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Pre-Positioning and Cross-Border Financial Intermediation

Nicholas K. Tabor & Jeffery Y. Zhang[1]

July 11, 2022

Abstract

The benefits of cross-border financial activity are wide-ranging, from greater competition and more efficient markets to broader and more stable access to capital. During normal economic times, the official sector and private sector share an incentive to foster such cross-border financial activities. During a financial crisis, however, the short-term alignment of official- and private-sector incentives can diverge—sometimes significantly. We present a game-theoretic model of the underlying trade-offs and discuss lessons for international financial regulators, placing them in the context of the 2008 financial crisis, when challenges in cross-border cooperation both channeled and amplified financial stress. We also discuss the critical unfinished business of post-crisis regulatory measures to improve oversight of internationally active financial institutions.

[1] Board of Governors of the Federal Reserve System and University of Michigan Law School, respectively. The authors wish to thank their Federal Reserve colleagues for their helpful guidance on this topic, including Benjamin Dennis, Linda Goldberg, and Molly Mahar. We especially want to thank Ricardo Correa for his generous and thoughtful comments. The views expressed in this article are the authors' alone and do not indicate concurrence by other members of the Federal Reserve System staff, the Board of Governors, or the United States government.

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Introduction

> "[M]ost large complex financial institutions are global—at least in life if not in death."
> – Mervyn King, Governor of the Bank of England, 2010[2]

During the 2008 financial crisis, challenges in cross-border cooperation both channeled and amplified stress in financial markets, leading central banks to develop novel approaches to stanch the emerging distress. When the crisis abated, authorities enacted new measures to improve common oversight of internationally active financial institutions. These measures included structural changes, recovery and resolution plans, and—the focus of this paper—the "pre-positioning" of capital and liquid assets, at the affiliates and in the jurisdictions most likely to need them in an emergency. Many of these measures are still being implemented, even in major financial-center jurisdictions; the fallout from the COVID-19 pandemic has not helped this task, even as it demonstrated their relevance to financial stability.[3]

The potential benefits of cross-border financial activity are wide-ranging, from greater competition and more efficient markets, to broader and more stable access to capital. Financial institutions have strong incentives to act in ways that promote these benefits, by obtaining funding from its most affordable source, and allocating it to the investments and markets with the greatest opportunities for return. The same internationalization of financial activity provides strong incentives for financial institutions to honor their commitments, regardless of the country or currency in which they obtain.

The official sector shares a similar incentive to foster such cross-border financial activities. Although their mandates may differ, regulatory bodies, central banks, and finance ministries all share a general obligation to serve the domestic public that appoints them, directs them, and holds them to account. That public is best served by a stable financial system with a range of financial services providers, including foreign banks. Cross-border banks counter the credit contraction of domestic firms during economic downturns in local markets, smoothing disruptions in lending.

During a crisis, however, the short-term alignment of official- and private-sector incentives can diverge. Cross-border financial institutions will generally seek to move resources quickly between affiliates to honor claims, since a credit event anywhere can quickly lead to a run on the entire global firm. For the official sector, by contrast, will generally seek to ensure that local obligations are met before, or at least *pari passu* with, other global claims on a bank, to prevent or mitigate domestic losses.[4]

Below, we demonstrate these varied official-sector incentives through both a stylized model and a simple game-theoretic framework. The parameters used are calibrated using existing empirical research on the impact of abrupt changes in cross-border funding flows. We show how pre-positioning requirements can improve welfare in ordinary market conditions, allow for participation in a Single Point of Entry ("SPOE")

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[2] Mervyn King, "Banking: From Bagehot to Basel, and Back Again," remarks at the Buttonwood Gathering, New York, NY (Oct. 25, 2010).

[3] *See, e.g.*, Linda S. Goldberg and Fabiola Ravazzolo, "The Fed's International Dollar Liquidity Facilities: New Evidence on Effects," NBER Working Paper 29982 (Apr. 2022). For reasons of scope, we do not engage with the performance of the financial sector during the COVID-19 pandemic, an area ripe for analysis as more bank-specific data becomes publicly available. For further work on cross-border funding in the COVID event generally, we strongly encourage readers to review the work of the Bank of International Settlements research staff.

[4] *See* Randal K. Quarles, "Government of Union: Achieving Certainty in Cross-Border Finance," remarks at the Financial Stability Board Workshop on Pre-Positioning, Ring-Fencing, and Market Fragmentation, Philadelphia, Pennsylvania (Sep. 26, 2019).

regime in resolution, and provide the certainty necessary to prevent market fragmentation.[5] Finally, we discuss areas where the disparity between home and host resources has deteriorated since the 2008 financial crisis.

Part I. Background

A. Home Countries, Host Countries, and Cross-Border Financial Intermediation

Financial institutions, even the largest and most internationally active ones, are typically creatures of domestic (or "municipal") law.[6] They gain legal personality through the affirmative grant of a public charter, accompanied by a host of municipal rights and obligations. A charter can give an institution the right to take deposits, make loans, underwrite securities, accept and process payments, and access certain forms of public financing. A charter also typically creates an obligation to follow local laws, submit to examination, and pay restitution or otherwise remedy injuries to local parties.

Like natural persons, financial institutions can also be endowed with freedom of movement. A "**home jurisdiction**" can grant an institution the right to accept deposits from, or make loans to, parties based overseas.[7] A home jurisdiction can allow an institution to hire an agent or, with permission from host authorities, open an office in another country, to take part in these and other transactions. A home jurisdiction can allow the institution to own part, or all, of a foreign company to do the same.

Like most travelers, a financial institution must also follow the laws of the "**host jurisdiction**" to which it travels, including those limiting its conduct. A host-country **subsidiary**, for example, is generally chartered under host-country law and faces similar requirements to those of a domestic bank, adhering to the principle of national treatment. A subsidiary must typically meet minimum capital and liquidity levels, obtaining a certain amount of equity locally, and retaining a certain proportion of local assets that it can sell quickly with little risk of loss. A subsidiary must also typically submit to host-country supervision and examination, just like a local bank. In exchange, a subsidiary can typically conduct most of the same activities as local banks.

By contrast, a host-country **branch** is typically an agent of its home-country financial institution, which acts and incurs obligations on that institution's behalf. A branch, as an extension of the parent, may face some limits on its conduct, such as retail deposit-taking, but is not generally subject to the same local requirements as a domestic entities, such as standalone capital or liquidity requirements. Despite this reliance on the home countries supervision and regulation to maintain the safety and soundness of the

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[5] These concepts, which are a staple of sovereign debt literature for decades, are beginning to enter into the literature on foreign bank regulation. *See, e.g.*, Jonathan Eaton and Mark Gersovitz, "Debt with Potential Repudiation: Theoretical and Empirical Analysis," 48 *Rev. of Econ. Stud.* 289 (1981); Patrick Bolton and Martin Oehmke, "Bank Resolution and the Structure of Global Banks," Columbia Business School Res. Paper No. 18-39 (rev. Aug. 17, 2018); *see also* Viral V. Acharya and Philipp Schnabl, "Do Global Banks Spread Global Imbalances? Asset-Backed Commercial Paper During the Financial Crisis of 2007-09," 58(1) *IMF Econ. Rev.* 37 (2010) (documenting the role that "global banking flows, rather than global imbalances," played in determining "the geography of the financial crisis").

[6] The international legal personality and obligation of financial institutions that are also international organizations is beyond the scope of this paper. For further discussion of this special case, *see, e.g.*, Kristina Daugirdas, "How and Why International Law Binds International Organizations," 57(2) *Harv. Int'l L. J.* 325 (2016); John W. Head, "Evolution of the Governing Law for Loan Agreements of the World Bank and Other Multilateral Development Banks," 90(2) *Am. J. of Int'l L.* 214 (Apr. 1996).

[7] For general definitions in this section, *see* Committee on the Global Financial System, Bank for International Settlements, "Funding patterns and liquidity management of internationally active banks," CGFS Papers #39 (2010), at 3 ("Concepts and approaches").

branch, host-country supervisors rarely have authority to examine the home-country operations of a branch or representative office. We will return to this issue and its potential to exacerbate stress in the discussion below.

B. Financial Crises and "Walk-Away Risk"

Most host countries give foreign banks some ability to operate locally, whether through subsidiaries, branches, or both. For the host country, the benefits of doing so can be substantial. "Lending" branches and subsidiaries of foreign banks can be an important source of credit to a host country, potentially dampening downturns in domestic credit cycles.[8] "Funding" branches and subsidiaries can offer greater access to foreign currencies and an additional source of liquidity, reducing reliance on the open foreign exchange market. Foreign institutions can also bring other benefits, like technical expertise or signaling value to foreign counterparties.[9] Overall, greater banking-sector integration across borders can dampen economic volatility within them.[10]

In ordinary times, when market conditions are stable and volatility is low, the incentives of home, host, and financial institution typically align to secure these benefits. In extraordinary times, however, those incentives can shift. Such changes are grounded not in a legal reality, but in a practical one: The assets and third-party liabilities of a cross-border institution are often located in different jurisdictions from one another.

Consider, for example, a hypothetical firm Bank #1, with its main office in Country A and an affiliate in Country B. For simplicity, assume that parent and affiliate are of equal size, and that both parent and affiliate take retail deposits and make loans. Under ordinary circumstances, Bank #1 can accept deposits in whatever market provides them at the lowest cost, and it can invest them in projects in whatever market provides the greatest return; national boundaries are irrelevant to the decision. A real-life cross-border financial institution would face transaction costs, agency rents, and other internal frictions, which could lead it to allocate more expensive funding to less profitable investments.[11] But in theory, this "internal capital market" functions much like an external one, allocating resources to their most (privately) efficient use.[12]

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[8] *See* Nicola Cetorelli and Linda S. Goldberg, "Banking Globalization and Monetary Transmission," 67(5) *Am. Fin. Assoc.* 1811, 1826 (Oct. 2012) (finding a 0.13 point reduction in the slope path of lending growth for median cross-border bank, given a 100 basis point change in monetary policy).

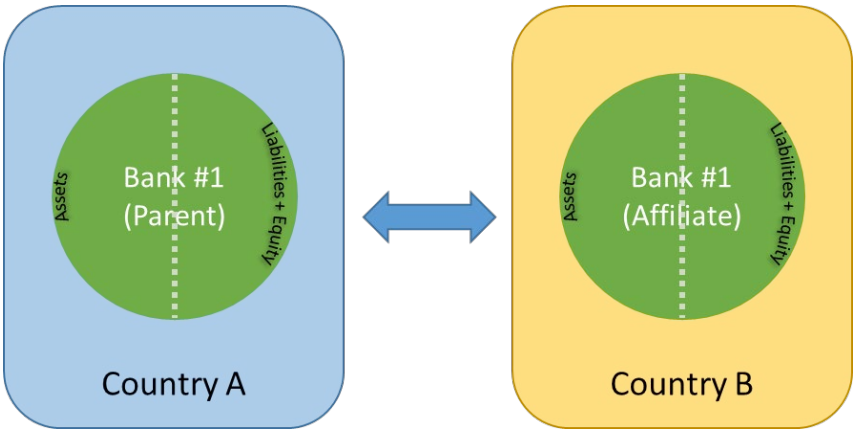
[9] For further discussion of the distinction between lending and funding branches in the context of cross-border supervision, *see* Daniel K. Tarullo, "Regulation of Foreign Banking Organizations," remarks at the Yale School of Management Leaders Forum, New Haven, CT (Nov. 28, 2012).

[10] *See* Donald P. Morgan, Bertrand Rime, and Philip E. Strahan, "Bank Integration and State Business Cycles," 119(4) *Q. J. of Econ.* 1555 (Nov. 2004) (examining banking-sector linkages across U.S. state lines).

[11] *See* Ronald Coase, "The Nature of the Firm," 4 *Economica* 386 (Nov. 1937).

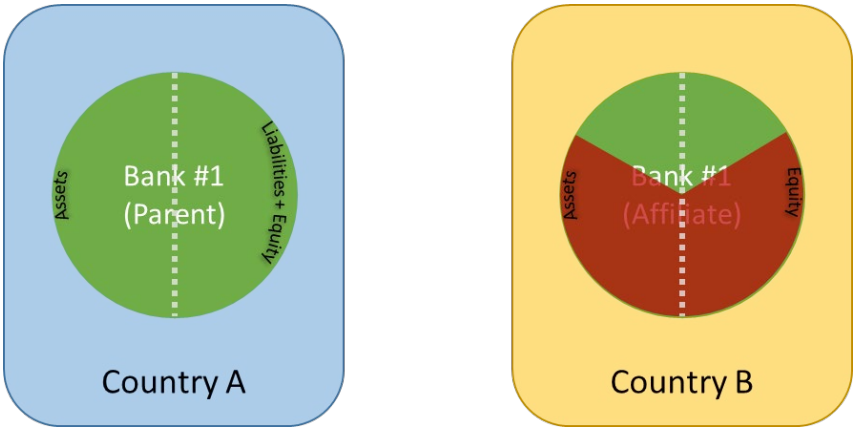
[12] Cetorelli and Goldberg, *supra* note 8 at 1812 (citing, among others, Adam B. Ashcraft and Murillo Campello, "Firm balance sheets and monetary policy transmission," 54(6) *J. of Monetary Econ.* 1515 (Sept. 2007)).

Fig. 1: Steady-State Operations of Bank #1



Even a frictionless firm, however, retains the capacity for surprise. Assume that Bank #1 faces an extreme exogenous shock in Country B—an act of God, like a flood, which destroys the collateral backing much of its local assets. If Bank #1 had funded these assets wholly with equity, it would face no challenge in meeting its obligations to investors, since no such obligations would exist. Equity is a contingent right to the residual value of the firm issuing it; in a postdiluvian world, the value of that right may be lower, but Bank #1's shareholders would have no legal remedy to address this decline.[13] Even in the face of substantial losses, the Country B affiliate would remain well capitalized.

Fig. 2: Exogenous Shock in Country B, with Full Equity Funding



If Bank #1 instead funded these assets with deposits (a form of debt), then a loss would do nothing to diminish its financial obligation to its depositors.[14] To complicate matters, most of the bank's assets in Country B no longer have any value; to pay Country B depositors, Bank #1 would have to transfer liquid assets from Country A to Country B.[15]

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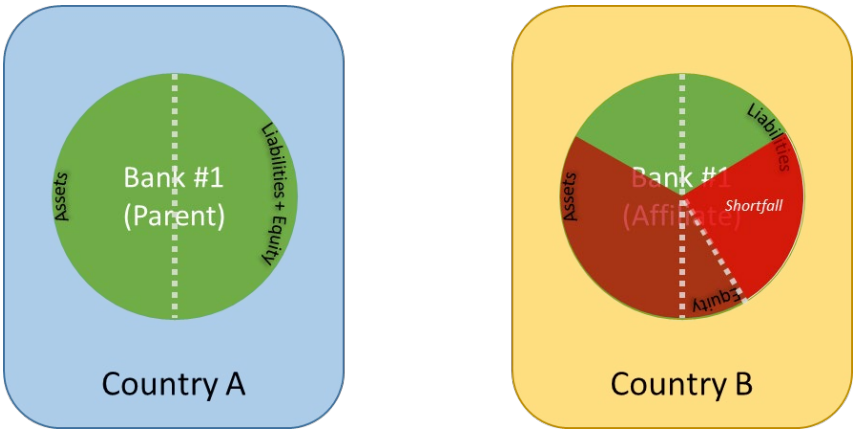
[13] *See* Financial Accounting Standards Board, Accounting Codification 505-10-05-3 ("Equity").

[14] *See, e.g.*, 12 U.S.C. 1813 (I) ("Deposit").

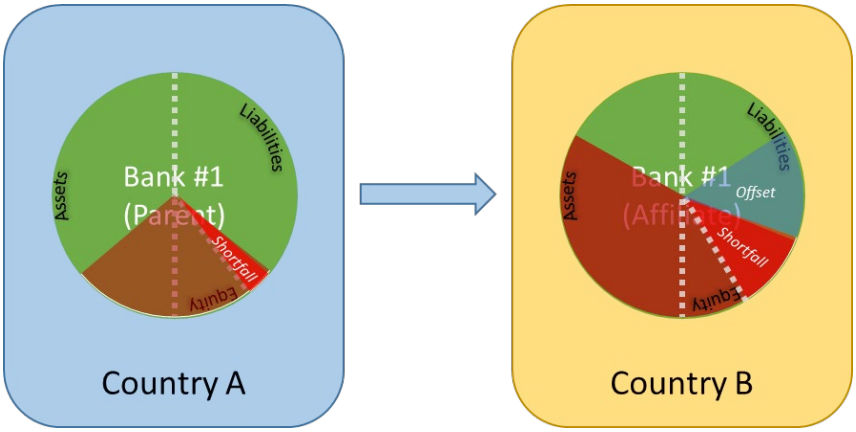
[15] For simplicity, this example focuses on a lack of adequate equity. In either country, however, a lack of liquid assets or a disproportionately short-term debt structure would create a similar dilemma. Sufficient levels of liquid assets would let the Country B affiliate satisfy creditor demands, without selling large volumes of assets at a loss, and long-term creditors could enforce immediate demands for liquidity in the first place. The same would be true at the Country A parent, at the point of transferring liquid assets to the Country B affiliate.

Fig. 3: Exogenous Shock in Country B, with Partial Equity Funding, Without Transfers



The parent thus faces a choice. One option, in a world of free capital flows, is to pay the debts of the Country B affiliate. Here, again, if the parent were funded fully from equity (and had liquid assets available), doing so would not impair its own solvency. However, in this example (and in most real-world banks), the parent also funds its own operations using both debt and equity instruments, the latter contingent and the former fixed. Depending on the balance of the two (and the size of the shock), a transfer could create a new shortfall in Country A, without filling the funding gap in Country B.

Fig. 4: Exogenous Shock in Country B, with A-to-B Transfer in Excess of Country A Equity



In theory, the parent also retains another option: to "walk away," defaulting on its obligations to Country B depositors and accepting the legal, reputational, or financial consequences.[16] However, even in a country with a legal regime that permits such an action—and with a legal-entity structure eligible for such a regime—cross-border financial institutions have compelling reasons to avoid taking it. An involuntary bail-in of depositors would typically qualify as a credit event, which could trigger rating-agency downgrades, the payment of credit-default swaps, and supervisory corrective action, not just for the Country B affiliate,

[16] *See* D. Wilson Ervin, "The Risky Business of Ring-Fencing" (2017), at 22 (discussing "conditions [under which] the group [would] be tempted to 'walk away' from the first (US) subsidiary and let it fail (if that was legally possible)," while noting such decisions are "fraught" and "extremely rare"). Our example is restricted to bankruptcy, for simplicity, but "walk-away" events could also encompass a range of other activities, including those not sanctioned by municipal law..

but also for the Country A parent. [17] Even short of a formal credit event, an exogenous shock confined to Country B could have substantial second-order effects in Country A—on Country A capital markets, for example, or the performance of Country A firms doing business in Country B—and formally abandoning the Country B affiliate is unlikely to prevent these effects. Banking institutions themselves have repeatedly emphasized the strength and durability of these concerns as a reason that walk-away is highly costly, if not unrealistic.[18] A cross-border bank, then, faces a strong incentive to honor its obligations, in whatever country or currency they may obtain.

C. "Ring-Fencing" and the Official Sector

The official sector, by contrast, faces a different set of stakeholders, incentives, obligations, and priorities. Like private institutions, central banks, banking supervisors, and finance ministries are creatures of municipal law and local governance, with conditions and duties imposed by those laws or actors. Unlike private institutions, however, they are public institutions, bound to satisfy obligations imposed by a domestic public. The long-term interests of different domestic publics align; countries are best served by a safe, sound, and stable financial system, with robust prudential standards that limit the possibility for arbitrage.[19] However, their short-term interests can conflict—for example, over which creditors, in which countries, can access a dwindling pool of internal liquidity.[20] These conflicts are often discussed in the context of sovereign debt, but they also occur in the context of private obligations. [21]

Assume, for example, that Country A and Country B each have one prudential supervisor with one responsibility: making sure that each country's banking institutions are solvent. (Assume also that the assets

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[17] *See, e.g.*, 12 U.S.C. § 1831o (U.S. "Prompt Corrective Action" framework). For a CDS primer, *see* Cecilia Caglio, R. Matthew Darst, and Eric Parolin, "A Look Under the Hood: How Banks Use Credit Default Swaps," FEDS Note, Board of Governors of the Federal Reserve System (Dec. 22, 2016).

[18] *See, e.g.* Ervin, *supra* note 16 at 11 ("[A]ny event that suggested that the group lacked the ability or the willingness to support a subsidiary would be regarded as a fundamental and potentially life-threatening issue"); Bank for International Settlements, *supra* note 7 at 31 ("most banks indicated, in bilateral interviews and at the roundtable, that, for reasons of signaling, it would be difficult to let go of a troubled subsidiary in times of global stress"); Independent Commission on Banking, "Final Report Recommendations" (Sep. 2011), at 63 ("Reputational links mean that it is likely that a ring-fenced bank would if possible be saved from failure by the rest of its corporate group if it got into difficulty").

[19] *See* Randal K. Quarles, "America's Vital Interest in Global Efforts to Promote Financial Stability," remarks at the Utah Bankers Association 110th Annual Convention, Sun Valley Inn, Sun Valley, Idaho (Jun. 27, 2018).

[20] For simplicity, the stylized example in this section refers to liquid assets held, both legally and physically, by a financial institution itself. As was the case in the 2008 financial crisis, however, a sudden and steep increase in the cost of short-term funding can have the same effect, given an excess reliance on such funding. *See* Gary B. Gorton and Andrew Metrick, "Securitized Banking and the Run on Repo," 104 J. Fin. Econ. 425 (2012).

[21] *See, e.g.*, Clifford Krauss, "Argentina Limits Withdrawals as Banks Near Collapse," *N.Y. Times* (Dec. 3, 2001) (discussing initial redemption limits imposed during broader currency crisis); Padma Desai, "Why Did the Ruble Collapse in 1998?" 90(2) *Amer. Econ. Rev.* 48 (May 2000) (discussing Aug. 17, 1998 "moratorium on payments by Russian commercial banks to foreign creditors"); Alan Riding, "Brazil to Suspend Interest Payments to Foreign Banks," *N.Y. Times* (Feb. 21, 1987); Michael Birnbaum, "Greece will close banks for 6 days, impose limits on withdrawals," *Wash. Post* (Jun. 28, 2015); Michael Birnbaum, "Cyprus bailout deal reached as long-term impact remains uncertain," *Wash. Post* (Mar. 25, 2013); David Enrich and Alessandra Galloni, "Turmoil Frays Ties Across Continent," *Wall St. J.* (May 31, 2012) (detailing 2012 regulatory restrictions on borrowing by Unicredit from German affiliate); Jonathan R. Macy, "Are Any Creditors 'Particularly Deserving'?: On the Enduring Attraction of the Ring-Fence Approach to Cross-Border Insolvencies of Financial Institutions," Yale Law School Faculty Scholarship Series #5266 (2014), at 711 (detailing U.S. actions regarding 1991 failure of Bank of Credit and Commerce International); Giacomo Calzolari, Jean-Edouard Colliard, and Gyöngi Lóránth, "Multinational Banks and Supranational Supervision," HEC Paris Research Paper No. FIN-2016-1152 (Jan. 12, 2017), at 2 (detailing cross-border resolutions involving UK and Icelandic banks).

of the parent and affiliate are both physically and legally located within their respective countries.) Given that responsibility, the Country B supervisor cannot tolerate the substantial shortfall pictured above in Fig. 3; to repay its creditors, the Country B affiliate requires a transfer of resources from its parent. At the same time, the Country A supervisor cannot tolerate the kind of transfer pictured above in Fig. 4; a large outflow of liquid assets to Country B would impair the solvency of the Country A parent. The relative levels of local capital and loss—in both home and host jurisdictions—have turned a positive-sum game into a zero-sum one: To satisfy its mandate, each supervisor has a strong incentive to "ring-fence" the assets currently within its own jurisdiction, preventing their transfer to the other entity.

In the real world, this incentive begs a second, surprisingly complicated question: Where are these assets actually located? Even in a world with only bilateral capital flows, the issue of currency complicates the situation. The Country B affiliate might hold cash in Country A currency—but that cash might reside in the Country A parent's account at the Country A central bank, or in the account of a third-party counterpart in Country B, with its own Country A central bank account. The Country A parent might own title to a Country A bond—but that bond might reside in a third-party Country B custody account, which itself has an account at a Country A bank, which is ultimately deposited at the Country A central bank. Any attempt to "ring-fence" one of these assets is unlikely to pass without dispute, causing uncertainty and confusion when Bank #1's creditors, investors, and supervisors can least tolerate it.

In limited circumstances, and under limited market stress, the economic consequences of such ring-fencing actions may also be limited, since the counterparties to the ring-fenced bank have access to other private sources of financing. But in a major shock, short-term funding markets can dry up quickly.[22] When they do, the rapid and near-total retreat of cross-border funding flows can be one of the first and most dramatic consequences. When such a withdrawal occurs, an institution's losses and the resources to absorb them may be scattered across different jurisdictions—leaving the institution, and its supervisors, with no choice but to trigger a disorderly "multiple-point-of-entry" resolution.[23]

The 2008 financial crisis showed exactly how such a retreat can occur. Internal capital markets were a critical channel for cross-border financial activity through the early 2000s, yet the funding that ran through those channels proved highly elastic.[24] As funding stress mounted, gross capital flows plummeted as a percentage of world GDP, even as world GDP itself began to collapse.[25] Foreign affiliates of financial

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[22] *See, e.g.*, Daniel Covitz, Nellie Liang, and Gustavo Suarez, "The Evolution of a Financial Crisis: Panic in the Asset-Backed Commercial Paper Market," FEDS Note 2009-36, Board of Governors of the Federal Reserve (Aug. 18, 2009) (detailing $350 billion contraction in ABCP in 2007); Naohiko Baba, "From turmoil to crisis: Dislocations in the FX swap market before and after the failure of Lehman Brothers," 28(8) *J. Int'l. Money and Fin.* 1350, 1356 (Dec. 2009) (detailing up to 1000 percent increase in bid-ask spreads on foreign exchange swaps in 2008).

[23] For this reason, some argue that it is critical to take banks' geographic structure into account as a part of any stress-testing exercise. *See, e.g.*, Eugenio Cerutti and Christian Schmeider, "Ring fencing and consolidated banks' stress tests," 11 *J. of Fin. Stability* 1 (Apr. 2014) (showing how "ring-fencing" behavior in the non-EU operations of EU banking groups could "trigger up to 3% of new Core Tier I capital needs").

[24] This elasticity was particularly evident after the opening of central bank swap lines, when central banks replaced host-country affiliates as the principal conduit for cross-border official-sector liquidity. *See* Bank of International Settlements, *supra* note 7 at 18 (citing Patrick McGuire and Goetz von Peter, "The US dollar shortage in global banking and the international policy response," BIS Working Paper No. 291 (Oct. 14, 2009) at 18). For analysis specifically on the role of U.S. branches of non-U.S. banking organizations in channeling funding outside the U.S., see Nicola Cetorelli and Linda Goldberg, "Banking globalization and monetary transmission," 5 *J. of Fin.* 1811 (2012) (documenting the role of such internal capital markets at large global banks during 25-year sample period).

[25] In the United States, for example, while net inflows fell by $20 billion, gross inflows decreased by $1,600 billion. Claudio Boro and Piti Disyatat, "Global imbalances and the financial crisis: Link or no link?" BIS Working Paper No. 346 (May 2011), at 14, 15. Within the euro area, gross cross-border bilateral flows (public and private) fell from

institutions intended as a release valve instead became a conduit for strain, restricting both lending and interbank credit.[26] The abrupt withdrawal of local funding became a new problem in its own right, spreading funding stress even to local institutions far from the epicenter of the mortgage crisis.[27] This pattern unfolded despite extraordinary official-sector cooperation and support, some forms of which central banks and finance ministries are now restricted in providing.[28] A similar pattern recurred in the eurozone crisis in 2011, with U.S. branches of euro-area banks experiencing a wholesale funding run, and responding by cutting lending to host-country firms.[29]

Especially given these post-crisis restrictions, intra-bank capital and liquidity levels play a pivotal role in preventing destabilizing disputes among national supervisors. Higher capital levels in Country B can eliminate the need for a transfer of equity or liquid assets from Country A, and higher capital levels in Country A can allow a transfer to the Country B affiliate without creating a second shortfall. Higher liquidity levels in Country B can extend the time-horizon for meeting creditor demands, letting the Country A parent or Country B affiliate find alternative sources of funding (or, at minimum, to forestall a run).

D. Mutuality of Exposures: Cancellation, Retaliation, and Signaling

Critically, mutuality of exposures can also provide a "cancellable" buffer when an intracompany transfer is necessary, either in the form of ready equity or patient debt. Take, for instance, the example in Fig. 4, where the Country A parent of Bank #1 ultimately provides liquid assets to a group of Country B creditors via the Country B affiliate. If these creditors are third parties, then to effect the transfer, the assets must both leave the bounds of Bank #1 and cross country lines. However, if the parent is itself a creditor to the affiliate, no cross-border transfer of assets is necessary to offset the Country B losses. Instead, the affiliate may be able to cancel, restructure, or simply defer payment on the debt to the parent—and with its own solvency at risk, the parent may be a more patient creditor than a third party would be.

This combination of equity and patient debt effectively multiplies the "total loss-absorbing capacity" (TLAC) of the parent.[30] Short of a write-down, the affiliate is less likely to face a call on its debt, and in the event of a write-down, the inter-affiliate debt and equity can both offset the affiliate's losses. The former

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roughly $1,400 billion to less than zero. Alexandr Hobza and Stefan Zeugner, "The 'imbalanced balance' and its unravelling: current accounts and bilateral financial flows in the euro area," European Commission Economic Papers No. 520 (Jul. 2014), at 13.

[26] Cetorelli and Goldberg, *supra* note 24 at 1 (providing "direct evidence that internal capital markets are active in global banks and contribute to the international propagation of shocks"); Nicola Cetorelli and Linda S. Goldberg, "Global Banks and International Shock Transmission: Evidence from the Crisis," NBER Working Paper No. 15974 (May 2010); Bryan Hardy, "Emerging markets' reliance on foreign bank credit," BIS Quarterly Review (Mar. 2019), at 15 (describing foreign banks as providing "a conduit for the transmission of financial conditions to (and from) EMEs"); *see also* Ricardo Correa, Linda Goldberg, and Tara Rice, "Liquidity Risk and U.S. Bank Lending at Home and Abroad," International Finance Discussion Papers No. 1105, Board of Governors of the Federal Reserve System (May 29, 2014), at 4 (showing that "differences in the transmission of liquidity risk into lending across global banks are more strongly associated with their organizational liquidity management strategies, as reflected in outstanding internal borrowing or lending with the rest of their organization").

[27] *Id.*

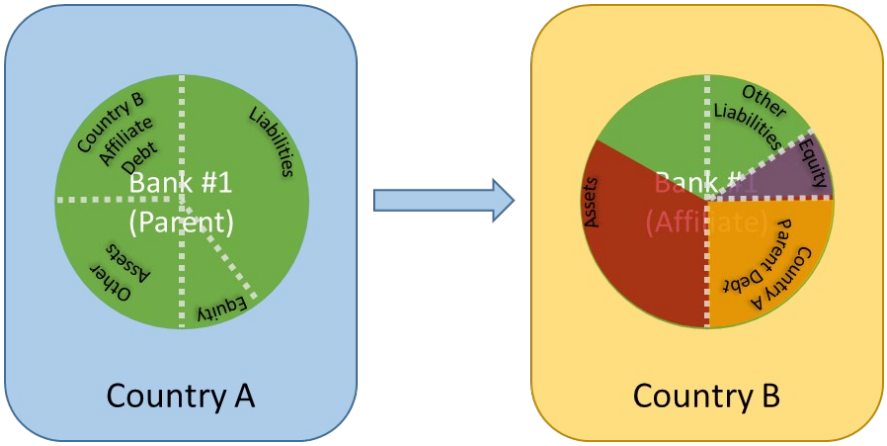
[28] "Managing the Next Financial Crisis: An Assessment of Emergency Arrangements in the Major Economies," Group of Thirty (Sep. 2018).

[29] Ricardo Correa, Horacio Sapriza, and Andrei Zlate, "Wholesale funding runs, global banks' supply of liquidity insurance, and corporate investment," 133 *J. Int'l. Econ.* 103519 (Nov. 2021).

[30] *See* Financial Stability Board, "Principles on Loss-absorbing and Recapitalisation Capacity of G-SIBs in Resolution and Total Loss-absorbing Capacity Term Sheet" (Nov. 9. 2015); *see also* Financial Stability Board, "Guiding Principles on the Internal Total Loss-Absorbing Capacity of G-SIBs ('Internal TLAC')," news release (Jul. 6, 2017).

relieves stress on the affiliate; the latter relieves the regulator of immediate concerns about the parent's solvency due to the affiliate's losses.

Fig. 5: Exogenous Shock in Country B, with Internal Loss Absorption



TLAC also fosters supervisory cooperation through another channel: the possibility of mutual discipline. To see how it does so, we must relax three assumptions in the example above.

The first and most critical is **time**. Above, we assumed that supervisors acted simultaneously. However, institutions, supervisors, and other national authorities interact in the global financial system repeatedly and over time; they have the capacity to signal cooperation or defection, to reward the former or deter the latter. If the Country A supervisor prevents the Country B institution from accessing local resources when needed—and thus prevents the Country B supervisor from satisfying its official mandate—the Country B supervisor can do the same in the future, when the balance of exigencies changes.

The second assumption is the coincidence of legal and physical custody of assets, and the **balance of cross-border funding**. Above, just two cross-border claims were enough to create the incentives for a supervisory conflict: the parent's claim on the affiliate's assets, and the affiliate's claim on the parent's support. As such, we did not specify how much funding Bank #1 receives from Country A or Country B. However, a balance of claims—even within a single hypothetical institution—can reduce or eliminate the incentive for ring-fencing altogether.

Assume, for example, that the Country A assets of Bank #1 are funded by Country B liabilities, and vice versa—in other words, all Bank #1 funding crosses a border before being put to use. If the Country A regulator suspends the claims of creditors in Country B, the Country B regulator could suspend the claims of creditors in Country A, either simultaneously or in a future period. As the relative level of foreign assets in each jurisdiction grows, so does that jurisdiction's capacity for mutual discipline.[31] (The same dynamic exists when there is a balance of funding between the financial sectors of two *countries*, no matter the number of institutions involved, as Fig. 7 shows.[32])

[31] Bolton and Oehmke, *supra* note 5 at 19-20 (discussing "ex ante incentive compatible" nature of single-point-of-entry resolution regime only if "probabilities of making and receiving transfers are sufficiently symmetric" and "cash flows in each jurisdiction are sufficiently symmetric").

[32] *See, e.g.*, Stefan Avdjev, Robert N. McCauley, and Hyun Song Shin, "Breaking free of the triple coincidence in international finance," BIS Working Paper No. 524 (Oct. 2015) at 13 (picturing gross cross-border bank claims by regions).

Fig. 6: Balanced 100 Percent Cross-Border Funding of Assets

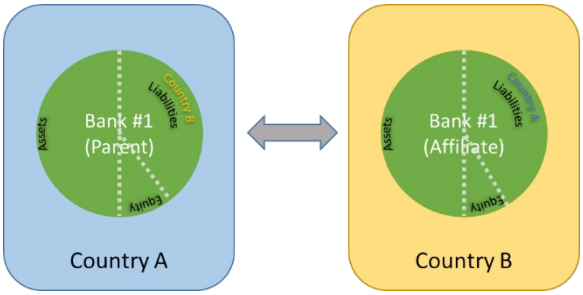
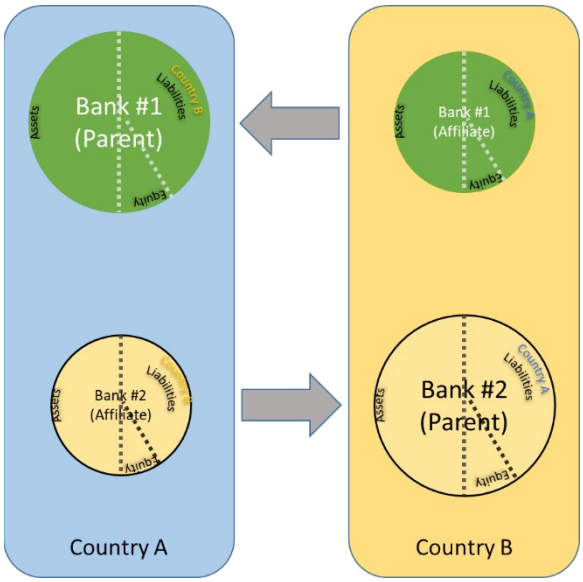


Fig. 7: Balanced Cross-Border Funding at Sector-Level, with Imbalanced Cross-Border Funding at Institution-Level



The third assumption is the lack of spillover effects from an exogenous shock, and the **synchronicity of stress**.[33] Above, the losses in Country B were unaccompanied by losses in Country A. In reality, however, this assumption is frequently violated, creating simultaneous needs at distinct institutions. Take, for example, the two large parent institutions with smaller overseas affiliates, pictured in Fig. 7. If Country B experiences a shock, the smaller Bank #1 affiliate may need a transfer of resources from Country A, while the larger Bank #1 parent may not. However, if a portion of the same shock also affects Country A, the smaller Bank #2 affiliate there may require a transfer of resources as well. If so, both affiliates will need simultaneous support from their parents—and if one is blocked, the other could be as well.

Part II. Pre-Positioning and Ring-Fencing in an Official-Sector Game

The importance of these assumptions becomes clear when official-sector interaction is modeled as a game. Several academic papers have used such an approach to explore the optimal capital structure of financial institutions, but those papers differ in their choice of actor, time frame, and objective function.[34] However, even a simple stage game can demonstrate the underlying dynamics, revealing how different levels of pre-positioning can create—or curtail—the conditions for cooperation under stress.

A. Parameters

This game has two **players**: the official sectors of Countries A and B, including, but not limited to, central banks, supervisors, and finance ministries, A and B are both home and host jurisdictions, housing domestic

[33] Relaxation of this assumption is also borne out by historic experience, as both real and financial channels can act as conduits for synchronous declines in economic activity. *See* Richard Baldwin, "The great trade collapse: What caused it and what does it mean?" *VoxEU* (Nov. 27, 2009).

[34] *See* Bolton and Oehmke, *supra* note 5; Ervin, *supra* note 16; Calzolari, Colliard, and Lóránth, *supra* note 21; Faia and di Mauro, *supra* note 41.

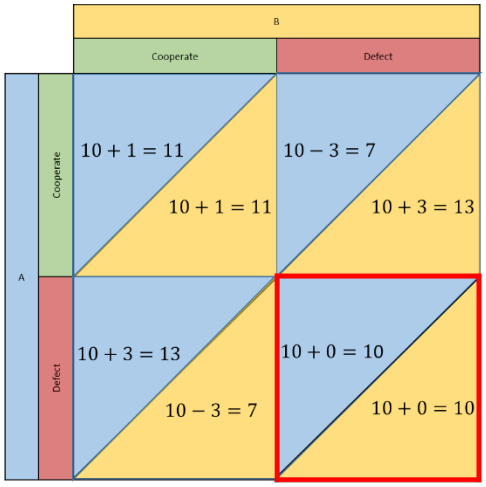
parents with foreign affiliates and the domestic affiliates of foreign parents. These parent and affiliate institutions are of equal size.

Each player acts rationally to maximize an **objective function**, goal, or mandate. There are several plausible candidates for this function among the wide range of domestic supervisory mandates, including ensuring solvency, minimizing domestic losses, and avoiding public-sector support. For simplicity, we assume A and B seek to maximize financial resources legally and physically available in country, as a loose proxy of both credit availability and domestic utility.

A and B's participation in the global financial system is a cooperative endeavor, requiring each authority to expend effort on monitoring and other supervisory activities. We assume this cooperation produces net benefits, like greater access to liquidity and returns to scale, which increase welfare within and among their jurisdictions. Cooperation, therefore, is the Pareto-efficient **strategy**. However, as above, each authority retains another option: to defect—to seize, or ring-fence, the resources located in its jurisdiction, belonging to the other country's financial institutions or customers. In a single-stage, simultaneous game, neither player can punish the other for doing so; the defector gains additional resources, in the form of increased credit, without bearing any cost.

A simple hypothetical payoff table demonstrates the problem that this defection strategy creates. If the private gains from cooperation are sufficiently small, then each authority has an incentive to ring-fence; doing so leads to a larger payoff, no matter which strategy the other country chooses, but a reduction in the overall quantity of credit. The result is a "prisoner's dilemma," in which mutual defection is the sole equilibrium.[35]

Fig. 8: Steady-State Ring-Fencing Prisoner's Dilemma



B. *Discounting and Cooperation*

If ring-fencing is privately optimal, why is it not ubiquitous, even under normal market conditions? The answer lies in the first assumption listed above: time. The interaction between official sectors (and financial institutions) is a repeated game, introducing two changes to each sector's objective function.

- First, later payoffs are discounted; the more urgent the situation, the higher the discount rate (and lower the discount factor), and the less valuable future payoffs are. (With a 50 percent discount rate,

[35] *See also* Ervin (2017) *supra* note 16 at 4 (identifying a "jurisdictional 'prisoner's' dilemma, absent model component).

for example, the discount factor will also be 50 percent; a payoff is worth twice as much in the current period as in the following period. With a zero percent discount rate, the discount factor is 1, and a player is indifferent between receiving a payoff now or in a future period.)

- Second, each sector can respond in future rounds to actions taken in the early rounds, giving it the capacity to reward cooperation and punish defection.

In principle, games between official sectors have an infinite duration. As a result, each player's net payoff is the sum of the converging geometric series of stage payoffs:

$$Net\ Payoff = (1-\delta)\sum_{t=0}^{\infty}\delta_i^t\,\rho_{it}$$

where δ represents the discount factor, $(1-\delta)$ the discount rate, and ρ the payoff of player i in period t.[36]

Any multi-stage game is iterative; each player can commit to a strategy that affects the other player's subsequent payoffs. With a "grim-trigger" strategy, if A defects in a round, B will defect in every subsequent stage; with a "tit for tat" strategy, A will defect only if B defected in the previous stage.

Together, discount factors and payoffs determine whether cooperation is sustainable. Using a grim-trigger strategy, for example, A would secure one payoff of 13 in Fig. 8, but would see payoffs reduced to 10 in all subsequent periods. For that strategy to be worthwhile, A would have to value the payoff today much more than future payoffs. To sustain cooperation, then, A's discount factor would have to exceed a fixed level:

$$(1-\delta)\sum_{t=0}^{\infty}(\delta_i^t * 11) \geq (1-\delta)\left[13+\sum_{t=0}^{\infty}(\delta_i^t * 10)\right]$$

$$11\sum_{t=0}^{\infty}(\delta_i^t) \geq 13 + 10\sum_{t=0}^{\infty}(\delta_i^t)$$

$$\frac{11}{1-\delta_i} \geq 13 + \frac{10}{1-\delta_i}$$

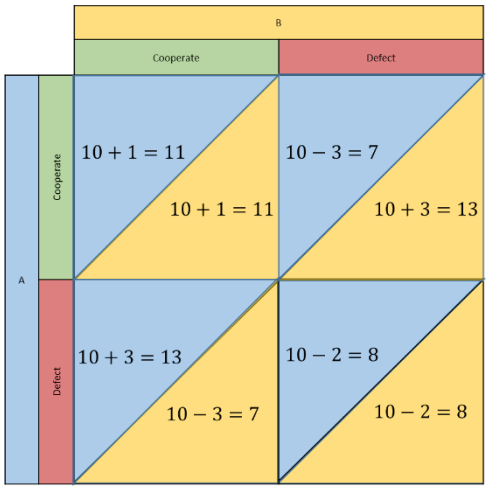
$$\frac{1}{1-\delta_i} \geq 13$$

$$\delta_i \geq \frac{12}{13} \approx 0.92$$

If Country A is sufficiently patient, then, Countries A and B can cooperate indefinitely. Greater gains from cooperation—or losses from defection—can make such cooperation easier to sustain. In the example below, if a defector's future payoff falls from 10 to 8, the required discount factor for cooperation also falls, allowing cooperation with greater "impatience."

[36] Adapted from Carlos Hurtado, "Infinitely Repeated Games," U. of Illinois at Urbana-Champaign (June 12, 2015).

Fig. 9: Cooperative-Equilibrium Discount Factor with Reduced {D,D} Payoffs



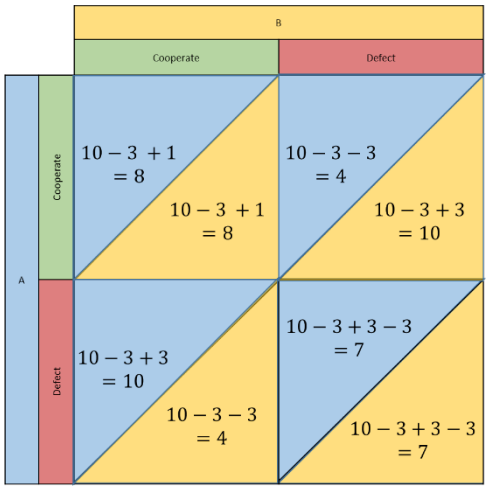
$$(1-\delta)\sum_{t=0}^{\infty}(\delta_i^t * 11) \geq (1-\delta)\left[13 + \sum_{t=0}^{\infty}(\delta_i^t * 8)\right]$$

$$\frac{11}{1-\delta_i} \geq 13 + \frac{8}{1-\delta_i}$$

$$\delta_i \geq \frac{10}{13} \approx 0.76$$

An economic shock, however, can offset these gains—particularly, as in the final assumption detailed above, when the shock affects both players simultaneously. For example, assume that A and B experience an exogenous and permanent shock of 3, roughly proportional to the decline in U.S. home prices in during the 2008 crisis.[37] In response, each country seeks to withdraw 20 percent of its resources from the other jurisdiction (above the mean branch-parent exposure detailed in Cetorelli and Goldberg (2012), but well below the maximum).[38] Each of A or B can either cooperate by allowing this withdrawal, or it can defect by prohibiting the withdrawal. If both official sectors cooperate, they preserve the domestic welfare gains from cross-border banking activity; if they defect, they receive a one-time payoff but face a grim-trigger strategy from the other player.

Fig. 10: Required Discount Factor for Cooperative Equilibrium, Infinite Game, Exogenous Shock, Grim Trigger



$$(1-\delta)\sum_{t=0}^{\infty}(\delta_i^t * 8) \geq (1-\delta)\left[10 + \sum_{t=0}^{\infty}(\delta_i^t * 7)\right]$$

$$\frac{8}{1-\delta_i} \geq 10 + \frac{7}{1-\delta_i}$$

$$\delta_i \geq \frac{9}{10} = 0.90$$

[37] Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, *Firefighting: The Financial Crisis and Its Lessons* (2019), at 219 (using Case-Shiller Home Price Index data).

[38] Nicola Cetorelli and Linda S. Goldberg, "Follow the Money: Quantifying Domestic Effects of Foreign Bank Shocks in the Great Recession," 102(3) *Am. Econ. Rev.* 213, 217 (2012) (finding that U.S. branch of a foreign banking organization with mean $2.8 billion of internal balance conducts 12 percent internal funding "withdrawal" in response to a home-country financial shock, corresponding to a 50 percent reduction in credit extended in the foreign jurisdiction).

Sustaining cooperation in this payoff structure requires almost the same discount factor as the single-stage game; in effect, each country must *increase* its tolerance for near-term domestic losses, precisely when it faces a growing domestic need for resources. In reality, crisis conditions make the opposite much more likely; as supervised institutions face potential insolvency, even a patient supervisor may have a reduced ability to forbear.[39] As these parties' discount factor approaches zero, future payoffs become irrelevant; the game itself collapses into a single stage, eliminating the possibility of sustained cooperation.

C. Pre-Positioning and Payoff Structures

How can authorities preserve cooperation when discount factors plummet, as the natural urgency of a crisis takes hold? If authorities cannot raise their discount factors, they can still commit in advance to a different payoff structure, in two ways: by increasing the gains, or reducing the risk-adjusted costs, of cooperation; and by reducing the gains, and increasing the costs, of defection. Pre-positioning affects cooperation through both of these channels.

First, pre-positioning can act as an investment-backed **signal of compliance** with international regulatory and supervisory standards, particularly around resolution. The pre-positioning of TLAC remains a cornerstone of post-crisis recovery and resolution reforms, largely because of its mechanical function in the event of insolvency. However, with adequate, verifiable disclosure, pre-positioning requirements can also be a down payment on cooperation in the event of market stress. No free commitment can be credible, and minimum levels of TLAC do impose costs, by keeping firms from obtaining funding from only the cheapest possible source, and by requiring firms to carefully match their assets and liabilities across jurisdictions. In the process, however, pre-positioning also signals the investment-backed willingness of both an institution and its supervisor to offset losses as required, and to avoid a competitive grab for liquidity.

Second, and as a result, pre-positioning can **reduce costs** associated with participating in cross-border financial activity.[40] Substituted compliance regimes require domestic supervisors to develop deep expertise in the laws, practices, and structures of foreign banking systems, sometimes dozens at a time. Even with such expertise and full cooperation from home-country supervisors, visibility into the activities of a foreign institution can remain limited. Pre-positioning requirements can act as a backstop, simplifying and reducing the cost of host-country supervision, and ensuring a minimum level of loss absorbency if prudential oversight falls short. As such, by improving monitoring and reducing expected losses in the event of stress, pre-positioning requirements can also increase the quantity of cross-border financial activity, and reduce market fragmentation.[41]

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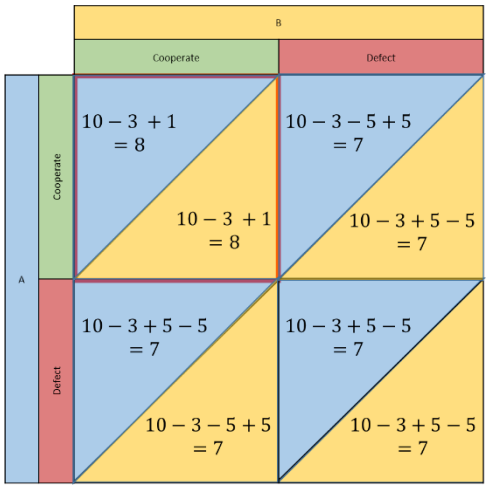
[39] *See* Nicholas K. Tabor, "Trust But Verify: Domestic Politics and International Coordination in U.S. Post-Crisis Financial Regulatory Policy," 39 *U. Pa. J. In'tl. L.* 889 (2018). For further discussion of the Odyssean analogy, *see*, *e.g.*, Charles L. Evans, Jonas D.M. Fisher, Alejandro Justiniano, and Jeffrey R. Campbell, "Macroeconomic Effects of FOMC Forward Guidance," 43(1) *Brookings Papers on Econ. Activity* 1 (Spring 2012); Peter Conti-Brown, "Ulysses and the Punch Bowl: The Governance, Accountability, and Independence of the Federal Reserve," 24 *Geo. Mason L. Rev.* 617 (2017).

[40] *See* Financial Stability Board (2017), *supra* note 30 at 1 (noting how the local presence of TLAC "diminish[es] any incentives on the part of host authorities to ring-fence assets domestically, either ex ante or ex post in a resolution, and thereby avoid[s] the adverse consequences of such actions, including global fragmentation of the financial system. . . ."); Calzolari, Colliard, and Lóránth, *supra* note 21 at 26 (noting that common cross-border monitoring is "easier for two countries . . . if MNBs [multi-national banks] are more symmetrically distributed").

[41] *See, e.g.*, Ester Faia and Beatrice Weder di Mauro, "Cross-Border Resolution of Global Banks," Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute Working Paper No. 236 (May 2015) (showing how non-cooperative resolution regimes "discourage banks (ex ante) from engaging in cross-border activity"); *see also* Calzolari, Colliard, and Lóránth, *supra* note 21 (showing that selection into branch structures decreases overall monitoring activity by regulators).

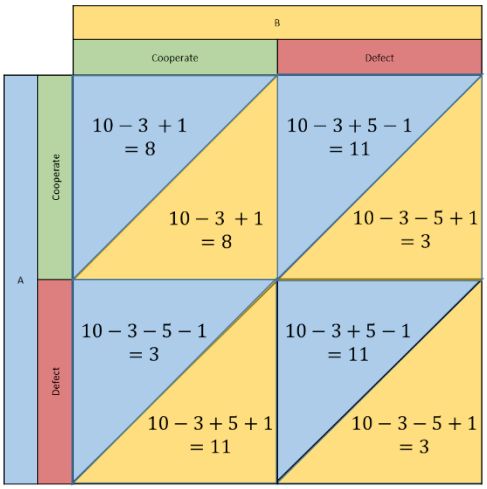
Third, as described above, pre-positioned resources can increase a country's capacity for **mutual discipline**, by reducing the immediate gains from ring-fencing. For example, assume that A and B defaulted to a single-stage game, but retained the capacity to respond to any ring-fencing conduct immediately, automatically, and in kind. If authorities in Country A took actions to reduce Country B credit by 50 percent (as Cetorelli and Goldberg (2012) suggests[42]), Country B could do the same, eliminating entirely any initial gains from defection. In Fig. 11, this pre-positioning arrangement changes cooperation to the weakly dominant strategy for both parties.

Fig. 11: Weakly Dominant Cooperative Equilibrium with Symmetric Pre-Positioning, Infinite Game ($\delta = 0$), Exogenous Shock



By contrast, when this symmetry of pre-positioning disappears, so does the cooperative equilibrium. Assume instead that Countries A and B have banking sectors of equal size, but while 50 percent of Country B's resources are located in Country A, only 10 percent of Country A's assets are located in Country B. As a result, Country A's capacity to ring-fence is much greater than Country B's, giving Country A strong incentive to defect.

Fig. 12: Weakly Dominant Defective Equilibrium with Asymmetric Pre-Positioning, Infinite Game ($\delta = 0$), Exogenous Shock



[42] Cetorelli and Goldberg, *supra* note 38.

Conclusion: Regulatory Implications

A. Capital's Role in Preventing Ring-Fencing

Even this simplified model has some lessons for regulatory design. The first and clearest is the overriding importance of adequate capital, both within a jurisdiction and at a cross-border financial institution. In both places, appropriate levels of truly contingent funding arrangements can stop a competitive scramble for resources before it starts. Given the broad lack of local capital requirements at branch-like structures—and the growing role of foreign branches in cross-border banking activity, discussed below—this observation also has implications for the structure of cross-border financial institutions.

Importantly, capital also supports the rebuilding of cross-border financial ties after a crisis, an effect visible long after the crisis itself has passed. Banking systems with higher levels of capital before the 2008 financial crisis engaged in more lending afterwards, a manifestation of the well-demonstrated effects of capital on business resilience.[43] Entering the COVID event, better-capitalized systems represent a higher share of post-crisis international lending and are less sensitive to foreign monetary shocks.[44] By contrast, institutions from less well-capitalized banking systems responded to crisis losses by withdrawing resources to their home country and reducing foreign lending.[45] This retrenchment accounts for almost the entire post-crisis decline in cross-border banking assets—the retreat from "peak finance" into a more fragmented banking system.[46]

Importantly, a "more fragmented" banking system is not the same as a "fragmented" banking system, and "banking fragmentation" is not identical to "financial fragmentation." A look at the post-crisis, pre-COVID state of cross-border financial activity clarifies the distinction: Overall cross-border banking assets fell from roughly 60 percent of global GDP in 2007 to roughly 40 percent in 2017.[47] However, cross-border bond financing exhibited a much less pronounced tapering, and in fact increased substantially after the crisis, largely in response to increases in official-sector liquidity.[48] As a result, it rose from roughly 36 to 44 percent of global liquidity; relative to GDP, overall liquidity from both sources was at roughly 2004 levels before COVID began.[49] Cross-border financial flows are still substantial, and the financial system is still global—offering benefits and posing risks to the institutions, financial and non-financial, that participate in it.

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[43] Stefan Avdjiev, Leonardo Gambacorta, Linda S. Goldberg, and Stefano Schiaffi, "The shifting drivers of global liquidity," BIS Working Papers No. 644 (June 2017); *see also* [contagion notes]

[44] Avdjiev et al., *supra* note 43 at 3; Cetorelli and Goldberg, *supra* note 42.

[45] Robert N. McCauley, Agustín S. Bénétrix, Patrick M. McGuire, and Goetz von Peter, "Financial deglobalisation in banking?" BIS Working Papers No. 650 (June 2017), at 1. This reaction was by no means specific to the financial crisis, but the magnitude of the home-country retreat is closely related to the capitalization of the cross-border entity; *see* Correa et al, *supra* note 26.

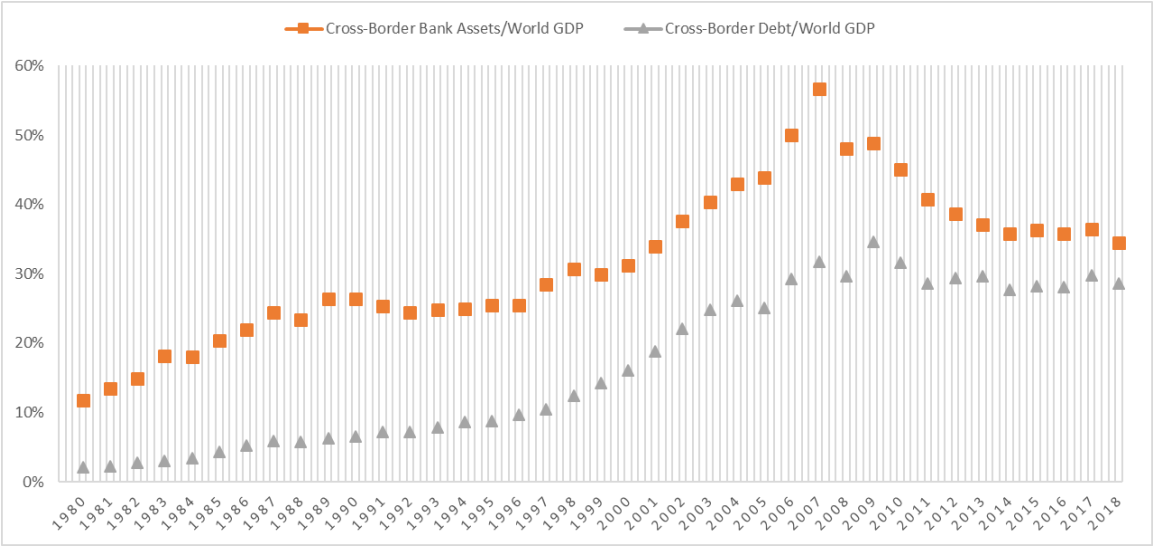
[46] McCauley, *supra* note 45 at 1 (citing Jaime Caruana, "Have we passed 'peak finance'?", lecture at the International Center for Monetary and Banking Studies, Geneva (Feb. 28, 2017)).

[47] *Id.*

[48] *See* Hyun Song Shin, "The Second Phase of Global Liquidity and Its Impact on Emerging Economies," evening keynote address to Federal Reserve Bank of San Francisco Asia Economic Policy Conference: Prospects for Asia and the Global Economy (2013).

[49] Definition of global liquidity comes from Avdjiev et al., *supra* note 43.

Fig. 13: Global Cross-Border Banking Assets and International Debt Securities as Percentage of World GDP, Pre-COVID-19. Adapted from McCauley et al., supra *note 45. Sources: IMF (GDP, current prices); BIS (International Banking Statistics and International Debt Securities Statistics, World).*



B. The Uneven Costs of Market Fragmentation

Our simplified model also shows that such benefits and risks are not borne evenly. In the abstract, the greater the disparity in the location of resources between jurisdictions, the lower the potential for cooperation in the event of stress. The pre-positioning of resources can encourage cooperation by reducing this disparity. However, absolute levels of cross-border assets also matter—making it even more critical in banking relationships between smaller and larger jurisdictions.

If two countries have a significant volume of cross-border banking assets, then even a sizable disparity in those assets will still likely allow for cooperation. For example, assume that the cross-border assets located in Country A (and belonging to Country B) equal 80 percent of Country A GDP, and the cross-border assets located in Country B (belonging to Country A) equal 90% of Country B GDP. Country B has a 10-point "margin" over Country A and, in theory, can more than reciprocate any ring-fencing action that Country B takes. In reality, though, a substantial ring-fencing action would create uncertainty, at home and abroad, over title to a significant portion of Country B banking assets, creating costs that even their "margin" is unlikely to cover.[50]

The same, however, cannot be said for smaller jurisdictions engaged with larger ones. Assume that Country A is a large financial-center jurisdiction, while Country B is an emerging market economy (EME). Even if the two have perfectly equal levels of cross-border assets in each jurisdiction (say, $10 billion Country B assets in Country A, and vice-versa), the overseas assets of Country B are a much larger portion of its GDP (and, in rough proportion, of its financial sector). Even if Country B were to impose complete capital

[50] This point—the importance of absolute, rather than simply relative, numbers in preserving economic interactions between large jurisdictions—echoes the gravity literature in international trade, which has been shown to have parallels in financial services. *See, e.g.*, Michael Brei and Goetz von Peter, "The Distance Effect in Banking and Trade," BIS Working Papers No. 658 (Aug. 2017) (citing, as background, Keith Head and Thierry Mayer, "Gravity Equations: Workhorse, Tookit, and Cookbook," in Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, eds., 4 *Handbook of Int'l. Econ.* 131 (2014).

controls on its locally held Country A banking assets, the relative value of those assets to Country A might be too low to act as a deterrent against ring-fencing.

This dilemma is not purely academic. Cross-border banking activity is highly concentrated among large economies, with 55 percent of cross-border credit passing between just five jurisdictions (France, Germany, Japan, the United Kingdom, and the United States).[51] However, EMEs still rely heavily on concentrated sources of cross-border lending.[52] Foreign banking organizations extend 15 to 20 percent of their credit to emerging markets, and a growing proportion of that credit goes to the real economy, rather than other financial institutions.[53] Critically, since 2008, a growing amount of this activity has taken place through branches, not subsidiaries, where lighter capital and liquidity requirements can increase incentives for the larger jurisdiction to ring-fence.[54]

There are valid, even necessary reasons why some EMEs rely more heavily on branch activity by foreign banks.[55] Historical "lending branches" offered a channel for foreign direct investment—and "funding branches," for the investment of excess local resources—when local financial infrastructure was lacking. However, the above exercise suggests there are strong reasons to avoid such an arrangement, which extend beyond the simple possibility of undercapitalization. Prolonged reliance on cross-border branches can incentivize ring-fencing behavior by large jurisdictions, and with it, deeper fragmentation of banking markets in the event of stress. EMEs tend to bear the brunt of this fragmentation, in the form of less domestic credit, lower output, and higher unemployment. Only large-financial-market jurisdictions can credibly take the lead in addressing this asymmetry, and in fostering conditions where ring-fencing—and the welfare losses associated with it—are least likely to occur.[56]

C. Pre-Positioning and Optimal Contract Design

Several elements of the post-crisis regulatory framework reflect these lessons about the conditions for regulatory cooperation. The Financial Stability Board and Standard-Setting Bodies have established standards for loss-absorbency at large cross-border financial institutions.[57] These standards, which jurisdictions have begun to implement, can facilitate domestic oversight of foreign banks, provide adequate resources in the event of resolution, and offer enough certainty to prevent disruptive ring-fencing actions.

The calibration of pre-positioning requirements, however, remains an active area of regulatory and economic study. Our model is a reminder that this calibration is, at heart, a question of contract design. It must not only be socially optimal; as a threshold matter, it must also be privately efficient for each

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[51] Iñaki Aldasoro and Torsten Ehlers, "Concentration in cross-border banking," BIS Quarterly Review (June 2019), at 5.
[52] Hardy, *supra* note 26 at 23.
[53] *Id.* at 5; Hardy, *supra* note 26 at 15.
[54] *See, e.g.*, Iñaki Aldasoro, Torsten Ehlers, Patrick McGuire, and Goetz von Peter, "Global banks' dollar funding needs and central bank swap lines," BIS Bulletin No. 27 (Jul. 16, 2020); Iñaki Aldasoro and Torsten Ehlers, "The geography of dollar funding of non-US banks," BIS Quarterly Review (Dec. 2018), at 16.
[55] *See* Eugenio Cerutti, Giovanni Dell'Ariccia, and Maria Soledad Martínez Pería, "How banks go abroad: Branches or subsidiaries?" 31 *J. of Banking and Fin.* 1669 (2007).
[56] *See also* Mark Carney, "The Growing Challenges for Monetary Policy in the current International Monetary and Financial System," speech given at the Jackson Hole Symposium, Jackson Hole, WY (Aug. 23, 2019) at 11 (detailing importance of "building resilience of their banks" and "deepening their domestic capital markets" as steps to "increase sustainable capital flows" among EMEs, and noting "the interests of advanced economies" in the "local financial stability" of EMEs [emphasis in original]).
[57] *See* Financial Stability Board, "FSB issues final Total Loss-Absorbing Capacity standard for global systemically important banks," news release (Nov. 9, 2015); Financial Stability Board, "FSB publishes review of TLAC Standard," news release (July 2, 2019).

jurisdiction and official sector that participates in it. In short, pre-positioning requirements must simultaneously **induce participation**, **sustain cooperation**, and **prevent defection** in the event of stress.

The decision to participate or withdraw from cross-border financial activity is vastly overdetermined. For discussion purposes, however, it is possible to model each of these constraints as a function of risk-adjusted benefits and costs. Benefits can come in a variety of forms: increased domestic credit volume; lower domestic credit volatility; lower cost of funding to domestic institutions; lower operational costs as a consequence of knowledge transfer; lower cost of credit from improved competition; or higher output. Costs can come in other forms: the direct expense of supervisory monitoring and the operation of regulatory organizations; indirect expense to monitored institutions; increased probability of exposure to foreign financial-sector strain; and the potential extension of support in an emergency.

Pre-positioning is an input to each of these gains and costs, from its role in buffering the cross-border transmission of shocks, to its role in lowering the ongoing cost of supervisory monitoring. In any such model, pre-positioning should be set at a level that not only absorbs local losses in resolution, but also preserves incentives for continued participation in the event of stress. Such pre-positioning comes with its own costs, which such a model should reflect, and it should allow jurisdictions to opt for decreased participation if they choose not to bear those costs. Properly calibrated, however, it can determine the optimal level of pre-positioned resources, and of jurisdictional participation, in cross-border financial activity.