Financial Sanctions and the Global Payments Network*

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Abstract

Financial sanctions are widely viewed as a powerful tool of economic statecraft, yet direct evidence on their effects remains limited. We study how sanctions affect access to global payment networks using data on correspondent banking relationships, which link banks across countries and currencies to enable cross-border transactions. We first show that the dollar and euro networks offer the broadest global connectivity, supported by a small number of key hubs in the U.S. and Europe. Sanctions that restrict access to these hubs are therefore potentially powerful. We then show how financial sanctions imposed during 2021-2025 – a period of rapid growth in sanctions – reduced targeted banks' access to major-currency networks by severing correspondent relationships. Sanctioned institutions often retained access but only through longer, indirect, and more fragile chains of intermediaries. Finally, in countries where sanctions expanded sharply, non-sanctioned banks also lost connectivity to Western networks, likely reflecting de-risking. These banks reoriented toward alternatives, particularly the Chinese yuan. Outside these heavily sanctioned economies, shifts away from the dollar and toward the yuan remain minimal on average.

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1 Introduction

Financial sanctions are widely viewed as a powerful tool of economic statecraft. This view is especially strong for U.S. sanctions, largely reflecting the dollar's central role in global payments. The use of sanctions has grown rapidly: the number of entities appearing on the U.S. Treasury's primary sanctions list of "Specially Designated Nationals" (SDN) increased from below 1,000 in 2000 to nearly 20,000 today. More recently, the European Union and United Kingdom have repeatedly expanded their sanctions on banks in Russia and in third countries. Yet there is little systematic evidence on how these sanctions affect banks' access to cross-border payments and the global financial system.

In this paper, we study how financial sanctions restrict and reshape banks' access to global payment networks, focusing on the correspondent relationships that allow financial institutions to send and receive payments in various currencies and countries. We highlight features of these networks that make financial sanctions potentially potent: dollar and euro correspondent networks connect more banks and route payments through shorter chains than alternatives such as the yuan network. These shorter chains are possible because the networks are highly concentrated, with a few key hubs – especially in the dollar network. We then show that sanctioned banks lose much of their access to dollar, euro, pound, and yuan payment networks. More surprisingly, non-sanctioned banks located in heavily sanctioned countries undergo a similar reduction in access to Western payment infrastructures. These non-sanctioned banks also reorient toward alternatives, particularly correspondent relationships in the Chinese yuan. These shifts away from the dollar and toward the yuan are pronounced in heavily sanctioned economies such as Belarus, Kyrgyzstan, Myanmar, and Russia, but minimal in other emerging markets and developing economies (EMDEs).

To understand how international payments work, consider a Belarusian fertilizer producer that exports to a customer in Azerbaijan and invoices in U.S. dollars. Suppose both parties' banks (the "respondents") maintain dollar correspondent relationships, and thus dollar accounts, with large U.S. banks (their "correspondents"): Citibank (Citi) for the Belarusian bank and JPMorgan Chase (JPM) for the Azerbaijani bank. To route the payment, JPM debits the dollar account of the Azerbaijani bank, and Citi credits the dollar account of the Belarusian bank. Citi and JPM both hold accounts at the U.S. Federal Reserve (Fed) and so settle with each other using central bank reserves. This chain has three hops: the two banks to their correspondents, and Citi to JPM through the Fed. Transfers like this, via the correspondent banking network, form the backbone of global cross-border payments in all major currencies.

Suppose the Belarusian bank were sanctioned by the United States. Citi would likely sever the relationship. As a result, the Belarusian bank would then need to receive dollar payments through longer chains of intermediaries outside the United States, if those connections were available. Such routing would be more costly and less reliable than the original direct access to the U.S. correspondent.

Each additional hop adds administrative processing and compliance and regulatory checks. It also ties up pre-funded capital. And without the Fed as settlement agent, it involves counterparty credit risk and lacks settlement finality. Alternatively, the Belarusian exporter could invoice in a currency such as the yuan or ruble, with payment cleared by non-U.S. correspondents. Or it could switch to a different local bank still able to transact cheaply in dollars. Each of these substitutions, where feasible, carries costs.

What would happen if several other banks within Belarus were also sanctioned? One possibility is that demand for payment services shifts to unsanctioned institutions, which in response expand their ability to pay in dollars. In this case, even broad sanctions might have little aggregate effect. Alternatively, concerns about secondary or future sanctions may lead correspondents to pull back from all Belarusian banks, including those that are not sanctioned, a dynamic often known as "de-risking". In this case, the non-sanctioned banks might instead expand their correspondent relationships in currencies other than the dollar.

We explore these issues using data on correspondent banking relationships and sanctions exposures from LexisNexis Risk Solutions (LNRS), a commercial provider of licensed datasets collected from external sources on global banking relationships and sanctions data. These data are licensed by financial institutions as inputs into their own payments-routing analyses and sanctions-screening processes. They allow us to directly observe how banks are connected through correspondent relationships across currencies and countries and to track how those relationships change over time.

We begin by documenting three characteristics of correspondent banking networks that underlie the efficacy of financial sanctions, particularly those imposed by the United States and EU. We focus on access from EMDEs, where sanctions are most common.

First, the reach of the dollar and euro networks exceeds that of other networks. Of EMDE banks that list correspondents, almost all have a dollar correspondent (90%) or a euro correspondent (88%), substantially more than have correspondents in the pound (62%) or yuan (34%).[1] In fact, most of those banks list a "direct" correspondent for dollars and euros, meaning their dollar correspondents are U.S. banks or their euro correspondents are located in the eurozone, and so likely hold accounts at the Fed or European Central Bank (ECB). This is not always the case: more banks report "indirect" yuan correspondents – clearing yuan through banks outside of China – than report direct yuan correspondents. Second, chains of dollar or euro correspondents can connect four-to-five times as many cross-border banking pairs as the yuan, and those connections on average involve only three interbank hops with the dollar or euro versus close to four for the yuan. The shortest path connecting an EMDE bank with a foreign bank is along the dollar or euro correspondent networks in about three-quarters of cases, while the yuan network offers the shortest path for less than 3 percent of such pairs. Third, network connectivity is supplied by a small number of key hubs. The top 10 banks account for 77% of the dollar

[1] About two thirds of commercial banks do not list a correspondent in any currency, likely because they are focused on domestic payments or use a domestic clearer without listing it as a formal correspondent.

network's total PageRank values, a measure of node centrality, much larger than the (still substantial) shares for the euro (51%) and yuan (52%).[2]

The reach, concentration, and dominance of the dollar and euro cross-border payment networks underlie the potential efficacy of financial sanctions as a tool of U.S. and EU economic statecraft. When the ability to efficiently send or receive cross-border payments in key global currencies runs through a few central correspondents typically located in the sanctioning jurisdiction, the threat or act of removing access to those hubs is powerful. Moreover, if de-risking leaves non-sanctioned banks in the same economy with less access to those hubs, the economy's overall payment connectivity can degrade.

Having characterized these key features of correspondent banking networks, we turn to how financial sanctions alter connectivity to these networks. Our analysis covers 2021-2025, a period in which the number of banks sanctioned by the United States, Europe, or the United Kingdom rose by nearly 40%. Russian banks comprise the bulk of this increase, but sanctions also substantially increased in several other countries such as Belarus, Kyrgyzstan, and Myanmar. Importantly, even in these heavily sanctioned economies, not all banks are designated, leaving a mix of sanctioned and unsanctioned institutions.

We document three main findings. First, at the bank level, sanctions substantially reduce access to the global payments network, though sanctioned institutions often retain partial and indirect access. Sanctioned banks lose direct correspondents that offer payment routes through central bank accounts. They also lose indirect correspondents that route payments through third countries. For example, banks sanctioned by the United States lose dollar clearing with U.S. banks as well as with European and Asian banks. These contractions appear across major currencies, including the dollar, euro, pound, and yuan.

Sanctions also degrade the quality of whatever access to the payments network remains. Before designation, eventually sanctioned banks typically have dollar correspondents with PageRank values that sum to about 12%, capturing one-eighth of dollar-network connectivity. After designation, that share falls to about 3%, driven by the severing of relationships with large U.S. banks that serve as key hubs for dollar clearing. The loss of these central correspondents also lengthens payment chains. Among sanctioned banks that retain dollar access, the number of interbank hops needed to reach banks in their top-5 trading partners typically rises by about a third. These patterns suggest that, rather than eliminating connectivity altogether, sanctions likely make payments costlier, slower, and riskier. We document these dynamics both in summary statistics and by using a difference-in-differences approach that compares changes in the payment network connections of sanctioned and unsanctioned banks located in the same country and in the same year.

[2]PageRank measures a node's centrality and can be conceptualized as the likelihood a node is reached by a random walk taken over the network of correspondent links. A bank will have a higher PageRank value if other well-connected banks connect to it. PageRank values for nodes in a given network sum to 100, giving them a percentage interpretation.

Second, in heavily sanctioned countries, sanctions also degrade the ability of non-sanctioned banks to make cross-border payments. During 2021-2025, Belarus, Kyrgyzstan, Myanmar, and Russia all saw large increases in the share of banks sanctioned, while retaining a large unsanctioned share. Rather than expanding their dollar, euro, or pound connectivity to substitute for the lost connectivity of the sanctioned banks, non-sanctioned banks saw payment connectivity to those currencies decline, especially via direct correspondents.

Third, in this small set of heavily sanctioned countries, we document significant substitution away from Western correspondents and toward clearing in yuan. The share of these countries' correspondent relationships denominated in yuan grows, even after accounting for changes in the share of their imports and exports that is traded with China. This reorientation makes the yuan more attractive as a means of payment. For example, in 2021, the dollar or euro offered the shortest cross-border paths from banks in Belarus to more than 80% of financial institutions in other countries, with the yuan almost never offering the route with the fewest hops. This changed sharply after the wave of sanctions imposed on Belarus. By 2025, the dollar or euro accounted for less than half of the shortest paths, while the yuan accounted for about 20 percent, more than the dollar. By this same measure, yuan connectivity also grew substantially in the other sanctioned economies over this period.

Is this reorientation toward the yuan part of a global decline in the role of the dollar? No. In 2025, the shortest cross-border path between all EMDE and foreign banks was either using the dollar or euro correspondent networks in roughly three-quarters of cases, about the same as in 2021. Outside the heavily sanctioned economies, in aggregate, our data show no significant evidence of shifts away from the correspondent banking network of the dollar and toward that of the yuan.

2 Related Literature

Our paper offers the first complete global view of the correspondent banking network and merges it with high-frequency data on sanctions designations. It relates to five bodies of work.

Geoeconomics studies how countries leverage their economic and financial linkages for economic or non-economic goals (Hirschman, 1958, 1980); Mohr and Trebesch (2025) offer a recent review. Farrell and Newman (2019) argue that states with jurisdiction over key network hubs can exclude adversaries or monitor their transactions. Clayton, Maggiori and Schreger (2026) and Clayton, Maggiori and Schreger (2024) model how a hegemon can exploit others' reliance on its financial infrastructure, and how coercion can push targets to reduce that reliance, fragmenting the system. In Bianchi and Sosa-Padilla (2025), sanctions create a trade-off between their use and dollar dominance. We measure the structures these theories operate on: a few hubs, primarily in the United States and Europe, supply much of the networks' connectivity, underpinning sanctions' potential power. We observe the margins the theories emphasize: sanctioned banks lose direct access and retain longer, more fragile chains;

non-sanctioned banks in heavily sanctioned economies also lose Western connectivity and expand yuan clearing.

Within the economics of sanctions, Itskhoki and Ribakova (2024) connect theory to practice and discuss payment system sanctions. They leave as an open question whether sanctions will fragment the global payment system. Our evidence speaks directly to this question: through 2025, fragmentation is concentrated in sanctioned banks and heavily sanctioned economies, while the dollar's and euro's positions elsewhere remain stable. Itskhoki and Mukhin (2022) map sanction instruments into exchange rate responses, and Felbermayr, Kirilakha, Syropoulos, Yalcin and Yotov (2020) document the global incidence of sanctions and their trade effects. Closest to us, Drott, Goldbach and Nitsch (2024) show that payments involving sanctioned Russian banks in the Eurosystem's TARGET2 settlement system decline, with exclusion from the Society for Worldwide Interbank Financial Telecommunication (SWIFT) having the largest effect. Their data cover a single settlement system; we instead observe the global network of correspondent relationships across five major currencies – where connectivity is severed, what indirect access remains, and how non-sanctioned banks in heavily sanctioned economies adjust.

A set of policy-oriented papers documents the withdrawal of correspondent banking relationships and its consequences for cross-border payments (Erbenová, Liu, Kyriakos-Saad, López Mejía, Gasha, Mathias, Norat, Fernando and Almeida, 2016; World Bank, 2015; Grolleman and Jutrsa, 2017); Rice, von Peter and Boar (2020) document a 20 percent decline in global correspondent relationships during 2011-2018. Collin, Cook and Soramaki (2016), Fracassi, Lee and Roukny (2025), and Borchert, De Haas, Kirschenmann and Schultz (2024) link anti-money laundering enforcement to declines in payment messages, trade and FDI, and affected customers' exports, respectively. Cipriani, Goldberg and La Spada (2023), Robinson, Dörry and Derudder (2023), and Myles (2025) recount the history and architecture of SWIFT and correspondent banking, and Perez-Saiz, Zhang and Iyer (2023) and Cerutti, Firat and Hengge (2025) measure payments and currency usage with SWIFT message data. We add the first complete map of the network itself: relationship-level data on more than 17,000 EMDE financial institutions across five currency networks, merged with designation-level sanctions data. The network's topology – hubs, path lengths, and indirect connections rather than aggregate counts or message volumes – lets us characterize how sanctions reshape access.

Our findings on the dollar's stability speak to the dollar dominance literature, which documents its leading role as a vehicle and invoicing currency (Devereux and Shi, 2013; Goldberg and Tille, 2008; Gopinath, Boz, Casas, Díez, Gourinchas and Plagborg-Møller, 2020), in the funding of global banks (Ivashina, Scharfstein and Stein, 2015), as the dominant anchor currency (Ilzetzki, Reinhart and Rogoff, 2019), and in cross-border securities holdings (Maggiori, Neiman and Schreger, 2019, 2020), with Rogoff (2025) offering a broad account of the postwar dollar system. Theories explain a dominant currency's emergence and persistence through complementarities among these roles (Gopinath and Stein,

2021; Chahrour and Valchev, 2022; Mukhin, 2022; Coppola, Krishnamurthy and Xu, 2026), supported by policies such as Federal Reserve swap lines (Kekre and Lenel, 2025). We measure an additional dimension of dominance: the capacity to transact. Dollar and euro correspondent chains connect four-to-five times as many cross-border bank pairs as the yuan network, in fewer hops, through a small set of central hubs – infrastructure on which the other dimensions of dominance run, and a potential additional source of the network effects these theories posit.

Whether the dollar's position can shift is a long-standing question. Eichengreen, Mehl and Chiţu (2018) argue from historical transitions that network effects generate less lock-in than once believed, and Arslanalp, Eichengreen and Simpson-Bell (2022) document gradual diversification of official reserves away from the dollar. Work on renminbi internationalization (Eichengreen and Kawai, eds, 2015; Prasad, 2016) studies drivers including central bank swap lines (Bahaj and Reis, 2026), the opening of China's bond market (Clayton, Dos Santos, Maggiori and Schreger, 2025), and the timing of China's incentives to leave the dollar system (Jiang, 2026). We document one such shift and identify sanctions as its trigger: in heavily sanctioned economies the yuan's share of correspondent relationships and of shortest payment paths rises, with sanctions exposure – not trade reorientation toward China – accounting for the shift; elsewhere we find no comparable movement through 2025.

Our focus on correspondent banks connects to the literature placing financial intermediaries at the center of international finance: reserve-currency status rests on intermediation capacity (Maggiori, 2017); exchange rates are shaped by intermediaries' balance sheets and financial shocks (Gabaix and Maggiori, 2015; Itskhoki and Mukhin, 2021; Du, Tepper and Verdelhan, 2018); and global banks transmit dollar funding conditions across borders, generating a global financial cycle that constrains national policy and centers on the dollar (Bruno and Shin, 2015; Rey, 2015; Jiang, Krishnamurthy and Lustig, 2024). Our results highlight a largely unmeasured dimension of intermediation: a bank's position in the payments network. Correspondent hubs supply transaction connectivity rather than risk-bearing capacity, and access to these hubs determines whether, and through how many intermediaries, a bank can transact in a currency.

Finally, the frictions we measure motivate research on payments innovation: digital currencies and interoperable fast payment systems could reduce dependence on chains of correspondents (Duffie, 2019, 2020), and Chung (2025) incorporates correspondent banks into a Melitz (2003) trade model to evaluate central bank digital currencies. Our estimates of hub dependence and chain length quantify the frictions this literature seeks to reduce – the same features that underlie the potency of financial sanctions.

3 Key Features of the Global Payments Network

Cross-border payments differ fundamentally from domestic payments because they lack a single central bank that provides universal access to settlement in a given currency. In domestic systems, large banks settle payments by transferring balances between their accounts held at the central bank, ensuring speed and finality while eliminating counterparty risk. For cross-border payments, including those involving foreign currencies, no single central bank covers both sides of the transaction. Instead, banks must hold accounts with other banks, called correspondents, that provide access to settlement in the relevant foreign currency.

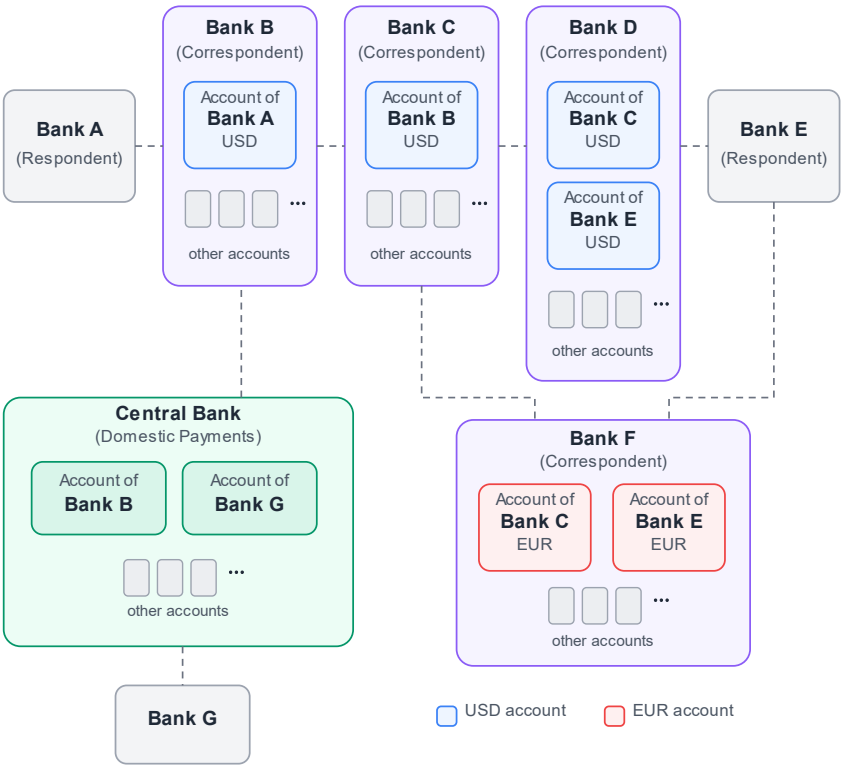
We start this section by walking through the mechanics of a cross-border transfer through the correspondent system. We then highlight key features of the correspondent network in each currency that make sanctions effective. We show that banks often list multiple correspondents for multiple currencies, but dollar and euro correspondents are by far the most common. This is one reason the dollar and euro correspondent networks can typically connect banks in fewer hops than can the yuan network. Such routing efficacy reflects significant network concentration, with a small number of key hubs essential for overall connectivity, particularly in the dollar network.

3.1 How Correspondent Banking Works

To see how a cross-border transfer through the correspondent banking network works, consider a bank located outside of the United States that wants to receive a payment in U.S. dollars. To do so, it must maintain a dollar account with a correspondent that can credit it. If the bank making the payment also holds a dollar account with the same correspondent, the transaction can be completed within a single institution by debiting one account and crediting another. However, if the sending and receiving banks do not share a common correspondent for U.S. dollar transactions, the payment must be routed through a longer, more fragile chain of correspondent institutions. For example, the receiving bank may hold a dollar account with a regional correspondent, while the sending bank uses a different dollar correspondent, requiring the payment to pass through additional intermediaries that connect the two. If the sender funds a dollar payment from a euro account, a currency conversion must occur somewhere along the chain, at a bank holding accounts in both currencies. This typically involves an additional fee. In this sense, a bank's ability to receive dollar payments depends on how it connects to these networks of relationships.

An example of such a correspondent chain is illustrated in Figure 1. Suppose Bank A wishes to pay $1 to Bank E. Bank A has a dollar account (or dollar correspondent relationship) with Bank B, while Bank E has a dollar account at Bank D. Since A and E do not share a dollar correspondent, transfers would have to pass through several hops. The sequence would start with a $1 reduction in the value of Bank A's account held at Bank B, which would shortly be matched by a $1 reduction in the value

Figure 1: Example of Cross-Border Payment via Correspondent System



of Bank B's account held at Bank C. Bank C would then pass the dollar along, leading to a decline in its balance held at Bank D, enabling D to increase the balance of Bank E's account. This would be an example of a 4-hop path.[3] Bank E also has a euro correspondent bank relationship with Bank F. If Bank E wanted to make a payment in dollars and deliver a payment to Bank A in euros, it could route payments through F and then connect to the dollar network via Bank C, which also has F as its euro correspondent.

These chains of correspondent relationships introduce frictions. Payments that pass through multiple intermediaries require a sequence of debits and credits across different institutions, potentially located in different countries and time zones. This increases the scope for delays when intermediary banks execute the payment and check for compliance with regulation, higher costs and fees, and disruptions if any intermediary errs or fails to process the transaction. More fundamentally, a bank's ability to receive funds through a correspondent depends on the solvency and willingness of that institution to honor its obligations, the legal enforceability of those claims, and the correspondent's ability to convert its accounting claims into actual money on demand, giving rise to counterparty risk.

Central banks occupy structurally unique positions in the payment network by mitigating these frictions. For example, many U.S. banks can settle dollar payments with one another by simply trans-

[3]By the end of the transaction, intermediary banks B and C have each lost $1 of assets and $1 of liabilities, while Bank D replaces its $1 liability to C with a $1 liability to E.

ferring balances held at the U.S. Federal Reserve – similar to how transfers work using correspondent accounts, but without the need for intermediaries and with immediate settlement finality.[4] This is also illustrated in Figure 1, which shows that Bank B and Bank G – assumed to be in the same country – can settle directly on the Central Bank's books, without any direct relationship. Central bank settlement thus collapses chains of risky claims between intermediaries, dramatically shortens the paths through which payments must travel, and increases confidence that claims can be converted to actual currency. As such, direct correspondents – those located in the country that issues the currency and connected to the central bank or payment system – offer improved connectivity to the cross-border payments network compared to indirect correspondents that are located in other countries.

Below, we document how sanctions disrupt or sever the links through which banks access the global correspondent banking network and key settlement systems. Sanctioned banks, and non-sanctioned banks in heavily sanctioned countries, often lose access to direct correspondents in certain currencies and must instead rely on longer, indirect, and more fragile chains of intermediaries. Sanctions can therefore increase the costs, risks, and complexity of executing cross-border payments, even if access is not eliminated entirely.

3.2 Global Correspondent Banking Data

In this section, we document three key aspects of correspondent banking networks, which underlie the power of financial sanctions, particularly those enacted by U.S. and EU authorities. First, while banks often list multiple correspondents in many currencies, it is far more common for banks to have dollar and euro correspondents than other currencies. Second, it typically takes multiple hops to connect any two banks located in different EMDEs, but connections on the dollar and euro networks are typically shortest. Third, correspondent network connectivity typically reflects the disproportionate importance of a few key hubs. This is particularly the case for U.S. banks on the dollar network.

To document these features of correspondent banking networks, we use data licensed from LNRS, a commercial data services provider. LNRS offers technologies and analytics tools to help organizations manage sanctions risk and improve the efficiency of cross-border payments, among other core business concerns of global banks and other financial institutions. LNRS offers multiple products, but the key database used in our analysis is their "Global Payments File (GPF) Plus". The GPF provides a broad range of information on all included banks, including contact information and measures of size. Most importantly for our purposes, the GPF collects each bank's "standard settlement instructions" (SSIs), which list, for each currency the bank can receive, the identity and key details (such as a SWIFT or "BIC" code) of the correspondent bank(s) through which it can receive a payment in that currency.

[4] In practice, U.S. dollar payments between banks with access to the Federal Reserve are processed through systems such as Fedwire or CHIPS, which facilitate the transfer of central bank balances and interbank claims. Related setups apply to other major currencies, including the euro, the British pound, and the Chinese yuan, and involve payment or settlement systems T2 (previously TARGET2), CHAPS, and CIPS, respectively.

The GPF does not record realized payment flows, transaction values, or the exact routing of individual payments. LNRS also provides sanctions information collected from official government sources, which institutions incorporate into their own sanctions-screening systems, including information on authorities of the United States, the United Kingdom, and the European Union.

We study GPF data from September 2021, September 2022, September 2023, September 2024, and November 2025.[5] Because changes in sanctions status and correspondent banking relationships are highly persistent, little is lost for our purposes from only having (roughly) annual updates of our data. In aggregate, the data include about 70,000 financial institutions.[6] If a bank has a presence in multiple countries, each will count as a distinct institution. For example, Barclays Bank PLC has its global headquarters in London, which would be treated under this definition as a different entity from its Americas headquarters, which is in New York. Within each country, however, all branches or offices of the same institution share an identifier. The total number of locations in the data, therefore, vastly exceeds 70,000. This paper focuses on sanctions, which are far more common in emerging market and developing economies (EMDEs) – countries classified by the World Bank as upper-middle, lower-middle, or low income – than in advanced economies. As such, to allow for more useful comparisons of sanctioned and non-sanctioned banks, we restrict the sample to the roughly 17,000 financial institutions located in EMDEs (though still capture their linkages to correspondents in advanced economies).[7]

Nearly 45 percent of the EMDE institutions in our data are "Depository Financial Institutions", a broad classification that includes non-bank entities such as corporate treasuries (with SWIFT codes), securities broker-dealers, investment managers, insurance companies, and fintech firms. "Commercial Banks" account for the next largest share, about a third. The remaining roughly 20 percent includes "Deposit-taking institutions", "Cooperative Banks", and "Edge Act Corporations".[8]

3.3 Correspondent Banking Relationships Across Currencies

Respondent banks use correspondent banking relationships for sending and receiving cross-border foreign currency payments. Because most banks do not need such a service, at least not directly, most institutions in the data do not report any correspondent relationships or SSIs. Many institutions in our data are credit unions or savings & loans banks that may operate exclusively within their domestic clearing systems. Smaller regional banks might have a domestic clearing provider, but may not list

[5] Historically, this information was printed in physical volumes called the "Banker's Almanac." See the GloCoBank Project at Oxford University, which studies correspondent banking relationships across the 20th century.

[6] We use the institution identifier generated by LNRS. For certain datasets, individualization of data may benefit from LNRS-generated internal reference identifiers that help distinguish records which might otherwise appear confusingly similar. These identifiers are used solely for dataset indexing and retrieval. Institutional identity itself is defined by the legal and regulatory attributes of the institution, not by LNRS.

[7] The Appendix offers some summary statistics for U.S. banks in the data.

[8] Appendix Figure A1 shows the share accounted for by each of these categories. To calculate the shares, we pool all snapshots, but only count each unique institution once. In rare cases where an institution's type classification changes, we use the first instance. Edge Act Corporations are entities chartered by the U.S. Federal Reserve to engage in international banking and trade finance. Since the analysis is restricted to institutions located in EMDEs, these are the foreign affiliates of the U.S. entities.

it as a formal correspondent or publish the relevant SSIs. About 85 percent of non-sanctioned banks and about 70 percent of sanctioned banks never list any domestic or foreign correspondents for any currency at any time, though both of these numbers are lower (closer to 65 percent) for commercial banks, the most sanctioned financial institution type. Since there is no scope for such banks to reduce their correspondents in response to sanctions (the number cannot drop lower than 0), many of our analyses exclude this set of banks.

The distribution of correspondent relationships is significantly skewed. For any given currency, most banks have no more than a few correspondents, while a smaller set of banks have a large number of correspondents. About 60 percent of banks reporting at least some correspondents have 1 to 9 correspondent relationships. The other 40 percent of respondents list at least ten correspondents.

Dollar and euro correspondents are much more prevalent than those in other currencies. Of EMDE banks listing at least one correspondent, nearly 90% have at least one dollar correspondent and 88% have at least one euro correspondent. Further, the large majority of these are direct correspondents. 68% of banks have dollar correspondents in the United States and 73% have euro correspondents in the eurozone. This connectivity significantly exceeds EMDE bank connectivity to correspondent networks in other currencies. For example, 62%, 34%, and 11% of EMDE banks report at least one correspondent relationship in pounds, yuan, or rubles, respectively. More banks report indirect yuan correspondents, with banks located outside of China, than report direct yuan correspondents.

A smaller share of banks serve as correspondents to other institutions. Of the roughly 8 percent of EMDE institutions that report at least one respondent, over 70 percent serve at least one cross-border respondent, while about 30 percent serve at least one domestic respondent, with some serving both. The distributions are highly skewed. Most correspondents serve only a small number of respondents, but a small group serves very large client networks, some with more than 100 domestic respondents or more than 1,000 cross-border respondents.[9]

3.4 Payment Access and Chain Length

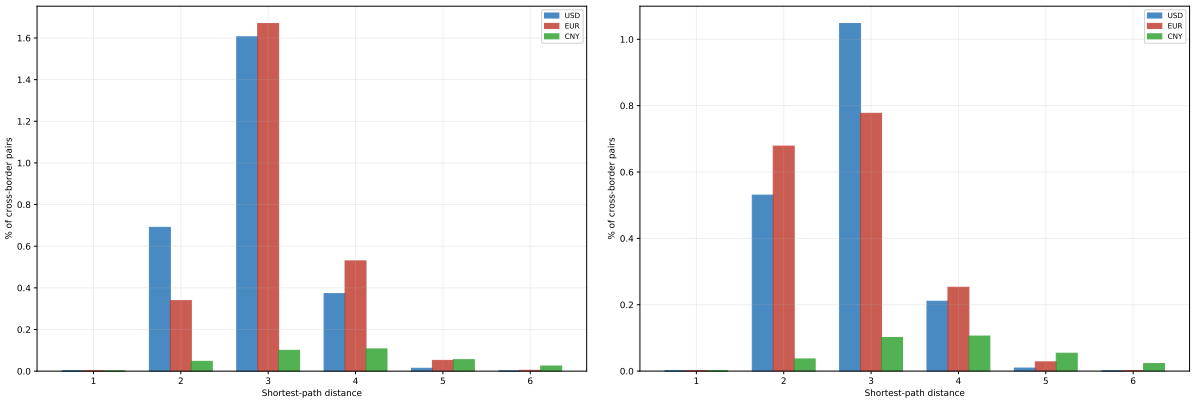
The fact that more banks have correspondents in the dollar and euro than in other currencies means that payments in the dollar and euro have the greatest ability to reach banks in foreign countries without requiring any FX conversion. In 2021, EMDE banks were able to reach 2.7 percent of banks in other EMDEs using correspondent chains in the dollar alone, slightly higher than the share that can be reached using euro correspondent chains and about eight times the share reachable using yuan correspondent chains. By 2025, the reachable percentages decline somewhat for dollar and euro chains, but remain about five times higher than the share that can be reached via chains of yuan correspondents. Results are similar when studying connectivity from EMDE banks to all foreign banks,

[9]Most EMDE correspondents, whether serving cross-border or domestic respondents, are likely clearing payments in their local currency. Therefore, while there is a greater propensity to serve as a dollar correspondent than a correspondent in other major currencies, the differences are relatively muted.

including those in developed countries, with the dollar and euro networks able to make four-to-five times as many of these cross-border connections as the yuan network.

Figure 2: Shortest Cross-Border Paths to Reachable Banks, 2021

(a) EMDE to EMDE **(b)** EMDE to World



The dollar and euro payment networks also offer the shortest payment chains conditional on access. We compute the shortest distance between banks from EMDE banks to banks in other countries for a given currency.[10] Figure 2 shows the share of cross-border connections to other EMDEs that required a given number of hops as of 2021, ranging from 1 to 6 along the x-axis. The bars sum to small total percentages because each network can only reach a limited share of total possible bank-pair connections. Nonetheless, even among those that can be reached, they typically require fewer hops with dollars (an average of 2.9 hops) and euros (3.2) and more with yuan (3.7). Figure 2b shows the same pattern to reach foreign banks in all countries: the average number of required hops is lower in the dollar and euro networks (2.8) than in the yuan network (3.8). Equivalent figures for 2025 exhibit similar patterns. These results suggest that transactions made in dollars and euros are most efficient and connections to the dollar and euro networks are most valuable.

3.5 Correspondent Banking Hubs

Finally, all correspondent banking networks are highly concentrated and rely on a small number of key hubs to achieve their connectivity. We compute PageRank, a measure of network centrality, for each bank in the correspondent network for a given currency. A bank's PageRank in a given currency can be interpreted as the likelihood that a random walk (or transaction) across the network would reach (or be intermediated by) that bank, with the scores normalized to sum to 100. For all major currencies, the top 10 banks – typically direct correspondents located in the currency's issuer – account for at least half of the overall network's PageRank values. This concentration is particularly large in the dollar

[10]Here, and for the remainder of our analysis, we assume that connections between any two banks in a given country, made in that country's currency, require only a single hop. We make this assumption to capture the typical role played by central banks in connecting domestic banks and operating their country's payment system, as discussed above.

network, where the top 10 banks account for 77 percent, versus 51 percent for the euro and 52 percent for the yuan.

4 Sanctions during 2021-2025 and the Implications for Payments

4.1 Financial Sanctions and Correspondent Banking: Restrictions and Exemptions

Most financial sanctions imposed by the U.S., EU, and the UK (through His Majesty's Treasury, HMT) restrict correspondent banking relationships.[11] The primary U.S. tool is the Specially Designated Nationals (SDN) list. This blocking sanction bars U.S. persons from nearly all transactions with the sanctioned entity, including those entailed by correspondent banking. OFAC also maintains a separate list of Correspondent Account or Payable-Through Account (CAPTA) sanctions, which are less severe than blocking sanctions. CAPTA sanctions are targeted directly at correspondent banking relationships. In contrast, the EU and UK sanctions frameworks mainly rely on asset freezes. Asset freezes do not necessarily ban every transaction the way OFAC's SDN blocking does, but do require the severing of correspondent relationships.

Sanctions differ in terms of their reach. OFAC's "primary sanctions" restrict U.S. persons, including firms and institutions, from interacting with the sanctioned entity, but do not prevent banks in third countries from doing so. Primary sanctions would prevent a U.S. bank from serving as a correspondent to a sanctioned bank, but would not prevent a bank from a third country from offering correspondent services, even in the dollar. OFAC's secondary sanctions go further: a non-U.S. bank that serves as a correspondent to a sanctioned entity, regardless of currency, risks being sanctioned itself. Neither the EU nor the UK formally impose secondary sanctions.

Sanctions do not necessarily forbid all activity with targeted institutions. All three jurisdictions grant licenses which allow for a specific set of transactions to continue. For example, OFAC general licenses can exempt transactions including humanitarian trade in food and medicine and program-specific carve-outs. For sanctions programs in Russia, general licenses specifically allowed for certain agricultural and energy-related payments, even with sanctioned banks. Sanctioning authorities can also issue specific licenses, which are issued case-by-case, to a named applicant, for a particular set of transactions. Sanctioned institutions thus may be able to preserve some of their correspondent relationships for the purpose of conducting licensed transactions.

4.2 Sanctions Data

LNRS data provides information on which financial institutions are sanctioned by the U.S., EU, and UK. Reporting is based on each jurisdiction's official sanctions list but also includes proprietary ad-

[11] There are some sanctions, such as OFAC's "sectoral sanctions identifications", which restrict specific activities like issuing new debt but do not require closing correspondent accounts.

ditions to capture entities subject to sanctions-related directives or restrictions that are not formally listed.

We match each sanction flagged in the LNRS data to official sources.[12] Roughly nine in ten OFAC designations in our data are SDN listings and carry secondary-sanctions risk. Most of the rest are CAPTA listings. Every EU designation we can match is an asset freeze, and every UK designation is either an asset freeze or an explicit correspondent-banking restriction. Fewer than two dozen designations of the hundreds of flagged sanctions in the data leave correspondent banking permitted, and these are almost all U.S. sectoral sanctions. We still group these with the blocking designations because even non-blocking sanctions might be expected to lead correspondents to cut ties. Our baseline analyses therefore pool all sanctions from OFAC, the EU, and HMT into a single indicator.

Of the 17,344 EMDE financial institutions in the data in November 2025, LNRS reports that 284 (1.6 percent) are under a sanction from the United States, United Kingdom, or European Union. Appendix Table A1 shows that sanctions have been applied to a broad set of financial institution types but primarily involve commercial banks. Of 284 sanctioned institutions, 193 are commercial banks, but sanctioned entities also include depository financial institutions, government banks, development banks, and investment banks, among others. Broadly, the composition of the three authorities' sanctions across institution types is similar.

4.3 Growth in Sanctions

Sanctioning activity has grown rapidly in EMDEs since 2021, as shown in Figure 3. The number of banks under sanctions from any of the three jurisdictions grew by almost 40 percent from 204 in September 2021 to 284 in November 2025. The United States has imposed the largest number of sanctions over this period: OFAC sanctions applied to 199 banks in September 2021 and grew to 251 by November 2025. The European Union nearly doubled the number of sanctioned banks during the same period, from 76 to 148. Banks targeted by HMT similarly grew from 74 to 128.[13]

Little of this growth reflects entry or exit of financial institutions: between September 2022 and November 2025, only 4 sanctioned banks entered the data and only 19 exited. The growth instead reflects new sanctions imposed on entities already in the data.

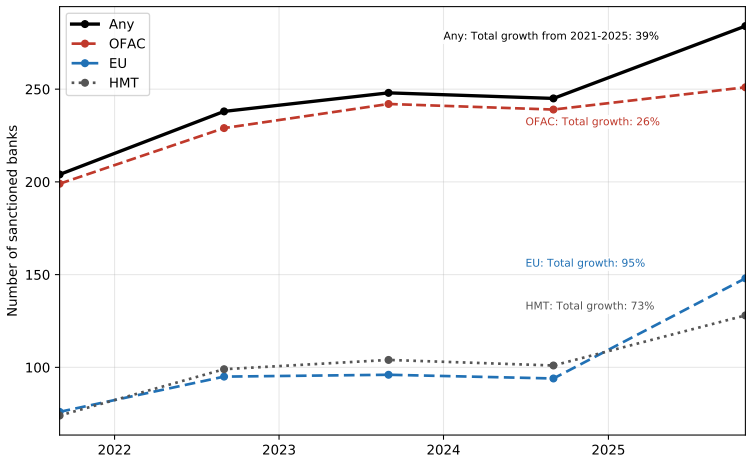
The timing of new sanctions differs somewhat across the three authorities, but the three bodies often designate the same banks.[14] Table 1 shows that OFAC sanctioned 32 entities by September 2022

[12]For the United States, we use OFAC's SDN and non-SDN list together with OFAC's archive files, which record list membership and a secondary-sanctions-risk indicator for each entry. Where a bank could not be matched to an official record by its identifier (BIC) or name, we assigned it by hand, using the OFAC search tool and the public OpenSanctions database. We similarly match with the EU Financial Sanctions List and the UK Sanctions List. A small number of records—46 bank-authority pairs—could not be tied to any official designation. These likely reflect additions made by LNRS using proprietary intelligence, including analysis of beneficial ownership and news reporting.

[13]For the time-series growth in sanctions applied world-wide, not just in EMDEs, see Appendix Figure A3. EMDEs account for roughly 80 percent of global financial sanctions, and a larger share of newly imposed financial sanctions, in our data.

[14]80 percent of sanctioned EMDE banks in 2025 were targeted either by OFAC alone or by all three bodies. Less than 10 percent of sanctioned banks in 2025 were designated by either the EU alone or HMT alone. See Appendix Table A2.

Figure 3: Banks Under Sanctions, by Authority, 2021-2025



that were not sanctioned one year earlier, added 18 more by September 2023, added 2 more over the subsequent 12 months, and then added 16 more between September 2024 and November 2025. The EU and HMT similarly added entities in large waves, with more designations late in the sample: 57 and 30 new sanctions, respectively, after September 2024, compared to smaller numbers from OFAC over the same period. Only one bank had sanctions completely removed during the sample period.

Table 1: Staggering of Sanctions Imposition and Removal by Authority

	September 2021	September 2022	September 2023	September 2024	November 2025
N→Y OFAC	—	32	18	2	16
N→Y EU	—	22	4	0	57
N→Y HMT	—	29	7	0	30
N→Y (Any)	—	36	15	2	43
Y→N OFAC	—	0	0	0	1
Y→N EU	—	0	0	0	1
Y→N HMT	—	1	0	0	1
Y→N (Any)	—	0	0	0	1

4.4 Which Countries Have Sanctioned Banks?

In 2021, sanctioned financial institutions were concentrated in a small number of countries, largely reflecting longstanding U.S. sanctions programs. Iran (42 sanctioned entities, 100% of their total), Russia (41, 3.4%), Syria (22, 100%), North Korea (20, 100%), Ukraine (12, 4.2%), Venezuela (10, 11.9%), Cuba (10, 100%), and Belarus (9, 24.3%) account for the bulk. These programs have diverse origins such as Russia's 2014 annexation of Crimea, North Korea's missile program, and longstanding policies toward Cuba and Venezuela, but share the common feature of predating Russia's 2022 invasion of Ukraine.

Table 2 lists sanctioned and total financial institutions for all EMDE countries with at least one sanctioned institution in 2021 or 2025. Sanctions are not limited to these heavily sanctioned countries:

financial institutions are also sanctioned across Africa (e.g. Angola and Sudan), Latin America (e.g. Bolivia and Uruguay), the Middle East (e.g. Egypt and Saudi Arabia), and Europe (e.g. Croatia and Serbia). Financial institutions have also been designated in high-income countries such as France and Japan, though these are excluded from Table 2 since our analysis focuses on EMDEs.

Table 2: Sanctioned Banks in EMDEs

	September 2021			**November 2025**		
Country	All Banks	Sanctioned	% Sanctioned	All Banks	Sanctioned	% Sanctioned
Russia	1,220	41	3.4	1,077	100	9.3
Iran	42	42	100.0	44	40	90.9
Syria	22	22	100.0	23	22	95.7
North Korea	20	20	100.0	20	20	100.0
Belarus	37	9	24.3	35	13	37.1
Ukraine	289	12	4.2	290	13	4.5
Cuba	10	10	100.0	11	11	100.0
Venezuela	84	10	11.9	83	10	12.0
China	3,107	3	0.1	4,162	7	0.2
Iraq	93	5	5.4	95	5	5.3
Myanmar	58	2	3.4	60	5	8.3
Tajikistan	64	2	3.1	68	4	5.9
Kyrgyzstan	27	0	0.0	28	3	10.7
Lebanon	100	4	4.0	98	3	3.1
Georgia	99	1	1.0	107	2	1.9
Afghanistan	20	1	5.0	17	2	11.8
Yemen	23	0	0.0	36	2	5.6
Libya	30	2	6.7	33	2	6.1
India	2,124	2	0.1	2,217	2	0.1
Cambodia	73	0	0.0	83	2	2.4
Azerbaijan	60	2	3.3	58	2	3.4
Angola	45	1	2.2	45	2	4.4
Armenia	24	2	8.3	26	2	7.7
Kazakhstan	65	3	4.6	126	2	1.6
Egypt	96	1	1.0	97	1	1.0
Bolivia	100	1	1.0	97	1	1.0
Malaysia	340	1	0.3	364	1	0.3
Peru	73	1	1.4	79	1	1.3
Serbia	54	2	3.7	58	1	1.7
Sudan	47	0	0.0	45	1	2.2
Turkey	221	1	0.5	250	1	0.4
Viet Nam	169	1	0.6	483	1	0.2
Total (EMDEs with Sanctions)	8,835	204	2.3	10,315	284	2.8
Total (all EMDEs)	15,151	204	1.3	17,344	284	1.6

The increase in sanctioned financial institutions between 2021 and 2025 largely reflects sanctions imposed in response to Russia's invasion of Ukraine and is particularly notable in Russia, Belarus, Kyrgyzstan, and Myanmar. Russia saw more than a doubling of sanctioned institutions, from 41 to 100 — raising the share of its financial sector under sanctions by about 6 percentage points (from 3% to 9%). The other three countries have smaller financial sectors, so the absolute increases are modest, but comparable in percentage terms: Belarus added 4 newly sanctioned institutions, raising the share under sanctions by 13 percentage points to 37 percent; Kyrgyzstan went from no sanctioned banks to three, comprising 10 percent of its institutions; and Myanmar added three sanctioned entities, raising its sanctioned share by about 5 percentage points to 8 percent.

Below, we study how these newly imposed sanctions affect connectivity to the correspondent banking network – both for the sanctioned banks and for heavily sanctioned economies as a whole – across traditional global currencies like the dollar and emerging ones like the yuan.

5 Sanctions and the Global Payment Network

In this section, we explore how sanctions reshape individual banks' connections to each currency's global payment networks. We examine both sides of the correspondent banking relationship: a bank's ability to send and receive cross-border payments through correspondents (its role as a respondent) and its ability to intermediate payments on behalf of other banks (its role as a correspondent).

5.1 Sanctioned Banks' Access to the Global Payment Network Deteriorates

Following sanctions, banks experience a large decline in their access to the global payment networks in all major currencies. Table 3 reports the share of banks with correspondent access, differentiating between those that are never sanctioned (by OFAC) in our data ("Never"), those that will later be sanctioned ("Pre"), those that were sanctioned ("Post"), and those always under sanction ("Always"). The table only includes banks reporting at least one correspondent. Dollar-clearing access (through banks in any country) of eventually sanctioned banks (87%) is similar to that of banks that are never sanctioned (90%). After being sanctioned by OFAC, only 28% retain dollar correspondents. The decline is similar for euro correspondents (85% to 22%) and pound correspondents (53% to 9%). Perhaps more surprising is that sanctioned banks also lose correspondents in the yuan and, to a lesser degree, in the ruble. We get similar results (not reported here) when we calculate these summary statistics for sanctions imposed by the EU and HMT.

Table 3: Correspondent Access of Non-Sanctioned and (OFAC) Sanctioned Banks

	In Any Country				**Direct**				**Indirect**			
	Never	Pre	Post	Always	Never	Pre	Post	Always	Never	Pre	Post	Always
N (banks)	2,523	51	51	62	2,523	51	51	62	2,523	51	51	62
USD	89.9	86.9	28.4	38.9	67.8	47.7	16.3	25.7	49.0	67.3	14.2	21.6
EUR	87.9	85.0	22.0	66.2	72.9	61.7	10.6	52.0	37.2	45.8	15.6	36.5
GBP	62.4	53.3	9.2	31.1	42.4	29.0	5.7	22.0	25.1	39.3	3.5	11.5
CNY	33.7	67.3	17.7	31.1	16.7	35.5	12.8	24.0	23.1	54.2	14.2	16.9
RUB	10.6	23.4	18.4	32.4	9.0	23.4	18.4	32.1	3.2	1.9	1.4	0.7

Sanctioned banks lose direct and indirect correspondents. For example, after OFAC sanctions, the share of banks with U.S.-based dollar correspondents drops from 48% to 16%. In other words, the ability to clear payments using the U.S. banking system, which are often settled through the Fed, declines. The share of sanctioned banks with access to dollar correspondents outside of the U.S. also falls, from 67% to 14%. This same pattern holds for other currencies as well, with sanctioned banks having significantly fewer direct and indirect correspondents in the euro, pound and yuan. While sanctioned banks also have fewer ruble correspondents, the differences are muted. These results suggest that the threat of secondary sanctions and de-risking by correspondents extend the effects of sanctions beyond the dollar, and more broadly, beyond the major Western currencies.

Sanctions also degrade the quality of whatever access to the payments network remains. The loss of correspondents following sanctions results in longer payment chains, including to top-5 trade partners

Table 4: Payment Connectivity of Non-Sanctioned and Sanctioned Banks

	Distance to Trade Partners (average minimum to top-5)				Distance to Issuer (minimum)				PageRank of Access (sum across correspondents)			
	Never	Pre	Post	Always	Never	Pre	Post	Always	Never	Pre	Post	Always
N (banks)	2,523	51	51	62	2,523	51	51	62	2,523	51	51	62
USD	1.99	2.13	2.83	2.22	1.26	1.56	2.46	1.56	15.30	12.16	3.06	6.06
EUR	2.15	2.20	3.04	2.43	1.19	1.35	2.50	1.43	4.46	4.06	0.40	2.28
GBP	2.31	2.51	2.88	2.76	1.34	1.46	1.90	1.57	3.37	1.12	0.11	1.01
CNY	2.37	2.49	3.17	2.49	1.73	1.53	2.08	1.30	0.92	1.47	0.32	0.40
RUB	2.34	1.95	1.94	2.11	1.22	1.50	1.00	1.00	0.86	1.50	0.25	1.64

for the country in which the sanctioned bank is located. We calculate the minimum hops required to connect to a reachable bank in each country and currency. We then take the average across these top-5 partners, separately for each currency, and report results in Table 4. Prior to OFAC sanctions, it takes on average 2.13 hops to connect with a bank in a large trade partner through the dollar correspondent banking system. After sanctions, this distance rises to 2.83, an increase of almost one-third. The distance in euros rises from 2.20 to 3.04 (38%) and the yuan distance rises from 2.49 to 3.17 (27%).

Sanctions also increase a bank's distance to direct clearing in major currencies. Table 4 shows that the shortest chain to reach a U.S. bank in dollars averages 1.56 for banks that will eventually be sanctioned. After being sanctioned, the average rises to 2.46, an increase of 58%. The same measure of distance almost doubles when comparing "Pre" and "Post" for the euro and increases significantly for the pound and yuan. Since each additional hop in the payment chain brings additional costs, delays, and counterparty risks, sanctions make payments costlier, slower, and riskier.

Sanctions significantly reduce access to payment network hubs in major currencies. As discussed in Section 3.5, correspondent banking networks are highly concentrated and rely on a small number of key hubs. As shown in Table 4, among banks that are eventually sanctioned by OFAC, the average sum of PageRank values across dollar correspondents is 12.16. Almost all of that PageRank sum is contributed by direct correspondents. In other words, U.S. hubs are critical for the connectivity of eventually sanctioned banks prior to their being sanctioned. As such, it is perhaps not surprising that, after OFAC sanctions, the total PageRank of dollar correspondents declines by 75% to 3.06. Sanctions similarly appear to disconnect banks from the most important correspondent hubs in the other currency networks.

5.2 Robustness: Difference-in-Differences

Our results suggest that sanctions operate by sharply degrading banks' connectivity to the global correspondent banking networks in all major currencies. However, the comparisons made in Tables 3 and 4 may also reflect underlying differences in country and institutional characteristics rather than sanctions alone. Newly sanctioned institutions, for example, are far more likely to be located in Russia or Belarus than in countries such as Argentina or Thailand, and may interact with the global correspondent banking network differently for reasons beyond their exposure to sanctions. Similarly, financial

institutions that are always sanctioned in our data are disproportionately located in Iran, Cuba, Syria, or North Korea – countries whose economic connections to the global financial system differ substantially from those of most other EMDEs for reasons that only partly reflect financial sanctions.

To address these concerns, we implement a matched difference-in-differences framework that compares connectivity outcomes for sanctioned banks with those of otherwise similar, non-sanctioned banks in the same country and of the same institution type. By comparing the change in outcomes for sanctioned institutions before and after designation to the contemporaneous change for the matched control group, we better isolate the incremental effects of sanctions. After all, if the primary drivers of shifts in correspondent relationships are broader country-level shocks – such as changing bilateral trade patterns or shifts in aggregate financial flows – then we would expect to observe similar changes for all banks in the country.

More formally, let $\mathcal{S}$ denote the set of financial institutions that transition from unsanctioned to sanctioned during the sample, and let τ_i denote the date at which we first observe financial institution $i \in \mathcal{S}$ with a sanctions flag. For each sanctioned financial institution i, we only use data from $\tau_i - 1$ and τ_i. For each sanctioned financial institution i located in country n_i and classified as institution type k_i, we create a matched control group $\mathcal{C}_i$ from all financial institutions j in that same country n_i and with institution type k_i that are never sanctioned at any of the five dates in our sample.[15] In this analysis, we only use institutions that have at least one correspondent (in any currency) at date $\tau_i - 1$.[16]

We study date t outcomes $Y_{\cdot,t}^{(m)}$, where m varies to index different measures of connectivity, like the count of correspondents clearing a particular currency and located in a particular country. The financial institution-level difference-in-differences on outcome m for sanctioned financial institution i is:

$$\text{DiD}_i^{(m)} = \underbrace{\left(Y_{i,\tau_i}^{(m)} - Y_{i,\tau_i-1}^{(m)}\right)}_{\text{sanctioned financial institution's change}} - \underbrace{\left(\bar{Y}_{\mathcal{C}_i,\tau_i}^{(m)} - \bar{Y}_{\mathcal{C}_i,\tau_i-1}^{(m)}\right)}_{\text{matched controls' average change}}, \tag{1}$$

where the average outcome m for sanctioned financial institution i's control group $\mathcal{C}_i$ at date t is:

$$\bar{Y}_{\mathcal{C}_i,t}^{(m)} \equiv \frac{1}{|\mathcal{C}_i|} \sum_{j \in \mathcal{C}_i} Y_{j,t}^{(m)}. \tag{2}$$

We then report the simple average effect across all sanctioned financial institutions:

$$\beta^{(m)} = \frac{1}{|\mathcal{S}|} \sum_{i \in \mathcal{S}} \text{DiD}_i^{(m)}, \tag{3}$$

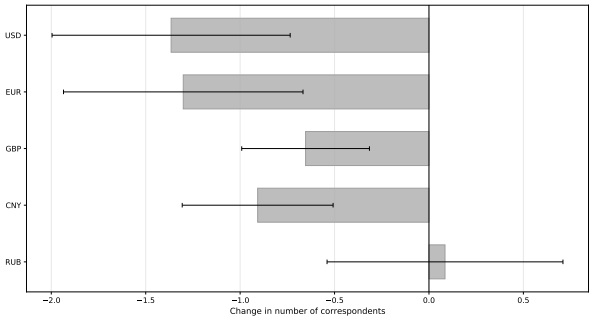
[15] If there are no matches on country and institution type, we simply include all never-sanctioned financial institutions in country n_i.

[16] Of the 68 financial institutions that transition from unsanctioned to sanctioned under OFAC, 21 had no correspondents at $\tau_i - 1$ and are excluded. The shares are larger for EU and HMT sanctions, where we exclude nearly two-thirds of the newly sanctioned financial institutions.

where $|\mathcal{S}|$ is the number of sanctioned financial institutions contributing to the estimate.[17] We use this difference-in-differences framework both to capture changes in the count of correspondents, as described above, but also to capture percentage changes in correspondents, where we instead calculate the key values in equation (1) in percentage change form, i.e. $\left(Y^{(m)}_{\cdot,t} - Y^{(m)}_{\cdot,t-1}\right) / Y^{(m)}_{\cdot,t-1}$.

The difference-in-differences results confirm that sanctioned banks' access to global payment networks deteriorates even when accounting for contemporaneous macroeconomic and banking shocks. Sanctions lead to economically and statistically significant declines in correspondent banking relationships across most currencies. Figure 4 shows that, in levels, sanctions reduce the number of correspondents in all cases except the ruble, with the largest declines – between 1 and 1.5 correspondents – occurring for dollar and euro clearers. By contrast, there is no decline in ruble correspondents. We also find similarly significant declines when measuring in percentage terms, as shown in Appendix Figure A4.

Figure 4: Change in Number of Correspondents After Sanctions, By Currency



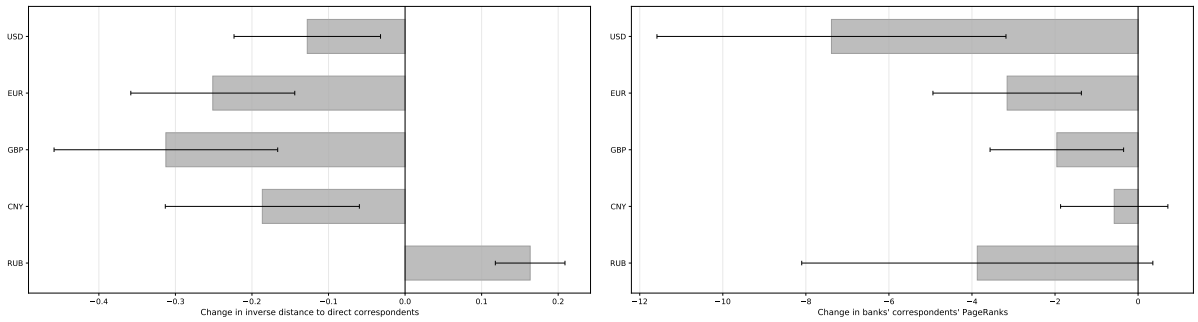
The difference-in-differences approach also confirms that sanctions degrade the quality of whatever correspondent connections remain. Figure 5a plots the effects of sanctions on inverse distance to a direct correspondent (inverse distance is 1/hops). Inverse distance can accommodate cases where there is no path between a bank and any direct correspondents by setting the inverse distance to zero. Most coefficients are negative, implying sanctions significantly decrease inverse distance (and increase the effective distance) to the most important correspondents. Similarly, Figure 5b plots results from a difference-in-differences estimate on the sum of the PageRank values of banks' correspondents. The negative and statistically significant estimates for the dollar, euro, and pound show that sanctions reduce access to the most essential hubs of those networks.

The above difference-in-differences analyses combine banks that lose access to all of their correspondents (the "extensive margin") with those that retain at least one correspondent but experience

[17] We compute standard errors treating each sanctioned financial institution's DiD as an independent draw. We suppress estimates based on fewer than 5 sanctioned financial institutions. Note that each sanctioned financial institution receives equal weight, regardless of the size of its control group $|\mathcal{C}_i|$. Because our control group consists exclusively of never-sanctioned financial institutions and each sanctioned financial institution's difference-in-differences is computed independently at its own transition date, our estimator avoids the staggered-treatment biases that can arise in traditional two-way fixed effects regressions when already-sanctioned units serve as controls for later-sanctioned units, as discussed in Goodman-Bacon (2021), Callaway and Sant'Anna (2021), and Sun and Abraham (2021).

Figure 5: Change in Connectivity Measures After Sanctions, by Currency

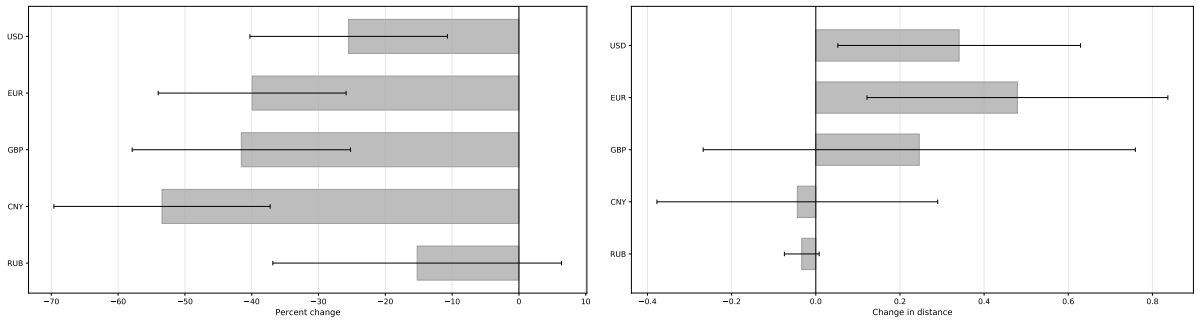
(a) Inverse Distance to Direct Correspondents **(b)** Sum of Correspondents' PageRank Values



a deterioration in access quality (the "intensive margin"). Figure 6a focuses on the extensive margin and plots the coefficients capturing the likelihood that sanctions shut off all access to correspondents. Relative to non-sanctioned banks in the same country, sanctioned banks are 25 percentage points more likely to lose access to all dollar correspondents and 40 percentage points more likely to lose access to all euro correspondents. Figure 6b focuses on the intensive margin and plots coefficients from a difference-in-difference that captures changes in the quality of connections of banks that retain at least one correspondent in the relevant currency. Even when a bank retains connectivity, sanctions lengthen the payment chains those banks must use. For example, the average distance of a shortest dollar chain to a U.S. bank increases by 0.3 hops more for a sanctioned bank relative to an unsanctioned bank. Sanctions increase the shortest euro chain to an EU bank by 0.4 hops. The difference-in-differences results confirm that the simple summary statistics results we document above are not driven by economy-wide shocks or aggregate shocks to the banking system.

Figure 6: Change in Connectivity After Sanctions, Extensive and Intensive Margins, By Currency

(a) Change in Access **(b)** Change in Distance to Issuers Given Access



While useful, the difference-in-differences approach has limits when assessing the aggregate impact of sanctions in heavily sanctioned economies. As we detail in Section 6 below, even non-sanctioned banks in those economies lose access due to de-risking by correspondents or secondary sanctions. As such, difference-in-differences estimates understate the aggregate effect of sanctions because they only

capture the differential behavior of sanctioned and non-sanctioned banks.

5.3 Financial Institutions as Correspondents

Section 5.1 examined how sanctions affect a respondent's access to correspondents; here, we examine the reverse relationship and study how sanctions affect a bank's ability to function as a payment intermediary for other banks. If sanctioned correspondents lose respondents, sanctions generate broader spillovers, degrading not only the targeted institution's own payment access but also the cross-border clearing capacity of the banks that rely on it. Indeed, OFAC-sanctioned banks are more likely to clear dollars for domestic respondents than non-sanctioned banks.

Table 5: Share of Non-Sanctioned and (OFAC) Sanctioned Banks Serving as Correspondents

Serving:	**Cross-Border Respondents**				**Domestic Respondents**			
	Never	Pre	Post	Always	Never	Pre	Post	Always
N (banks)	1,454	31	31	43	1,454	31	31	43
Any Currency	71.5	68.9	53.3	57.4	26.7	63.9	58.7	38.2
USD	18.5	29.5	19.6	17.6	11.7	45.9	51.1	14.7
EUR	13.4	27.9	19.6	28.4	8.2	41.0	46.7	15.2
GBP	4.4	8.2	8.7	4.4	3.5	16.4	14.1	5.9
CNY	6.5	3.3	10.9	10.3	4.7	34.4	35.9	6.4
RUB	4.5	55.7	43.5	24.0	3.0	21.3	16.3	13.7

Sanctioned correspondent banks lose respondents after sanctions. Compared to banks that are never sanctioned by OFAC, the most striking difference is in their domestic correspondent activity. Table 5 presents data on the 1,454 banks that serve as correspondents to at least one respondent, of which 31 were sanctioned by OFAC during 2022-2025. For the dollar, euro, pound, and yuan, more than twice the share of eventually sanctioned institutions serve as correspondents to domestic respondents. Differences are more muted for cross-border respondents, except for the ruble, where eventually sanctioned banks are also far more likely to serve cross-border respondents. Comparing the "Pre" and "Post" columns, we see that, after sanctions, the number of banks serving cross-border respondents drops in general (i.e. for any currency), driven in part by drops in services to dollar, euro, and ruble respondents. There are only minimal differences between "Pre" and "Post" for the share of banks serving domestic respondents. Overall, our results suggest that sanctions reduce banks' ability to provide correspondent banking services, although the estimates are too noisy to meet conventional standards of statistical significance.[18]

6 Connection to the Payment System at the Country Level

In Section 5, we show that sanctioned banks typically lose some, if not all, of their ability to clear payments in major currencies. This loss partially operates through the breakdown of direct correspondent

[18]Difference-in-differences estimates are directionally consistent with the summary statistics in Table 5, but lack power and are statistically insignificant. We find similar, fairly muted, results (not reported) for EU and HMT sanctions.

banking relationships with banks in the currencies and jurisdictions of the sanctioning authorities. Sanctioned institutions also lose correspondents in other countries and currencies. In addition, we find weaker, but suggestive, evidence that sanctions impair their ability to provide foreign currency payment services to other banks.

However, in many heavily sanctioned economies, the majority of banks still remain unsanctioned. Country-level connectivity therefore hinges on what happens to the non-sanctioned banks' correspondent relationships. For example, the non-sanctioned banks could develop relationships to replace those severed with sanctioned banks, largely preserving aggregate access to Western currency clearing. Alternatively, U.S. correspondents may de-risk from non-sanctioned banks, causing the non-sanctioned banks to shift their payment infrastructure toward non-Western currencies and jurisdictions.

In this section, we examine how non-sanctioned banks adjust their correspondent relationships following sanctions on their peers, focusing on the four countries with large sanctions shocks – Belarus, Kyrgyzstan, Russia, and Myanmar – where at least three institutions were newly sanctioned during 2021–2025 and where the share of banks that were under sanctions increased by at least 5 percentage points.[19] We find that non-sanctioned banks in these countries lose much of their access to dollar, euro, and pound clearing, likely due to de-risking. Further, they often expand their clearing relationships in alternative currencies, particularly the yuan. Outside of these heavily sanctioned countries, on average, we do not find evidence of a comparable reorientation away from the dollar and toward the yuan.

6.1 Belarus

We begin with Belarus, where, as shown in Table 2, the share of sanctioned banks increased from 24 percent in 2021 to 37 percent in 2025. Table 6 reports Belarus' full set of cross-border correspondent relationships at the start and end of the sample. It covers dollar, euro, pound, ruble, and yuan, broken out by partner country.

For each currency and foreign country, the table separately reports the number of correspondent relationships involving Belarusian banks. For example, the second row of the left panel shows that in 2021, Belarus had 11 correspondent banking relationships in Austria involving 11 total Belarusian banks and 1 Austrian correspondent bank. Rows in red mark currency-country pairs where all relationships were severed by 2025. For example, Belarus lost all 11 dollar clearing relationships through Austria. Rows in blue mark pairs that first appeared in 2022 or later, such as dollar clearing through China. Rows in black represent pairs where at least some linkages persist over the full period.

The table reveals two key patterns. First, there is a sharp contraction in Belarus's access to Western currency clearing. Access to dollar, euro, and pound clearing declines dramatically. Belarusian banks maintained 139 correspondent relationships across these three currencies (61, 60, and 18, respectively)

[19]The only two other countries with an increase of about 5 percentage points or more in the share of banks under sanction were Afghanistan and Yemen, but they had only one and two newly sanctioned banks, respectively.

Table 6: Cross-Border Correspondents: Belarus (BY)

Currency	Destination	September 2021			November 2025		
		Corrs.	BY FIs	CBs	Corrs.	BY FIs	CBs
USD	**TOTAL**	**61**	**25**	**13**	**4**	**3**	**3**
	AT	11	11	1	0	0	0
	CN	0	0	0	1	1	1
	DE	3	3	1	0	0	0
	GE	2	2	1	0	0	0
	KZ	1	1	1	3	2	2
	LB	1	1	1	0	0	0
	RU	24	15	5	0	0	0
	US	19	13	3	0	0	0
EUR	**TOTAL**	**60**	**25**	**13**	**15**	**7**	**9**
	AT	15	15	1	2	2	1
	BE	1	1	1	0	0	0
	DE	27	20	4	0	0	0
	GE	0	0	0	1	1	1
	KZ	1	1	1	2	2	1
	LB	1	1	1	0	0	0
	PL	2	2	1	5	5	1
	RS	0	0	0	2	1	2
	RU	13	8	4	2	1	2
	UZ	0	0	0	1	1	1
GBP	**TOTAL**	**18**	**18**	**8**	**0**	**0**	**0**
	DE	6	6	2	0	0	0
	GB	4	4	3	0	0	0
	GE	1	1	1	0	0	0
	RU	7	7	2	0	0	0
RUB	**TOTAL**	**47**	**25**	**11**	**23**	**13**	**10**
	KZ	1	1	1	1	1	1
	RU	46	25	10	22	13	9
CNY	**TOTAL**	**15**	**13**	**9**	**13**	**11**	**8**
	CN	3	3	2	9	8	5
	DE	1	1	1	0	0	0
	GE	0	0	0	1	1	1
	KZ	0	0	0	1	1	1
	RU	11	10	6	2	2	1

in 2021, compared with only 19 in 2025. Where connectivity persists, it becomes highly concentrated. For example, dollar clearing in 2021 was provided to 25 Belarusian banks by 13 foreign correspondents; by 2025, only three Belarusian institutions retained dollar correspondents, connected to two institutions in Kazakhstan and one in China. In other words, Belarusian banks now rely more on a limited number of indirect nodes to clear payments through the correspondent network.

Second, there is a reconfiguration of remaining connections toward a smaller set of intermediaries and alternative currencies. Belarusian banks reorient part of their external connectivity toward the yuan clearing via correspondents in China. While the total number of yuan correspondent relationships declines modestly from 15 to 13, this masks a reallocation away from Russian intermediaries and toward Chinese institutions. Yuan clearing with Chinese correspondents expands from three to nine relationships, with the number of Belarusian and Chinese institutions involved rising from three to eight and from two to five, respectively. New clearing relationships in both dollars and euros also emerge through third countries such as Kazakhstan and Georgia, indicating a shift toward more indirect clearing channels.

To disentangle these aggregate changes, we separately examine sanctioned and non-sanctioned banks. The contraction in Belarus's external connectivity reflects changes at both sanctioned and non-sanctioned banks, although the effect is more severe among sanctioned banks, in line with our difference-in-differences results. Non-sanctioned banks, however, generate new connections and reconfigure their networks, including through expanded yuan clearing with Chinese banks and new connections via third countries.

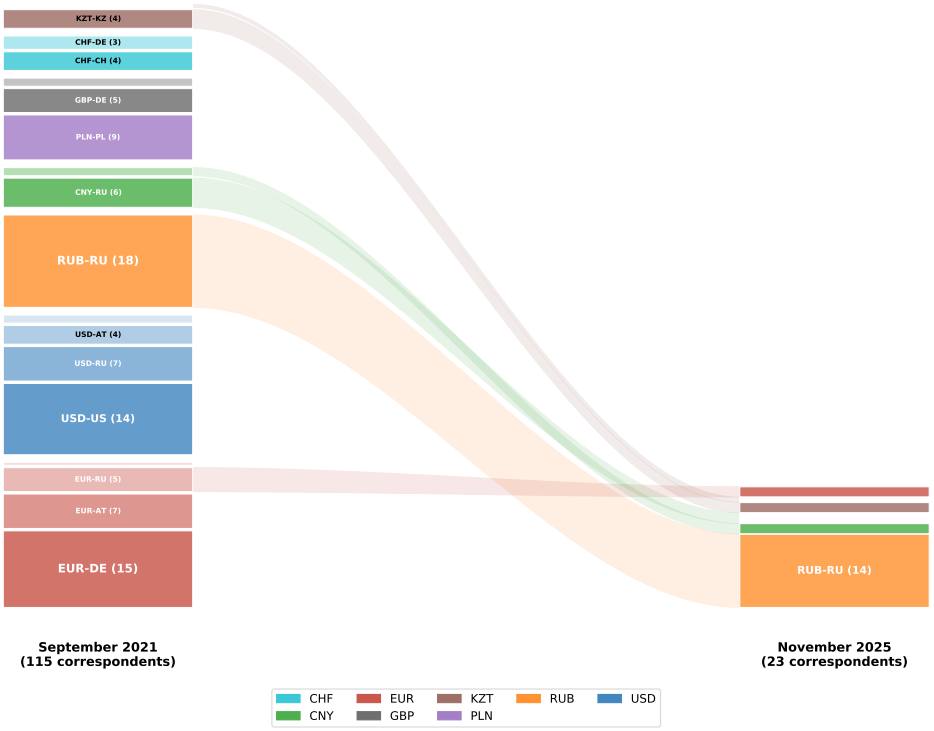
Figure 7a shows a near-complete collapse in sanctioned institutions' access to major currency clearing, particularly through direct correspondents. In 2021, these institutions cleared dollars through U.S. banks, euros through Eurozone banks, and zloty through Polish banks. By 2025, these links are almost entirely eliminated. The total number of cross-border correspondents falls from 115 to 23, and all 28 dollar, 24 euro (excluding Russia), 9 zloty, 8 pound, and 8 Swiss franc correspondent relationships disappear. The remaining connections are concentrated in a much narrower set of currencies and jurisdictions, primarily ruble correspondents in Russia, with limited residual links in yuan, euro, and regional currencies through Russia, China, and Kazakhstan.

In contrast, Figure 7b shows that non-sanctioned banks adjust by reconfiguring their correspondent networks, while they experience a decline in their access to Western currency clearing. Dollar, pound, and Swiss franc clearing largely disappear among these institutions as well, with only limited residual connections through China and Kazakhstan. Euro clearing proves more resilient, continuing through existing partners such as Austria and Poland and through newly established links to Georgia, Kazakhstan, Serbia, and Uzbekistan. Most prominently, though, yuan clearing through China expands significantly, increasing from a single correspondent relationship in 2021 to seven in 2025.

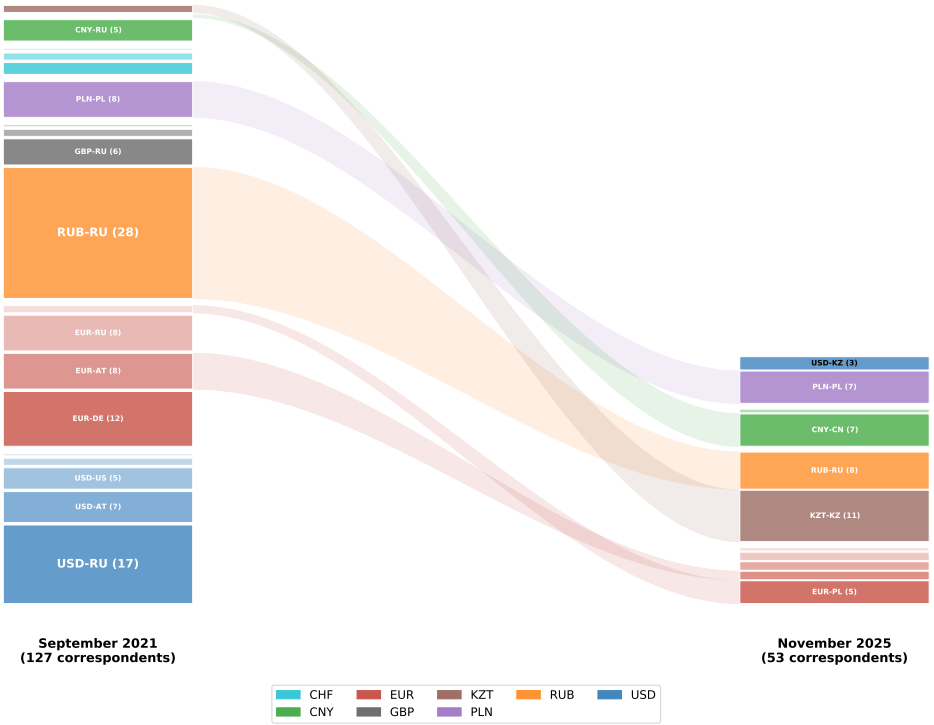
Table 6 and Figure 7 treat all correspondent relationships as equal. But, as discussed in Section

Figure 7: Evolution of Belarus' Correspondent Banking Relationships, 2021-2025

(a) Sanctioned Banks



(b) Non-sanctioned Banks

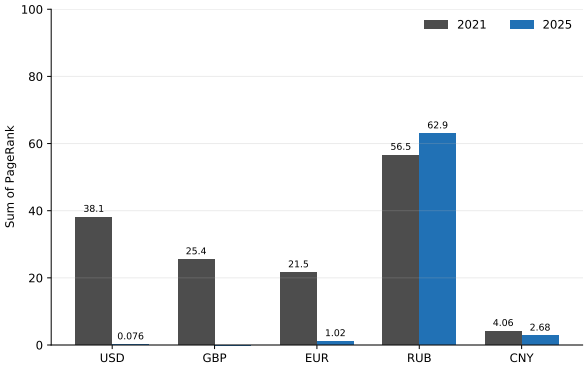


3.5, a small set of banks serve as key nodes in each payment network. Losing access to a key direct correspondent damages the country's ability to make payments to a far larger extent than losing access to a small indirect one. Equivalently, maintaining an account with a single essential dollar-clearing hub might largely preserve a country's ability to transact in dollars, even if it loses all other correspondents.

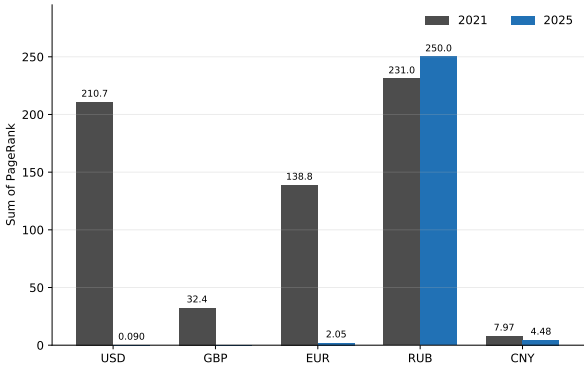
Figure 8 captures this distinction by plotting the change before and after sanctions of Belarus' access to correspondents, weighted by the correspondents' PageRank values using two different aggregation schemes. The schemes make different implicit assumptions on how substitutable Belarusian banks are from the perspective of their customers for cross-border payments. If customers can seamlessly switch between Belarusian banks, then as long as one Belarusian bank is connected to a dollar hub, the Belarusian economy is connected to that hub. In that case, the relevant correspondent PageRank values should be aggregated at the country level, the procedure we use in Figure 8a. Alternatively, if it is difficult for customers to substitute across domestic banks, then when a specific bank loses access to a dollar hub, its customers lose access to the ability to make payments through that hub. In that case, the most important notion would sum the PageRank of foreign correspondents for all relationships with domestic respondents, which we do in Figure 8b.

Figure 8: Belarus' Payment Connectivity Before and After Sanctions (Cumulative PageRank)

(a) Country-level Access



(b) Sum of Bank-level Access



After sanctions, Belarus lost most of its connectivity to the dollar, euro, and pound clearing networks, but lost a much smaller share of its connectivity to the yuan network. The leftmost bars in Figure 8a show that Belarus in 2021 had access to correspondents accounting for a large share (38.1%) of connectivity to the dollar payment network. In other words, the country was connected to important dollar clearing hubs. As discussed above, by 2025, it only retained dollar correspondents in Kazakhstan and expanded dollar clearing with a Chinese bank. However, none of these banks are important nodes in the global dollar correspondent network, so the 2025 bar for the dollar in Figure 8a has a value of (essentially) zero. As the figure illustrates, the dollar, euro, and pound clearing was almost entirely lost by 2025. By contrast, this measure of connectivity to the yuan network only declined by one-third and connectivity to the ruble network increased. The scale is of course different in Figure 8b, but the

results are qualitatively similar. Belarus suffered a near complete loss of access to Western currencies and shifted its cross-border payment infrastructure toward the ruble and yuan.

The shift towards yuan clearing can also be observed in the improved relative efficiency of the yuan network, captured by its ability to connect Belarusian and foreign banks in a smaller number of hops than alternative currencies. For each currency, we compute the share of cross-border connections in which that currency's network requires the fewest hops. Figure 15, below, shows these least-distance currency shares, which sum to 100%. In 2021, the dollar or euro correspondent networks connected Belarusian banks to foreign counterparts with the fewest hops in more than four-fifths of the cases. The yuan almost never represents the shortest path. However, the dollar and euro lost significant ground by 2025, accounting then for less than half of Belarus' shortest-path connections. Further, in 2025, the yuan correspondent network connected Belarusian banks most efficiently to more than 20 percent of its foreign counterparts, a share exceeding that of the dollar alone.

6.2 Kyrgyzstan and Russia

Kyrgyzstan and Russia show patterns similar to Belarus, despite differences in scale. In Kyrgyzstan, sanctions affected only three banks, but this represents more than 10 percent of the 28 institutions in the data. Figure 9 shows that the number of Kyrgyz correspondents declines from 346 in 2021 to 255 in 2025 – a more moderate contraction than in Belarus or Russia – but is accompanied by a clear reconfiguration of clearing relationships. In 2021, dollar clearing occurred both through U.S. banks, which provide direct access to dollar payment systems, and through Russian intermediaries. By 2025, these relationships largely disappear. Kyrgyz banks retain the ability to clear dollars, but do so primarily through Chinese, Kazakhstani, and Uzbek banks, indicating a shift toward more indirect clearing channels. At the same time, yuan correspondent relationships with Chinese banks expand significantly, from 14 in 2021 to 33 in 2025.

As with Belarus, we compute two different measures of the centrality of Kyrgyzstan's correspondents and present their evolution between 2021 and 2025 in Figure 10. At the country level, Kyrgyzstan lost hubs that previously provided three-quarters of its access to the dollar-clearing network and hubs accounting for more than half of its access to euro clearing. Although the number of yuan correspondent relationships rose, PageRank-weighted yuan access dipped slightly, since the newly added Chinese correspondents are not central nodes in the yuan's global correspondent network. And as with Belarus, payments in yuan became much more efficient relative to the dollar and the euro during 2021-2025. Figure 15 shows a clear rise in the share of cross-border paths from Kyrgyzstan for which the yuan offers the shortest route.

Changes in Russia's correspondent banking relationships, shown in Figure 11, are more pronounced and broad-based, reflecting the scale and scope of sanctions applied to its financial system. Direct access to Western currency clearing is almost entirely eliminated, with sharp contractions across

Figure 9: Evolution of Kyrgyzstan's Correspondent Banking Relationships, All Banks, 2021-2025

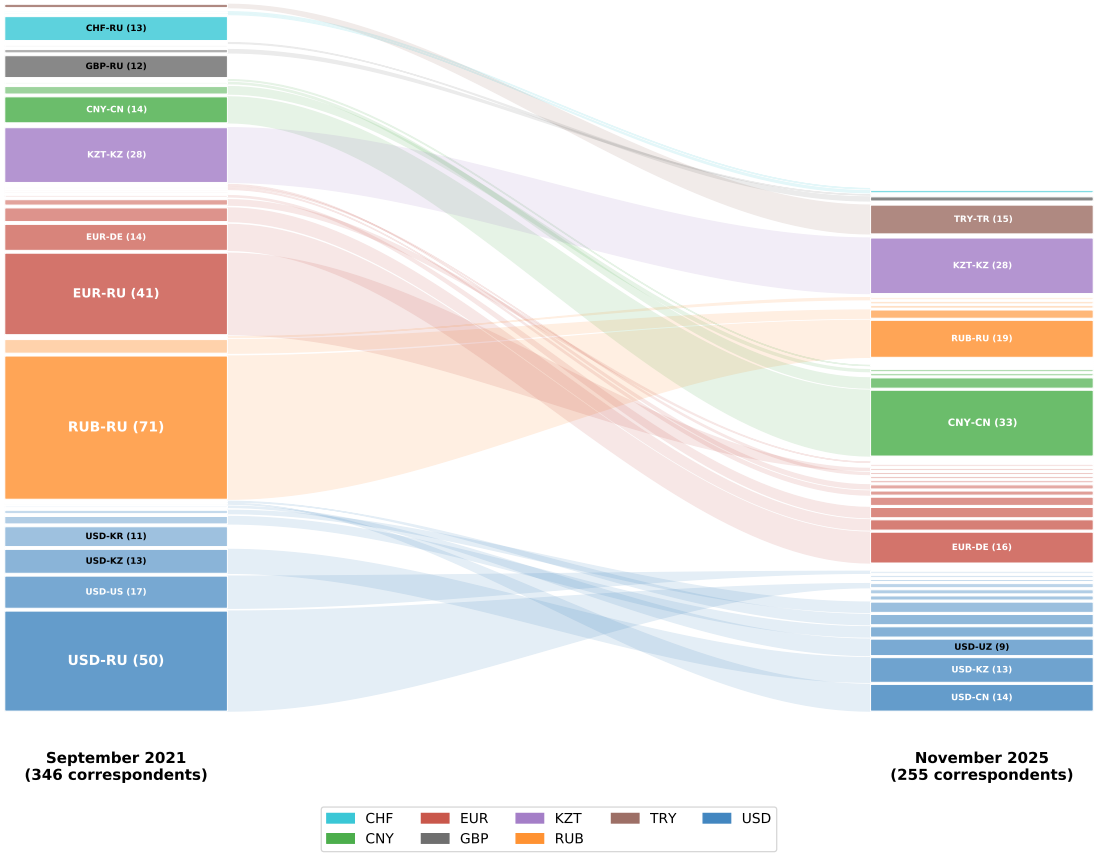
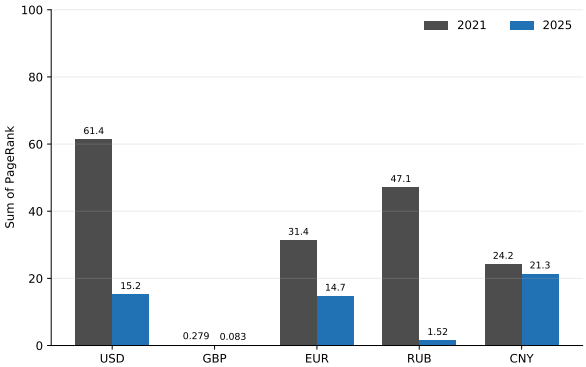
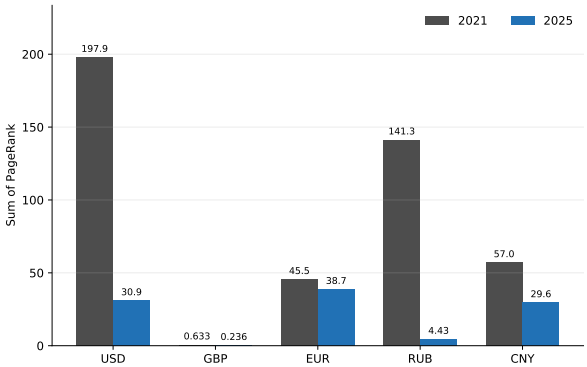


Figure 10: Kyrgyzstan's Payment Connectivity Before and After Sanctions (Cumulative PageRank)

(a) Country-level Access

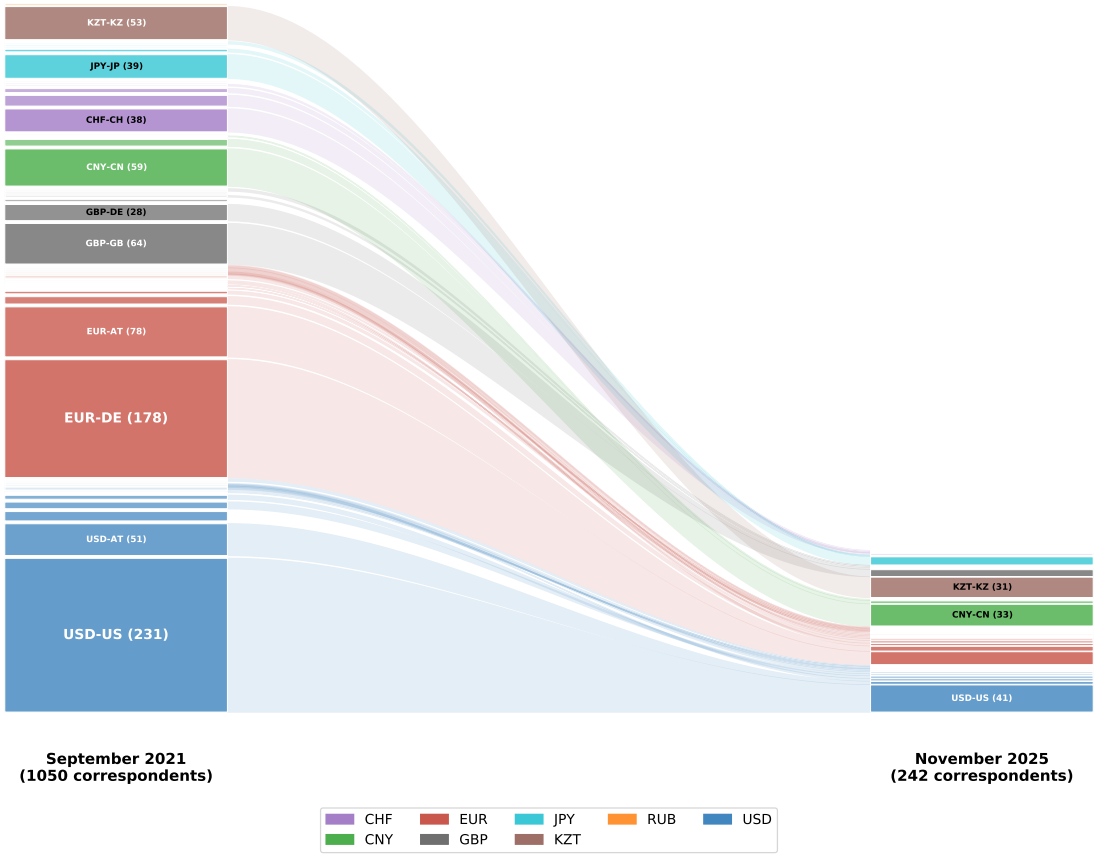


(b) Bank-level Access



dollar, euro, and pound correspondents. As in Belarus and Kyrgyzstan, the remaining connections become increasingly indirect and concentrated in a smaller set of currencies and intermediary jurisdictions. At the same time, the importance of yuan clearing via Chinese banks rises markedly, as does clearing of the Kazakhstani tenge through Kazakhstani institutions. Figure 15 shows that between 2021 and 2025, the yuan network significantly increases its shortest-route share of cross-border paths from Russia. These patterns highlight a broader reorientation of Russia's external financial linkages away from Western currency systems and toward alternative currency networks and regional intermediaries.[20]

Figure 11: Evolution of Russia's Correspondent Banking Relationships, All Banks, 2021-2025

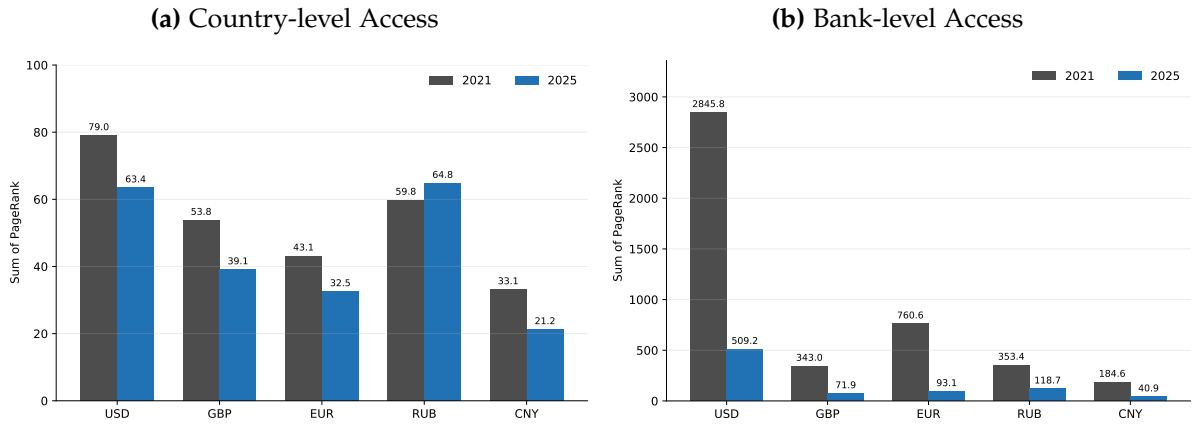


Despite this collapse in the number of correspondent relationships of Russian banks, as shown in Figure 12a, there is a relatively small decline in correspondents' PageRank at the country level, but a much larger decline when added up across banks. This suggests that at least one Russian bank appears to have maintained a relationship with key hubs in each of the Western payment networks. The larger declines in Figure 12b likely reflect that most Russian banks lost access to key hubs. As discussed in Section 4, general and specific licenses allow for some transactions to occur, even through sanctioned

[20] Additional tables and figures describing correspondent banking relationship networks in Kyrgyzstan, Russia, and Myanmar are found in the Appendix.

banks. We suspect that, unlike trade with Belarus, Kyrgyzstan, and Myanmar, there is sufficient critical trade with Russia – in agriculture and energy, say – that at least one large bank retained capacity to make payments to support licensed goods.

Figure 12: Russia's Payment Connectivity Before and After Sanctions (Cumulative PageRank)



We relegate Myanmar's country-level detail to the Appendix because its patterns largely mirror those above. Across all four of the heavily sanctioned economies, sanctions sharply reduce direct access to Western currency clearing while leaving residual connectivity that is largely indirect and concentrated in a smaller set of intermediary institutions. The remaining correspondent relationships are reoriented toward alternative currencies and jurisdictions, especially yuan clearing in China.

6.3 Yuan Reorientation

The reorientation toward yuan correspondents documented above does not simply reflect broader global trends, including China's economic growth and efforts to internationalize its currency. Rather, the increase in yuan-based correspondent banking relationships in heavily sanctioned economies is not, on average, found in other EMDEs, as we show below.

Figure 13 plots, across EMDEs, the change in the share of sanctioned banks between 2021 and 2025 against the change in the share of cross-border yuan correspondents. The horizontal dotted line shows that the average increase in the yuan share is small, as is the average change in the share of EMDE banks that are under sanctions, shown with the dotted vertical line. Belarus, Kyrgyzstan, Myanmar, and Russia – highlighted in the figure – stand out as clear outliers, with increases in sanctions and in yuan connectivity far exceeding the EMDE average. This indicates that the reorientation toward the yuan in these countries is not simply part of a global trend.

This pattern is not driven by changing trade flows. One might imagine that economies which are heavily sanctioned also reorient their trade toward China, necessitating more payments in the yuan. Figure 14a plots the change in share of each country's correspondents that clear in yuan during 2021-2025 against growth in the share of their trade (imports and exports) with China during the same

Figure 13: Sanctions and Yuan Share of Correspondents, 2021-2025

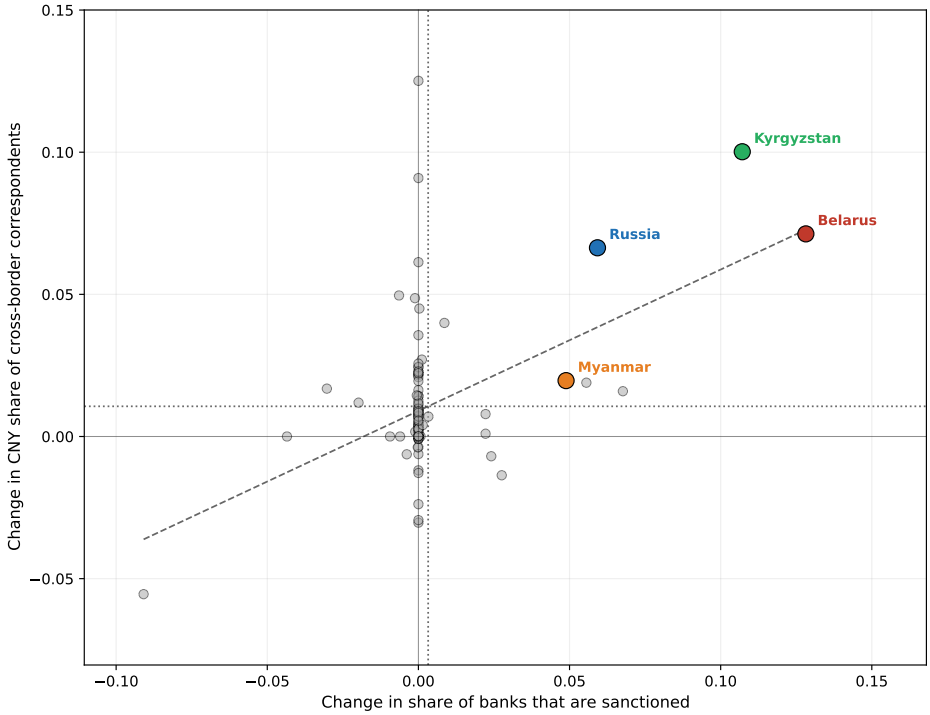
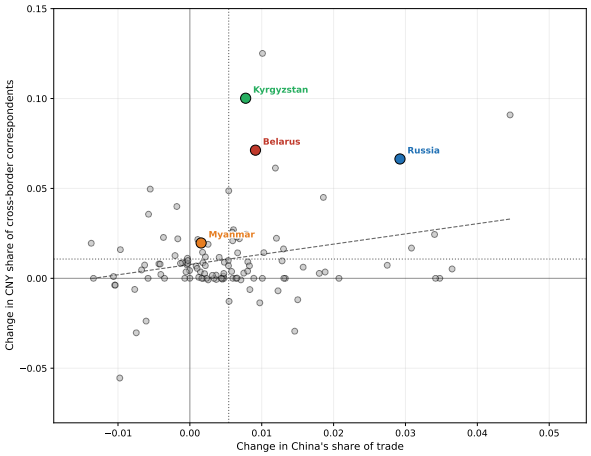
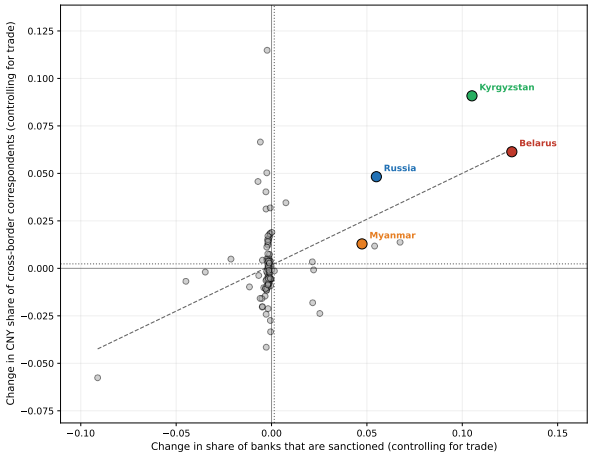


Figure 14: Trade, Sanctions, and Yuan Share of Correspondents

(a) Trade and Correspondents



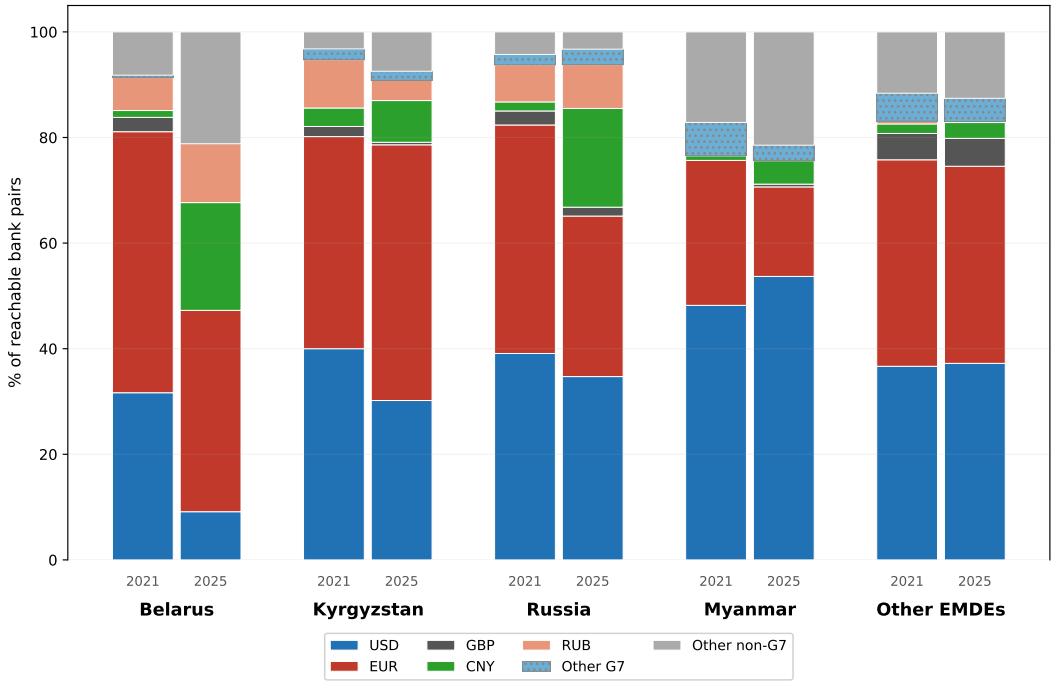
(b) Controlling for Trade



period. Among Belarus, Kyrgyzstan, Myanmar, and Russia, only Russia is in the top 25 EMDEs in trade reorientation with China. Three of these countries are in the top five with respect to the changes in yuan's share of their correspondents and increases in the share of their banks that are sanctioned. Figure 14b more formally confirms that the relationship between sanctions and shifts toward the yuan holds even after accounting for shifts in trade with China.[21]

Besides China's increase in trade and global economic activity, other trends unrelated to sanctions could plausibly drive improvements in the connectivity of the yuan correspondent network. For example, China has expanded its CIPS payment clearing system and has expressed interest in growing the international use of its currency. As shown in the rightmost bars of Figure 15, however, the yuan's increasing share of shortest routes from the heavily sanctioned economies does not manifest on average in the other EMDEs. While there is a visible increase in the yuan share, the change is minimal at about 1 percentage point. Further, the dollar's and euro's shares remain highly stable between 2021 and 2025, each with values a bit below 40 percent in both years.[22] At least through 2025, the reorientation toward the yuan observed in heavily sanctioned economies is not a broader phenomenon.

Figure 15: Currency Delivering Shortest Route



In Appendix Figure A7, we consider two alternative measures: the share of total cross-border correspondents and weighted measures of each currency's shortest-route shares. Both measures show

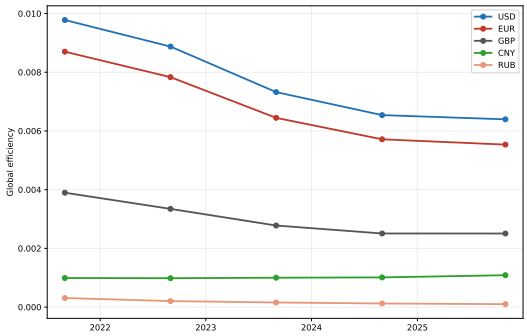
[21] The data points in Figure 14b are residuals from a partial regression, which residualizes both the changes in correspondents (the y variable) and changes in sanctions (x variable) with respect to trade.

[22] These shares equally weight all bank-to-bank transfers. This is likely the reason that the dollar's share is below the higher values reported from data on payment values or trade invoicing, such as in Cerutti et al. (2025) and Gopinath and Stein (2021).

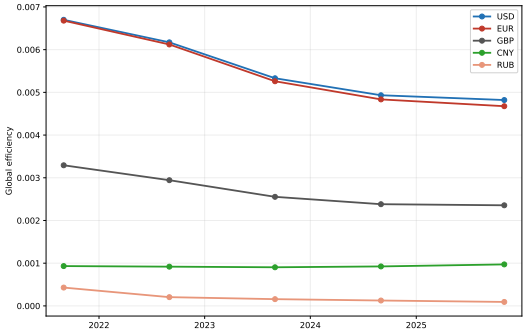
the yuan gaining between 2021 and 2025 at the dollar's or euro's expense in Belarus, Kyrgyzstan, Myanmar, and Russia. Aggregated across all other EMDEs, neither exhibits a significant shift.

Figure 16: Efficiency of Payment Networks

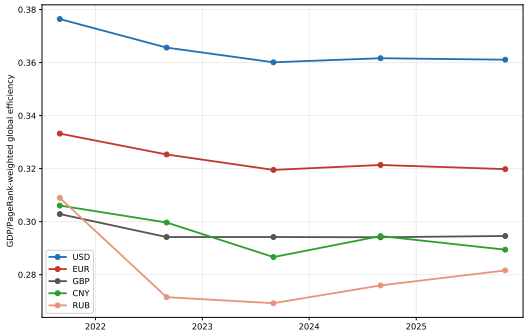
(a) EMDE to EMDE



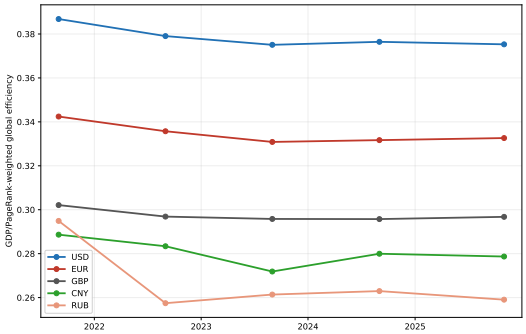
(b) EMDE to World



(c) EMDE to EMDE, Weighted



(d) EMDE to World, Weighted



Finally, we measure how the connectivity offered by each currency's correspondent network has evolved during 2021-2025. We calculate the global network efficiency measure of Latora and Marchiori (2001), which is constructed as the average inverse distance between all possible bank-to-bank connections. Bank-to-bank connections that cannot be made – conceptually, with an infinite distance – enter this calculation with a value equal to zero. Global efficiency values will therefore be higher for networks that (i) allow more feasible connections and (ii) reach feasible connections with fewer hops.

The dollar correspondent network is the most efficient, followed closely by the euro; the ruble and yuan networks offer the least connectivity, with the pound somewhere in between. This is true when considering cross-border connections of banks from one EMDE to banks in another, as shown in Figure 16a, as well as when considering connections from EMDE banks to all foreign banks, as shown in Figure 16b. The relative ordering of currencies remains unchanged from 2021 to 2025, though the yuan network is the only one offering increasing efficiency over the full period in these specifications. The efficiency of the dollar and euro networks has declined somewhat. This decline would be expected, for example, if global de-risking severed connections between large hubs and small banks. Figures 16c and 16d offer versions of this measure where bank-to-bank connections are weighted in proportion

to the product of their country's GDP and their share of their country's banks' total PageRank value. Results with these weights are more volatile and show a greater relative efficiency of the dollar. Taken together, the four plots in Figure 16 show little change in the dollar and euro networks' positions as offering EMDEs the most expansive and efficient access to global payments.

7 Conclusions

This paper offers the first comprehensive look at how financial sanctions reshape the global correspondent banking network. We start by studying commercial data on the correspondent relationships of more than 17,000 EMDE financial institutions to characterize key features of global payment networks across currencies. We find that the dollar and euro networks can connect EMDE banks to the largest share of foreign banks and do so with the fewest interbank hops. Both rely on a small set of key hubs, especially the dollar network, which is the most concentrated of all. These features underlie the potential power of Western sanctions regimes.

Next, combining the data on correspondents with data on sanctions designations, we reach our three main findings. First, sanctioned institutions lose correspondents across nearly all currencies and countries, though some retain access, at least through indirect dollar clearers in third countries. Second, the effects reach beyond the sanctioned banks themselves. In countries where a substantial share of the financial sector came under new sanctions during 2021–2025, non-sanctioned banks also lost access to clearing through Western hubs. Further, they preserved or expanded their yuan clearing connections, particularly with Chinese financial institutions. Third, this reorientation appears to be concentrated in these directly affected countries. Across the rest of the EMDE world, the dollar's shortest-route share did not slip and the yuan's share increased by only one percentage point. The large-scale restructuring of correspondent banking toward the yuan is, at least so far, a feature of heavily sanctioned economies, not a broad global trend.

These findings carry implications for policymakers weighing the costs and benefits of financial sanctions. Sanctions clearly degrade targeted institutions' access to the global payments network. But they also appear to catalyze a search for alternatives among the unsanctioned institutions that remain, shifting the currency and geographic composition of a country's overall financial infrastructure. Still, our results suggest that the U.S. dollar is highly resilient as a medium of international payment, at least over the time horizon of our study. Access to dollar clearing persists even under significant sanctions through indirect correspondent networks and shows no sign of waning across the broader set of EMDEs. And direct access to the core dollar clearing system is tightly controlled by U.S.-based financial institutions, implying that the United States retains substantial influence over the terms of that access.

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Appendix to:

Financial Sanctions and the Global Payments Network

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June 2026

This Appendix includes four sections:

- Section A with additional descriptions of the data, some including U.S. financial institutions that are excluded from our baseline given its focus on EMDEs.
- Section B includes additional information on sanctions, including those implemented beyond EMDEs.
- Section C includes additional difference-in-differences results referenced in the main body of the paper.
- Section D provides additional information on the heavily sanctioned countries covered in Section 6 of the main paper.

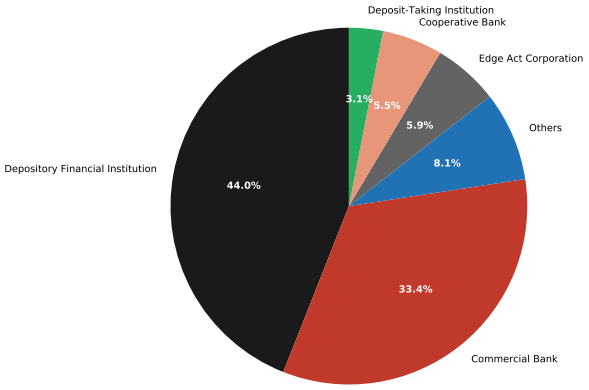
Appendix A. Additional Data Descriptions, Including U.S. Banks

The overall dataset has more than 17,000 EMDE financial institutions and roughly 20,000 U.S. financial institutions. Appendix Figure A1 shows the distribution of these institutions by LNRS-assigned type. LNRS' classifications are not intended to correspond exactly to regulatory charter types used by national banking authorities. Nonetheless, Appendix Figure A2 shows the highly similar levels and trends in four key categories of the counts of U.S. financial institutions in the LNRS data and those in publicly available regulatory sources. For example, the top-left panel plots in a solid black line the count of U.S. commercial banks in the data relative to year-end reporting by the Federal Deposit Insurance Corporation (FDIC). The basic magnitudes are highly similar, and any discrepancy between the lines accounts for less than 5 percent of their levels. Further, both lines capture the same slight downward trend over recent years. The other three panels also suggest the LNRS data and external counts closely track each other, with the largest gap (for holding companies) totaling only about 10

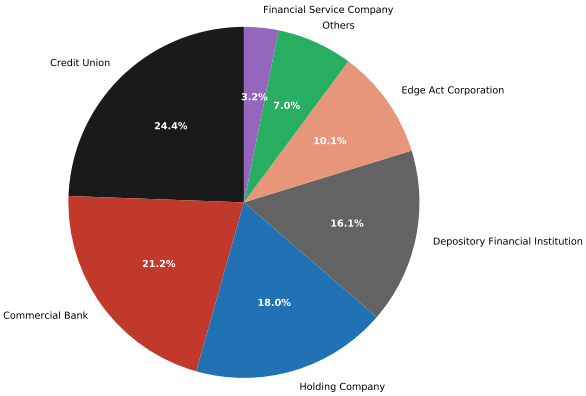
percent of average levels.[1]

Figure A1: Distribution of Financial Institution Types in Data

(a) EMDE Banks



(b) U.S. Banks



Appendix B. Additional Information on Sanctions

Appendix Table A1 characterizes which types of EMDE financial institutions are most commonly sanctioned. "Commercial Banks", "Depository Financial Institutions", and "Government Banks" account for the vast majority of institutions as well as OFAC, EU, and HMT sanctions. As such, the main body typically uses the term "banks", even though some of these institutions are non-bank financial institutions.

Figure 3 in the main text demonstrated the time-series of sanctions applied to EMDE financial institutions. Appendix Figure A3 shows the evolution of sanctions applied to all financial institutions, anywhere in the world. The pattern of growth is similar, but the total count is roughly one-quarter larger.

Appendix Table A2 shows how sanctions of EMDEs overlap between our three sanctioning authorities.

Appendix C. Additional Difference-in-Differences Results

Section 5.2 reported results on changes in correspondent count for sanctioned banks using a difference-in-differences approach. Appendix Figure A4 shows equivalent results, but where change in corre-

[1]For the external source on commercial banks and savings institutions, see "FDIC Statistics at a Glance", reported at year-end, available here. The external count of credit unions is set equal to the number of federally insured credit unions reported quarterly in the National Credit Union Administration Quarterly Data Summaries, available here. Finally, the external data on holding companies comes from the count of "bank holding companies in operation" in the Supervision & Regulation chapter of the Federal Reserve Board's Annual Reports, available here.

Figure A2: Comparison with External Sources on U.S. Financial Institutions

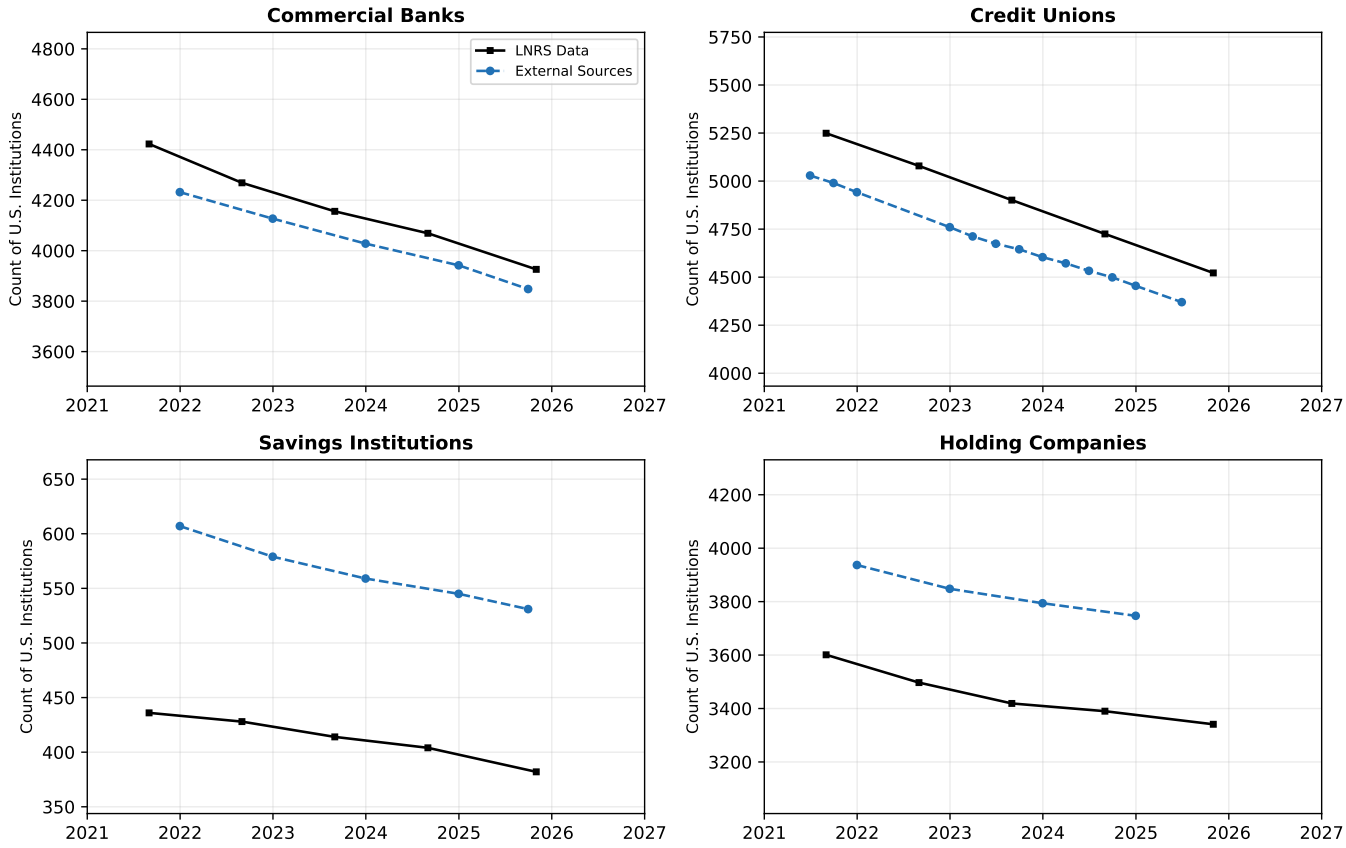


Table A1: Sanctions by Financial Institution Type

Type	Total	OFAC		EU		HMT		Any	
		N	%	N	%	N	%	N	%
Commercial Bank	5,797	169	2.9	102	1.8	82	1.4	193	3.3
Depository Financial Institution	7,632	30	0.4	14	0.2	12	0.2	35	0.5
Government Bank	89	11	12.4	6	6.7	7	7.9	13	14.6
Other	1,119	10	0.9	6	0.5	7	0.6	12	1.1
Development Bank	166	6	3.6	4	2.4	4	2.4	6	3.6
Central Bank	97	5	5.2	3	3.1	3	3.1	5	5.2
Savings Bank	54	4	7.4	3	5.6	3	5.6	4	7.4
Private Bank	140	4	2.9	1	0.7	1	0.7	4	2.9
Investment Bank	125	4	3.2	3	2.4	3	2.4	4	3.2
Cooperative Bank	950	2	0.2	2	0.2	2	0.2	2	0.2
Industrial Bank	6	2	33.3	2	33.3	2	33.3	2	33.3
Financial Service Company	368	2	0.5	2	0.5	2	0.5	2	0.5
Agricultural Bank	10	1	10.0	0	0.0	0	0.0	1	10.0
Holding Company	38	1	2.6	0	0.0	0	0.0	1	2.6
Types without sanctions	753	0	0.0	0	0.0	0	0.0	0	0.0
Total	17,344	251	1.4	148	0.9	128	0.7	284	1.6

spondents is expressed in percentage terms.

Figure A3: Banks Under Sanctions, by Authority, 2021-2025

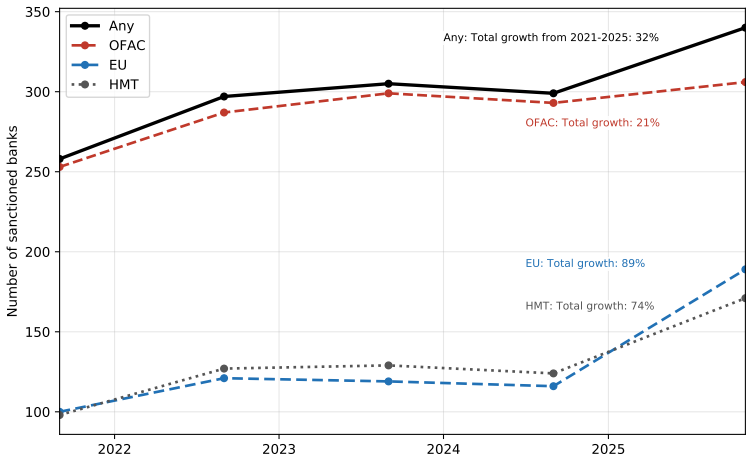
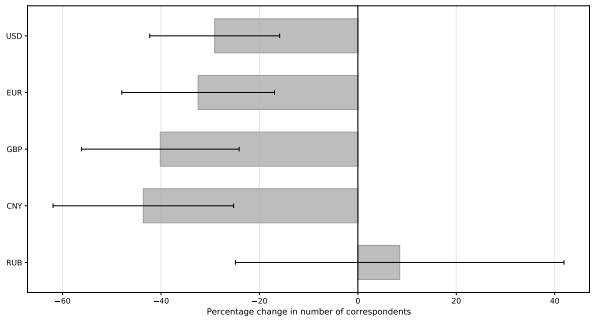


Table A2: Sanctions Overlap by Authority

	September 2021	September 2022	September 2023	September 2024	November 2025
OFAC + EU + HMT	71	86	88	86	109
OFAC + EU	0	2	3	3	14
OFAC + HMT	0	7	12	11	6
EU + HMT	3	4	3	3	5
OFAC only	128	134	139	139	122
EU only	2	3	2	2	20
HMT only	0	2	1	1	8
Total	204	238	248	245	284

Figure A4: Loss of Correspondents (Percentage) After Being Sanctioned



Appendix D. Additional Results in Heavily sanctioned Countries

Section 6 offered figures and tables characterizing the full correspondent banking relationship network for Belarus. Here we offer similar tables and figures for the cases of Kyrgyzstan, Russia, and Myanmar.

Figure 15 showed our preferred shortest-distance currency share measure of the connectivity offered by each currency to each country. We document an increase in yuan share in the heavily sanctioned countries, but show that, on average, this is not the case in other EMDEs. Appendix Figure A7 shows alternative measures aiming to capture similar dynamics. Appendix Figure A7a shows the share of each currency in overall correspondents and Appendix Figure A7b shows the shortest-distance

Table A3: Cross-Border Correspondents: Kyrgyzstan (KG)

Currency	Destination	September 2021 Corrs.	KG FIs	CBs	November 2025 Corrs.	KG FIs	CBs
USD	**TOTAL**	**103**	**21**	**32**	**72**	**18**	**31**
	AM	0	0	0	3	3	2
	AT	0	0	0	1	1	1
	AZ	0	0	0	3	3	2
	BH	0	0	0	1	1	1
	CN	1	1	1	14	10	3
	DE	5	5	1	6	6	1
	GE	1	1	1	6	6	1
	HK	0	0	0	2	2	1
	KR	11	11	1	0	0	0
	KZ	13	10	5	13	11	6
	OM	0	0	0	1	1	1
	RU	50	16	13	3	2	3
	TJ	0	0	0	2	2	1
	TR	3	2	2	6	5	3
	US	17	9	6	2	2	1
	UZ	2	2	2	9	8	4
EUR	**TOTAL**	**74**	**21**	**32**	**52**	**17**	**26**
	AM	0	0	0	2	2	2
	AT	4	3	2	1	1	1
	AZ	0	0	0	2	2	1
	BH	0	0	0	1	1	1
	CN	0	0	0	5	3	3
	DE	14	10	6	16	12	3
	ES	1	1	1	0	0	0
	FR	1	1	1	0	0	0
	GE	1	1	1	3	3	1
	IT	1	1	1	2	2	1
	KZ	8	6	4	6	4	4
	OM	0	0	0	1	1	1
	RU	41	16	13	2	2	2
	TJ	0	0	0	2	2	1
	TR	2	1	2	6	4	3
	UZ	1	1	1	3	2	2
GBP	**TOTAL**	**18**	**10**	**11**	**4**	**4**	**2**
	DE	1	1	1	3	3	1
	KR	2	2	1	0	0	0
	KZ	3	2	3	1	1	1
	RU	12	9	6	0	0	0
RUB	**TOTAL**	**80**	**21**	**21**	**31**	**16**	**18**
	AM	0	0	0	2	2	2
	KZ	8	8	2	5	4	3
	RU	71	21	18	19	15	8
	TJ	0	0	0	1	1	1
	TR	0	0	0	2	2	2
	UZ	1	1	1	2	2	2
CNY	**TOTAL**	**22**	**12**	**14**	**48**	**16**	**23**
	AM	0	0	0	1	1	1
	CN	14	10	7	33	15	11
	GE	0	0	0	2	2	1
	HK	1	1	1	1	1	1
	KZ	2	2	2	6	4	4
	RU	5	4	4	2	2	2
	TJ	0	0	0	1	1	1
	TR	0	0	0	1	1	1
	UZ	0	0	0	1	1	1

Table A4: Cross-Border Correspondents: Myanmar (MM)

Currency	Destination	September 2021 Corrs.	MM FIs	CBs	November 2025 Corrs.	MM FIs	CBs
USD	**TOTAL**	**146**	**19**	**29**	**81**	**16**	**23**
	CN	2	2	1	1	1	1
	HK	2	2	1	0	0	0
	ID	0	0	0	1	1	1
	IN	11	11	1	6	6	1
	JP	6	6	2	2	2	2
	KR	9	8	3	7	5	4
	MY	16	9	4	2	2	1
	SG	57	18	8	34	14	6
	TH	38	13	6	24	9	4
	TW	5	2	3	4	2	3
EUR	**TOTAL**	**51**	**18**	**19**	**27**	**14**	**13**
	DE	4	4	3	1	1	1
	HK	1	1	1	0	0	0
	IN	3	3	1	2	2	1
	JP	0	0	0	1	1	1
	KR	2	2	1	1	1	1
	MY	4	4	2	1	1	1
	SG	29	15	6	17	10	6
	TH	7	5	4	3	3	1
	VN	1	1	1	1	1	1
GBP	**TOTAL**	**0**	**0**	**0**	**1**	**1**	**1**
	GB	0	0	0	1	1	1
CNY	**TOTAL**	**6**	**4**	**4**	**8**	**3**	**7**
	CN	5	4	3	7	3	6
	HK	1	1	1	1	1	1

Table A5: Cross-Border Correspondents: Russia (RU)

Currency	Destination	September 2021			November 2025		
		Corrs.	RU FIs	CBs	Corrs.	RU FIs	CBs
USD	**TOTAL**	**346**	**170**	**45**	**70**	**50**	**33**
	AM	1	1	1	4	4	2
	AT	51	51	1	5	5	1
	AZ	1	1	1	2	2	2
	BY	2	2	2	1	1	1
	CH	1	1	1	1	1	1
	CN	14	10	4	3	3	3
	CZ	1	1	1	0	0	0
	DE	18	18	2	0	0	0
	HK	1	1	1	0	0	0
	HU	1	1	1	0	0	0
	IT	0	0	0	1	1	1
	KR	10	8	2	4	3	3
	KZ	5	4	2	1	1	1
	MD	1	1	1	0	0	0
	MN	1	1	1	0	0	0
	PL	1	1	1	0	0	0
	SE	1	1	1	1	1	1
	TH	1	1	1	0	0	0
	TJ	0	0	0	1	1	1
	TR	2	2	2	2	2	2
	US	231	129	17	41	30	11
	UZ	2	1	2	3	2	3
EUR	**TOTAL**	**315**	**181**	**56**	**57**	**47**	**35**
	AM	1	1	1	4	4	2
	AT	78	78	4	8	7	2
	AZ	1	1	1	2	2	2
	BE	8	8	1	1	1	1
	BY	2	2	2	1	1	1
	CH	4	3	3	1	1	1
	CN	1	1	1	2	2	2
	CZ	2	2	2	0	0	0
	DE	178	135	13	20	19	7
	ES	1	1	1	0	0	0
	FI	1	1	1	0	0	0
	FR	15	15	7	4	4	3
	GB	3	3	2	3	3	3
	HU	1	1	1	1	1	1
	IE	1	1	1	0	0	0
	IT	4	4	2	2	2	2
	KR	1	1	1	2	1	2
	KZ	3	3	3	1	1	1
	LU	1	1	1	0	0	0
	MN	1	1	1	0	0	0
	NL	1	1	1	1	1	1
	PL	3	2	2	0	0	0
	SE	1	1	1	1	1	1
	TJ	0	0	0	1	1	1
	TR	2	2	2	2	2	2
	UZ	1	1	1	0	0	0
GBP	**TOTAL**	**115**	**92**	**28**	**17**	**16**	**12**
	AT	7	7	1	0	0	0
	AZ	0	0	0	1	1	1
	BE	2	2	1	0	0	0
	CH	6	5	3	1	1	1
	CZ	1	1	1	0	0	0
	DE	28	27	3	2	2	2
	FR	0	0	0	1	1	1
	GB	64	54	12	11	11	6
	IT	1	1	1	0	0	0
	KR	1	1	1	0	0	0
	KZ	1	1	1	0	0	0
	NL	1	1	1	1	1	1
	SE	1	1	1	0	0	0
	TR	1	1	1	0	0	0
	UZ	1	1	1	0	0	0
RUB	**TOTAL**	**5**	**2**	**5**	**2**	**2**	**2**
	AZ	1	1	1	0	0	0
	KZ	2	2	2	0	0	0
	TJ	0	0	0	1	1	1
	TR	2	1	2	0	0	0
	UZ	0	0	0	1	1	1
CNY	**TOTAL**	**80**	**51**	**23**	**42**	**33**	**17**
	CN	59	39	13	33	28	8
	DE	5	5	2	2	2	2
	GB	1	1	1	0	0	0
	HK	14	14	6	5	5	5
	KZ	0	0	0	1	1	1
	SG	1	1	1	0	0	0
	TJ	0	0	0	1	1	1

Figure A5: Evolution of Myanmar's CBRs, 2021-2025

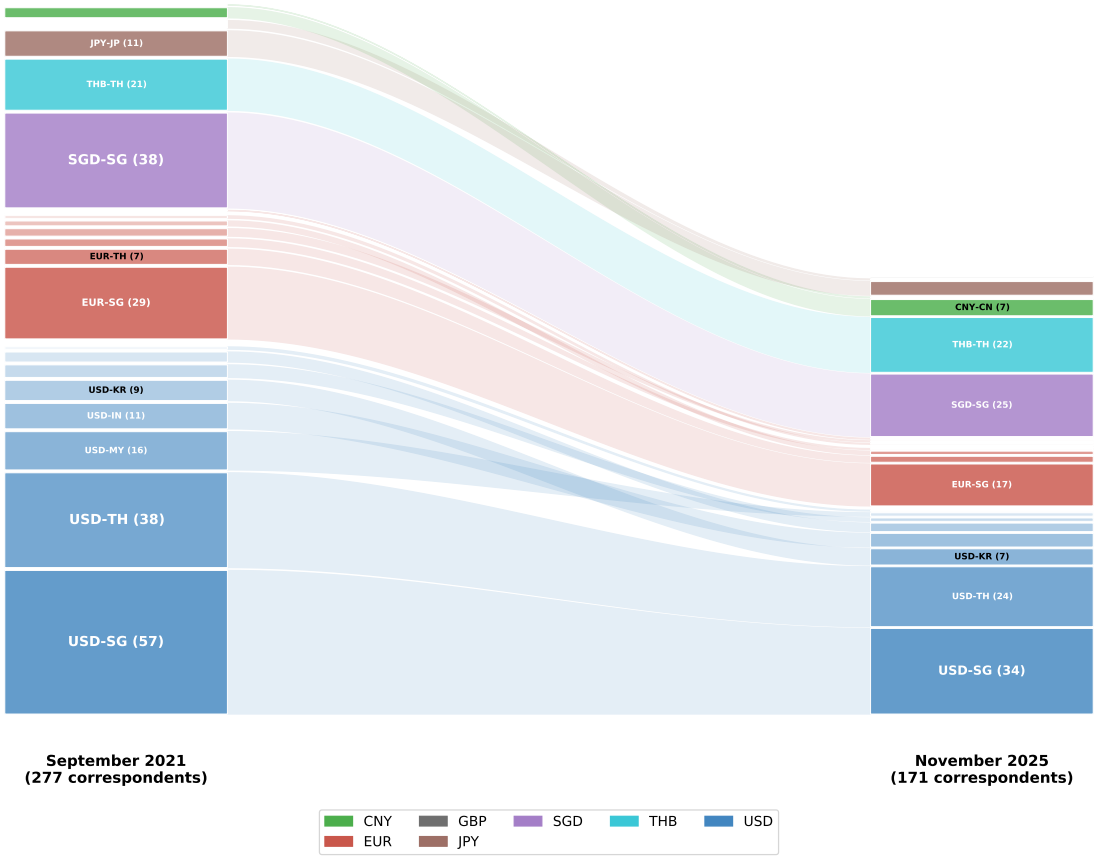
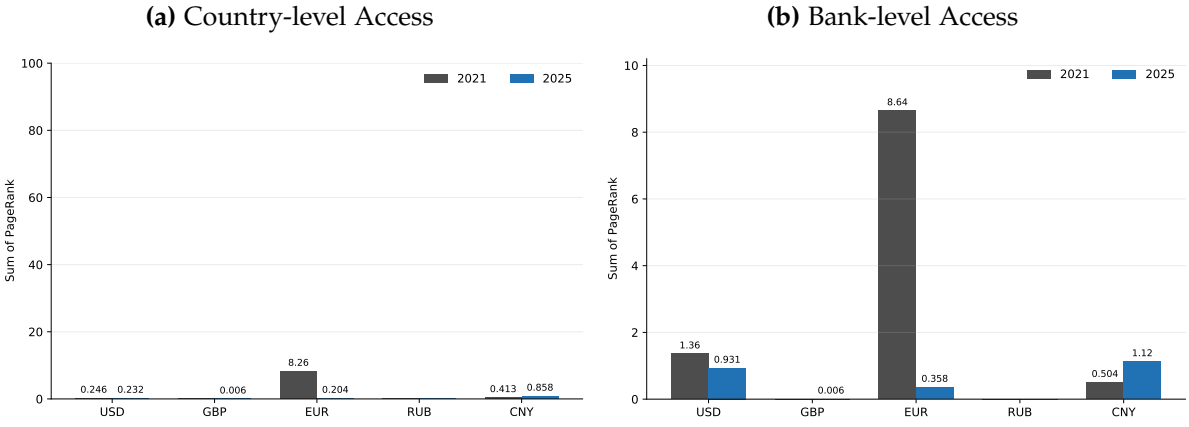


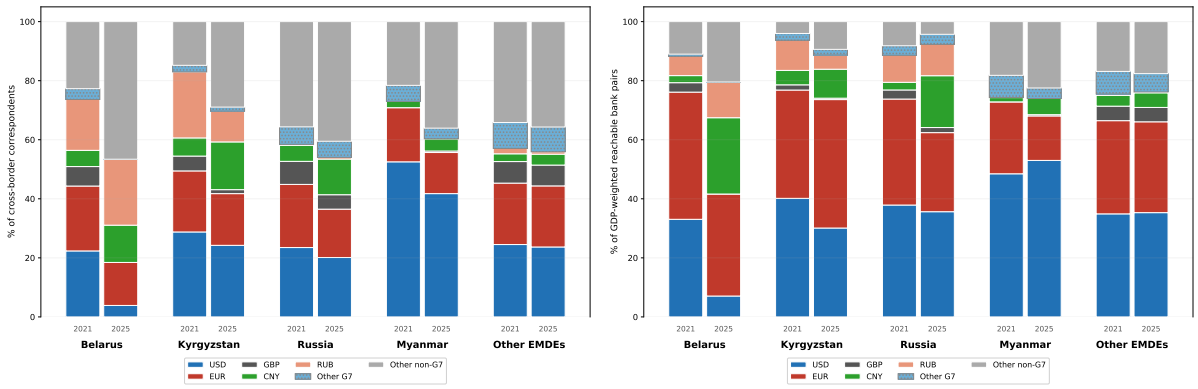
Figure A6: Reduction in Correspondents: Myanmar (Cumulative PageRank)



shares, but when weighting bank-to-bank pairs in proportion to their country's GDP and each bank's PageRank share of its country's total. The conclusion is the same: there is a clear reorientation toward the yuan in the four heavily sanctioned economies, but no evidence of such a strong shift, on average, in the other EMDEs.

Figure A7: Alternative Measures of Most-Linked Currency

(a) Count of Correspondents **(b)** Currency Delivering Shortest Route, Weighted



The main text closely examines four heavily sanctioned economies – Belarus, Kyrgyzstan, Myanmar, and Russia. Appendix Figure A8 and Appendix Figure A9 show equivalent measures for three "always-sanctioned" economies – Cuba, Iran, and Syria – as well as other EMDEs and the entire world.

Figure A8: Currency Delivering Shortest Route

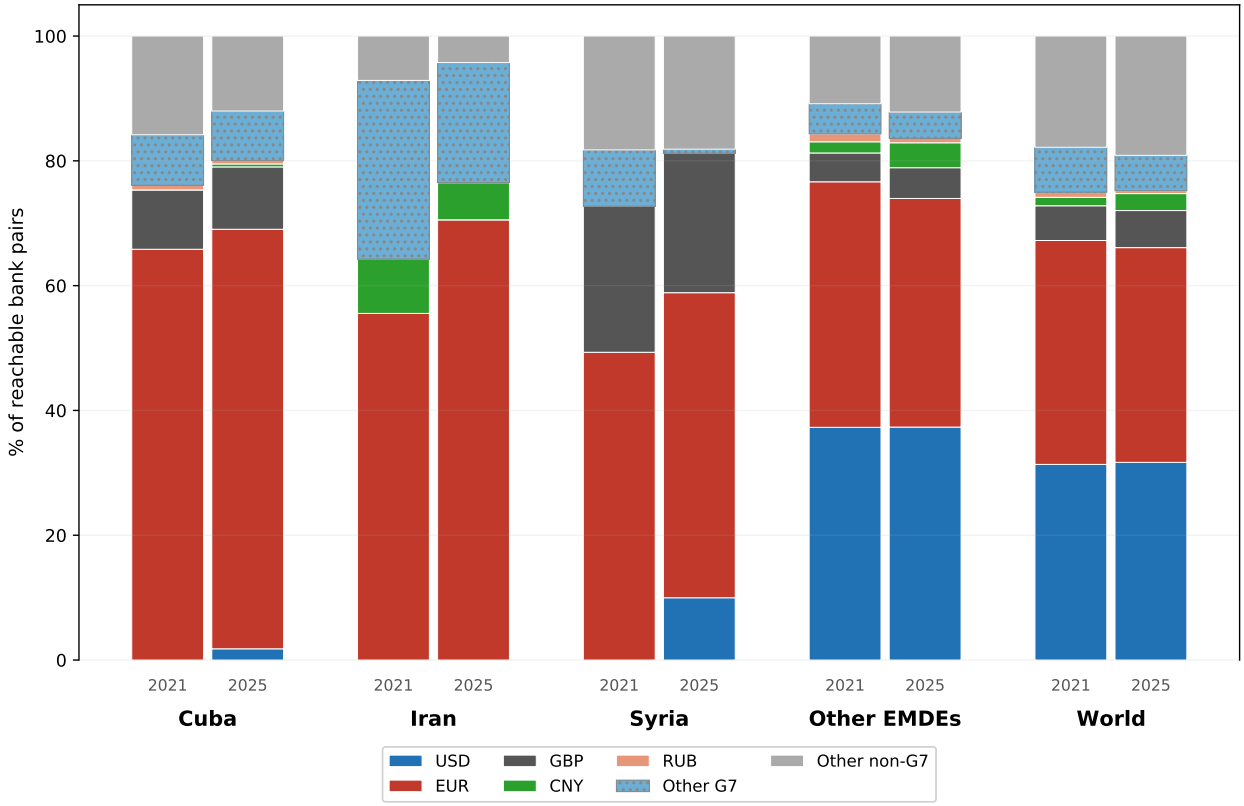
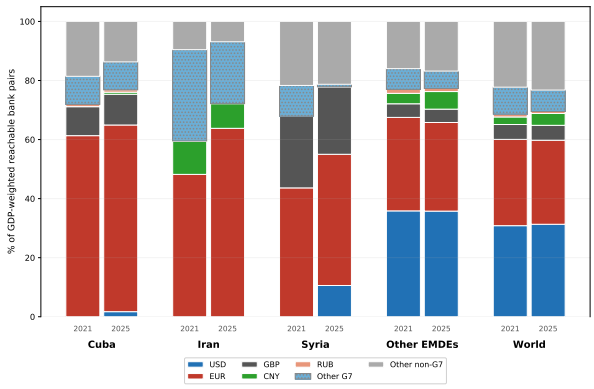


Figure A9: Alternative Measures of Most-Linked Currency

(a) Weighted by GDP and PageRank



(b) Count of Correspondents

