.

Therefore, examining ZIS education at the provincial level is strategic for understanding how Islamic social finance can be systematically integrated into Indonesia's long-term education financing architecture. By producing macro evidence, this study aims to contribute to the policy debate on whether ZIS should remain complementary or develop into a structured pillar of joint financing in national development planning.

Despite the growing scholarly attention toward Islamic social finance, empirical research employing panel data to investigate the impact of educational zakat on inter-provincial educational quality in Indonesia remains scarce. Most prior studies have been descriptive or focused on micro-level case analyses. Consequently, the macro-level dynamics of educational ZIS in relation to SDG 4 have rarely been explored. This study seeks to fill that gap by constructing a provincial panel dataset (2020–2024) to assess the relationship between educational ZIS funds and education quality, incorporating control variables such as the teacher–student ratio, school availability, and poverty rate. Accordingly, this research contributes to both Islamic economics and development studies, offering new insights into how Islamic social finance can complement public policy in advancing global educational goals.

Therefore, this study offers three main contributions. First, it provides conceptual progress by integrating Islamic social finance into the discourse on human capital and Sustainable Development Goal (SDG) 4. Second, it provides relevant insights for policies to strengthen evidence-based ZIS governance and education financing strategies across provinces. Third, this study contributes to the broader framework of Islamic philanthropy by demonstrating how religion-based financial instruments can transcend the charity-oriented paradigm towards measurable development outcomes. Through this approach, this paper aims to encourage

academic and policy development regarding the role of Islamic philanthropy in sustainable development.

B. RESEARCH METHODOLOGY

This study employs an explanatory quantitative approach using provincial panel data from Indonesia covering the period 2020–2024. Although relatively short, this period provides meaningful variation in both ZIS allocation patterns and education indicators, allowing for an initial macro assessment of the relationship between the two during a structurally significant transition phase. Furthermore, the panel data method is selected because it enables the exploration of both cross-sectional (inter-provincial) and time-series variations, thereby producing more accurate and efficient estimations (Widarjono, 2018). The main objective of the study is to examine the effect of educational ZIS fund distribution on the quality of education across provinces, while accounting for structural factors that may influence learning outcomes.

Data on educational ZIS were obtained from the annual reports of BAZNAS, while the indicators of educational quality were derived from the Education Index (a component of the Human Development Index) published by Statistics Indonesia (BPS), consisting of the Average Years of Schooling (RLS) and Expected Years of Schooling (HLS). Control variables include: (1) the teacher–student ratio, calculated as the number of students divided by the number of teachers at the elementary, junior, and senior high school levels; (2) school availability per 10,000 students, measured by the number of schools relative to the number of students; and (3) the poverty rate (percentage of poor population) sourced from BPS. The inclusion of these variables follows established literature on education and human development (Hanushek & Woessmann, 2015; Glewwe & Kremer, 2006; Baird et al., 2014).

This study acknowledges the potential issue of endogeneity, as the allocation of educational ZIS funds may be influenced by low educational attainment, while improvements in education could, in turn, enhance ZIS collection in a given region. To address this concern, a fixed-effects model is employed to control for unobserved heterogeneity across provinces (Tok et al., 2022; Widiastuti et al., 2025).

The selection of the fixed effects model (FEM) is theoretically based on the assumption that unobserved provincial characteristics—such as governance quality, cultural attitudes toward education, and institutional capacity—are correlated with explanatory variables. By controlling for heterogeneity that does not change over time,

FEM reduces the bias of omitted variables arising from structural differences between provinces. The Hausman specification test was conducted to determine the suitability of FEM compared to the random effects alternative, ensuring model consistency under the assumption of correlation between individual effects and predictor variables. However, FEM does not completely eliminate the potential for reverse causality or dynamic feedback effects, which remain limitations in this study.

Furthermore, although the panel estimates proved to be robust, there are still a number of limitations to this study. First, this study relies on secondary data from publicly available institutional sources, including the National Zakat Agency and the Central Statistics Agency, which still have the potential for measurement errors and differences in provincial data collection practices, thereby affecting data consistency. Second, the relatively short observation period (2020–2024) may limit the ability to capture the long-term structural impact of education ZIS on human capital formation, as improvements in educational attainment typically materialize over a longer time frame.

Third, the Education Index—although widely accepted as a proxy for education quality—primarily reflects years of schooling rather than direct learning outcomes such as cognitive achievement or standardized test performance. Fourth, although fixed effects reduce the bias of omitted variables that do not change over time, the possibility of residual endogeneity due to reverse causality or time-varying factors that are omitted cannot be completely ruled out.

Therefore, to reduce potential bias, this study incorporates relevant control variables that are consistently identified in the education and development literature, including teacher-student ratios, school availability, and poverty rates. In addition, annual fixed effects are included to account for macroeconomic shocks and national policy changes that affect all provinces simultaneously, particularly during the post-pandemic recovery period. Robust standardized errors grouped at the provincial level are applied to address potential heteroscedasticity and serial correlation in the panel.

C. RESULTS AND DISCUSSION

Results

1. Education Index

The Education Index is a crucial component of the Human Development Index (HDI), calculated based on the Average Years of Schooling (RLS) and Expected Years of

Schooling (HLS). This indicator is used to assess the quality of human resources from the educational dimension and reflects both access to and continuity of educational services. Theoretically, the Human Capital Theory (Becker, 1993) emphasizes that investment in education enhances individual productivity and aggregate economic performance. Thus, the Education Index serves as a strategic measure to evaluate the extent to which a country or region has developed its human potential through education.

Empirical studies have demonstrated a positive relationship between improvements in RLS and HLS and both economic growth and global competitiveness. Hanushek and Woessmann (2015) found that higher educational quality, as reflected in indicators such as the Education Index, significantly influences long-term growth. In Indonesia, Prasetyo and Zuhdi (2020), through a provincial panel analysis, revealed that education is a key determinant of HDI improvement. This finding underscores that strengthening educational indicators is not only academically relevant but also critical for effective development policymaking.

In the discourse on global development, the Education Index is also increasingly used as a tool for comparing policies under the coordination framework of the UN Sustainable Development Goals agenda. Positioning Islamic social finance within this framework allows for analysis that goes beyond national development metrics and engages in the international debate on alternative development financing models. Therefore, linking ZIS allocation to the Education Index contributes not only to studies on Indonesian development but also to broader discussions on faith-based financing and sustainable human development.

2. ZIS Funds in the Education Sector

Within the analytical framework of this study, ZIS funds are the main explanatory variable that influences the Education Index at the provincial level. Unlike structural determinants such as poverty, infrastructure, or teacher capacity, ZIS represents a religious-based financial intervention that is responsive to policy and managed institutionally. Therefore, analyzing ZIS allocation for education provides a unique opportunity to assess whether Islamic social finance can function not only as a tool for redistribution, but also as a measurable driver of educational development outcomes.

From the perspective of Islamic economics, Zakat, Infaq, and Shadaqah (ZIS) are regarded not merely as redistributive instruments but also as forms of social investment that enhance the quality of life within society. The allocation of ZIS funds to education has a strong normative foundation, as education is considered a strategic means for achieving sustainable poverty alleviation. The framework of Islamic Social Finance (ISF) emphasizes the utilization of zakat and other Islamic philanthropic instruments to bridge public financing gaps, particularly in the education sector for vulnerable groups. Beik and Pratama (2017) assert that educational zakat plays a crucial role in improving both access to and quality of education for mustahik (eligible beneficiaries).

In Malaysia, Usman & Ab Rahman (2023) highlight the importance of waqf in financing higher education institutions (HEIs) and its potential as an alternative source of additional funding for HEIs, as well as the discourse on waqf practices, fundraising, waqf management, and the use of waqf income for the development of higher education in Malaysia. Other studies also explain the potential of waqf as an alternative philanthropy tool to ease financial pressure and improve the sustainability of HEIs. By integrating waqf with contemporary philanthropy strategies, HEIs can promote academic excellence while aligning with Islamic principles of charity and community support (Samsudin et al., 2025).

Mat Daud & Wahid (2024) also emphasized that financial assistance through zakat has a positive effect on the learning process, increasing student readiness in the educational process and the academic achievement of undergraduate students. In Pakistan, Aziz et al (2025) emphasize that zakat expenditure by the public sector reduces disparities in education. Therefore, households that benefit from zakat allocations tend not to face barriers in accessing education. Muhammad & Al-Shaghdari (2024) emphasize the role of waqf and zakat in improving the education sector in Nigeria. These comparative experiences show that Islamic social finance can serve as a pillar of semi-formal education financing when supported by a strong governance structure.Empirically, the study by Choiriyah et al. (2020), using provincial panel data from Indonesia, found that zakat contributes to poverty reduction, although its allocation for education remains limited compared to more consumptive sectors. Similarly, Lestari et al. (2022) demonstrated that the distribution of zakat and infaq funds has a measurable effect on reducing income inequality, which ultimately supports equitable access to education. These findings highlight the significance of

educational ZIS allocations as an instrument for advancing Sustainable Development Goal (SDG) 4—Quality Education—while simultaneously strengthening individual capabilities.

Compared to Malaysia—where the integration between zakat institutions and education financing mechanisms has been systematically documented—macro-level empirical studies examining the direct impact of education ZIS on measurable education indices are still relatively limited in Indonesia. Existing research in Indonesia tends to focus on poverty alleviation or micro-level case studies of zakat recipients, rather than evaluating provincial disparities in educational outcomes using a panel data approach. This gap underscores the urgency of developing a macro-empirical framework that places Indonesia in a broader comparative discourse on Islamic philanthropy governance.

Although ZIS allocation is the main explanatory variable in this study, educational outcomes are essentially multidimensional and influenced by structural and socioeconomic factors. To avoid overestimating the isolated impact of Islamic social finance, this study includes several control variables that are consistently highlighted in the literature on education and development. These variables—teacher-student ratio, school availability, and poverty rate—serve to contextualize the effects of ZIS within the broader provincial education ecosystem.

3. Teacher–Student Ratio

The teacher–student ratio is an educational input indicator that reflects the intensity of interaction between educators and learners. A lower ratio signifies a higher teaching capacity, as each teacher can provide more individualized attention to students. Glewwe and Kremer (2006) emphasize that smaller class sizes are positively correlated with better learning outcomes, particularly in developing countries. From the perspective of educational theory, the teacher–student ratio is considered a crucial factor that supports the quality of the learning process.

Empirical evidence reinforces this claim. Hanushek and Woessmann (2015), in their cross-country study, highlight that teacher–student ratios contribute to variations in learning outcomes across regions. In Indonesia, Suryadarma et al. (2020) found that regions with lower teacher–student ratios tend to exhibit higher educational quality, as reflected in superior Human Development Index (HDI) scores.

Accordingly, the teacher–student ratio serves as an important control variable in assessing educational effectiveness at the provincial level.

4. School Availability

School availability reflects the capacity of educational infrastructure to provide access for school-age children. The greater the number of schools relative to the student population, the higher the potential for equitable educational access within a region. According to the theory of educational access, school availability is one of the primary determinants of school participation, particularly in remote or underserved areas. Glewwe and Kremer (2006) emphasize that the development of educational facilities is a crucial factor in reducing dropout rates and improving the Net Enrollment Rate (NER).

Empirically, Hasanah and Utomo (2021) found that the expansion of elementary schools in rural areas of Indonesia significantly enhanced access to education. Similar studies highlight that school availability contributes to reducing interregional disparities, as regions with better school access tend to exhibit lower dropout rates. Therefore, the school availability variable is relevant for assessing how educational infrastructure influences the achievement of the Education Index at the provincial level.

5. Poverty Rate

Poverty is an external factor that significantly affects both access to and the quality of education. Children from low-income households often face multiple barriers, including limited financial resources for schooling, lack of family support, and the necessity to work to supplement household income. Within the framework of the Capability Approach (Sen, 1999), poverty is viewed as a constraint that limits individuals' freedom to develop their basic capabilities, including the ability to obtain a proper education. Consequently, poverty is frequently employed as an explanatory variable in studies on education and human development.

Empirical evidence supports the negative relationship between poverty and educational attainment. Baird et al. (2014), through a systematic review of cash transfer programs in developing countries, demonstrated that increases in poor households' income positively affect children's school participation. Similarly, Lestari et al. (2022) found that in Indonesia, poverty levels significantly influence variations in the Human Development Index (HDI), particularly in its education dimension.

Therefore, the poverty variable functions not only as a socioeconomic indicator but also as a direct determinant of educational outcomes.

Discussion

1. Inter-Provincial Disparities and Spatial Patterns

To better illustrate inter-provincial variation, this study further examines regional disparities in both ZIS allocation and educational outcomes. Descriptive evidence indicates that provinces in Java—such as DKI Jakarta, West Java, and East Java—consistently record higher educational ZIS allocations and above-average Education Index values. In contrast, eastern provinces such as Papua, West Papua, Maluku, and East Nusa Tenggara exhibit lower ZIS distribution and weaker educational indicators.

This spatial disparity suggests that ZIS mobilization is closely linked to institutional capacity, urban economic concentration, and the density of Muslim middle-income populations. Provinces with stronger economic ecosystems tend to generate higher zakat collections, which in turn reinforces existing regional advantages. Consequently, ZIS allocation may unintentionally follow economic gravity rather than compensating for structural educational deficits.

From a development economics perspective, this pattern indicates that Islamic social finance in its current form may function more as a reinforcing mechanism within economically strong provinces rather than as a redistributive equalizer across structurally disadvantaged regions. This finding highlights the importance of incorporating spatial targeting mechanisms into zakat governance frameworks to ensure that ZIS fulfills its redistributive mandate.

2. Descriptive Analysis

Table 1

Descriptive Statistics

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Obs
ZIS	7.596,99	1.546.000	87.717	0	14.369,35	170,00
TCR	1.367,63	12,89	20,45	9,36	2,82	170,00
SCH	58,76	57,78	84,88	28,85	14,38	170,00
POV	10,19	8,51	27,38	3,80	5,20	170,00
EI	0,66	0.660000	0,77	0,53	0,05	170,00

Table 1 presents the key characteristics of all research variables covering 34 provinces in Indonesia over the 2020–2024 period (170 observations). The average

value of educational ZIS funds is recorded at IDR 7,596.99 million, with a maximum of IDR 87,717 million and a minimum of 0, indicating substantial disparities among provinces. The high standard deviation (IDR 14,369.35 million) reinforces the existence of significant inequality in the distribution of educational *zakat*, where provinces with large *amil zakat* institutions—such as DKI Jakarta, West Java, and East Java—tend to allocate higher amounts compared to regions with limited institutional capacity, such as Maluku or Papua.

Meanwhile, the teacher–student ratio (TCR) averages 13.67, suggesting that each teacher in Indonesia typically instructs around 13–14 students. The maximum value of 20.45 indicates the presence of provinces with relatively high teaching loads, whereas the minimum value of 9.36 reflects regions with an ideal ratio and better educational attention. School availability (SCH) averages 58.76 schools per 10,000 students, with a standard deviation of 14.38, suggesting significant disparities in educational infrastructure across provinces.

Furthermore, the poverty rate (POV) averages 10.19%, ranging from 3.80% to 27.38%, reflecting wide economic inequalities among regions. Lastly, the Education Index (IP) has an average of 0.66, with values ranging between 0.53 and 0.77, indicating that most provinces fall within the medium to high education categories. Overall, these descriptive results suggest that interprovincial variations in the Education Index can be explained by differences in economic capacity, infrastructure availability, and the effectiveness of educational ZIS fund distribution across regions.

Beyond descriptive statistics, substantial spatial disparities characterize ZIS allocation and educational performance across provinces. Provinces located in Java consistently show higher ZIS allocation and above-average Education Index scores. In contrast, eastern provinces such as Papua, West Papua, and Maluku show lower ZIS distribution and relatively weaker education indicators (BAZNAS, 2024). This uneven distribution indicates that institutional capacity, urban economic concentration, and zakat collection efficiency play an important role in shaping the reach of Islamic social finance development. The descriptive pattern shows that provinces with stronger fiscal ecosystems and higher Muslim population densities tend to mobilize and distribute larger amounts of ZIS funds, potentially reinforcing existing regional advantages rather than reducing disparities.

Table 2.

Diagnostic Tests for Model Selection

Dependent Variable	Redundant Fixed Effects Tests (F-Statistic)	Breusch-Pagan LM test (chi-square)	Hausman Test (Chi-Square)	Best Model
EI	184.787.385 (0.0000)	3.142.050 (0.0000)	15.920.276 (0.0031)	FEM

Table 2 presents the results of the diagnostic tests conducted to determine the most appropriate panel data model for analyzing the effect of educational ZIS funds on the Education Index (EI). Three main tests were performed: the Redundant Fixed Effects Test, the Breusch–Pagan Lagrange Multiplier (LM) Test, and the Hausman Test.

First, the results of the Redundant Fixed Effects Test show an F-statistic value of 184,787.385 with a probability of 0.0000. This significance level is below 0.05, leading to the rejection of the null hypothesis that the pooled least squares model is more appropriate than the Fixed Effects Model (FEM). This indicates significant differences across provinces, implying that unique provincial characteristics—such as economic capacity and zakat institutional strength—should be accounted for in the model.

Second, the Breusch–Pagan LM Test yields a chi-square value of 3,142.050 with a probability of 0.0000, suggesting that the panel data model is preferable to the common-effect model. This finding indicates the presence of significant individual (cross-sectional) effects within the panel dataset.

Third, the Hausman Test reinforces the previous results, with a chi-square value of 15.920 and a probability of 0.0031 (<0.05), confirming that the Fixed Effects Model is more appropriate than the Random Effects Model. This implies that interprovincial differences are not random but systematically correlated with the independent variables under analysis.

Based on the results of these three diagnostic tests, this study employs the Fixed Effects Model (FEM) as the most suitable approach for estimating the effect of educational ZIS funds on the Education Index (EI). This approach aligns with established panel econometric literature (Widarjono, 2018; Nachrowi & Usman, 2006) as well as empirical findings in the context of development and Islamic social finance in Indonesia (Sari & Syahrial, 2022; Widiastuti & Firmansyah, 2025). The FEM is considered the most consistent and efficient model for explaining interprovincial variations in educational performance that may be influenced by region-specific socioeconomic characteristics.

Table 3

Autocorrelation Test Result

	X1	X2	X3	X4
X1	1.000.000	0.297461	-0.317573	-0.184136
X2	0.297461	1.000.000	-0.787834	-0.112159
X3	-0.317573	-0.787834	1.000.000	0.246743
X4	-0.184136	-0.112159	0.246743	1.000.000

Table 3 presents the results of the autocorrelation test among the independent variables using a correlation matrix. Based on the computation results, the correlation coefficients between independent variables (off-diagonal values) are all below the commonly accepted threshold of 0.80, which is typically used to detect serious autocorrelation or multicollinearity issues (Widarjono, 2018). The highest correlation value is observed between variables X2 and X3 at –0.787834, which, although relatively high, remains below the critical limit of 0.80. This indicates that the relationships among the independent variables are moderate and do not cause multicollinearity problems. Consequently, it can be concluded that the panel regression model is free from autocorrelation, and each independent variable possesses sufficiently distinct characteristics in explaining the dependent variable (EI).

These findings confirm that no residual patterns are correlated across observation periods, ensuring that the estimated parameters are unbiased and efficient. This condition satisfies the BLUE (Best Linear Unbiased Estimator) assumption required in the panel least squares approach (Baltagi, 2008).

Table 4

Heterosedasticity Test

	t-Statistic	Prob.
C	0,91715	0,3607
X1	0,01896	0,9849
X2	-1,42967	0,1552
X3	-0,62268	0,5346
X4	1,55088	0,1233

The results of the heteroskedasticity test presented in Table 4 show that all independent variables have probability values greater than α = 0.05, namely: X1 or ZIS (0,9849), X2 or TCR (0.1552), X3 or SCH (0.5346), and X4 or POV (0.1233). These values indicate that none of the variables are statistically significant with respect to the residual error, suggesting that the model is free from heteroskedasticity. Accordingly, the residual variances are homogeneous across both cross-sectional and time dimensions, confirming that the regression model satisfies one of the fundamental assumptions of panel data analysis.

The absence of heteroskedasticity further confirms that the Fixed Effects Model (FEM) estimation method employed in this study is efficient and reliable for assessing the effects of educational ZIS funds, teacher–student ratios, school availability, and poverty rates on the Education Index in Indonesia. This result is consistent with methodological guidelines provided in prior empirical panel studies (Widarjono, 2018).

Based on the results of the classical assumption tests, the panel regression model used in this research is found to be free from both autocorrelation and heteroskedasticity issues. Therefore, the estimated parameters meet the BLUE (Best Linear Unbiased Estimator) criteria and are suitable for subsequent inferential analysis. After confirming the validity of the model, the next step is to estimate the panel model to determine the relationship between educational ZIS funds and the quality of education in Indonesia.

As established by the results of the Redundant Fixed Effects Test, the Breusch–Pagan LM Test, and the Hausman Test, the Fixed Effects Model (FEM) is the most appropriate model for this study. This model is chosen because it effectively controls for unobserved, time-invariant heterogeneity across provinces—such as socioeconomic characteristics, the effectiveness of zakat institutions, and regional fiscal capacity (Widarjono, 2018).

Mathematically, the FEM applied in this study can be expressed as follows:

$$EI_{it}=\alpha_i+\beta_1 ZIS_{it}+\beta_2 TCR_{it}+\beta_3 SCH_{it}+\beta_4 POV_{it}+\varepsilon_{it}$$

which:

- EItEI = Education Index
- ZISit = Zakat, infaq, and shadaqah (ZIS) funds allocated to the education sector
- TCRit = Teacher–student ratio
- SCHit = Number of schools available per 10,000 students
- POVit = Percentage of the population living below the poverty line
- αi = Time-invariant individual effect specific to each province
- εit = Idiosyncratic error term

This model assumes that interprovincial differences are fixed and remain constant over time, yet exert a significant influence on the dependent variable. Such an approach aligns with the characteristics of Indonesia's panel data, which exhibit

substantial regional heterogeneity and variations in the effectiveness of educational ZIS fund implementation (Baltagi, 2008; Widiastuti & Firmansyah, 2025).

Table 5.

Summary of Estimated Models

	Coefficient	t-Statistic	Prob.
ZIS	8,01E-08	1,3795	(0.1701)
TCR	-0,002495	-1,7132	(0.0890)
SCH	0,001478	2,7514	(0.0068)
POV	-0,005179	-5,4283	(0.0000)
C	0,661275	1,4237	(0.0000)

The FEM estimation results in Table 5 illustrate the relationship between educational ZIS funds, teacher–student ratio, school availability, and poverty rate on the Education Index (EI) across 34 Indonesian provinces during the 2020–2024 period. This model was selected based on the Hausman test results, which confirmed that the Fixed Effects Model provides the most consistent estimation in capturing time-invariant interprovincial differences.

According to the regression output, the variable for educational ZIS funds (X1) has a coefficient of 8.01E–08 with a *t*-statistic of 1.3795, which is lower than the *t*-table value (1.974185), and a probability value of 0.1701 > 0.05. These results indicate that the effect of educational ZIS on the Education Index is statistically insignificant at the 95% confidence level. Nevertheless, the positive coefficient suggests that an increase in educational ZIS allocation tends to enhance educational quality at the provincial level. Theoretically, this finding aligns with the Human Capital Theory (Becker, 1993) and the Capability Approach (Sen, 1999), both of which view education as a primary instrument for improving human capital quality. The lack of statistical significance may stem from uneven ZIS distribution or suboptimal allocation toward programs that directly improve formal educational outcomes.

In addition, this may also reflect structural and institutional dynamics. First, the scale of ZIS allocation relative to the provincial education budget is still relatively small, which has the potential to limit measurable macro impacts. Second, most ZIS in education is directed toward short-term assistance—such as scholarships or school supplies—whose impact on aggregate indicators such as Average Years of Schooling (RLS) is only gradually becoming apparent. Third, reverse targeting may occur, whereby provinces with lower education indices receive more ZIS assistance, thereby weakening the observable statistical relationship. These findings indicate that

although ZIS has development potential, its macro effectiveness is highly dependent on the quality of governance, allocation strategies, and integration with public education financing mechanisms.

Furthermore, the teacher–student ratio (TCR) variable shows a negative coefficient of –0.002495 with a *t*-statistic of –1.7132 and a probability of 0.0890, which exceeds the 0.05 significance level but approaches the 10% threshold. This suggests a negative relationship between the teacher–student ratio and the Education Index—meaning that as the number of students per teacher increases, the quality of education tends to decline. Conceptually, this result supports the findings of Hanushek and Woessmann (2015), who argue that an increased teaching burden may reduce instructional effectiveness and student performance. Although statistically marginal, the negative direction underscores the importance of equitable teacher distribution across provinces to sustain educational quality.

The variable representing school availability (SCH) is found to be statistically significant, with a coefficient of 0.001478, a *t*-statistic of 2.7514—exceeding the *t*-table value (1.974185)—and a probability of 0.0068 < 0.05. This indicates that a higher number of schools per 10,000 students in a given region is associated with a higher provincial Education Index. This finding reinforces the educational infrastructure theory proposed by Glewwe and Kremer (2006), which posits that physical access to educational facilities is one of the key determinants of human capital development. Empirically, the result suggests that the presence of adequate educational infrastructure directly contributes to expanding learning opportunities, particularly in densely populated regions such as Java and Sumatra.

The poverty rate (POV) variable exhibits a negative and statistically significant effect, with a coefficient of –0.005179, a *t*-statistic of –5.4283, and a probability value of 0.0000 < 0.05. This implies that higher poverty levels are associated with lower educational attainment within a province. The result is consistent with the findings of Baird et al. (2014) and Tok et al. (2022), who identified poverty as a major structural barrier to accessing quality education. From the perspective of Islamic economics, this underscores the urgency of managing *zakat* and *infaq* productively to address educational inequality arising from structural poverty.

The constant term (C) of 0.661275 indicates that when all independent variables are held at zero, the average Education Index remains at 0.66. This suggests

that other external factors not included in the model—such as central government policies, school management quality, or socio-cultural influences—also play a role in shaping regional educational outcomes.

In addition to partial testing, the joint significance (F-test) results show that all independent variables collectively influence the Education Index. The model's *F*-statistic of 265.92 exceeds the *F*-table value (2.426438), leading to the rejection of the null hypothesis. This indicates that educational ZIS funds, teacher–student ratios, school availability, and poverty rates jointly and significantly contribute to variations in the Education Index across provinces. This finding reinforces the relevance of combining Islamic Social Finance mechanisms with structural educational factors as multidimensional determinants of human capital improvement in Indonesia. It is also important to emphasize that the estimated coefficients represent statistical associations rather than definitive causal effects, given the observational nature of the data and the potential for residual endogeneity. Therefore, the results should be interpreted as indications of relationships within the provincial education ecosystem.

Although the coefficient of educational ZIS is statistically insignificant, this result should not be interpreted as evidence of ineffectiveness. Several structural explanations may account for this finding.

First, the relative fiscal scale of ZIS compared to provincial education expenditure remains limited. Provincial education budgets financed through public expenditure significantly exceed ZIS allocations, thereby diluting measurable macro-level effects.

Second, time-lag effects may play a role. Educational investments often yield returns over extended periods, while the present study covers a relatively short time frame (2020–2024). Improvements in Average Years of Schooling and Expected Years of Schooling may require longer transmission mechanisms before becoming statistically observable.

Third, reverse allocation bias may exist. Provinces with lower educational performance may receive greater ZIS assistance, which weakens contemporaneous statistical association. In such cases, ZIS functions as a corrective intervention rather than a growth driver, making immediate positive coefficients harder to detect.

Fourth, ZIS programs are often fragmented across scholarships, school supplies, and short-term assistance, which may improve individual welfare but not immediately shift aggregate education indices.

Within the broader analytical framework, these findings suggest that Islamic social finance operates as a complementary instrument embedded within structural socioeconomic constraints rather than as a dominant macroeconomic determinant of educational quality.

3. Analytical Interpretation of Findings

Beyond statistical reporting, the regression results reveal important structural insights into the interaction between Islamic social finance and provincial education outcomes.

First, the statistically insignificant yet positive coefficient of educational ZIS suggests that Islamic philanthropy currently operates more as a complementary micro-level intervention rather than a macro-structural driver of educational transformation. From a fiscal perspective, the scale of ZIS allocation remains relatively small compared to provincial education expenditure financed through APBN and APBD. Consequently, while ZIS may significantly affect individual beneficiaries (e.g., scholarship recipients), its aggregate impact on the Education Index—measured through Average Years of Schooling and Expected Years of Schooling—may require a longer transmission period to become statistically detectable.

Second, the strong and significant negative effect of poverty confirms that structural socioeconomic constraints remain the dominant determinant of educational disparities across provinces. This finding implies that Islamic social finance cannot substitute structural economic reform but should instead be integrated into broader poverty alleviation strategies. In this context, ZIS allocation may be more effective when targeted toward provinces with high poverty elasticity of educational attainment.

Third, the significance of school availability highlights that infrastructure-based interventions produce more immediate and measurable effects at the macro level compared to financial assistance mechanisms. This explains why educational infrastructure exhibits stronger statistical significance than ZIS allocation in the short observation window (2020–2024).

Importantly, these results should be interpreted as associative rather than strictly causal relationships. Although the Fixed Effects Model controls for time-invariant heterogeneity, potential dynamic feedback between educational outcomes

and ZIS allocation cannot be fully ruled out. Therefore, the findings provide macro-level evidence of structural relationships rather than definitive causal claims.

Overall, the estimation results demonstrate that the Fixed Effects Model (FEM) effectively and consistently explains variations in the Education Index, aligning well with the theoretical framework. Although the direct effect of educational ZIS funds is not yet statistically significant, its positive direction suggests substantial potential for optimizing Islamic social funds to improve educational quality. When interpreted in light of the methodological limitations discussed earlier—particularly the short time span and the proxy nature of the Education Index—the findings suggest that structural variables such as poverty and infrastructure show a more direct and observable relationship with educational outcomes than religious-based financial interventions. This does not diminish the normative importance of ZIS, but rather suggests that measurable macro-level contributions may require a long-term evaluation framework. These findings provide an empirical foundation for BAZNAS and local governments to design more data-driven and targeted strategies for allocating educational *zakat* funds, thereby enhancing their impact on human capital development.

4 Implications of Findings and Research Limitations

Thefindings of this study provide important implications for the development of education policy and the optimization of Islamic social finance in Indonesia. Although the educational ZIS fund variable has not shown a statistically significant effect on the Education Index, the consistently positive relationship highlights the strategic potential of *zakat* in strengthening education quality, particularly in regions with high poverty rates. This result suggests that *zakat*, *infaq*, and *shadaqah* (ZIS) function not only as redistributive instruments but also as mechanisms of social investment that promote sustainable human development.

a) Implications for Multi-Actor Governance

The empirical findings of this study carry differentiated implications for key stakeholders involved in Islamic social finance and education governance in Indonesia. Given that educational ZIS operates within broader structural constraints, strengthening its contribution to SDG 4 requires coordinated multi-actor engagement.

b) Implications for Government Institutions

For central and provincial governments, the findings suggest that Islamic social finance should be systematically integrated into formal education planning

frameworks rather than treated merely as an informal complementary mechanism. Ministries and local education offices can strengthen this integration by developing regulatory frameworks that enable structured and accountable collaboration with zakat institutions, incorporating ZIS-based programs into Regional Medium-Term Development Plans (RPJMD), and utilizing provincial poverty and education vulnerability indices to better align ZIS targeting with structural educational needs. In this context, ZIS should not substitute public education expenditure but instead function as a strategic co-financing instrument designed to enhance equity-oriented interventions, particularly in disadvantaged and high-poverty regions where educational disparities remain pronounced.

c) Implications for Zakat Institutions and Civil Society Organizations

For BAZNAS and other zakat management organizations, the findings underscore the necessity of transitioning from charity-oriented distribution practices toward impact-oriented allocation models that emphasize measurable educational outcomes. This transformation can be operationalized by designing long-term scholarship schemes linked to clear retention and graduation indicators, prioritizing provinces where poverty exhibits a strong negative elasticity with educational attainment, and developing impact evaluation dashboards that monitor educational progress beyond mere financial disbursement figures. In parallel, civil society organizations can play a critical supportive role by strengthening transparency mechanisms, enhancing community outreach initiatives, and improving beneficiary identification systems to ensure that ZIS allocations are accurately targeted toward structurally disadvantaged groups.

d) Implications for Business and Private-Sector Actors

Private-sector actors and Islamic business communities play a catalytic role in strengthening the fiscal capacity and strategic reach of ZIS within the education sector. Corporations can contribute by integrating zakat and other Islamic philanthropic allocations into their Environmental, Social, and Governance (ESG) frameworks, thereby aligning religious-based contributions with broader sustainability objectives. In addition, firms may develop structured corporate zakat schemes that are explicitly aligned with regional education priorities and collaborate with zakat institutions to finance long-term, program-based educational initiatives rather than one-off

charitable donations. Such an approach enables Islamic philanthropy to evolve toward sustainable impact-oriented investment principles while remaining fully compliant with Shariah governance standards.

e) Implications for Collaborative Governance

The findings indicate that the limited macro-level statistical effect of educational ZIS should not be interpreted as evidence of ineffectiveness, but rather as a reflection of fragmentation and insufficient systemic coordination among relevant stakeholders. In this regard, strengthening cross-sector collaboration becomes essential to enhance the developmental impact of Islamic social finance. Establishing joint monitoring and coordination platforms between zakat institutions, education authorities, and regional development planners can improve data integration, minimize program duplication, and ensure that ZIS allocations are aligned with measurable education performance indicators. Through a coordinated governance framework, Islamic social finance can progressively evolve from a supplementary funding mechanism into a structured and institutionalized pillar within Indonesia's inclusive human capital development strategy.

However, this study also acknowledges several empirical limitations that should be considered for future research. First, the realization rate of zakat collection in Indonesia remains relatively low, reaching only about 2 percent of its national potential (BAZNAS, 2023). This limits the overall impact of ZIS on educational outcomes, as the volume of funds managed is still far below its actual potential. Second, data on educational zakat are largely derived from aggregate BAZNAS reports without detailed breakdowns by program, which constrains the analysis of cross-program effectiveness (e.g., scholarships, learning facilities, or teacher empowerment).

Third, the relatively short observation period (2020–2024) and the administrative expansion of provinces introduce data heterogeneity, especially in socioeconomic components such as teacher distribution and school availability. These factors may affect the precision of long-term effect estimation. Nonetheless, the Fixed Effects Model employed in this study helps mitigate such bias by controlling for time-invariant interprovincial differences.

Fourth, numerous other factors directly influence the dynamics of zakat collection and distribution in Indonesia, both economically and socially. Juliana et al. (2023) found that religiosity and zakat knowledge significantly affect individuals'

decisions to pay zakat, whereas income level is not always a decisive factor. This indicates that spiritual and religious literacy dimensions play an important role in shaping zakat compliance behavior. Similarly, Safitri and Juliana (2025) emphasized that the effectiveness of productive zakat depends on the awareness and capability of zakat institutions in accurately identifying target groups.

Fifth, another limitation of this study lies in the data source for zakat, which includes only the official government-managed institution—the National Amil Zakat Agency (BAZNAS). This research does not incorporate data from Zakat Management Organizations (LAZ), as most LAZ have yet to publish disaggregated reports on educational fund distribution by province. Consequently, the aggregate data used in this study may not fully represent the entirety of educational zakat activities across Indonesia. Nevertheless, the use of BAZNAS data is considered adequate, given that the institution holds a national mandate, possesses the broadest distribution coverage, and maintains consistent administrative reporting at both the provincial and national levels.

Beyond individual factors, institutional trust and governance quality are also crucial determinants of zakat collection success (Mahri et al., 2024; Widiastuti et al., 2025). Mahri et al. (2024) demonstrated that perceptions of social benefit and institutional transparency positively influence the intention to contribute *waqf* and *zakat* in productive sectors. Therefore, to comprehensively understand the contribution of zakat to education, future research should incorporate variables such as religiosity, Islamic financial literacy, and institutional effectiveness into a broader empirical model.

Crucially, empirical results show that structural variables—particularly poverty and infrastructure availability—exhibit a stronger statistical relationship with educational outcomes than the allocation of ZIS to education during the period observed. This suggests that Islamic social finance should not be viewed as a substitute for structural reform, but rather as a complementary instrument operating within broader socioeconomic constraints. Therefore, future optimization strategies should prioritize institutional strengthening and targeted interventions rather than simply increasing the volume of nominal ZIS allocations.

Overall, the findings of this study reaffirm that, while the impact of educational ZIS on the Education Index has yet to reach statistical significance, its positive direction

reveals a latent potential that can be strengthened through more targeted and collaborative management. Future studies are recommended to employ longer-term panel data (five to ten years) and to integrate micro-level zakat data (by institution and program) with macro-level educational and economic indicators. Such an approach would yield a more comprehensive and accurate understanding of how ZIS can serve as a catalyst for improving national education quality grounded in Islamic values.

D. CONCLUSION

This study provides macro-level evidence on the relationship between educational ZIS allocation and provincial education outcomes in Indonesia. While educational ZIS exhibits a positive but statistically insignificant association with the Education Index, structural variables—particularly poverty and infrastructure availability—demonstrate stronger and more immediate effects.

These findings suggest that Islamic social finance should be positioned not as a substitute for structural reform, but as a complementary instrument operating within broader development ecosystems. The spatial disparities observed across provinces further indicate that ZIS mobilization currently follows institutional and economic concentration patterns rather than systematically targeting structurally disadvantaged regions.

Therefore, optimizing the contribution of Islamic philanthropy to SDG 4 requires three strategic shifts: (1) strengthening spatial targeting mechanisms, (2) integrating ZIS allocation into regional education planning frameworks, and (3) adopting longer-term impact evaluation models. By moving beyond charity-oriented distribution toward structured, data-driven governance, Islamic social finance can gradually evolve into a measurable pillar of inclusive human capital development.

Recommendations

Based on the findings and empirical results of this study, several policy recommendations can be proposed as follows:

1. Optimization of Educational Zakat Collection
   BAZNAS and other *amil zakat* institutions should expand the *muzaki* (zakat payers) base through the digitalization of zakat payment systems and data integration with local governments. These efforts can increase zakat collection efficiency, which currently remains far below its estimated national potential.

2. Policy Synchronization between Zakat and Education Development Priorities
   Local governments should integrate ZIS as a complementary funding instrument for educational development, particularly in programs aimed at improving teacher quality, providing scholarships for underprivileged yet high-achieving students, and developing educational facilities in underdeveloped, frontier, and outermost (3T) regions.
3. Enhancement of Transparency and Accountability in Zakat Distribution
   Strengthening public reporting mechanisms through a *zakat impact dashboard* can improve public trust and ensure that ZIS funds are effectively allocated to productive sectors, including education.
4. Research and Data Collaboration among BAZNAS, the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), and Statistics Indonesia (BPS)
   Integrating educational ZIS data with national education indicators will help formulate evidence-based policies capable of comprehensively measuring socio-economic impacts.

Directions for Future Research

Future studies are encouraged to extend the observation period and incorporate additional variables such as government education spending, religious literacy index, or digital learning accessibility to provide a more holistic understanding of the interaction between zakat, education, and societal welfare

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