

TOURISM INVESTMENT, LABOR GAINS, AND DELAYED GROWTH: A SYNTHETIC CONTROL EVALUATION OF INDONESIA'S DPSP

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Article Info	Abstract
<p>Keywords: Super Priority Destination, SCM, Tourism, Economic Growth, Indonesia.</p> <p>Received: December 22, 2025</p> <p>Approved: May 29, 2026</p> <p>Published: June 29, 2026</p>	<p>Indonesia's Super Priority Tourism Destinations program identifies five regions outside Bali as strategic hubs for concentrated tourism investment. However, rigorous causal evidence of its economic impact remains largely absent from the literature. This study assesses the program's effect on regional economic growth in North Sumatra and North Sulawesi—the provinces that host Lake Toba and Likupang—using the Synthetic Control Method, complemented by the Mann-Whitney U test to examine changes in tourism-related employment, wages, and output in the accommodation sector. The Synthetic Control results indicate that aggregate regional output in both provinces remained below their respective counterfactual trajectories throughout 2020–2024, with mean treatment effects of -0.0428 log points in North Sumatra and -0.0496 log points in North Sulawesi. In contrast, the Mann-Whitney U test reveals statistically significant increases in tourism-related employment and average wages in both provinces over the same period. This divergence between aggregate and sectoral outcomes constitutes the study's central finding. The results are consistent with a sequential interpretation of the Tourism-Led Growth Hypothesis, in which labor market adjustments emerge earlier than broader output multipliers, particularly under conditions of early-stage destination development and pandemic-related demand disruptions. These findings extend the Tourism-Led Growth Hypothesis literature to settings shaped by a simultaneous global economic shock and make a methodological contribution by introducing a multi-level evaluation framework for tourism policy assessment.</p>

How to cite:

Siallagan, S. U., Fazaalloh, A. M. (2026). Tourism Investment, Labor Gains, and Delayed Growth: A Synthetic Control Evaluation of Indonesia's DPSP. *Jurnal Kepariwisata Indonesia: Jurnal Penelitian dan Pengembangan Kepariwisata Indonesia*, 20(1), 115-134. <https://doi.org/10.47608/jki.v20i12026.115-134>

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INTRODUCTION

Background and Objectives

Indonesia’s tourism sector has shown remarkable resilience in the post-pandemic period. By 2023, international tourist arrivals to Indonesia reached 11.68 million, a 98.3 percent increase from 2022, and climbed to 13.9 million in 2024, the highest figure in four years (BPS Bali, 2024). However, as shown in Figure 1, this recovery remains highly concentrated: Bali alone accounts for nearly half of all international arrivals, a structural imbalance that persists rather than narrowing during the post-pandemic recovery. Although tourism is widely recognized as a driver of economic growth through its multiplier effects on hospitality, transport, retail, and local services (Chidakel et al., 2021; Cui, 2024), these benefits remain unevenly distributed across Indonesia, providing the core motivation for a redistributive tourism development policy at the national level.

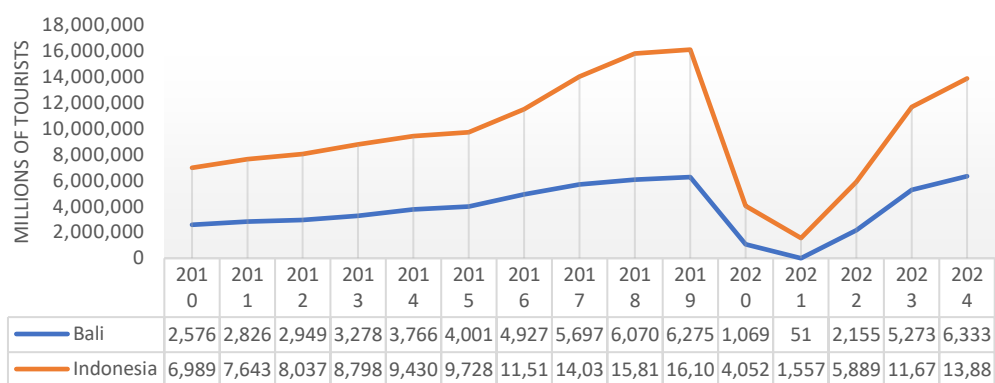


Figure 1. Number of International Tourist Arrivals to Bali and Indonesia, 2010–2024
Source: Bali Province Central Bureau of Statistics (BPS), 2024

To address these challenges, the Indonesian government accelerated national tourism growth by launching the Super Priority Tourism Destinations (Destinasi Pariwisata Super Prioritas/DPSP) under Presidential Regulation No. 18 of 2020, as part of the National Medium-Term Development Plan (RPJMN) 2020–2024. The program designates five destinations outside Bali, namely Lake Toba (North Sumatra), Likupang (North Sulawesi), Borobudur (Central Java), Mandalika (West Nusa Tenggara), and Labuan Bajo (East Nusa Tenggara), as strategic development hubs for targeted infrastructure investment, improved connectivity, and destination promotion. Specifically, the DPSP aims to increase both international and domestic tourist arrivals by developing physical and non-physical supporting infrastructure (Purnomo & Khairunnisa, 2024).

Table 1. Physical and Non-Physical Development Programs of the DPSP in Lake Toba and Likupang

Year	DPSP Development Programs	
	Lake Toba (North Sumatra)	Likupang (North Sulawesi)
2020	Physical programs: Construction of the Balige Bypass Road, access road to Huta Ginjang, Sipinsur Road, and Aek Halian Bridge.	— No program recorded —
2021	Physical programs: Construction of wastewater treatment plant (IPAL) in Parapat.	Physical programs: Construction and upgrading of 45.47 km of roads along the DPSP Manado–Bitung–Likupang corridor; road preservation and construction of one bridge (Bitung–Likupang yratory road);



	<p>Physical programs: Development of venues for the F1H2O in Lake Toba.</p> <p>Events: Gondang Naposo Festival (Samosir); Lake Toba Rally (Parapat); Bunga dan Buah Festival (Berastagi); Sisingamangaraja Festival (Humbang Hasundutan); Samosir Jamming Paradise; Samosir Lake Toba Marathon; Toba Silalahi Arts Festival; Lake Toba Asia Pacific Rally Championship (APRC); and others.</p>	<p>development of the Likupang Special Economic Zone (SEZ); improvement of “rumah swadaya” quality to support tourism.</p> <p>Non-physical programs: Basic training for homestay managers and tourism village managers in Likupang.</p> <p>Event: Likupang Tourism Festival 2021.</p>
2022	<p>Physical programs: Upskilling and reskilling training for human resources in the hotel sector around Lake Toba and capacity building for creative economy business actors in the Lake Toba area.</p> <p>Event: F1H2O held in Lake Toba.</p>	<p>Non-physical programs: Training for creative economy human resources in the musicpreneur subsector in Likupang.</p> <p>Events: Likupang Tourism Festival 2022; Likupang Santa Charity Run; Likupang North Sulawesi International Fishing Competition (LNSIFC).</p>
2023	<p>Non-physical programs: Ministry of Tourism and Creative Economy (Kemenparekraf) forum on improving destination governance in Likupang.</p> <p>Event: Likupang Tourism Festival 2023.</p>	<p>Non-physical programs: Ministry of Tourism and Creative Economy (Kemenparekraf) forum on improving destination governance in Likupang.</p> <p>Event: Likupang Tourism Festival 2023.</p>

Source: Kemenparekraf (2023)

Table 1 outlines the scope of DPSP interventions at the two destinations examined in this study. The breadth of both physical and non-physical programs underscores that the DPSP is not a narrow sectoral subsidy but a comprehensive destination development strategy. Critically, these two components are likely to generate economic effects across different time horizons. Physical infrastructure investment requires years of construction and visitor adoption before generating measurable output effects. Consistent with evidence from China and Singapore, infrastructure's contribution to economic growth is inherently more significant in the long run, as it takes time to enhance accessibility and activate multiplier effects (Karimi et al., 2024; Liu et al., 2022). By contrast, non-physical interventions such as human resource training and destination marketing tend to produce more immediate but narrower sectoral responses. This temporal heterogeneity is broadly consistent with the Tourism-Led Growth Hypothesis, which posits that the transmission from tourism investment to aggregate output is gradual, as sectoral adjustments in employment and service demand typically precede broader regional multiplier effects (Shahzad et al., 2017; Suhel & Bashir, 2018). This consideration motivates the multi-level evaluation framework adopted in this study.

Although the DPSP was designed to stimulate local economic growth beyond Bali, rigorous causal evidence of its impact remains scarce. Most existing assessments rely on descriptive analysis, input-output modeling, or pre-post comparisons without adequate counterfactual controls, approaches that cannot isolate policy effects from concurrent economic trends (Abadie et al., 2010). A critical identification problem further complicates inference: the DPSP launched in early 2020, precisely when COVID-19 imposed an unprecedented shock on global tourism. DiD estimation is difficult to apply here because the parallel-trends assumption is hard to satisfy when a large external shock affects provinces with varying degrees of tourism dependence in heterogeneous ways (Bouttell et al., 2018; Kreif et al., 2016). Panel regression is limited by unobserved heterogeneity and the non-random timing of the pandemic. The Synthetic Control Method addresses these limitations by constructing a province-specific counterfactual from an optimally weighted

combination of untreated units, accounting for time-varying unobserved confounders without requiring parallel trends (Abadie et al., 2010; Abadie & Gardeazabal, 2003; Bouttell et al., 2018).

Two additional gaps motivate the study's design. First, although the identification challenge posed by COVID-19 is addressed methodologically through SCM, the TLGH literature has paid limited attention to whether its predicted transmission mechanisms remain operative or are merely delayed when policy implementation coincides with a major demand shock. Second, existing evaluations typically focus on aggregate output, overlooking early-stage sectoral signals, particularly in labor markets, where tourism development effects often precede macroeconomic multiplier effects by several years.

To address this research gap, this study examines the impact of the DPSP policy on regional economic growth using the Synthetic Control Method (SCM), focusing on North Sumatra Province (Lake Toba DPSP) and North Sulawesi Province (Likupang DPSP). Two research questions guide the analysis: (1) Has the DPSP generated higher regional economic growth in treated provinces relative to a credible counterfactual? (2) Has the DPSP produced statistically significant shifts in tourism-related sectoral indicators, namely employment, wages, and accommodation sector output, that may signal early-stage policy transmission even in the absence of short-term aggregate effects? These sectoral indicators are selected for their direct relevance to the tourism transmission mechanism. Employment captures the labor market response to destination investment, typically the earliest observable signal of policy transmission. Wages reflect improvements in labor productivity and service quality, while accommodation sector output provides a direct measure of tourism service utilization and early-stage demand response. Differences in sectoral indicators before and after the intervention are analyzed using the Mann-Whitney U test, given its robustness under small sample sizes and non-normal distributions.

This study makes three distinct contributions to the literature on tourism economics, regional development policy, and causal inference. First, to the authors' knowledge, it is the first application of the Synthetic Control Method to evaluate the DPSP program in Indonesia, filling a critical methodological gap in the country's tourism policy evaluation literature. Conventional approaches are insufficient given the small number of treated units and the concurrent pandemic shock. Second, by combining SCM with the Mann-Whitney U test, this study introduces a multi-level evaluation framework that separates aggregate macroeconomic effects from sectoral labor market dynamics and can detect policy signals that aggregate indicators may miss. Third, the study extends the empirical TLGH literature by examining the hypothesis's predictions under a simultaneous global economic shock caused by COVID-19, a context that prior TLGH evaluations have rarely examined systematically. It also contributes empirical evidence on the conditionality of the tourism-growth relationship in early-stage destination development contexts.

Literature Review

The Tourism-Led Growth Hypothesis (TLGH) is the theoretical cornerstone of much of the literature on the economic impacts of tourism, suggesting that strategic development in this sector can significantly catalyze sustained regional growth by increasing demand (Shahzad et al., 2017; Suhel & Bashir, 2018). Within this framework, tourism activity, reflected in tourist arrivals and tourism expenditure, supports the expansion of related sectors, increases value added, and strengthens the overall

performance of regional economies. Empirical studies generally support the TLGH, showing that tourism expansion contributes positively to economic growth through employment creation, investment stimulation, and demand spillovers. However, the strength, timing, and magnitude of these effects vary considerably across institutional, structural, and macroeconomic contexts, suggesting that tourism-led growth is not a uniform phenomenon but one shaped by the specific conditions of each destination.

Empirical findings confirm this context dependence. While many studies report a significant positive relationship (Cannonier & Burke, 2019; Garidzirai & Pasara, 2021; Scarlett, 2021; Wijesekara et al., 2022), the magnitude and direction of this impact vary substantially across economic structures. In economies dominated by large manufacturing sectors, tourism's contribution to GDP tends to be modest, whereas in service-based or slower-growing economies, it more often serves as a significant growth catalyst (Shahzad et al., 2017). This divergence reflects differences in absorptive capacity, namely the ability of local economies to convert tourism expenditure into broader domestic production linkages and multiplier effects. In contexts where high-productivity alternative sectors already exist, tourism expenditure tends to generate weaker economy-wide multipliers because tourism constitutes only a relatively small share of total economic activity. By contrast, in less diversified economies, tourism expansion may exert stronger spillover effects across employment, household income, and local demand.

Institutional quality further moderates the relationship. Destinations with stronger governance frameworks retain tourism revenues more effectively, whereas weak institutions may divert economic benefits from local communities (Adedoyin et al., 2022; Tang & Tan, 2018). At the extreme, excessive tourism dominance risks Dutch Disease dynamics, in which foreign exchange inflows appreciate the real exchange rate and draw productive resources away from tradable sectors, thereby weakening manufacturing competitiveness and long-run growth (Ojaghlou, 2019). Taken together, these findings suggest that tourism-led growth is conditioned by structural and institutional factors rather than tourism volume alone, a consideration directly relevant to emerging destinations such as Lake Toba and Likupang, where diversification remains limited and institutional capacity is still developing.

Despite broad empirical support for the TLGH, important questions remain about how tourism-led development performs in emerging destinations facing structural limitations and large external shocks. This issue is particularly relevant to Indonesia's DPSP policy, implemented in emerging tourism regions precisely as the COVID-19 pandemic began disrupting global tourism demand. Yet the TLGH has rarely been tested in contexts where a large external shock coincides with policy implementation, leaving it unclear whether tourism-led growth mechanisms remain operative under crisis conditions or whether their effects are delayed rather than absent. Moreover, prior evaluations of tourism development policies in comparable contexts generally focus on aggregate output indicators while paying limited attention to sectoral transmission mechanisms that may emerge earlier than broader macroeconomic outcomes. This gap motivates a study that applies a credible causal inference framework to evaluate the effectiveness of tourism policy in an emerging destination context shaped by structural constraints and pandemic-induced disruptions.

METHODOLOGY

Data and Variables

This study uses secondary data from official publications of the Central Statistics Agency (Badan Pusat Statistik/BPS). The unit of analysis is the provincial level, focusing on two provinces with DPSP locations: North Sumatra Province (Lake Toba DPSP) and North Sulawesi Province (Likupang DPSP). The observation period spans 2010–2024, with 2010–2019 as the pre-intervention period and 2020–2024 as the post-intervention period, consistent with the formal designation of DPSP locations under the RPJMN 2020–2024.

In the SCM framework, the primary outcome variable is Gross Regional Domestic Product (GRDP) per capita, which serves as an indicator of regional economic performance and welfare. To construct a synthetic control unit that closely resembles the treated provinces before the intervention, three predictor variables are used: the Labor Force Participation Rate (LFPR), Mean Years of Schooling (MYS), and the population growth rate. These variables are selected for their theoretical relevance to regional economic growth. LFPR reflects labor supply conditions that determine a province's responsiveness to investment-driven demand shocks (Bartik, 2015; Beverly et al., 2023), a channel directly relevant to DPSP's employment transmission mechanism. MYS proxies human capital accumulation (Laverde-Rojas et al., 2019), which conditions the capacity of local economies to capture productivity gains from tourism investment. Population growth is included as a demographic scaling variable to ensure that the synthetic control tracks the treated province's demographic trajectory and prevents spurious divergence attributable to differential population dynamics. Together, these predictors ensure that the synthetic control unit provides a credible counterfactual representation of what economic conditions in the treated provinces would have looked like absent the DPSP intervention.

In addition to the main analysis, this study incorporates sectoral variables to examine the mechanisms underlying the DPSP policy, particularly employment and wage dynamics in tourism-related sectors. These indicators are analyzed using the Mann-Whitney U test. Notably, the sectoral classification of employment and wages in BPS labor statistics changed over time. From 2010 to 2014, the publication *Keadaan Angkatan Kerja Indonesia* used a 9-sector classification, in which Wholesale and Retail Trade, Restaurants, and Hotels were reported as a single category. Starting in 2015, the classification expanded to 17 sectors, separating these components. This reclassification introduces a potential measurement risk that could bias trend comparisons across the observation period. This limitation is addressed by aggregating the post-2015 subcategories to reproduce the pre-2015 classification structure, using their combined values as a consistent proxy for tourism-related employment and wage indicators throughout the observation window. While this approach introduces a degree of measurement approximation, it preserves time-series integrity and is considered methodologically defensible given the structural similarity of the aggregated categories. The operational definitions, measurement units, and data sources for all variables are summarized in Table 2.

For the SCM analysis, a donor pool is formed from provinces that were not exposed to the DPSP policy intervention. Provinces hosting other DPSP sites are excluded to prevent potential contamination of the policy impact. Provinces included in the donor pool are selected based on similarities in economic characteristics during the pre-intervention period, particularly GRDP per capita levels and economic growth trends before 2020. This

procedure ensures that the synthetic control unit provides a credible counterfactual representation for the treated provinces in the absence of the DPSP policy.

Table 2. Variables, Measurement and Data Sources

	Variable	Variable Measurement	Source
<i>Synthetic Control Method</i>	Economic Growth	Gross Regional Domestic Product (GRDP) per capita	BPS
	Labor Participation (LFPR)	Force Rate Percentage of population aged 15 years and over who are part of the labor force (%)	BPS
	Mean Years of Schooling (MYS)	Average number of years completed by the population aged 15 years and over in formal education (years)	BPS
	Population Growth	Annual population growth rate (%)	BPS
<i>Mann-Whitney U Test</i>	Number of Workers in the Tourism Sector	Population aged 15 years and over who worked during the last week according to main occupation: a. Accommodation and Food & Beverage Services b. Wholesale and Retail Trade	BPS
	Average Wages in the Tourism Sector	Average monthly wage/salary of workers by main occupation (IDR): a. Accommodation and Food & Beverage Services b. Wholesale and Retail Trade	BPS
	Accommodation and Food & Beverage Sector	Growth rate of GRDP of the accommodation and food & beverage sector at constant prices (%)	BPS

Source: Central Bureau of Statistics (BPS), 2024

Data Analysis

The impact of Indonesia’s DPSP policy on regional output is analyzed using the Synthetic Control Method (SCM). This approach builds on the seminal work of Abadie & Gardeazabal (2003) and the methodological extensions by Abadie et al. (2010). SCM is selected for this study because the DPSP policy was implemented in only a limited number of provinces and there is no clearly comparable untreated region. Conventional comparative approaches, such as Difference-in-Differences, may be less appropriate in this context, given the heterogeneity of regional economic structures and the difficulty of satisfying the parallel-trend assumption. SCM addresses this limitation by constructing a synthetic comparison unit from weighted combinations of control provinces so that the resulting synthetic unit closely reproduces the characteristics and pre-intervention trajectory of the treated province. Accordingly, post-intervention differences between the treated province and its synthetic counterpart can be interpreted as the policy's causal impact (Abadie et al., 2010; Abadie & Gardeazabal, 2003; Yan & Chen, 2023). By using the SCM approach, this study generates a credible proxy for the non-intervention scenario, enabling a rigorous comparison between actual economic output and the projected trajectory in the absence of DPSP.

The validity of the SCM estimates depends heavily on the quality and composition of the donor pool. Therefore, the donor pool in this study was restricted to provinces that did not receive the DPSP intervention and had relatively similar economic characteristics before 2020. This restriction aims to improve the credibility of the synthetic counterfactual and reduce potential bias from structural differences across provinces. However, because the number of eligible comparison provinces is limited, the external validity of the findings should be interpreted cautiously, as the estimated effects primarily reflect the institutional and economic contexts of North Sumatra and North Sulawesi rather than those of all tourism destinations in Indonesia.



A potential source of bias also stems from the COVID-19 pandemic, which created a simultaneous global economic shock during the post-intervention period. If the pandemic affected treated and donor pool provinces to different degrees, particularly because tourism-dependent regions were more vulnerable to mobility restrictions and declining travel demand, the estimated post-intervention gaps may partially reflect differences in shock exposure rather than policy effects alone. This study attempts to mitigate this risk by restricting the donor pool to provinces with broadly comparable economic structures, thereby reducing the likelihood of differential shock absorption between treated and control units. In addition, placebo tests provide further inferential support by assessing whether the observed gaps are substantially larger than those in provinces exposed to the same pandemic environment. Nevertheless, the estimated effect sizes should still be interpreted with caution, given the severity of the pandemic shock during the observation period.

To assess the robustness and statistical significance of the findings, a series of placebo tests was conducted. This involved iteratively applying the SCM to each province in the donor pool, reassigning treatment status to each control unit as if it had received the DPSP intervention. However, because the number of available units is limited, the resulting placebo distribution is relatively coarse, yielding low-resolution p-values. For instance, with only ten units, the smallest attainable p-value is 0.1, which constrains inference at the conventional 5% significance level (Chen & Yan, 2023). Following the methodology outlined by Abadie et al. (2010) and Yan & Chen (2023), and adopting the approach of Lahura & Sabrera (2023), statistical significance is assessed by comparing the post-intervention-to-pre-intervention Mean Squared Prediction Error (RMSPE) ratio between the treated provinces and the placebo units. When North Sumatra and North Sulawesi show the highest RMSPE ratios within the donor pool and exhibit distinctively large gap patterns, the effects are deemed statistically significant. This suggests that the observed impacts are not due to chance but can be credibly attributed to the implementation of the DPSP policy.

To provide a more comprehensive perspective, this research integrates the Mann-Whitney U test to assess shifts in sectoral metrics following the DPSP's introduction. This non-parametric technique was selected for its robustness with small sample sizes and non-normal data. The evaluation specifically examines changes in the distribution of the tourism-related workforce, industry wage levels, and the output of the accommodation and food & beverage sectors between the pre- and post-policy eras. All computational procedures, including both the SCM and non-parametric inferences, were performed using Stata.

FINDINGS AND DISCUSSION

Estimation of the DPSP Impact

Table 3 presents the weights assigned to each control province in constructing the synthetic counterparts for North Sumatra and North Sulawesi. The pre-intervention economic trajectory of North Sumatra is most closely reproduced by a weighted combination of Central Kalimantan and South Sulawesi, whereas North Sulawesi's counterfactual is constructed from a mix of Central Sulawesi, West Sumatra, Central Kalimantan, and South Sumatra. The other provinces in the donor pool receive a weight of 0.



Table 3. Unit Donor Pool & Optimal Unit Weights

North Sumatra		North Sulawesi	
Donor Pool	U.weights	Donor Pool	U.weights
West Sumatra	0	South Kalimantan	0
South Sumatra	0	West Sumatra	0.3310
Central Kalimantan	0.5490	Central Kalimantan	0.1740
South Sulawesi	0.4510	South Sulawesi	0
West Java	0	Central Sulawesi	0.4080
		South Sumatra	0.0870

Source: Author Analysis

Figures 2 and 3 present the actual versus synthetic economic trajectories for both provinces over 2010–2024. During the pre-intervention period (2010–2019), the synthetic control closely tracks the actual outcome in both provinces, confirming a strong pre-treatment fit, the foundational requirement for causal identification under SCM. This close correspondence indicates that the synthetic unit captures each treated province's underlying economic structure prior to the DPSP intervention, and that post-intervention divergences can be credibly attributed to the policy rather than to pre-existing differences.

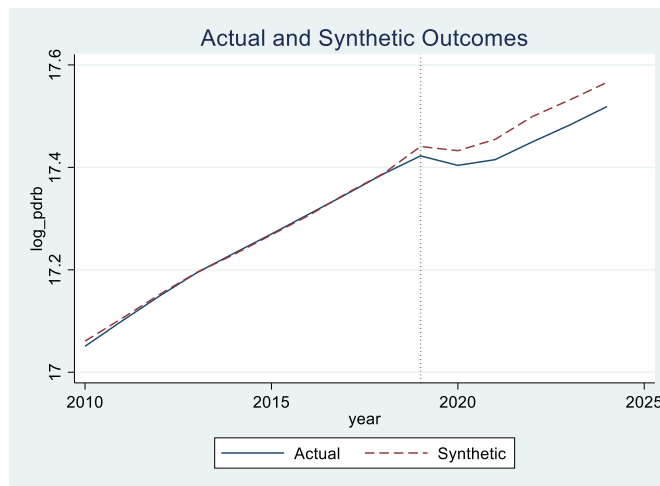


Figure 2. Actual and Predicted paths (North Sumatra)
 Source: Author Analysis

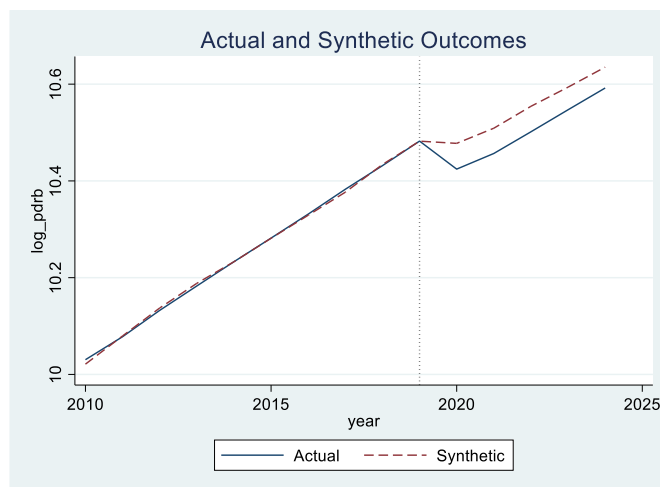


Figure 3. Actual and Predicted paths (North Sulawesi)
 Source: Author Analysis



Following the implementation of the DPSP in 2020, a persistent negative divergence emerges in both provinces: actual GRDP per capita falls and remains below the synthetic counterfactual throughout the post-intervention period. Tables 4 and 5 provide a year-by-year summary of this divergence.

Table 4. Prediction results in the post-treatment periods (North Sumatra)

Time	Actual Outcome	Synthetic Outcome	Treatment Effect
2020	17.4039	17.4326	-0.0287
2021	17.4151	17.4546	-0.0395
2022	17.4497	17.4993	-0.0496
2023	17.4827	17.5317	-0.0490
2024	17.5187	17.5659	-0.0472
Mean	17.4540	17.4968	-0.0428

The average treatment effect over the post-treatment period is -0.0428.

Source: Author Analysis

Table 5. Prediction results in the post-treatment periods (North Sulawesi)

Time	Actual Outcome	Synthetic Outcome	Treatment Effect
2020	10.4244	10.4776	-0.0532
2021	10.4567	10.5089	-0.0522
2022	10.5015	10.5542	-0.0527
2023	10.5470	10.5938	-0.0467
2024	10.5920	10.6352	-0.0431
Mean	10.5043	10.5539	-0.0496

The average treatment effect over the post-treatment period is -0.0496.

Source: Author Analysis

The treatment effect, measured as the gap between actual and synthetic outcomes, was consistently negative across all five post-intervention years, ranging from -0.0287 in 2020 to -0.0496 in 2022, before narrowing slightly to -0.0472 in 2024. The mean treatment effect over the full post-intervention period is -0.0428 log points below the counterfactual trajectory. A similar pattern holds for North Sulawesi, where actual outcomes fell from 10.4244 in 2020 to a mean of 10.5043, against a synthetic mean of 10.5539, yielding a mean treatment effect of -0.0496 log points below the counterfactual. These numbers require careful theoretical interpretation. A negative treatment effect in the SCM framework does not mean the DPSP caused economic contraction. Rather, it indicates that treated provinces grew at a rate lower than the synthetic counterfactual would have projected in the absence of the intervention. This gap is consistent with the early-stage nature of DPSP implementation, where infrastructure investment and destination development typically precede measurable output effects by several years.

To assess the statistical significance of the estimated effects, placebo tests were conducted using a placebo-in-space approach, in which each province in the donor pool was alternatively treated as if it had received the policy intervention. The results are shown in Figures 4 and 5. The gray lines display the placebo estimates for the comparison provinces, whereas the black line indicates the estimated effect for the treated provinces. The findings reveal that the gaps observed for North Sumatra and North Sulawesi are considerably larger than those of the comparison provinces. Furthermore, both provinces have the highest post-intervention-to-pre-intervention ratios of Root Mean Squared Prediction Error (RMSPE) within the donor pool. These results imply that the estimated

effects are unlikely to arise randomly and are strongly linked to the implementation of the DPSP policy.

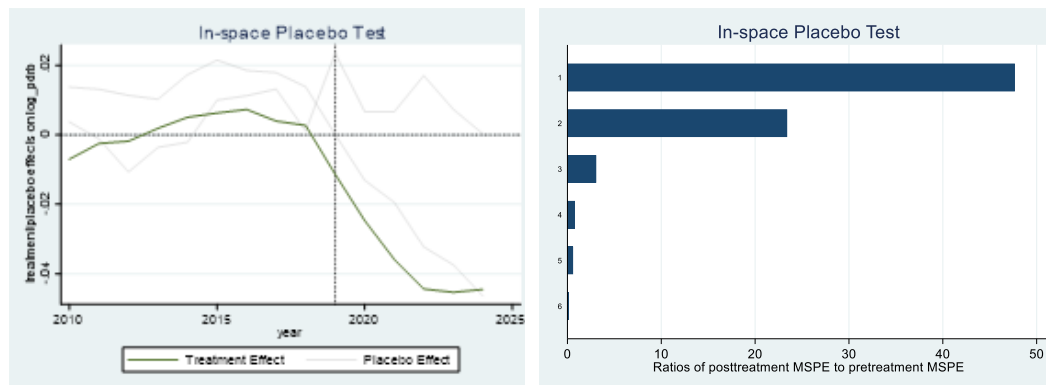


Figure 4. In-space placebo test North Sumatra
 Source: Author Analysis

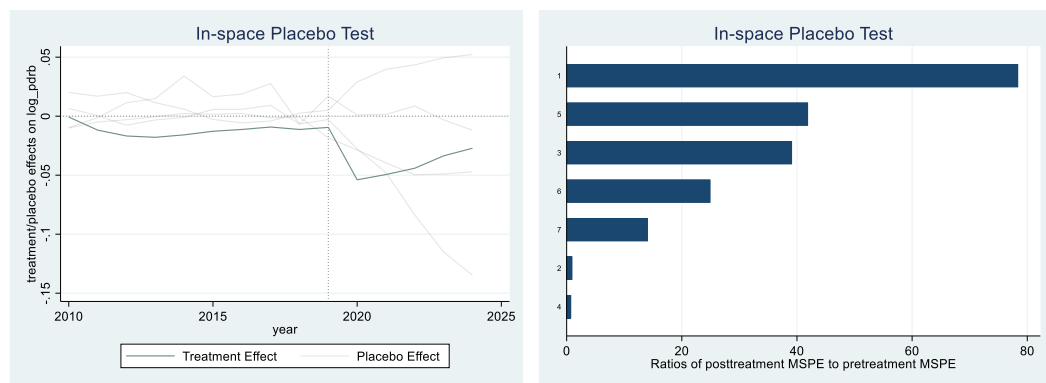


Figure 5. In-space placebo test North Sulawesi
 Source: Author Analysis

In addition to the placebo in-space test, a placebo in-time test was conducted by shifting the treatment year to a period before the DPSP policy was implemented. This test assesses whether similar effects would arise if the DPSP policy were assumed to have taken effect earlier. As shown in Figure 6, no significant differences between actual and synthetic economic growth are observed when the intervention is assumed to occur in 2017, a period before the DPSP policy was implemented. This finding further supports the validity of the estimated impacts and reinforces the interpretation that the divergences observed after 2020 are attributable to the implementation of the DPSP policy.

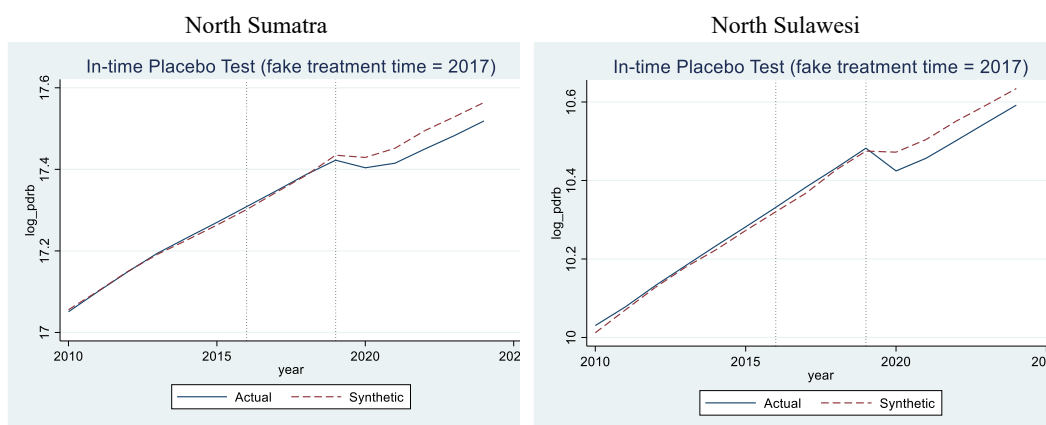


Figure 6. In-time Placebo Test North Sumatra & North Sulawesi

Source: Author Analysis

Sectoral Outcomes

Tables 6 and 7 present the results of the Mann-Whitney U test comparing tourism-related indicators before and after the implementation of the DPSP policy in North Sumatra and North Sulawesi. In North Sumatra, the results indicate statistically significant differences in the number of workers in the tourism sector ($p = 0.0022$) and average wages in the tourism sector ($p = 0.0071$) between the pre- and post-policy periods. However, no significant difference is observed in the performance of the accommodation and food & beverage sector ($p = 1.000$), suggesting that the distributions of values across the two periods remain similar. It should also be noted that the post-intervention period contains only five observations, which may limit the statistical power of the non-parametric test.

In North Sulawesi, significant differences are also observed in the number of tourism sector workers ($p = 0.0033$) and average wages ($p = 0.0101$), whereas the accommodation and food & beverage sector shows no statistically significant change ($p = 0.4634$). Notably, the pre-intervention observations for this sector span nine years rather than ten because data for 2010 were not available in the 2010 base-year series; the sector was still reported using the 2000 base year in the provincial statistics.

Table 6. Mann-Whitney U test North Sumatra

Variable	Period	Obs	Rank sum	Expected	Prob > z
Number of Workers in the Tourism Sector	post	5	65	40	0.0022
	pre	10	55	80	
Average Wages in the Tourism Sector	post	5	62	40	0.0071
	pre	10	58	80	
Accommodation and Food & Beverage Sector	post	5	40	40	1.000
	pre	10	80	80	

Source: Author Analysis

Table 7. Mann-Whitney U test North Sulawesi

Variable	Period	Obs	Rank sum	Expected	Prob > z
Number of Workers in the Tourism Sector	post	5	64	40	0.0033
	pre	10	56	80	
Average Wages in the Tourism Sector	post	5	61	40	0.0101
	pre	10	59	80	
Accommodation and Food & Beverage Sector	post	5	43	37.5	0.4634
	pre	9	62	67.5	

Source: Author Analysis



Discussion

The SCM results indicate that regional economic growth in both North Sumatra and North Sulawesi remained below their respective synthetic counterfactuals throughout the 2020–2024 post-intervention period. Within the SCM framework, however, this result does not imply that the DPSP reduced economic activity. Rather, it suggests that growth in the treated provinces had not yet exceeded the trajectory expected in the absence of the policy intervention. This distinction is important because the evaluation period coincided with a major external shock that affected both the treated and comparison provinces.

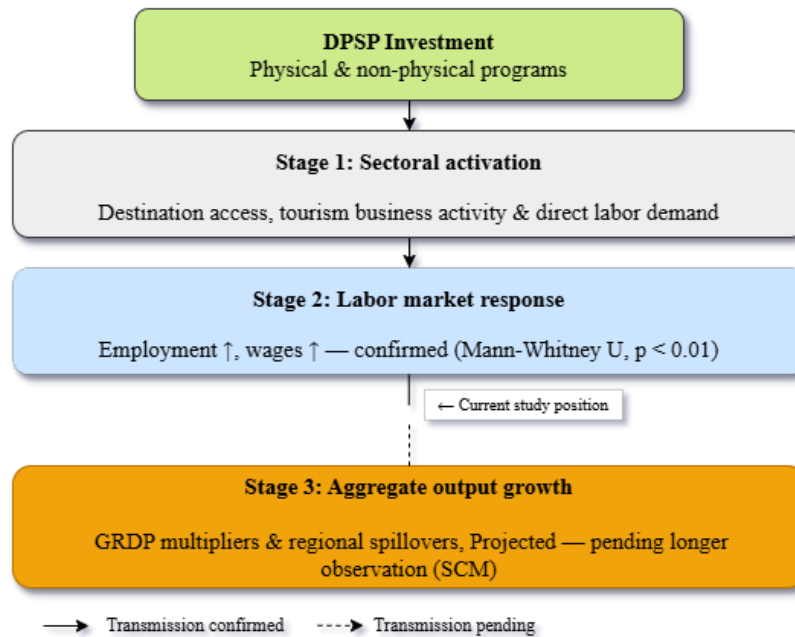


Figure 7. Illustrative Framework of Sequential Tourism-Led Growth Transmission Based on Study Findings
 Source: Author’s Illustration

Drawing on the tourism investment and growth literature, this study proposes a sequential interpretation of the TLGH transmission mechanism that aligns with the observed empirical pattern. In the first stage, tourism investment, including physical infrastructure development, destination promotion, institutional support, and improvements to tourism-related services, enhances destination accessibility, visibility, and carrying capacity, thereby stimulating tourism-related business activity and direct labor demand. In the second stage, rising employment and wages strengthen household income, consumption, and backward linkages to local supplier networks. In the third stage, accumulated sectoral gains gradually generate broader regional output multipliers that become visible at the aggregate provincial level. The current findings suggest that North Sumatra and North Sulawesi remain in an intermediate transition phase, with labor market adjustments already observable, while broader aggregate growth effects have not yet fully materialized.

Although the present analysis does not directly estimate causal effect sizes at the sectoral level, the consistency of significant results across employment and wage indicators in the two provinces suggests that the observed labor market improvements are unlikely to be economically trivial. However, whether these early-stage gains are sufficient to generate

broader regional multiplier effects ultimately depends on the longer-term trajectories of tourist arrivals, tourism expenditure, and local business expansion.

Several structural factors help explain this pattern. In Likupang, marine transportation services, including boat conditions, ticketing systems, and port accessibility, remain relatively underdeveloped, with overall service quality estimated at about 60 percent (Marpaung et al., 2024). Destination visibility also remains lower than in other DPSP locations, as reflected in Google Trends search intensity data (Waruwu et al., 2023). In Lake Toba, environmental management and sanitation quality remain problematic at several tourist sites, and community participation in tourism development remains uneven across surrounding areas (Khair et al., 2022; Widianingsih et al., 2023). These constraints likely limit tourist flows and tourism expenditure, thereby weakening the multiplier effects needed to generate measurable provincial-level output growth.

A second contributing factor was the COVID-19 pandemic, which disrupted the demand-side conditions necessary for tourism expansion during the early phase of DPSP implementation (Gössling et al., 2020; Värzaru et al., 2021). The accommodation and food service sector contracted sharply in 2020, by -9.26 percent in North Sumatra and -25.81 percent in North Sulawesi, reflecting the severe collapse in tourism demand. Under these conditions, tourism investments intended to stimulate visitor arrivals and spending could not operate under normal market conditions. Consequently, the transmission from tourism investment to aggregate regional output was likely delayed.

An important interpretive caveat concerns the attribution of observed labor market improvements. Although the Mann-Whitney U test identifies statistically significant shifts in employment and wages following DPSP implementation, these changes may not be attributable solely to the program. Broader post-pandemic recovery dynamics, including national employment stimulus initiatives, general economic normalization, and the gradual reopening of the hospitality sector across all provinces, likely contributed to labor market improvements in the treated provinces as well (Värzaru et al., 2021). The absence of a credible sector-level counterfactual makes it difficult to fully disentangle DPSP-specific effects from broader recovery trends. These findings should therefore be interpreted as suggestive evidence of early-stage policy transmission rather than definitive causal evidence of DPSP-driven labor market transformation.

The findings also support the argument that the effects of tourism investment are marked by substantial time lags (Fuinhas et al., 2020; Karimi et al., 2024; Muvawala et al., 2021; Nguyen, 2021). Tourism infrastructure projects typically require several years to produce stable increases in visitor flows and local spending. Destination branding cycles, tour operator network development, and traveler awareness accumulate gradually over time (Lahura & Sabrera, 2023; Nguyen, 2021). In Lake Toba and Likupang, where several infrastructure programs were still being completed during 2020–2023, the current evaluation window primarily captures the construction and early activation phase rather than the mature operational phase, when larger multiplier effects would normally emerge. Comparable evidence is provided by Lahura & Sabrera (2023), who applied SCM to evaluate Peru's Kuelap cable car development and found that aggregate economic effects became visible only several years after infrastructure completion. The absence of immediate aggregate growth effects in the present study should therefore not be interpreted as policy failure but as evidence that the current observation period likely precedes the stage at which infrastructure returns become fully observable.

These labor market gains align with previous studies highlighting tourism as a labor-intensive sector capable of generating direct and indirect employment opportunities (Santos, 2023; Spektor & Naira, 2021). Taken together, the coexistence of significant labor market improvements and aggregate output below the counterfactual constitutes the study's primary empirical contribution and is consistent with a sequential interpretation of TLGH, in which sectoral effects emerge before aggregate multipliers, with direct implications for how tourism development policies should be designed and evaluated.

These findings also carry several policy implications. First, evaluating tourism development policies solely on short-term aggregate GRDP indicators may underestimate their early-stage effects, especially during crises. Second, destination-specific constraints require tailored policy responses. In Likupang, improving maritime connectivity and strengthening destination promotion remain key priorities, whereas in Lake Toba, environmental governance and community-based tourism participation require greater attention. Third, tourism policy evaluation frameworks should incorporate sequential indicators that capture different stages of tourism-led development, including labor market outcomes, sectoral performance, and broader regional output indicators over longer time horizons. Such an approach would provide a more comprehensive assessment of how tourism investment translates into regional economic transformation.

CONCLUSION

This study presents one of the first causal evaluations of Indonesia's Super Priority Tourism Destinations (DPSP) policy using the Synthetic Control Method (SCM), focusing on North Sumatra (Lake Toba) and North Sulawesi (Likupang). The SCM results indicate that regional economic growth in both provinces during the 2020–2024 post-intervention period remained below their respective synthetic counterfactual trajectories, suggesting that large-scale tourism investment has not yet yielded measurable aggregate output gains within the current observation window.

The most important finding, however, comes from the contrast between aggregate and sectoral outcomes. The Mann-Whitney U test shows statistically significant increases in tourism-related employment and average wages in both provinces, while aggregate GRDP remains below its counterfactual trajectory. These findings contribute to the TLGH literature by suggesting that tourism-led development may proceed through sequential stages of transmission, with labor market responses emerging before broader aggregate output multipliers, particularly in emerging destinations exposed to major external shocks. The absence of aggregate growth effects is closely tied to two compounding factors. The DPSP was implemented during the COVID-19 pandemic, which sharply reduced tourism demand and delayed the transmission mechanism by which tourism investment generates regional multiplier effects. Destination-specific structural constraints, including limited maritime connectivity and lower destination visibility in Likupang, as well as environmental management deficiencies and uneven community participation in Lake Toba, likely further constrained the scale of tourism spillovers during the observation period.

The findings yield several actionable policy implications. First, maritime transport connectivity in Likupang should remain a development priority, particularly by improving transport reliability, port accessibility, and tourism mobility infrastructure. Second,



environmental governance at Lake Toba requires stronger sanitation management systems and clearer destination quality standards to support sustainable tourism development. Third, digital destination marketing for Likupang requires more targeted investment, given its relatively lower visibility compared with other DPSP destinations. Finally, the DPSP monitoring and evaluation framework should adopt a sequential approach, tracking labor market indicators in the short term, sectoral performance in the medium term, and aggregate GRDP in the longer term. Such an approach would provide a more realistic basis for evaluating how tourism investment translates into sustainable regional economic development.

Limitations of the Study and Future Research

This study is subject to several limitations that also suggest directions for future research. First, the analysis is constrained by a limited donor pool, which limits the granularity of placebo-based inference at conventional significance thresholds. Future studies could strengthen robustness by expanding the donor pool or by combining SCM with complementary causal inference methods.

Second, the post-intervention period spans only five years (2020–2024), which may be insufficient to capture the long-term trajectory of tourism-led development. This limitation is compounded by the COVID-19 pandemic, which disrupted tourism activity and the policy transmission mechanism. Future research should revisit the DPSP evaluation as longer post-pandemic data become available, enabling clearer identification of whether the labor market effects observed in this study ultimately translate into broader regional output growth.

Third, this study focuses on only two of the five DPSP destinations and therefore cannot fully capture variation across the national program. Future comparative studies that cover all DPSP locations within a unified causal inference framework would provide deeper insights into how infrastructure readiness, institutional capacity, geographic accessibility, and destination characteristics shape heterogeneous policy outcomes across regions.

Fourth, the provincial-level aggregation used in this study does not capture the distributional and microeconomic dimensions of tourism development. Future research could incorporate firm- and household-level data to examine how tourism investment affects employment, business performance, income distribution, and welfare across local communities. These micro-level analyses would complement aggregate regional indicators by clarifying who benefits most from tourism-led development and whether economic gains are distributed inclusively.

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