SDG 8 Dynamics and SDG 3 Outcomes in ASEAN: Two-Way Fixed Effects Evidence on Under-5 and Neonatal Mortality (2000–2023)

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Abstract

This study evaluates SDG interlinkages between SDG 8 economic dynamics and SDG 3 child survival outcomes in ASEAN using a balanced panel of 11 economies observed annually from 2000 to 2023 (N = 264), compiled from the Asian Development Bank Key Indicators Database (KIDB) SDMX system. Under-5 mortality (SH_DYN_MORT) and neonatal mortality (SH_DYN_NMRT) are modeled as functions of real GDP per capita growth (NY_GDP_PCAP) and real GDP per employed person growth (SL_EMP_PCAP; labor productivity growth) using two-way fixed effects (economy and year) with economy-clustered standard errors. In the preferred two-way fixed effects models, GDP per capita growth is statistically weak for both outcomes (under-5 mortality: β = 0.0130, SE = 0.2369; neonatal mortality: β = 0.0141, SE = 0.0713). By contrast, labor productivity growth is positively associated with mortality (under-5: β = 0.2540, SE = 0.1397, p = 0.069; neonatal: β = 0.0680, SE = 0.0348, p = 0.050). Timing robustness tests using one-year lagged predictors (N = 253) preserve and strengthen the productivity-mortality association (under-5: β = 0.3043, SE = 0.1337, p = 0.0228; neonatal: β = 0.0705, SE = 0.0360, p = 0.0499), whereas lagged GDP per capita growth remains weak. Results indicate that productivity gains in ASEAN over 2000-2023 are not reliably accompanied by improvements in child survival, consistent with mediating distributional, sectoral, and health-system channels that condition whether SDG 8 progress translates into SDG 3 gains.

Keywords: *ASEAN; SDG 3; SDG 8; under-5 mortality; neonatal mortality; GDP per capita growth; labor productivity growth; panel data; two-way fixed effects; ADB KIDB SDMX.*

1. Introduction

Sustainable Development Goal (SDG) 3 frames population health as both an intrinsic development objective and a foundational capability that enables learning, work participation, and productivity. In ASEAN economies, improvements in child survival outcomes have been a long-run policy priority, yet trajectories remain heterogeneous across countries and over time. At the same time, SDG 8 emphasizes decent work and economic growth as an organizing principle for inclusive development. The link between SDG 8 dynamics and SDG 3 outcomes is theoretically straightforward—economic growth and productivity can expand household resources, improve fiscal space for health spending, and strengthen health-system capacity—yet empirically nontrivial because growth may be unevenly distributed, may coincide with environmental and urban stressors, or may be offset by institutional constraints that prevent economic gains from translating into health improvements.(Bloom et al., 2018; Quinto & Atento, 2025)

Within the development economics and health economics literature, multiple mechanisms motivate an association between macroeconomic performance and child survival. Higher income levels and improved labor productivity can increase household consumption of nutrition and healthcare inputs, enhance the affordability and availability of preventive services, and support infrastructure investments that reduce exposure to health risks (e.g., water and sanitation deficits).(Bloom et al., 2018; Menez & Atento, 2026) Conversely, growth episodes can fail to reduce health burdens if they are accompanied by persistent inequality, weak social protection, or insufficient health-service access, which may particularly affect mothers and children.(Temporada et al., 2025) This ambiguity makes SDG 3–SDG 8 linkages an empirical question that benefits from designs capable of separating cross-country structural differences from within-country changes over time.

Existing ASEAN-focused quantitative work often relies on descriptive comparisons or association mapping, including country-specific

correlations and indicator profiling, and frequently emphasizes alternative child well-being outcomes such as nutrition indicators. Such approaches are valuable for pattern recognition but can be limited in their ability to isolate within-economy associations net of unobserved heterogeneity and common time shocks.(Atento, 2026; Quinto & Atento, 2025) A panel regression framework with economy and year effects offers a complementary contribution by estimating how changes in business/economic performance within a country over time relate to changes in child survival outcomes, while controlling for time-invariant country characteristics (e.g., geography, baseline institutional capacity) and shared year shocks (e.g., global cycles).(Atento, 2026; Doerr & Hofmann, 2022; Hofmann & Doerr, 2022).

Accordingly, this study develops a balanced ASEAN panel for 2000–2023 using the Asian Development Bank Key Indicators Database (KIDB) SDMX system, operationalizing SDG 3 child survival outcomes and SDG 8 business/economic predictors. The analysis focuses on two mortality indicators—under-5 mortality and neonatal mortality—and tests whether SDG 8 growth and labor productivity dynamics are associated with improvements in these SDG 3 outcomes. By pairing a parsimonious specification with robustness checks using an alternative dependent variable and lagged predictors, the study provides disciplined evidence on SDG 3–SDG 8 interlinkages in ASEAN without collapsing the analysis into a high-dimensional "kitchen sink" model.(Quinto & Atento, 2025; Si et al., 2025; Stecyk, 2023)

1.1 Objectives of the Study

The study aims to estimate the association between SDG 8 business/economic dynamics and SDG 3 child survival outcomes in ASEAN using a balanced panel dataset (11 economies, 2000–2023).

Specifically, it seeks to:

a. Estimate baseline fixed-effects panel models linking SDG 8 predictors—real GDP per capita growth (NY_GDP_PCAP) and real GDP per employed person growth (SL_EMP_PCAP)—to SDG 3 under-5 mortality (SH_DYN_MORT) across ASEAN economies.

b. Test robustness using an alternative health outcome, re-estimating the same panel specifications with neonatal mortality (SH_DYN_NMRT) as the dependent variable.

c. Assess timing robustness and reduce simultaneity concerns by estimating two-way fixed-effects models using one-year lagged SDG 8 predictors, for both mortality outcomes.

1.2 Research Questions

a. To what extent are within-economy changes in real GDP per capita growth associated with changes in under-5 mortality and neonatal mortality in ASEAN?

b. To what extent are within-economy changes in labor productivity growth associated with changes in under-5 mortality and neonatal mortality in ASEAN?

c. Do the estimated associations persist when business/economic predictors are lagged by one year?

2. Review of Related Literature

2.1 Growth and Child Survival

The proposition that economic growth improves child survival is anchored in the classical development view that rising aggregate income expands both private household capability and public fiscal capacity (Gebregziabher & Niño-Zarazúa, 2014). In this view, growth functions as an upstream determinant of health because it increases the material resources available for nutrition, housing quality, sanitation, transportation, and medical care. For children—whose health status is highly sensitive to basic inputs and preventive services—improvements in household purchasing power can translate into higher consumption of micronutrient-rich diets, safer water sources, better hygiene conditions, and more consistent care-seeking behavior for common infectious conditions (Miguel et al., 2006). The growth-to-child-survival pathway is thus often conceptualized as a broad income effect: as economic activity expands, the "budget constraint" facing households loosens, enabling higher investments in child well-being and, consequently, reductions in mortality risk (Deaton, 2006).

Complementing the household channel is a fiscal–institutional channel. Growth can raise the government's tax base and improve the feasibility of financing public goods that are crucial for child survival, such as immunization programs, primary care expansion, maternal and neonatal service coverage, rural health infrastructure, and public health surveillance (Bloom et al., 2020). The logic here is not merely that governments spend more when they have more, but that growth can enable stable funding horizons, capital expenditures, and workforce investments that sustain health service delivery. This pathway aligns with the view that improvements in child mortality are strongly driven by preventive services and system capacity (e.g., antenatal care, skilled birth attendance, neonatal support, and routine immunization), all of which require sustained public investment and administrative capability. In the most optimistic formulations, economic growth supports institutional strengthening that improves service quality and geographic equity, producing durable child survival gains (García et al., 2024; Saha et al., 2015).

Despite this broadly positive theoretical expectation, the relationship between growth and child survival is not necessarily linear, immediate, or uniform across contexts. Child mortality reflects a combination of structural determinants—household living conditions, maternal education, nutrition, water and sanitation access, and health system readiness—that may evolve more slowly than macroeconomic aggregates (Hanf et al., 2013; Quinto & Atento, 2025). Annual variations in growth may therefore be weakly correlated with year-to-year changes in mortality, particularly in settings where long-run structural constraints dominate (Cutler et al., 2006). Moreover, growth can exhibit diminishing marginal health returns: once basic service coverage thresholds are achieved, further mortality reductions may depend on more complex improvements (e.g., quality of care, referral systems, and neonatal complication management), which may not respond mechanically to additional GDP growth (Bloom et al., 2018; Deaton, 2006).

A further complexity is that growth does not guarantee broad-based welfare improvements. The distributional character of growth matters for child survival because households most exposed to mortality risks—lower-income families, rural communities, and populations with limited service access—may not experience proportional gains when growth is concentrated in narrow sectors or regions (Parsa-Parsi, 2016; Ramos et al., 2020). In such cases, aggregate growth can coexist with persistent deprivation and uneven health access, limiting the extent to which improvements in GDP per capita translate into reductions in child mortality. This "non-translation" problem is especially salient when growth is accompanied by rising inequality, weak social protection, or constrained public service delivery, all of which can prevent economic expansion from improving health outcomes among vulnerable groups (Denburg & Daneman, 2010; Ward & Viner, 2017).

Growth may also generate adverse externalities that counteract potential health gains. Rapid urbanization, industrialization, and infrastructure expansion can increase exposure to air pollution, occupational risks, traffic injuries, and environmental degradation. While these channels are often emphasized for adult morbidity and non-communicable disease burdens, they can also affect child health indirectly through household exposure and service congestion in fast-growing areas. Thus, the net effect of growth on child survival depends on whether the positive resource and fiscal channels dominate the negative externality and distributional channels (Büttner et al., 2023; Klobodu et al., 2018).

Methodologically, this theme underscores an important distinction between cross-sectional income gradients and within-country dynamics. Cross-country comparisons may show that richer countries have lower child mortality, but this does not automatically imply that short-run fluctuations in growth within a country predict contemporaneous changes in mortality. In panel settings, where unobserved structural differences between countries are controlled, the estimated relationship captures within-economy co-movement over time (Heutel & Ruhm, 2016; Ruhm, 2006). In such designs, the growth effect may appear weaker if mortality declines are driven by long-term structural improvements, health system reforms, or targeted programs rather than by annual growth performance per se. The implication is not that growth is irrelevant, but that its relationship to child survival may be mediated, delayed, or contingent on policy and institutional translation mechanisms (Büttner et al., 2023; Rajapakse et al., 2025).

Taken together, the literature on growth and child survival is organized around a central tension. On one side is the resource-based expectation that growth enables household investments and public health financing, supporting reductions in child mortality. On the other side is the conditional translation argument: growth improves child survival primarily when it is inclusive, when public systems convert fiscal space into effective service delivery, and when negative externalities are mitigated (Klobodu et al., 2018; Rajapakse et al., 2025). For ASEAN and comparable regions characterized by heterogeneous development levels and differing institutional capacities, these competing logics suggest that empirical findings may vary by country context, time period, and outcome definition (e.g., under-5 vs neonatal

mortality), and that a panel design focusing on within-economy variation can illuminate whether growth is reliably accompanied by improvements in child survival outcomes once structural differences and common shocks are accounted for (Deaton, 2006; Lin & Wang, 2020; Makhlouf et al., 2017; Rajapakse et al., 2025).

2.2 Productivity and Structural Change as a Determinant of Child Survival

Beyond aggregate growth, development pathways frequently emphasize productivity improvements and structural transformation as deeper drivers of sustained welfare gains. In macro-level evidence, increases in economic output—often treated as a proxy for underlying productivity gains—are commonly associated with reductions in under-5 and infant mortality, particularly in low-income settings where incremental resource gains translate more strongly into basic health inputs and service access.

A multi-country analysis spanning 2001 to 2020 reports that higher GDP is significantly correlated with lower under-5 mortality, with the steepest declines per unit of growth observed in the poorest countries (Haque & Farid, 2025). This gradient implies that productivity-linked growth may yield larger marginal returns for child survival where initial incomes and health infrastructure are most limited. Similarly, evidence from a cross-national African context indicates that GDP growth significantly reduces infant mortality, although the effect is partially mediated by malnutrition prevalence and health system quality (Djoumessi, 2022). These findings are consistent with the canonical understanding that productivity-enhancing economic expansion can generate resources that households and governments deploy toward nutrition, healthcare access, water and sanitation, and broader infrastructure—determinants closely linked to child survival (Bloom et al., 2020; Haque & Farid, 2025; Quinto & Atento, 2025; Rajapakse et al., 2025).

However, productivity-linked dynamics introduce additional interpretive complexity, especially when productivity is proxied through measures that embed structural change. In particular, labor productivity growth—captured by indicators such as GDP per employed person—may rise through broad-based output gains, but it may also rise during employment contraction or sectoral restructuring. Consequently, productivity improvements can coexist with uneven household welfare trajectories if gains are concentrated, if labor-market insecurity increases for vulnerable groups, or if structural transformation generates transitional social costs. This is consistent with the broader literature's emphasis that the mortality impact of growth and productivity depends on whether economic gains are translated into health-relevant investments and whether these gains are broadly distributed.

Two qualifications are repeatedly emphasized in macro evidence. First, diminishing returns are often observed: once countries reach higher income thresholds, further productivity gains yield progressively smaller mortality reductions, suggesting that non-income factors such as service delivery equity and healthcare quality become increasingly determinative (Djoumessi, 2022; Haque & Farid, 2025). Second, translation is not automatic; mortality benefits depend on whether productivity dividends are channeled into maternal and child health services, nutrition programs, and basic infrastructure. Where mediating investments are absent, the survival impact of productivity-linked growth may be attenuated (Haque & Farid, 2025; Klasen, 2006).

Notably, much of the literature infers the productivity–mortality link through GDP aggregates rather than directly estimating labor productivity growth effects within explicit structural models. Nonetheless, the consistency of macro findings across settings supports the view that productivity-enhancing structural change can contribute meaningfully to child survival—particularly when accompanied by pro-health investments and equitable distribution of gains (Haque & Farid, 2025; Ray & Lindén, 2018).

2.3 Conditional Translation: Environmental Externalities and Macroeconomic Shocks

The proposition that growth and productivity gains invariably improve child survival requires critical qualification. A growing body of evidence shows that the health dividends of growth can be weakened, delayed, or offset when expansion is accompanied by adverse externalities or destabilizing shocks. Two frequently highlighted channels are environmental degradation (particularly pollution) and macroeconomic volatility, both of which can counteract resource-based improvements in household well-being and public service delivery (Liu, 2023).

Pollution-intensive growth represents a salient pathway through which economic expansion may harm child health. Evidence indicates that while growth may directly reduce under-5 mortality, pollutant emissions generated by that growth can significantly attenuate the beneficial effect. In some contexts, greenhouse gas emissions and CO_2 in particular appear to offset part of the mortality-reducing contribution of growth, implying that the net effect of expansion depends on the environmental composition of production (Fotio et al., 2023). Similar patterns are reported in South Asian settings where CO_2 levels are associated with higher neonatal, infant, and child mortality despite concurrent GDP and health spending growth, suggesting that pollution can act as a structural obstacle to achieving child mortality targets (Wang et al., 2024). Evidence from China further complicates the narrative, documenting nonlinearities (e.g., U-shaped patterns) wherein beyond certain thresholds, additional growth may coincide with higher pollution-attributable mortality (Xue et al., 2025). Related findings show that environmental pollution can directly raise perinatal mortality and may weaken the protective effect of GDP expansion on child outcomes (Zhao et al., 2022).

Macroeconomic volatility and negative shocks represent a second channel through which the growth–child survival relationship becomes conditional. Downturns can rapidly affect child nutrition and household health inputs, particularly in low- and middle-income contexts. Evidence indicates that negative growth shocks increase child wasting prevalence, with implied downstream mortality risks due to the close relationship between acute undernutrition and child survival vulnerability (Headey & Ruel, 2022). Model-based estimates further suggest that GDP contractions can translate into substantial additional under-5 deaths at global scale, with effects concentrated in regions facing heightened baseline vulnerabilities (Cardona et al., 2022).

Collectively, this literature underscores that growth and productivity gains are not intrinsically protective; their relationship with child survival is conditional upon the environmental composition, stability, and governance of expansion. Achieving sustained mortality reduction requires not merely growth, but growth structured to minimize environmental harms and buffer households against economic shocks.

2.4 Conditional Translation: Inequality and Inclusion

A substantial body of work emphasizes that the child survival dividend of growth and productivity gains depends critically on the distribution of economic benefits. Inequality can weaken, distort, or offset expected reductions in under-5 mortality because health improvements are mediated by who captures income gains and whether vulnerable populations gain access to services and protective inputs.

Empirical evidence indicates that inequality is directly associated with adverse child survival outcomes even after accounting for national income and health spending. In some regional contexts, higher income inequality (e.g., measured by the Gini index) is positively associated with under-5 mortality, implying that unequal distribution counteracts the protective effect of growth. Systematic evidence similarly argues that economic growth alone is insufficient; equitable resource distribution and effective governance are prerequisites for translating macro expansion into lower maternal and child mortality (Sepehrdoust et al., 2022; Yeboah et al., 2025).

Cross-national evidence further suggests that growth can improve average mortality while leaving persistent inequalities or even widening relative gaps. In analyses of low- and middle-income countries, higher GDP is associated with lower absolute inequalities in infant and under-5 mortality but higher relative inequalities—implying that better-off groups may capture a disproportionate share of health gains, while disadvantaged populations remain behind (Freeman et al., 2025). Similar conclusions appear in studies showing that the effect of per capita GDP on under-5 mortality depends strongly on healthcare infrastructure and prevailing inequality; countries with comparable growth rates can exhibit markedly different mortality reductions depending on inclusiveness and service readiness (Fernando et al., 2025; Rajapakse et al., 2025).

Threshold and concentration effects complicate the relationship further. Some evidence points to nonlinear patterns wherein improvements in economic conditions reduce inequality in under-5 mortality up to certain development or inequality levels, beyond which inequality becomes independently harmful for health equity. Moreover, child undernutrition and acute respiratory infection remain concentrated among poorer households in many contexts, indicating that uneven within-country gains allow key mortality risks to persist despite aggregate progress (Atento, 2025; Birhanu et al., 2024; Yao et al., 2025; Zhu et al., 2025).

Taken together, this literature supports a strong conclusion: economic progress translates less effectively into mortality reductions when income and service improvements are unevenly shared. This underscores the relevance of inclusion and equity as conditioning factors in the SDG 8 → SDG 3 linkage.

2.5 Health-System Mediation: Service Coverage, Quality, and Financing

Even where growth and productivity improvements expand aggregate resources, reductions in child mortality depend on whether these gains are converted into effective maternal and child health services. Health-system mediation can be conceptualized along three dimensions: coverage (access and utilization), quality (clinical effectiveness and safety), and continuity (system reliability). Child survival—particularly neonatal survival—is strongly influenced by service readiness: antenatal care, skilled birth attendance, emergency obstetric and neonatal capacity, referral systems, and postnatal follow-up. As countries move beyond basic access thresholds, further mortality reductions often depend less on income growth per se and more on the quality and equity of service delivery (Lawn et al., 2016; Wilson et al., 2024).

Health-system mediation also operates through public financing and governance. Economic expansion may increase fiscal space, but mortality outcomes depend on whether this space is translated into prioritized and effectively deployed investments in primary care, immunization systems, maternal care coverage, and rural health infrastructure (Buckley et al., 2014; Kasper et al., 2023). Where fiscal gains are poorly targeted or constrained by administrative capacity, the growth-to-health translation can be muted; where growth is matched by deliberate service delivery strengthening, mortality reductions become more plausible and sustained. Thus, the SDG 8 → SDG 3 pathway is best interpreted as a mediated process that hinges on institutional conversion of economic gains into effective health service delivery (Bloom et al., 2020; García et al., 2024; Saha et al., 2015).

2.6 Synthesis, Gaps, and Contribution of the Study

Taken together, the literature supports a broad expectation that economic growth is associated with improved child survival through household resource expansion and increased public capacity for health investment. However, it also emphasizes that this relationship is frequently conditional: distributional patterns, environmental externalities, macroeconomic volatility, and health-system readiness can attenuate—or in some contexts complicate—the expected gains. These qualifications are especially relevant in multi-country settings where structural transformation and institutional capacity vary substantially across economies and over time.

Two gaps motivate the present study. First, there remains a need for SDG-aligned empirical testing of SDG 8 dynamics against SDG 3 child survival outcomes using a design that isolates within-economy associations net of time-invariant heterogeneity and common year shocks. Second, evidence remains limited on whether productivity-oriented indicators—particularly GDP per employed person growth—are systematically associated with improvements in under-5 and neonatal mortality within ASEAN economies, and whether any associations persist under timing robustness checks. Addressing these gaps, the present study constructs a balanced ASEAN panel (2000–2023) using the ADB KIDB SDMX system and estimates two-way fixed effects models linking GDP per capita growth (NY_GDP_PCAP) and labor productivity growth (SL_EMP_PCAP) to under-5 mortality (SH_DYN_MORT) and neonatal mortality (SH_DYN_NMRT), with robustness evaluated through an alternative dependent variable and one-year lagged predictors.

The study also responds to a broader call in the literature to examine whether inclusive economic participation—including women's empowerment—operates as a mechanism linking growth to health outcomes (Menez & Atento, 2026). By focusing on within-ASEAN variation, the design controls for unobserved heterogeneity across economies and isolates whether improvements in productivity and average income coincide with measurable gains in child survival, conditional on the mediating and moderating factors identified in the preceding sections.

3. Methodology

3.1 Research design

The study uses a quantitative, explanatory design based on a balanced cross-country time-series dataset (panel data). The empirical objective is to evaluate SDG interlinkages between SDG 8 economic dynamics and SDG 3 child survival outcomes in ASEAN by estimating within-economy associations over time, while controlling for time-invariant cross-economy heterogeneity and common year shocks.

3.2 Data source, coverage, and unit of analysis

Data were retrieved programmatically from the Asian Development Bank (ADB) Key Indicators Database (KIDB) using the SDMX v4 API. The analytic sample is a balanced annual panel covering 11 ASEAN economies from 2000 to 2023 (N = 264 country–year observations). The unit of analysis is the economy–year.

ASEAN economies included: BRU, CAM, INO, LAO, MAL, MYA, PHI, SIN, THA, TIM, VIE.

3.3 Variables and operationalization

Health outcomes (SDG 3). Two dependent variables are used:

(1) under-5 mortality rate (SH_DYN_MORT), and

(2) neonatal mortality rate (SH_DYN_NMRT).

These indicators operationalize child survival and are widely used as population health outcomes reflecting health-system performance and socio-economic conditions. Mortality indicators are expressed as rates per 1,000 live births.

Business/economic predictors (SDG 8). Two independent variables are used:

(1) real GDP per capita growth (NY_GDP_PCAP), and

(2) real GDP per employed person growth (SL_EMP_PCAP), treated as a labor productivity growth proxy.

The SDG 8 predictors are annual growth rates expressed in percentage terms.

Table 1 presents the operational definitions and measurement codes, aligned with the SDG dataflow structure used for extraction (ADB,SDG_03 and ADB,SDG_08).

3.4 Data preparation

All series were retrieved in annual frequency. Observations were aligned using a country–year key (economy_code, year). The resulting dataset is balanced for the study window (2000–2023). For timing robustness, one-year lags of SDG 8 predictors were constructed within each economy; this reduces contemporaneous simultaneity concerns and aligns with delayed transmission channels from economic conditions to health outcomes. Lagged models necessarily omit the first year per economy, yielding **N = 253** for the lagged specifications.

3.5 Statistical treatment and model specification

The primary estimator is a two-way fixed effects (TWFE) panel regression model with economy effects and year effects. This specification identifies within-economy associations over time net of:

(a) unobserved time-invariant differences across economies (e.g., geography, baseline institutional capacity), and

(b) common year shocks (e.g., global cycles).

The baseline contemporaneous model is specified as:

$$Y_{i,t} = \alpha + \beta_1 \text{GDPpcGrowth}_{i,t} + \beta_2 \text{ProdGrowth}_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

where $Y_{i,t}$ denotes either under-5 mortality (SH_DYN_MORT) or neonatal mortality (SH_DYN_NMRT), μ_i denotes economy fixed effects, and λ_t denotes year fixed effects.

For timing robustness, the lagged predictor model is estimated as:

$$Y_{i,t} = \alpha + \beta_1 \text{GDPpcGrowth}_{i,t-1} + \beta_2 \text{ProdGrowth}_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

Inference is based on economy-clustered standard errors to account for within-economy serial correlation and heteroskedasticity. Given the limited number of clusters (11 economies), inference is interpreted conservatively; where feasible, statistical significance may be verified using small-sample cluster adjustments or wild cluster bootstrap procedures.

Benchmark specifications are estimated for transparency: pooled OLS with year effects and one-way (economy) fixed effects, followed by the preferred two-way fixed effects model. Robustness checks include replication using the alternative mortality dependent variable and estimation with one-year lagged predictors.

3.6 Ethical considerations

The study uses publicly available secondary data and does not involve human participants or identifiable personal information; thus, it is exempt from human-subject ethical review requirements.

4. Results and Discussion of Findings

4.1 Descriptive statistics and data coverage

Table 2 summarizes the distribution of under-5 mortality (SH_DYN_MORT) and the SDG 8 predictors (GDP per capita growth and GDP per

employed person growth) for the balanced ASEAN panel (2000-2023; N = 264). Descriptive patterns provide context for interpreting the fixed-effects estimates, particularly by clarifying the range and dispersion of the mortality outcome and the volatility inherent in annual growth measures.

4.2 Correlation structure and collinearity diagnostic

Table 3 reports pooled Pearson correlations among the study variables. Under-5 and neonatal mortality are highly correlated (r = 0.9824), consistent with their conceptual proximity as child survival indicators and with neonatal mortality constituting a major component of under-5 mortality. Both mortality outcomes exhibit moderate positive pooled correlations with SDG 8 growth and productivity measures (r ≈ 0.27-0.31).

Additionally, GDP per capita growth and GDP per employed person growth are strongly correlated (r = 0.7457), indicating potential collinearity. For this reason, substantive interpretation is anchored on the fixed-effects specifications with economy-clustered inference rather than on bivariate associations. Given the correlation between SDG 8 predictors, supplementary models estimating each predictor separately are reported in Table 7 to assess sensitivity to collinearity.

4.3 Fixed-effects estimates for under-5 mortality

Table 4 reports panel regression estimates using pooled OLS with year effects and one-way fixed effects as benchmarks, with interpretation focused on the preferred two-way fixed effects (TWFE) specification (economy and year effects) using economy-clustered standard errors. In the TWFE model (N = 264; R^2 = 0.8923), GDP per capita growth (NY_GDP_PCAP) shows a positive but statistically weak association with under-5 mortality (β = 0.0130, SE = 0.2369). In contrast, GDP per employed person growth (SL_EMP_PCAP), used as a labor productivity growth proxy, is positively associated with under-5 mortality (β = 0.2540, SE = 0.1397, p = 0.069). These coefficients are interpreted as within-economy associations over time after accounting for time-invariant economy characteristics and common year shocks.

4.4 Fixed-effects estimates for neonatal mortality

Table 5 replicates the baseline specifications using neonatal mortality as the dependent variable.

In the preferred TWFE model (N = 264; R^2 = 0.94), GDP per capita growth remains statistically weak (β = 0.0141, SE = 0.0713), while GDP per employed person growth is positively associated with neonatal mortality (β = 0.0680, SE = 0.0348, p = 0.050). The replication of directionality across both mortality outcomes strengthens confidence that the observed pattern is not specific to a single child survival indicator.

4.5 Robustness: lagged SDG 8 predictors

To address timing and reduce concerns about contemporaneous simultaneity, Table 6 reports TWFE estimates using one-year lagged SDG 8 predictors. As expected, the lagged models exclude the first year per economy (N = 253). For under-5 mortality, lagged GDP per capita growth is negative but statistically weak (β = −0.1275, SE = 0.2509, n.s.), while lagged labor productivity growth remains positive and statistically stronger (β = 0.3043, SE = 0.1337, p < 0.05). For neonatal mortality, lagged GDP per capita growth remains weak (β = −0.0062, SE = 0.0785, n.s.), whereas lagged labor productivity growth remains positive and statistically significant (β = 0.0705, SE = 0.0360, p < 0.05). Overall, the lag structure robustness check indicates that the productivity–mortality association persists and strengthens under delayed timing, whereas GDP per capita growth remains weak across both outcomes.

4.6 Sensitivity: single-predictor TWFE

Table 7 reports two-way fixed effects (economy and year) models estimated separately for each SDG 8 predictor to assess sensitivity to collinearity between GDP per capita growth and GDP per employed person growth (r = 0.7457 in Table 3). Results are substantively consistent with the main specifications. When entered alone, GDP per capita growth (NY_GDP_PCAP) remains statistically weak for both outcomes (under-5 mortality: β = 0.2584, SE = 0.2143, p = 0.2278; neonatal mortality: β = 0.0798, SE = 0.0621, p = 0.1985). In contrast, labor productivity growth (SL_EMP_PCAP) retains a positive association that is closer to conventional significance thresholds (under-5 mortality: β = 0.2612, SE = 0.1542, p = 0.0903; neonatal mortality: β = 0.0759, SE = 0.0413, p = 0.0660). The stability of direction and relative significance across the single-predictor models indicates that the observed productivity–mortality pattern is not driven solely by including both correlated SDG 8 predictors in the same specification.

4.7 Discussion of Findings

4.7.1 Consolidated interpretation of the empirical patterns

The study's results indicate a consistent pattern across specifications, outcomes, and robustness checks. First, GDP per capita growth (NY_GDP_PCAP) shows weak and statistically non-robust associations with both under-5 and neonatal mortality in the preferred two-way fixed effects (TWFE) models, and remains weak in the lagged predictor specifications. Second, labor productivity growth (SL_EMP_PCAP) exhibits a positive association with both mortality outcomes in the preferred models and remains positive under timing robustness tests using one-year lags. The replication of direction and relative strength across the two mortality indicators reduces the likelihood that the findings are specific to a single dependent variable definition and supports the inference that the observed pattern reflects a stable within-economy regularity within the ASEAN panel over 2000–2023.

The descriptive correlation structure is directionally consistent with these results: both mortality outcomes co-move strongly with each other, while the SDG 8 predictors are themselves highly correlated. This reinforces the need to interpret coefficients primarily through the fixed-effects framework rather than through bivariate associations, and to treat sensitivity checks as integral to inference.

4.7.2 Why GDP per capita growth may be weak in two-way fixed effects settings

A weak GDP growth–mortality association in TWFE models is substantively plausible. Child survival outcomes respond strongly to structural and policy-driven determinants—such as immunization coverage, maternal care access, nutrition adequacy, water and sanitation access, and health system capacity—that often evolve more slowly than annual macroeconomic fluctuations. In addition, TWFE models absorb time-invariant economy differences and common year shocks, leaving identification to rely on within-economy year-to-year variation. If mortality improvements are driven primarily by long-run service delivery reforms, cumulative public health investments, or targeted programs, then short-run growth variation may have limited predictive content for mortality once fixed effects are included.

From a policy standpoint, this pattern cautions against using macroeconomic growth as a standalone proxy for health progress. It is consistent with the SDG logic that improvements in child survival require institutionalized translation mechanisms—through service delivery expansion, coverage guarantees, and quality improvement—rather than reliance on aggregate growth dynamics alone.

4.7.3 Interpreting the positive productivity–mortality association: conditional translation and structural dynamics

The positive association between labor productivity growth and child mortality should not be interpreted as evidence that productivity "causes" higher mortality. Rather, it indicates that, within economies over time, periods of higher measured productivity growth tend to coincide with higher mortality levels (or slower improvements), after controlling for economy and year fixed effects. Several mechanisms can rationalize this pattern within a conditional translation framework.

(a) Composition and labor-shedding dynamics.

GDP per employed person can rise through output expansion, but it can also rise when employment falls faster than output. In such cases, measured productivity growth may partly reflect labor shedding, informalization, or restructuring that weakens household income security. Reduced household buffers can affect nutrition, care-seeking, and maternal-child health inputs among vulnerable populations even when aggregate "productivity" improves.

(b) Uneven distribution of productivity gains.

Productivity improvements can be concentrated in capital-intensive sectors or geographically concentrated growth corridors with limited spillovers to household welfare. Without inclusive wage channels, social protection, and accessible services, aggregate productivity gains may not translate into broad-based child survival improvements.

(c) Externalities of productivity-driven expansion.

High-productivity episodes may coincide with intensified industrial activity, congestion, pollution exposure, and occupational risks. Where mitigation capacity is limited, these externalities can increase health risks directly or indirectly and can strain local service delivery systems.

(d) Health system and governance constraints as mediators.

Even where productivity expands fiscal space, the SDG 8 → SDG 3 pathway depends on whether economic gains are converted into maternal and child health coverage, quality, and access. Bottlenecks in staffing, service quality, supply

chains, and referral systems can prevent productivity-driven gains from becoming measurable child survival improvements.

(e) Time-varying omitted factors and conservative inference.

TWFE models cannot fully eliminate time-varying confounding (e.g., immunization scale-ups, health financing reforms, nutrition shocks, conflict/disaster disruptions). The productivity coefficient may partly reflect co-movement with such processes. Accordingly, estimates are best framed as within-economy associations rather than causal effects.

Two elements strengthen the credibility of the observed pattern. First, the positive association persists—and becomes stronger—in lagged predictor models, suggesting that it is not purely contemporaneous co-movement. Second, sensitivity checks that estimate each SDG 8 predictor separately show that the positive productivity–mortality association is not driven solely by shared variance with GDP per capita growth, although it remains subject to the limitations of observational panel designs.

4.7.4 Policy implications for aligning SDG 8 with SDG 3 in ASEAN

The results suggest that ASEAN policy approaches should treat SDG interlinkages as a governance and distribution challenge, not a simple growth challenge. Productivity gains should be paired with labor-market protections and social protection that stabilize households during restructuring, particularly for populations most exposed to child survival risks. Governments should institutionalize explicit mechanisms that convert macro gains into maternal and child health investments—coverage, quality, and access—rather than assuming that improved economic performance automatically produces health dividends. Externalities associated with industrial expansion should be mitigated through environmental regulation, urban planning, and occupational health safeguards. Finally, strengthening service delivery capacity remains central: without health system readiness and equitable access, SDG 8 progress may fail to translate into SDG 3 child survival improvements.

5. Conclusions, Recommendations, Study Implications, and Future Directions

5.1 Conclusions

Using a balanced ASEAN panel from 2000–2023 drawn from the ADB KIDB SDMX system, this study assessed SDG interlinkages between SDG 8 economic dynamics and SDG 3 child survival outcomes. Two-way fixed effects models indicate limited evidence that GDP per capita growth is systematically associated with under-5 or neonatal mortality within economies over time. In contrast, labor productivity growth (GDP per employed person growth) is positively associated with both mortality outcomes, and this pattern persists in lagged specifications. These findings caution against assuming an automatic translation from productivity improvements to child survival gains, and instead suggest that distributional, structural, and health-system channels condition whether SDG 8 progress produces SDG 3 improvements. For policy, the results support integrating inclusive labor-market measures, health-system strengthening, and externality mitigation into productivity-oriented development strategies to ensure that economic advances translate into measurable improvements in child survival.

5.2 Recommendations

Building on the two-way fixed effects evidence for ASEAN (2000–2023), the study's central practical implication is that SDG 8 improvements—particularly measured labor productivity growth—do not automatically translate into SDG 3 child survival gains. Recommendations therefore emphasize translation mechanisms that align economic performance with maternal–child health outcomes.

5.2.1 Policy recommendations for ASEAN governments and development agencies

1. Institutionalize SDG translation mechanisms (SDG 8 → SDG 3).

Economic agencies and health agencies should treat child survival gains as an explicit target of growth and productivity strategies. This can be operationalized through cross-sectoral budgeting rules and delivery commitments that ensure that periods of strong economic performance are accompanied by predictable investments in maternal and child health services.

2. Stabilize households during productivity-driven restructuring.

Because productivity measures can rise during labor shedding or sectoral restructuring, governments should strengthen social protection tools that stabilize household welfare and health inputs during transitions. Priority instruments include targeted cash transfers, maternity-related support, nutrition support, and community health outreach financing, particularly for lower-income households most relevant to child survival risk.

3. Protect maternal and child health service continuity during high-growth episodes.

Growth corridors and rapid urban-industrial transitions can increase service demand and health risk exposure. Policy should prioritize continuity of prenatal care, skilled birth attendance, immunization supply chains, neonatal care readiness, and referral systems in areas where economic expansion is concentrated.

4. Strengthen service delivery capacity as the key mediator.

Child survival outcomes respond strongly to service access and quality. ASEAN governments should prioritize health-system capacity building as the primary mediator that enables SDG 8 gains to translate into SDG 3 outcomes—especially staffing models, rural access, maternal care readiness, and primary care quality assurance.

5. Create co-accountability SDG metrics for monitoring translation.

Adopt monitoring indicators that explicitly track whether economic gains are being converted into health improvements (e.g., responsiveness of maternal–child health spending to productivity changes; child survival improvement rates relative to economic expansions), allowing early identification of "non-translating growth."

5.2.2 Recommendations for business and industry stakeholders

6. Incorporate community health externalities into productivity strategies.

Firms in industrial and high-growth zones should treat environmental and social externalities as business risks. Health-oriented externality management (pollution mitigation, occupational safety, community monitoring) reduces the likelihood that productivity improvements coincide with adverse health outcomes.

7. Strengthen workforce support policies that indirectly protect child health.

Employer practices that stabilize households—health coverage, maternal benefits, wage progression, predictable schedules, childcare support—represent plausible micro-level channels through which business performance becomes compatible with improved child survival outcomes.

8. Support public–private service access initiatives in growth corridors.

Where firms draw labor into expanding areas, public–private partnerships can help prevent service overload through co-financed mobile clinics, referral partnerships, transport support for prenatal care, and local health system strengthening.

5.2.3 Data and analytics recommendations

9. Develop an ASEAN SDG interlinkage dashboard.

Given the counterintuitive sign on productivity growth, an ASEAN monitoring dashboard should routinely track growth/productivity, employment dynamics, distributional proxies, health service coverage proxies, and child survival outcomes to detect periods where economic gains fail to translate into health improvements.

10. Improve inference robustness in official analytics.

With a limited number of country clusters, economy-clustered inference should be supplemented (where feasible) with small-sample cluster adjustments or wild cluster bootstrap verification as a routine robustness practice in SDG analytics.

5.3 Limitations and Future Research

5.3.1 Limitations

L1. The findings are associational rather than causal.

Two-way fixed effects remove time-invariant economy differences and common year shocks, but do not eliminate all time-varying confounding. Unobserved changes in immunization programs, health spending, governance quality, conflict exposure, or disaster shocks may correlate with both economic predictors and mortality outcomes.

L2. Parsimonious predictors limit mechanism testing.

The study intentionally uses two high-coverage SDG 8 predictors to preserve a balanced panel and avoid overfitting. However, this limits direct testing of mediating pathways (inequality, poverty, WASH access, education, health system coverage, and nutrition) through which economic conditions may affect child survival.

L3. The productivity proxy may embed labor-market contraction.

GDP per employed person can rise during employment contraction or sectoral restructuring. Without explicit modeling of employment levels, wages, and sectoral composition, the positive association between productivity growth and mortality cannot be uniquely attributed to one mechanism.

L4. The number of clusters is limited.

Economy-clustered standard errors are appropriate, but the sample contains 11 economies. Cluster-robust inference can be sensitive with few clusters; results should be interpreted conservatively and, where possible, verified using small-sample cluster adjustments or wild cluster bootstrap procedures.

L5. Outcome scope is restricted to child survival indicators.

Under-5 and neonatal mortality are strong health outcomes, but do not capture other health burdens (e.g., adult non-communicable disease burden, morbidity, mental health) that may exhibit different relationships with SDG 8 dynamics.

L6. Annual frequency limits timing resolution.

Annual data constrain identification of short-run disruptions and policy implementation timing. The lagged models partially address timing, but richer dynamics may require distributed-lag specifications or alternative data frequencies.

5.4 Future research directions

F1. Expand mediators and conditioning variables.

Future models should add a small set of theory-driven mediators (e.g., health expenditure proxies, immunization coverage, WASH access, inequality/poverty indicators) to test whether SDG 8 gains translate into SDG 3 improvements only under specific institutional or distributional conditions.

F2. Decompose productivity dynamics.

Introduce sectoral composition measures and explicit labor-market variables (employment levels, informality proxies, wage indicators) to determine whether productivity growth reflects inclusive gains or restructuring that weakens household welfare for vulnerable groups.

F3. Use alternative identification strategies for stronger causal interpretation.

Where data and context permit, apply dynamic panel approaches, event studies around major reforms, synthetic control designs for country-specific policy shifts, or instrument-based strategies to improve causal inference.

F4. Test nonlinearities and thresholds.

Assess whether SDG 8 $\rightarrow$ SDG 3 linkages differ by development level or structural transformation phase, using interactions (e.g., productivity $\times$ inequality; productivity $\times$ health-system coverage) or threshold models.

F5. Extend outcomes and update the time window.

Future work may incorporate maternal mortality, life expectancy, disease-specific burdens, and post-2023 updates when available, to evaluate stability of the observed associations across health domains and time periods.

F6. Explore subnational analyses where feasible.

If subnational SDMX series or compatible sources can be integrated, within-country regional panels may reveal localized health effects of growth and productivity dynamics that national aggregates can obscure.

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7. Tables

Table 1. Operationalization of Variables

Variable	Code	Role	Dataflow	Construct rationale	Expected sign vs mortality
Under-5 mortality rate	SH_DYN_MORT	Dependent variable (Health outcome)	ADB,SDG_03	Population health outcome (child survival), widely used as a proxy for health system performance and socio-economic conditions.	—
Real GDP per capita growth (annual)	NY_GDP_PCAP	Independent variable (Business/economic performance)	ADB,SDG_08	Macro performance proxy influencing resources available for health, nutrition, and public services.	Negative
Real GDP per employed person growth (annual)	SL_EMP_PCAP	Independent variable (Labor productivity)	ADB,SDG_08	Labor productivity growth proxy; captures efficiency/earnings capacity that may translate to better household health inputs.	Negative

Table 2. Descriptive Statistics and Coverage

Variable	N_total_rows	Observations nonmissing	Missing	Coverage_%	Mean	Std Dev	Min	Max
SH_DYN_MORT	264	264	0	100	33.83	27.19	2.10	110.50
NY_GDP_PCAP	264	264	0	100	3.75	5.08	(21.70)	29.50
SL_EMP_PCAP	264	264	0	100	3.31	6.32	(14.20)	77.47

Table 3. Pearson Correlation Matrix (pooled N = 264)

	SH_DYN_MORT	SH_DYN_NMRT	NY_GDP_PCAP	SL_EMP_PCAP
SH_DYN_MORT	1	0.9824	0.2669	0.3143
SH_DYN_NMRT	0.9824	1	0.2837	0.308
NY_GDP_PCAP	0.2669	0.2837	1	0.7457
SL_EMP_PCAP	0.3143	0.308	0.7457	1

Table 4. Fixed-Effects Models for Under-5 Mortality (SH_DYN_MORT)

DV	Model	term	beta	se_cluster	t	p	N	R2	Country_FE	Year FE
SH_DYN_MORT	M1 Pooled OLS + Year FE	NY_GDP_PCAP	0.2625	1.3451	0.195	0.8453	264	0.1853	N	Y
SH_DYN_MORT	M1 Pooled OLS + Year FE	SL_EMP_PCAP	1.0938	0.3169	3.451	<0.001	264	0.1853	N	Y

SH_DYN_MORT	M2 Country FE	NY_GDP_PCAP	0.268	0.4049	0.662	0.508	264	0.793	Y	N
SH_DYN_MORT	M2 Country FE	SL_EMP_PCAP	0.3415	0.1302	2.623	0.0087	264	0.793	Y	N
SH_DYN_MORT	M3 Two-way FE	NY_GDP_PCAP	0.013	0.2369	0.055	0.9563	264	0.8923	Y	Y
SH_DYN_MORT	M3 Two-way FE	SL_EMP_PCAP	0.254	0.1397	1.818	0.0691	264	0.8923	Y	Y

Table 5. Fixed-Effects Models for Neonatal Mortality (SH_DYN_NMRT)

DV	Model	term	beta	se_cluster	t	p	N	R2	Country _FE	Year _FE
SH_DYN_NMRT	M1 Pooled OLS + Year FE	NY_GDP_PCAP	0.22	0.53	0.41	0.68	264	0.15	N	Y
SH_DYN_NMRT	M1 Pooled OLS + Year FE	SL_EMP_PCAP	0.35	0.11	3.15	<0.001	264	0.15	N	Y
SH_DYN_NMRT	M2 Country FE	NY_GDP_PCAP	0.1	0.13	0.77	0.44	264	0.88	Y	N
SH_DYN_NMRT	M2 Country FE	SL_EMP_PCAP	0.09	0.04	2.3	0.02	264	0.88	Y	N
SH_DYN_NMRT	M3 Two-way FE	NY_GDP_PCAP	0.01	0.07	0.2	0.84	264	0.94	Y	Y
SH_DYN_NMRT	M3 Two-way FE	SL_EMP_PCAP	0.07	0.03	1.96	0.05	264	0.94	Y	Y

Table 6. TWFE Models with One-Year Lagged Predictors (Both Outcomes)

DV	Model	term	beta	se_cluster	t	p	N	R2	Country FE	Year FE
SH_DYN_MORT	TWFE with L1 IVs	L1_NY_GDP_PCAP	-0.1275	0.2509	-0.508	0.6113	253	0.901	Y	Y
SH_DYN_MORT	TWFE with L1 IVs	L1_SL_EMP_PCAP	0.3043	0.1337	2.276	0.0228	253	0.901	Y	Y
SH_DYN_NMRT	TWFE with L1 IVs	L1_NY_GDP_PCAP	-0.0062	0.0785	-0.08	0.9366	253	0.9486	Y	Y
SH_DYN_NMRT	TWFE with L1 IVs	L1_SL_EMP_PCAP	0.0705	0.036	1.961	0.0499	253	0.9486	Y	Y

Table 7. TWFE Sensitivity: Single-Predictor Models

DV	Model	term	beta	se_cluster	t	p	N	R2	Country _FE	Year_FE
SH_DYN_MORT	TWFE single IV: NY_GDP_PCAP	NY_GDP_PCAP	0.2584	0.2143	1.206	0.2278	264	0.891	Y	Y
SH_DYN_MORT	TWFE single IV: SL_EMP_PCAP	SL_EMP_PCAP	0.2612	0.1542	1.694	0.0903	264	0.8923	Y	Y
SH_DYN_NMRT	TWFE single IV: NY_GDP_PCAP	NY_GDP_PCAP	0.0798	0.0621	1.286	0.1985	264	0.9439	Y	Y
SH_DYN_NMRT	TWFE single IV: SL_EMP_PCAP	SL_EMP_PCAP	0.0759	0.0413	1.838	0.066	264	0.9446	Y	Y