Geoeconomic Pressure, Dollar Dependence and the Harmonization of Global Finance: Evidence From Sanctions Enforcement

Andre Poyser
Auckland University of Technology
andre.poyser@aut.ac.nz

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Abstract

The impact of economic statecraft on the growth and development of financial markets is often overlooked; particularly, the effects of secondary sanctions and the role of dollar dominance. I quantify these effects by collecting 18 years (2003-2021) of data on secondary sanctions imposed on 690 financial and non-financial entities via Office of Foreign Assets Control (OFAC) enforcement actions and using the input–output network propagation framework proposed by Clayton, Maggiori and Schreger (2023) to link these actions to country-level measures of financial development. A dynamic difference-in-differences analysis provides support for the intuition that secondary sanctions have led to improvements in financial development across countries through institutional upgrading across the global financial network as financial institutions implement compliance programmes to address and avoid further sanctions violations. Consistent with a dollar-centered network channel, these effects are strongest for countries more integrated into U.S. dollar correspondent and securities networks, although sanctions pressure does not produce statistically meaningful shifts in reserve currency composition or central bank digital currency adoption. An examination of the sender-side effects of secondary sanctions reveals that financial development improves meaningfully only when enforcement originates at the core of U.S.-centric financial infrastructure and institutional upgrading within the U.S. diffuses through the exposure of non-U.S. institutions to USD correspondent and Swift linkages. The demonstration effect of major penalties on multinational financial institutions outside the U.S. does not propagate upgrading to the same extent.

JEL Classification: C4, F3, F4, G3.

Keywords: Geoeconomics, Sanctions, Chokepoints, Economic Coercion, International Political Economy.

1 Introduction

An open secret within the banking sector of many developing nations is that the widespread adoption of anti-money laundering (AML) and counter-terrorism financing (CTF) requirements was largely due to the threat of losing correspondent banking relationships with U.S. banks which faced stricter regulations aimed at combating the use of the financial system by terrorist groups in the aftermath of 9/11. Correspondingly, the implementation of the Common Reporting Standard (CRS) and ISO 20022[1] by financial institutions is a direct result of the policy actions of the U.S. Treasury Department to combat tax evasion using the supranational powers of the Foreign Account Tax Compliance Act (FATCA)[2] . Although several small states have experienced economic fallout from the risk of debanking, the AML/CTF standards and the CRS are generally viewed as catalysts which harmonized financial markets and institutions, ultimately leading to deeper financial development across the global financial sector (Gadzo and Klemencic, 2017; Ofoeda et al., 2022). One could argue that the enforcement of economic sanctions have had a similar effect.

A general consensus around economic sanctions is that they are intended to, and often do, have negative effects on target states (Gutmann, Neuenkirch and Neumeier, 2020; Drezner, 2024; Lee, 2024). However, as most economic sanctions are implemented through the plumbing and chokepoints of the global financial system, which is largely controlled by U.S.-led financial infrastructure, a less examined consequence of economic statecraft is the effect it may have had in forcing unsanctioned states to harmonize their financial systems to meet U.S. requirements so as to address and avoid sanctions violations. Sanctions enforcement, hereafter referred to as secondary sanctions and used interchangeably[3], which generally requires the cooperation of non-target states, often necessitates regulatory reform, greater transparency, and stronger institutional mechanisms within unsanctioned countries (Early and Preble, 2020a; Early and Peterson, 2021; Early and Peterson, 2023). These positive externalities, engineered through coercive control of the levers of global finance by the U.S. and supported by the dominant role of the dollar in international finance (Aizenman and Cheung, 2020), may have contributed to the development of financial markets and financial infrastructure in countries which would not have otherwise implemented the reforms. In their bid to achieve compliance, manage regulatory risk and respond to the geoeconomic pressure of secondary sanctions, countries may have evolved towards more developed financial institutions and financial markets. Another less examined financial system outcome of secondary sanctions is that they may have affected how countries manage their dollar dependence given the use of dollar system integration as a tool of economic warfare (Clayton, Maggiori and Schreger, 2026).

[1]Officially called ISO 20022 Financial Services - Universal financial industry message scheme.

[2]The CRS is an information standard for the Automatic Exchange Of Information (AEOI) regarding financial accounts on a global level, between tax authorities. The forerunner to the CRS is FATCA intergovernmental agreements (IGAs) negotiated between targeted tax haven countries and the U.S. Treasury Department.

[3]The International Relations and Political Science literature has defined secondary sanctions in various ways; for practical reasons, I have settled on a broad definition which will allow me to make use of the full sample of OFAC enforcement data.

To study these questions, I first construct a dataset which relates the enforcement actions of the Office of Foreign Assets Control (OFAC) in the U.S. Department of Treasury to the Financial Development (FD) Index produced by the International Monetary Fund (IMF). I then use country-level portfolio holdings of U.S. long-term securities, provided in the Federal Reserve's Enhanced Financial Accounts, to also test for a link between dollar system integration and the FD Index. Beyond the outcome of financial development, I further use the OFAC data to explore whether countries shift the currency composition of their international reserves in response to sanctions enforcement pressure and whether this in turn accelerates Central Bank Digital Currency (CBDC) adoption.

The basic economic intuition which allows me to link measures of geoeconomic pressure to financial market development and dollar system integration is based on the spillovers of geopolitical dynamics; an empirical case which supports this intuition is the spillovers of manufacturing growth and increased employment in space-related sectors attributed to the Cold War-era space race in recent empirical work by Kantor and Whalley (2025). Another motivating factor is the fact that the instruments of statecraft are often deployed with unintended consequences[4]. To discipline and formalize the basic intuition, I extend the organizing framework of geoeconomic pressure promulgated by Clayton, Coppola, Maggiori and Schreger (2025), hereafter referred to as the CCMS framework, by placing greater emphasis on studying bystanders and third-parties. The CCMS framework structures the analysis of geoeconomic pressure around senders, receivers, means and instruments but pays less attention to the spillover effects for states and entities which are neither senders nor receivers but may play intermediary roles in the targeting of the means and the implementation of the policy instruments.

From an empirical standpoint, it is not clear whether the spillover effects of economic statecraft should be positive or negative. In the updated version of the CCMS framework (Clayton, Maggiori and Schreger, 2026), both positive and negative spillovers are contemplated through production externalities and input–output network propagation which the sender or hegemon exploits if they are particularly favorable for its policy preferences. While sanctions are generally designed to impose costs on their targets, the network structure of global finance and the interdependent nature of cross-border financial intermediation means that enforcement shocks can also generate positive externalities which contribute to the global diffusion of financial development and deepening of dollar dominance. The global financial sector, therefore, provides an ideal empirical setting to test the input–output network propagation channel proposed in the CCMS framework.

The main insight I argue for is that secondary sanctions, effected by means of chokepoints in the U.S.-led financial infrastructure on which a majority of countries rely, serve as a coordinating mechanism by which the U.S. has foisted its policy preferences, for how financial

[4]A poignant example of this is the accelerated development of the DeepSeek artificial intelligence model by Chinese tech firms in response to semiconductor export controls. The export controls were intended to halt China's technological momentum but seem to have had the opposite effect.

institutions and financial markets should be operated globally, on third-parties and bystanders (Peterson, 2021). The adoption of these policy preferences, largely neoliberal in nature, I further argue, has had a harmonizing effect of improved financial development across countries. I also argue that dollar dominance plays a similar coordinating role for U.S. policy preferences[5].

A less contemplated consideration in the CCMS framework is the fact that a majority of enforcement actions for sanctions violations are actually targeted at entities domiciled in the sender country. One of the first stylized facts I document is that, OFAC enforcement actions overwhelmingly[6] target U.S. financial institutions, which, oftentimes, unwittingly violate sanctions by doing business with sanctioned countries and entities. Building on this basic empirical observation, I innovate within the input–output network propagation channel of the CCMS framework by arguing that improvement in financial development begins in the financial institutions and markets of the sender and through a process of diffusion and network propagation, spreads to third-parties and bystanders through the network of global finance. Financial institutions in the sender country which are subject to secondary sanctions are incentivized to invest in improving their systems, which would, in large part, entail greater management and control of the exposure they have to sanctioned countries and entities via their network connections to third-party and bystander financial institutions given that the primary way around sanctions is through these intermediaries. In order to maintain their position in the global financial network, third-party and bystander financial institutions are, in turn, also forced into institutional upgrading. In this dual structure (receiver-originating and sender-originating) extension to the CCMS framework, sanctions enforcement is not simply pressure on receivers, but also an endogenous driver of compliance upgrading in the sender's institutions, which then propagates globally through financial networks. This dual structure implies receiver-side effects which one would expect from the direct enforcement action each country faces[7] and sender-side effects which emanate from the sender and receivers and diffuses to third-parties and bystanders. Empirically, I distinguish and estimate both receiver-side effects and sender-side effects.

For the receiver-side effects of OFAC enforcement actions on financial development outcomes, I first make the strong assumption of an absorbing treatment regime and utilize the estimator developed by Callaway and Sant'Anna (2021). The absorbing design directly accommodates the fact that the majority of enforcement actions target U.S. entities; by collapsing repeated events into a single, persistent treatment state, it more faithfully isolates the sender-side effects for the U.S. and the receiver-side effects for other countries subjected to enforcement. I then relax the absorbing treatment assumption and, in keeping with the true data generating

[5]I ground these arguments in empirical work by Efing, Goldbach and Nitsch (2023), which uses the context of sanctions enforcement among German banks to show that harmonization with banks across non-target countries is often a pre-requisite for effective sanctions enforcement. The extensive OFAC compliance programmes that financial institutions are required to implement also provides some impetus for this argument (Early and Preble, 2020a; Early and Preble, 2020b).

[6]73% of OFAC enforcement actions are against U.S. based entities.

[7]In this instance receivers include target states, third-party and bystander states as well as the sender state which is simultaneously a sender and receiver.

process, allow enforcement exposure to switch on and off over time using the episodic estimator of de Chaisemartin and d'Haultfoeuille (2024).

For sender-side effects I focus on sender-originating events in which U.S. entities face enforcement action and the demonstration effect of major enforcement actions against multinational firms. To examine the diffusion of these events to third-parties and bystanders, I operationalize the network-propagation channels theorized in the dual-structure extension of the CCMS framework through the construction of a regional exposure measure which captures the share of active U.S. dollar correspondents within each region to which a country belongs[8]. Causal estimates are obtained from a Borusyak–Hull (2023)–style exposure design which interacts sender-side enforcement shock with predetermined exposure. A similar strategy is deployed to examine the impact of sanctions enforcement on the currency composition of international reserves and CDBC adoption.

By way of preview, the receiver-side results confirm a strong association between secondary sanctions and improvements in financial development. For the Callaway and Sant'Anna (2021) estimates obtained using never-treated countries as the control group, OFAC enforcement onset is associated with an average treatment effect on the treated (ATT) of 0.011 in the year of first exposure ($p < 0.01$). The effect grows over time, peaking around four years after treatment at approximately 0.033 ($p < 0.01$). Given a mean level of financial development of 0.2548 in the sample, these estimates correspond to an initial increase of about 4.3 percent in financial development at treatment onset, rising to roughly 13 percent within four years. These estimates for receiver-side effects should, however, be interpreted as descriptive rather than fully causal. Although the event-study coefficients exhibit no clear systematic pre-treatment pattern, the formal joint pre-trend test rejects the null of zero pre-treatment effects. Given the very large number of lead coefficients included in the test, this rejection likely reflects high statistical power rather than economically meaningful divergence, but it nevertheless cautions against a strong causal interpretation. The results are conditioned on a rich set of covariates capturing economic growth, financial openness, foreign direct investment, and the importation of financial services and ICT, as well as multiple layers of fixed effects that absorb time-invariant country characteristics and common global shocks. When the absorbing-treatment assumption is relaxed, the episodic estimator of de Chaisemartin and d'Haultfoeuille (2024) delivers a similar pattern of results which do not pass the bar for causal identification due to strong pre-trend violations.

The sender-side results, on the other hand, show that financial development improves meaningfully only when enforcement originates at the core of U.S.-centric financial infrastructure and institutional upgrading within the U.S. diffuses through the exposure of non-U.S. institu-

[8]I construct a measure of regional correspondent banking exposure using data provided by Swift to the Committee on Payments and Market Infrastructures (CPMI) of the Bank for International Settlements (BIS). The CPMI dataset reports the number of active correspondent relationships at the sub-regional level, separately identifying those involving U.S. dollar transactions and those in all currencies. Active correspondents are defined as financial institutions that have exchanged MT 103 or MT 202 cross-border payment messages during a given year, and therefore serve as a meaningful proxy for engagement with the U.S.-centered financial system.

tions to USD correspondent and Society for Worldwide Interbank Financial Telecommunication (Swift) linkages; countries more exposed to U.S. sanctions enforcement pressure (whether directly or indirectly through regional correspondent exposure) show greater convergence toward financial development. The sender-side test, which investigates a possible demonstration effect of major penalties on multinational financial institutions, suggests a more muted propagation effect in comparison to the effect of enforcement which targets U.S.-based financial institutions. These results indicate that the consequences of exclusion from the U.S.-led global financial network serves as a credible threat that forces third-parties and bystanders into harmonization; in keeping with evidence from Drott, Goldbach and Nitsch (2024) which shows that exclusion from Swift led to significant reductions in financial transactions with sanctioned Russian bank accounts in TARGET2 , the Eurosystem's real-time gross settlement system. Additionally, the sender-side results reinforce the view that the geoeconomic reach of the United States stems not merely from the signaling value of its enforcement actions, but from its structural position at the heart of the global financial network. When discipline is applied at those chokepoints, compliance enhancements propagate outward. When the shock occurs further from the core, its influence dissipates. As it relates to the impact of sanctions enforcement on the currency composition of international reserves and CDBC adoption, the results show no statistically meaningful relationship for either measure.

The identification strategies I employ for both receiver-side effects and sender-side effects face several potential threats; as such, I conduct a suite of robustness checks. A first concern relates to the choice of the comparison group in the absorbing-treatment design and whether the estimates are sensitive to this choice. In the main specification, I restrict the control group to countries that are never subject to enforcement over the sample period. This choice avoids potential contamination arising from using not-yet-treated countries whose outcomes may already be affected by anticipation effects, partial exposure, or gradual adjustment to enforcement risk. As a robustness exercise, I re-estimate the model using not-yet-treated countries as the comparison group. This alternative design delivers broadly similar post-treatment dynamics, suggesting that the qualitative association between enforcement and financial development is not driven by a particular choice of control group. At the same time, the sensitivity of pre-trend behavior across designs underscores that identification in the absorbing-treatment framework rests on strong assumptions, which motivates the subsequent analysis that relaxes absorbing treatment and allows enforcement to be episodic. Another major concern is that for the sender-side effects, enforcement exposure may be mechanically correlated with pre-existing levels or trajectories of financial development. I investigate this issue using several exposure diagnostics. While countries with higher baseline financial development and stronger pre-2003 financial development trends are more likely to be exposed to enforcement and to experience more persistent exposure, neither baseline levels nor pre-trends predict enforcement timing or intensity conditional on treatment. These patterns are consistent with secondary sanctions operating through network position rather than endogenous reform paths. To further probe this channel, I examine the composition of exposure cohorts and show that higher correspondent exposure reflects the long-run structural integration of

the global finance network rather than random assignment. Correspondingly, I implement demanding controls that allow countries with different baseline levels or pre-treatment trends to follow fully flexible post-treatment trajectories. While the diffusion effect remains statistically significant when conditioning on baseline heterogeneity, it attenuates once pre-treatment trends are fully absorbed. This attenuation is informative rather than problematic, indicating that sanctions-induced institutional upgrading reinforces and coordinates existing financial development trajectories rather than generating abrupt departures from trend.

While the robustness checks which probe non-random exposure by allowing flexible baseline and pre-trend specific dynamics raise reasonable doubts about the stability of the sender-side estimates, when taken as a whole, the results are sufficiently robust and novel to warrant inclusion in the emerging canon on geoeconomics (Clayton, Maggiori and Schreger, 2026; Clayton, Coppola, Maggiori and Schreger, 2025; Huynh and Ongena, 2025; Mohr and Trebesch, 2025) as they consistently point to a sender-originating diffusion mechanism in which enforcement shocks propagate through U.S.-centric correspondent networks, strengthening financial institutions in already integrated systems.

In light of the doubts raised by the nonrandom exposure diagnostics, I go a step further and implement a Borusyak–Hull (2023)–style exposure design, to more definitively show that the positive relationship between sanctions enforcement and financial development holds when non-random exposure to the global financial system is accounted for. The Borusyak–Hull (2023)–style exposure design fixes predetermined exposure at its 2011 level for each country and treats it as time-invariant throughout the sample. This choice reflects the stability of correspondent banking structures prior to the 2010s and avoids mechanically incorporating post-treatment variation into the exposure measure. Identification arises from comparing how countries with different predetermined exposure shares respond to the same sender-side enforcement shock. The results show that countries with higher predetermined correspondent exposure experience larger improvements in financial development when sender-side enforcement intensity increases, even after absorbing global time shocks and sanctions-programme heterogeneity. I also stress test the Borusyak–Hull (2023)–style exposure design by conducting a randomization-inference exercise which constructs counterfactual realizations of the predetermined exposure measure. The aim of this exercise is to more dutifully align with the key insight of Borusyak and Hull (2023) which argues that in settings of non-random exposure to aggregate shocks credible inference can be strengthened by evaluating outcomes under counterfactual exposure structures.

Even after the extensive set of robustness exercises, one might still wonder whether the sender-originating diffusion mechanism maps cleanly onto real-world financial and geopolitical structure. To satisfy this curiosity, I test whether enforcement exposure has differential effects for China and Iran. In a boundary-condition test, I examine whether China's efforts to resist geoeconomic pressure, through capital controls and policies that limit reliance on U.S. financial infrastructure, attenuate the estimated exposure effect relative to other countries. Iran, by contrast, serves as a potent boundary-condition placebo as it has been structurally in-

sulated from U.S. dollar correspondent networks throughout the sample period, and therefore the diffusion channel should not operate.

Contrary to expectation, but consistent with the sectoral dominance of the United States in financial services and the high level of interdependence in the global financial network (Clayton, Coppola, Maggiori and Schreger, 2025), the effect of exposure to sender-side enforcement shocks is stronger for China than for other countries. This suggests that even large economies with capital controls remain deeply exposed to U.S.-centered financial infrastructure. For Iran, however, I find the expected null result, indicating that the effect of secondary sanctions on financial development operates through exposure to the U.S.-controlled global financial network. In unreported results, Russia also loads very strongly on the enforcement shock, reflecting both its historical integration into dollar and European correspondent networks and its central position in contemporary sanctions regimes. When sender-side enforcement intensity rises, Russia's financial system therefore faces unusually strong compliance pressure, correspondent withdrawal, de-risking, and institutional upgrading.

Taken together, these boundary-condition results line up closely with real-world financial and geopolitical structure. Iran shows a near-zero interaction because it is structurally insulated from U.S. dollar correspondent networks; China exhibits a strong positive interaction despite capital controls, reflecting the inescapability from U.S.-centric financial infrastructure; and Russia displays an even stronger interaction, consistent with its deep historical integration into Western financial networks and its central position in contemporary sanctions regimes. These patterns reflect real-world dynamics in the way geoeconomic pressure should propagate through the architecture of the global financial system in keeping with the input–output network propagation channel of the CCMS framework.

This paper ties in to a rich body of work in international relations and political science which interrogates the welfare effects and policy effectiveness of sanctions as a tool of foreign policy and economic statecraft; see Drezner (2024) for a review, and adds to empirical work on the whale hunting strategy of sanctions enforcement previously theorized in the political science literature (Early and Preble, 2020a; Early and Preble, 2020b; Preble and Early, 2024; Early and Peterson, 2023).

Primarily, however, the paper advances the growing interest of the economics and finance literature in the dynamic interaction between geopolitics and economics (Mohr and Trebesch, 2025; Huynh and Ongena, 2025). In addition to providing empirical support for emerging theories of geoeconomics (Clayton, Maggiori and Schreger, 2026; Clayton, Coppola, Maggiori and Schreger, 2025), the principal innovation of this article is that it brings disparate strands of the economics and finance literature which examines the financial implications of economic sanctions, as it relates to global safe assets and determinants of international reserves (Aizenman and Cheung, 2020; Aizenman, Cheung and Qian, 2020), bank lending (Efing, Goldbach and Nitsch, 2003), banking flows (Raynor, 2022; Ha and Thang, 2023; Newman and Zhang, 2024) cross-border payments infrastructure and financial information flows (Cipriani, Goldberg and La Spada, 2023; Conlon et al., 2024), macro-level exchange rate dynamics (Itskhoki

and Mukhin, 2025) and firm export activity (Crosignani et al., 2026), into dialogue with a more mature strand of literature which studies the political economy of financial development (Rajan and Zingales, 2003; Guiso, Sapienza and Zingales, 2004; Aghion, Howitt and Mayer-Foulkes, 2005; Lerner and Schoar, 2005; Biais and Mariotti, 2005; Do and Levchenko, 2007; Broner and Ventura, 2016; Leibovici, 2021).

Previous work has argued that financial development is a function of a variety of institutional arrangements such as legal enforcement and legal origin (Glaeser and Shleifer, 2002; Lerner and Schoar, 2005), institutional quality (Papaioannou, 2009), security design and interest rates (Biais and Mariotti, 2005; Gopinath et al., 2017), the political influence of industry interest groups (Rajan and Zingales, 2003) and structural and technological transformation (Aghion, Howitt and Mayer-Foulkes, 2005; Do and Levchenko, 2007; Bustos, Garber and Ponticelli, 2020). In the spirit of Tabellini and Magistretti (2025) who show that the economic integration facilitated through trade subversively promotes the transmission of democracy and Do and Levchenko (2007) who also use trade to establish a link between external finance and financial development, this paper draws attention to similar subversive effects of geoeconomic pressure in creating incentives for systemic adjustments to and upgrading of the institutional arrangements which facilitate financial intermediation and ultimately underpin financial development.

In conceptualizing secondary sanctions and dollar dominance as coordinating mechanisms for the preferences of the hegemon (Peterson, 2021) as it relates to the institutional arrangements for financial intermediation, I advance theorizing and empirical validation of geoeconomic pressure as a framework for geoeconomics (Clayton, Coppola, Maggiori and Schreger, 2025). Specifically, I demonstrate that the effects of geoeconomic pressure extend beyond the sender–receiver dyad and innovate within the CCMS framework by integrating a dual structure which argues that sanctions enforcement is not simply pressure on receivers, but also an endogenous driver of compliance upgrading in the sender's institutions, which then propagates globally through financial networks. This paper is one of the first to introduce and provide empirical evidence for this dual structure of geoeconomic pressure which identifies both sender-side effects and receiver-side effects.

The remainder of the paper progresses as follows: a theoretical framework to contextualize the empirical results is presented in Section 2, Section 3 presents a detailed description of the data along with the empirical strategy, Section 4 analyzes the trends in the secondary sanctions data while Section 5 does the same for the financial development dataset. In section 6, the empirical results are presented and analyzed. I wrap up the paper with concluding thoughts in Section 7.

2 Theoretical Framework

The CCMS framework structures economic statecraft around four elements: senders (S), the governments applying pressure; receivers (R), the countries, firms, or sectors targeted; means (M), the economic chokepoints through which pressure is exercised; and instruments (I), the specific policy tools deployed. While powerful for analyzing bilateral coercion, the framework pays less explicit attention to the position of third-parties (T), countries and firms not directly targeted but indirectly affected through reliance on M (the means); and bystanders (B), small or peripheral states dependent on global financial access. The extension of the CCMS framework developed here focuses on these actors, recognizing that the propagation of geoeconomic pressure through global financial networks generates effects that reshape institutions and markets beyond the immediate sender–receiver dyad.

The mechanism that connects geoeconomic pressure to T and B outcomes is the input–output network propagation channel (Clayton, Maggiori and Schreger, 2026). In the financial domain, the relevant chokepoint is the U.S.-led global financial infrastructure[9] , where compliance with U.S. preferences becomes the propagated adjustment. The position of T and B in the network means they must adapt their institutions to remain integrated in the network of global finance. When OFAC intensifies enforcement against sanctioned entities, compliance expectations are transmitted through the network. Banks, firms, and regulators in countries not directly targeted nonetheless face heightened pressure to strengthen supervisory systems, and ensure alignment with U.S. requirements[10]. Through these network effects, the coercive leverage of S over R propagates into broader institutional upgrading across the network, as T and B adapt to avoid the risk of exclusion.

A less obvious avenue through which upgrading takes place is through sanctions enforcement actions directed at U.S. financial institutions, which are penalized for facilitating transactions with sanctioned entities. These actions incentivize sender-country banks to invest heavily in compliance infrastructure; strengthening monitoring, reporting, and risk management systems. Because these institutions operate at the core of the global financial network, their upgraded standards cascade outward to their foreign counterparts. To preserve access to correspondent banking and dollar clearing, third-party and bystander financial institutions are compelled to adopt similar standards, leading to institutional upgrading.

This mechanism reframes the channel of input–output propagation emphasized by CCMS. Rather than beginning in the receiver, improvement in financial development begins in the sender's own institutions and diffuses outward through the network of global finance. Sanctions enforcement thus acts as a coercive coordinating mechanism by disrupting targets while

[9]Particularly dollar clearing, correspondent banking, and access to messaging systems such as Swift.

[10]Sanctions enforcement on R raises compliance requirements in the U.S.-controlled financial network (e.g., OFAC screening, AML/CTF standards). To preserve access to global financial infrastructure, T and B countries must harmonize with U.S. standards, even if not directly targeted. This harmonization leads to institutional upgrading (e.g., stronger regulatory frameworks, supervisory capacity), market deepening (greater investor confidence, improved cross-border financial flows) and standard convergence (international integration into common financial practices) which in turn improves financial development across countries.

simultaneously forcing systemic harmonization of compliance standards across third-party states. Over time, this harmonization contributes to financial development, particularly by strengthening the institutional and regulatory underpinnings of financial systems.

This dual structure (receiver-originating and sender-originating) extension to the CCMS framework yields the following empirical predictions:

1. Compliance-induced Harmonization: Countries which experience an enforcement shock exhibit stronger improvements in financial development compared to those which do not, even if not direct sanctions targets.

2. Institutional Concentration of Effects: Positive spillovers will be concentrated in the institutional dimensions of financial development rather than in the market infrastructure dimensions.

3. Sender-Originating Diffusion: Countries more reliant on U.S. financial infrastructure, via correspondent banking, Swift dollar linkages, or broader dollar system exposure, exhibit stronger improvements in financial development following enforcement shocks, even if not direct sanctions targets. OFAC enforcement actions targeting U.S. financial institutions lead to domestic compliance upgrading, which then diffuses through global correspondent banking networks, inducing financial development in third-party and bystander countries.

Figure 1, shown below, illustrates how sanctions enforcement begins with the sender, generates compliance upgrading in sender institutions, diffuses to third-party and bystander institutions, and ultimately impacts harmonization and financial development.

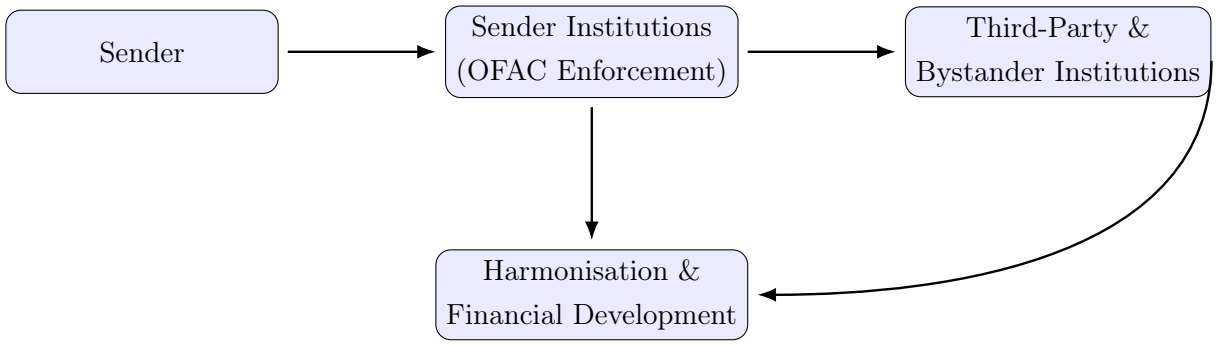


Figure 1: Mechanism of sanctions spillovers: OFAC enforcement upgrades sender institutions, which then diffuse heightened standards through correspondent networks to third-party/bystander institutions, culminating in global harmonization and financial development.

3 Data and Empirical Strategy

3.1 Secondary Sanctions Data

I make use of sanctions enforcement data from two departments within the U.S. federal government; the Office of Foreign Assets Control (OFAC) in the U.S. Department of Treasury and the Bureau of Industry and Security (BIS) in the U.S. Department of Commerce. I download from OFAC's website the Consolidated Sanctions List , the Specially Designated Nationals (SDN) List and details of OFAC enforcement actions from 2003 to 2021. The enforcement actions include data on the name of the entity subject to secondary sanctions, details of the violation and the US dollar amount of the civil penalties for each violation. From these data I identify the country of origin for each entity, categorize the types of violations and pinpoint the violated sanctions programme(s).

Entity-level enforcement actions are aggregated to the country–year level to construct both treatment indicators and outcome measures. I use OFAC's enforcement records to identify all entities targeted within a country in each year, and count the number of actions to capture enforcement intensity. A binary indicator is then defined equal to one if at least one enforcement action occurred in that country-year and zero otherwise. I focus on the timing of a country's first enforcement action to define the initial transition into an enforcement regime; subsequent enforcement actions contribute to post-treatment exposure but do not alter the treatment timing. This aggregation aligns the level of treatment assignment with the level at which financial development outcomes are analyzed, ensuring conceptual coherence between the intervention and its measured impacts.

3.2 Dollar Dependence Data

To capture the degree of dollar system integration across countries I collect data on foreign portfolio holdings of U.S. long-term securities from the Treasury International Capital (TIC) Securities Long-Term reporting system, as compiled in the Federal Reserve's Enhanced Financial Accounts. These data report monthly country-level holdings of U.S. long-term securities at market value, including Treasury securities, agency bonds, corporate bonds, and equities. For data on the currency composition of central bank international reserves I deploy the database developed by Ito and McCauley (2020).

3.3 Financial Development Data

The measures of financial development I employ are from the Financial Development (FD) Index developed by the International Monetary Fund (IMF). The FD Index provides a comprehensive measure of financial system development across countries, capturing the depth, access, and efficiency of both financial institutions and financial markets (Sahay et al., 2015; Svirydzenka, 2016). It allows for cross-country and temporal comparisons of financial system characteristics, serving as a composite indicator of the overall financial development of an

economy. The FD Index is constructed as a composite of the Financial Institutions Index (FI) and the Financial Markets Index (FM) sub-indices.

Financial Institutions Index (FI): This component measures the structure and performance of financial intermediaries such as banks, insurance companies, and other non-bank financial institutions[11]. It aggregates three dimensions:

Depth (FID): Reflects the size and liquidity of financial institutions, measured by variables such as private sector credit to GDP and insurance premiums (life and non-life) to GDP.

Access (FIA): Captures the availability and reach of financial services, using indicators such as the number of commercial bank branches per 100,000 adults and the number of ATMs per 100,000 adults.

Efficiency (FIE): Gauges the performance and cost-effectiveness of financial institutions through metrics including net interest margin, lending–deposit rate spread, overhead costs to total assets, return on assets, and return on equity.

Financial Markets Index (FM): This component assesses the development of financial markets that facilitate trading, capital allocation, and risk diversification[12]. It also aggregates three dimensions:

Depth (FMD): Captures market size and liquidity, including stock market capitalization to GDP, stock market total value traded to GDP, and total debt securities of financial and non-financial corporations to GDP.

Access (FMA): Reflects the extent to which market participants can engage with capital markets, proxied by the share of market capitalization outside the top ten largest companies and the number of listed domestic and external firms per 100,000 adults.

Efficiency (FME): Measures the effectiveness of markets in facilitating transactions, captured through stock market turnover ratio (value of shares traded relative to market capitalization).

The FD Index is constructed at an annual frequency for 183 countries over the period 1980–2022. The underlying dataset is compiled from multiple sources, including the World Bank's FinStats database, the IMF Financial Access Survey, the Bank for International Settlements (BIS) debt securities database, and the Dealogic corporate debt database (Sahay et al., 2015; Svirydzenka, 2016). Each sub-index is composed of a set of quantitative indicators

[11]The financial institutions component includes four measures of depth (private-sector credit to GDP; pension fund assets to GDP; mutual fund assets to GDP; and life and non-life insurance premiums to GDP), two measures of access (number of commercial bank branches and ATMs per 100,000 adults), and six indicators of efficiency (net interest margin, lending–deposit spread, non-interest income to total income, overhead costs to total assets, return on assets, and return on equity).

[12]The financial markets component includes five indicators of market depth (stock market capitalization to GDP, stock market value traded to GDP, international debt securities of governments to GDP, total debt securities of financial corporations to GDP, and total debt securities of non-financial corporations to GDP), two measures of access (percentage of market capitalization outside the ten largest listed companies and number of domestic and external corporate debt issuers per 100,000 adults), and one indicator of efficiency (stock market turnover ratio).

selected on the basis of their empirical relevance, data coverage, and consistency across countries. Importantly, the index captures both the intermediation capacity of the global financial system and its ability to mobilize savings, allocate capital, and provide liquidity (Sahay et al., 2015; Svirydzenka, 2016). These are the financial chokepoints which the whale hunting strategy of sanctions enforcement (Early and Preble, 2020a; Early and Preble, 2020b; Preble and Early, 2024; Early and Peterson, 2023) are designed to target.

3.4 Macro-Financial Controls

For each country in the IMF FD Index, I obtain data on its level of financial openness from the Chinn-Ito index and a selection of relevant macro variables from the World Development Indicators Database maintained by the World Bank. I provide a brief overview of these data below.

Foreign Direct Investment (FDI) as a Percentage of GDP: This variable measures net inflows of foreign direct investment expressed as a share of a country's gross domestic product. FDI captures cross-border investments made to establish a lasting interest or effective control over an enterprise operating in the reporting economy. Net inflows include equity capital, reinvested earnings, and intra-company loans from non-resident investors, offset by capital repatriation and loan repayments. Expressing these flows relative to GDP provides a scale-adjusted indicator of the extent to which external capital contributes to domestic investment activity and economic development. The role of external capital in facilitating financial development has been documented by Do and Levchenko (2007). Data are sourced from the World Development Indicators maintained by the World Bank, based on balance-of-payments reporting consistent with the IMF's international statistical standards.

GDP Per Capita Growth (annual % growth): This variable captures the annual percentage change in real gross domestic product per capita, measured in constant 2015 US dollars. It reflects the evolution of average economic output or income per person, adjusting for both inflation and changes in population size. The indicator, which is also sourced from the World Development Indicators maintained by the World Bank, is derived from national accounts data compiled in accordance with the System of National Accounts (SNA) standards and provides a widely used measure of improvements in living standards and long-run economic performance.

Insurance and Financial services (% of commercial service imports): This variable measures the value of imported insurance and financial services—such as banking, financial risk management, liquidity transformation, life and non-life insurance, reinsurance, pension services, and related auxiliary activities—as a share of a country's commercial service imports. The indicator reflects the extent to which residents source financial and insurance services from non-resident providers, offering a proxy for external financial sector support and integration. Imports of these services can directly contribute to the upgrading of domestic financial systems by facilitating access to sophisticated financial intermediation, risk management products,

reinsurance arrangements, and auxiliary support services. As per the empirical evidence from Do and Levchenko (2017) greater reliance on imported financial expertise and infrastructure may lead to improvements in the institutional depth and operational capacity of the financial sector over time. Data are sourced from the World Development Indicators, based on balance-of-payments statistics.

Chinn–Ito Financial Openness Index (KAOPEN): Given that capital account liberalization expands the ability of domestic financial institutions and firms to access international markets, controlling for the degree of financial openness is essential to disentangling the specific contribution of secondary sanctions to financial development. Greater openness may facilitate deeper cross-border capital flows, encourage the adoption of international financial standards, and enable technology and knowledge spillovers from foreign investors. Consequently, changes in financial development over time may partly reflect evolving regulatory restrictions on capital mobility rather than compliance driven institutional upgrading induced by geoeconomic pressure. To account for this, I include the Chinn–Ito Financial Openness Index, a widely used measure of the extent to which a country maintains restrictions on cross-border financial transactions. The index is constructed as the first principal component of four binary indicators that codify regulatory controls on international capital movements, multiple exchange rate practices, and requirements to surrender export proceeds, as reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Higher values indicate fewer restrictions and a more open capital account. The KAOPEN dataset covers 182 countries from 1970 to 2022, with values recalculated upon each update to incorporate revised and newly available regulatory information. Data are sourced directly from the Chinn–Ito website[13].

ICT Imports (% of Commercial Service Imports): This variable measures the value of imported communications, computer, information, and related technical services, from international telecommunications and data services to professional, cultural, and business support services, as a percentage of total commercial service imports. It captures the extent to which residents rely on non-residents for essential technological and informational capabilities that underpin modern financial activity. The indicator is constructed from balance-of-payments records aligned with international statistical standards and is sourced from the World Development Indicators database. The importation of advanced communications, computer, and information services can directly support upgrading within the domestic financial system. These services facilitate digital infrastructure development, financial technology adoption, secure communications, and modern risk-management capabilities. Countries with higher dependence on imported ICT services may therefore experience financial development improvements independent of external pressures from secondary sanctions. Controlling for ICT imports helps to more accurately isolate the causal influence of secondary sanctions from broader technology-driven financial sector modernization.

[13]https://web.pdx.edu/ ito/Chinn-Ito_website.htm

3.5 Empirical Strategy

While OFAC enforcement actions are not randomly assigned, several institutional features support a plausible exogeneity assumption that lends quasi-experimental identification power. Enforcement is triggered by idiosyncratic compliance failures within financial institutions headquartered in the sender country, typically uncovered through investigations unrelated to macro-financial conditions in third-party and bystander economies. Because penalties reflect regulatory discovery rather than targeted coercion of specific foreign jurisdictions, the timing and severity of enforcement actions are difficult for foreign financial systems to anticipate or influence. Moreover, exposure to enforcement shocks is mediated mechanically through exposure to the U.S.-led financial architecture of global finance rather than through endogenous political alignment or domestic reforms. These institutional characteristics imply that, conditional on fixed effects and standard controls, OFAC enforcement events provide plausibly exogenous compliance shocks that differentially affect countries according to their pre-existing network exposure. This structure offers quasi-random treatment assignment across countries, enabling causal interpretation.

I, therefore, estimate dynamic causal effects of OFAC enforcement actions on financial development outcomes using a staggered-adoption difference-in-differences framework. The empirical strategy builds on the semiparametric estimator proposed by Callaway and Sant'Anna (2021), which compares treated countries only to units that are either never treated or not yet treated in the same period, thereby avoiding biases arising from already-treated units serving as controls. Let Y_{it} denote a financial development outcome for country i in year t, and let G_i represent the first year that country i is exposed to OFAC enforcement, with $G_i = 0$ for those never treated. The group–time average treatment effect is defined as:

$$\mathrm{ATT}(g,t) = \mathbb{E}[Y_{it}(1) - Y_{it}(0) \mid G_i = g,\ t \geq g]\,, \tag{1}$$

which captures the causal effect for the cohort treated first in year g, where $g \in \{2003, \ldots, 2021\}$. Identification relies on the assumption that, in the absence of enforcement, outcomes for treated cohorts would have followed the same evolution as those of the comparison group (a conditional parallel trends assumption). To improve precision, I include a vector of time-varying controls reflecting macro-financial determinants of financial development. I report aggregated event-time treatment effects, which trace dynamic adjustments before and after enforcement, allowing visual assessment of pre-treatment parallel trends and the temporal profile of enforcement impacts on financial development. Although the FD Index is available from 1980 onward, treatment variation begins only in 2003. All observations prior to 2003 therefore serve solely to identify baseline outcome levels and fixed effects and do not contribute to treatment effect identification.

Before executing the empirical strategy, I provide, in the following sections, rich summary and descriptive statistics of the secondary sanctions data and the FD Index.

4 The Modern Architecture of Sanctions Enforcement

4.1 Descriptive Statistics and Trends in Secondary Sanctions

Table 1 shows that between 2003 and 2021, the United States accounted for the majority of enforcement actions (562 cases, or 73% of the total) against entities. The United Kingdom (4%), Germany (2.5%), Switzerland (1.7%), and the Netherlands (1.7 %) constitute the next largest group of jurisdictions, indicating the concentration of enforcement activity in advanced financial centers. A second tier of countries, including the United Arab Emirates, Canada, France, China, Italy, and Japan, each account for roughly 1% of all cases, while the remaining countries individually represent less than 1%. In total, 769 enforcement actions against entities[14] were recorded across 52 countries.

The data further reveals that 233 (30%) of all enforcement actions were targeted at financial institutions with the majority (59%) being against financial institutions domiciled in the U.S. Furthermore, 137 (24%) of the secondary sanctions against U.S. entities were targeted at financial institutions. Comparatively, 96 (46%) non-U.S. financial entities were subject to secondary sanctions over the sample period, representing a larger share of the 207 enforcement actions targeted at entities outside of the U.S. These statistics demonstrate the significant role of the global financial network in the execution of economic statecraft.

Of significance, also, is the fact that 33 (14%) of the actions targeted at financial institutions were major financial enforcement events, which I define as penalties against multinational financial institutions which are greater than or equal to one million dollars[15].

To paint a more detailed picture of the enforcement architecture of secondary sanctions, I present, in Figure 2, a chart of the number of enforcement actions, against both entities and individuals, over the sample period and a corresponding chart of the value of penalties in Figure 3. Across the full sample, a combined total of 1,993 enforcement actions were recorded for entities and individuals, with an aggregate penalty value of approximately USD 5.75 billion.

The distribution of enforcement actions over time has been described by Early and Preble (2020a) as five distinct enforcement eras reflecting sparse enforcement pre-1990s, ramp-up in late 1990s, explosion post-2001, financialization and AML tightening post-2008 and renewed geopolitical enforcement post-2014. For ease of analysis I deviate from the Early and Preble (2020a) taxonomy and categorize the megatrend in the distribution of enforcement actions over time into two distinct phases.

[14] When individuals are included, this figure increases to 1,993.

[15] I argue that these events represent major shocks to the global financial network and have a notable demonstration effect. Table 2 provides details on these enforcement actions

Country	Number of Enforcement Actions	Percentage
United States	562	73%
United Kingdom	31	4%
Germany	19	2.5%
Switzerland	13	1.7%
Netherlands	13	1.7%
United Arab Emirates	12	1.6%
Canada	11	1.4%
France	11	1.4%
China	10	1.3%
Italy	9	1.2%
Japan	7	0.9%
South Korea	5	0.7%
Brazil	4	0.5%
Singapore	4	0.5%
Australia	4	0.5%
Finland	3	0.4%
Ireland	3	0.4%
Sweden	5	0.7%
Denmark	3	0.4%
Mexico	3	0.4%
Norway	3	0.4%
Mauritius	2	0.3%
Poland	2	0.3%
Spain	2	0.3%
India	2	0.3%
Argentina	2	0.3%
Colombia	1	0.1%
Turkey	2	0.3%
Luxembourg	1	0.1%
Micronesia, Fed. Sts.	1	0.1%
Pakistan	1	0.1%
Chile	1	0.1%
Egypt	1	0.1%
Bahamas	1	0.1%
Jordan	1	0.1%
Belgium	1	0.1%
Austria	1	0.1%
Bahrain	1	0.1%
Russian Federation	1	0.1%
Thailand	1	0.1%
Hungary	1	0.1%
Costa Rica	1	0.1%
Romania	1	0.1%
Indonesia	1	0.1%
Jamaica	1	0.1%
Cote d'Ivoire	1	0.1%
Kuwait	1	0.1%
Greece	1	0.1%
Israel	1	0.1%
	769	100%

Table 1: **Distribution of OFAC Civil Enforcement Actions by Country**. This table reports the number and percentage of civil enforcement actions undertaken by OFAC for violations of U.S. sanctions between 2003 and 2021, disaggregated by the country of the penalized entity. The data represent the full universe of OFAC civil penalties issued during this period and capture enforcement against both domestic and foreign firms and financial institutions.

The first phase, spanning 2003 to 2008, was characterised by a large volume of enforcement cases but relatively modest penalty values. In particular, OFAC recorded 391 actions in 2003, 514 in 2004, and a peak of 645 in 2005, before declining sharply to double-digit figures from 2006 onwards. This early surge coincided with intensified compliance scrutiny following the post-9/11 expansion of U.S. sanctions policy, as well as a series of smaller administrative settlements involving domestic financial institutions. The total value of penalties during this period remained low, rarely exceeding a few million dollars annually, suggesting that these early cases were primarily administrative rather than high-value corporate violations.

The second phase, beginning around 2009, marked a structural shift in enforcement intensity from numerous low-value cases to fewer but higher-value settlements. Although the annual number of actions fell below 30 per year after 2009, the aggregate value of penalties increased substantially, driven by large corporate settlements with global banks and multinational firms. Notable peaks occurred in 2009 (USD 772 million), 2012 (USD 1.14 billion), 2014 (USD 1.21 billion), 2015 (USD 600 million), and 2019 (USD 1.29 billion). These peaks align with high-profile cases involving major financial institutions accused of facilitating transactions through sanctioned jurisdictions. Table 2 shows that these major financial enforcement events have cost these institutions USD 5.3 billion, representing 93% of the aggregate value of penalties.

Major financial enforcement events are concentrated among major global banks and multinational financial institutions, such as BNP Paribas (USD 963.6 million, 2014), ING Bank (USD 619 million, 2012), Standard Chartered Bank (USD 657 million, 2019), UniCredit Bank (USD 611 million, 2019), Credit Suisse (USD 536 million, 2009), and Crédit Agricole (USD 330 million, 2015). Most violations involved funds transfers processed through U.S. correspondent accounts in contravention of sanctions restrictions, though several cases also concern provision of services and export-related breaches.

The geographical distribution, illustrated in Figure 4, underscores the global reach of U.S. financial jurisdiction: enforcement actions were taken against banks headquartered in Europe (United Kingdom, France, Germany, Switzerland, Netherlands, Italy, and Luxembourg), Asia (Japan and China), the Middle East (United Arab Emirates and Israel), and North America (United States). Collectively, these cases illustrate OFAC's post-2009 strategic shift toward large-scale corporate settlements with cross-border implications, aligning with the observed transition in Figures 2 and 3 from high-frequency, low-value enforcement to fewer but high-value actions targeting globally integrated financial intermediaries.

The foregoing summary statistics illustrate an evolution in OFAC's enforcement strategy, from high-frequency, low-penalty domestic enforcement in the early years to a regime dominated by fewer, high-penalty corporate actions against globally active financial institutions. This transition towards what has been described as a whale hunting strategy in the political science literature (Early and Preble, 2020a), provides further motivation for why financial institutions and governments might invest in compliance infrastructure and improving financial systems in response to the more muscular and punitive approach in the use of secondary sanctions as instruments of economic statecraft. I further argue that this whale hunting strategy

of high-penalties against major global banks and multinational financial institutions (Early and Preble, 2020b) has had a strong demonstration effect which has catalyzed upgrading throughout the global financial network. I test for this as a sender-side effect in later sections of the paper.

This sender-side analysis will take its impetus from theoretical and empirical work in the political science literature which demonstrates that the whale hunting strategy which characterizes major enforcement events not only has powerful signaling and reputational impacts but also forces third-party compliance with U.S. foreign policy preferences (Early and Preble, 2020a; Early and Preble, 2020b; Early and Peterson, 2021; Peterson, 2021; Early and Peterson, 2023; Preble and Early, 2024).

Because multinational institutions are more deeply connected in the cross-border payment network, their enforcement outcomes should propagate more rapidly and broadly compared to smaller domestic violations. I, therefore, follow the logic of the political science literature on the whale hunting strategy of sanctions enforcement (Early and Preble, 2020a; Early and Preble, 2020b; Early and Peterson, 2021; Peterson, 2021; Early and Peterson, 2023; Preble and Early, 2024) and conjecture that major financial enforcement events represent salient shocks that heighten industry-wide risk perceptions and incentivize accelerated compliance upgrading within the global financial network.

Through this analysis I aim to show that sanctions enforcement does not only transmit through direct regulatory coercion but also through reputational spillovers and strategic compliance responses, consistent with the broader geoeconomic logic of financial statecraft. Under the whale hunting strategy of sanctions enforcement which informs the demonstration effect, the disciplining of one systemically important bank can induce systemic improvements in the financial development of distant economies linked through correspondent banking relationships. This will provide an important complementary sender-side effect to sender-originating diffusion as a distinct feature of the dual structure of the CCMS framework. It underscores how the visibility, scale, and symbolic force of enforcement actions shape the global harmonization of financial infrastructure.

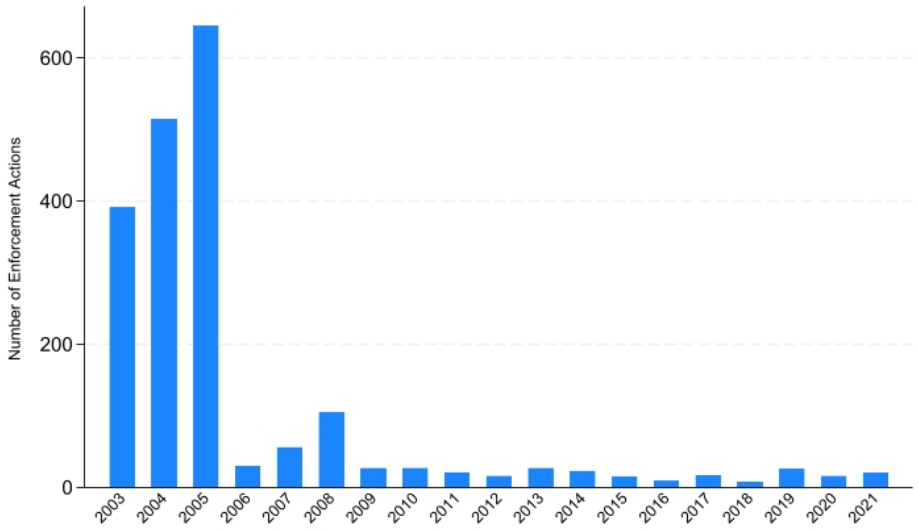


Figure 2: **Number of OFAC Civil Enforcement Actions**. This figure illustrates the annual trend in the frequency of OFAC civil enforcement actions for violations of U.S. sanctions between 2003 and 2021.

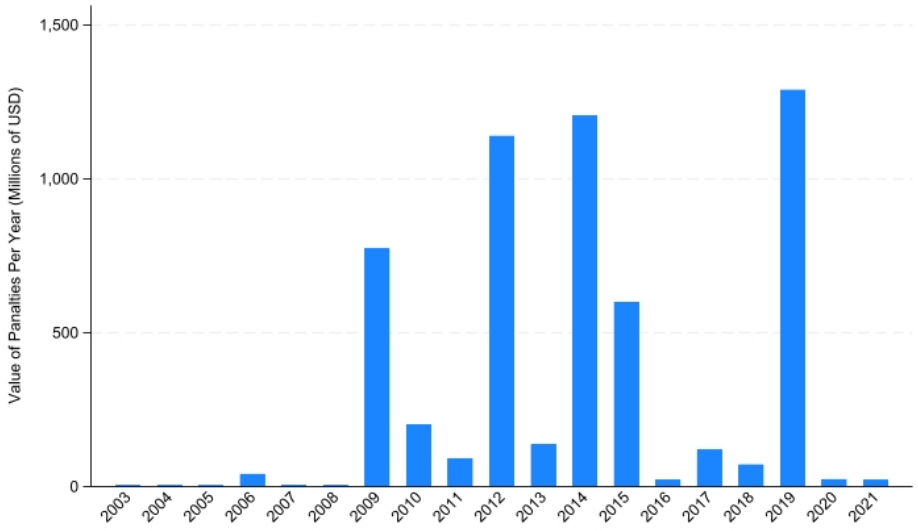


Figure 3: **Value of OFAC Civil Penalties**. This figure illustrates the annual trend in the monetary value of OFAC civil enforcement actions for violations of U.S. sanctions between 2003 and 2021.

Year	Financial Institution	Violation	Penalty Size	Programme	Country
2006	ABN AMRO Bank, N.V.	Funds Transfer	40,000,000	Iran	Netherlands
2009	Australia and New Zealand Bank	Funds Transfer	5,750,000	Multiple	Australia
2009	Credit Suisse AG	Funds Transfer	536,000,000	Multiple	Switzerland
2009	Lloyds TSB Bank, plc	Funds Transfer	217,000,000	Multiple	United Kingdom
2010	Barclays Bank PLC	Funds Transfer	176,000,000	Multiple	United Kingdom
2011	JP Morgan Chase Bank	Funds Transfer	88,300,000	Multiple	United States
2012	ING Bank N.V.	Funds Transfer	619,000,000	Multiple	Netherlands
2012	Standard Chartered Bank	Funds Transfer	132,000,000	Multiple	United Kingdom
2012	HSBC Holdings	Funds Transfer	375,000,000	Multiple	United Kingdom
2012	Bank of Tokyo-Mitsubishi UFJ	Funds Transfer	8,571,634	Multiple	Japan
2013	Intesa Sanpaolo S.p.A.	Funds Transfer	2,949,030	Multiple	Italy
2013	American Express	Dealing in Property	5,226,120	Multiple	United States
2013	Alma Investment	Funds Transfer	1,500,000	Multiple	United Arab Emirates
2013	Royal Bank of Scotland	Funds Transfer	33,122,307	Multiple	United Kingdom
2014	Clearstream Banking	Provision of Services	151,902,000	Multiple	Luxembourg
2014	Bank of Moscow	Funds Transfer	9,492,525	Multiple	Russian Federation
2014	BNP Paribas SA	Funds Transfer	963,619,900	Multiple	France
2014	Bank of America	Funds Transfer	16,562,700	Multiple	United States
2015	Commerzbank AG	Funds Transfer	258,660,796	Multiple	Germany
2015	PayPal, Inc.	Funds Transfer	7,658,300	Multiple	United States
2015	UBS AG	Funds Transfer	1,700,100	Multiple	Switzerland
2015	Crédit Agricole	Funds Transfer	329,593,585	Multiple	France
2016	Barclays Bank Plc	Funds Transfer	2,485,890	Zimbabwe	United Kingdom
2018	JPMorgan Chase Bank	Funds Transfer	5,263,171	Multiple	United States
2018	Société Générale	Funds Transfer	53,966,916	Multiple	France
2019	Standard Chartered Bank	Funds Transfer	657,040,033	Multiple	United Kingdom
2019	UniCredit Bank	Funds Transfer	611,023,421	Multiple	Italy
2019	British Arab Commercial Bank	Funds Transfer	4,000,000	Sudan	United Kingdom
2020	Berkshire Hathaway	Export	4,144,651	Iran	United States
2020	Generali Global Assistance	Provision of Services	5,864,860	Cuba	Italy
2021	Bank of China	Funds Transfer	2,329,991	Sudan	China
2021	Payoneer Inc.	Funds Transfer	1,385,901	Multiple	Israel
2021	Union de Banques Arabes et Françaises	Funds Transfer	8,572,500	Syria	France
			5,335,686,331		

Table 2: **Major OFAC Civil Enforcement Actions Against Financial Institutions**. This table lists the largest civil penalties imposed by the U.S. Department of the Treasury's Office of Foreign Assets Control (OFAC) on financial institutions for sanctions violations over the period 2006–2021. The data include cases involving both U.S. and foreign institutions and cover a range of sanctions programmes, including those targeting Iran, Cuba, Sudan, Syria, and multiple jurisdictions under combined sanctions regimes. The penalties reflect OFAC's expanded enforcement against systemic compliance failures in international banking and funds transfer operations, rather than isolated individual violations.

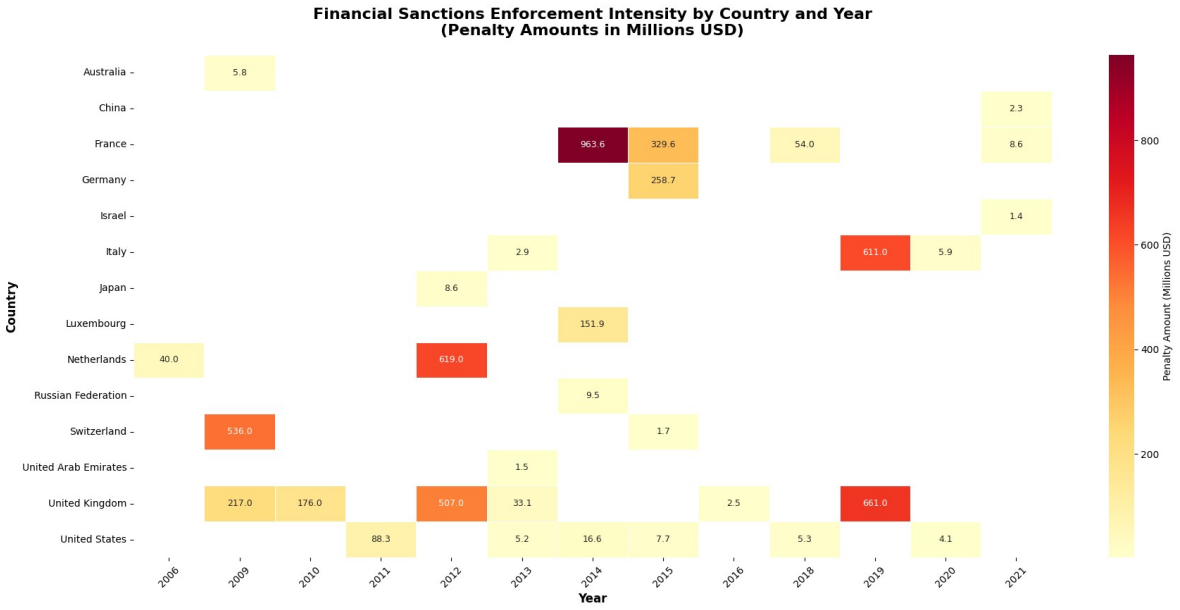


Figure 4: **Financial Sanctions Enforcement Intensity by Country and Year**. This heatmap visualises the temporal and geographical distribution of major sanctions enforcement actions taken by the U.S. Department of the Treasury's Office of Foreign Assets Control (OFAC) between 2006 and 2021 against multinational financial institutions. Each cell represents the total monetary value of civil penalties (in millions of USD) imposed on financial institutions domiciled in the listed countries during a given year, with colour intensity proportional to the magnitude of penalties. The pattern reveals clear clustering of enforcement intensity across time and space. The United Kingdom, France, and Switzerland dominate the landscape of enforcement activity, reflecting their central roles in the global financial system and the prevalence of U.S. dollar–clearing operations through their banking networks. The United Kingdom exhibits consistent enforcement presence, with large settlements in 2009 (Lloyds TSB, USD 217 million), 2010 (Barclays, USD 176 million), 2012 (Standard Chartered and HSBC, totalling over USD 500 million), and 2019 (Standard Chartered, USD 657 million). France similarly shows pronounced peaks in 2014 (BNP Paribas, USD 963.6 million) and 2015 (Crédit Agricole, USD 329.6 million), as well as renewed activity in 2018 (Société Générale, USD 54 million) and 2021 (Union de Banques Arabes et Françaises, USD 8.6 million). The United States, while maintaining a steady presence, shows smaller and more dispersed cases, primarily involving domestic institutions such as JP Morgan Chase, Bank of America, and PayPal, reflecting ongoing compliance oversight of U.S.-based banks. The Netherlands experienced two significant enforcement events (2006 and 2012), each exceeding USD 40 million, while Italy demonstrates a marked increase in recent years, with high-value penalties in 2019 (UniCredit, USD 611 million) and further cases in 2020 (Generali Global Assistance, USD 5.9 million).The 2012–2015 period emerges as the most active phase of global sanctions enforcement, corresponding to a shift from frequent low-value actions to fewer but high-penalty corporate settlements, as reflected in earlier figures. The visual intensity across European jurisdictions underscores OFAC's growing extraterritorial reach and the concentration of enforcement risk in major international banking hubs. The darker red cells signal landmark cases, particularly in France, the United Kingdom, and the Netherlands, that collectively define the architecture of modern secondary sanctions enforcement. These patterns provide insight into the network effects by which secondary sanctions might have led to the harmonization of global finance through improvements in financial development across countries.

4.2 Secondary Sanctions By Violation Type and Sanctions Programme

As it relates to the types of violations for which entities have faced enforcement actions over the sample period, Table 3 shows that the most prevalent violation categories are funds transfer and export-related breaches, which together account for 69% of all enforcement actions and an overwhelming 96% of total penalty value. Funds transfer violations alone represent 35% of cases but 90% of all monetary penalties, underscoring OFAC's strong focus on monitoring financial institutions' compliance with sanctions restrictions in cross-border payment and settlement systems. These cases typically involve the unlicensed processing of U.S. dollar transactions through the U.S. financial system on behalf of sanctioned parties or jurisdictions.

Export violations account for a comparable share of total cases (34%) but a much smaller proportion of total penalties (6%), suggesting that while export controls are frequently enforced, they tend to involve smaller firms and lower-value settlements. Provision of services ranks third in frequency (12%) and represents about 3% of total penalty value, reflecting the expanding scope of sanctions enforcement beyond traditional trade and banking activities into areas such as insurance, consulting, and digital services.

Overall, the data reveal that OFAC's enforcement landscape is heavily skewed toward the financial sector and cross-border transaction monitoring, where systemic compliance failures carry substantial monetary consequences. The predominance of funds transfer violations demonstrates the central role of international payment systems in sanctions enforcement and the extraterritorial leverage exerted through U.S. dollar–clearing operations.

Violation Type	**Number of Actions**	**%**	**Value of Penalties**	**%**
Funds Transfer	267	35%	5,179,355,129	90%
Export	258	34%	346,496,681	6%
Provision of Services	96	12%	182,152,965	3%
Import	34	4%	16,504,278	0.29%
Dealing in Property	12	2%	14,729,352	0.26%
Contract in which Cuba has an interest	34	4%	9,540,333	0.17%
Provision of Travel Related Services	47	6%	1,154,156	0.02%
Letter of Credit	7	1%	326,091	0.01%
Failure to Furnish Information	5	1%	238,000	0.004%
Currency travel-related transaction	5	1%	43,361	0.001%
Sales	3	0.39%	10,500	0.000%
Failure to File Report	1	0.13%	1,000	0.000%
	769	**100%**	**5,750,551,846**	**100%**

Table 3: **Distribution of OFAC Civil Enforcement Actions by Violation Type**. This table presents the distribution of civil enforcement actions undertaken by the U.S. Department of the Treasury's Office of Foreign Assets Control (OFAC) across different categories of sanctions violations between 2003 and 2021. The data cover 769 enforcement actions with a cumulative penalty value of approximately USD 5.75 billion. The table highlights a clear concentration of enforcement activity in a small number of violation types, both in terms of frequency and financial magnitude.

The related sanctions programme for which enforcement actions were taken over the sample period are displayed in Table 4. The table demonstrates that enforcement activity is highly concentrated in a small subset of sanctions regimes, both in terms of the number of actions and the financial magnitude of penalties.

The multiple sanctions programme category, which aggregates cases involving violations across two or more sanctions regimes, dominates the enforcement landscape. It accounts for only 5% of all actions but an overwhelming 92% of the total penalty value (USD 5.29 billion). This category encompasses all the major financial enforcement events against large multinational financial institutions, such as BNP Paribas, Standard Chartered, HSBC, and ING Bank. Outside the multiple category, enforcement actions are most frequent under the Iran (28%), Cuba (23%), and Kosovo (20%) sanctions programmes, together accounting for 71% of all cases. However, the monetary penalties under these regimes are relatively modest, collectively representing less than 7% of total penalties. The Iran programme, despite generating the highest number of single-regime cases, accounts for only 6% of total penalty value, suggesting that these actions primarily involved smaller institutions and individual exporters rather than major multinational firms. Overall, the data reveal a bifurcated enforcement pattern; a small number of high-value, multi-programme cases drive nearly all monetary outcomes, while a larger pool of single-programme cases accounts for most of the enforcement activity by count.

Sanctions Programme	**Number of Actions**	**%**	**Value of Penalties**	**%**
Multiple	38	5%	5,285,147,887	92%
Iran	212	28%	367,633,791	6%
Cuba	176	23%	38,028,816	1%
Sudan	77	10%	16,088,575	0.28%
Syria	1	0%	8,572,500	0.15%
Global Terrorism	7	1%	8,297,296	0.14%
Belarus	2	0%	7,788,977	0.14%
Ukraine	5	1%	4,169,748	0.07%
Iraq	14	2%	4,042,531	0.07%
North Korea	4	1%	2,690,942	0.05%
Zimbabwe	1	0%	2,485,890	0.04%
Narcotics Kingpin	13	2%	1,555,139	0.03%
Kosovo	151	20%	2,125,795	0.04%
Burma	7	1%	1,259,296	0.02%
Libya	49	6%	384,444	0.01%
Narcotics Trafficking	8	1%	266,347	0.00%
Liberia	4	0.52%	13,872	0.00%
	769	**100%**	**5,750,551,846**	**100%**

Table 4: **Distribution of OFAC Civil Enforcement Actions by Sanctions Programme**. This table presents the distribution of civil enforcement actions undertaken by the U.S. Department of the Treasury's Office of Foreign Assets Control (OFAC) across specific sanctions programmes between 2003 and 2021. The dataset covers 769 enforcement actions with a cumulative penalty value of approximately USD 5.75 billion.

5 The Evolution of Financial Development

5.1 Trends in Financial Development

Figure 5, which illustrates the average level of financial development across countries between 1980 and 2022, shows that advanced economies remain the most financially developed, emerging markets occupy a middle position characterized by steady but uneven progress, and developing economies continue to lag substantially behind.

Panel A illustrates the distribution among emerging market economies, revealing a moderate but uneven spread across countries. Values cluster largely between 0.1 and 0.4, with a few economies reaching above 0.5. This dispersion indicates that, while most emerging markets have achieved some degree of financial deepening, significant cross-country heterogeneity persists. A few countries demonstrate levels comparable to the higher range of advanced economies, reflecting the presence of more mature financial systems within this group. Panel B presents the corresponding averages for low-income and developing economies, which display markedly lower financial development levels overall. The majority of countries fall below 0.2, with only a few outliers approaching or slightly exceeding 0.3. This pattern underscores the structural limitations faced by developing economies, such as, weaker institutional frameworks, limited access to credit, and underdeveloped capital markets, that constrain their financial intermediation capacity. Panel C depicts the same index for advanced economies, which consistently record the highest levels of financial development, with most values ranging between 0.4 and 0.8. The distribution across these countries is tighter relative to emerging and developing economies, suggesting convergence around high levels of financial sophistication. The advanced market panel also highlights regional leaders such as the United States, Switzerland, and Singapore, whose financial sectors exhibit robust institutional depth and market efficiency.

To get a more granular picture of the trend over time, I present in Figure 6, the annual level of financial development across IMF country income groups. The data indicate a general upward trend across all groups, with advanced economies achieving the highest levels of financial development, emerging markets displaying steady and sustained gains, and developing economies showing slower but consistent progress over the last four decades. Panel A shows a steady upward trajectory in financial development among emerging markets from 1980 to 2022. The Financial Development Index in this group rose from around 0.15 in 1980 to just above 0.3 by 2022, reflecting a gradual strengthening of financial systems, deeper credit markets, and improved financial infrastructure over time. The growth appears relatively smooth, with no pronounced reversals, indicating sustained institutional and market development across the period. Panel B depicts lower-income and developing economies, where the increase in financial development has been more modest. The index starts near 0.08 in 1980 and rises slightly above 0.13 by 2022, suggesting incremental improvements in access to finance and financial intermediation but at a much slower pace than in emerging markets. The flatter slope of this trend line underscores persistent structural challenges that constrain

deeper financial development. Panel C highlights advanced economies, where financial development expanded rapidly during the 1980s and 1990s, peaking around 2007 at approximately 0.67. This sharp rise corresponds to an era of financial liberalization, technological innovation in financial services, and deepening capital markets. Following the Global Financial Crisis, however, the trend shows a mild but sustained decline, stabilizing around 0.6 after 2010. This post-crisis plateau likely reflects heightened regulatory scrutiny, deleveraging, and structural adjustments in the global financial system.

Figure 5 and Figure 6 illustrate a clear trend of convergence whereby emerging and developing economies have experienced steady financial deepening over the past four decades, while advanced economies, though maintaining the highest levels of financial development, have seen their expansion moderate since the mid-2000s. The widening yet gradually narrowing gap across groups reflect forces of harmonization across the global financial network; I argue and will try to show empirically that one of these forces is the positive externalities of geoeconomic pressure effected through secondary sanctions and major financial enforcement actions taken against multinational financial institutions for sanctions violations.

Sahay et al. (2015) and Svirydzenka (2016) have argued that this pattern of a widening and then gradually narrowing gap is not accidental, but reflects the interaction between (i) structural differences in how financial systems evolve across income levels and (ii) cyclical and crisis-driven dynamics in advanced economies. Svirydzenka (2016) shows that financial development is a multi-dimensional process and that the cross-group gap is not uniform across dimensions: emerging economies are much closer to advanced economies in financial institutions than in financial markets, and access remains low across all income groups, making it the slowest-converging margin of development.

Sahay et al. (2015) and Svirydzenka (2016) explain convergence mainly through internal dynamics of financial development and its growth–stability trade-off. I extend this view by arguing that convergence is also shaped by network-level externalities operating through the global financial system. In particular, the moderation of financial development in advanced economies and the steady upgrading of systems in emerging economies have not occurred in isolation. They have taken place in an environment characterized by intensified regulatory coordination, extraterritorial enforcement, and secondary sanctions applied to globally active financial institutions.

To deepen understanding of the underling components which underpin the increasing trend in financial development highlighted in Figure 5 and Figure 6, I also present, in the following sections, the trends for the financial institutions and financial markets sub-indices which make up of the FD Index.

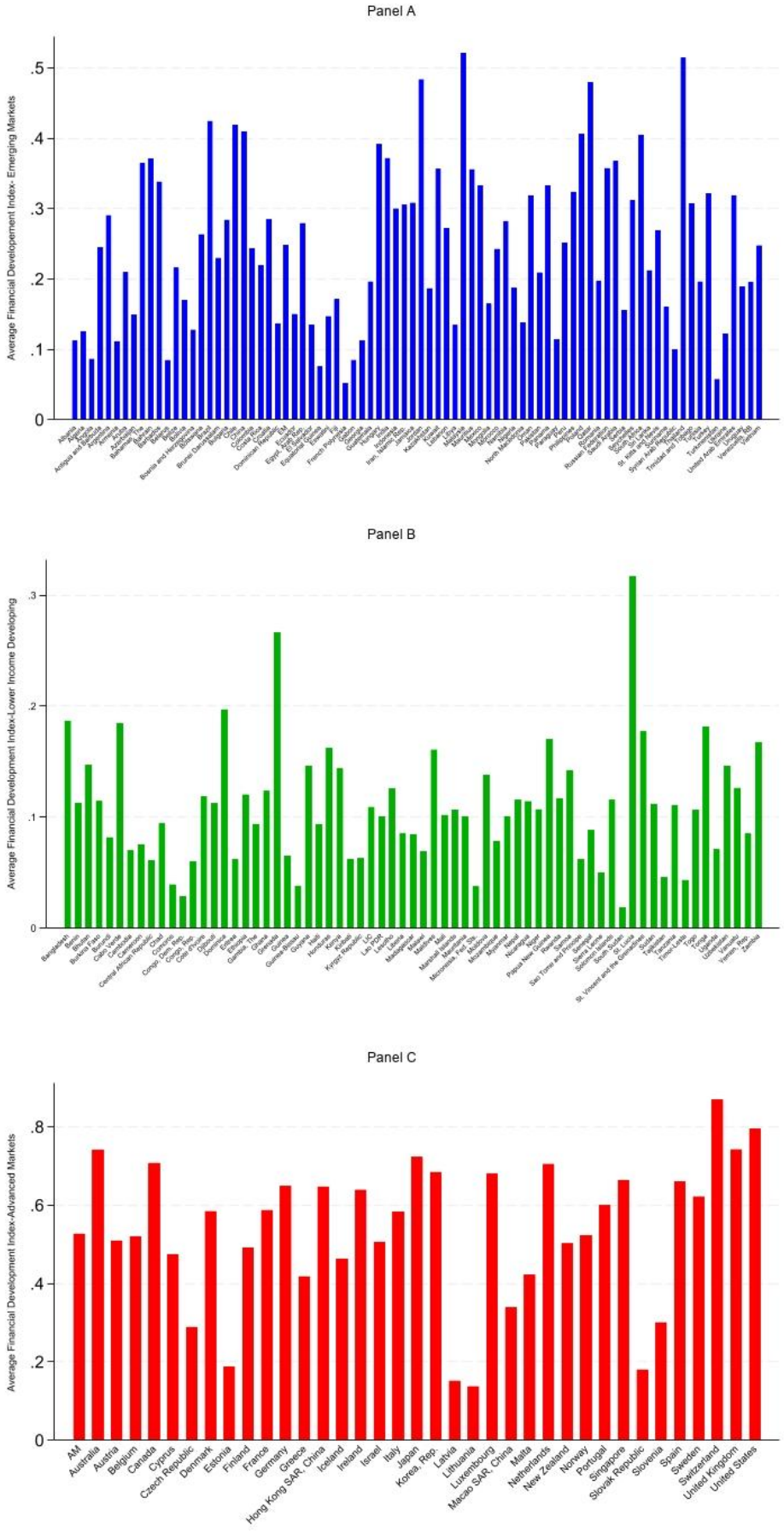


Figure 5: **Average Financial Development Across Countries**. This figure presents the average level of financial development for 154 countries over the period 1980–2022, as reported in the IMF FD Index.

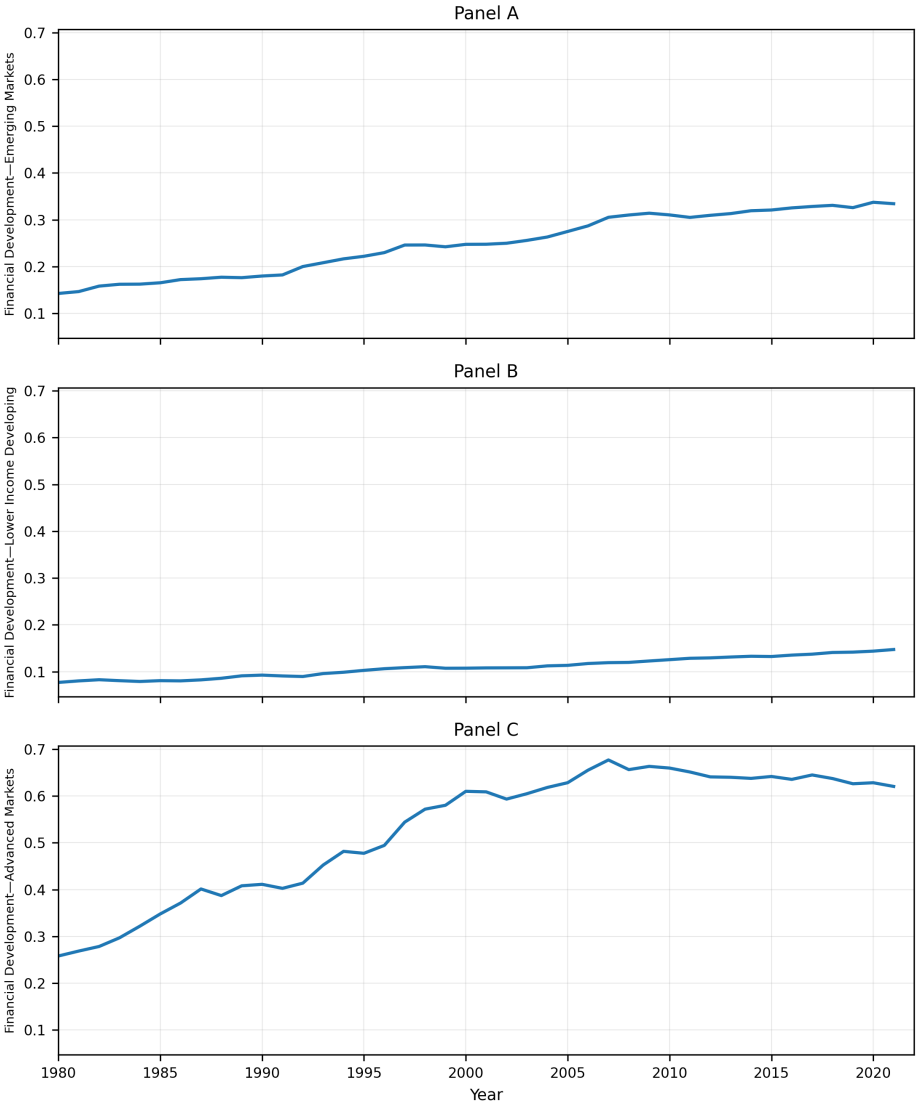


Figure 6: **Annual Trend in Financial Development Across Country Income Groups**. This figure shows the evolution of financial development over time for three country groups using the IMF Financial Development Index. Panel A depicts emerging markets, Panel B represents lower-income and developing countries, and Panel C shows advanced economies.

5.2 Trends in Financial Institutions Development

As before, I begin examination of the financial institutions sub-index by looking at the average level of the index for all countries across the past four decades. As illustrated in Figure 7, emerging markets have, within the last four decades, leveled up with advanced economies in terms of the depth, access and efficiency of their financial institutions.

Panel A of Figure 7 displays the average financial institutions sub-index for emerging markets between 1980 and 2022. The results show considerable heterogeneity across countries, with most emerging markets recording values between 0.2 and 0.5, and a few exceeding 0.6. This indicates significant progress in the depth, access, and efficiency of financial institutions such as banks, insurance companies, and pension funds. The upper range of these values re-

flects the growing sophistication and inclusiveness of financial intermediation in several large emerging economies, many of which now approximate the institutional characteristics of advanced financial systems. Panel B illustrates the corresponding averages for lower-income and developing countries, which remain substantially below those of emerging and advanced economies. Most countries in this group register sub-index values between 0.1 and 0.3, with only a handful approaching 0.4 or higher. These figures suggest that while there has been some institutional deepening, progress remains uneven and constrained by structural barriers such as limited formal banking penetration, inadequate regulatory frameworks, and low savings mobilization rates. The persistence of these limitations underscores the slower pace of financial institutional development among the world's poorest economies. Panel C presents the average sub-index for advanced economies, which maintain the highest overall levels of financial institutional development. The values generally range from 0.5 to 0.9, with several economies—including Switzerland, the United States, and Singapore—approaching or exceeding 0.8. This reflects well-developed, diversified, and efficient financial institutions capable of mobilizing and allocating capital effectively. However, the relatively narrower dispersion within this group also suggests convergence among high-income countries toward a uniformly strong institutional base.

The annual trend in the financial institutions sub-index, presented in Figure 8, provides suggestive evidence that the leveling up and narrowing gap between emerging and advanced economies in terms of financial institutional development stems not only from improvements in emerging markets but also from the post-crisis slowdown among advanced economies, where financial depth and efficiency have plateaued. This suggests a global rebalancing of financial institutional dynamism, with emerging markets increasingly driving growth in the international financial landscape.

Panel A of Figure 8 illustrates the trajectory of the financial institutions sub-index for emerging markets from 1980 to 2022. The trend exhibits a clear and steady upward movement, with the index rising from roughly 0.2 in 1980 to around 0.45 by 2022. This sustained growth signals progressive improvements in the depth, access, and efficiency of financial institutions within emerging economies. Panel B presents the corresponding trend for lower-income and developing economies, where financial institutional development remains at relatively lower levels. The index rises only modestly, from about 0.15 in 1980 to approximately 0.25 by 2022, indicating gradual yet uneven progress. The slope of the curve is notably flatter compared to that of emerging markets, suggesting that while these economies have made strides in financial inclusion and institutional access, their progress has been constrained by weaker regulatory environments, limited capital formation, and dependence on informal financial systems. Panel C shows the evolution of financial institutions in advanced economies, which initially experienced rapid growth between 1980 and 2007, as the index climbed from about 0.4 to a peak near 0.72. This period corresponds with substantial financial innovation, liberalization, and expansion in global banking networks. However, following the 2008 Global Financial Crisis, the trend stabilizes and slightly declines, settling near 0.65 by 2022.

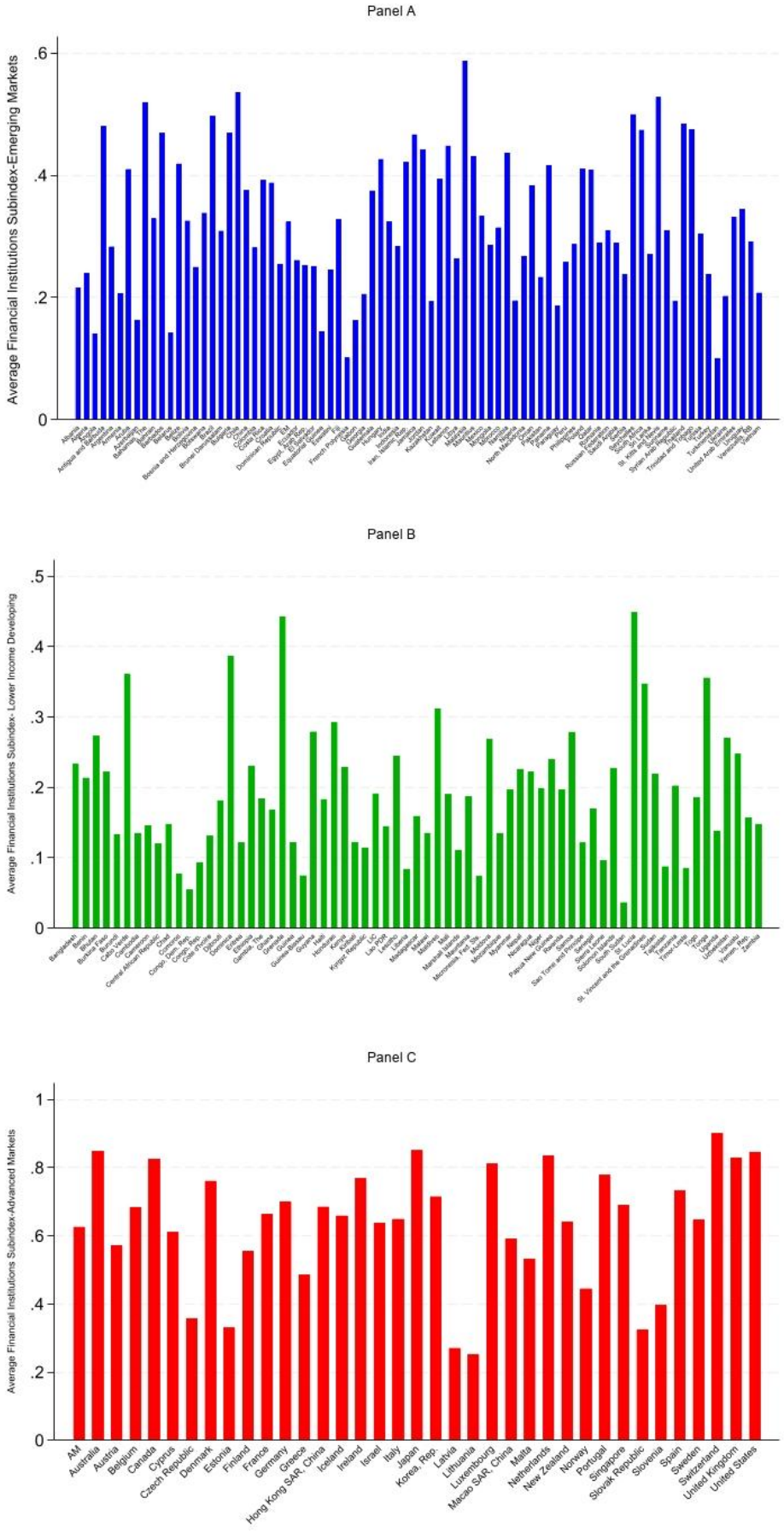


Figure 7: **Average Financial Institutions Across Countries**. This figure presents the average level of the financial institutions sub-index for 154 countries over the period 1980–2022.

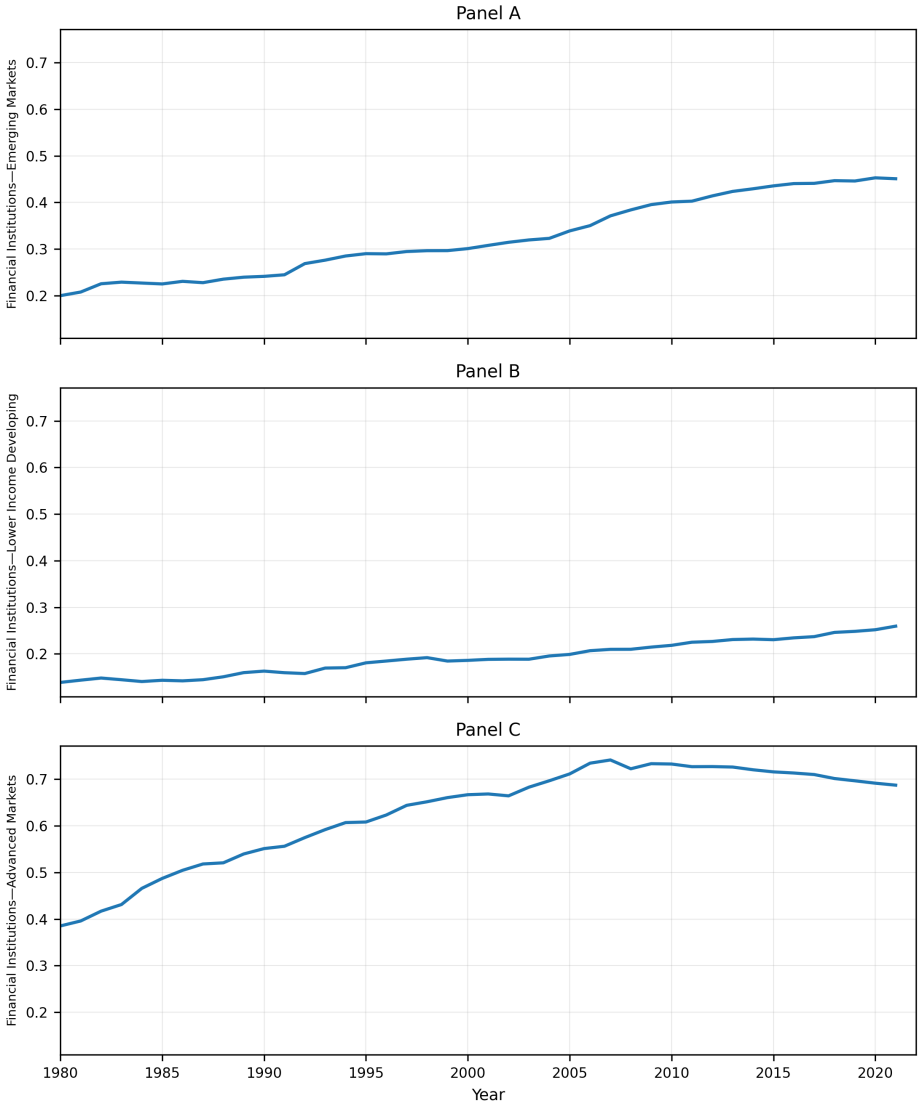


Figure 8: **Annual Trend in Financial Institutions Across Country Income Groups**. This figure shows the evolution of the financial institutions sub-index over time for country income groups. Panel A depicts emerging markets, Panel B represents lower-income and developing countries, and Panel C shows advanced economies.

5.3 Trends in Financial Markets Development

To close out examination of the trends in financial development, I present the distribution for the financial markets sub-index in Figure 9 and Figure 10 which both show more modest improvements in financial markets development when compared to the development of financial institutions showcased in the previous section. These patterns point to a global financial landscape where institutional deepening has outpaced the expansion and sophistication of market-based financial structures.

Panel A of Figure 9 presents the distribution of the average financial markets sub-index among emerging markets, highlighting substantial cross-country heterogeneity and only moderate levels of financial market development. Most emerging economies cluster between 0.1 and 0.4, with only a small number reaching values above 0.5. This pattern reflects the uneven evolution

of capital markets, with some countries strengthening their equity, bond, and derivatives markets while others continue to rely heavily on bank-based financing. Panel B shows the corresponding distribution for lower-income and developing countries, where financial market development remains at very low levels. The majority of countries record values close to zero, with only a few exceeding 0.1 or 0.15. Panel C illustrates the average sub-index for advanced economies, which consistently exhibit the highest levels of financial market development. Most advanced economies record values between 0.4 and 0.8, reflecting well-capitalized, liquid, and diversified markets. Nonetheless, the distribution shows greater variation relative to the financial institutions sub-index, with some economies displaying considerably lower levels of market development despite robust banking sectors.

Panel A of Figure 10 shows the annual evolution of the financial markets sub-index for emerging markets from 1980 to 2022. The trajectory indicates gradual improvements over the four-decade period, with the index rising from around 0.08 in 1980 to just above 0.20 by the early 2020s. The pace of growth is modest compared to the strengthening observed in financial institutions. The series shows brief periods of acceleration, particularly in the mid-1990s and early 2000s, but these gains are neither as steep nor as sustained as those seen in the institutional component. This pattern suggests that while emerging markets have expanded their equity and bond markets over time, progress has been uneven and continues to lag behind the institutional side of their financial systems. Panel B depicts the corresponding trend for lower-income and developing economies, where financial market development remains very limited. The sub-index fluctuates narrowly between 0.01 and 0.03 for most of the sample period, showing only marginal improvement over time. This near-flat trend indicates that capital market development has progressed at an extremely slow rate. Panel C presents the long-run trend for advanced economies, where the financial markets sub-index rises sharply from roughly 0.12 in 1980 to a peak near 0.58 in the mid-2000s. This rapid growth corresponds to a period of financial liberalization, expanding institutional investment, and integration with global capital markets. However, after the Global Financial Crisis, the index stabilizes and then exhibits a mild decline, settling between 0.50 and 0.55 in the 2010s and early 2020s.

From Figure 9 and Figure 10, it is clear that improvements in financial markets have been considerably more subdued than the gains achieved in financial institutions. Advanced economies continue to lead by a wide margin, but their post-2008 plateau has contributed to a slight narrowing of the gap with emerging markets. Even so, emerging markets remain far behind in terms of market depth and liquidity, and lower-income economies exhibit almost no meaningful progress. These trends underscore the global asymmetry in the development of market-based finance and suggest that deepening among financial institutions through the global finance network has driven most of the improvement in overall financial development over the past forty years.

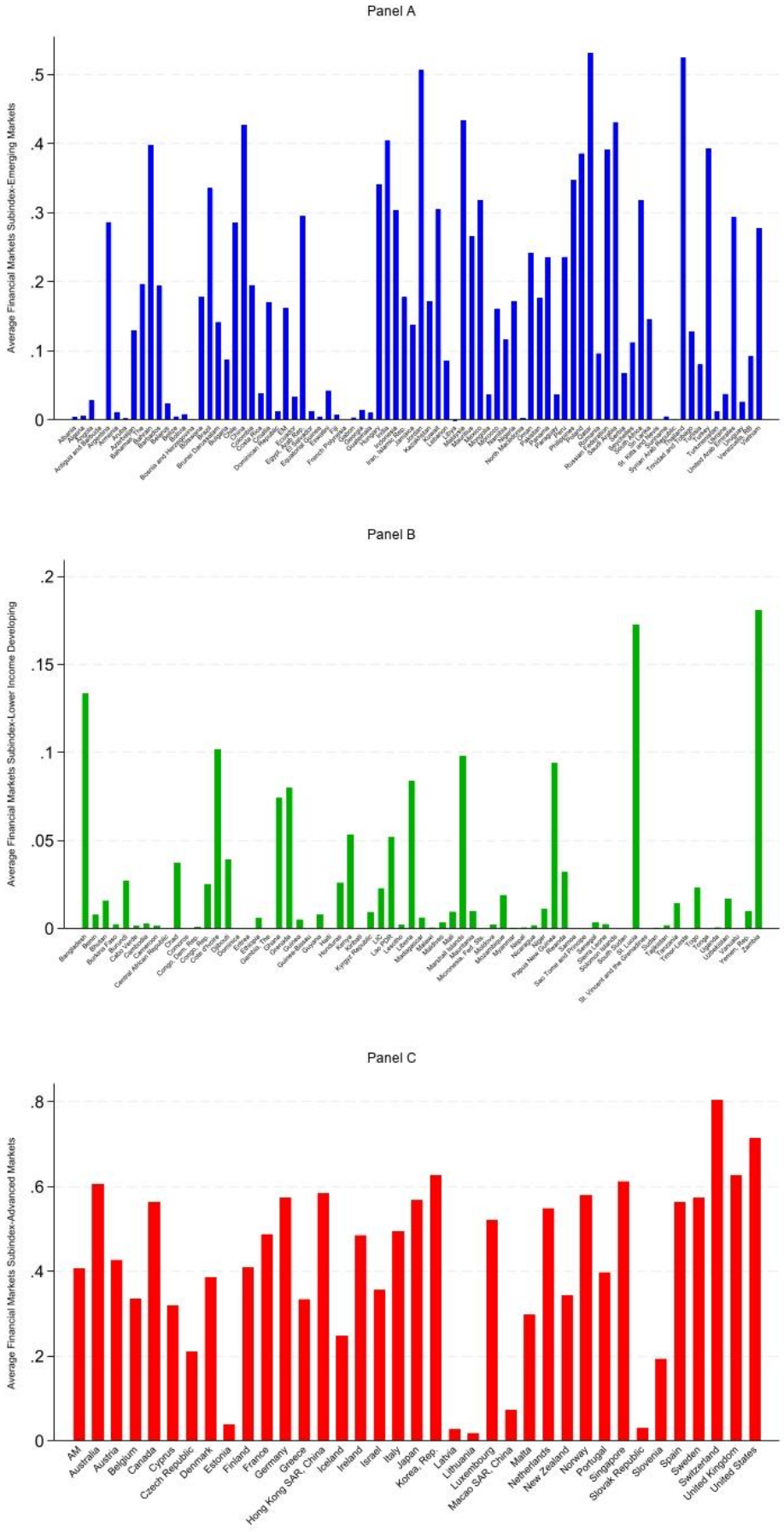


Figure 9: **Average Financial Markets Across Countries**. This figure presents the average level of the financial markets sub-index for 154 countries over the period 1980–2022.

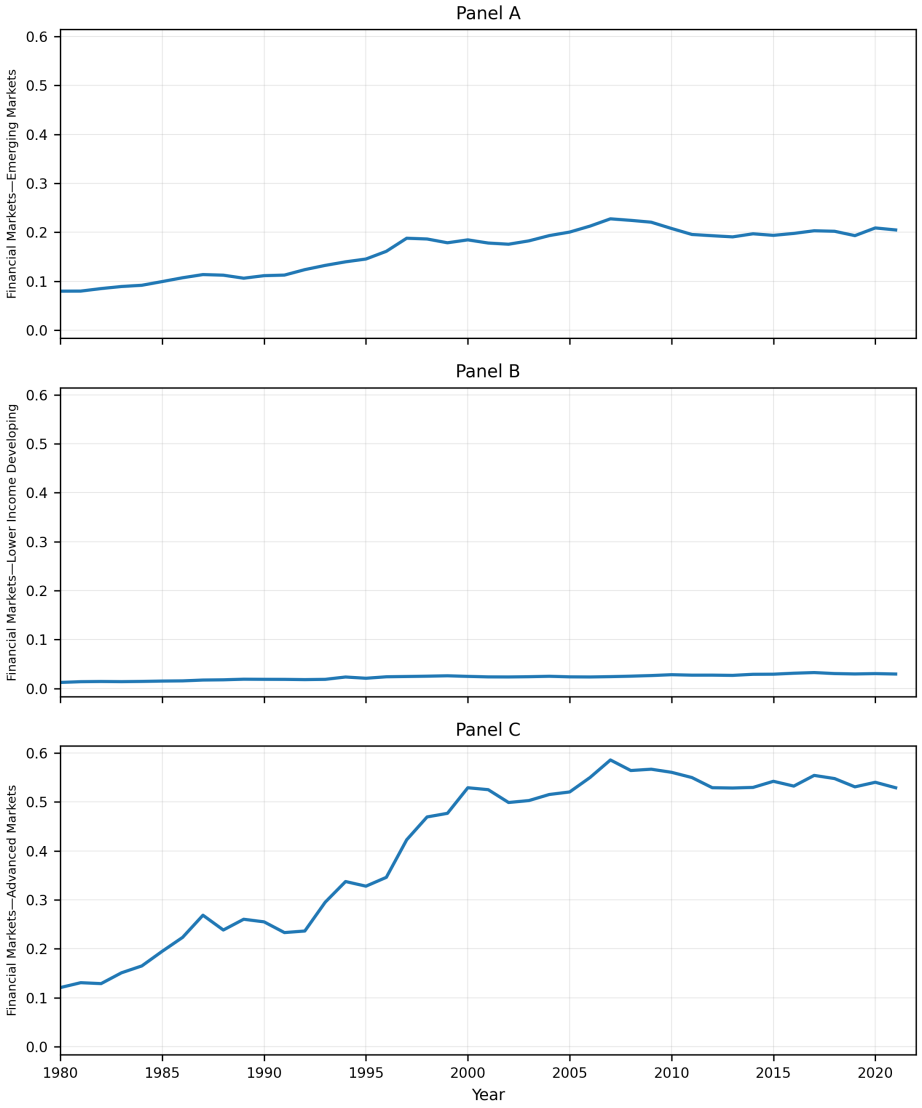


Figure 10: **Annual Trend in Financial Markets Across Country Income Groups**. This figure shows the evolution of the financial markets sub-index over time for country income groups. Panel A depicts emerging markets, Panel B represents lower-income and developing countries, and Panel C shows advanced economies.

6 Results

6.1 Receiver-side effects

I begin by studying receiver-side events whereby countries become treated when their own entities face enforcement action. To reflect the fact that enforcement action can trigger an enduring compliance regime which shifts how financial institutions in a country operate, I make a strong assumption of treatment absorption and obtain a first set of estimates using the Callaway and Sant'Anna (2021) estimator. Given, however, that enforcement is episodic and often one-off, I also obtain estimates using the de Chaisemartin and d'Haultfoeuille (2024) estimator designed for repeated treatment switches, varying treatment intensities, and heterogeneous treatment effects over time.

6.1.1 Absorbing Treatment

In the first step of the empirical analysis, I estimate dynamic treatment effects using the Callaway and Sant'Anna (2021) difference-in-differences estimator, restricting the control group to countries that are never treated. This choice delivers a particularly transparent comparison group, but it comes at the cost of a strong identifying assumption whereby treatment is assumed to be absorbing, so that once a country is exposed to an OFAC enforcement shock it remains treated thereafter. I settle on the absorbing design as a first step as it addresses the fact that the majority of enforcement actions target U.S. entities. By construction, the absorbing design reduces the number of treatment episodes to one per country and as such more faithfully captures receiver-side effects for the sender country as well as for other countries that have experienced an enforcement event.

Figure 11 reports the event-time average treatment effects on the Financial Development Index. When never-treated countries are used as the control group, the post-treatment dynamics display a clear and persistent increase in financial development following the onset of enforcement exposure. The contemporaneous treatment effect is positive and statistically significant (ATT at t = 0 equals 0.011, $p < 0.01$). Treatment effects continue to grow over the following years, peaking approximately four years after treatment onset at around 0.033 ($p < 0.01$), before stabilizing at slightly lower but still positive levels for several subsequent periods.

The pre-treatment coefficients are generally small in magnitude and mostly statistically indistinguishable from zero at conventional levels. There is no systematic monotonic pattern in the pre-treatment event-time estimates, and the coefficients fluctuate around zero without a clear trend, which is visually consistent with the conditional parallel trends assumption. Although the event-study coefficients show no clear systematic pre-treatment trend, the formal joint test of all pre-treatment coefficients rejects the null of zero pre-trends ($\chi^2(364) = 9.575 \times 10^7$, $p < 0.001$). This rejection reflects the extremely large number of lead coefficients included in the test, so that even very small and economically negligible deviations from zero generate statistical rejection.

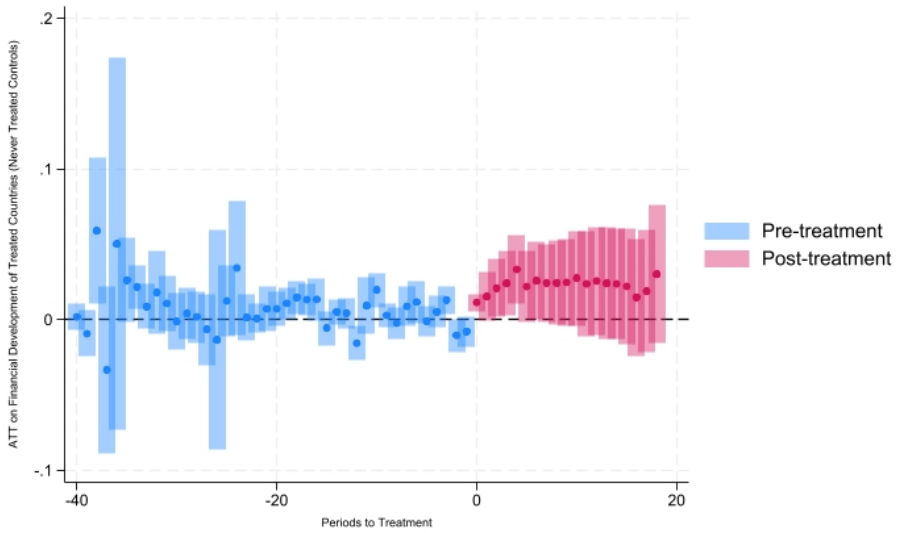


Figure 11: **Dynamic Treatment Effects of OFAC Enforcement Actions (Strict Untreated Comparison)**. This event-study plot displays the estimated group-time average treatment effects from the Callaway and Sant'Anna (2021) difference-in-differences estimator using never treated countries as the comparison group. Blue dots represent estimated coefficients in the pre-treatment period. Red dots represent dynamic post-treatment effects.

To test whether secondary sanctions induce improvements in the institutional dimension as opposed to the market infrastructure dimension, I re-estimate the difference-in-differences models using the financial institutions (FI) and financial markets (FM) sub-indices of the FD Index as outcomes, restricting the control group to countries that are never treated over the sample period. Stronger effects in the financial institution sub-index would provide evidence for compliance-induced harmonization through institutional upgrading.

The resulting dynamic event-time estimates are presented in Figures 12 and 13. The formal pre-trend tests strongly reject the null of zero pre-treatment coefficients for both FI ($\chi^2(364) = 705,900$, $p = 0.000$) and FM ($\chi^2(364) = 6.56 \times 10^6$, $p = 0.000$). Visually, the event-study plots display pronounced and systematic movements in the pre-treatment period, indicating that countries that are eventually treated were already on different trajectories prior to enforcement onset. With never-treated countries as the control group, the financial institutions sub-index does not display stronger effects than the financial markets sub-index. In fact, FI shows no statistically meaningful average post-treatment effect, while FM exhibits a positive average effect that is nevertheless contaminated by strong pre-treatment trend differences. Consequently, neither pattern can be interpreted causally in this specification.

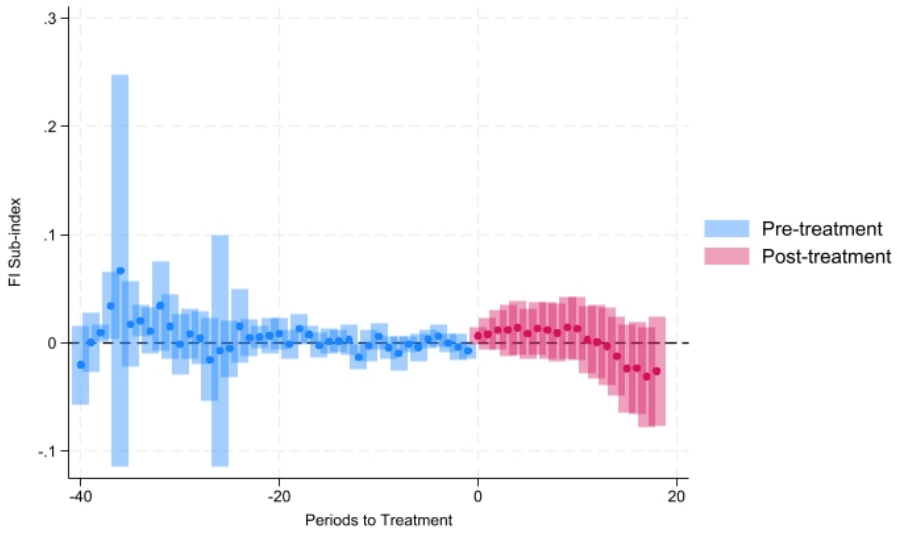


Figure 12: **Dynamic effects of OFAC Enforcement Actions on the Financial Institutions Sub-index (Strict Untreated Comparison)** .This figure plots the estimated average treatment effects for the financial institutions dimension of financial development using never treated countries as the comparison group. Blue dots denote pre-treatment coefficients while red dots trace the evolution of post-treatment effects.

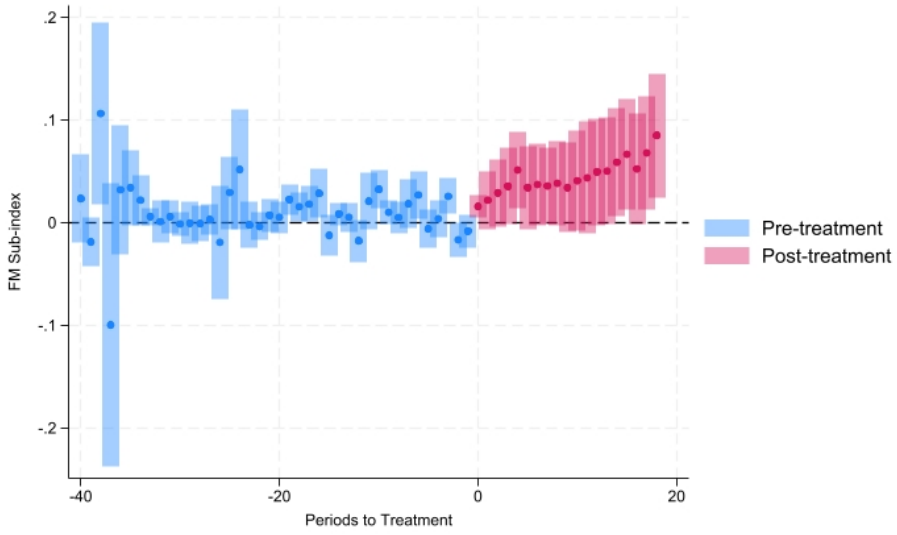


Figure 13: **Dynamic effects of OFAC Enforcement Actions on the Financial Markets Sub-index (Strict Untreated Comparison)**. This event-study graph reports the estimated group-time average treatment effects for the financial markets dimension of financial development using never treated countries as the comparison group. Blue dots denote pre-treatment coefficients while red dots trace the evolution of post-treatment effects.

6.1.2 Episodic Treatment

When I relax the absorbing treatment assumption and allow enforcement exposure to switch on and off over time, the episodic estimator of de Chaisemartin and d'Haultfoeuille (2024) delivers a pattern that is consistent with the main results, while relying on a much weaker

but more realistic treatment structure. The estimator compares units that switch treatment status to units that do not switch in the same period, accounting for multiple switches and varying treatment intensity.

Table 5 reports the average treatment effect (ATE) and the dynamic effects by treatment-switch period for the Financial Development (FD) Index and its two sub-indices. The respective event study graphs are presented in Figure 14, 15 and 16.

	FD Index	FI Sub-index	FM Sub-index		
	(1)	**(2)**	**(3)**		
ATE	0.072 **	0.110 **	0.030	N	Switch x Period
	(0.023)	(0.037)	(0.021)	3236	451
Treatment Switch Period				N	Switchers
1	0.011 **	0.011	0.011 **	1977	62
	(0.003)	(0.007)	(0.003)		
2	0.022 **	0.028 **	0.015 **	1825	66
	(0.006)	(0.011)	(0.005)		
3	0.018	0.021	0.013 *	1801	48
	(0.011)	(0.021)	(0.005)		
4	0.030 **	0.046 **	0.012	1786	42
	(0.009)	(0.016)	(0.008)		
5	0.035 **	0.059 **	0.011	1635	41
	(0.009)	(0.014)	(0.009)		
6	0.026 *	0.047 **	0.004	1487	40
	(0.011)	(0.016)	(0.011)		
7	0.028 *	0.047 **	0.008	1476	40
	(0.011)	(0.016)	(0.011)		
8	0.024 *	0.043 **	0.005	1329	40
	(0.011)	(0.016)	(0.011)		
9	0.026 *	0.044 **	0.007	1181	36
	(0.012)	(0.017)	(0.013)		
10	0.023	0.040 *	0.006	1037	36
	(0.013)	(0.018)	(0.013)		

Table 5: **Dynamic Effects of Enforcement Exposure under Repeated Treatment Switching**. This table reports estimates from the de Chaisemartin and d'Haultfoeuille (2024) episodic difference-in-differences estimator, which allows for repeated treatment switches, time-varying treatment intensity, and heterogeneous treatment effects over time. The outcomes are the aggregate Financial Development (FD) Index (column 1), the Financial Institutions sub-index (column 2), and the Financial Markets sub-index (column 3).The first row reports the average treatment effect (ATE) across all treatment episodes. Subsequent rows report dynamic effects by treatment-switch period, where "period 1" denotes the first period after a switch in enforcement exposure, "period 2" the second period after the switch, and so on. Standard errors are shown in parentheses. The columns labelled "N" and "Switch × Period" report, respectively, the number of country-year observations contributing to each estimate and the number of treatment-switch events used at each horizon.

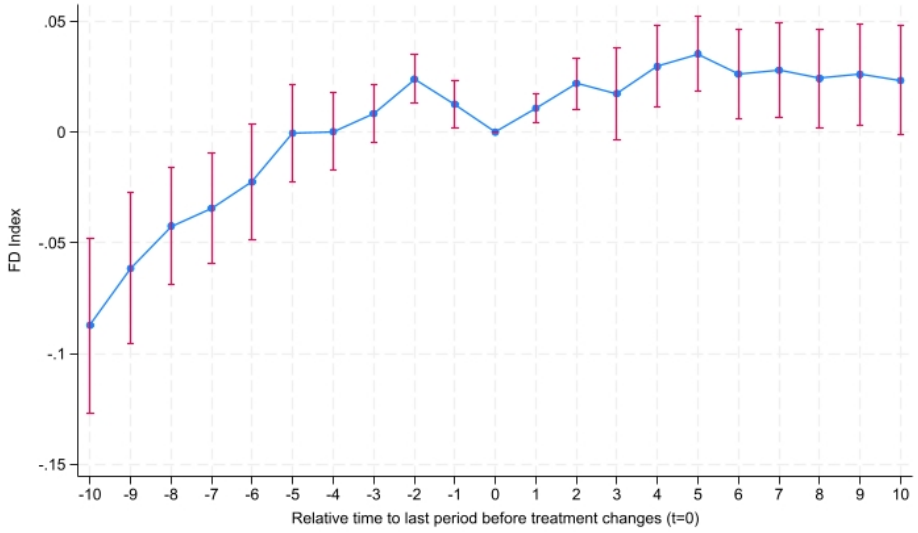


Figure 14: **Dynamic effects of episodic enforcement on the Financial Development Index**.This figure plots event-study estimates from the de Chaisemartin and d'Haultfoeuille (2024) episodic estimator for the aggregate Financial Development (FD) Index. The horizontal axis reports event time relative to the last period before a change in enforcement exposure (t = 0). Negative values denote periods before a treatment switch and positive values denote periods after the switch. Points show estimated average treatment effects at each relative time, and vertical bars denote 95 percent confidence intervals.

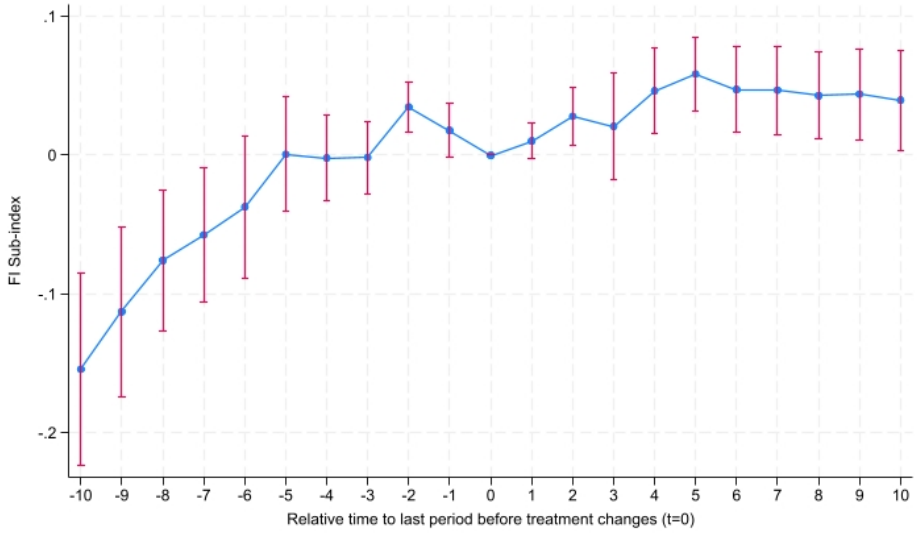


Figure 15: **Dynamic effects of episodic enforcement on the Financial Institutions Sub-index**.This figure presents event-study estimates for the Financial Institutions sub-index using the de Chaisemartin and d'Haultfoeuille (2024) episodic estimator. Event time is measured relative to the last period before a treatment switch (t = 0). Estimates and 95 percent confidence intervals are shown. The figure indicates that gains in financial institutions are the main driver of the overall financial development response, with positive and statistically meaningful effects emerging shortly after treatment switches and remaining persistent over subsequent periods.

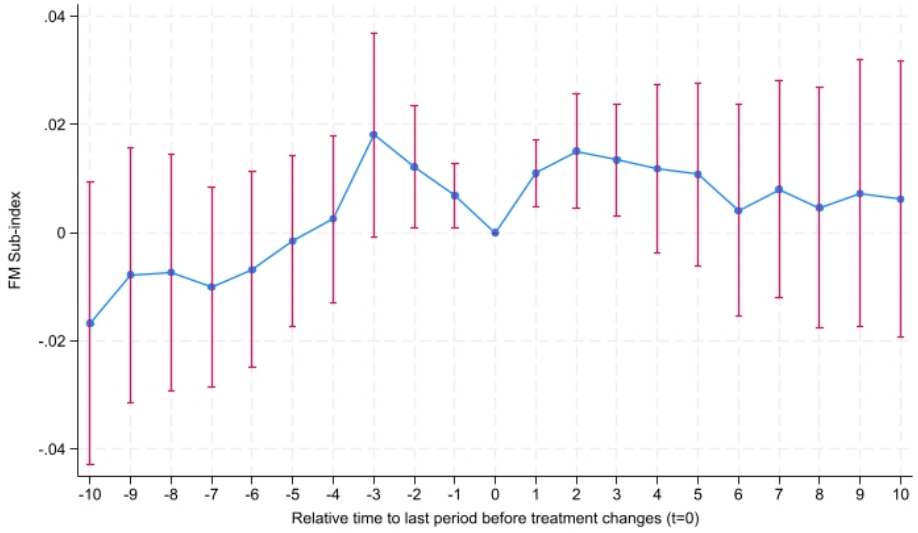


Figure 16: **Dynamic effects of episodic enforcement on the Financial Institutions Sub-index**.This figure shows event-study estimates for the Financial Markets sub-index based on the de Chaisemartin and d'Haultfoeuille (2024) episodic estimator. The x-axis reports event time relative to the last pre-switch period (t = 0), and the y-axis shows estimated treatment effects with 95 percent confidence intervals.

Across all three outcomes, the estimated ATE is positive. For the aggregate FD Index, the ATE is 0.072 and statistically significant at the 5 percent level. The effect is even stronger for the Financial Institutions sub-index, where the ATE reaches 0.110 and is also statistically significant. For the Financial Markets sub-index, the ATE is smaller, around 0.030, and not precisely estimated. This already suggests that enforcement exposure primarily operates through institutional upgrading rather than through deepening or expansion of financial markets.

Looking at the dynamic pattern by treatment-switch period reveals a clear and economically intuitive trajectory. For the FD Index, the effect is already positive and significant in the first two switch periods, rises in magnitude through periods four and five, and remains positive through period ten, although it becomes less precisely estimated at longer horizons as sample size shrinks.

The Financial Institutions sub-index displays the strongest and most persistent response. From switch period two onward, the coefficients are consistently positive and statistically significant across nearly all horizons. The magnitude increases through periods four to six and remains large through period ten. By contrast, the Financial Markets sub-index shows much weaker and less stable effects. While a few early and mid-horizon coefficients are positive and occasionally significant, most estimates are small and imprecise. This suggests that enforcement exposure does not robustly translate into deeper or more liquid markets, but rather into institutional upgrading.

6.2 Sender-side Effects

I now turn attention to two types of sender-side effects. The first type examines sender-originating events in which U.S. entities face enforcement action and the second examines the demonstration effect of major enforcement actions against multinational firms. I test for the extent to which these events diffuse to other countries and trigger improvements in financial development.

6.2.2 Sender-Originating Diffusion

To operationalize sender-originating diffusion, I construct a measure of regional correspondent banking exposure using data provided by Swift to the Committee on Payments and Market Infrastructures (CPMI) of the Bank for International Settlements (BIS). The CPMI dataset reports the number of active correspondent relationships at the sub-regional level, separately identifying those involving U.S. dollar transactions and those in all currencies. Active correspondents are defined as financial institutions that have exchanged MT 103 or MT 202 cross-border payment messages during a given year, and therefore serve as a meaningful proxy for engagement with the U.S.-centered financial system. Each correspondent represents a financial institution involved in cross-border payments and is counted once per corridor and month, yielding a granular view of the network of relationships through which international payment messages flow. I aggregate the CPMI sub-regional classifications to the five IMF regions and compute the exposure measure as the share of active U.S. dollar correspondents relative to total active correspondents in each region and year[16] as indicated in Equation 2.

$$\text{Regional Correspondent Exposure}_{r,t} = \frac{\text{Active USD Correspondents}_{r,t}}{\text{Active All-Currency Correspondents}_{r,t}} \tag{2}$$

As the CPMI data are only available from 2011 to 2022, I assume that the regional correspondent structures observed in 2011 reasonably approximate earlier years and extend this measure backward to match the 1980–2021 panel on financial development. This approach reflects necessary data constraints but is supported by evidence that correspondent banking networks and the U.S. dollar's dominance evolved slowly prior to the 2010s[17]. Each country is then assigned the exposure value of its respective IMF region, allowing for an assessment of how regional dependence on U.S.-linked correspondent networks shapes the diffusion of compliance norms and institutional upgrading in response to U.S. sanctions enforcement.

[16]This ratio captures the share of correspondent banking activity denominated in U.S. dollars, an indicator of the region's embeddedness in U.S.-centric financial networks. Regional sums were computed from the sub-regional series to align with the five IMF regions and merged into the country-year panel on Financial Development and Secondary Sanctions.

[17]The CPMI dataset covers 2011–2022, whereas the financial development panel spans 1980–2021. To extend coverage backwards, it is assumed that the regional correspondent structure observed in 2011 reflects a relatively stable network topology for the preceding years (1980–2010). This assumption is necessary but defensible given the historically slow evolution of correspondent banking networks before the 2010s and the stability of the U.S. dollar's dominance as a settlement currency. Nevertheless, the interpolation should be interpreted cautiously: earlier years lack direct observational data, and any pre-2011 variation reflects only country-level shifts in financial development, not observed changes in cross-border correspondence intensity.

The resulting regional correspondent exposure measure serves as a proxy for regional dependence on the U.S.-centered financial system, which I use to test the sender-originating diffusion effect. I estimate whether the effect of sanctions enforcement depends on the degree of a region's exposure to U.S.-centric correspondent banking networks. The outcome variable, FD_{ct}, is the IMF Financial Development Index for country c in year t. The explanatory variable of interest is an interaction between regional correspondent exposure to U.S. banks and the intensity of sanctions enforcement by the U.S. Treasury.

The regional exposure measure, $\mathsf{Exposure}_{r(c)}$, captures the share of active U.S. dollar correspondents within each IMF region r to which country c belongs. The enforcement measure, $\mathsf{Enforce}_t$, is constructed from OFAC sanctions enforcement actions against U.S. financial institutions and reflects the scale and severity of compliance shocks originating in the sender country.

The baseline specification exploits cross-sectional variation in regional exposure and time-series variation in U.S. enforcement intensity in a two-way fixed effects framework:

$$FD_{ct} = \alpha_c + \lambda_t + \beta\big(\mathsf{Exposure}_{r(c)} \cdot \mathsf{Enforce}_t\big) + \gamma' X_{ct} + \varepsilon_{ct}, \tag{3}$$

where α_c are country fixed effects, λ_t are year fixed effects, and X_{ct} is a vector of the controls. A positive estimate of β indicates that sanctions enforcement in the sender induces compliance upgrading through correspondent banking networks. I measure the annual intensity of sanctions enforcement in the sender by aggregating OFAC enforcement actions against U.S. financial institutions. For each year, I compute the number of such actions and the total value of penalties (in U.S. dollars), and use the log of total penalties as my main enforcement measure. In robustness checks, I use the count of actions and a composite index that averages the normalized counts and normalized log penalties.

Identification arises from comparing changes in financial development between more and less exposed regions as sanctions enforcement fluctuates. Country fixed effects absorb time-invariant institutional and structural characteristics (e.g., legal origin, history, geography), while year fixed effects capture global shocks affecting all economies. The interaction design therefore represents a difference-in-differences estimator with continuous treatment intensity.

Two features of the data strengthen identification. First, the correspondent exposure measure is largely predetermined and slow-moving: for 1980–2010, regional exposure is fixed at its observed 2011 value due to limitations in historical CPMI–Swift availability, reflecting the stability of correspondent banking structures before the 2010s. Second, variation in U.S. enforcement intensity derives from geopolitical events and idiosyncratic violations by U.S. financial institutions, rather than conditions in bystander economies, aligning with the sender-originating diffusion mechanism and the conceptualization of sender-side effects. Standard errors are clustered at the country level to allow for serial correlation within panels, with robustness checks incorporating two-way clustering by country and year. The associated baseline results are presented in Table 6.

In Panel A, the coefficient on the interaction between enforcement intensity and regional correspondent exposure is positive and statistically significant in columns (1), (3), and (4). This indicates that when sanctions enforcement intensifies in the United States, countries located in regions more tightly connected to U.S. dollar correspondent banks experience higher levels of financial development. The estimates remain economically meaningful after absorbing country and year fixed effects, suggesting that the observed effect does not simply reflect long-run institutional differences or global shocks. Panel B shows that the inclusion of controls does not materially alter this conclusion. The coefficient on the interaction term remains positive and statistically significant in the most restrictive specification (column 4), though with slightly reduced precision. This stability indicates that the estimated effect is not driven by contemporaneous changes in trade openness, capital-account liberalization, GDP growth, or technological goods imports. As with the unconditional results, the effect survives the inclusion of country and year fixed effects.

	Financial Development Index			
Panel A	**(1)**	**(2)**	**(3)**	**(4)**
Enforcement x Exposure	0.009 **	-0.022	0.009 *	0.009 *
	(0.001)	(0.023)	(0.004)	(0.004)
Constant	0.261 **	0.396 **	0.262 **	0.262 **
	(0.003)	(0.125)	(0.021)	(0.019)
Adjusted R-squared	0.911	0.180	0.933	0.934
Panel B				
Enforcement x Exposure	0.008 **	-0.004	0.009	0.008 *
	(0.001)	(0.012)	(0.004)	(0.004)
FDI XGDP	0.000	-0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
GDP PC Growth	0.000	0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
IFS Imports	0.002 **	0.010 *	0.000	-0.001
	(0.001)	(0.004)	(0.001)	(0.001)
Chinn Ito Index	0.019 **	0.074 **	0.011 *	0.011 *
	(0.005)	(0.012)	(0.004)	(0.004)
ICT Imports	0.001 **	0.003 **	0.001 *	0.000 *
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.230 **	0.152 **	0.244 **	0.246 **
	(0.008)	(0.055)	(0.021)	(0.021)
Adjusted R-squared	0.917	0.485	0.934	0.936
Country FE	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	Yes
Violation Type FE	No	No	No	Yes
Sanctions Programme FE	No	No	No	Yes
N	8,290	8,290	8,290	8,285

Table 6: **Sanctions Enforcement and USD Correspondent Exposure**. This table reports the baseline estimates from equation (3), examining whether the effect of sanctions enforcement depends on regional exposure to U.S. correspondent banking relationships. Panel A presents specifications without additional controls, while Panel B introduces standard macro-financial covariates. Across both panels, columns (1)–(3) sequentially introduce fixed effects, and column (4) reports the preferred specification, which includes country, year, sanctions-programme, and violation-type fixed effects.

To examine the dynamic propagation of sanctions enforcement through correspondent banking networks, I estimate a distributed-lag specification that traces the evolution of financial development before and after enforcement shocks:

$$\text{FD}_{it} = \sum_{k=-5}^{7} \beta_k(\text{Exposure}_{it} \times \mathbf{1}\{t - g_i = k\}) + \alpha_i + \gamma_t + X'_{it}\delta + \varepsilon_{it} \tag{4}$$

The coefficients β_k capture the dynamic response of financial development in countries with greater exposure to U.S. correspondent banking relationships, relative to less exposed countries, at different horizons around the timing of sanctions enforcement. Country fixed effects absorb time-invariant heterogeneity, while year fixed effects control for global financial cycles, enforcement regimes, and common regulatory shocks.

The model is informed by the descriptive statistics in Section 4.1 and previous work by Early and Preble (2020a) and Early and Preble (2020b), which shows that sanctions enforcement is globally clustered in time. Early and Preble (2020a) describe five distinct enforcement eras reflecting sparse enforcement pre-1990s, ramp-up in late 1990s, explosion post-2001, financialization and AML tightening post-2008 and renewed geopolitical enforcement post-2014; the model accounts for the clustering of enforcement episodes in these distinct enforcement eras with year fixed effects.

The identifying structure of the model implies that each β_k is estimated from within-year, cross-country variation in exposure, rather than from global changes in sanctions intensity over time. As such, the specification isolates the diffusion of enforcement through correspondent networks over and above shared macro-financial conditions. Table 7 reports the results. Column 4, which includes country, year, sanctions-programme, and violation-type fixed effects, constitutes the preferred specification.

First, the coefficients on the leads are small in magnitude and statistically indistinguishable from zero. A joint test of the five pre-enforcement coefficients fails to reject the null of no pre-trends ($F(5,182) = 1.11$, $p = 0.36$), indicating that more and less exposed countries followed parallel paths in financial development prior to enforcement once common global shocks are accounted for. Second, the contemporaneous effect of enforcement is positive and statistically significant, suggesting that exposure to enforcement shocks is associated with an immediate improvement in financial development. This effect strengthens in the first post-enforcement year. Third, the dynamic pattern exhibits persistence over the medium run. While some later coefficients attenuate and lose precision, the early post-enforcement profile remains positive, for at least up to three years. While economic intuition would suggest a more delayed response which would align with the institutional nature of the sender-originating diffusion mechanism: investments in AML/KYC systems, monitoring technologies, and correspondent relationship governance require time to implement and diffuse through global financial networks; a delayed institutional mechanism is entirely consistent with an early, sharp effect once year fixed effects are imposed.

The concentration of the estimated effects in the first three years reflects the identifying role of year fixed effects, which absorb gradual global compliance harmonization and isolate relative adjustment across countries within the same enforcement regime. Enforcement actions constitute discrete regulatory shocks that trigger rapid repricing of correspondent risk, supervisory triage, and reorganization of financial intermediation in highly exposed jurisdictions. These adjustments can affect measured financial development quickly, even as deeper investments in AML/KYC infrastructure and governance continue to unfold over a longer horizon. Once these initial reallocations occur, cross-country dispersion narrows and subsequent institutional deepening is common across countries, limiting the variation available for identification with year fixed effects. The results therefore capture the front-loaded relative response to enforcement, rather than the full time path of institutional convergence.

Figure 17 visualizes these dynamics. When year fixed effects are included, the event-study profile shows a modest but clearly defined increase in financial development following enforcement, with no evidence of anticipatory divergence beforehand. The magnitude of the effects are smaller and less precisely estimated than in models without year fixed effects, but the identifying variation is a consequence of, what I would argue is, credible identification. Figure 18 provides a point of comparison by plotting the estimates from the specification in Column 4 that excludes year fixed effects. In this case, the dynamic coefficients are substantially larger and highly significant both before and after enforcement, and the joint pre-trend test strongly rejects parallel trends. These patterns reflect the confounding influence of global sanctions expansion, secular financial deepening, and common regulatory reforms that coincide with enforcement episodes.

As a further step of assurance and to bring greater clarity around the timing of the institutional adjustments induced by the sender-originating diffusion mechanism, I re-estimate equation 4 using the financial institutions sub-index as the dependent variable. If the preceding results for the aggregate FD Index are to be believed and if, as the dual structure CCMS framework predicts, the impact of sanctions enforcement is concentrated in the institutional dimension, then the financial institutions sub-index should show the same sharp and early timing of effects registered in the aggregate FD Index even more clearly.

As shown in Figure 19 and Table 8, the response of institutional financial development is concentrated in the contemporaneous and first post-enforcement year, with statistically significant increases in both periods. This pattern is consistent with a rapid institutional reclassification and governance response to enforcement shocks, rather than a slow process of capital deepening[18].

[18]One could argue that this early spike is too fast to be institutional, but it is exactly the timing one would expect for formal institutional upgrading and compliance visibility which can change rapidly following enforcement.

	Financial Development Index			
	(1)	**(2)**	**(3)**	**(4)**
Lead 5	0.036 **	0.034 **	0.034 **	0.044
	(0.004)	(0.004)	(0.004)	(0.031)
Lead 4	0.002	0.003	0.002	0.037
	(0.002)	(0.002)	(0.002)	(0.022)
Lead 3	0.003	0.004 *	0.005 *	0.019
	(0.002)	(0.002)	(0.002)	(0.021)
Lead 2	0.024 **	0.022 **	0.022 **	0.033
	(0.002)	(0.002)	(0.002)	(0.021)
Lead 1	0.008 **	0.007 **	0.007 **	0.004
	(0.002)	(0.002)	(0.002)	(0.017)
Enforcement x Exposure	0.027 **	0.024 **	0.025 **	0.040 *
	(0.002)	(0.001)	(0.002)	(0.019)
Lag 1	0.025 **	0.024 **	0.023 **	0.057 **
	(0.002)	(0.001)	(0.002)	(0.019)
Lag 2	0.004 *	0.006 **	0.006 **	0.024
	(0.002)	(0.002)	(0.002)	(0.021)
Lag 3	0.018 **	0.019 **	0.019 **	0.020
	(0.002)	(0.002)	(0.002)	(0.024)
Lag 4	0.017 **	0.017 **	0.016 **	-0.021
	(0.002)	(0.002)	(0.002)	(0.025)
Lag 5	-0.019 **	-0.015 **	-0.014 **	-0.035
	(0.003)	(0.003)	(0.003)	(0.023)
Lag 6	0.021 **	0.019 **	0.019 **	-0.024
	(0.003)	(0.003)	(0.003)	(0.031)
Lag 7	0.026 **	0.025 **	0.025 **	-0.023
	(0.004)	(0.004)	(0.004)	(0.035)
FDI XGDP	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
GDP PC Growth	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
IFS Imports	0.001	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Chinn Ito Index	0.013 **	0.013 **	0.013 **	0.010 *
	(0.004)	(0.004)	(0.004)	(0.004)
ICT Imports	0.001 **	0.001 *	0.001 **	0.000 *
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.182 **	0.185 **	0.185 **	0.184 **
	(0.008)	(0.008)	(0.008)	(0.033)
Adjusted R-squared	0.887	0.888	0.888	0.900
Country FE	Yes	Yes	Yes	Yes
Violation Type FE	No	Yes	Yes	Yes
Sanctions Programme FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
N	7,503	7,501	7,494	7,494

Table 7: **Dynamic Diffusion of Sanctions Enforcement Through Correspondent Networks**. This table reports the baseline estimates from equation (4), examining the dynamic effect of sanctions enforcement through regional exposure to U.S. correspondent banking relationships. Columns (1)–(3) sequentially introduce fixed effects, and column (4) reports the preferred specification, which includes country, year sanctions-programme, and violation-type fixed effects.

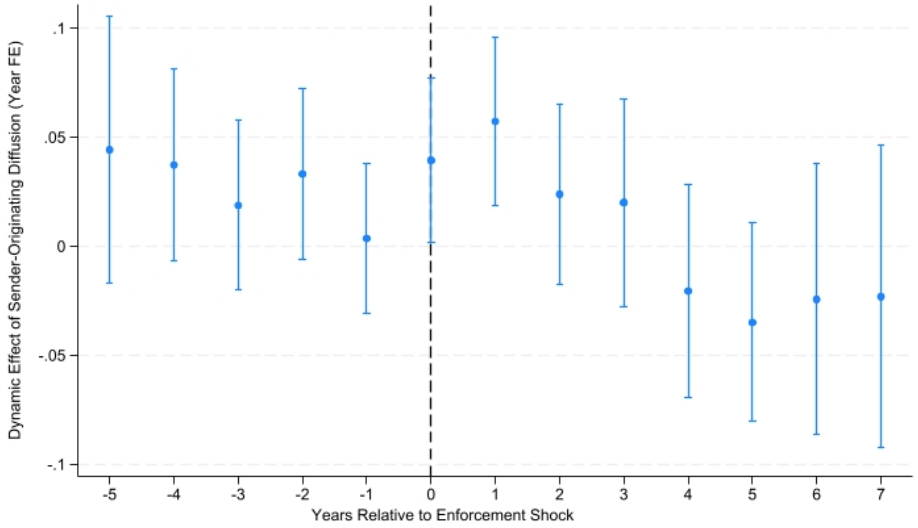


Figure 17: **Dynamic Diffusion of Sanctions Enforcement (Year FE)**.This event-study plot displays the estimated dynamic coefficients from the preferred specification of equation (4) which includes year fixed effects. The estimates trace the evolution of the effect of U.S. sanctions enforcement on financial development as a function of regional exposure to U.S. dollar correspondent banking networks. Coefficients measure the interaction between regional exposure and enforcement activity relative to the year of the enforcement shock ($\ell = 0$). Negative ℓ values represent pre-shock leads .

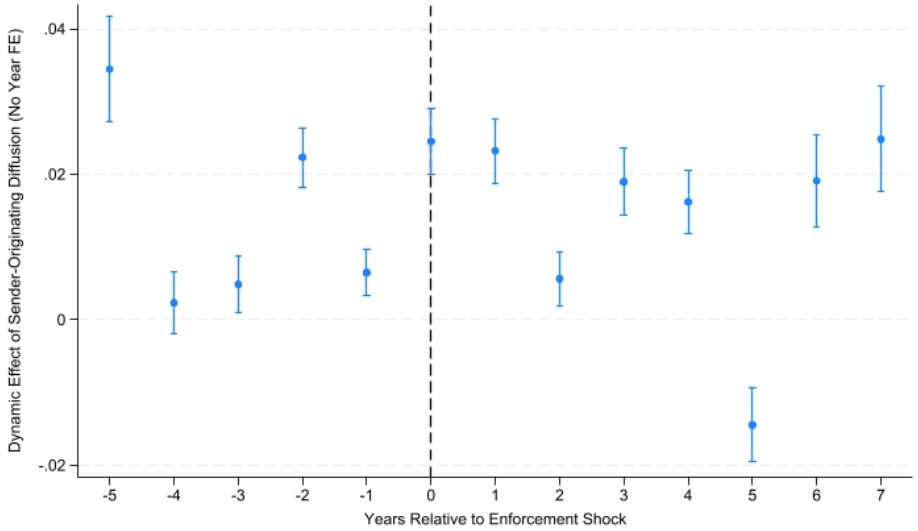


Figure 18: **Dynamic Diffusion of Sanctions Enforcement (No Year FE)**.This event-study plot displays the estimated dynamic coefficients from a less demanding specification of equation (4) which does not include year fixed effects. The estimates trace the evolution of the effect of U.S. sanctions enforcement on financial development as a function of regional exposure to U.S. dollar correspondent banking networks. Coefficients measure the interaction between regional exposure and enforcement activity relative to the year of the enforcement shock ($\ell = 0$). Negative ℓ values represent pre-shock leads .

	Financial Institutions Sub-index
	(1)
Lead 5	0.085 *
	(0.039)
Lead 4	0.041
	(0.025)
Lead 3	-0.004
	(0.022)
Lead 2	0.035
	(0.028)
Lead 1	0.042
	(0.023)
Enforcement x Exposure	0.061 **
	(0.023)
Lag 1	0.067 **
	(0.022)
Lag 2	0.040
	(0.024)
Lag 3	0.007
	(0.031)
Lag 4	0.012
	(0.032)
Lag 5	-0.042
	(0.031)
Lag 6	-0.054
	(0.038)
Lag 7	0.008
	(0.047)
FDI XGDP	0.000
	(0.001)
GDP PC Growth	-0.001
	(0.001)
IFS Imports	0.001
	(0.001)
Chinn Ito Index	0.011 *
	(0.005)
ICT Imports	0.001
	(0.001)
Constant	0.237 **
	(0.041)
Adjusted R-squared	0.862
Country FE	Yes
Violation Type FE	Yes
Sanctions Programme FE	Yes
Year FE	Yes
N	7,677

Table 8: **Dynamic Diffusion of Sanctions Enforcement via Financial Institutions Sub-index**. This table reports estimates from equation (4), examining the dynamic effect of sanctions enforcement through regional exposure to U.S. correspondent banking relationships on the financial institutions sub-index. The estimates are from the version of the model which includes country, year sanctions-programme, and violation-type fixed effects.

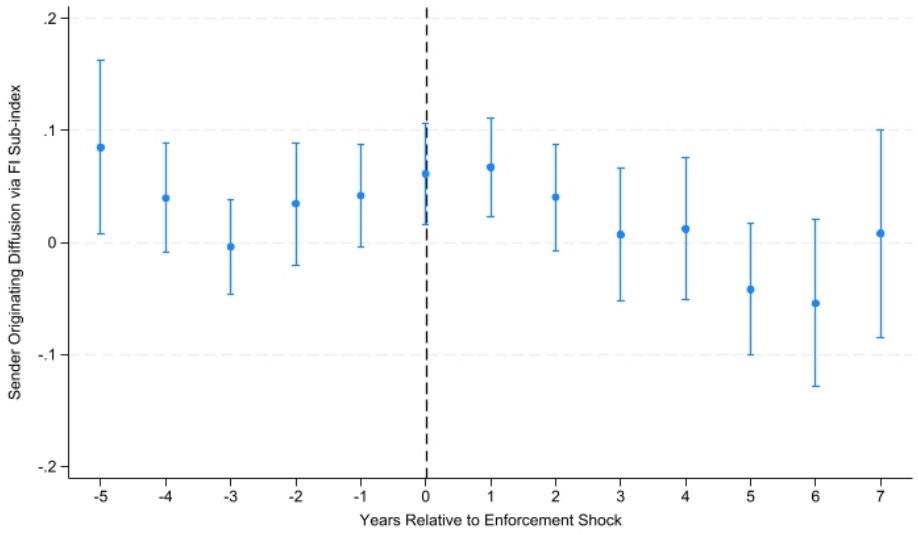


Figure 19: **Dynamic Diffusion via Financial Institutions Sub-index**.This event-study plot displays the estimated dynamic coefficients from the estimation of equation (4) which uses the financial institutions sub-index as the dependent variable. The estimates trace the evolution of the effect of U.S. sanctions enforcement on financial development as a function of regional exposure to U.S. dollar correspondent banking networks. Coefficients measure the interaction between regional exposure and enforcement activity relative to the year of the enforcement shock ($\ell = 0$). Negative ℓ values represent pre-shock leads .

The aggregate FD Index showed early, sharp relative gains. As expected, the financial institutions sub-index shows the same timing, even more clearly. Furthermore, once year fixed effects are included, neither shows a slow, monotonic rise.

This pattern, reflected in the event-study plots presented in Figure 17 and Figure 19, not only strengthens interpretation of the theorized mechanism, but shows very precisely that sanctions enforcement operates as a discrete institutional coordination shock, not as a gradual capital accumulation process which one would expect to occur over a longer time horizon. This shock triggers rapid institutional formalization, governance intensification and compliance-driven restructuring in the financial institutions of the sender country which diffuses through the global financial network, thereby propelling improvements in financial development across countries. The timing of the mechanism appears to be in concert with the work done by Early and Preble (2020a) and Early and Preble (2020b) on the effect that sanctions enforcement is intended to have on the reputation of financial institutions and why they might want to respond quickly to improve compliance so as to address and avoid further sanctions violations. This, one could argue, is the raison d'etre of secondary sanctions.

When considered as a whole, the results support the sender-originating diffusion as a sender-side effect in the dual structure extension to the CCMS framework. Sanctions enforcement appears to induce compliance upgrading within core financial institutions, and these improvements propagate outward through correspondent banking networks to third-party and bystander economies.

6.2.3 Demonstration Effect of Major Financial Enforcement Events

If we think of the global financial network as a kind of social technology embedded within professional and industry-wide social networks then it is not difficult to imagine that enforcement events which impose a significant financial burden can have a powerful demonstration effect. A poignant example of this is the 2014 enforcement action against the French multinational bank, BNP Paribas; the EUR 9 billion dollar fine was almost equivalent to the bank's entire 2013 pre-tax income[19] and was the largest ever against a financial institution.

Building on the correspondent links established for sender-side effects, I study the intensification of geoeconomic power through the imposition of these significant penalties against multinational financial institutions as another sender-side effect which catalyzes improvements in financial development and the harmonization of global finance. This analysis is based on theoretical and empirical work from the political science literature which demonstrates that the whale hunting strategy which characterizes these major enforcement events serve as visible compliance shocks with industry-wide signaling and reputational effects (Early and Preble, 2020a; Early and Preble, 2020b; Preble and Early, 2024; Early and Peterson, 2023). Because multinational institutions are more deeply connected in the cross-border payment network, their enforcement outcomes should propagate more rapidly and broadly compared to smaller domestic violations. I conjecture that these events represent salient shocks that heighten industry-wide risk perceptions and incentivize accelerated compliance upgrading within the global correspondent banking network.

I construct an annual measure of the intensity of major enforcement shocks[20] using the aggregated value of penalties associated with these actions, expressed as the logarithm of total penalties in year t. This serves as the main variable of interest, $\mathsf{MajorEnforce}_t$. In robustness checks, I also use the count of major enforcement actions per year and a composite index that averages the normalized log-penalty and event-count series, ensuring that results are not driven by any single dimension of enforcement intensity. The associated baseline results are presented in Table 9.

Across all specifications, the interaction between regional correspondent exposure and major enforcement shocks is positive and statistically significant in the simplest model, and remains positive, though somewhat less precisely estimated, when progressively richer fixed effects are introduced. In the preferred specification (column 4), which includes country, year, sanctions-programme, and violation-type fixed effects, the coefficient remains positive and stable in magnitude. This suggests that more exposed regions experience faster improvements in financial development following highly visible enforcement actions against large multinational banks.

[19] BNP's pre-tax income for 2013 was 8.2bn euros (USD $11.2bn)

[20] I operationalize the demonstration effect of large and highly visible enforcement actions, by defining major financial enforcement events as cases where multinational financial institutions incur penalties exceeding USD $1 million.

	Financial Development Index			
Panel A	**(1)**	**(2)**	**(3)**	**(4)**
MajorEnforcement x Exposure	0.006 **	-0.018	0.005	0.005
	(0.001)	(0.019)	(0.004)	(0.004)
Constant	0.276 **	0.375 **	0.280 **	0.281 **
	(0.002)	(0.104)	(0.014)	(0.014)
Adjusted R-squared	0.911	0.180	0.933	0.934
Panel B				
MajorEnforcement x Exposure	0.005 **	-0.005	0.005	0.005
	(0.001)	(0.011)	(0.004)	(0.004)
FDI XGDP	0.000	-0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
GDP PC Growth	0.000	0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
IFS Imports	0.002 **	0.010 *	0.000	-0.001
	(0.001)	(0.004)	(0.001)	(0.001)
Chinn Ito Index	0.022 **	0.074 **	0.011 *	0.011 *
	(0.005)	(0.012)	(0.004)	(0.004)
ICT Imports	0.001 **	0.003 **	0.001 *	0.000 *
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.241 **	0.155 **	0.262 **	0.265 **
	(0.008)	(0.043)	(0.016)	(0.016)
Adjusted R-squared	0.911	0.485	0.934	0.935
Country FE	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	Yes
Violation Type FE	No	No	No	Yes
Sanctions Programme FE	No	No	No	Yes
N	8,290	8,290	8,290	8,285

Table 9: **Major Financial Enforcement and USD Correspondent Exposure**. This table reports the baseline estimates from the version of equation (3) which uses major financial enforcement events as the main enforcement shock. Panel A presents specifications without additional controls, while Panel B introduces standard macro-financial covariates. Across both panels, columns (1)–(3) sequentially introduce fixed effects, and column (4) reports the preferred specification, which includes country, year, sanctions-programme, and violation-type fixed effects.

These findings show that financial enforcement does not only transmit through direct regulatory coercion but also through reputational spillovers and strategic compliance responses, consistent with the broader geoeconomic logic of financial statecraft. In other words, the disciplining of one systemically important bank can induce systemic improvements in the financial development of distant economies linked through correspondent banking relationships. It underscores how the visibility, scale, and symbolic force of enforcement actions shape the global harmonization of financial infrastructure.

The results are also consistent with the theoretical and empirical work on the whale hunting strategy of sanctions enforcement (Early and Preble, 2020a; Early and Preble, 2020b; Preble and Early, 2024; Early and Peterson, 2023) which predicts the reputational spillovers of significant enforcement actions against large financial institutions.

Importantly, however, the results in Table 9 suggest that the impact of large, visible enforcement actions is more muted than the mechanism implied by a pure demonstration effect would predict. While the coefficient on the interaction between major enforcement shocks and regional correspondent exposure is positive in the unconditional specifications, the effect becomes statistically indistinguishable from zero once richer fixed effects are incorporated in the preferred model (column 4). This indicates that, conditional on country, year, sanctions-programme, and violation-type heterogeneity, the intensity of major enforcement actions does not independently generate measurable improvements in financial development among bystander economies.

This contrast with the sender-originating diffusion results is instructive. When enforcement falls directly upon U.S. financial institutions, the core hubs of the global correspondent network, the diffusion effects are both statistically significant and economically meaningful. The magnitude of these effects is consistently larger, implying that the upgrading of compliance systems within the sender country forms a more powerful propagation channel than generalized reputational spillovers of the whale hunting strategy from major enforcement cases (Early and Preble, 2020a; Early and Preble, 2020b; Preble and Early, 2024; Early and Peterson, 2023).

The lack of significance in the preferred specification suggests that it is not the severity or visibility of enforcement that drives institutional upgrading, but rather who is being disciplined. Enforcement that targets highly connected U.S. banks imposes operational changes that must be pushed outward through their foreign correspondent relationships, affecting compliance expectations and technological standards system-wide. In contrast, multinational institutions headquartered outside the United States, even when subject to major penalties , may not occupy central positions in U.S.-dollar payment architecture, limiting their ability to transmit compliance innovation to the broader network.

These findings would suggest that improvements in global financial development are led and dominated by enforcement pressures applied at the core of the U.S.-centric financial infrastructure. The demonstration mechanism appears secondary: highly visible shocks may heighten risk awareness, but without sender-driven compliance upgrading, they do not reliably incentivize structural reform in bystander jurisdictions. This asymmetry reinforces the central role of the United States within the CCMS conceptualization of geoeconomic power and suggests that financial statecraft operates most effectively when its enforcement tools engage the global network at its chokepoints, rather than its periphery.

To round out the analysis of the demonstration effect analysis, I present in Table 10 and Figure 20 the results which examine the dynamic diffusion of major enforcement through correspondent networks. While the coefficients display some dynamic variation, including isolated positive effects several years after a major enforcement shock, the overall pattern provides limited support for a demonstration-based diffusion mechanism.

	Financial Development Index		
	(1)	**(2)**	**(3)**
Lead 5	0.002 **	0.002 **	0.002 **
	(0.001)	(0.001)	(0.001)
Lead 4	0.002 **	0.002 **	0.002 **
	(0.001)	(0.001)	(0.001)
Lead 3	-0.001 **	-0.001 **	-0.001 **
	(0.001)	(0.001)	(0.001)
Lead 2	-0.002 **	-0.002 **	-0.002 **
	(0.001)	(0.001)	(0.001)
Lead 1	0.002 **	0.002 **	0.002 **
	(0.001)	(0.001)	(0.001)
MajorEnforcement x Exposure	0.001 **	0.001 **	0.001 **
	(0.001)	(0.001)	(0.001)
Lag 1	-0.001 **	-0.001 **	-0.001 **
	(0.001)	(0.001)	(0.001)
Lag 2	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
Lag 3	0.003 **	0.003 **	0.003 **
	(0.001)	(0.001)	(0.001)
Lag 4	0.001 **	0.001 **	0.001 **
	(0.001)	(0.001)	(0.001)
Lag 5	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
Lag 6	0.001 **	0.001 **	0.001 **
	(0.001)	(0.001)	(0.001)
Lag 7	0.003 **	0.003 **	0.003 **
	(0.001)	(0.001)	(0.001)
FDI XGDP	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
GDP PC Growth	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
IFS Imports	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
Chinn Ito Index	0.012 **	0.012 **	0.012 **
	(0.004)	(0.004)	(0.004)
ICT Imports	0.001 **	0.000 *	0.000 *
	(0.001)	(0.001)	(0.001)
Constant	0.201 **	0.203 **	0.203 **
	(0.007)	(0.007)	(0.007)
Adjusted R-squared	0.909	0.910	0.910
Country FE	Yes	Yes	Yes
Violation Type FE	No	Yes	Yes
Sanctions Programme FE	No	No	Yes
N	5,490	5,488	5,485

Table 10: **Dynamic Diffusion of Major Sanctions Enforcement Through Correspondent Networks**. This table reports the baseline estimates for the version of equation (4), which examines the dynamic effect of major sanctions enforcement against multinational financial firms. Columns (1)–(2) sequentially introduce fixed effects, and column (3) reports the preferred specification, which includes country, sanctions-programme, and violation-type fixed effects.

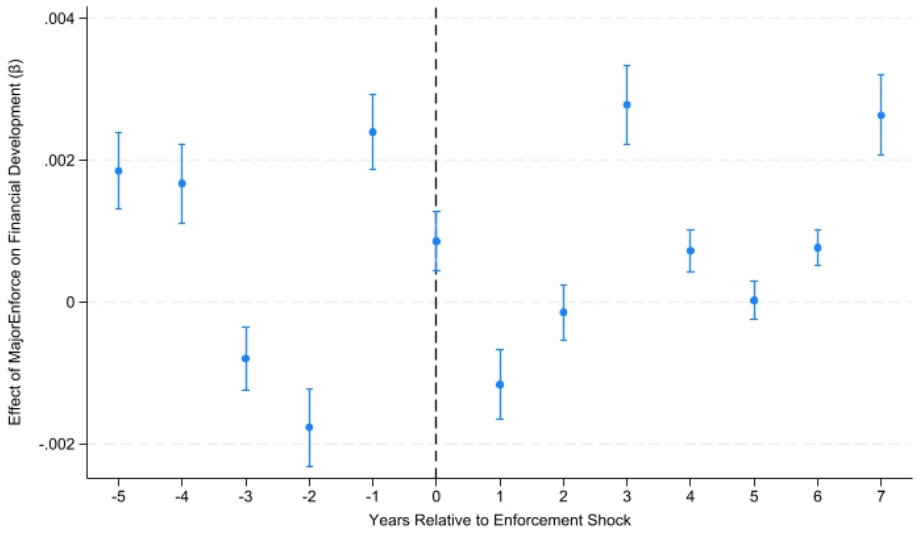


Figure 20: **Dynamic Diffusion of Major Sanctions Enforcement Through Correspondent Networks**.This event-study plot displays the estimated dynamic coefficients from the distributed-lag specification for the version of equation (4), which examines the dynamic effect of major sanctions enforcement against multinational financial firms. Coefficients measure the interaction between regional exposure and major enforcement intensity relative to the year of the enforcement shock ($\ell = 0$). Negative ℓ values represent pre-shock leads and show no meaningful divergence in financial development trends, supporting the identifying assumption. The post-shock lagged effects turn positive later periods but the effect is muted and uneven.

6.3 Dollar Dependence and Geoeconomic Pressure

6.3.1 Portfolio Holdings of U.S. Long-term Securities

Dollar dominance can be understood not only as a monetary phenomenon but also a complementary coordination mechanism for the harmonization of global finance. A reasonable measure of dollar-system financial integration is country level cross-border portfolio holdings of U.S. securities. Countries that hold larger portfolios of U.S. long-term securities are more deeply integrated into U.S. financial markets, custodial systems, disclosure standards, settlement infrastructure, and regulatory expectations. I argue that this dollar dependence plausibly encourages institutional alignment, reporting harmonization, and supervisory upgrading, all of which are core components of measured financial development.

To test whether dollar dependence is systematically associated with financial development, for a sample of countries for which data is available, I construct country-year measures of foreign portfolio holdings of U.S. long-term securities using data from the Treasury International Capital (TIC) Securities Long-Term reporting system, as compiled in the Federal Reserve's Enhanced Financial Accounts. These data report monthly country-level holdings of U.S. long-term securities at market value, including Treasury securities, agency bonds, corporate bonds, and equities. I aggregate the monthly observations to a yearly frequency by taking annual averages and construct two measures: average total holdings of U.S. long-term securities and

average holdings of U.S. long-term Treasury securities. These variables serve as proxies for dollar-system financial integration and exposure to U.S. financial infrastructure and custodial networks. To avoid pure size effects I also scale the average holdings by GDP to construct a ratio which measures dollar-asset intensity relative to the size of each country's economy[21].

	Financial Development Index			
	(1)	**(2)**	**(3)**	**(4)**
US Securities (total)	0.000			
	(0.001)			
US Treasuries		0.000		
		(0.001)		
US Securities (total)/GDP			0.000	
			(0.001)	
US Treasuries/GDP				0.000
				(0.001)
FDI XGDP	0.000	0.000 *	0.000	0.000 *
	(0.001)	(0.001)	(0.001)	(0.001)
GDP PC Growth	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
IFS Imports	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Chinn Ito Index	-0.004	-0.004	-0.004	-0.004
	(0.003)	(0.003)	(0.003)	(0.003)
ICT Imports	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.355 **	0.352 **	0.359 **	0.364 **
	(0.006)	(0.006)	(0.006)	(0.007)
Adjusted R-squared	0.990	0.990	0.990	0.990
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	1,542	1,542	1,532	1,532

Table 11: **Dollar Dominance and Financial Development**. This table reports fixed effects panel regressions of financial development on measures of dollar-system portfolio exposure derived from country holdings of U.S. long-term securities. Columns (1) and (2) use level measures of dollar exposure based on average annual holdings of total U.S. long-term securities and U.S. long-term Treasury securities. Columns (3) and (4) implement a stricter scaling by normalising holdings by GDP in order to remove pure size effects and capture dollar-asset intensity relative to the scale of the domestic economy. Across all specifications, the dependent variable is the Financial Development Index, and all regressions include country and year fixed effects together with the full set of macro-financial controls. Standard errors are clustered at the country level.

The results, presented in Table 11, do not support a strong empirical link between dollar dominance, measured through cross-border holdings of U.S. long-term securities, and financial development within countries over time. Columns (1) and (2) uses the level measures of dollar exposure based on average annual holdings of total U.S. long-term securities and U.S. long-term Treasury securities, respectively. In both cases, the estimated coefficients are

[21]Holdings of U.S. long-term securities are reported in billions of U.S. dollars in the TIC dataset. I convert these values to U.S. dollar units before scaling by GDP (current U.S. dollars) to ensure unit consistency when constructing portfolio-holdings-to-GDP ratios.

close to zero and statistically insignificant. The point estimates are precisely estimated and economically negligible, indicating no detectable within-country association between changes in U.S. securities holdings and changes in measured financial development once country and year fixed effects are absorbed. Columns (3) and (4) which uses the ratio-based measures also produce coefficients that are near zero and statistically insignificant.

In contrast to the enforcement-based diffusion channel documented earlier, portfolio exposure to U.S. securities does not appear to be systematically associated with institutional upgrading as captured by the Financial Development Index. This suggests that, in these data, dollar dominance by itself is not a sufficient coordination mechanism for measurable improvements in financial development. The role of the U.S. dollar in weaponized interdependence is, however, undisputed (Aizenman and Cheung, 2020; Chinn, Frankel and Ito, 2025) and as such, in what follows, I explore how dollar dependence interacts with sanctions enforcement vis-à-vis international reserves and central bank digital currencies.

6.3.2 Sanctions Enforcement and International Reserves

Does sanctions enforcement pressure shift the currency composition of reserves toward USD? Under rising U.S. financial enforcement pressure central banks may increase the USD share of their foreign exchange reserves as implicit compliance, insurance, or signaling behavior in keeping with hegemonic currency safety and sanctions risk management. To examine this hegemonic alignment hypothesis whereby geoeconomic pressure results in strategic alignment among targets (Clayton, Maggiori and Schreger, 2026) and induces portfolio tilt toward the hegemon's currency, I build on a recent literature which demonstrates that central banks engage in reserve portfolio rebalancing behavior under perceived regime risk (Gopinath and Stein, 2018; Eichengreen, Mehl and Chitu, 2019; Ito and McCauley, 2020; Chinn, Ito and McCauley, 2022; Chinn, Frankel and Ito, 2024; Chinn, Frankel and Ito, 2025).

To capture exposure to enforcement pressure I construct treatment intensity as

$$D_{it} = s_i \times Z_t, \tag{5}$$

where Z_t denotes the aggregate sender-side enforcement shock in year t, measured as the logarithm of total OFAC penalties imposed on U.S. financial institutions, and s_i is a country-specific exposure share capturing reliance on U.S. correspondent banking networks at the regional level. To ensure predetermined exposure, s_i is fixed at its 2011 level for each country and treated as time-invariant throughout the sample. This choice reflects the stability of correspondent banking structures prior to the 2010s and avoids mechanically incorporating post-treatment variation into the exposure measure.

Using the dataset of reserve currency shares constructed by Ito and McCauley (2020), I test for portfolio reallocation within the share of foreign exchange reserves held by a sample of countries for which reserve currency composition data is available. The baseline specification I estimate is

$$USDshare_{it} = \alpha_i + \lambda_t + \beta\, D_{it} + \gamma' X_{it} + \varepsilon_{it}, \tag{6}$$

where $USDshare_{it}$ denotes the USD share of foreign exchange reserves for country i in year t, α_i are country fixed effects, λ_t are year fixed effects, and X_{it} is a vector of controls. I also estimate a similar specification for the share of Euro, Yen, British Pound and the reserve composition spread between the USD and the Euro. The results, presented in Table 12, do not support the portfolio reallocation thesis. Sanctions enforcement pressure does not appear to induce portfolio reallocation toward the U.S. dollar or any other reserve currency for that matter.

	FX Reserves Composition				
	USD Share	**Euro Share**	**JPY Share**	**GBP Share**	**USD Share - Euro Share**
Enforcement Exposure Intensity	0.003	-0.006	0.001	0.031	0.019
	(0.069)	(0.023)	(0.012)	(0.017)	(0.161)
FDI XGDP	0.001	0.001	-0.002 **	-0.001	0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
GDP PC Growth	-0.001	0.001	-0.001	-0.002	0.000
	(0.002)	(0.002)	(0.001)	(0.001)	(0.004)
Chinn Ito Index	-0.016	0.005	-0.005	0.009	-0.017
	(0.014)	(0.013)	(0.007)	(0.007)	(0.027)
Constant	0.536	0.509 *	0.271 *	-0.193	-0.062
	(0.584)	(0.221)	(0.125)	(0.146)	(1.392)
Adjusted R-squared	0.791	0.891	0.968	0.673	0.845
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
N	847	1,175	994	553	632

Table 12: **Enforcement Pressure and Reserve Currency Composition**. This table reports panel fixed effects estimates of the relationship between U.S. financial enforcement exposure and the currency composition of foreign exchange reserves. The dependent variables are the shares of U.S. dollar, euro, Japanese yen, British pound, and the dollar–euro spread in total reserves. Enforcement Exposure Intensity is constructed as the interaction of a country's 2011 exposure to U.S. correspondent banking networks and the log of annual OFAC penalties imposed on U.S. financial institutions. All specifications include country and year fixed effects. Standard errors are clustered at the country level.

To extend the analysis I consider two major sanctions intensification events which occurred in 2014. The 2014 Russia–Crimea sanctions and a record penalty of approximately USD $9 billion imposed on BNP Paribas by OFAC within the same year represent a salient escalation in the enforcement of financial sanctions. The Russia–Crimea sanctions increased the use of financial channel restrictions as major Russian banks and corporates were targeted; even though reserve freezes came later (2022), 2014 is widely viewed as the first modern wave of systemic financial sanctions against a major economy. The BNP Paribas penalty was a landmark enforcement action, against a major European bank for sanctions violations, with extremely high signal content due to the size of the penalty and the demonstration of the extraterritorial reach of the U.S. enforcement apparatus. From a central bank perspective, these events are potent demonstrations of the ability of the U.S. to weaponize the plumbing

of the dollar–euro banking system to meet its geopolitical objectives. I, therefore, treat the events of 2014 as a global enforcement salience shock and examine whether countries with greater predetermined exposure to Euro correspondent banking networks[22] exhibited differential adjustments in the currency composition of their foreign exchange reserves.

These events are operationalized as a common post-2014 enforcement salience shock and estimated in a two-way fixed effects difference-in-differences specification in which the post-2014 indicator is interacted with a predetermined measure of Euro correspondent banking exposure. The estimating equation takes the form

$$y_{it} = \beta \left(\text{Post2014}_t \times \text{EuroExposure}_i \right) + \Gamma X_{it} + \alpha_i + \lambda_t + \varepsilon_{it}, \tag{7}$$

where y_{it} is the currency share in foreign exchange reserves, EuroExposure_i is measured prior to 2014 using the same network-based construction as the USD correspondent exposure metric, X_{it} is a vector of macro-financial controls, and country and year fixed effects absorb time-invariant country characteristics and global shocks. Identification therefore comes from differential changes after 2014 between countries with high versus low pre-existing Euro correspondent exposure.

The estimates indicate a statistically significant compositional shift in reserves associated with higher Euro correspondent exposure after 2014. As reported in Table 13, the interaction between Post-2014 and Euro correspondent exposure is negative and significant for the USD reserve share and positive and significant for the Euro reserve share. The corresponding coefficient for the USD share is -0.351 ($p < 0.05$), while the Euro share increases by 0.266 ($p < 0.05$). The spread specification, defined as USD share minus Euro share, also declines significantly (-0.584, $p < 0.05$). Taken together, these estimates are consistent with a post-2014 rebalancing pattern in which more Euro-exposed countries tilt reserve composition away from dollars and toward euros, consistent with sanctions-risk hedging and currency diversification within the reserve portfolio.

These estimates should be interpreted with appropriate caution because several contemporaneous macro-financial forces overlap with the 2014 enforcement salience shock. First, the post-2014 period coincides with the ECB balance sheet expansion and the later phase of the eurozone crisis and recovery, which may independently affect the attractiveness and supply of euro-denominated reserve assets. Second, Russia-specific geopolitical risk following the Crimea annexation may have induced reserve adjustments among geographically, financially, or politically connected countries through channels unrelated to correspondent banking exposure per se. Third, global dollar cycle dynamics, including shifts in U.S. monetary policy expectations and global dollar liquidity conditions, can mechanically influence both reserve accumulation and currency composition. Fourth, reserve share measures are affected by valuation effects, since exchange rate and asset price movements alter the market value weights

[22] Countries more embedded in Euro correspondent networks were more exposed to the compliance shock transmitted through the BNP Paribas case and coordinated Russia sanctions.

of reserve portfolios even in the absence of active rebalancing.

Accordingly, the 2014 difference-in-differences results are best viewed as evidence of structured heterogeneity in reserve composition responses around a major sanctions-salience episode, rather than as a clean causal estimate of enforcement effects alone. Nonetheless, the fact that the differential response loads systematically on predetermined Euro correspondent exposure supports the interpretation that financial network structure conditions how central banks adjust reserve currency composition when sanctions enforcement risk becomes more salient.

	FX Reserves Composition		
	USD Share	**Euro Share**	**USD Share - Euro Share**
Post-2014 × Euro Correspondent Exposure	-0.351 **	0.266 **	-0.584 **
	(0.101)	(0.082)	(0.176)
FDI XGDP	0.001	0.001	0.001
	(0.001)	(0.001)	(0.002)
GDP PC Growth	0.001	-0.002	0.003
	(0.002)	(0.001)	(0.003)
Chinn Ito Index	-0.020	0.008	-0.023
	(0.014)	(0.013)	(0.025)
Constant	0.652 **	0.298 **	0.248 **
	(0.031)	(0.024)	(0.051)
Adjusted R-squared	0.808	0.886	0.861
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	958	718	718

Table 13: **Post-2014 sanctions salience shock, Euro correspondent exposure, and FX reserve currency composition**. This table reports two-way fixed effects difference-in-differences estimates of the relationship between the post-2014 sanctions intensification period and the currency composition of foreign exchange reserves. The treatment variable is the interaction between a Post-2014 indicator and a predetermined measure of Euro correspondent banking exposure. Dependent variables are the USD reserve share, the Euro reserve share, and the USD minus Euro reserve share spread. All specifications include country and year fixed effects and control for FDI to GDP, GDP per capita growth, and financial openness (Chinn–Ito index). Standard errors are clustered at the country level and reported in parentheses.

6.3.3 Sanctions Enforcement and Central Bank Digital Currencies

Central Bank Digital Currency (CBDC) adoption can be interpreted as a strategic response to geoeconomic fragmentation and sanctions risk. A CBDC provides an alternative settlement rail, reduces dependence on foreign correspondent banking networks, and may facilitate cross-border payments outside traditional dollar clearing channels. I therefore test whether sanctions-related financial network exposure is associated with progression along the CBDC adoption ladder.

CBDC status is measured using the Atlantic Council CBDC Tracker, which classifies countries into mutually exclusive stages of development: launched, pilot, development, research, inactive, and none. Because the tracker reports current status rather than a historical time path, these indicators do not vary by year in the available data. I therefore treat CBDC

status as a country-level, time-invariant attribute and implement a cross-sectional estimation strategy rather than a panel design. The tracker categories are mapped into three outcome measures. First, I construct an ordered CBDC stage index ranging from 0 to 5, where 0 corresponds to no CBDC activity, 1 to inactive projects, 2 to research, 3 to development, 4 to pilot programmes, and 5 to fully launched CBDCs. Second, I define a binary CBDC active indicator equal to one for countries in development, pilot, or launched stages. Third, I define a binary CBDC advanced indicator equal to one for countries in pilot or launched stages. Where multiple tracker flags appear for a country, a priority rule is applied so that the most advanced stage determines the classification.

The main explanatory variable is predetermined USD correspondent exposure, measured by the regional USD exposure metric constructed from correspondent banking linkages and fixed at its predetermined level. To avoid mechanical post-treatment correlation, control variables are included as pre-period country averages. Given the time-invariant nature of the CBDC outcomes, the models are estimated at the country level using cross-sectional OLS for the ordered stage index and binary response models for the active and advanced indicators, with robust standard errors. Country and year fixed effects are not included because they would be collinear with time-invariant CBDC status.

The results, presented in Table 14, indicate no statistically meaningful relationship between predetermined USD exposure and CBDC adoption status. The estimated coefficients on USD exposure are negative across all three specifications but imprecisely estimated and not statistically different from zero. The explanatory power of the models is low, with R-squared and pseudo R-squared values close to zero, indicating that progression along the CBDC adoption ladder is largely orthogonal to sanctions-risk exposure and correspondent network dependence, and is more likely driven by domestic payment system objectives, financial innovation policy, and central bank technology strategy than by geoeconomic enforcement pressure.

	CBDC Status		
	CBDC Stage	**CBDC Active**	**CBDC Advanced**
USD Exposure	-1.251	-2.009	-2.556
	(1.885)	(2.293)	(2.432)
Constant	3.127 *	1.207	1.181
	(1.35)	(1.64)	(1.731)
R-squared/Pseudo R-squared	0.003	0.004	0.006
N	153	153	153

Table 14: **CBDC Adoption Status and Predetermined USD Correspondent Exposure**. This table reports cross-sectional regressions of Central Bank Digital Currency (CBDC) adoption status on predetermined USD correspondent exposure using country-level data from the Atlantic Council CBDC Tracker. The dependent variables are: (1) CBDC Stage, an ordered index from 0 to 5 capturing progression from no activity to launched CBDC; (2) CBDC Active, a binary indicator equal to one for countries in development, pilot, or launched stages; and (3) CBDC Advanced, a binary indicator equal to one for countries in pilot or launched stages.

6.4 Robustness

6.4.1 Not-Yet-Treated Comparison

A possible threat to the absorbing treatment strategy is that the results may be driven by the choice of control group. To mitigate these concerns I re-estimate Equation 1 using not-yet-treated countries as the control group. The results are graphically represented in Figure 21.

The event-time coefficients for financial development are small and mixed in sign throughout the pre-treatment period and do not display any systematic upward or downward pattern, lending visual support to the conditional parallel trends assumption. However, a joint test of equality between all pre-treatment coefficients rejects the null at conventional levels ($\chi^2(366) = 1.06 \times 10^6,\ p < 0.001$).

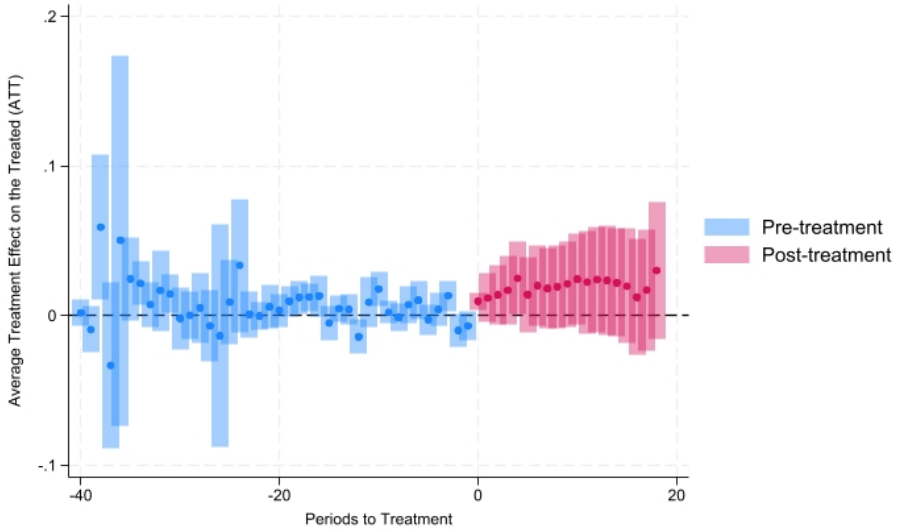


Figure 21: **Dynamic Treatment Effects of OFAC Enforcement Actions on Financial Development**. This event-study plot displays the estimated group-time average treatment effects from the Callaway and Sant'Anna (2021) difference-in-differences estimator using not-yet-treated countries as the comparison group. Blue dots represent estimated coefficients in the pre-treatment period. Red dots represent dynamic post-treatment effects.

In terms of post-treatment effects, the year of first enforcement shows a precisely estimated positive effect ($\text{ATT} = 0.0097,\ p < 0.01$), indicating an immediate improvement in financial development. Post-treatment effects remain directionally positive across most horizons, with a significant increase emerging four years after treatment ($\text{ATT} = 0.0249,\ p < 0.05$). Although uncertainty grows at longer event times, the aggregate profile suggests that OFAC enforcement actions are associated with economically meaningful enhancements in financial development, particularly in the early years following enforcement events.

While the never-treated estimates for the financial institution and financial markets subindices limited causal interpretation because of strong pre-trend violations, when not-yet-treated countries are used as the comparison group, a more definitive pattern emerges.

The dynamic event-time results for the financial institution sub-index are graphically represented in Figure 22. Following the onset of enforcement the estimated treatment effects become substantially larger and statistically significant, with an immediate improvement in the enforcement year (ATT $= 0.0136,\ p < 0.01$) that grows steadily in magnitude. The effect more than quadruples within four years of treatment (ATT $= 0.0565,\ p < 0.01$) and remains significant and economically meaningful over the longer post-treatment horizon. In contrast, the financial markets sub-index, graphically represented in Figure 23, exhibits no systematic response to enforcement actions; post-treatment coefficients are generally small, statistically indistinguishable from zero, and show no sustained positive trajectory. Together, these patterns indicate that enforcement pressure, rather than directly enabling market intermediation or deepening, primarily operate through institutional upgrading in areas such as regulatory compliance and financial transparency within the banking and payments architecture.

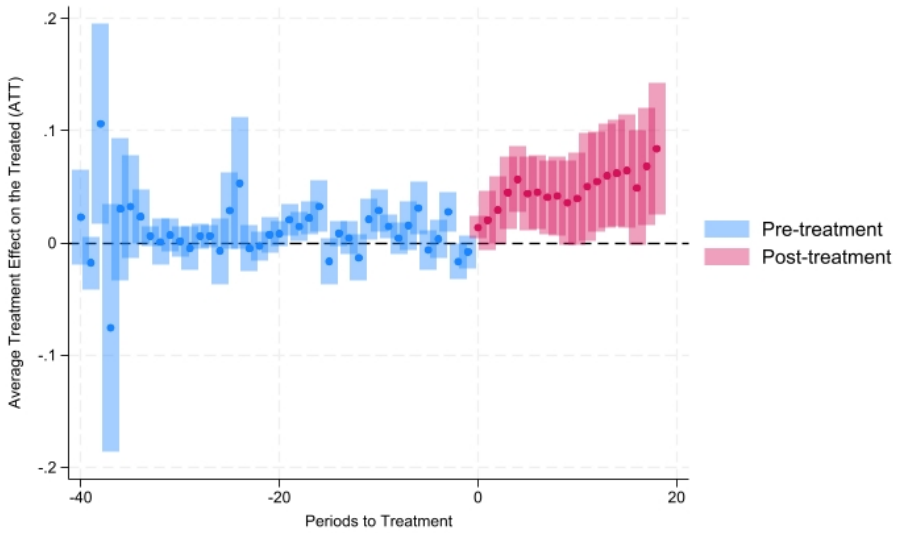


Figure 22: **Dynamic effects of OFAC Enforcement Actions on the Financial Institutions Sub-index**.This figure plots the estimated average treatment effects for the financial institutions dimension of financial development using not-yet-treated countries as the comparison group . Blue dots denote pre-treatment coefficients, with associated confidence bands, and indicate no systematic divergence between treated and control countries prior to enforcement. Red dots trace the evolution of post-treatment effects, which become statistically significant and grow steadily over time.

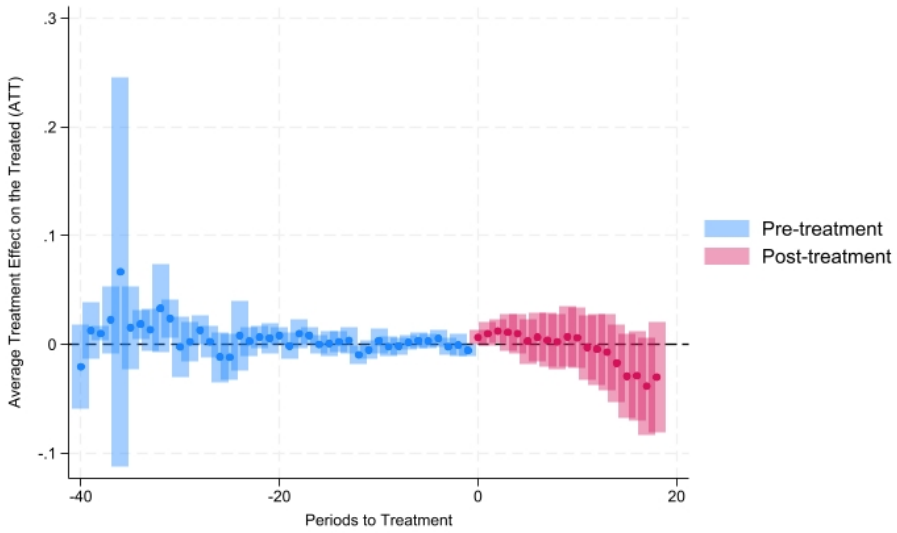


Figure 23: **Dynamic effects of OFAC Enforcement Actions on the Financial Markets Sub-index**. This event-study graph reports the estimated group-time average treatment effects for the financial markets dimension of financial development using not-yet-treated countries as the comparison group. Pre-treatment coefficients (blue markers with confidence bands) fluctuate around zero. In contrast to the sharp and persistent improvements observed for financial institutions, post-treatment estimates for financial markets (red markers) remain small, statistically imprecise, and become slightly negative over longer horizons.

6.4.2 Alternative Measures of Enforcement Intensity

To assess whether the sender-originating diffusion mechanism depends on how sanctions enforcement intensity is quantified, I re-estimate the baseline model using two alternative constructions of the enforcement measure. First, I replace the log of total penalties with the count of sanctions enforcement actions against U.S. financial institutions in each year. Second, I construct a composite enforcement index that averages the standardized count and standardized log-penalty series, ensuring that the intensity measure captures both the frequency and financial severity of enforcement actions.

The results reported in Tables 15 and 16 demonstrate that the main diffusion effect is robust to these alternative measures. In both robustness exercises, the interaction between regional exposure and enforcement intensity remains positive and statistically significant in the preferred specification with country, year, programme, and violation-type fixed effects. Although magnitudes vary slightly relative to the baseline log-penalty results, the estimates consistently indicate that financial development increases more strongly in regions that are more deeply connected to U.S. correspondent networks during years of intensified U.S. enforcement.

These findings reinforce the core interpretation that network structure, specifically exposure to the U.S. financial core, is the critical determinant of whether sanctions enforcement activity diffuses to bystander economies through institutional upgrading. The persistence of positive results across all three intensity measures confirms that the earlier findings are not an artefact of functional form and that the sender-originating compliance channel is a systematic feature

of U.S. economic statecraft.

Taken together, the robustness exercises provide strong empirical validation that financial development gains induced by sanctions enforcement are not dependent on how intensity is measured, but instead reliably emerge whenever U.S. financial institutions, the dominant nodes in the global banking network, face compliance shocks.

	Financial Development Index			
Panel A	**(1)**	**(2)**	**(3)**	**(4)**
EnforceCount x Exposure	0.044 **	-0.051	0.052 *	0.052 *
	(0.004)	(0.099)	(0.023)	(0.022)
Constant	0.275 **	0.332 **	0.270 **	0.269 **
	(0.002)	(0.084)	(0.014)	(0.013)
Adjusted R-squared	0.898	0.177	0.933	0.934
Panel B				
EnforceCount x Exposure	0.036 **	0.028	0.051 *	0.051 *
	(0.003)	(0.066)	(0.023)	(0.021)
FDI XGDP	0.000	-0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
GDP PC Growth	0.000	0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
IFS Imports	0.003 **	0.010 *	0.000	-0.001
	(0.001)	(0.004)	(0.001)	(0.001)
Chinn Ito Index	0.022 **	0.074 **	0.011 *	0.011 *
	(0.005)	(0.012)	(0.004)	(0.004)
ICT Imports	0.001 **	0.003 **	0.001 *	0.000 *
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.229 **	0.116 **	0.250 **	0.252 **
	(0.009)	(0.043)	(0.015)	(0.015)
Adjusted R-squared	0.908	0.485	0.934	0.936
Country FE	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	Yes
Violation Type FE	No	No	No	Yes
Sanctions Programme FE	No	No	No	Yes
N	8,290	8,290	8,290	8,285

Table 15: **Sanctions Enforcement Count and USD Correspondent Exposure**. This table reports the baseline estimates from equation (3), where the log of the number of penalties is used as an alternate measure of enforcement intensity. Panel A presents specifications without additional controls, while Panel B introduces standard macro-financial covariates. Across both panels, columns (1)–(3) sequentially introduce fixed effects, and column (4) reports the preferred specification, which includes country, year, sanctions-programme, and violation-type fixed effects.

	Financial Development Index			
Panel A	**(1)**	**(2)**	**(3)**	**(4)**
EnforceIndex x Exposure	-0.004	0.540 *	0.020	0.022
	(0.004)	(0.236)	(0.014)	(0.015)
Constant	0.302 **	0.288 **	0.301 **	0.301 **
	(0.001)	(0.029)	(0.001)	(0.001)
Adjusted R-squared	0.882	0.182	0.932	0.934
Panel B				
EnforceIndex x Exposure	-0.001	0.309 **	0.021	0.023
	(0.004)	(0.076)	(0.015)	(0.016)
FDI XGDP	0.000	-0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
GDP PC Growth	0.001 *	0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
IFS Imports	0.004 **	0.010 *	0.000	-0.001
	(0.001)	(0.004)	(0.001)	(0.001)
Chinn Ito Index	0.027 **	0.074 **	0.011 *	0.011 *
	(0.005)	(0.012)	(0.004)	(0.004)
ICT Imports	0.001 **	0.003 **	0.001 *	0.000 *
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.243 **	0.127 **	0.281 **	0.283 **
	(0.011)	(0.025)	(0.006)	(0.006)
Adjusted R-squared	0.898	0.487	0.934	0.936
Country FE	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	Yes
Violation Type FE	No	No	No	Yes
Sanctions Programme FE	No	No	No	Yes
N	8,290	8,290	8,290	8,285

Table 16: **Sanctions Enforcement Index and USD Correspondent Exposure**. This table reports the baseline estimates from equation (3), where a composite index that averages the normalized counts and normalized log penalties is used as an alternate measure of enforcement intensity. Panel A presents specifications without additional controls, while Panel B introduces standard macro-financial covariates. Across both panels, columns (1)–(3) sequentially introduce fixed effects, and column (4) reports the preferred specification, which includes country, year, sanctions-programme, and violation-type fixed effects.

6.4.3 Enforcement Exposure Diagnostics: Baseline-level Test

To solidify the credibility of the exogenous timing and intensity of enforcement shocks conditional on exposure[23], I investigate whether exposure to OFAC enforcement is mechanically correlated with pre-existing financial development by testing whether the baseline level of the Financial Development Index in 2002 predicts subsequent enforcement exposure. The results, presented in Table 17, indicate that countries with higher baseline financial development were more likely to be exposed to enforcement actions (test for incidence), were treated earlier (test for timing), and experienced enforcement in a larger share of post-2003 years (test for persistence). These patterns are consistent with the institutional design of secondary sanctions, which operate through highly connected segments of the global financial system rather than

[23]This is the key identifying assumption.

being randomly assigned across countries. The diagnostics show that OFAC enforcement exposure is concentrated where financial activity is already high[24]. These are intuitive results and are exactly what one would expect from an enforcement regime operating through correspondent banking linkages, dollar clearing and large cross-border institutions.

	Enforcement Exposure Outcome			
	Ever Treated (Logit)	First Treatment Year (OLS)	Total Enforcement Count (OLS)	Share of Treated Years (OLS)
Financial Development Index (2002)	7.589***	−7.432**	7128.1	0.505***
	(1.213)	(3.043)	(6804.8)	(0.133)
Observations	183	46	46	46
Pseudo / R^2	0.340	0.089	0.068	0.353
Specification	Baseline logit	Treated only	Treated only	Treated only

Table 17: **Baseline Financial Development and Exposure to OFAC Enforcement**. This table reports diagnostic regressions examining whether the level of financial development prior to the start of the OFAC enforcement data predicts subsequent exposure to sanctions enforcement. The explanatory variable is the IMF Financial Development Index measured in 2002. Column (1) reports a logit model where the dependent variable is an indicator for whether a country is ever exposed to OFAC enforcement after 2003 (test for incidence). Column (2) regresses the year of first enforcement exposure on baseline financial development, conditional on being treated (test for timing). Column (3) examines whether baseline financial development predicts the cumulative number of enforcement actions (test for intensity), and column (4) tests whether it predicts the share of post-2003 years in which enforcement occurs (test for persistence). Robust standard errors are reported in parentheses.

Importantly, the test for intensity shows that, conditional on treatment, baseline financial development does not predict the intensity of enforcement (as measured by total enforcement count), nor does it explain the dynamic response of financial development following enforcement shocks once country and year fixed effects are included. These findings suggest selection on levels of financial integration rather than on differential pre-treatment trends, reinforcing the validity of the difference-in-differences identification strategy. The empirical design accounts for this selection in four ways. First, country fixed effects absorb baseline differences in financial development; second, event-study dynamics test for trend breaks, not level differences; third, the Callaway and Sant'Anna (2021) estimator compares treated units only to not-yet-treated units at the same time; and finally, the interaction between enforcement intensity and regional correspondent exposure (Enforcement x Exposure) used to operationalize the sender-originating diffusion mechanism uses predetermined network structure, not country choice. Taken together, the baseline level diagnostics and the safeguards around selection provide reassurance that financial development predicts where enforcement happens, but not how enforcement shocks change financial development over time.

These diagnostics also provide further support for the sender-originating diffusion mechanism.

[24]These results are consistent with secondary sanctions targeting the financial core, not with reverse causality. Additionally, the diagnostics are consistent with enforcement acting through network position, not through endogenous reform paths.

Enforcement exposure is strongly correlated with baseline levels of financial development, indicating that sanctions enforcement activity is concentrated in countries that are more financial developed and which are therefore more deeply integrated into U.S.-centric financial networks. At the same time, baseline financial development does not predict the intensity of enforcement conditional on exposure, nor does it account for the post-enforcement improvements documented in the main results. This pattern is consistent with a network-based diffusion process in which enforcement shocks originate at the core of the global financial system and propagate outward through correspondent relationships, rather than reflecting endogenous reform trajectories in recipient countries.

6.4.4 Enforcement Exposure Diagnostics: Pre-trend Test

Even if the timing and intensity of enforcement shocks are credibly exogenous, enforcement might still coincide with countries on an upward trajectory in financial development for other reasons. To investigate this possibility, I estimate each country's pre-2003 FD slope, then test whether that slope predicts enforcement exposure after 2003[25]. As with the preceding baseline test, I examine exposure enforcement outcomes in terms of incidence, timing, intensity and persistence so as to capture the nuance of the secondary sanctions setting and the sender-originating diffusion mechanism.

Specifically, I estimate a country-specific linear trend in the pre-treatment period by estimating the following regression:

$$FD_{it} = \alpha_i + \beta_i \cdot t + u_{it}, \qquad t \in [1980, 2002], \tag{8}$$

where FD_{it} denotes financial development in country i at time t, α_i captures country fixed effects, and u_{it} is an idiosyncratic error term. The coefficient β_i is then extracted and interpreted as the country-specific pre-trend slope.

The results, presented in Table 18, suggest that countries with faster improvements in financial development before 2003 were significantly more likely to ever be exposed to OFAC enforcement; pre-trends therefore seem to predict selection into exposure (incidence). In respect of timing and intensity, conditional on treatment, faster pre-2003 FD trends do not explain when enforcement first occurs and pre-FD growth does not lead to more enforcement actions. For persistence of exposure, however, countries with steeper pre-2003 FD growth experienced enforcement exposure in a larger fraction of post-2003 years.

[25]If the pre-2003 slope does not predict exposure, it supports the idea that enforcement is not merely coinciding with countries already on steeper FD improvement paths.

	Enforcement Exposure Outcome			
	Ever Treated	Treatment Timing	Enforcement Intensity	Persistence
	(1)	(2)	(3)	(4)
Pre-2003 FD Slope	123.172***	−70.329	53072.230	7.531***
	(25.954)	(96.744)	(55489.820)	(2.395)
Constant	−2.052***	2007.796***	322.309	0.091***
	(0.306)	(1.642)	(353.876)	(0.023)
Observations	183	46	46	46
Estimator	Logit	OLS	OLS	OLS
Robust SEs	Yes	Yes	Yes	Yes

Table 18: **Pre-2003 Financial Development Trends and Subsequent OFAC Enforcement Exposure**. This table examines whether pre-2003 trends in the IMF Financial Development Index predict exposure to OFAC enforcement. Column (1) reports a logistic regression where the dependent variable equals one if a country is ever exposed to enforcement after 2003. Column (2) examines treatment timing, measured as the first year of exposure. Column (3) considers enforcement intensity, measured by the total number of enforcement actions. Column (4) captures persistence, defined as the share of post-2003 years in which a country is exposed to enforcement. Pre-2003 trends predict selection into exposure and persistence, but do not predict enforcement timing or intensity conditional on treatment. Robust standard errors are reported in parentheses.

While faster pre-2003 improvements in financial development are associated with a higher likelihood of exposure and greater persistence of enforcement over time, they do not predict the timing or intensity of enforcement conditional on treatment. This pattern suggests that sanctions enforcement is concentrated in financially dynamic and globally integrated systems, rather than being triggered by short-run accelerations in financial development. Importantly, these diagnostics do not account for the post-enforcement improvements documented in the main analysis, which arise from within-country changes following enforcement shocks and are identified through fixed effects and the staggered-adoption design.

The fact that pre-treatment trends are related to the incidence and persistence of enforcement exposure does not invalidate the empirical strategy as identification in this setting does not require that enforcement exposure be unrelated to levels or long-run growth paths. Identification instead relies on no differential trend break at the time of treatment absent enforcement, exogenous timing and intensity of shocks conditional on exposure and proper conditioning on fixed effects and dynamic controls; all of which are supported by the main results as well as the pre-trend diagnostics.

As was the case for the baseline-level diagnostics, the pre-trend results are consistent with the sender-originating diffusion mechanism. Countries with greater levels of financial development are more deeply embedded in U.S. correspondent networks and as such enforcement is therefore more likely and more persistent there but shock timing and severity are not driven by these trends. Selection, therefore, operates on network position and long-run financial dynamism, not on short-run trend innovations that would mechanically generate post-treatment effects.

6.4.5 Cohort Composition Test for Sender-Originating Diffusion Mechanism

Given that the preceding enforcement exposure diagnostics indicate that higher levels of financial development are correlated with the incidence and persistence of enforcement exposure but not the timing and intensity of enforcement, one might worry that the diffusion estimates, which were used to confirm the sender-originating diffusion mechanism in Section 6.2.2, are driven by differential secular trends correlated with initial financial development or pre-2003 improvements. I tackle this concern with a cohort composition test which interrogates the composition of exposure cohorts so as to clarify the implications and economic interpretation of the non-random sorting of countries into exposure. The cohort composition diagnostic examines whether countries in regions with higher correspondent exposure already exhibit systematically different pre-treatment financial development trends[26].

The results, presented in Table 19, indicates that regional correspondent exposure is positively associated with pre-2003 improvements in financial development, even after controlling for baseline financial development levels. This pattern suggests that correspondent exposure reflects structural integration into global finance, not exogenous assignment. This provides clarity around what exposure is and isn't. In this setting, exposure captures the structural dynamics relating to long-run financial integration and a country's position in the global financial network, not just post-2003 sanctions transmission; therefore, its correlation with pre-2003 improvements in financial development does not necessarily mean that the post-2003 enforcement effects, reported earlier, are mechanically driven by pre-trends, provided those trends are properly controlled for.

	Pre-2003 Financial Development Trend	
	(1)	**(2)**
Regional Correspondent Exposure	0.015 **	0.015 **
	(0.001)	(0.001)
Baseline Financial Development (2002)		0.023 **
		(0.001)
Constant	-0.003 **	-0.011 **
	(0.001)	(0.055)
R-squared	0.020	0.567
N	8,290	8,290

Table 19: **Composition Balance Test**. This table examines whether regional exposure to U.S.-centric correspondent banking networks is associated with differential trends in financial development prior to the onset of OFAC enforcement. Column (1) regresses the pre-2003 financial development trend on regional correspondent exposure. Column (2) controls for baseline financial development in 2002 to separate long-run growth dynamics from initial levels. Robust standard errors are reported in parentheses.

[26] Although exposure is not randomly assigned, this diagnostic assesses whether countries in higher-exposure cohorts are drawn from systematically different pre-treatment populations. The purpose is to inform the interpretation of subsequent difference-in-differences estimates rather than to establish random assignment.

6.4.6 Controlling for Pre-trends in Financial Development

Building on the preceding evidence that exposure reflects a country's position in the global financial network, which itself is associated with earlier financial development, a sensible robustness strategy for the sender-originating diffusion estimates is to control for this pre-existing financial development. To do this, I allow countries with different baseline financial development to follow fully flexible, year-specific trajectories by interacting baseline financial development (measured in 2002) for each country with year fixed effects in column 1 of Table 20. The key question the strategy seeks to answer is: does the effect of enforcement survive after controlling for pre-existing financial development?

Reassuringly, the interaction between sanctions enforcement intensity and regional correspondent exposure remains statistically significant, albeit with a negative sign, even after controlling for the non-randomness of exposure. This finding indicates that the estimated diffusion effects are not driven by the continuation of pre-2003 trends or by differential baseline trajectories, but instead reflect post-enforcement institutional adjustment transmitted through correspondent banking networks.

As it raises reasonable doubts about the stability of the estimates reported, I now discuss, with some detail, why the negative sign on the interaction is not likely a contradiction of the main results.

The negative sign on the interaction arises because the model now subtracts out countries' expected financial development paths; what remains reflects incremental adjustment relative to those paths, not overall improvement[27]. Once expected paths are controlled for, the financial development of highly exposed countries was already predicted to improve significantly. What the results suggest is that enforcement still triggers upgrading, but part of that upgrading is now attributed to the underlying path of financial development that countries might have already been on. So what's left for the interaction term to pick up is the difference between actual improvement and predicted improvement. If highly exposed countries improve slightly less than their very steep predicted path in enforcement years then the interaction coefficient can become negative. This does not mean enforcement hurts financial development, but rather suggests that after accounting for how fast countries were already improving, enforcement does not push them even further ahead than expected. As the main mechanism I argue for is harmonization and coordination rather than divergence, these results actually provide support for such a mechanism. The critical distinction is that I do not claim, nor do the main results show, that sanctions enforcement create brand-new financial development but rather that secondary sanctions push already integrated systems to align, upgrade, and standardize. Given the multitude of potential factors which drive financial development, I do not claim that the improvements in financial development I report would not have occurred in the absence of

[27] As I am now estimating a partial effect conditional on baseline-specific year paths, the interaction captures incremental reallocation of FD gains toward more exposed regions relative to what their baseline trajectory would predict. In other words, after accounting for the fact that highly exposed regions were already on steeper paths, the marginal effect of enforcement is still present and statistically meaningful.

secondary sanctions, but rather argue that the results suggest that OFAC enforcement actions accelerate trends in in financial development which were already underway. Once baseline levels and long-run momentum are controlled for, a negative interaction simply implies that sanctions enforcement does not amplify existing divergence; it reinforces convergence. This is fully consistent with sender-originating diffusion, network-based compliance upgrading and the harmonization of global finance.

As an additional robustness check, I also allow countries with different pre-2003 financial development trends to follow fully flexible post-2003 time paths by interacting the pre-treatment slope of the Financial Development Index with year fixed effects. This absorbs not only linear continuation of pre-trends, but any arbitrary time pattern correlated with them. Under this more demanding specification, shown in column 2 of Table 20, the interaction between sanctions enforcement intensity and regional correspondent exposure becomes statistically indistinguishable from zero. This attenuation indicates that the diffusion effects documented in the baseline specifications are closely linked to long-run financial integration trajectories and that sanctions-induced upgrading operates through institutions already on financially dynamic paths, rather than generating abrupt deviations from trend. The sender-originating diffusion mechanism is therefore best interpreted as reinforcing and coordinating institutional convergence, not creating it from scratch. Since some of the enforcement $\times$ exposure effect is shared with long-run financial integration and institutional sophistication captured by the pre-2003 slopes, once these partial out in the year-by-year interactions, the remaining marginal effect becomes harder to distinguish statistically. This, of course, does not mean the mechanism is spurious; it means the mechanism is structurally linked to long-run integration trajectories, which the cohort balance diagnostics already showed. The fact that the effect attenuates when I allow pre-2003 momentum to fully soak up post-2003 dynamics is consistent with a network-mediated institutional diffusion, as opposed to a short-run exogenous shock story. Taken together, the results suggest that secondary sanctions reinforce and coordinate institutional upgrading among financially integrated systems, rather than generating financial development independently of underlying structural dynamics.

	Financial Development Index	
	(1)	**(2)**
Enforcement x Exposure	-0.013 *	-0.008
	(0.006)	(0.006)
Year 1 x Baseline FD/Pre-FD Slope	-0.005	0.147
	(0.007)	(0.319)
Year 2 x Baseline FD/Pre-FD Slope	-0.022 *	-0.261
	(0.011)	(0.524)
Year 3 x Baseline FD/Pre-FD Slope	-0.011	0.441
	(0.015)	(0.675)
Year 4 x Baseline FD/Pre-FD Slope	-0.005	0.972
	(0.023)	(0.786)
Year 5 x Baseline FD/Pre-FD Slope	-0.074 **	-1.299
	(0.025)	(1.281)
Year 6 x Baseline FD/Pre-FD Slope	-0.028	0.375
	(0.021)	(0.851)
Year 7 x Baseline FD/Pre-FD Slope	-0.029	0.148
	(0.016)	(0.758)
Year 8 x Baseline FD/Pre-FD Slope	-0.055 *	-0.413
	(0.022)	(0.936)
Year 9 x Baseline FD/Pre-FD Slope	-0.070 **	-1.131
	(0.013)	(0.756)
Year 10 x Baseline FD/Pre-FD Slope	-0.065 **	-1.022
	(0.012)	(0.752)
Year 11 x Baseline FD/Pre-FD Slope	-0.066 **	-0.980
	(0.014)	(0.787)
Year 12 x Baseline FD/Pre-FD Slope	-0.066 **	-1.040
	(0.016)	(0.824)
Year 13 x Basline FD/Pre-FD Slope	-0.086 **	-1.500
	(0.017)	(0.815)
Year 14 x Baseline FD/Pre-FD Slope	-0.088 **	-2.187 **
	(0.013)	(0.673)
Year 15 x Basline FD/Pre-FD Slope	-0.087 **	-2.030 *
	(0.016)	(0.792)
Year 16 x Basline FD/Pre-FD Slope	-0.100 **	-2.411 **
	(0.016)	(0.767)
FDI XGDP	0.000	0.000
	(0.001)	(0.001)
GDP PC Growth	-0.001 **	-0.001
	(0.001)	(0.001)
IFS Imports	-0.001 *	0.000
	(0.001)	(0.001)
Chinn Ito Index	0.003	0.010 *
	(0.003)	(0.004)
ICT Imports	0.000	0.001 *
	(0.001)	(0.001)
Constant	-2.959 **	0.189 **
	(0.274)	(0.007)
Adjusted R-squared	0.989	0.917
Country FE	Yes	Yes
Violation Type FE	Yes	Yes
Sanctions Programme FE	Yes	Yes
N	3,695	3,695

Table 20: **Robustness to Differential Baseline Levels and Pre-Treatment Trends**. This table reports robustness estimates that allow countries with different initial levels of financial development (Column 1) or different pre-2003 financial development trends (Column 2) to follow heterogeneous post-2003 time paths by interacting these pre-treatment measures with year fixed effects. All specifications include country, sanctions-programme, and violation-type fixed effects, as well as standard macro-financial controls, with standard errors clustered at the country level.

6.4.7 Borusyak–Hull–Style Exposure Design

To address concerns that countries' exposure to sanctions enforcement intensity may be non-random and correlated with pre-existing trends in financial development, I also implement an exposure design in the spirit of Borusyak and Hull (2023). The key insight of this approach is to separate exogenous aggregate shocks from predetermined exposure shares, and to identify causal effects from the interaction of the two. Rather than relying exclusively on variation in treatment timing, the design exploits heterogeneity in how strongly different countries are exposed to a common sender-side shock. As per the operationalization of the original sender-originating diffusion mechanism, country exposure is defined at the regional level.

Formally, I construct a Borusyak–Hull–style treatment intensity as

$$D_{it} = s_i \times Z_t, \tag{9}$$

where Z_t denotes the aggregate sender-side enforcement shock in year t, measured as the logarithm of total OFAC penalties imposed on U.S. financial institutions, and s_i is a country-specific exposure share capturing reliance on U.S. correspondent banking networks at the regional level. To ensure predetermined exposure, s_i is fixed at its 2011 level for each country and treated as time-invariant throughout the sample. This choice reflects the stability of correspondent banking structures prior to the 2010s and avoids mechanically incorporating post-treatment variation into the exposure measure.

The estimating equation is given by

$$FD_{it} = \alpha_i + \lambda_t + \beta\, D_{it} + \gamma' X_{it} + \varepsilon_{it}, \tag{10}$$

where FD_{it} denotes the IMF Financial Development Index for country i in year t, α_i are country fixed effects, λ_t are year fixed effects, and X_{it} is a vector of macro-financial controls. Identification arises from comparing how countries with different predetermined exposure shares respond to the same sender-side enforcement shock. Intuitively, when enforcement intensity against U.S. financial institutions rises, countries that are more tightly connected to regional U.S. correspondent banking networks face stronger incentives to upgrade compliance systems, internal controls, and financial infrastructure in order to preserve access to the global payments system.

This design directly addresses the concern highlighted by Borusyak and Hull (2023) that treatment intensity may be correlated with unobserved trends if exposure is endogenous. By fixing exposure prior to the enforcement period and interacting it with a common, plausibly exogenous shock, the design isolates variation that is orthogonal to country-specific shocks and pre-existing trends. Any remaining correlation between exposure and baseline financial development is absorbed by country fixed effects, while common global shocks are absorbed by year fixed effects.

Table 21 reports the results from this Borusyak–Hull–style exposure design. Across all spec-

ifications, the coefficient on the exposure variable is positive and economically meaningful. In the baseline specification, higher exposure to regional U.S. correspondent banking networks amplifies the effect of sender-side enforcement on financial development. As year fixed effects and increasingly restrictive combinations of enforcement-related fixed effects are introduced, precision attenuates modestly, but the magnitude of the estimated effect remains stable. Taken together, these results indicate that the positive relationship between sanctions enforcement and financial development is not driven by non-random exposure or pre-existing trends, but instead reflects sender-originating diffusion through regional correspondent banking networks.

	Financial Development Index		
	(1)	**(2)**	**(3)**
BH-Style Exposure Intensity	0.009 **	0.007	0.008
	(0.001)	(0.007)	(0.006)
FDI XGDP	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
GDP PC Growth	0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
IFS Imports	0.001 *	0.000	0.000
	(0.001)	(0.001)	(0.001)
Chinn Ito Index	0.016 **	0.010 *	0.010 *
	(0.005)	(0.004)	(0.004)
ICT Imports	0.001 **	0.001 *	0.001 *
	(0.001)	(0.001)	(0.001)
Constant	0.231 **	0.245 **	0.246 **
	(0.007)	(0.032)	(0.031)
Adjusted R-squared	0.922	0.934	0.935
Country FE	Yes	Yes	Yes
Year FE	No	Yes	Yes
Violation Type FE	Yes	No	Yes
Sanctions Programme FE	Yes	No	Yes
N	7,904	7,908	7,904

Table 21: **Borusyak–Hull (2023)–Style Exposure Design**.This table reports estimates from a Borusyak–Hull (2023)–style exposure design that exploits heterogeneous, predetermined exposure to sender-side sanctions enforcement shocks. The key regressor, BH-Style Exposure Intensity, is constructed as the interaction between a country's predetermined exposure to U.S. correspondent banking networks, measured by regional correspondent exposure fixed at its 2011 level, and a common sender-side enforcement shock, measured by the log of total OFAC penalties imposed on U.S. financial institutions. Column (3) reports the preferred specification, which simultaneously includes country, sanctions-programme, and violation-type fixed effects, as well as standard macro-financial controls, with standard errors clustered at the country level.

6.5 Placebo and Boundary-condition Tests

6.5.1 Randomization Inference with Counterfactual Exposure Assignments

A central insight of Borusyak and Hull (2023) is that, in settings where exposure to aggregate shocks is non-random, credible inference can be strengthened by evaluating outcomes under counterfactual exposure structures. Rather than assuming exposure is exogenous, this approach asks whether estimated effects are robust to alternative, observationally plausible reallocations of exposure that preserve the aggregate shock process. This perspective is particularly relevant in the present setting, where exposure to U.S. sanctions enforcement intensity reflects correspondent banking networks that are unlikely to be randomly assigned across countries.

Building on this insight, I conduct a randomization-inference exercise that constructs counterfactual realizations of the predetermined exposure measure. In the baseline specification, country-level exposure s_i is defined as regional correspondent banking dependence fixed at its 2011 level, while enforcement intensity enters through a common sender-side shock Z_t, defined as the logarithm of total OFAC penalties imposed on U.S. financial institutions in year t. The resulting Borusyak–Hull–style treatment intensity is given by

$$D_{it} = s_i \times Z_t. \tag{11}$$

To assess whether the estimated effect of D_{it} reflects economically meaningful exposure or merely mechanical correlation with the aggregate enforcement shock, I generate counterfactual exposure assignments via restricted permutation. Specifically, I randomly reassign the exposure weights s_i across countries within IMF regions, holding fixed (i) the time series of the enforcement shock Z_t, and (ii) the regional distribution of exposure. This procedure preserves the broad structure of the international financial network while breaking any country-specific mapping between exposure and outcomes.

For each permutation $b = 1, \ldots, B$, I construct a placebo treatment

$$D_{it}^{(b)} = s_i^{(b)} \times Z_t, \tag{12}$$

and re-estimate the baseline regression of financial development outcomes on $D_{it}^{(b)}$, obtaining a distribution of placebo coefficients $\{\hat{\beta}^{(b)}\}_{b=1}^{B}$. This yields a randomization-inference test that asks the following falsification question: if exposure carried no special causal meaning and merely acted as a relabeling of countries within regions, would the enforcement shock still generate an effect of comparable magnitude?

Figure 24 presents the resulting placebo distribution based on 1,000 within-region permutations. The distribution is approximately bell-shaped and centered around a positive coefficient of approximately 0.01, reflecting the fact that a common, time-varying enforcement shock interacting with regionally concentrated exposure generates positive correlations even under

random reassignment. Importantly, the observed estimate from the true exposure assignment[28] lies well within this distribution, with a two-sided randomization p-value of between 0.61-0.69[29].

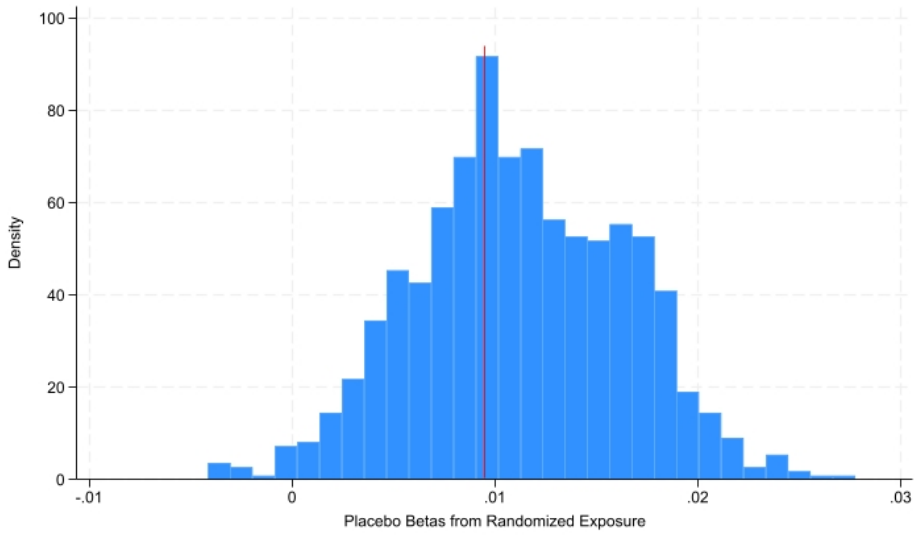


Figure 24: **Randomization Inference for Counterfactual Exposure.** This figure plots the distribution of placebo coefficients obtained from 1,000 randomized exposure assignments constructed by permuting country-level correspondent exposure shares within IMF regions. In each permutation, the sender-side enforcement shock (log OFAC penalties imposed on U.S. financial institutions) is held fixed, while exposure is reassigned across countries within regions to generate counterfactual Borusyak–Hull–style treatment intensities. The histogram shows the resulting distribution of estimated coefficients on the placebo exposure measure. The vertical line (red) indicates the coefficient obtained using the true, predetermined exposure fixed at 2011 levels.

These randomization inference results substantially weaken any claim that the Borusyak–Hull (2023)–style exposure design, by itself, delivers causal identification in this setting. The estimated effect lies near the center of the placebo distribution generated by random exposure assignments, indicating that similar coefficients arise frequently even when exposure is assigned arbitrarily. Between 60 and 70 percent of placebo estimates exceed the observed coefficient in absolute value. This implies that the exposure-based result cannot be interpreted as providing strong causal identification on its own. Rather, it should be viewed as a consistency check showing that the estimated association is not driven by a particular exposure configuration, but also not sharply distinguishable from patterns that could arise under random exposure.

As a clarifying point on interpretation, it should be noted that the randomization procedure relied on permuting s_i within IMF regions, reflecting limitations in the correspondent banking data[30]. This procedure destroys country-specific exposure structure while preserving regional

[28] $\hat{\beta}^{\text{obs}} \approx 0.0079 - 0.009$

[29] This means roughly 60 to 70 percent of placebo coefficients generated by randomly permuting exposure within IMF regions are at least as large in absolute value as the observed coefficient.

[30] The CPMI–Swift data are only available at the regional level for much of the sample.

averages. In this setup, the randomization test asks whether any country within the same IMF region could have been assigned a different exposure profile without materially changing the estimated effect. The results indicate that the effect is not sensitive to country-level reassignment within regions, suggesting that the identifying variation is primarily regional rather than country-idiosyncratic. Viewed through this lens, the results are consistent with a sender-originating enforcement mechanism that propagates through regional financial hubs. In the context of the CCMS network-propagation framework, what appears to matter for the effect of secondary sanctions on financial development is not fine-grained country exposure, but membership in regions with high U.S. correspondent banking dependence and the transmission of enforcement pressure through regional financial infrastructure.

6.5.2 Boundary-condition Test: Financial Openness of China

Because China maintains capital controls and a policy stance that limits reliance on US-linked financial intermediation, it provides a useful boundary-condition test for the correspondent-diffusion mechanism. I therefore allow the effect of enforcement exposure intensity to differ for China by estimating a China-specific interaction term. As I have argued and presented earlier evidence which shows that the sender-origination diffusion mechanism runs through USD correspondent dependence and compliance upgrading, the boundary-condition test explores whether China's efforts to resist geoeconomic pressure, by limiting dependence on U.S. financial infrastructure and enacting policies which reduce financial openness, attenuates the estimated exposure effect for China relative to other countries.

As an important prior for the boundary-condition test, I also use an interaction with the Chinn Ito Index to directly test whether financial openness moderates the exposure effect. This is based on the logic that more openness amplifies the transmission channel. Economically, enforcement pressure propagates through financial networks; the structure of financial intermediation means that countries that are more financially open are more tightly wired into those networks, therefore, they are more sensitive to sender-originating enforcement shocks so that increased financial openness amplifies transmission. If capital controls and restricted financial openness dampen the correspondent-compliance transmission channel, the sanctions–exposure effect should be weaker for China than for otherwise similar countries. The results for the Chinn Ito Index interaction are presented in Column 1 of Table 22 while the results for the China interaction are presented in Column 2.

The results for the Chinn Ito Index interaction confirm that the exposure effect is strongly heterogeneous with respect to financial openness. While the average effect of enforcement exposure is modest, it increases sharply with the Chinn–Ito index, indicating that enforcement pressure propagates more powerfully through financially open economies. A 1-unit increase in the Chinn–Ito index raises the marginal effect of enforcement exposure by about 0.002. This result provides the basis for interpreting the boundary-condition test for the financial openness of China.

Contrary to the restricted financial openness hypothesis, the China-specific interaction term is

positive and highly significant. While the average effect of enforcement exposure outside China is modest, the implied effect for China is large and precisely estimated. This suggests that sender-originating enforcement shocks propagate through the global financial infrastructure in ways that even highly regulated systems cannot fully avoid and points to the significant geoeconomic power that the U.S. has over the global financial system. Furthermore, China's financial system, despite capital controls, is still deeply integrated into global USD settlement, trade finance, and clearing which are shaped by U.S. regulatory reach. Capital controls may change how flows move, but they cannot make a country impervious to the power of the hegemon in the global financial network as resistance to geoeconomic pressure has to be organized inside a system whose arteries were built under U.S. influence. As noted by Clayton, Coppola, Maggiori and Schreger (2025), the sectoral dominance of the U.S. in financial services and the high level of interdependence of the global financial network makes it difficult for countries to devise alternatives as a means to resist or avoid geoeconomic pressure from the U.S.

6.5.3 Boundary-condition Placebo Using Iran

As a boundary-condition placebo, I further test whether enforcement exposure has differential effects for Iran, a country that has been structurally insulated from the U.S.-dollar correspondent banking system for much of the sample period. The rationale for this test is based on the logic that if Iran has been structurally insulated from USD correspondent networks for the sample period, then the diffusion channel (sender enforcement pressure propagating through correspondent relationships) should not operate.

To test this, I use a simple treated-unit placebo interaction framework which accounts for the fact that Iran is a sanctioned/isolated outlier. Based on the diffusion channel logic, there should be no differential response for Iran when US enforcement spikes, relative to other countries. A null result for the Iran placebo test would confirm whether the estimated effect is being driven by a mechanical time-series relationship between enforcement and global trends in financial development (or by general global compliance upgrading unrelated to correspondent dependence), rather than by network-based exposure.

The results for the Iran placebo test are presented in Column 3 of Table 22. Consistent with the diffusion mechanism, the interaction between enforcement exposure and an indicator for Iran is small and statistically insignificant. This suggests that countries largely disconnected from U.S.-linked correspondent networks do not exhibit heightened sensitivity to sender-side enforcement pressure, reinforcing the interpretation that the main effects operate through correspondent banking channels rather than generic time-varying correlations.

	Financial Development Index		
	(1)	**(2)**	**(3)**
BH-Style Exposure Intensity	0.010	0.006	0.007
	(0.006)	(0.007)	(0.007)
BH-Style Exposure Intensity x China		0.012 **	
		(0.001)	
BH-Style Exposure Intensity x Chinn Ito Index	0.002 **		
	(0.001)		
BH-Style Exposure Intensity x Iran			0.001
			(0.001)
FDI XGDP	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
GDP PC Growth	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
IFS Imports	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
Chinn Ito Index	0.001	0.011 *	0.010 *
	(0.004)	(0.004)	(0.004)
ICT Imports	0.000	0.001 **	0.001 **
	(0.001)	(0.001)	(0.001)
Constant	0.241 **	0.250 **	0.245 **
	(0.031)	(0.032)	(0.032)
Adjusted R-squared	0.936	0.934	0.934
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	7,908	7,908	7,908

Table 22: **Heterogeneity and Boundary-Condition Tests for Borusyak–Hull (2023)–Style Exposure Design**.This table reports heterogeneous effects of the Borusyak–Hull (2023) style enforcement exposure intensity on the Financial Development Index. Column (1) tests whether the exposure effect varies with financial openness, measured by the Chinn–Ito index. Column (2) examines a boundary-condition case for China, a large economy with capital controls and partial insulation from U.S.-linked correspondent banking, by interacting exposure with an indicator for China. Column (3) provides a treated-unit placebo using Iran, a country structurally insulated from U.S. correspondent banking networks, for which the diffusion channel is expected to be weak or absent. All specifications include country and year fixed effects and standard macro-financial controls. Standard errors are clustered at the country level.

7 Concluding Discussion

An underappreciated feature of the neoliberal orthodoxy which came to govern the global economy within the last three decades is the significant threat of economic pressure which the U.S. was able to exert to force countries to liberalize their economies and adopt financial best practices promoted by the U.S. While much of this pressure was exerted through diplomatic soft power and the spread of free market ideology by the Chicago school of economics, the implementation of secondary sanctions through the arteries of the global financial system may have served to increase the degree of financial development within countries as systems were implemented to both address and avoid sanctions violations and meet compliance requirements imposed by the U.S. as a condition for access to the global financial system. This article presented empirical evidence which suggests this may indeed be the case.

By integrating secondary sanctions into an extended dual-structure interpretation of the CCMS framework, I show that sanctions enforcement can act as a coordinating mechanism that encourages third-party and bystander states to harmonize financial institutions and market structures with the regulatory preferences of the hegemon. The empirical evidence demonstrates that exposure to OFAC enforcement triggers meaningful improvements in financial development over time. These effects are concentrated in the institutional rather than the market infrastructure dimension, consistent with a form of compliance-driven institutional upgrading.

Furthermore, analysis of the sender-side effects indicates that improvements originate primarily with enforcement directed at U.S.-based global financial intermediaries. As these core institutions implement enhanced compliance systems in response to penalties, stricter standards propagate outward through correspondent banking and Swift linkages, compelling foreign institutions to adopt comparable practices. By contrast, penalties targeting multinational financial institutions outside the United States show weaker global spillovers, suggesting that network position, rather than size or multinational reach alone, governs whether enforcement shocks diffuse effectively.

Taken together, the findings demonstrate that the effects of geoeconomic pressure extend beyond the sender–receiver dyad to shape the broader evolution of the global financial system. Secondary sanctions, while designed to constrain sanctioned actors, have generated positive externalities by incentivising institutional strengthening across numerous jurisdictions seeking to preserve access to vital financial chokepoints. This dynamic highlights an underappreciated role of sanctions in the harmonisation of financial governance standards globally, particularly in developing and emerging economies for which continued connectivity to the U.S.-centric financial network remains indispensable. More broadly, the evidence suggests that economic statecraft has become an increasingly important channel through which the institutional architecture of global finance continues to evolve.

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