



Evaluating the effect of e-Samsat implementation on tax revenue optimization: a difference-in-differences analysis of West Java and South Sumatra

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Abstract

Purpose – This study evaluates the effect of e-Samsat implementation on regional tax revenue in Indonesia using a Difference-in-Differences (DiD) approach to compare changes in tax revenue between West Java and South Sumatra.

Design/methodology/approach – A quantitative quasi-experimental research design was employed using secondary annual data on regional tax revenue obtained from the Central Bureau of Statistics for the 2015–2019 period. The analysis applied a Difference-in-Differences regression model incorporating Treatment, Post, and the Treatment × Post interaction term to estimate the policy effect of e-Samsat implementation.

Findings – The results indicate that the Treatment variable is positive and statistically significant, reflecting baseline differences in regional tax revenue between West Java and South Sumatra. However, neither the Post variable nor the Treatment × Post interaction term is statistically significant. Consequently, the analysis does not provide sufficient statistical evidence that e-Samsat implementation increased regional tax revenue in the treatment province relative to the comparison province during the study period.

Research limitations – The study is limited to two provinces and a five-year observation period. In addition, the analysis does not explicitly control for other economic and administrative factors that may influence regional tax revenue. Future research should incorporate longer observation periods, additional comparison provinces, and relevant control variables to provide a more comprehensive assessment of the long-term effects of digital tax reforms.

Implications – The findings suggest that digital tax payment systems alone may not generate immediate fiscal gains. Their effectiveness is likely to depend on complementary policies, including improvements in tax administration, digital infrastructure, and taxpayer engagement.

Originality – This study contributes to the literature on digital government by applying a Difference-in-Differences approach to evaluate the fiscal impact of e-Samsat implementation. Unlike much of the existing literature that focuses on service quality or taxpayer compliance, this study provides causal evidence on the short-term effect of digital tax reform on regional tax revenue.

Keywords: e-Samsat, Difference-in-Differences, e-Government Implementation, Digital Infrastructure, Tax Compliance, Public Adoption

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INTRODUCTION

Digital transformation has become a central strategy for improving the efficiency, transparency, and accessibility of public services worldwide. Governments increasingly employ digital technologies to streamline administrative processes, reduce operational costs, improve citizen engagement, and strengthen accountability in service (Idrus et al., 2024; Latupeirissa et al., 2024; Rapaya & Sasan, 2026). In the field of public finance, digitalisation has also become an important instrument for modernising tax administration by simplifying filing and payment procedures, reducing compliance costs, improving transparency, and strengthening revenue performance (Hesami et al., 2024; Lagodiienko et al., 2022; Nose, 2023). Evidence from both developed and developing economies suggests that digital tax reforms can improve tax compliance, strengthen revenue performance, and enhance fiscal sustainability (Barabás et al., 2025; Frățilă et al., 2023; Nose et al., 2025). However, these benefits depend on complementary investments in digital infrastructure, institutional capacity, legal and administrative reforms, and organisational readiness, while inadequate digital access, literacy, interoperability, cybersecurity, and technical capability may reduce policy effectiveness (Andersson et al., 2021; Kamara & Kamara, 2024; Mangai & Ayodele, 2025). Consequently, assessing whether digital government reforms generate sustained and context-specific policy outcomes remains an important concern in public policy research.

In Indonesia, the Electronic Samsat (e-Samsat) system has been introduced as a digital government initiative to simplify motor vehicle tax payments through online, banking, and mobile channels, reduce queuing and face-to-face transactions, and improve administrative efficiency (Arif et al., 2025; Priastuti et al., 2022; Sari et al., 2025). Motor vehicle tax constitutes one of the principal sources of provincial own-source revenue (*Pendapatan Asli Daerah*, PAD), making effective tax administration important for regional fiscal capacity and development financing (L. G. K. Dewi & Yenni Latrini, 2020; Makhmudi, 2025; Yulinda & Sudiana, 2024). Existing evidence suggests that e-Samsat improves accessibility, convenience, transparency, and payment efficiency by enabling taxpayers to complete transactions more quickly and remotely through integrated digital platforms (Arif et al., 2025; Enggaryanti, 2024; Fa'izah & Mursyidah, 2025; Norawati et al., 2025). Several studies conducted in Denpasar, Renon, Kediri, Bandung, and Central Java report a positive association between e-Samsat implementation or broader tax administration modernisation and motor vehicle taxpayer compliance (I. Dewi & P, 2019; Nisa & Saepuloh, 2025; Sunaningsih et al., 2024; Yulinda & Sudiana, 2024).

Nevertheless, implementation outcomes vary substantially across provinces and districts because adoption depends on local digital infrastructure, service design, banking integration, taxpayer literacy, public socialisation, and administrative capacity (Priastuti et al., 2022; Priyono et al., 2022). Evidence from Sukabumi and North Sulawesi indicates that digital convenience alone does not always increase compliance, whereas studies from Lampung, East Jakarta, and Panyabungan show that uneven internet access, limited public awareness, procedural complexity, and weak system support may constrain utilisation and revenue gains (Aryani & Hendaris, 2025; Bintary, 2020; Turambi et al., 2022). Overall, the literature indicates that although e-Samsat has the potential to improve tax administration, its effectiveness appears to vary across regions and implementation contexts.

Previous studies have primarily examined e-Samsat from the perspectives of service quality, taxpayer satisfaction, technology adoption, and compliance behaviour rather than direct fiscal outcomes (Congda, 2022; I. Dewi & P, 2019; Mudjiyanti et al., 2024; Pratomo, 2025). These studies generally find that e-Samsat improves convenience, accessibility, and administrative efficiency and is often associated with higher taxpayer compliance, although the magnitude of the effect differs across regions (Arif et al., 2025; Enggaryanti, 2024; Turnip et al., 2024). However, most existing research relies on descriptive, qualitative, survey-based, or cross-

sectional designs, making it difficult to distinguish the effect of e-Samsat from broader economic changes or regional policy trends (Andayani et al., 2022; Makhmudi, 2025; Priyono et al., 2022). Consequently, little causal evidence exists regarding whether e-Samsat implementation has increased regional tax revenue, despite indications that digital Samsat services may contribute to improved local revenue performance and faster service delivery (Fritiar, 2026; Saputra et al., 2025).

To address this gap, the present study evaluates the effect of e-Samsat implementation on regional tax revenue using a Difference-in-Differences (DiD) approach. The Difference-in-Differences method is a quasi-experimental approach that estimates policy effects by comparing changes in outcomes between treatment and comparison groups before and after policy implementation. This approach is particularly suitable when randomised experiments are not feasible. In this study, West Java serves as the treatment province because it adopted e-Samsat earlier, whereas South Sumatra serves as the comparison province because implementation occurred later (Wibowo et al., 2023; Wiradani et al., 2025). The difference in implementation timing provides a natural quasi-experimental setting for identifying the effect of e-Samsat while accounting for time-invariant regional differences and common temporal trends.

The theoretical foundation of this study is grounded primarily in the Diffusion of Innovation theory developed by Rogers (1995). This theory explains how innovations spread through a social system over time and suggests that organisations or jurisdictions that adopt an innovation earlier are more likely to realise its benefits sooner than later adopters. In the context of this study, the earlier implementation of e-Samsat in West Java provides a basis for examining whether earlier adoption was associated with higher regional tax revenue than in a province that adopted the system later.

The Difference-in-Differences framework complements this perspective by providing an empirical strategy for estimating policy effects. Whereas Diffusion of Innovation theory explains why earlier adoption may lead to different outcomes, the Difference-in-Differences approach enables those differences to be estimated empirically by comparing changes in tax revenue between treatment and comparison provinces before and after implementation (Angrist & Pischke, 2009; Callaway, 2022). Within this framework, the interaction between treatment status and the post-implementation period represents the estimated policy effect, while the treatment and time indicators capture baseline regional differences and common temporal changes.

Unlike previous studies that primarily examine taxpayer perceptions, service quality, or compliance behaviour, this study estimates the causal policy effect of e-Samsat implementation on regional tax revenue using a Difference-in-Differences framework. By exploiting variation in implementation timing across provinces, the study contributes methodologically to the evaluation of digital government policies in Indonesia.

Accordingly, this study aims to evaluate the effect of e-Samsat implementation on regional tax revenue in Indonesia by comparing tax revenue trends between West Java and South Sumatra during the 2015–2019 period. The findings are expected to contribute to the literature on digital government by providing empirical evidence on the effectiveness of e-Samsat as a public sector innovation and by informing policymakers about the extent to which digital tax reforms translate into measurable fiscal outcomes.

METHOD

This study employed a quantitative quasi-experimental research design using the Difference-in-Differences (DiD) approach to evaluate the effect of e-Samsat implementation on regional tax revenue. The DiD approach is widely used for policy evaluation because it estimates the causal effect of an intervention by comparing changes in outcomes between treatment and comparison groups before and after policy implementation. Unlike conventional before-and-

after comparisons, the DiD framework controls for time-invariant differences between groups and common time trends, thereby providing a more credible estimate of the policy effect when random assignment is not feasible.

The study used secondary annual data on regional motor vehicle tax revenue collected from the Central Bureau of Statistics (BPS) of West Java and South Sumatra. The observation period covered 2015–2019, corresponding to the period surrounding the phased implementation of e-Samsat in the two provinces. West Java implemented e-Samsat earlier and therefore served as the treatment province, whereas South Sumatra implemented the system later and served as the comparison province. The difference in implementation timing provides the variation required for the Difference-in-Differences design. Because the objective of the study was to compare provinces with different implementation schedules, purposive sampling was employed to select these two provinces.

The initial population comprised all provinces in Indonesia that have implemented e-Samsat. The sample was selected purposively, focusing on two provinces, West Java and South Sumatra, that exhibit distinct socio-economic characteristics and differing timelines of e-Samsat adoption. West Java was selected as the treatment group (early adopter), while South Sumatra served as the comparison group (late adopter). This selection enables a robust comparison of policy effects across regions with varying levels of infrastructure readiness and public acceptance.

The dependent variable in this study was annual regional tax revenue, measured in trillion Indonesian Rupiah (IDR). The independent variables comprised three indicators. The Treatment variable was a binary indicator coded as 1 for West Java (the treatment province) and 0 for South Sumatra (the comparison province). The Post variable was also binary, taking a value of 1 for observations in the post-implementation period and 0 for those in the pre-implementation period. Finally, the interaction term between Treatment and Post (Treatment $\times$ Post) represented the Difference-in-Differences (DiD) estimator, which captured the average treatment effect of e-Samsat implementation on regional tax revenue. The data analysis procedure comprised several sequential stages. The Difference-in-Differences model can be expressed through the following equation:

$$Y_{it} = \alpha + \beta_1 \text{Treatment}_i + \beta_2 \text{Time}_t + \beta_3 (\text{Treatment}_i \times \text{Time}_t) + \varepsilon_{it}$$

Where Y_{it} represents the dependent variable (tax revenue), Treatment_i indicates the adoption of e-Samsat, Time_t denotes the period before and after implementation, $\text{Treatment}_i \times \text{Time}_t$ is the interaction term that captures the causal effect of e-Samsat, and ε_{it} is the error term.

The regression model was estimated using ordinary least squares (OLS). Statistical inference was conducted at the 5% significance level. The primary parameter of interest was the coefficient of the interaction term (β_3). A statistically significant interaction coefficient indicates that changes in regional tax revenue differed between the treatment and comparison provinces following e-Samsat implementation. In contrast, a non-significant coefficient indicates insufficient evidence of a measurable policy effect within the study period.

RESULTS AND DISCUSSION

Figure 1 present the descriptive pattern of regional tax revenue in West Java and South Sumatra during the 2015–2019 observation period. Throughout the study period, West Java consistently recorded substantially higher tax revenue than South Sumatra, reflecting differences in economic size, population, and motor vehicle ownership. Although both provinces exhibited an upward trend in tax revenue over time, the descriptive evidence alone does not indicate whether these changes were attributable to e-Samsat implementation. A causal

assessment requires the Difference-in-Differences estimation presented in the following subsection.

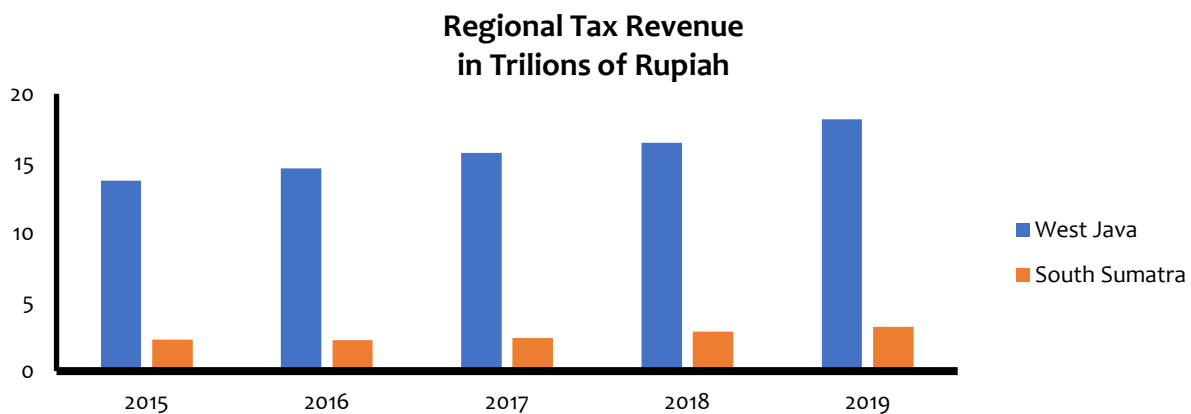


Figure 1. Comparison between Tax Revenue of West Java and South Sumatra

Table 1 presents the results of the Difference-in-Differences (DiD) regression estimating the effect of e-Samsat implementation on regional tax revenue. The overall regression model is statistically significant ($F = 121.700$, $p < 0.001$), indicating that the explanatory variables jointly account for a substantial proportion of the variation in regional tax revenue. The model explains approximately 98.4% of the observed variation ($R^2 = 0.984$). Nevertheless, the interpretation of the policy effect relies primarily on the estimated interaction coefficient (Treatment $\times$ Post), rather than on the overall model fit.

The coefficient of the Treatment variable is positive and statistically significant ($\beta = 11.486$, $p < 0.001$), indicating that West Java recorded higher average regional tax revenue than South Sumatra during the observation period. However, this coefficient represents baseline differences between the two provinces and should not be interpreted as the causal effect of e-Samsat implementation.

The coefficient of the Post variable is positive but not statistically significant ($\beta = 0.392$, $p = 0.760$), suggesting that there was no statistically significant common change in regional tax revenue following the implementation period after controlling for provincial differences.

Most importantly, the coefficient of the interaction term (Treatment $\times$ Post), representing the Difference-in-Differences estimator, is positive but not statistically significant ($\beta = 2.100$, $p = 0.271$). Although the estimated coefficient is positive, it is not statistically distinguishable from zero at the 5% significance level. Consequently, the analysis does not provide sufficient statistical evidence that e-Samsat implementation increased regional tax revenue in the treatment province relative to the comparison province during the study period.

Table 1: Regression Analysis Result

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
(Constant)	2.268	1.096			2.069	0.084
Treated	11.486	1.55	0.86		7.411	0
Post	0.392	1.225	0.023		0.32	0.76
DiD	2.1	1.733	0.154		1.212	0.271

The regression equation can be formulated as follows:

$$Y = 2.268 + 11.486(\text{Treated}) + 0.392(\text{Post}) + 2.1(\text{DiD}).$$

Overall, the regression results indicate that the Treatment variable is positive and statistically significant, reflecting baseline differences in regional tax revenue between West Java and South

Sumatra. In contrast, the Post and Treatment $\times$ Post (DiD) variables are not statistically significant. Because the interaction term represents the estimated policy effect in the Difference-in-Differences framework, the findings do not provide sufficient statistical evidence that e-Samsat implementation significantly increased regional tax revenue during the study period. The positive but statistically insignificant DiD coefficient suggests that any estimated increase in tax revenue cannot be distinguished from random variation within the available data. Future research may benefit from incorporating a longer observation period, additional comparison provinces, and relevant control variables to provide a more comprehensive assessment of the policy's effectiveness.

The primary objective of this study was to evaluate whether the implementation of e-Samsat affected regional tax revenue. The Difference-in-Differences (DiD) estimation indicates that the interaction term (Treatment $\times$ Post) is positive but not statistically significant. Accordingly, the available evidence does not support the conclusion that e-Samsat implementation generated a measurable increase in regional tax revenue in West Java relative to South Sumatra during the 2015–2019 observation period. This interpretation is consistent with the logic of the DiD framework, in which the interaction term represents the estimated policy effect by comparing changes in outcomes over time between the treatment and comparison groups under the parallel trends assumption (Feng et al., 2024; Saeed et al., 2019; Wing et al., 2018).

The statistically significant coefficient of the Treatment variable should not be interpreted as evidence of the effectiveness of e-Samsat. Instead, it reflects pre-existing structural differences between West Java and South Sumatra. Provincial tax revenue is strongly influenced by factors such as population size, motor vehicle ownership, gross regional domestic product, and the overall tax base, all of which differ substantially between the two provinces (Bagana et al., 2022; Pongilatan et al., 2025; Praja & Wijaya, 2024). This interpretation is consistent with the Indonesian fiscal context, where motor vehicle tax constitutes a major source of provincial own-source revenue and is generally higher in provinces with larger populations and greater numbers of registered vehicles, such as West Java (Fanida et al., 2025; Subroto & Sudibyo, 2025).

Several factors may explain why the estimated policy effect was not statistically significant. First, the observation period was relatively short, particularly because South Sumatra implemented e-Samsat only in 2019, leaving limited post-treatment observations. The DiD approach generally requires sufficient pre- and post-intervention observations to identify policy effects reliably, especially when treatment adoption is staggered across units (Saeed et al., 2019; Wang et al., 2024; Feng et al., 2024). Second, regional tax revenue is determined by a wide range of economic and administrative factors beyond the implementation of e-Samsat. Previous studies have shown that variables such as Motor Vehicle Tax (PKB), Motor Vehicle Title Transfer Fee (BBNKB), gross regional domestic product, transport-sector activity, fiscal incentives, and other regional policies significantly influence provincial own-source revenue and motor vehicle tax collection (Abiprayu & Rasyid, 2026; Rismawati, 2022). Because these factors were not explicitly controlled for in the present model, part of the observed variation in tax revenue may reflect influences unrelated to the implementation of e-Samsat.

The findings differ from much of the existing literature on digital tax administration, which has generally reported improvements in taxpayer compliance, service quality, administrative efficiency, and transparency following the adoption of digital tax systems (Rokhman et al., 2022; Ruhara, 2025; Umbet et al., 2025). However, improvements in service delivery and taxpayer compliance do not necessarily translate into immediate increases in government revenue. Evidence from broader tax digitalisation studies suggests that fiscal benefits are often modest and depend on complementary factors such as institutional capacity, digital infrastructure, administrative capability, and supporting policy reforms (Kennedy-Shaffer, 2024; Kochanova et al., 2018; Usman et al., 2025). Consequently, the statistically insignificant DiD estimate should not be

interpreted as evidence that e-Samsat is ineffective. Rather, it indicates that the present study did not detect a statistically significant short-term fiscal effect within the observed period. Future research employing longer observation periods, additional comparison provinces, and more comprehensive control variables would provide a more robust assessment of the long-term effectiveness of e-Samsat implementation.

CONCLUSION

Conclusion

Based on the Difference-in-Differences (DiD) analysis, this study finds that the interaction term (Treatment $\times$ Post), which represents the estimated policy effect of e-Samsat implementation, is positive but not statistically significant. Accordingly, the available evidence does not provide sufficient statistical support for the conclusion that e-Samsat implementation significantly increased regional tax revenue in West Java relative to South Sumatra during the 2015–2019 observation period. The statistically significant Treatment coefficient reflects baseline differences in regional tax revenue between the two provinces rather than the causal impact of the policy intervention.

These findings suggest that while digital tax administration may improve service delivery and administrative efficiency, its short-term fiscal impact may be limited or influenced by other economic and institutional factors that were not explicitly captured in the model. Future research should employ longer observation periods, include additional comparison provinces, and incorporate relevant control variables to provide a more comprehensive evaluation of the long-term effectiveness of e-Samsat implementation.

Limitations

Several limitations of this study should be acknowledged. First, the analysis was limited to two provinces and a five-year observation period (2015–2019), resulting in a relatively small sample that may reduce statistical power and limit the generalisability of the findings to other provinces or longer time horizons. Second, although the Difference-in-Differences (DiD) approach controls for time-invariant differences between provinces and common temporal trends, the model did not explicitly account for other determinants of regional tax revenue, such as regional economic growth, motor vehicle ownership, fiscal incentives, and changes in tax administration or government regulations. Consequently, part of the observed variation in tax revenue may reflect factors beyond the implementation of e-Samsat. Finally, the study relied on secondary data obtained from official government sources, which constrained the analysis to the variables available in those datasets and prevented the inclusion of additional explanatory variables that may influence regional tax revenue.

Research Implications

The findings of this study have both practical and theoretical implications. From a practical perspective, the results suggest that the implementation of e-Samsat alone may not be sufficient to generate measurable improvements in regional tax revenue within a relatively short period. Although the estimated policy effect was positive, it was not statistically significant, indicating that digital tax payment systems should be accompanied by complementary policies that strengthen tax administration and encourage taxpayer compliance. These may include improvements in digital infrastructure, particularly in regions with limited technological capacity, as well as continuous training for government personnel responsible for operating and maintaining the e-Samsat system.

The findings also highlight the importance of increasing public awareness and promoting the effective use of digital tax services. Improving accessibility, providing clear information on system

benefits and procedures, and enhancing the reliability of digital platforms may contribute to greater public acceptance and more effective implementation of e-Samsat. In addition, regular monitoring and evaluation should be undertaken to assess implementation across provinces, identify implementation challenges, and support evidence-based improvements to digital tax administration policies.

From a theoretical perspective, this study contributes to the growing literature on digital government and public sector innovation by demonstrating the importance of distinguishing between differences in baseline regional characteristics and the causal effects of policy interventions. By applying a Difference-in-Differences approach, the study provides a more rigorous evaluation of e-Samsat implementation than descriptive or cross-sectional studies. The findings further suggest that improvements in digital public services do not necessarily translate into immediate fiscal gains, highlighting the need for future research using longer observation periods, additional comparison provinces, and more comprehensive control variables to better understand the long-term effects of digital tax reforms.

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