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Beyond infrastructure: evaluating the financial inclusion effects of China's BRI participation across partner economies

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ABSTRACT

This study analyzes the impact of participation in the Belt and Road Initiative (BRI) on financial inclusion across 135 countries from 2007 to 2021. Using an Ordinary Least Squares Interrupted Time Series Analysis (OLS-ITSA), the findings show that BRI participation significantly improves access to financial infrastructure, particularly through increased Automated Teller Machines (ATM) penetration in low- and middle-income countries. However, a decline in life insurance usage and slight increases in borrowing, deposits, and Small Medium Enterprises (SME) lending suggest persistent gaps in broader financial participation and a continued household preference for liquidity. Foreign direct investment (FDI) under the BRI primarily supports traditional financial infrastructure, with limited spillovers into digital finance and SME financing. The outcomes of financial inclusion are also affected by macroeconomic variables such as Gross Domestic Product (GDP) per capita, inflation, and internet penetration. The findings demonstrate how infrastructure investments can alter financial accessibility and align with institutional theory and innovation diffusion models. The study concludes that realizing the full financial inclusion potential of the BRI requires complementary reforms, particularly in digital and institutional finance.

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1. Introduction

Financial inclusion is fundamental to sustained economic development, gaining recognition from politicians, researchers, and international institutions. This denotes the process through which individuals and enterprises, especially in marginalised communities, gain access to beneficial and inexpensive financial services, encompassing banking, credit, insurance, and digital payments (Swamy 2014; Lenka 2021).

Financial development strengthens institutions, markets, and infrastructures enabling more efficient resource allocation. Although theoretically separate, financial development and financial inclusion are closely interconnected: the former establishes the institutional and technological groundwork for the latter, while enhanced access fortifies the financial ecosystem (Sarma 2008; Lenka 2021).

The BRI, initiated by China in 2013, enhances the relationship between financial inclusion and financial development through investments in infrastructure, commerce, and financial connectivity across Asia, Europe, and Africa (Mcbride, Berman, and Chatzky 2020). While the geopolitical and economic implications of the BRI have been extensively examined, its effects on financial inclusion remain relatively underexplored (Reinman 2015; Ozili 2020; Azimi 2022).

This paper addresses a critical gap in the literature by investigating how participation in the BRI affects financial inclusion across partner countries. Most existing studies treat financial inclusion as a domestically driven process, focusing on local institutions, education, and income. By contrast, this study evaluates how external infrastructure initiatives can influence access to and usage of financial services. Specifically, it explores the extent to which BRI participation alters financial inclusion across several dimensions: ATM and branch accessibility, borrowing, deposits, life insurance, SME credit, and mobile banking.

Theoretically, we argue that BRI participation may affect financial inclusion through three core channels. First, infrastructure-led access expands as physical banking networks, such as ATMs and branches, increase.

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Second, institutional spillovers emerge when policy coordination and bilateral cooperation strengthen trust in financial institutions regulations. Third, digital diffusion occurs as improved connectivity supports the adoption of mobile and fintech services. These mechanisms draw upon institutional theory (North 1990), innovation diffusion theory (Rogers 2003), and structural transformation theory (Lin 2011), yet have not been systematically tested in the context of the BRI.

An OLS-ITSA with staggered adoption evaluates BRI's effects across 135 host countries. The model accounts for time-invariant elements, global shocks, and macroeconomic variables.

Results indicate substantial post-BRI enhancements in ATM accessibility, particularly in low- and middle-income nations, validating an infrastructure-driven access paradigm. Nonetheless, the impacts on borrowing, deposits, and insurance are minimal or insignificant, but declines in life insurance may indicate a household transition towards liquidity.

These findings highlight the importance of macroeconomic conditions and the limited transformative power of infrastructure alone. In high-income countries, borrowing increases gradually. In contrast, low-income countries experience steady growth in ATM penetration but little progress in broader financial inclusion. These patterns point to the need for complementary institutional, legal, and digital reforms.

The paper proceeds as follows: Section 2 reviews the literature on financial inclusion and the BRI; Section 3 outlines the data and methodology; Section 4 presents findings; and Section 5 concludes with implications and future research directions.

2. Literature review

2.1. Financial inclusion and economic development

Financial inclusion is a key driver of economic progress, particularly in developing economies where access to financial services is inconsistent. It enhances economic resilience, boosts productivity, and reduces vulnerability to financial shocks by enabling individuals and businesses to access formal financial institutions. Policymakers recognise it as essential for sustainable growth, poverty alleviation, income equity, and financial stability, prompting extensive research on its impact (Sarma and Pais 2011; Sethi and Acharya 2018; Inoue 2019).

Sarma and Pais (2011) highlight the importance of national-level factors in shaping financial inclusion and its importance for development. Empirical research shows that increased financial access fosters economic growth and reduces poverty, particularly in emerging economies. It also helps narrow income disparities and enhances economic stability (Inoue 2019).

Financial inclusion is also positively associated with human development. Indicators such as Human Development Index scores share a bidirectional relationship with financial inclusion, as improved access to financial services supports broader socio-economic progress (Sethi and Acharya 2018). In Africa, Ajide (2020) shows that financial inclusion significantly promotes entrepreneurship and self-employment, highlighting the importance of digital finance and mobile banking in expanding financial services across the continent.

While domestic factors are critical, international efforts also play a crucial role in expanding financial access. External initiatives, including those from international organisations and partnerships, can impact financial sector stability, economic conditions, and regulatory frameworks, all of which influence financial inclusion (Ozili 2020). However, their impact varies across regions and institutions (Reinman 2015; Azimi 2022).

The existing research underscores the importance of external initiatives in financial inclusion but calls for a more nuanced understanding of the factors that shape their effectiveness (Barajas et al. 2020). Our study examines the BRI's impact on financial inclusion, contributing to the growing body of research on the role of global initiatives in enhancing access to financial services. The following section explores the theoretical framework and relationship between the BRI and financial inclusion.

2.2. Theoretical framework and hypothesis development

Despite the BRI's profound economic and geopolitical significance, its implications on financial inclusion remain underexplored. Existing literature has primarily focused on the BRI's impact on trade, infrastructure development, and debt sustainability (Rolland 2017; Mcbride, Berman, and Chatzky 2020), with limited

attention to how it may reshape the financial systems of participating countries. Meanwhile, research on financial inclusion has largely concentrated on domestic factors such as income, education, and regulatory quality (Sarma and Pais 2011; Kim, Yu, and Hassan 2018), often overlooking the role of international infrastructure initiatives like the BRI.

To address this gap, we propose a multi-theoretical framework that explores how BRI participation may influence financial inclusion through three key mechanisms: infrastructural access, institutional transformation, and the diffusion of digital finance.

Empirical evidence from several BRI partner economies illustrates how these mechanisms operate in practice. In Pakistan, the China–Pakistan Economic Corridor (CPEC) included substantial investments in fibre-optic networks and digital infrastructure, which strengthened telecommunications capacity and enabled the expansion of mobile and branchless banking services into previously underserved regions (Khan, Baig, and Muhammad 2020). In Kenya, improvements linked to the Mombasa–Nairobi Standard Gauge Railway enhanced regional connectivity and facilitated the growth of rural banking outlets along new commercial routes (Uwe and Yuan 2017). A comparable pattern emerges in Southeast Asia, where BRI-related transport and logistics investments have strengthened interregional connectivity and economic integration across secondary cities and peripheral regions. Large-scale Chinese investments in transport corridors, ports, and logistics networks have reduced trade costs, expanded market access, and stimulated commercial activity beyond major urban centres. These improvements have enhanced the feasibility of extending basic financial services, such as banking outlets, payment points, and transactional infrastructure, into previously underserved local markets by lowering operational and connectivity constraints faced by financial institutions (Yu 2024).

Ethiopia provides an additional example: Chinese-led investments in telecommunications and digital systems have strengthened the technological foundations necessary for mobile money expansion, contributing to the uptake of digital financial services across urban and peri-urban communities (Alemu 2019).

These experiences illustrate distinct channels through which BRI participation can shape financial inclusion outcomes.

The first channel operates through physical infrastructure. Transport and energy investments reduce transaction costs, increase market access, and make it more feasible for financial institutions to expand into new geographic areas (Lotter and Okoro 2023). Improved connectivity enables the installation of ATMs, the establishment of bank branches, and the deployment of agent-banking networks in locations that were previously costly or unprofitable to serve.

The second channel concerns institutional and regulatory cooperation. BRI agreements often involve technical exchanges, coordination between financial authorities, and the introduction of new financial technologies by Chinese institutions operating abroad (Yu 2024). These interactions can support improvements in financial regulation, risk management, and supervisory capacity. Stronger institutions, in turn, improve credit allocation, mobilise savings, and build the trust needed for broader financial participation.

The third channel derives from digital infrastructure improvements. Many BRI projects include telecommunications upgrades, fibre network extensions, and enhancements to internet reliability. These developments lower barriers to adopting digital financial services, encourage the diffusion of mobile banking platforms, and facilitate the use of online payments and deposits (Alemu 2019; Niu et al. 2022). In contexts where digital readiness is initially low, such improvements can play a fundamental role in accelerating financial inclusion.

By combining theoretical reasoning with concrete country examples, this framework demonstrates more clearly how BRI participation can influence multiple dimensions of financial inclusion through infrastructure development, institutional change, and digital transformation.

First, large-scale investments in physical infrastructure are expected to improve access to financial services by expanding the presence of ATMs and bank branches. This is consistent with structural transformation theory (Lin 2011), which suggests that development is catalysed by infrastructure that enhances connectivity and access to services.

Recent global evidence indicates that ATM usage has been declining in many high-income economies due to the rapid expansion of digital payment ecosystems. As mobile banking, e-wallets, and contactless technologies become more prevalent, ATMs increasingly serve a reduced role in accessing financial services (Arner, Buckley, and Zetzsche 2018). This global trend is important to acknowledge when interpreting ATM-

based measures of financial inclusion, as it highlights the uneven relevance of ATM infrastructure across different levels of digital maturity. However, in low- and middle-income BRI partner countries, ATMs remain a central and reliable indicator of basic financial access. In these contexts, ATMs continue to provide essential transactional functions, cash withdrawals, balance cheques, and basic banking interactions, especially where digital financial infrastructure is incomplete or unevenly distributed (Beck, Demirgüç-Kunt, and Honohan 2007; Demirgüç-Kunt et al. 2018). Therefore, despite global digitalisation trends, ATM penetration still reflects meaningful improvements in financial access within our sample.

As a result, we hypothesise the following:

H1: Participation in the BRI is associated with an expansion of basic financial infrastructure, particularly ATM availability and bank branch presence, as improved transport and connectivity reduce the cost of extending financial services into previously underserved areas.

Second, building on institutional theory, which emphasises that predictable rules and enforcement mechanisms reduce uncertainty and transaction costs (North 1990), BRI engagement has the potential to drive regulatory reforms, enhance legal harmonisation, and foster trust in financial institutions. Concurrently, innovation diffusion theory (Rogers 2003) posits that external partnerships can accelerate the adoption of digital finance tools, particularly in regions with emerging digital infrastructure. Therefore, we hypothesise:

H2: The impact of BRI participation on access to loans, savings, and insurance is moderated by the quality of institutions and the availability of digital infrastructure.

Third, drawing from development economics, we argue that low- and middle-income countries are more likely to benefit from infrastructure-driven financial access due to their higher unmet needs. In these contexts, the marginal impact of improved infrastructure is more pronounced compared to high-income economies with already saturated financial systems. Thus, we hypothesise:

H3: BRI participation has a stronger positive effect on digital financial inclusion in countries with higher levels of digital readiness and internet penetration, as telecommunications investments and enhanced connectivity facilitate the adoption and usage of mobile financial services.

Finally, institutional readiness, along with macroeconomic stability, is crucial for translating infrastructure gains into inclusive outcomes. This aligns with the absorptive capacity literature in development economics and global political economy (Dollar 2019). Infrastructure alone may be insufficient without robust regulatory, financial, and digital ecosystems. Thus, we hypothesise:

H4: The impact of BRI participation on financial inclusion varies across income groups. Low- and middle-income countries are expected to experience larger gains in basic financial access, while high-income countries exhibit more limited effects due to existing financial infrastructure saturation.

By translating these four hypotheses into empirical models, we aim to isolate the direct pathways through which China's BRI influences inclusive finance in host countries which is represented in Figure 1. In line with China's growing global economic role, our approach emphasises the BRI as a vehicle for financial connectivity and digital transformation.

3. Methodology

3.1. Database

This study explores the impact of BRI on the financial inclusion of BRI countries. Our data cover the period 2007–2021, including the pre-BRI (2007–2013) and post-BRI periods (2014–2021). The data set was compiled from the World Bank (WB) database, the International Monetary Fund (IMF), Financial Access Survey (FAS), and the Organisation for Economic Co-operation and Development (OECD) data bank. Data that is not available in the mentioned resources is extracted from the following secondary data banks: https://www.statista.com/, https://fred.stlouisfed.org/, https://www.theglobaleconomy.com/, and https://www.worldometers.info/, https://www.ceicdata.com/en.

The BRI consists of 151 countries. However, all countries that joined the BRI after 2021 and those with missing information are not included in the sample, which leaves us with 135 countries. The sample period ends in 2021 due to a lack of data beyond this year. For the purpose of subgroup analysis and consistent with international standards, countries are classified according to the WB's 2021 income group categories:

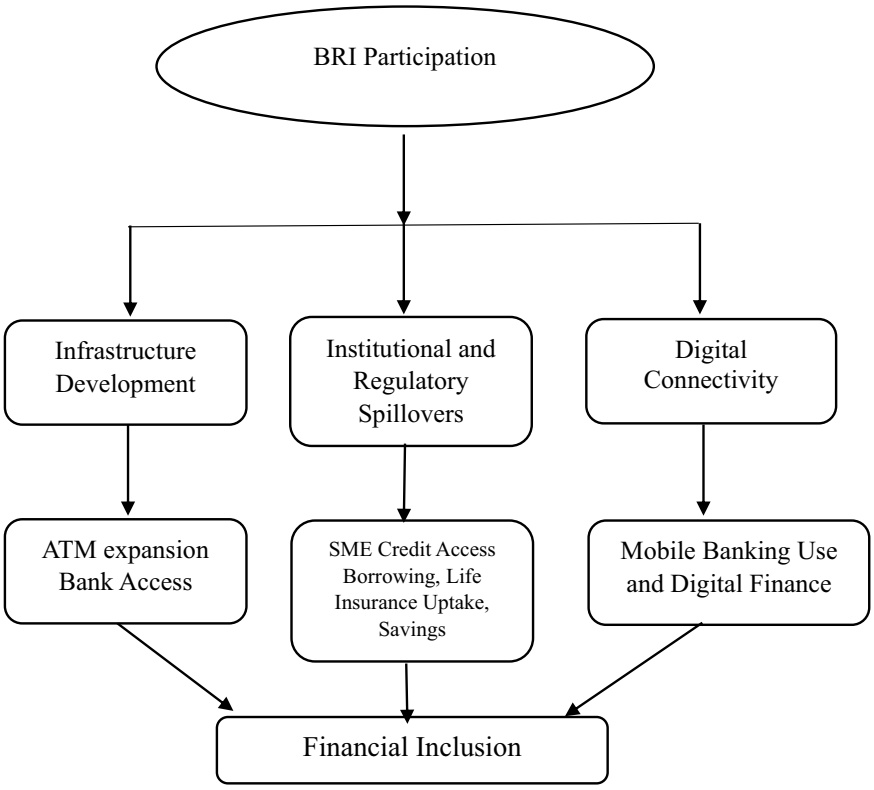


Figure 1. Causal pathway of BRI participation. Source: own elaboration.

low-income, lower-middle-income, upper-middle-income, and high-income economies. This classification allows us to examine heterogeneous BRI effects across different levels of economic development and to contextualise financial inclusion outcomes within comparable income segments.

3.2. Data elaboration

Financial inclusion captures the degree to which individuals and firms access financial services. It is commonly assessed through indicators like account ownership, savings, credit use, and insurance coverage (Demirgüç-Kunt and Klapper 2012; Werff, Hogarth, and Peach 2013). In this study, ATMs per 100,000 adults serve as a proxy for account penetration, given the limited availability of direct account data. Bank branches per 100,000 adults reflect the reach of financial institutions, while deposit accounts per 1,000 adults capture savings behaviour. Borrowers from commercial banks per 1,000 adults indicate credit access, and life insurance premiums to GDP represent the uptake of insurance (Kim, Yu, and Hassan 2018). Mobile money accounts per 1,000 adults are used as a measure of mobile banking (Fan and Shirono 2020), and outstanding SMEs loans capture access to institutional credit (Beck, Demirgüç-Kunt, and Honohan 2007). Due to data limitations mobile money and SMEs loans are included only for a subsample of 55 and 67 countries respectively.

While the indicators used in this study are standard in the financial inclusion literature, they rely primarily on supply-side annual data due to the constraints of the ITSA design. Demand-side indicators, such as account ownership, saving behaviour, and usage intensity from the Global Findex database, are only available every three years, making them incompatible with annual event-study estimation. As a result, our proxies (ATMs, bank branches, deposit accounts, borrowers, and insurance premiums) capture access and infrastructure more reliably than actual financial behaviour or usage quality. This limitation is partially mitigated by incorporating deposit accounts and life-insurance uptake, which more closely reflect demand-side engagement, yet the dataset remains unable to measure transaction activity, account dormancy, or financial capability.

To strengthen the robustness of our measurement approach, we compare ATM penetration with our other financial inclusion indicators, particularly deposit accounts per 1,000 adults (LNDEPO). Deposit accounts are widely viewed as a proxy for account ownership and saving activity, providing a more direct measure of financial engagement than ATM availability alone (Werff, Hogarth, and Peach 2013; World Bank 2013). Although ATMs primarily capture physical access to financial infrastructure, the patterns observed in LNDEPO closely mirror those of ATM penetration across most low- and middle-income BRI countries. This consistency supports the validity of using ATM availability as a proxy for baseline financial access while acknowledging that ATM indicators do not capture the quality or intensity of financial usage. The comparison also highlights data constraints: indicators such as Global Findex account ownership are available only every three years, making them unsuitable for the annual structure required by the ITSA design.

Internet usage (INTUSAGE) is included to control for digital financial literacy, which plays a crucial role in financial access, particularly in developing regions (Evans 2018; Chu et al. 2023b).

To account for broader economic and demographic influences, the model includes macroeconomic controls drawn from prior research: GDP per capita (GDPPC), inflation (INF), population growth (POPG), unemployment (UNEMP), school enrolment (SEP), trade openness (TRADE), financial crisis (CRISIS), and foreign direct investment inflows (LNFDI). These variables allow us to isolate the BRI's effect on financial inclusion while acknowledging key contextual drivers. Table 1 provides a detailed description of the variables and Appendix A offers a clear comparison of the evaluation criteria used in this study with those of: Demirgüç-Kunt and Klapper, 2012; Werff, Hogarth, and Peach 2013; World Bank 2013; Kim, Yu, and Hassan 2018.

3.3. Empirical strategy

3.3.1. OLS-ITSA model

This study uses an OLS-ITSA with a staggered adoption approach to assess the impact of the BRI on financial inclusion across partner countries. This methodology is ideal for our research as the BRI was implemented at different times across countries, allowing us to analyse financial inclusion trends before and after each country joined the BRI (Chen 2023). The staggered adoption approach accounts for varying adoption periods and is effective for evaluating policy changes across countries (Linden 2015; Athey and Imbens 2018).

To mitigate selection bias, the model includes country fixed effects to control for unobservable characteristics, year fixed effects for global macroeconomic shocks, and macroeconomic controls (GDP per capita, inflation, unemployment, trade openness, school enrolment, FDI) to isolate the effect of the BRI. The signing of the BRI agreement is treated as a quasi-natural experiment, with 135 BRI-participating countries as the treatment group. The model is constructed as follows:

$$Y_{it} = \alpha + \sum_{k=-12}^{-2} \beta_k lead_{ik} + \sum_{k=1}^{8} \delta_k lag_{ik} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where Y_{it} is a proxy for the financial inclusion indicators for country i at time t. $lead_{ik}$ are pre-treatment event dummies for k years (2–12 years) before BRI participation, β_k are the coefficients for the pre-treatment dummies. lag_{ik} are post-treatment dummies for k years (1–8 years) after signing the agreement. δ_k are the coefficients for the post-treatment dummies. Although the event-study framework uses leads and lags around BRI participation, the underlying treatment variable remains a binary indicator capturing only the timing of accession to the BRI. This coding does not reflect variation in project size, sectoral composition, financing structure, or implementation intensity, thereby masking heterogeneity across participating countries.

X_{it} represents the proxy for the control variables (internet usage, macroeconomic factors and banking crisis), μ_i are country-fixed effects, λ_t are year-fixed effects, ϵ_{it} is the error term. The following data are used in natural logarithm form: *LNATM, LNBRCH, LNDEPO, LNBORR, LNGDPPC, LNMOBILE, LNSMES*. Before testing our models, the VIF and the Pearson correlation are applied to test for multicollinearity of the data and do not show the existence of any issue on this level as summarised in Table 2 and in Appendix B.

Table 1. Variables description.

Symbol	Variable	Source
Dependent variables		
LNATM	ATM machines per 100,000 of individuals	WB Data Bank FAS OECD data bank Statista.com Stlouisfed.org The global economy Worldmeters.com Ceicdata.com
LNBORR	Borrowers from commercial banks per 1,000 adults	WB Data Bank FAS OECD data bank Statista.com Stlouisfed.org The global economy Worldmeters.com Ceicdata.com
LNBRNCH	Commercial banks branches per 1,000 adults	WB Data Bank FAS OECD data bank Statista.com Stlouisfed.org The global economy Worldmeters.com Ceicdata.com
LNDEPO	Deposits accounts with commercial banks per 1,000 adults	WB Data Bank FAS OECD data bank Statista.com Stlouisfed.org The global economy Worldmeters.com Ceicdata.com
LINSUR	Life insurance premium as percentage of GDP	WB Data Bank FAS OECD data bank Statista.com Stlouisfed.org The global economy Worldmeters.com Ceicdata.com
LNMOBILE	Number of registered mobile money accounts per 1,000 adults	FAS
LNSMES	Outstanding SMEs Loans as percentage of GDP	FAS WB Data Bank
Explanatory variables		
GDPPC	GDP per capita (current US$)	WB Data Bank FAS
UNEM	Unemployment rate	WB Data Bank FAS
TRADE	Trade as a percentage of GDP	WB Data Bank FAS
SEP	Primary school enrolment net percentage	WB Data Bank FAS
INF	Inflation measured by consumer prices annual percentage	WB Data Bank FAS
POPG	Population growth annual percentage	WB Data Bank FAS
INTUSAGE	Share of individuals using the internet	WB Data Bank FAS
BCRISIS	Dummy variable that takes the value of 1 if there is a financial or banking crisis and 0 otherwise	WB Data Bank FAS OECD data bank Statista.com Stlouisfed.org The global economy Worldmeters.com Ceicdata.com
FDI	Foreign Direct Investments (current US$, log-transformed)	WB Data Bank

Source: own elaboration.

Table 2. VIF test results.

Variable	VIF	1/VIF
LNBORR	3.93	0.26
LNDEPO	2.69	0.37
LNBRNCH	2.10	0.48
LINSUR	1.37	0.73
LNGDPPC	3.73	0.27
LNSMES	3.36	0.30
LNMOBILE	2.10	0.48
INTUSAGE	2.86	0.35
POPG	1.28	0.78
TRADE	1.23	0.82
SEP	1.14	0.88
UNEMP	1.10	0.90
INF	1.06	0.94
BCRISIS	1.05	0.95
LNFDI	2.72	0.37
Mean VIF	**1.96**	–

Source: own elaboration.

We used the Placebo-test for robustness check of our results (Brodeur et al. 2016 and Brodeur, Cook, and Heyes 2020, Dreber, Johannesson, and Yang 2023). The results are available in Appendix C. All Estimations were conducted using Stata 18 including the ITSA, VIF tests, and robustness cheques.

3.3.2. Addressing endogeneity and identification challenges

A central methodological concern in evaluating the effect of BRI participation on financial inclusion is the potential endogeneity of countries' decisions to join the initiative. Participation is neither random nor exogenous. Instead, it is shaped by a combination of geopolitical, economic, and institutional factors that may also influence financial inclusion trends.

First, geopolitical considerations play a substantial role in determining which countries join the BRI. Extensive evidence shows that alignment with China's strategic interests, diplomatic ties, and foreign policy orientation strongly influence participation (Ferdinand 2016; Dreher et al. 2018). These geopolitical factors may themselves correlate with financial system characteristics, creating challenges for isolating a purely infrastructure-driven effect.

Second, economic vulnerability and structural financing needs may drive selection into the BRI. Countries with infrastructure deficits, limited fiscal space, or slower domestic financial development often seek external investment, making them more likely candidates for BRI engagement (Blanchard and Flint 2017; Hillman 2018). This raises the possibility that pre-existing weaknesses, not BRI participation, partly shape observed financial inclusion trajectories.

Third, reverse causality cannot be fully ruled out. China often prefers to finance projects in countries with improving governance, financial stability, or institutional reforms (Dollar 2019), suggesting that enhancements in financial systems may precede and attract BRI-related investment. This dynamic complicates causal interpretation since financial development may influence, rather than solely result from, participation.

To address these concerns, the analysis employs a staggered adoption ITSA, which accounts for time-invariant country-specific characteristics and global shocks. Nonetheless, ITSA does not fully eliminate self-selection bias, and estimates should be interpreted as strong associations rather than fully exogenous causal effects (Bernal, Cummins, and Gasparrini 2017; Turner et al. 2025).

Sensitivity cheques are incorporated to strengthen the credibility of the findings. First, visual inspection of pre-treatment trends helps assess whether financial inclusion indicators follow approximately similar paths before BRI entry. Second, event-study plots are used to examine whether outcome variables change only after participation, which helps identify anticipatory effects or violations of parallel trend assumptions summarised in Appendix C (Schmidheiny and Siegloch 2020; Clarke and Tapia-Schythe 2021).

Although instrumental variable and matching approaches could theoretically address selection, valid global instruments for BRI participation do not exist, and commonly proposed instruments, such as political alignment, historical ties, or geographic distance, pose their own endogeneity and exclusion concerns (Cai

2017). Moreover, the heterogeneity of BRI projects across sectors and financing mechanisms further complicates instrument validity (Chin and He 2016; Jones and Zeng 2019).

By explicitly acknowledging these identification challenges, incorporating diagnostic tests, and clarifying the limits of the empirical strategy, the study situates its findings within appropriate methodological boundaries and enhances transparency regarding the interpretation of estimated BRI effects.

4. Results

4.1. Impact of BRI on financial inclusion

This section presents the OLS-ITSA results assessing the effect of BRI participation on financial inclusion. Table 3 summarises estimates for seven financial inclusion indicators. The results suggest limited pre-trend differences and support the identification strategy.

The *LNATM* results (Model 1) indicate a significant and sustained increase in ATM availability following BRI participation. The effect intensifies over time, with lag5 through lag8 showing increasing coefficients, suggesting long-term impact. These results are consistent with institutional theory, which argues that infrastructure initiatives reshape access mechanisms and strengthen trust in formal systems (North 1990). They also align with the literature identifying ATMs as key enablers of basic financial inclusion (Levin 2004).

In contrast, *LNBRNCH* (Model 3) and *LNBORR* (Model 2) show no significant post-BRI effects. While ATMs increase, bank branches remain largely unchanged as digital financial tools substitutes physical bank expansion (Demirgüç-Kunt et al. 2018). This outcome can be explained by innovation diffusion theory (Rogers 2003). The theory suggests that the adoption of new technologies, such as digital banking and mobile finance, reduces reliance on traditional banking infrastructure.

LIFEINS (Model 5) shows a marginally significant decline in *lag7* (−0.436), suggesting infrastructure investment may shift household behaviour away from long-term insurance toward short-term liquidity priorities consistent with development economics (Allen et al. 2016).

The study includes SME loans and mobile banking, two indirect markers of financial inclusion. Although *LNMSMES* (Model 6) has generally positive post-BRI lag coefficients, they are statistically insignificant, likely due to limited data. Similarly, *LNMOBILE* (Model 7) results are mixed, with no clear post-treatment trend. These findings indicate BRI participation has limited impact on digital finance and SME credit, both essential inclusion routes as per innovation diffusion theory and development economics (Rogers 2003).

FDI is positively associated with bank branches and borrowers, confirming that foreign investment can support financial infrastructure. However, its weak relationship with savings, insurance, and mobile finance suggests that capital inflows are not inherently inclusive. Alfaro et al. (2004) show that FDI enhances infrastructure when local financial markets are well developed. In contrast, Demirgüç-Kunt et al. (2018) argue that inclusive finance requires more than capital alone, highlighting persistent gaps in mobile, insurance, and savings access.

Looking at control variables, GDP per capita is positively associated with most indices, highlighting its importance in enabling inclusiveness (Beck and Levine 2018). Inflation reduces life insurance usage, as households prioritise immediate consumption during price surges. Population growth increases borrowing, and school enrolment boosts bank account growth, as financial literacy rises (Bollinger, Ding, and Lugauer 2022; Chen et al. 2024). Internet usage, counterintuitively, negatively impact physical access, suggesting a trend toward digital-only services (Arner, Buckley, and Zetzsche 2018).

Trade openness negatively affects deposits, borrowing, and branches, implying that global market exposure may cause volatility and credit contraction (Rahman et al. 2021). Banking crises boost ATM access while reducing long-term insurance planning. These findings align with evidence that crises prompt governments to maintain cash-based services while disrupting financial planning (Laeven and Valencia 2020).

Our data show that BRI membership increases ATM infrastructure, but there are limited improvements in borrowing, deposits, and SME lending, indicating that physical access alone does not guarantee financial inclusion. These results highlight the gap between infrastructure-driven inclusion and deeper financial integration. Effective inclusion requires institutional trust, financial literacy, and supportive regulatory frameworks. The lack of progress in mobile banking and SME credit further suggests that BRI benefits may not reach informal sectors, limiting widespread empowerment.

Table 3. Impact of BRI on financial inclusion of host countries.

VARIABLES	(1) LNATM	(2) LNBORR	(3) LNBRNCH	(4) LNDEPO	(5) LNIFEINS	(6) LNSMES	(7) LNMOBILE
lead12	−0.0581	0.0041	−0.0319	−0.0630	−0.0643	0.0114	
	(0.0775)	(0.0580)	(0.0442)	(0.0492)	(0.0665)	(0.1970)	
lead11	−0.0972	0.0150	−0.0295	−0.0629	−0.0651	−0.0207	
	(0.1060)	(0.0756)	(0.0571)	(0.0729)	(0.0745)	(0.3150)	
lead10	−0.1080	−0.0319	−0.0225	−0.0465	−0.0641	0.3190	−1.0580
	(0.1060)	(0.0857)	(0.0638)	(0.0653)	(0.0913)	(0.3310)	(1.5120)
lead9	−0.1210	−0.0815	−0.0063	−0.0727	−0.0657	0.4660	−0.1740
	(0.1160)	(0.107)	(0.0688)	(0.0683)	(0.0913)	(0.3320)	(0.9300)
lead8	−0.2180	−0.0997	−0.0313	−0.0684	−0.0692	0.5430	−0.7850
	(0.1360)	(0.108)	(0.0700)	(0.0703)	(0.0830)	(0.3470)	(0.8300)
lead7	−0.1970*	−0.0674	−0.0372	−0.0565	−0.0159	0.4610	0.1290
	(0.1140)	(0.1070)	(0.0739)	(0.0697)	(0.0814)	(0.325)	(0.590)
lead6	−0.1830*	−0.0545	−0.0151	−0.0488	−0.0085	0.371	0.596
	(0.1020)	(0.1000)	(0.0673)	(0.0669)	(0.0780)	(0.304)	(0.438)
lead5	−0.1470*	−0.0139	−0.0066	−0.0274	0.0281	0.307	0.460
	(0.0870)	(0.0838)	(0.0631)	(0.0595)	(0.0722)	(0.232)	(0.402)
lead4	−0.1150	−0.0101	−0.0006	−0.0334	0.0535	0.212	0.544*
	(0.0726)	(0.0684)	(0.0486)	(0.0480)	(0.0689)	(0.185)	(0.310)
lead3	−0.0888*	0.0117	0.0045	−0.0137	0.0392	0.136	0.234
	(0.0531)	(0.0493)	(0.0358)	(0.0370)	(0.0504)	(0.140)	(0.259)
lead2	−0.0307	0.0028	0.0199	−0.00534	0.0177	−0.0253	0.0841
	(0.0290)	(0.0282)	(0.0227)	(0.0212)	(0.0302)	(0.0894)	(0.126)
lag0	0.0906***	0.0269	−0.0061	0.0072	−0.0622	−0.0423	−0.0317
	(0.0338)	(0.0327)	(0.0263)	(0.0243)	(0.0464)	(0.0859)	(0.141)
lag1	0.1420**	−0.0079	−0.0401	−0.0185	−0.0363	−0.151	−0.213
	(0.0636)	(0.0613)	(0.0491)	(0.0466)	(0.0530)	(0.172)	(0.212)
lag2	0.1810*	0.0208	−0.0478	−0.0273	−0.1060	−0.267	−0.450*
	(0.0931)	(0.0953)	(0.0741)	(0.0722)	(0.0774)	(0.246)	(0.236)
lag3	0.2680**	0.0865	0.0170	−0.0093	−0.1190	−0.267	−0.362
	(0.1290)	(0.1310)	(0.1020)	(0.1000)	(0.1030)	(0.334)	(0.262)
lag4	0.2040	0.0701	−0.0186	−0.0276	−0.1030	−0.480	−0.349
	(0.1660)	(0.1680)	(0.1360)	(0.1240)	(0.1170)	(0.415)	(0.305)
lag5	0.4370**	0.1330	0.0680	0.0465	−0.2390	−0.550	−0.462
	(0.2130)	(0.2180)	(0.1690)	(0.1590)	(0.1500)	(0.487)	(0.445)
lag6	0.3690	0.1210	0.1010	0.0713	−0.2390	−0.622	−0.308
	(0.2480)	(0.2560)	(0.2050)	(0.1880)	(0.1650)	(0.6130)	(0.3090)
lag7	0.5170*	0.2220	0.0135	0.0815	−0.4360*	−0.8440	−0.2560
	(0.2980)	(0.3410)	(0.3120)	(0.2350)	(0.2470)	(0.7260)	(0.2580)
lag8	0.7110*	0.3860	0.0728	0.247	−0.0073	−0.7680	
	(0.3810)	(0.3890)	(0.3440)	(0.3180)	(0.2060)	(0.9030)	
LNGDPPC	0.6010***	0.1660	0.1010	0.128	−0.0139	0.8810***	−0.3350
	(0.1830)	(0.1430)	(0.118)	(0.0937)	(0.1170)	(0.2910)	(0.428)
INF	−0.0008	0.0017**	−0.0006	0.0004	−0.0033***	0.0037***	-4.1×10^{-5}
	(0.0010)	(0.0007)	(0.0004)	(0.0005)	(0.0009)	(0.0013)	(0.0007)
UNEM	0.0056	−0.0112	0.0088	0.0061	−0.0086	0.0405*	−0.0220
	(0.0108)	(0.0110)	(0.0064)	(0.0072)	(0.0130)	(0.0223)	(0.0830)
SEP	0.0026	0.0028	0.0022	0.0072**	0.0019	0.0157	0.0318*
	(0.0049)	(0.0045)	(0.0030)	(0.0028)	(0.0020)	(0.0109)	(0.0164)
TRADE	−0.0019	−0.0028	−0.0031**	−0.0014	0.0001	0.0026	0.0130
	(0.0026)	(0.0017)	(0.0015)	(0.0011)	(0.0015)	(0.0052)	(0.0082)
LNFDI	0.0362	0.0330*	0.0454***	0.0092	0.0162	−0.0051	−0.1190
	(0.0229)	(0.0189)	(0.0158)	(0.0195)	(0.0151)	(0.0395)	(0.0749)
INTUSAGE	−0.0086***	−0.0102***	−0.0077***	−0.0094***	0.0016	−0.0062	0.0152
	(0.0031)	(0.0031)	(0.0028)	(0.0026)	(0.0018)	(0.0083)	(0.0131)
BCRISIS	0.216**	−0.0256	0.0208	−0.0049	−0.1840**	−0.0851	−0.579
	(0.0906)	(0.0770)	(0.0454)	(0.0785)	(0.0779)	(0.2600)	(0.4600)
Constant	−2.7430	2.7850**	0.8000	4.3660***	0.6230	2.9930	10.6300**
	(1.8700)	(1.3830)	(1.1980)	(0.8270)	(1.0660)	(2.4140)	(3.9890)
Observations	2,194	2,198	2,202	2,202	2,201	683	391
R^2	0.9270	0.9320	0.9180	0.9310	0.9140	0.9910	0.9820

Notes: Robust standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

The results provide strong support for the proposed framework. BRI participation significantly increases ATM access, confirming H1 and highlighting the role of infrastructure in basic financial inclusion. However, limited effects on borrowing, deposits, SME lending, and mobile finance support H2, indicating that infrastructure alone is insufficient without strong institutions and digital capacity. The significance of macroeconomic variables such as GDP per capita, inflation, and internet use offers partial support for

H4, reinforcing the importance of absorptive capacity. Overall, the findings validate the need for complementary reforms to ensure BRI-driven inclusion reaches beyond infrastructure.

4.2. Upper- and high-income vs. middle- and low-income countries

The impact of BRI on financial inclusion varies significantly across countries based on their income levels (Li, Zhao, and Koh 2024; Chu, Huong, and Dung 2023a). For this reason, the OLS-ITSA is applied for middle- and low-income countries, as well as for upper- and high-income countries. Countries in the sample are categorised using the WB's 2021 income group classification. This stratification is essential for assessing how BRI participation influences financial inclusion differently across development levels and aligns with the subgroup analysis presented later in the results.

4.2.1. Upper- and High-income countries

This section presents the results of the event study analysis assessing the effect of BRI participation on financial inclusion in upper- and high-income countries. Table 4 reports the estimates of the OLS-ITSA.

In upper- and high-income countries, lead coefficients for *LNATM* and *LNMOBILE* are significantly negative prior to BRI participation, indicating a pre-existing decline in financial inclusion. This pattern challenges the parallel trends assumption and supports the 'policy endogeneity' perspective, suggesting that these nations may have joined the BRI in response to weakening financial access (Clarke and Tapia-Schythe 2021). It also hints at a strategic use of BRI partnerships to counter financial service stagnation.

Post-treatment, *LNATM* shows a consistent and statistically significant increase, with effects strengthening over time. This trend supports institutional theory (North 1990) and underscores the role of infrastructure in enhancing financial access (Dollar 2019). Meanwhile, *LNBORR* rises gradually, with delayed significance in later years, consistent with innovation diffusion theory, which suggests behavioural change following access expansion (Rogers 2003).

LNDEPO and *LIFEINS* remain largely unaffected, likely due to saturation effects in mature financial markets where additional infrastructure yields limited marginal gains (Khanh 2019). Declining insurance use may reflect a shift toward short-term liquidity preferences amid large public investments (Allen et al. 2016).

LNMOBILE follows a U-shaped pattern, with negative pre-trends and eventual resurgence, highlighting the transitional nature of digital adoption and the importance of internet infrastructure (Rogers 2003). *LNSMES* shows minimal post-BRI effects, constrained by data limitations.

Among controls, GDP per capita positively affects ATM access, reinforcing the finance–development nexus. Inflation negatively impacts insurance, while trade openness is associated with reduced borrowing and bank presence, likely due to competitive pressures (Baltagi, Demetriades, and Law 2008; Lin and Wu 2023). Internet usage predicts mobile banking growth, underscoring the synergy between digital readiness and inclusion (Demirgüç-Kunt et al. 2018). In contrast, FDI negatively affects SME lending and mobile banking, suggesting a crowding-out effect that favours large, formal institutions over inclusive channels (Alfaro et al. 2004). Lastly, banking crises have limited impact, reflecting the resilience of advanced financial systems (Demetriades and Law 2004).

The event study results for upper- and high-income countries provide mixed support for the hypotheses. Pre-treatment declines in ATM and mobile banking access suggest policy endogeneity, where BRI participation may respond to worsening financial inclusion. Post-treatment gains in ATM access and delayed borrowing improvements support H1, emphasising infrastructure and institutional effects. However, minimal or negative impacts on deposits, insurance, SMEs, and mobile finance, along with adverse FDI spillovers, support H2, indicating that infrastructure alone is inadequate. These findings highlight the importance of institutional capacity, digital readiness, and macroeconomic stability to translate infrastructure into inclusive financial outcomes, particularly in mature markets with limited marginal returns.

4.2.2. Middle- and Low-income countries

This section investigates the effects of BRI participation on financial inclusion in middle- and low-income countries. Table 5 presents the results of the OLS-ITSA model.

Table 4. Impact of financial inclusion on upper- and high-income countries.

VARIABLES	(1) LNATM	(2) LNBORR	(3) LNBRNCH	(4) LNDEPO	(5) LIFEINS	(6) LNSMES	(7) LNMOBILE
lead12	−0.2510***	−0.1120	−0.0229	−0.0404	−0.1630	−0.2940	
	(0.0942)	(0.0759)	(0.0401)	(0.0414)	(0.1230)	(0.2850)	
lead11	−0.2720**	−0.1150	−0.0185	−0.0823	−0.1300	−0.3800	
	(0.124)	(0.0846)	(0.0509)	(0.0537)	(0.1450)	(0.3100)	
lead10	−0.2610**	−0.1360	−0.0361	−0.0771	−0.2230	−0.0116	
	(0.1160)	(0.0997)	(0.0591)	(0.0617)	(0.1590)	(0.4440)	
lead9	−0.2830**	−0.1550	−0.0293	−0.0536	−0.1730	0.0607	−2.5600
	(0.1150)	(0.1310)	(0.0589)	(0.0751)	(0.1670)	(0.4170)	(1.6870)
lead8	−0.2800**	−0.1800	−0.0312	−0.0650	−0.2040	0.103	−5.4400***
	(0.1150)	(0.1310)	(0.0604)	(0.0824)	(0.1550)	(0.393)	(1.518)
lead7	−0.2550**	−0.1420	−0.0185	−0.0488	−0.1550	−0.0346	−2.7960**
	(0.1040)	(0.1300)	(0.0643)	(0.0881)	(0.1460)	(0.3740)	(1.1490)
lead6	−0.2110**	−0.0957	0.0030	−0.0198	−0.1030	0.0155	−2.5670***
	(0.0905)	(0.1160)	(0.0636)	(0.0924)	(0.1360)	(0.3100)	(0.8070)
lead5	−0.1620**	−0.0314	0.0044	−0.00720	−0.0420	−0.00695	−2.2710***
	(0.0801)	(0.0924)	(0.0561)	(0.0859)	(0.1220)	(0.2506)	(0.7620)
lead4	−0.1160	−0.0163	0.0117	−0.0026	0.0025	−0.0045	−1.0380*
	(0.0750)	(0.0757)	(0.0475)	(0.0722)	(0.1090)	(0.2000)	(0.5150)
lead3	−0.0992*	0.0136	0.0298	0.0106	−0.0059	−0.0580	−0.7100*
	(0.0532)	(0.0530)	(0.0363)	(0.0539)	(0.0735)	(0.1090)	(0.3780)
lead2	−0.0251	0.0258	0.0143	0.0249	0.0036	−0.0740	−0.1070
	(0.0349)	(0.0298)	(0.0223)	(0.0320)	(0.0434)	(0.0600)	(0.3520)
lag0	0.1130***	0.0325	0.0019	0.0124	−0.1050	0.0185	−0.0226
	(0.0342)	(0.0306)	(0.0246)	(0.0337)	(0.0694)	(0.0877)	(0.3440)
lag1	0.1530***	−0.0006	−0.0174	−0.0147	−0.0366	0.0377	−0.3740
	(0.0573)	(0.0494)	(0.0480)	(0.0689)	(0.0854)	(0.191)	(0.3760)
lag2	0.2080**	0.0260	−0.0135	−0.0255	−0.1160	0.0106	−0.5090
	(0.0869)	(0.0727)	(0.0784)	(0.1130)	(0.1320)	(0.2760)	(0.3290)
lag3	0.3010**	0.0245	−0.0050	0.0112	−0.1780	0.1220	0.1430
	(0.1190)	(0.0900)	(0.1050)	(0.1530)	(0.1840)	(0.3530)	(0.2560)
lag4	0.2990**	0.0399	−0.0173	0.0254	−0.0865	0.0985	0.5240*
	(0.1480)	(0.1250)	(0.1300)	(0.1920)	(0.2070)	(0.4430)	(0.2870)
lag5	0.4020**	0.0918	0.0783	0.0745	−0.3040	0.1250	0.3070
	(0.1810)	(0.1570)	(0.1650)	(0.2390)	(0.2830)	(0.5480)	(0.4150)
lag6	0.3990*	0.0712	0.0664	0.1630	−0.1680	0.2200	1.5340***
	(0.2140)	(0.1870)	(0.1800)	(0.2930)	(0.2900)	(0.6670)	(0.4840)
lag7	0.4650*	0.2820	0.0591	−0.1090	−0.6520	−0.1210	
	(0.2490)	(0.2190)	(0.2700)	(0.4060)	(0.3990)	(0.7590)	
lag8	0.5610*	0.3420	0.1210	−0.0640	0.1110	0.2580	
	(0.2830)	(0.2730)	(0.3360)	(0.4920)	(0.3960)	(0.8530)	
LNGDPPC	0.6530***	0.0904	0.1560	0.0820	−0.0963	0.503	−1.3410
	(0.2440)	(0.2320)	(0.1140)	(0.1230)	(0.2670)	(0.352)	(0.9410)
INF	0.0014	0.0002	0.0013	0.0015	−0.0103**	−0.0009	−0.0478
	(0.0050)	(0.0038)	(0.0019)	(0.0017)	(0.0048)	(0.0215)	(0.0340)
UNEM	0.0018	−0.0105	0.0087	−0.0013	−0.0171	0.0341**	0.1090
	(0.0088)	(0.0104)	(0.0064)	(0.0059)	(0.0184)	(0.0165)	(0.101)
SEP	0.0009	0.0059	0.0049	−0.0045	0.0011	0.0289*	−0.0257
	(0.0065)	(0.0099)	(0.0049)	(0.0042)	(0.0033)	(0.0154)	(0.0305)
TRADE	−0.0023	−0.0031*	−0.0007	−0.0021*	0.0006	−0.0085*	0.0141
	(0.0019)	(0.0018)	(0.0010)	(0.0011)	(0.0025)	(0.0045)	(0.0109)
POPG	−0.0013	0.0151	0.0192**	0.0047	−0.0061	0.1870*	0.3750**
	(0.0122)	(0.0117)	(0.0096)	(0.0092)	(0.0134)	(0.0970)	(0.1380)
LNFDI	−0.0208	0.0014	−0.0006	−0.0056	0.0106	−0.0402**	−0.4330**
	(0.0151)	(0.0163)	(0.0098)	(0.0190)	(0.0232)	(0.0168)	(0.1550)
INTUSAGE	0.0033	−0.0008	0.0013	0.0043	0.0071	0.0061	0.1020***
	(0.0038)	(0.0042)	(0.0021)	(0.0027)	(0.0043)	(0.0068)	(0.0344)
BCRISIS	0.0338	−0.0381	−0.0707*	−0.0005	−0.1410	−0.608*	−0.2900
	(0.0567)	(0.0519)	(0.0365)	(0.0417)	(0.1130)	(0.353)	(0.3150)
Constant	−1.8420	4.3640	4.4310***	2.6730*	1.8220	5.5960	25.5900***
	(2.7170)	(2.8160)	(1.1100)	(1.3460)	(2.7050)	(3.9307)	(6.2680)
Observations	1,203	1,203	1,203	1,203	1,202	439	110
R^2	0.8860	0.8760	0.9520	0.9160	0.9170	0.9950	0.9810

Notes: Robust standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Pre-treatment data show that BRI participation has no significant anticipated impacts on the majority of financial inclusion variables supporting the parallel trends assumption (Angrist and Pischke 2009). However, *LNSMES* and *LNMOBILE* show strong positive and significant pre-trends, which indicates that financial inclusion through digital tools and SMEs credits was already on the rise prior to BRI engagement. While

Table 5. BRI impact on financial inclusion of middle- and low-income countries.

VARIABLES	(1) LNATM	(2) LNBORR	(3) LNBRNCH	(4) LNDEPO	(5) LIFEINS	(6) LNSMES	(7) LNMOBILE
lead12	0.1800	0.1190	−0.1490	−0.0051	0.0495	0.5120**	
	(0.1130)	(0.0864)	(0.1040)	(0.0883)	(0.0389)	(0.1840)	
lead11	0.0976	0.1210	−0.1890	0.0316	0.0200	0.8380***	
	(0.1630)	(0.1240)	(0.1620)	(0.1120)	(0.0516)	(0.2950)	
lead10	0.0715	0.0487	−0.1200	0.0694	0.1290	1.2120***	−5.2240***
	(0.1900)	(0.1400)	(0.1290)	(0.1270)	(0.0799)	(0.3120)	(1.5050)
lead9	0.0217	−0.0636	−0.1730	0.0487	0.0622	1.3410***	−0.8960
	(0.2130)	(0.1600)	(0.1250)	(0.1170)	(0.0701)	(0.3790)	(1.1040)
lead8	−0.1850	−0.0737	−0.1470	0.0257	0.0832	1.4110***	−0.3770
	(0.2700)	(0.1630)	(0.1230)	(0.1130)	(0.0507)	(0.3980)	(0.9400)
lead7	−0.2290	−0.0693	−0.1460	−0.0254	0.1370*	1.2250***	0.5220
	(0.2080)	(0.1550)	(0.1230)	(0.1190)	(0.0692)	(0.2940)	(0.5550)
lead6	−0.2200	−0.0740	−0.1390	0.0157	0.1020	0.8590***	1.0260**
	(0.1810)	(0.1460)	(0.1130)	(0.0974)	(0.0692)	(0.2740)	(0.4530)
lead5	−0.1950	−0.0486	−0.0893	0.00282	0.1130	0.7590***	0.8620*
	(0.1500)	(0.1250)	(0.1070)	(0.0935)	(0.0764)	(0.2420)	(0.4960)
lead4	−0.1540	−0.0565	−0.1130	0.0181	0.1200	0.4770**	0.8000**
	(0.1240)	(0.1010)	(0.0830)	(0.0689)	(0.0852)	(0.1950)	(0.3840)
lead3	−0.0947	−0.0313	−0.0817	0.0105	0.100	0.3910*	0.4530
	(0.0884)	(0.0737)	(0.0640)	(0.0517)	(0.0663)	(0.2030)	(0.2750)
lead2	−0.0448	−0.0380	−0.0395	0.0251	0.0583	0.0094	0.1740
	(0.0432)	(0.0443)	(0.0376)	(0.0398)	(0.0436)	(0.1560)	(0.1070)
lag0	0.1190**	0.0425	0.0424	−0.0152	−0.0058	−0.1100	−0.0165
	(0.0549)	(0.0567)	(0.0439)	(0.0384)	(0.0617)	(0.1500)	(0.1250)
lag1	0.2130**	0.0182	0.0223	−0.0702	−0.0360	−0.3370	−0.0921
	(0.1000)	(0.1130)	(0.0838)	(0.0704)	(0.0626)	(0.2740)	(0.2190)
lag2	0.2880**	0.0987	0.0355	−0.0509	−0.0541	−0.5270	−0.3100
	(0.1440)	(0.1770)	(0.1190)	(0.0977)	(0.0805)	(0.3560)	(0.2380)
lag3	0.3550*	0.2860	0.0871	0.0315	−0.0812	−0.6120	−0.2520
	(0.1950)	(0.2400)	(0.1640)	(0.1320)	(0.1180)	(0.4640)	(0.2710)
lag4	0.2840	0.3460	0.1510	0.0162	−0.0817	−1.0410*	−0.2500
	(0.2530)	(0.2980)	(0.1960)	(0.1800)	(0.1220)	(0.5130)	(0.2890)
lag5	0.9030***	0.5190	0.2040	0.1950	−0.1930	−0.9410	−0.2630
	(0.3370)	(0.4340)	(0.2720)	(0.1970)	(0.1270)	(0.5790)	(0.3070)
lag6	0.7460**	0.5540	0.3760	0.1740	−0.2220	−1.1330	−0.1670
	(0.3330)	(0.4530)	(0.3200)	(0.2510)	(0.1660)	(0.7480)	(0.1500)
lag7	0.7590*	0.2980	0.3180	0.2250	−0.1040	−1.3140	−0.0440
	(0.4130)	(0.6540)	(0.3340)	(0.4230)	(0.2180)	(0.9830)	(0.1350)
lag8	0.9960**	0.6460	0.6300	0.2800	−0.1800	−1.3580	
	(0.4810)	(0.6400)	(0.4350)	(0.4100)	(0.2280)	(1.2320)	
LNGDPPC	0.3980*	0.0929	0.0478	−0.0560	−0.0392	0.8620***	−0.0202
	(0.2320)	(0.1780)	(0.1300)	(0.1720)	(0.0774)	(0.2250)	(0.3940)
INF	−0.0012*	0.0017**	0.0001	−0.0014***	−0.0034***	0.0043***	0.0002
	(0.0007)	(0.0007)	(0.0006)	(0.0004)	(0.0008)	(0.0010)	(0.0007)
UNEM	−0.0128	−0.0565**	−0.0275	0.0160	0.0059	0.0032	−0.0742
	(0.0234)	(0.0253)	(0.0177)	(0.0175)	(0.0149)	(0.0432)	(0.0626)
SEP	−0.0051	−0.0047	0.0046	0.0012	8.7×10^{-5}	−0.0040	0.0269
	(0.0063)	(0.0046)	(0.0040)	(0.0040)	(0.0020)	(0.0114)	(0.0193)
TRADE	0.0028	0.0002	−0.0003	−0.0031	0.0007	0.0219***	0.0163
	(0.0049)	(0.0027)	(0.0017)	(0.0025)	(0.0014)	(0.0060)	(0.0098)
POPG	−0.0102	0.0415	0.0190	−0.0497	0.0161	0.149	−0.2570
	(0.0412)	(0.0405)	(0.0278)	(0.0551)	(0.0212)	(0.157)	(0.4660)
LNFDI	0.0386	0.0240	−0.0129	0.0694**	0.0095	−0.0006	−0.0697
	(0.0326)	(0.0289)	(0.0385)	(0.0274)	(0.0152)	(0.0701)	(0.0790)
INTUSAGE	−0.0034	−0.0096*	−0.0127**	−0.0101*	0.0009	−0.0187	0.0107
	(0.0060)	(0.0049)	(0.0049)	(0.0055)	(0.0017)	(0.0171)	(0.0132)
BCRISIS	0.435***	−0.0562	0.0414	−0.0788	−0.2210**	0.2490	−0.5300
	(0.1600)	(0.1720)	(0.1880)	(0.1040)	(0.1040)	(0.3340)	(0.6160)
Constant	−1.5520	3.0550*	5.1320***	0.9730	0.3970	5.2260**	8.7420*
	(2.1390)	(1.5440)	(0.9850)	(1.6160)	(0.6830)	(2.0000)	(4.4240)
Observations	991	995	999	999	999	244	279
R^2	0.9060	0.9030	0.8960	0.8970	0.8170	0.9890	0.9870

Notes: Robust standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

these patterns do not contradict the research, they do suggest that the influence of BRI on various channels should be viewed with caution, given the possibility of self-selection or underlying growth dynamics.

Post-treatment data indicate that BRI participation has a significant and long-term impact on ATM expansion. These data lend support to the premise that BRI infrastructure projects significantly improve physical banking access in underdeveloped countries (Beck and Levine 2018; Huang, Shen, and Zhang

2020). However, the lack of significant effects on *LNBORR* and *LNDEPO* suggests that infrastructure alone may not drive changes in deeper financial behaviours like borrowing or savings. This finding is consistent with institutional theory. It suggests that regulatory barriers, weak institutions, and limited trust in financial systems can prevent physical infrastructure from translating into broader financial services (North 1990).

The reversal in SME lending after BRI participation, reflected in the negative post-treatment coefficient for *LNSMES*, suggests a crowding-out effect. BRI investments appear to favour large corporations and infrastructure projects, often at the expense of smaller businesses. This outcome reinforces concerns that infrastructure-led initiatives often overlook informal and small-scale sectors. As a result, their potential for empowerment remains limited (Rogers 2003). Similarly, the decline in life insurance penetration suggests that households, with improved access to physical banking infrastructure, may prioritise short-term liquidity over long-term financial products (Arner et al. 2020).

The negative post-BRI trend in mobile banking (*LNMOBILE*), despite positive pre-trends, further underscores the complexity of digital financial inclusion. It suggests that while digital financial services may have shown initial growth, the momentum may have shifted or stagnated post-BRI, pointing to a need for targeted digital policies to sustain progress (Mothobi and Kebotsamang 2024).

Among macroeconomic controls, GDP per capita has a positive impact on SME lending. Inflation has a considerable and detrimental influence on life insurance, ATM availability, and bank branches, demonstrating the vulnerability of financial services to macroeconomic volatility (Laeven and Valencia 2020). Internet usage has a negative impact on borrowing and branch presence, supporting the fact that digital banking can replace traditional models (Mothobi and Kebotsamang 2024).

Banking crises are associated with increased ATM expansion, suggesting that governments prioritise physical access during periods of instability to support economic stability. In contrast, higher unemployment reduces borrowing from commercial banks. This pattern is consistent with evidence that labour market uncertainty constrains loan availability (Lin and Wu 2023).

The findings strongly support the proposed hypotheses. H1 is confirmed, with BRI participation significantly increasing ATM access across all income groups, demonstrating infrastructure-led financial expansion. However, limited or negative effects on borrowing, deposits, insurance, mobile banking, and SME lending support H2, highlighting the need for complementary institutions and digital readiness. H3 shows that low- and middle-income countries experience greater improvements in financial access than high-income countries, where saturation limits gains. Finally, macroeconomic controls, such as GDP per capita, inflation, and internet usage, along with varying responses to trade openness, unemployment, and FDI, support H4, emphasising the conditional nature of BRI outcomes. These results underscore the necessity of institutional reforms and digital strategies to maximise the BRI's inclusion potential.

5. Conclusion

This paper investigates the impact of BRI participation on financial inclusion across different income groups. The results reveal that the most consistent finding is a significant increase in ATM availability, confirming the infrastructure-led impact of the BRI on financial access, particularly in low- and middle-income countries. However, the effects on borrowing, deposit accounts, and SME lending are more limited, suggesting that physical infrastructure alone is insufficient for deeper financial inclusion.

In high-income countries, ATM growth and borrowing show delayed but significant increases, while deposits and life insurance remain largely unchanged due to market saturation. Mobile banking exhibits a U-shaped pattern, reflecting shifts between traditional and digital financial structures. These results underscore that infrastructure development does not always lead to digital finance or SME credit growth.

Theoretically, the findings support institutional and innovation diffusion theories, emphasising that external investments in infrastructure can boost basic financial access. However, foreign direct investment may disproportionately benefit large institutions unless inclusive methods are incorporated.

Policy implications include the need for governments to combine infrastructure development with improvements in institutional trust, credit access, and digital literacy. Additionally, regulations must ensure that large-scale investments do not marginalise SMEs and digital finance platforms. Macroeconomic factors like unemployment and inflation also play a significant role in financial behaviour and must be considered in the assessment of infrastructure-led financial transformation.

Despite its contributions, this study has several limitations that should be acknowledged. First, data constraints restrict the availability of SME lending and mobile money indicators, which are only reported for a subset of countries, potentially limiting the generalisability of results in these areas. Second, the use of ATM availability as a proxy for financial inclusion may introduce measurement challenges, particularly in contexts where digital financial services are expanding and reducing reliance on physical infrastructure. Third, although the staggered adoption ITSA approach accounts for time-invariant heterogeneity, the possibility of endogeneity in BRI participation remains, as countries may self-select into the initiative based on unobserved political or economic conditions. Finally, the BRI encompasses highly heterogeneous forms of engagement, including differences in investment scale, project type (such as transport, energy, and digital infrastructure), financing modality (concessional vs. commercial lending), and the degree of Chinese state-owned versus private enterprise participation, yet the empirical design treats participation as a binary event. This aggregation prevents differentiation between distinct project types and intensities, and the estimates should therefore be interpreted as average associations across diverse forms of BRI involvement.

Future research should explore the long-term effects of BRI investments on financial inclusion, examining how these impacts evolve over time and across regions. Studies focusing on the social and cultural dimensions of financial inclusion, such as gender disparities and the role of financial education, will deepen understanding of how BRI can foster inclusive growth.

Ultimately, building inclusive financial systems in the BRI era requires a comprehensive approach that integrates infrastructure, financial innovation, regulatory support, and education, ensuring equitable prosperity for all.

Disclosure statement

The authors report there are no competing interests to declare.

Data

The data that support the findings of this study are available from the corresponding author, C.C., upon reasonable request.

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Appendices

Appendix A: Comparison of evaluation criteria

Table A1. Comparison of evaluation criteria.

Criterion	Our study	Demirgüç -Kunt & Klapper (2012)	Werff et al. (2013)	World Bank (2013)	Kim, Yu, and Hassan (2018)
Dependent Variables					
Account Ownership	ATMs per 100,000 adults	Not directly addressed	ATMs per 100,000 adults	ATMs per 100,000 adults	ATMs per 100,000 adults
Penetration rate of financial institutions	Bank branches per 100,000 adults	Bank branches per thousand square kilometres	Bank branches per 100,000 adults	bank branches per 100,000 adults.	Bank branches per 100,000 adults
The measure of saving behaviour	Deposits with commercial banks per 1000 adults	Adults saving at a formal financial institution in the past year	Accounts at formal financial institutions (% age 15+)	The proportion of adults (age 15+) who reported saving at a formal financial institution in the past years	Deposits with commercial banks per 1000 adults
Measure of credit	Borrowers from commercial banks per 1,000 adults	Adults borrow formal and informal sources.	Not directly addressed	Percentage of adults (age 15+) who have borrowed money from a formal financial institution	borrowers from commercial banks per 1,000 adults
Measure for risk	Life insurance premium volume to GDP	Percentage of adults paying personally for health and agriculture insurance	Not directly addressed	Percentage of adults who pay for health insurance	Life insurance premium volume to GDP
Measure of Mobile Banking	Number of registered mobile money accounts per 1,000 adults	Mobile money users by whether with or without a formal account (as % of all adults)	Not directly addressed	Mobile phone per 100 of people	Not directly addressed
Measure of SMEs financial inclusion	Outstanding SMEs loans	Not directly addressed	Not directly addressed	SMEs outstanding loans	Not directly addressed
Independent Variables					
Income Level and Economic Development	GDP per capita	GDP per capita	GNI per capita and GINI coefficient	GDP per capita	GDP per capita
Economic Stability	Inflation (annual %)	Not directly addressed	Long-term interest rates (10-year bonds)	Inflation (annual %)	Inflation (annual %)
Demand for Financial Services	Population growth rate	Not directly addressed	Not directly addressed	Population growth rate	Population growth rate (POP),
Education level and Financial Literacy	School enrolment for primary education	Adults with outstanding loans for school fees	Not directly addressed	Not specifically identified	School enrolment for primary education
Trade openness	Trade percentage of GDP	Not directly addressed	Not directly addressed	Trade percentage of GDP	Trade percentage of GDP
Unemployed Labour Force	Unemployment rate	Unemployment rate	Unemployment rate	Unemployment rate	Unemployment rate
Indirect Channel of BRI	Foreign Direct Investment	Not directly addressed	Not directly addressed	Not directly addressed	Not directly addressed

Sources: Own elaboration, Demirgüç-Kunt & Klapper (2012); Werff, Hogarth, and Peach (2013); World Bank (2013); and Kim, Yu, and Hassan (2018).

Appendix B: Pearson correlation

The Pearson correlation results, summarised in Table B1, highlight that a correlation value above 0.8 signals potential multicollinearity (Gujarati and Sangeetha 2007). The analysis reveals a strong correlation between *LNATM* and *LNBORR*. However, since these two variables are not included simultaneously in the same regression model, multicollinearity does not pose a concern in this context.

Table B1. Pearson Correlation.

	LNATM	*LNDEPO*	*LNBORR*	*LNBRNCH*	*LIFEINS*	*LNMOBILE*	*LNSMES*	*LNGDPPC*	*INF*	*UNEM*	*SEP*	*TRADE*	*POPG*	*INTUSAGE*	*LNFDI*
LNATM	1.000														
LNDEPO	**0.742*****	1.000													
	(0.000)														
LNBORR	**0.872*****	**0.745*****	1.000												
	(0.000)	**(0.000)**													
LNBRNCH	**0.675*****	**0.600*****	**0.627*****	1.000											
	(0.000)	**(0.000)**	**(0.000)**												
LIFEINS	**0.327*****	**0.259*****	**0.294*****	**0.241*****	1.000										
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**											
LNMOBILE	**0.182*****	**0.107*****	**0.039*****	**−0.074*****	0.103	1.000									
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	(0.762)										
LNSMES	**0.715*****	**0.572*****	**0.707*****	**0.714*****	**0.403*****	**−0.121***	1.000								
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.022)**									
LNGDPPC	**0.781*****	**0.608*****	**0.737*****	**0.613*****	**0.344*****	0.217	−0.363	1.000							
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	(0.352)	(0.435)								
INF	**−0.138*****	**−0.093*****	**−0.148*****	**−0.131*****	**−0.109*****	**−0.025*****	**−0.087*****	**−0.147*****	1.000						
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**							
UNEM	**0.046*****	−0.004	0.025	**0.137*****	**0.109*****	**−0.290*****	**0.194*****	**0.044****	**0.035***	1.000					
	(0.000)	(0.864)	(0.215)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.031)**	**(0.084)**						
SEP	**0.129*****	**0.122*****	**0.168*****	−0.003	**0.089*****	0.088	−0.290	0.030	**−0.058*****	**−0.140*****	1.000				
	(0.000)	**(0.000)**	**(0.000)**	(0.869)	**(0.000)**	(0.252)	(0.125)	(0.138)	**(0.004)**	**(0.000)**					
TRADE	**0.246*****	**0.250*****	**0.258*****	**0.199*****	**0.197*****	**−0.333*****	**0.269*****	**0.380*****	**−0.099*****	**0.070*****	**−0.114*****	1.000			
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**				
POPG	**−0.382*****	**−0.331*****	**−0.359*****	**−0.356*****	**−0.150*****	**0.051*****	**0.165*****	**−0.213*****	0.024	**−0.208*****	**−0.090*****	**−0.056*****	1.000		
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	(0.239)	**(0.000)**	**(0.000)**	**(0.006)**			
INTUSAGE	**0.741*****	**0.610*****	**0.704*****	**0.517*****	**0.263*****	**−0.187**	**0.237**	**0.768*****	**−0.114*****	0.019	0.004	**0.305*****	**−0.310*****	1.000	
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	(0.339)	(0.842)	**(0.000)**	**(0.000)**		
LNFDI	**0.142*****	**0.033*****	**0.140*****	**0.023*****	**−0.010*****	**0.619*****	**−0.059*****	**0.171*****	**−0.076****	−0.222	−0.140	**−0.138**	**−0.058**	0.035	1.000
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.002)**	**(0.001)**	**(0.001)**	**(0.002)**	**(0.005)**	(0.234)	(0.343)	**(0.000)**	**(0.000)**	(0.243)	
BCRISIS	−0.020	−0.020	−0.041	−0.017	0.016	**−0.035*****	**0.063*****	**0.021*****	0.099	**0.087*****	**0.045****	**−0.081*****	−0.027	−0.014	0.026
	(0.321)	(0.334)	(0.045)	(0.398)	(0.429)	**(0.000)**	**(0.000)**	**(0.000)**	(0.294)	**(0.000)**	**(0.027)**	**(0.000)**	(0.190)	(0.486)	(0.454)

$^{***}p < 0.01$, $^{**}p < 0.05$, * $p < 0.1$.
p-values in parentheses.
Source: own elaboration.

Appendix C: Robustness check- Placebo test

To ensure the robustness of the findings, a placebo test is used as a falsification exercise to verify that the observed effects are genuinely attributable to BRI participation rather than driven by other unobserved factors (Brodeur et al. 2016; Brodeur, Cook, and Heyes 2020). This involves assigning a fictitious treatment year to countries that have not yet participated in BRI and estimating the model using this artificial treatment. The lack of significant results for the placebo treatment variable provides further support for the validity of the identification strategy, reinforcing the credibility of the estimated effects (Dreber, Johannesson, and Yang 2023).

The placebo test serves as a robustness check by ensuring that the estimated effects are not the result of random variations or pre-existing trends. By applying the treatment to an arbitrary period where no actual intervention occurred, we assess whether the model incorrectly detects effects where none should exist. If the placebo test yields insignificant coefficients, this confirms that the findings are not driven by false correlations but rather reflect the true impact of BRI participation on financial inclusion (Dreber, Johannesson, and Yang 2023). Given that placebo tests are widely used in empirical economic research to validate causal claims, their inclusion in this study aligns with best practices in applied econometrics, strengthening the reliability of the identification strategy.

The placebo model is constructed as follows:

$$Y_{it} = \alpha + \beta PlaceboBRI_{it} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (C1)$$

Y_{it} is the financial inclusion indicator for country i at time t, $PlaceboBRI_{it}$ is the artificially assigned placebo treatment variable, where countries are treated in randomly shifted years, X_{it} represents the set of control variables, μ_i and λ_t are country and year fixed effects, controlling for unobserved heterogeneity, and ϵ_{it} is the error term. The results are summarised in Table B1.

The results indicate that the placebo treatment variable (*PlaceboBRI*) is insignificant across all financial inclusion indicators, including ATMs (*LNATM*), borrowers from commercial banks (*LNBORR*), bank branches (*LNBRNCH*), deposit accounts (*LNDEPO*), life insurance penetration (*LIFEINS*), mobile banking *(LNMOBILE*), and SMEs credits *(LNSMES)*. The coefficients remain close to zero, confirming that there is no systematic effect of the placebo treatment on financial inclusion. This finding supports the argument that the true effects observed in the main analysis are not driven by unrelated time trends or external shocks but rather by actual BRI participation. These results align with previous studies that employ placebo tests to validate staggered policy adoption effects in event studies (Clarke and Tapia-Schythe 2021).

Examining the pre-treatment period, lead coefficients largely remain insignificant, further reinforcing that no strong pre-trends exist. However, for *LNATM* and *LNDEPO*, a few lead coefficients (*lead12* to *lead5*) are positive and statistically significant, which could suggest that certain financial inclusion indicators were already increasing in some countries before the assigned placebo year. This could be due to broader financial sector reforms independent of BRI participation. Nevertheless, the post-treatment placebo effects remain statistically insignificant, meaning that these pre-trends do not translate into actual changes post-placebo treatment.

The macroeconomic control variables remain consistent with expectations. GDP per capita (*LNGDPPC*) is positively and significantly associated with financial inclusion, confirming that economic growth is a key determinant of access to financial services (Demirgüç-Kunt et al. 2018). Inflation (*INF*) negatively impacts financial inclusion, particularly deposit account penetration and life insurance uptake, which is consistent with prior findings that macroeconomic instability discourages long-term financial planning (Arner et al., 2020). Trade openness (*TRADE*) negatively affects ATM penetration but positively influences deposit accounts and life insurance, suggesting that financial openness fosters banking sector diversification.

Overall, the placebo test results confirm that the observed impact of BRI participation on financial inclusion is not driven by false correlations or pre-existing financial trends. The lack of significant effects for the placebo treatment reinforces the robustness of the main findings, affirming that BRI plays a direct role in improving financial inclusion metrics in participating countries. These results contribute to the broader literature on policy evaluation and infrastructure-driven financial development by demonstrating the credibility of event study methodologies in assessing staggered policy interventions (Angrist & Pischke 2009).

Table C1. Placebo-test.

VARIABLES	(1) LNATM	(2) LNBORR	(3) LNBRNCH	(4) LNDEPO	(5) LIFEINS	(6) LNSMES	(7) LNMOBILE
lead12	−0.2010	−0.0729	−0.0907	−0.0208	−0.0993	−1.3610	
	(0.1260)	(0.1270)	(0.1180)	(0.1010)	(0.1500)	(1.7050)	
lead11	−0.1330	−0.0495	−0.1170	0.0041	−0.1270	−0.3890	
	(0.1170)	(0.1130)	(0.1080)	(0.0993)	(0.1620)	(1.3790)	
lead10	−0.0721	−0.0921	−0.1050	0.0315	−0.1700	−0.2130	3.5470***
	(0.1140)	(0.1180)	(0.1100)	(0.0991)	(0.1530)	(1.1730)	(0.8840)
lead9	0.0443	−0.0783	−0.0707	0.0628	−0.1870	−0.2450	1.3140
	(0.1060)	(0.1220)	(0.1090)	(0.0970)	(0.1540)	(1.0790)	(2.0700)
lead8	0.0178	−0.0395	−0.0175	0.0352	−0.2320	0.1120	−0.9340
	(0.1170)	(0.1180)	(0.1060)	(0.0977)	(0.1490)	(1.0600)	(2.1460)
lead7	0.1010	−0.0058	0.0026	0.0146	−0.2700*	−0.0684	−1.5140
	(0.1050)	(0.1100)	(0.1020)	(0.0952)	(0.1450)	(0.9550)	(1.7260)
lead6	0.1480	0.0388	0.0494	0.0396	−0.3170**	−0.1360	−0.2030
	(0.1060)	(0.1100)	(0.1030)	(0.0902)	(0.1530)	(0.9740)	(1.4960)
lead5	0.2290**	0.1640	0.1270	0.0817	−0.2750*	0.2670	−0.6640
	(0.1020)	(0.1000)	(0.0962)	(0.0859)	(0.1470)	(0.8850)	(1.2270)
lead4	0.3100***	0.1870*	0.1390	0.0568	−0.1910	0.1050	−0.2740
	(0.0982)	(0.0989)	(0.0965)	(0.0843)	(0.1530)	(0.8590)	(1.1890)
lead3	0.3890***	0.2830***	0.2130**	0.0536	−0.1510	0.4710	0.0588
	(0.0930)	(0.0967)	(0.0950)	(0.0827)	(0.1500)	(0.8190)	(1.0740)
lead2	0.4740***	0.3140***	0.2850***	0.1090	−0.1430	0.5600	−0.3990
	(0.0915)	(0.0964)	(0.0952)	(0.0836)	(0.1580)	(0.8420)	(1.0950)
lag0	0.5260***	0.3600***	0.3770***	0.0552	−0.1920	0.2690	0.3760
	(0.0939)	(0.0966)	(0.0919)	(0.0847)	(0.1540)	(0.7870)	(1.1100)
lag1	0.5810***	0.4250***	0.4160***	0.0080	−0.1700	0.7230	0.3060
	(0.0925)	(0.0947)	(0.0937)	(0.0862)	(0.1560)	(0.7940)	(1.0830)
lag2	0.5610***	0.4460***	0.4200***	−0.0231	−0.1190	0.6610	0.3350
	(0.1010)	(0.1040)	(0.0991)	(0.0913)	(0.1690)	(0.7970)	(1.1320)
lag3	0.5630***	0.4810***	0.4500***	−0.0229	−0.2750	0.4870	0.6620
	(0.1110)	(0.1170)	(0.1200)	(0.1090)	(0.1740)	(0.7860)	(1.1680)
lag4	0.6300***	0.5550***	0.5130***	0.0283	−0.3750	1.7290*	0.2880
	(0.1400)	(0.1370)	(0.1330)	(0.1650)	(0.2570)	(1.0290)	(1.5920)
lag5	0.8710***	0.5920***	0.5840***	0.2300	−0.3370	2.0860*	−0.8700
	(0.1730)	(0.1640)	(0.1870)	(0.2080)	(0.5070)	(1.1500)	(1.8810)
lag6	0.6770***	0.4780***	0.4040*	0.2120	−0.4260	1.7790*	−0.5410
	(0.1880)	(0.1680)	(0.2120)	(0.2390)	(0.4280)	(1.0300)	(2.2070)
lag7	1.1820***	0.7300***	0.5140	0.1650	−0.4700	2.0090	−0.6450
	(0.1600)	(0.2420)	(0.4500)	(0.4850)	(0.3170)	(1.4000)	(3.3660)
lag8	1.1720***	0.7250***	0.5410	0.1870	−0.6220*	1.6360	0.9740
	(0.2260)	(0.2390)	(0.4610)	(0.4860)	(0.3320)	(1.3830)	(4.6510)
PLACEBOBRI	0.0372	0.0470	−0.0450	0.0753	−0.0184	−0.1660	0.2690
	(0.0926)	(0.0915)	(0.0944)	(0.1010)	(0.2020)	(0.6400)	(0.8840)
LBGPPC	0.9530***	0.8000***	0.5480***	0.5420***	0.2980***	−0.6760***	0.4420*
	(0.0205)	(0.0201)	(0.0181)	(0.0170)	(0.0252)	(0.1770)	(0.2270)
INF	−0.0020*	−0.0022	0.0003	−0.0021**	−0.0047**	−0.0082**	−0.0028
	(0.0012)	(0.0017)	(0.0007)	(0.0010)	(0.0021)	(0.0034)	(0.0042)
UNEM	0.0096***	0.0050	−0.0052	0.0237***	0.0287***	−0.1710***	0.0352
	(0.0033)	(0.0037)	(0.0033)	(0.0034)	(0.0092)	(0.0242)	(0.0339)
TRADE	−0.0019***	−0.0009***	0.0005	−0.0011***	0.0022***	−0.0186***	−0.0194***
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0008)	(0.0020)	(0.0059)
LNFDI	0.0211**	0.0730***	−0.0165	−0.0293***	0.0643***	0.7070***	0.0598
	(0.0106)	(0.0111)	(0.0134)	(0.0095)	(0.0151)	(0.1210)	(0.1400)
BCRISIS	−0.2000***	−0.3070***	−0.0886	−0.0889	−0.0058	2.0570***	−1.7830**
	(0.0730)	(0.0757)	(0.0705)	(0.0726)	(0.0895)	(0.5230)	(0.6890)
Constant	−5.6620***	−3.8110***	1.5440***	−1.7120***	−3.0530***	5.1150*	6.9780**
	(0.2160)	(0.2020)	(0.2390)	(0.1780)	(0.3310)	(2.9030)	(3.1300)
Observations	2,209	2,213	2,217	2,217	2,216	696	398
R^2	0.6780	0.6120	0.4150	0.4060	0.1500	0.2730	0.0550

Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Appendix D: Event study plots

Event-study plots for all financial inclusion indicators show that several outcomes exhibit mild upward pre-trends prior to BRI participation, particularly ATM penetration, bank branches, deposits, and mobile money (Figures D1–D7). These coefficients remain statistically indistinguishable from zero but display a positive slope toward the event year, suggesting that treated countries were already experiencing gradual improvements in financial access before joining the BRI. Borrower rates and SME lending show flatter pre-treatment trajectories, although confidence intervals are wide.

Following BRI entry, most indicators continue to rise gradually, with no sharp discontinuity at t = 0, indicating that post-treatment effects largely extend pre-existing trajectories rather than generating abrupt structural changes. These patterns align with identification concerns related to endogenous timing of participation and the gradual nature of infrastructure-driven financial development. In the event-study figures, the period immediately preceding BRI participation (t = −1) is omitted and serves as the reference year. Consequently, estimated coefficients are plotted starting from t = −2 and represent deviations relative to the pre-treatment baseline (Sun and Abraham 2021).

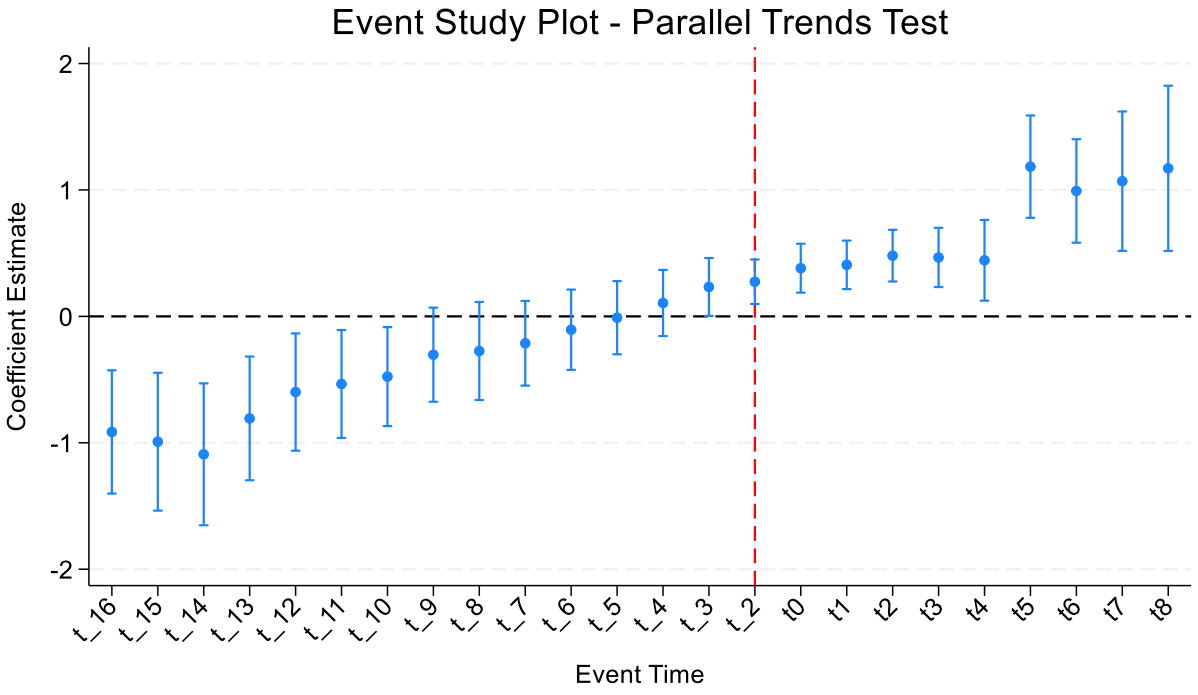


Figure D1. LNATM.

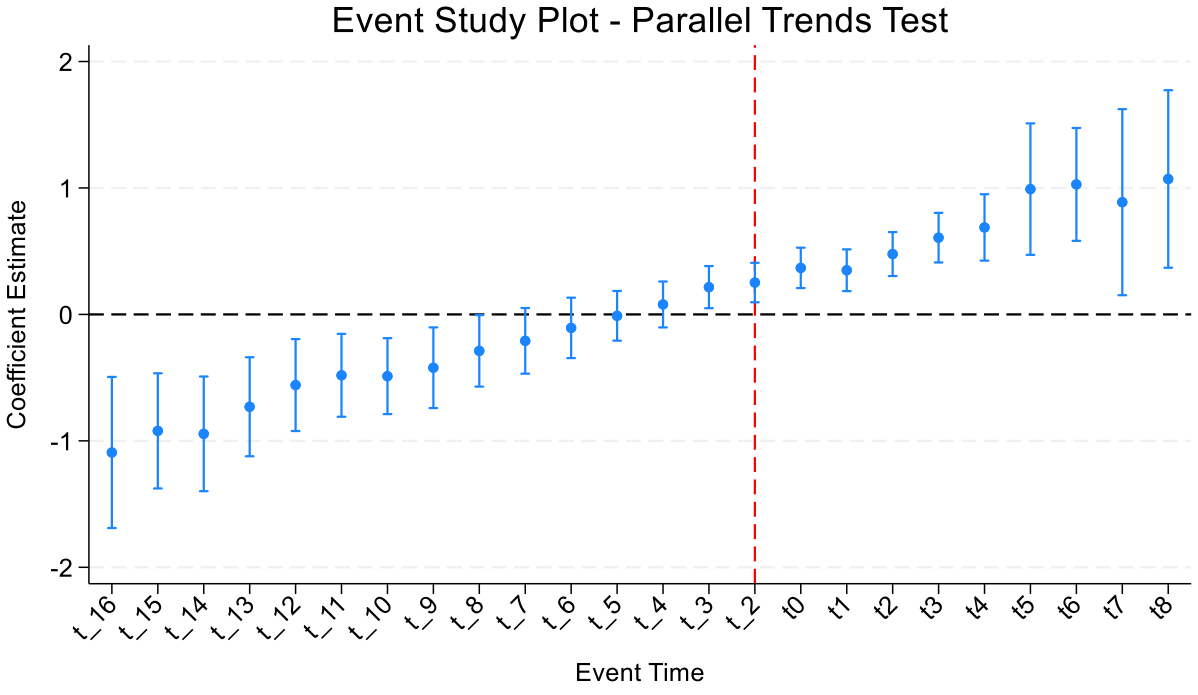


Figure D2. LNBORR.

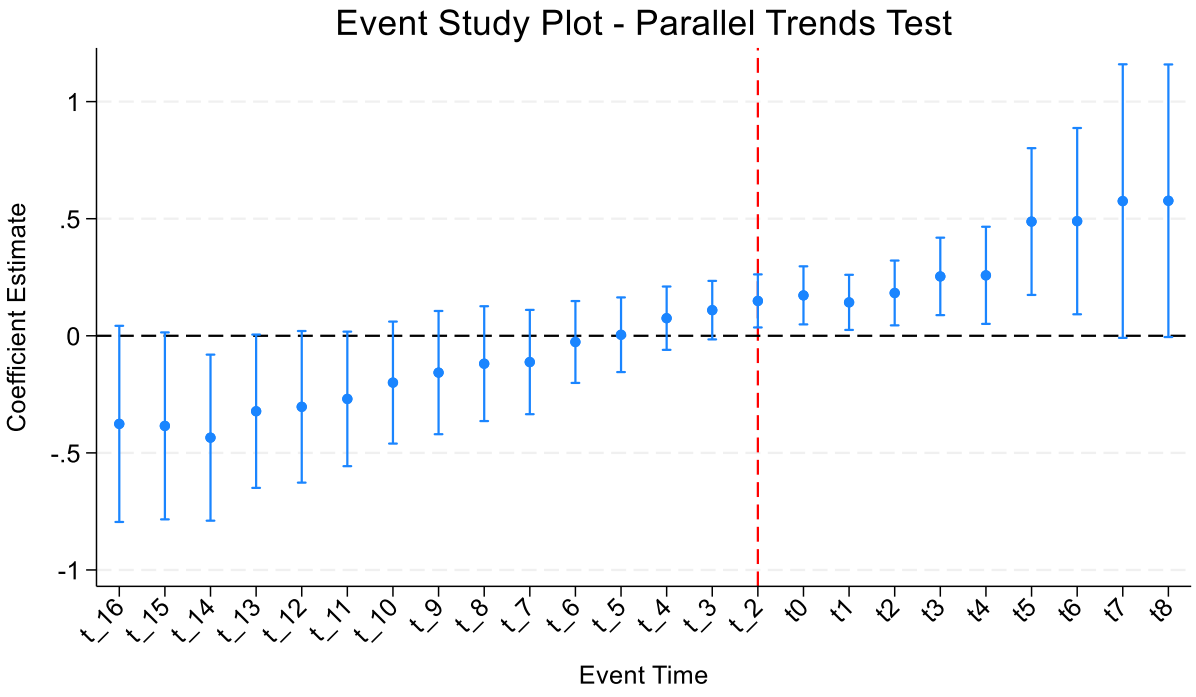


Figure D3. LNBRNCH.

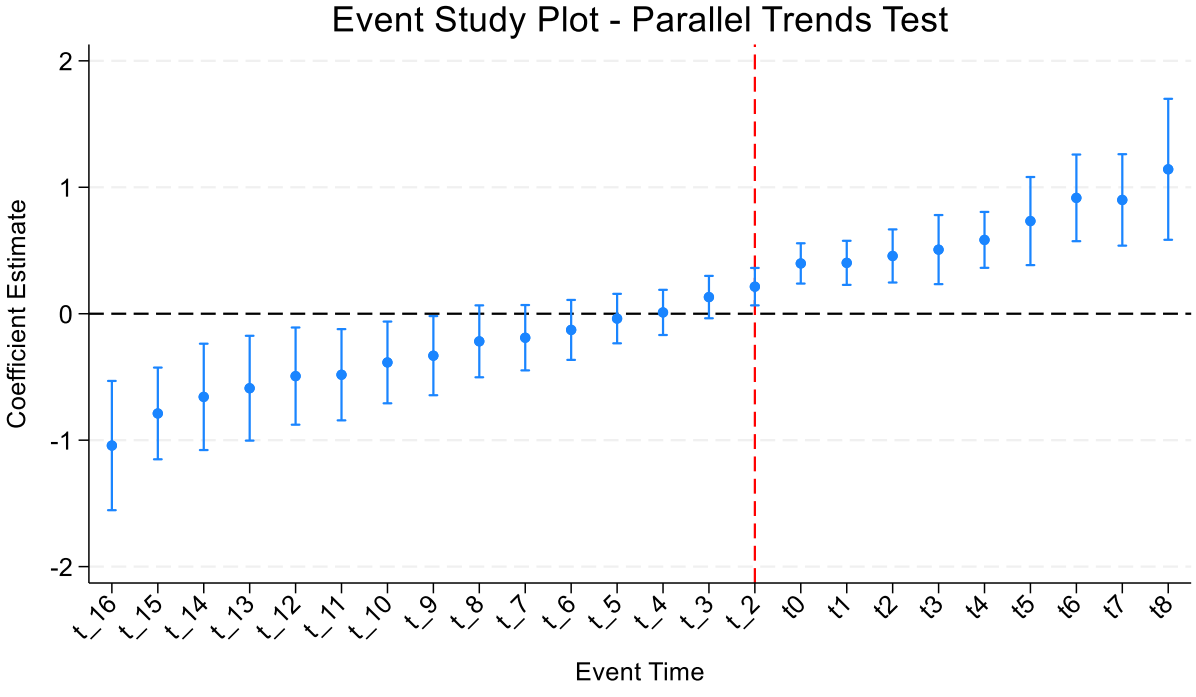


Figure D4. LNDEPO.

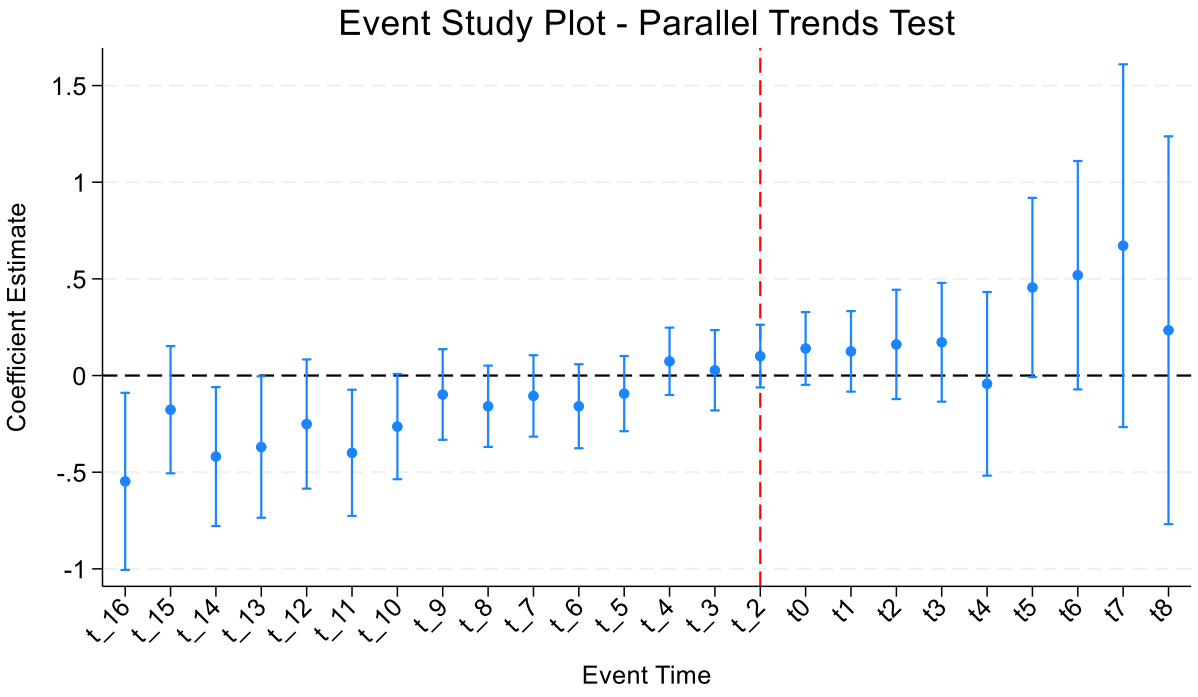


Figure D5. LIFEINS.

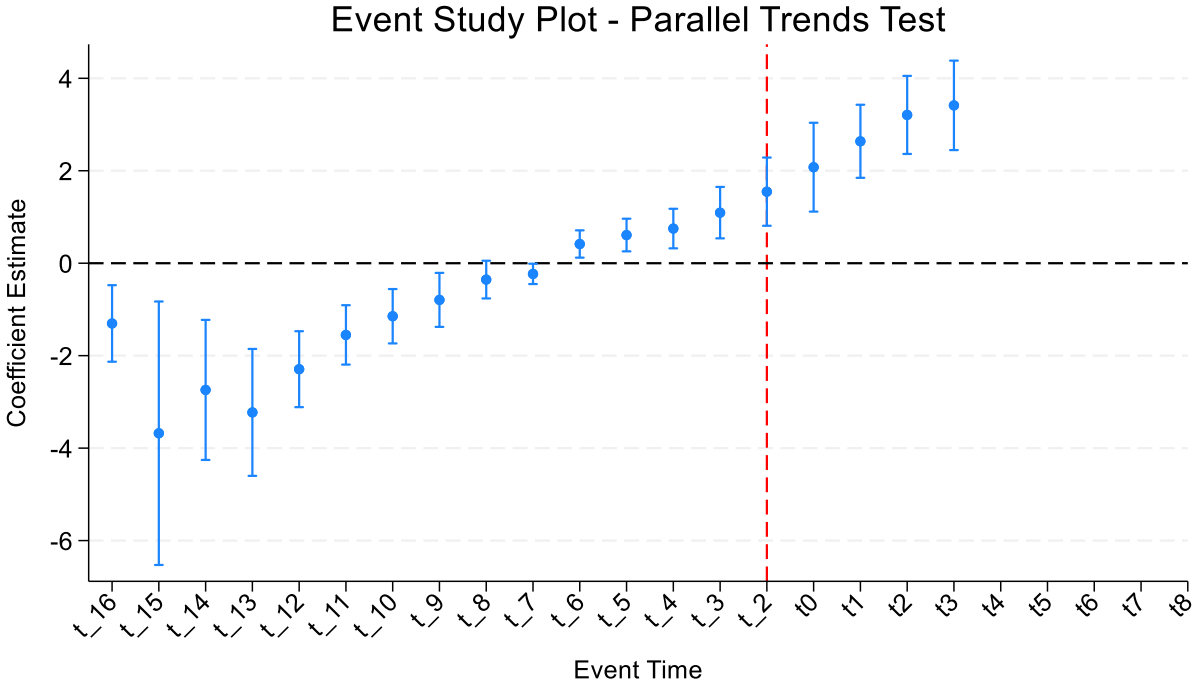


Figure D6. LNMOBILE.

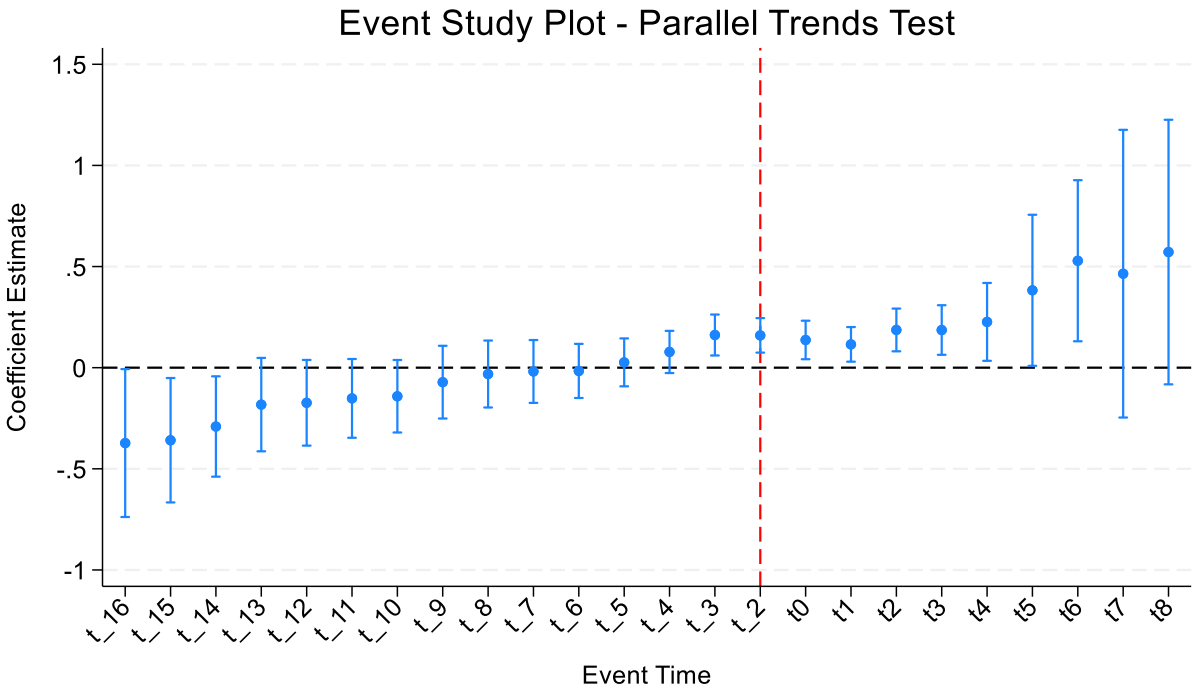


Figure D7. LNSMES.