The Impact of Bitcoin and Dollarization on Remittance Flows:

Evidence from El Salvador

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Abstract

This thesis examines whether the 2021 Bitcoin Law, introduced within El Salvador's pre-existing dollarization, had any measurable effect on remittance inflows. Using a Difference-in-Differences design, the study compares El Salvador to the Philippines—a country with similarly high remittance dependence, a shared colonial legacy under Spanish rule, and broadly comparable institutional foundations, but unaffected by the reform—over the period 1990–2023. The analysis focuses on remittances per capita in natural logarithmic form and includes covariates such as GDP per capita and pandemic effects. The baseline model finds no statistically significant effect of the reform. In contrast, the fully adjusted model yields a large and marginally significant increase in remittances; however, the magnitude appears implausible given survey data and macroeconomic indicators. A placebo test using pre-treatment years supports the parallel trends assumption. Overall, the findings suggest that Bitcoin adoption did not meaningfully alter remittance behavior in the short term, highlighting the limitations of legal mandates in changing financial habits without enabling conditions. The study contributes to the literature on digital currency reforms by isolating a remittance-specific outcome and offering insights into the behavioral constraints of financial digitalization.

Keywords: Remittances, Bitcoin Law, El Salvador, Dollarization, Difference-in-Differrences

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Abbreviations

Abbreviation	Description
ARDL	Autoregressive Distributed Lag
ATM	Automated Teller Machine
DiD	Difference-in-Differences
GDP	Gross Domestic Product
KYC/AML	Know Your Customer / Anit-Money Laundering

1. Introduction

Remittances are a critical financial lifeline in many developing countries, and nowhere is this more evident than in El Salvador, where they account for over 24% of GDP (World Bank Group, 2023a). With millions relying on these transfers for basic needs (USDA, 2023), any policy affecting remittance flows carries profound economic and social implications. Despite a global shift toward digital finance, remittance costs remain high, with traditional money transfer channels still dominating (Frisancho & Parrado, 2021). In 2021, El Salvador became the first country in the world to adopt Bitcoin as legal tender—a bold and controversial move, intended to reduce remittance costs, improving transaction speed, and expand financial inclusion (IMF, 2025a).

This thesis examines whether the 2021 Bitcoin Law, introduced within El Salvador's pre-existing dollarization, had any measurable effect on remittance inflows. The reform's stated goal of enhancing remittance efficiency makes this question especially relevant given the country's heavy reliance on cross-border transfers. To estimate the causal impact, a difference-in-differences (DiD) design is employed, comparing El Salvador to the Philippines—a structurally comparable but unaffected control group—using panel data from 1990 to 2023.

Existing literature has established the important role of remittances in poverty reduction, economic growth, and financial development across Latin America (e.g., Vacaflores, 2018; Ekanayake & Moslares, 2020). Scholars have also documented the stability and vulnerability of remittance flows under shocks such as COVID-19 (Caruso et al., 2021). Most closely related to this study, Goldbach and Nitsch (2024) assess the Bitcoin reform's effect on capital inflows using a DiD approach. However, their focus is broader and does not isolate remittances, leaving room for further research on household-level financial behavior.

This thesis makes three key contributions. First, it isolates the effect of Bitcoin adoption on remittances specifically—an outcome of direct relevance to household welfare—rather than aggregate capital flows. Second, it introduces the Philippines as a control group, enhancing identification by reducing regional spillovers. Third, it applies a rigorous empirical strategy with multiple robustness checks, including placebo testing and covariate adjustments, to strengthen the causal interpretation.

The remainder of the thesis is structured as follows. Chapter 1 outlines the background on remittances in El Salvador and the rationale for the Bitcoin reform. Chapter 2 reviews the literature on remittances, digitalization, and Bitcoin adoption. Chapter 3 describes the data and methodology, including the DiD framework. Chapter 4 presents the empirical results and a placebo test. Chapter 5 discusses the findings and their implications. Chapter 6 outlines key limitations, and Chapter 7 concludes with suggestions for future research.

1.1 Background

This section provides the contextual foundation for analyzing Bitcoin adoption and its potential impact on remittance flows in El Salvador. It begins by outlining the macroeconomic importance of remittances and the implications of dollarization for remittance reliance and monetary flexibility. The section then turns to Bitcoin's theoretical appeal for cross-border transfers, followed by an overview of El Salvador's 2021 Bitcoin reform and its implementation through the Chivo Wallet. Finally, broader regional and global factors—such as the COVID-19 pandemic and the choice of control group—are also discussed to situate the analysis within a comparative and time-sensitive framework.

1.1.1 The Role of Remittances in the Salvadoran Economy

Remittances play a central role in El Salvador's economy, accounting for 24.1 percent of GDP (World Bank Group, 2023a). According to the Central Reserve Bank and survey data collected in collaboration with the International Organization of Migration, approximately 94 percent of these inflows originate from the United States. An estimated 1.1 million Salvadorans residing in the U.S.—equivalent to roughly 25 percent of Salvadoran households—send remittances on a regular basis to support their families. The survey further reveals that 95 percent of recipients use these funds for household consumption, including food, healthcare, and education (USDA, 2023). These dynamics help explain the recent surge in domestic consumption and contribute to the country's broader economic resilience.

1.1.2 Dollarization in El Salvador

In January 2001, El Salvador officially adopted the U.S. dollar as legal tender through the Monetary Integration Law, replacing the colón. The primary objectives of the reform were to lower interest rates, reduce currency risk, and promote macroeconomic stability by adopting a currency associated with strong monetary credibility (IMF, 2005). However, dollarization also resulted in the loss of independent monetary policy, as the Central Reserve Bank of El Salvador no longer had control over interest rates or the domestic money supply—functions now determined by the U.S. Federal Reserve (Swinston, 2011). Within this monetary framework, external financial flows—particularly remittances—have become increasingly important for maintaining liquidity and supporting economic resilience. According to the World Bank Group (2025), El Salvador remains closely integrated with the U.S. economy through both trade and remittances, making these flows vital within a dollarized regime.

1.1.3 Bitcoin as a Financial Technology

Bitcoin is a decentralized digital currency introduced in 2008 by the pseudonymous developer Satoshi Nakamoto. Unlike traditional currencies, Bitcoin operates without a central bank or intermediary, relying instead on a peer-to-peer network maintained through a blockchain ledger (Nakamoto, 2008). Transactions are secured using cryptographic methods and are recorded transparently, enabling trust without centralized oversight. One of Bitcoin's foundational purposes, as stated by Nakamoto (2008), was to facilitate peer-to-peer payments without involving financial institutions. This design has been linked to the potential of reducing transaction costs, particularly in the context of cross-border money transfers. While Bitcoin was initially envisioned as a low-cost alternative to traditional payment systems (Nakamoto, 2008), empirical studies show that transaction fees fluctuate with network congestion (Tsang & Yang, 2021), which raises concerns about its long-term sustainability for remittances. Nevertheless, digital remittance channels in general have been found to lower remittance costs compared to traditional methods (Bersch et al., 2021).

1.1.4 The Bitcoin Law in El Salvador

On September 7, 2021, El Salvador became the first country in the world to adopt Bitcoin as legal tender, alongside the U.S. dollar. The legislation, commonly referred to as the "Bitcoin Law", was passed by the Legislative Assembly and required all economic agents to accept Bitcoin as a means of payment when offered by the buyer (Legislative Assembly of El Salvador, 2021). To facilitate this transition, the government launched Chivo Wallet—a digital wallet offering a $30 Bitcoin incentive upon registration—and installed a network of Bitcoin ATMs across the country (Quirk, 2021).

The reform was introduced with the stated goals of increasing financial inclusion, accelerating transaction speed, and reducing the cost of remittance transfers (Halaszyn, 2024; IMF, 2025a). Given the central role of remittances in the Salvadoran economy, the Bitcoin Law represented a radical policy experiment aimed at transforming the management of cross-border financial flows.

Although Bitcoin remained legal tender throughout the time frame analyzed in this study (2021–2023), it is worth noting that the law was repealed in 2025 as part of El Salvador's agreement with the International Monetary Fund (IMF, 2025b). This policy reversal, however, falls outside the temporal scope of the present analysis.

1.1.5 Bitcoin's Limited Uptake

Despite El Salvador's ambitions, empirical evidence indicates that actual Bitcoin usage within the country has remained low. A national survey by Alvarez et al. (2022) found that while many citizens downloaded the Chivo Wallet to claim the $30 incentive, only a small fraction continued to use the application for regular transactions. In fact, fewer than 20 percent of respondents reported continued use of the Chivo Wallet—and primarily for transactions in U.S. dollars. Less than 10 percent continued to use it for transactions in Bitcoin, and most remittances continued to flow through traditional channels. The study also found no evidence that the Chivo Wallet was being used to send remittances at any meaningful scale.

Several factors have contributed to this limited adoption. These include technological barriers such as unreliable internet access, widespread unfamiliarity with digital financial tools, Bitcoin's price volatility, and general distrust toward government-backed applications (Halaszyn, 2024). Moreover, the IMF (2025b) notes that the government has not actively enforced the legal requirement for businesses to accept Bitcoin, further weakening its role as a functional legal tender.

While these constraints raise important questions about the practical effectiveness of the reform, it remains relevant to investigate whether the introduction of Bitcoin—within El Salvador's already dollarized framework—had any effect on remittance flows. Even with limited direct usage, the reform's announcement, initial infrastructure investments, and short-term promotional activity may still have triggered behavioral responses. This study addresses that possibility using a difference-in-differences approach.

1.1.6 Cost Savings Through Digital Remittances

The digitalization of remittances has proven to be an effective strategy for reducing transaction costs and expanding access to financial services, particularly in low- and middle-income countries. According to the International Fund for Agricultural Development (IFAD & World Bank Group, 2021), sending $200 through cash-based services costs an average of 6.89 percent, compared to 4.6 percent for digital remittances. Mobile-to-mobile transfers are even more affordable, averaging 4.11 percent. These cost reductions are driven by improved infrastructure, increased competition among providers, and the accelerated adoption of digital channels during the COVID-19 pandemic.

In El Salvador, the launch of the government-backed digital wallet—Chivo—further illustrates the potential for cost savings through digital remittances. The app enables users to send and receive Bitcoin without any additional fees beyond those charged on the blockchain (Chivo Wallet, n.d.). By removing intermediaries

and eliminating extra transaction costs, Salvadorans could potentially save millions of dollars in remittance transfers.

1.1.7 The Impact of COVID-19 on Remittances

The COVID-19 pandemic constituted one of the most significant global shocks during the study period, with considerable implications for migration and remittance flows. Early projections anticipated a sharp decline—up to 20 percent—in global remittance volumes, driven by widespread lockdowns, job losses, and economic uncertainty. Contrary to these expectations, however, remittance flows to low- and middle-income countries proved remarkably resilient, falling by only 1.6 percent in 2020 compared to 2019 (World Bank Group, 2021).

In Latin America and the Caribbean, remittance inflows even increased by 6.5 percent, reaching $103 billion in 2020. Although El Salvador experienced a steep decline during the second quarter, flows rebounded strongly in the latter half of the year. This recovery has been attributed to improved employment conditions in the United States—where the majority of Salvadoran migrants reside—combined with fiscal stimulus measures and a shift from informal to formal remittance channels, prompted by travel restrictions and the increased use of digital payment methods (World Bank Group, 2021; Kpodar et al., 2021).

Kpodar et al. (2021) provide empirical support for this mechanism. Their study shows that remittances responded positively to COVID-19 outbreaks in migrants' home countries and that formal channels gained prominence as global travel restrictions disrupted informal transfer methods. They also document that fiscal stimulus in host countries played a stabilizing role for remittance flows.

In the context of this thesis, these pandemic-related dynamics represent a relevant confounding factor. If changes in remittance flows after 2020 were driven more by global pandemic effects than by El Salvador's Bitcoin reform, this could bias the analysis. However, by selecting a control country similarly exposed to the pandemic and including controls such as GDP per capita and a COVID-period dummy variable, the empirical strategy accounts for broad macroeconomic shocks that may have affected both countries in parallel.

1.1.8 Rationale for Using the Philippines as Control Group

This study uses the Philippines as the control group in the difference-in-differences design. Despite its geographical distance from El Salvador, the Philippines shares key structural characteristics that support its selection. Most notably, it is one of the largest recipients of remittances globally—ranking fourth

in 2023, with inflows totaling $40 billion (World Bank Group, 2023c), equivalent to approximately 8.9 percent of GDP (World Bank Group, 2023b). This comparable reliance on remittance income provides a strong basis for the parallel trends assumption.

Both El Salvador and the Philippines were governed by the Spanish Empire for extended periods—El Salvador from approximately 1524 to 1821, and the Philippines from 1565 to 1898. For much of that time, both were administered through the Viceroyalty of New Spain. During this era, Spanish civil law traditions and administrative institutions were introduced in both countries. Although their institutional paths have since diverged, this shared colonial legacy provides historical context that may contribute to structural comparability in the analysis of remittance behaviour and related financial policies (Browning & Flemion, 2025; Cullinane & Borlaza, 2025).

2. Literature Review

This chapter reviews relevant literature to contextualize the thesis within three strands of existing research: the socio-economic impacts of remittances, the vulnerability and digitalization of remittance flows under external shocks, and recent empirical evaluations of El Salvador's Bitcoin reform. The first strand underscores the developmental role of remittances in Latin America, highlighting their contributions to poverty alleviation, economic growth, and financial inclusion. The second body of work examines how global shocks—particularly the COVID-19 pandemic—have tested the resilience of remittances and shaped the adoption of digital transfer mechanisms. The final section reviews Goldbach and Nitsch's (2024) recent analysis of Bitcoin adoption in El Salvador, identifying both methodological and conceptual distinctions from the present study. Together, these strands provide the foundation for evaluating whether the Bitcoin reform measurably affected remittance flows to El Salvador, while situating this thesis within wider academic and policy discussions on digital finance and remittance-linked migration.

2.1 Remittances and Development in Latin America

Remittances are a key driver of socio-economic progress in Latin America and have therefore attracted substantial empirical interest. Vacaflores (2018) examines data from 18 Latin American countries between 2000 and 2013 using dynamic panel methods to assess whether remittances alleviate poverty and inequality. The study finds that higher remittance inflows significantly reduce overall poverty and income inequality in the region. Notably, while moderate poverty may worsen slightly, the reduction in overall poverty remains robust—indicating that the poorest segments of society benefit most. The effects are strongest in countries with lower remittance volumes or large diaspora populations, whereas domestic financial development plays only a limited role in enhancing the poverty-reducing impact of remittances. These findings position remittances as a stable safety net for low-income households, reinforcing their developmental importance and motivating closer examination of any policy—such as Bitcoin adoption—that could affect these flows.

Ekanayake and Moslares (2020) similarly emphasize the developmental role of remittances by analyzing their relationship with economic growth and poverty in 21 Latin American countries. Drawing on panel estimators and country-specific ARDL models for the 1980–2018 period, the authors test whether remittances stimulate long-run economic growth and reduce poverty. Their findings indicate that remittances have a positive and statistically significant effect on long-run

GDP growth in most countries, even though short-run effects are mixed. In addition, remittances are associated with lower national poverty rates, reinforcing the pattern identified by Vacaflores. By applying multiple econometric techniques, the study provides robust evidence that remittances function both as a growth catalyst and a poverty-reduction mechanism in Latin America. These insights strengthen the rationale for studying how policies that influence remittance flows—such as Bitcoin reform—could generate broad economic repercussions.

Beyond their macroeconomic and poverty implications, remittances have also been studied in relation to financial sector development. Fromentin (2018) explores this nexus using data from 32 Latin American and Caribbean countries and several dynamic panel estimators. The study documents a strong bidirectional relationship: remittances significantly promote financial development, while deeper financial systems lead to higher remittance inflows. This positive feedback loop suggests that remittances may support banking sector expansion—perhaps by increasing deposits or service demand—while financial inclusion makes it easier for migrants to send money home. Fromentin's findings are directly relevant to El Salvador's Bitcoin reform, which was introduced in part to promote financial inclusion. By altering the medium through which remittances are sent, Bitcoin adoption could affect this remittance–finance linkage—a possibility that places this thesis within the broader literature on financial development.

2.2 Remittances During Shocks and the Limits of Digitalization

The stability of remittance flows has been tested during periods of economic shocks, with recent studies focusing on the COVID-19 pandemic. Caruso et al. (2021) model the pandemic's impact on remittance-dependent countries in Central America—a region where remittances constitute a significant share of GDP (over 24 percent in El Salvador, as noted in section 1.1.1). Using U.S. labor market shocks and country-level data, they simulate a pandemic-induced drop in remittances and estimate the poverty implications. Their results suggest a sharp 14 percent decline in 2020 remittance inflows to Central America, with heterogeneous effects across countries: El Salvador and Nicaragua were projected to be hardest hit, while Panama would be least affected. Consequently, poverty in El Salvador was expected to rise by approximately 6 percent (compared to 1 percent in Guatemala) due to the remittance shock (Caruso et al., 2021). These findings underscore both the resilience and vulnerability of remittance flows—they are essential for household welfare, yet remain susceptible to external disruptions. This context is vital for the present thesis: understanding the baseline volatility and importance of remittances in El Salvador helps explain the rationale

behind a policy like Bitcoin adoption—aimed at easing remittance transfers—and why its effects warrant rigorous evaluation.

Alongside these shock-focused studies, scholars and institutions have examined whether the pandemic accelerated a shift toward digital remittances. Frisancho and Parrado (2021) investigate remittance service usage in Latin America during COVID-19, using Google search data to proxy demand for digital versus traditional transfer channels. They find that the collapse and rapid rebound of remittance flows in 2020 was accompanied by only a modest and temporary increase in interest in digital remittance methods. In other words, although lockdowns initially forced some senders to experiment with online or mobile platforms—and reduced reliance on brick-and-mortar transfer services—this effect proved short-lived. Traditional, cash-based providers regained dominance once mobility restrictions were lifted. This suggests that habit and accessibility continue to favor conventional remittance channels in the region. For the current thesis, this insight tempers expectations that simply introducing a new digital option—such as a national cryptocurrency wallet—would significantly alter remittance behaviour. It highlights the importance of assessing actual adoption and usage patterns, as is done in this study of Bitcoin in El Salvador, rather than assuming that the availability of technology leads to widespread use.

In a related contribution, Bersch et al. (2021) assess the potential of financial technology (fintech) innovations to improve remittance systems in Central America, offering relevant context for why digital currency was considered a potential solution. Their IMF study emphasizes that digital remittances remain nascent in the region, hindered by behavioral inertia, marginal cost advantages over cash methods, and low levels of financial literacy. The authors argue that while fintech solutions can reduce transfer costs and expand services to unbanked populations, this potential can only be realized through supportive partnerships and enabling policies. They stress the importance of strategic alliances between traditional money transfer operators and fintech firms, as well as the need for regulatory clarity and proportional KYC/AML requirements to ensure that small transfers are not discouraged by compliance burdens. (Bersch et al., 2021).

This study is highly relevant to the Salvadoran Bitcoin experiment: it reinforces that technology alone is insufficient—user trust, financial education, and regulatory support are crucial. Notably, most fintech innovations expand through voluntary adoption, whereas El Salvador's Bitcoin reform mandated legal acceptance, introducing a fundamentally different policy dynamic. In such a context, limited digital literacy, unreliable internet access, or incompatible devices may not simply reduce adoption but actively undermine the effectiveness of a legally imposed fintech solution. This thesis builds on these insights by evaluating whether a state-mandated digital alternative—introduced under assumptions of broad feasibility—had any measurable impact on remittance flows.

2.3 Bitcoin Reform and Remittances: Extending Prior Research

Goldbach and Nitsch (2024) examine the impact of El Salvador's Bitcoin reform on capital inflows using a difference-in-differences (DiD) approach with quarterly data. Their analysis focuses on aggregate capital flows rather than isolating remittances, which are more directly relevant to household welfare in El Salvador. While they report a temporary increase in capital inflows followed by a decline, the findings suggest that the reform's impact may have been short-lived or confined to specific sectors. Crucially, because remittances are not examined separately, their study leaves room for further research into how this specific component of external flows was affected.

Another notable difference lies in the selection of the control group. Goldbach and Nitsch primarily use neighboring Central American countries, which helps minimize the risk of heterogeneous external shocks. However, these countries may have been indirectly influenced by El Salvador's policy decisions. This thesis instead employs the Philippines as a control group, offering geographic distance and reducing concerns over regional spillovers. While this approach requires a more robust justification for structural comparability, such reasoning is provided in the background section.

In doing so, this thesis complements the previous study by isolating a more direct and economically salient outcome—remittances—and by adopting an alternative identification strategy that provides new insights into the effects of Bitcoin adoption.

3. Methodology

This chapter outlines the data, empirical approach, and identification strategy used to estimate the causal effect of El Salvador's Bitcoin reform on remittance flows. The analysis applies a difference-in-differences (DiD) framework, comparing changes in remittance trends over time between El Salvador—where the reform was implemented—and the Philippines, which serves as an unaffected control group.

3.1 Data and Variables

The study uses annual country-level data spanning from 1990 to 2023 for El Salvador and the Philippines. The outcome variable, remittances per capita, is expressed in natural logarithmic form, which normalizes the distribution, reduces the influence of outliers, and enables interpretation of coefficients in percentage terms. The treatment group is El Salvador, which implemented its Bitcoin reform in 2021. The Philippines functions as the control group and was selected due to its structural comparability and lack of exposure to the Bitcoin policy.

The DiD framework is operationalized through a binary indicator for El Salvador, a binary post-treatment indicator equal to 1 from 2021 onwards, and an interaction term capturing the average treatment effect. Additional control variables include GDP per capita and its squared term to account for non-linear income effects, as well as a dummy variable for the COVID-19 period (2020–2022) to control for pandemic-related distortions. All monetary values are expressed in current U.S. dollars. The regression model is estimated with robust standard errors clustered at the country level to correct for within-country serial correlation. However, the limited number of clusters (two countries) warrants cautious interpretation of statistical significance.

Below is an overview of the key variables used in the regression models and how to interpret them:

Table 1. Variable interpretation.

Variables	***Description***	***Interpretation***
Interaction	Interaction between being El Salvador and post-2021 period	The difference-in-difference estimator; captures the causal effect of the Bitcoin reform
El Salvador	Dummy variable: 1 if El Salvador, 0 if Philippines	Pre-treatment difference in remittance levels between El Salvador and the control group
Post (2021-2023)	Dummy variable: 1 for years ≥ 2021	Captures time trends affecting both countries after the Bitcoin reform
GDP per Capita	GDP per capita in current USD	Measures the linear effect of economic development on remittance inflows
GDP per Capita^2	GDP per capita squared	Captures non-linear (e.g., diminishing) effects of income on remittances
COVID	Dummy variable for COVID-affected years	Captures changes in remittances attributable to the global pandemic

3.2 Econometric Specification

The DiD regression model is specified as follows:

$$\ln(RemittancesPerCapita_{it}) = \beta_0 + \beta_1 El\ Salvador_i + \beta_2 Post_t + \beta_3(El\ Salvador_i + Post_t) + \beta_4 GDP_{it} + \beta_5 GDP_{it}^2 + \beta_6 COVID_{it} + \varepsilon_{it}$$

The coefficient of interest is β_3, which captures the average treatment effect of the Bitcoin reform on remittances per capita in El Salvador, relative to the Philippines. The model is estimated using country-level panel data, where *i* indexes the country (El Salvador or the Philippines) and *t* indexes the year (1990-2023). The error term, ε_{it}, captures unobserved factors that affect remittance flows and may vary across countries and over time.

3.3 Assumptions and Identification Strategy

A central assumption of the DiD method is that, absent the treatment, the treated and control units would have followed parallel trends in the outcome variable (Huntington-Klein, 2021). This parallel trends assumption is evaluated using two strategies. First, visual inspection of pre-treatment trends in logged remittances per capita reveals broadly similar trajectories for El Salvador and the Philippines. Second, a placebo regression using only pre-treatment years (with a fictitious treatment year set to 2018) is conducted. These diagnostic tools support the plausibility of the identifying assumption (Huntington-Klein, 2021).

3.4 Institutional Context and Interpretation

It is important to note that El Salvador had already dollarized in 2001, meaning that the Bitcoin reform was introduced within a highly digitized and dollar-based remittance system. Because El Salvador was already dollarized prior to the Bitcoin reform, the analysis is not confounded by currency conversion issues. This facilitates isolating the specific impact of adding Bitcoin as legal tender, without mixing it up with broader changes to the country's monetary system.

Taken together, this methodology aims to provide a credible empirical estimate of the Bitcoin reform's impact on remittance flows while addressing key econometric and contextual considerations.

4. Results

This chapter presents the empirical results of the study. It begins by assessing the plausibility of the parallel trends assumption, followed by an interpretation of the model's key variables to aid in understanding of the regression outputs. The main results are then presented, along with a placebo test using pre-treatment years to further evaluate the validity of the identification strategy. The chapter concludes with a summary of the key findings. By progressively building the empirical framework, this chapter aims to clarify both the robustness and interpretability of the causal estimates.

4.1 Parallel Trends Assumption

Before presenting the main results, it is essential to assess whether the parallel trends assumption is likely to hold. To this end, Figure 1 plots raw (unlogged) remittances per capita over time for El Salvador and the Philippines. This unadjusted comparison serves a diagnostic purpose: it illustrates baseline differences in remittance behaviour without controlling for structural, country-specific factors. Because this simple visual comparison reveals divergent trends, it underscores the importance of including covariates—such as GDP per capita—to adjust for these differences in the main analysis.

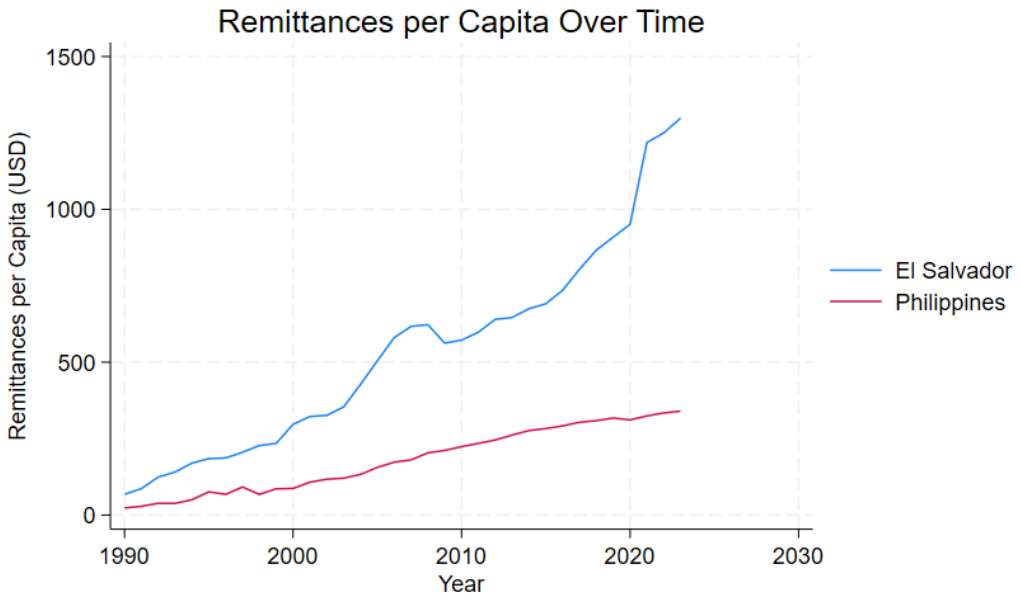

Figure 1. Remittances per capita in El Salvador and the Philippines, 1990-2023.

As illustrated in Figure 1, the pre-reform trajectories of remittances per capita differ noticeably between El Salvador and the Philippines. The divergence indicates that the parallel trends assumption would not be satisfied in an unadjusted model. It therefore justifies the application of both covariate adjustments and a logarithmic transformation, which together improve trend comparability and reinforce the validity of the difference-in-differences design.

To better assess the plausibility of the parallel trends assumption, Figure 2 presents the natural logarithm of remittances per capita for El Salvador and the Philippines. This transformation reduces scale differences and allows percentage changes to be compared more meaningfully across countries. Combined with the inclusion of relevant covariates in the regression model, the log specification offers a more accurate view of underlying trend similarities—especially important for validating the use of the difference-in-differences approach.

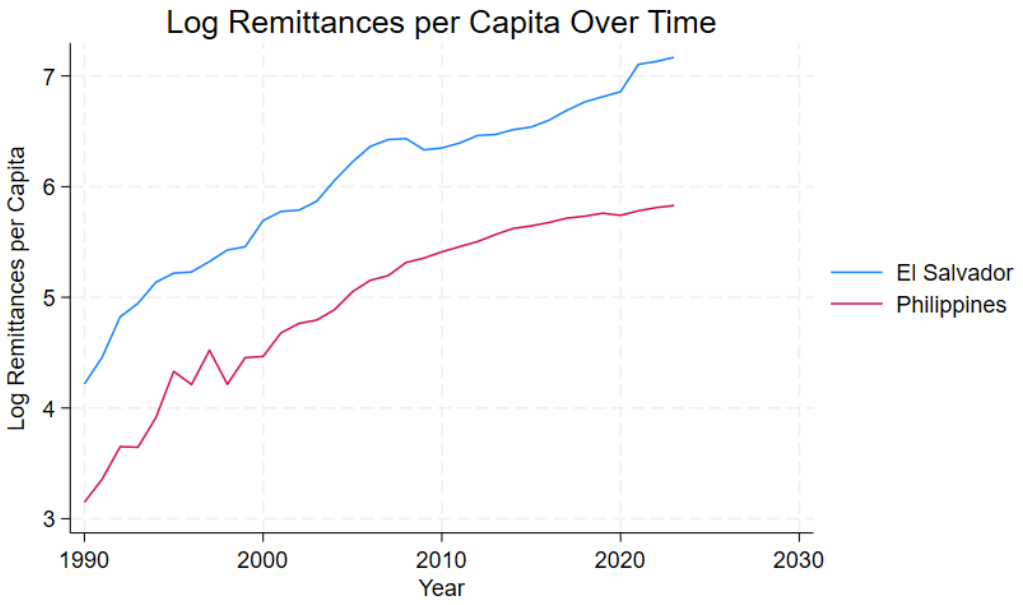

Figure 2. Log of remittances per capita in El Salvador and the Philippines, 1990-2023.

As shown in Figure 2, the log-transformed remittances per capita exhibit relatively parallel pre-reform trends between El Salvador and the Philippines. This visual similarity supports the validity of the parallel trends assumption in the adjusted model. By controlling for structural factors and focusing on relative changes, the logarithmic specification enhances comparability between treatment and control groups, lending greater credibility to the causal inference drawn from the DiD estimation.

4.2 Difference-in-Difference Regressions

Table 2. Effect of Bitcoin Reform on Log Remittances.

Variable	Baseline Model	Main Model
El Salvador	0.762***	0.709**
	(0.0871)	(0.027)
Post (2021-2023)	-0.775***	0.077
	(0.231)	(0.29)
Interaction	-0.024	1.072*
	(0.287)	(0.145)
GDP per Capita	0.000331***	0.01**
	(0.0000215)	(0)
GDP per Capita^2	-	0*
		(0)
COVID Dummy	-	-0.19
		(0.039)
Constant	3.278***	1.472***
	(0.119)	(0.006)
Observations	68	68
R-squared	0.882	0.958
Covid	NO	YES
GDP squared	NO	YES

*Notes: The dependent variable is the natural logarithm of remittances per capita. Robust standard errors clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.*

The baseline difference-in-differences regression uses the natural logarithm of remittances per capita as the dependent variable. The estimated coefficient on the treatment interaction term is −0.024. Using the transformation $\left(e^{\beta} - 1\right) x\ 100$, this corresponds to an approximate 2.37 percent decrease in remittances in El Salvador relative to the Philippines following the 2021 reform. However, the estimate is statistically insignificant, indicating that the Bitcoin reform did not produce a measurable effect on remittance flows.

When control variables are included, the interaction term becomes positive and marginally significant at the 10 percent level. The coefficient suggests an approximately 192 percent increase in remittances per capita in El Salvador compared to the Philippines, after accounting for GDP per capita, non-linear income effects, and COVID-related impacts. However, this result should be interpreted with caution due to statistical uncertainty. With only two clusters—El Salvador and the Philippines—standard errors may be imprecise, limiting the reliability of significance levels.

4.3 Placebo Test

Table 3. Placebo Test with 2018 as Treatment Year.

Variables	Placebo Model
El Salvador	0.730***
	(0.0892)
Placebo Post (2018-2023)	-0.780***
	(0.190)
Placebo Interaction	-0.0348
	(0.206)
GDP per Capita	0.000369***
	(0.0000253)
Constant	3.148***
	(0.128)
Observations	68
R-squared	0.890
Covid	NO
GDP squared	NO

*Notes: The dependent variable is the natural logarithm of remittances per capita. The placebo test assigns 2018 as the fictious treatment year. Robust standard errors clustered at the country level. *** p<0.01, ** p<0.05, *p<0.1.*

To assess the credibility of the parallel trends assumption, a placebo test was conducted by assigning a fictitious treatment year of 2018. This approach enables an evaluation of whether any statistically significant differences in remittance trends existed between El Salvador and the Philippines prior to the actual policy implementation in 2021. Had such differences had emerged, they would have called into question the assumption that the two countries followed similar pre-treatment trajectories.

The results of the placebo regression indicate that the interaction term is statistically insignificant. This suggests that no systematic divergence in remittance trends occurred around the placebo year, thereby lending support to the parallel trends assumption. While this does not conclusively validate the assumption, it increases confidence in the identification strategy by providing no evidence of spurious pre-treatment effects.

Consequently, the placebo test strengthens the credibility of the difference-in-differences framework and supports the interpretation that any observed post-2021 changes in remittance flows are plausibly attributable to the Bitcoin reform rather than to underlying pre-existing trends.

4.4 Summary of Findings

Taken together, the empirical results offer mixed evidence regarding the effect of El Salvador's Bitcoin reform on remittance flows. In the baseline difference-in-differences specification, which excludes additional controls, the estimated treatment effect is statistically insignificant and close to zero. This suggests no measurable impact of the 2021 reform on remittances per capita when controlling only for time and country fixed effects.

However, when macroeconomic covariates such as GDP per capita, its squared term, and a COVID-19 dummy are included, the estimated effect becomes large and positive, reaching marginal statistical significance. While this result could indicate a potential increase in remittance flows following the reform, its magnitude appears implausibly high given available descriptive and survey-based evidence on Bitcoin usage. Moreover, the small sample size and limited number of clusters raise concerns about statistical reliability.

The placebo regression, using 2018 as a false treatment year, reveals no significant pre-treatment differences between El Salvador and the Philippines, which supports the validity of the parallel trends assumption underlying the DiD approach. Overall, while the findings do not provide conclusive evidence of a causal effect, they call for cautious interpretation and suggest that any impact of the reform is likely to be context-dependent and mediated by additional factors.

5. Discussion

This study set out to examine whether the adoption of Bitcoin as legal tender in El Salvador in 2021 had any measurable impact on remittance inflows. Employing a difference-in-differences (DiD) approach with the Philippines as a control group and log remittances per capita as the outcome variable, the results provide mixed but ultimately inconclusive evidence of a treatment effect. Given that the Bitcoin reform was not introduced in direct response to remittance fluctuations, the policy can plausibly be treated as exogenous. This strengthens the credibility of the empirical design by reducing concerns about reverse causality or policy endogeneity.

The baseline specification found no statistically significant change in remittances following the reform. In contrast, the fully adjusted model—including controls for GDP per capita and pandemic effects—yielded a large and marginally significant increase. Specifically, the estimated effect corresponds to a nearly 192 percent rise in remittances per capita. While the estimated effect appears implausibly large at first glance, it is worth noting that Goldbach and Nitsch (2024) document a marked rise in broader capital inflows to El Salvador following the Bitcoin reform. Although their study does not isolate remittances, the observed increase in cross-border transactions suggests that certain financial channels may have responded more strongly than anticipated. If the reform succeeded in attracting more formal financial flows or temporarily shifting behavior among early adopters—such as digitally literate migrants or households with higher digital readiness—this could, in part, explain the elevated estimate. Nonetheless, the absence of supportive macroeconomic evidence limits the extent to which such dynamics can be confirmed, and the result should be interpreted with appropriate caution.

However, this magnitude is implausibly large and not supported by auxiliary evidence. Such an increase would imply a near doubling of remittance flows relative to the counterfactual trend, which would likely have manifested in user statistics, transaction volumes, or national financial accounts—none of which have provided evidence of such a shift, according to available surveys and institutional reports. Given that remittances already accounted for over 24 percent of El Salvador's GDP pre-reform, a surge of this scale would have produced visible macroeconomic ripple effects in household consumption, foreign reserves, or financial inclusion metrics. The absence of these signals suggests that the model may be attributing unrelated variation to the treatment variable, potentially due to overfitting, omitted confounders, or specification error. This disconnect between the model's output and real-world indicators casts doubt on the substantive meaning of the estimated effect, reinforcing the importance of cautious interpretation.

Importantly, these findings should be interpreted in the context of broader empirical insights into remittance behavior. Numerous studies have underscored the central role of remittances in reducing poverty, promoting economic growth, and supporting financial development in Latin America. As remittances are often a vital income source for the most vulnerable households, any change in volume—even marginal—could have meaningful welfare consequences. Against this backdrop, the absence of a clear policy effect in El Salvador suggests that the Bitcoin Law failed to alter a core financial lifeline, and by extension, did not affect the developmental outcomes linked to remittance flows.

One plausible explanation lies in the behavioral and structural limitations associated with digitalization efforts. Prior research indicates that digital remittance tools often face low uptake due to lack of trust, digital illiteracy, minimal perceived cost advantages, and infrastructural barriers. These frictions were particularly acute in El Salvador, where Bitcoin's price volatility and the limited enforcement of the reform further diminished its viability as a remittance vehicle. Notably, previous digital experiments in Central America have shown that even when new technologies are introduced, their impact is often transitory or limited to specific population segments. Thus, the persistence of cash-based remittance habits—reinforced by familiarity, accessibility, and reliability—likely overshadowed the reform's intended benefits.

It is also worth noting that remittances have shown resilience during economic shocks, particularly during the COVID-19 pandemic. Contrary to early forecasts of sharp declines, flows to Latin America remained strong or even increased, driven by fiscal stimulus in host countries, formalization of transfer channels, and migrants' commitment to supporting families back home. This resilience complicates the attribution of post-2021 changes in remittance trends to the Bitcoin reform alone, especially as economic recovery dynamics may have coincided with its implementation. Although the model includes a COVID-period dummy to address this, residual confounding effects are possible.

Finally, while the selection of the Philippines as a control group enhances geographic separation and mitigates policy spillovers, structural differences between the countries—such as diaspora composition or financial infrastructure—remain. These could have affected remittance patterns independently of the reform, casting additional uncertainty on the estimates.

In sum, the discussion underscores that policy ambition does not guarantee behavioral change. Legal mandates, in the absence of enabling conditions such as trust, usability, and clear incentives, are unlikely to transform established financial behaviors. This study contributes to the literature by empirically demonstrating how even high-profile digital currency reforms may have limited reach when structural readiness is lacking.

6. Limitations

Several limitations constrain the interpretation and generalizability of this study's findings. Most notably, the analysis is based on a small sample: only two countries observed over a 34-year period, with just three years of data available after the 2021 Bitcoin reform. This short post-treatment window limits the ability to detect long-term effects or behavioral shifts that may take time to materialize. Additionally, the small number of units restricts statistical power and reduces the reliability of inference. While standard practice is to cluster standard errors at the country level, doing so with only two clusters raises concerns about underestimated standard errors and inflated significance levels.

Second, although the parallel trends assumption is supported by visual inspection of the pre-treatment log trends and further backed by a placebo test, it cannot be formally verified. The structural comparability between El Salvador and the Philippines—justified through historical and institutional similarities—remains imperfect, and any unobserved time-varying differences between the countries may bias the estimated treatment effect.

Third, the analysis relies on macro-level data, which obscures heterogeneity in remittance behavior. Important variations in sender characteristics, recipient demographics, remittance channels, or transaction sizes cannot be observed. As such, the study cannot detect whether specific subgroups (e.g., digitally literate urban households) responded differently to the policy than others. It also cannot evaluate the frequency or mode of transfers, which are crucial to understanding technology adoption patterns.

Fourth, while GDP per capita and a COVID-period dummy are included to account for economic shocks, other unmeasured factors may have influenced remittance flows. These include U.S. stimulus policies, fluctuations in exchange rates, regional migration dynamics, or other domestic reforms not accounted for in the model.

Lastly, the study does not examine secondary channels through which remittance reforms might influence economic outcomes, such as effects on financial inclusion, banking sector development, or investment behavior. Previous research suggests that remittances and financial development are interlinked, potentially reinforcing one another over time. The exclusion of these dimensions narrows the scope of the analysis to short-term remittance volumes only.

7. Conclusion

This thesis investigated the impact of El Salvador's 2021 Bitcoin reform on remittance inflows, using a difference-in-differences methodology with the Philippines as a control group. The results provide no consistent evidence that the reform significantly altered remittance volumes in the short term. While one model specification yielded a large and positive effect, its credibility is undermined by conflicting survey evidence, implausibly high estimates, and limited statistical precision.

Given the developmental importance of remittances, particularly for poverty reduction and household resilience, the absence of measurable policy impact is itself a valuable finding. It suggests that digital currency reforms—even when introduced through legal mandate—are unlikely to succeed in shifting financial behaviors without addressing foundational constraints such as trust, digital literacy, and infrastructure readiness.

This study contributes to the literature by isolating a remittance-specific outcome in the context of a highly publicized monetary experiment. It highlights that technology-driven reforms require more than symbolic ambition; they demand complementary policies, inclusive design, and careful alignment with user needs and habits.

Future research should seek access to disaggregated data to assess adoption patterns and behavioral responses at the household level. Understanding who uses digital wallets, under what conditions and for which types of transfers, would provide deeper insights into the microfoundations of remittance behavior. Moreover, comparative studies across multiple countries—especially those with varying degrees of financial digitalization—could help identify the conditions under which cryptocurrency policies are most likely to succeed.

Although Bitcoin remained legal tender during the full time frame analyzed in this study (2021–2023), it is worth noting that the law was repealed in 2025 as part of El Salvador's agreement with the International Monetary Fund. However, this development lies outside the temporal scope of this analysis.

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