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The robustness of the global financial safety net: A multilayer network analysis

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ABSTRACT

Originally laid out as an integrated system centered on the International Monetary Fund (IMF), the Global Financial Safety Net (GFSN) has evolved into a multitiered architecture comprising IMF resources, regional financing arrangements, bilateral swap arrangements, and international reserves. Existing scholarship typically evaluates this complex web of institutions through the lens of institutional density, examining how the proliferation of liquidity arrangements affects the effectiveness of crisis management. Yet institutional topology—the inter-institutional structure of the system—also shapes the robustness of the GFSN by influencing its capacity to absorb global economic shocks. To examine this dimension, we conduct a multilayer network analysis of the GFSN from 1977 to 2024 and explore whether institutional change is systematically associated with greater system-level robustness. Our findings show that, despite substantial structural changes and increased institutional complexity, countries have not enhanced the capacity of the GFSN to reduce system-wide vulnerability to global economic shocks. While certain aspects of the system's configuration have improved over time, persistent gaps in coverage and uneven access to liquidity backstops leave many countries vulnerable to crises and with limited policy options.

KEYWORDS

Global financial safety net; institutional topology; international crisis finance; network analysis; system robustness

MOTS-CLÉS

finance de crise internationale; filet de sécurité financière international; analyse du réseau; solidité du système; topologie institutionnelle

RESUMEN

La red mundial de seguridad financiera (RMSF), originalmente diseñada como un sistema integrado centrado en el Fondo Monetario Internacional (FMI), ha evolucionado hacia una arquitectura de varios niveles que incluye recursos del FMI, acuerdos financieros regionales, acuerdos bilaterales de intercambio y reservas internacionales. La investigación académica existente tiende a analizar esta compleja red de instituciones a través del enfoque de densidad institucional, es decir, cómo la proliferación de acuerdos en materia de liquidez afecta sobre la efectividad de la gestión de las crisis. Sin embargo, la topología institucional (la estructura interinstitucional del sistema) también influye sobre la solidez de la RMSF dado que afecta a su capacidad para absorber choques económicos globales. Con el fin de analizar esta dimensión, realizamos un análisis de redes multinivel de la RMSF desde 1977

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hasta 2024 y estudiamos si el cambio institucional se encuentra asociado sistemáticamente con una mayor solidez a nivel del sistema. Nuestras conclusiones demuestran que, a pesar de cambios estructurales sustanciales y de una mayor complejidad institucional, los países. no han mejorado la capacidad de la RMSF para reducir la vulnerabilidad general del sistema frente a las crisis económicas globales. Si bien ciertos aspectos de la configuración del sistema han mejorado con el tiempo, las brechas persistentes en la cobertura y el acceso desigual a los mecanismos de respaldo a nivel de liquidez dejan a muchos países en situación de vulnerabilidad ante las crisis y con limitadas opciones en materia de políticas.

RÉSUMÉ

Initialement présenté comme un système intégré centré sur le Fonds monétaire international (FMI), le filet de sécurité financière international (GFSN) est aujourd'hui une architecture à plusieurs niveaux comprenant des ressources du FMI, des arrangements financiers régionaux, des accords de swap bilatéraux et des réserves internationales. Généralement, la recherche existante évalue ce tissu complexe d'institutions sous l'angle de la densité institutionnelle, en examinant l'effet de la prolifération des accords portant sur la liquidité sur l'efficacité de la gestion de crises. Pourtant, la topologie institutionnelle – la structure interinstitutionnelle du système – façonne également la solidité du GFSN en influençant sa capacité à absorber les chocs économiques mondiaux. Pour examiner cette dimension, nous menons une analyse du réseau du GFSN à plusieurs couches de 1977 à 2024. Nous explorons ainsi s'il existe systématiquement une association entre le changement institutionnel et une plus grande solidité au niveau du système. D'après nos résultats, malgré d'importants changements structurels et une complexité institutionnelle accrue, les pays n'ont pas amélioré la capacité du GFSN à réduire la vulnérabilité du système aux chocs économiques mondiaux. Bien que certains aspects de la configuration du système se soient peu à peu améliorés, des lacunes persistantes dans la couverture et un accès inégal aux filets de sécurité pour les liquidités rendent nombre de pays vulnérables aux crises et limitent leurs options politiques.

1. Introduction

Since the demise of the Bretton Woods system, the international financial architecture has undergone significant changes. Originally designed as an integrated system with the International Monetary Fund (IMF) at its center, it has since evolved into a multilayered network of bilateral, regional, and international arrangements—what is now known as the GFSN. This evolution forms part of a longer historical trajectory in international monetary cooperation, in which arrangements for crisis finance have repeatedly adapted to changes in capital mobility, exchange-rate regimes, and global liquidity conditions (Bordo and Schwartz 1994; Eichengreen 2019). Today,

the GFSN comprises four channels of liquidity provision intended to prevent and mitigate the adverse effects of financial crises: (i) IMF lending, which provides financial support to countries facing balance-of-payments crises and is usually subject to policy conditionality; (ii) regional financing arrangements (RFAs), which pool financial resources among countries that typically belong to the same geographic region; (iii) bilateral swap arrangements (BSAs), which enable central banks to exchange currencies during periods of market stress; and (iv) international reserves, consisting of external assets controlled by national monetary authorities and claims on international financial institutions that can be converted into foreign reserves (IMF 2025; Scheubel, Stracca, and Tille 2019).

The accumulation of these different forms of financial insurance has transformed the GFSN and increased its institutional complexity. On the one hand, some scholars emphasize the challenges associated with this evolution. In the absence of a grand design or shared purpose, they argue that the ad hoc layering of GFSN institutions has produced uneven coverage across countries, coordination failures, facility shopping, and moral hazard. From this perspective, institutional complexity risks fragmenting global financial governance and undermining effective crisis management (Chari et al. 2025; Hawkins, Rahman, and Williamson 2014; Henning 2017, 2019; IMF 2016, 2017, 2025; McKay, Volz, and Wölfinger 2011; Mühlich and Fritz 2018; Weder di Mauro and Zettelmeyer 2017).

On the other hand, other scholars highlight the potential benefits of institutional complexity. Grabel (2017), for example, argues that a decentralized, heterogeneous, and multipolar GFSN can enhance global financial stability by fostering "productive incoherence"—that is, by creating space for policy experimentation, institutional innovation, and diversity in crisis responses. Similarly, Scheubel, Stracca, and Tille (2019) show that a multilayered system can effectively address global crises, provided that countries deploy different GFSN instruments in line with the types of shocks they are designed to address, such as IMF programmes for balance-of-payments crises.

As a result, scholars remain divided over the implications of institutional complexity in global financial governance. Some emphasize the risks of fragmentation, while others stress the scope for institutional complementarity. Despite these divergent assessments, however, much of the literature shares a common analytical orientation: it treats institutional performance primarily as a function of institutional *density*—that is, the number of institutions operating within the global financial landscape (Abbott, Green, and Keohane 2016). Accordingly, existing studies typically assess whether institutional proliferation improves or worsens governance outcomes relative to a counterfactual system centered on a single multilateral institution (Henning 2019).

This density-based perspective has yielded important insights, including a clearer understanding of the forces shaping the evolution of the GFSN and the dynamics of cooperation and competition in global financial governance. Yet it leaves key questions unanswered, particularly regarding the role of institutional *topology* in shaping system outcomes. Unlike institutional density, which focuses on how many institutions operate within a policy domain, institutional topology examines the relationships among them—that is, the inter-institutional configuration of a system (Daßler 2023). Its central aim is to link structural features of a policy domain to governance outcomes, such as effectiveness, adaptiveness, and resilience (Kim 2020). For example, it considers how the degree of centralization may affect an institution's capacity to exert control, or how patterns of interdependence can generate spillovers that may threaten systemic stability. In this sense, institutional topology resonates with broader work on global governance architectures, which highlights how the overall institutional setting of a policy domain shapes coordination, legitimacy, and performance (Biermann et al. 2009).

Applied to the GFSN, an analysis of institutional topology provides a basis for assessing whether the international financial architecture can withstand global economic shocks. A growing body of scholarship identifies three structural attributes as central to system robustness: diversity, modularity, and redundancy (Bednar 2016; Biggs, Schlüter, and Schoon 2015b; Kharrazi et al. 2020; Levin 2019). Whether the configuration of the international financial architecture exhibits these features shapes its capacity to prevent and respond to disturbances. In particular, it affects the extent to which (i) countries have sufficient backstops to absorb shocks, (ii) interdependencies generate vulnerability to contagion, and (iii) different elements of the GFSN function as effective backup mechanisms.

Against this backdrop, we analyze the configuration of the international financial architecture from 1977 to 2024 and assess whether institutional change has enhanced the robustness of the system. We proceed in two steps. First, we undertake a multilayer network analysis of the GFSN to measure levels of diversity, modularity, and redundancy in the system. Second, we examine the relationship between these structural features and an index capturing the GFSN's vulnerability to global economic crises. Our results suggest that, while countries have expanded the range of available insurance mechanisms, these efforts have not generated robustness in a system-wide sense. While the international financial architecture appears better equipped to withstand disturbances than in the past, persistent gaps in GFSN coverage continue to undermine the adaptive efficiency of the system as a whole. In particular, countries in Sub-Saharan Africa remain highly exposed to financial crises and have limited access to GFSN resources.

This study makes several contributions to the literature on institutional complexity in global financial governance. To our knowledge, it is the first to adopt a network-based approach that captures the multilayered configuration of the GFSN as a whole. Existing research typically examines individual GFSN components in isolation or in partial combination (Grabel 2017; Henning 2017, 2019, 2023; Kring and Grimes 2019; Scheubel, Stracca, and Tille 2019), focuses on a subset of countries (Mühlich and Fritz 2018, 2021), or aggregates the various elements of the GFSN into a single layer (ECB 2016; Iancu, Kim, and Miksjuk 2021; IMF 2016, 2017, 2025), thereby overlooking important structural and functional differences among bilateral, regional, and multilateral arrangements (Hollway and Koskinen 2016). By mapping and analyzing the multitiered structure of the GFSN, our approach provides a comprehensive account of the system and its robustness.

In addition, we advance research on global financial governance by explicitly examining how institutional topology shapes system outcomes. In doing so, we move beyond density-based accounts and demonstrate empirically that institutional proliferation has not strengthened the robustness of the GFSN. While new financial arrangements have expanded the aggregate size and range of available resources, the IMF remains the only source of crisis finance for many emerging market and developing countries.

The remainder of the article is organized as follows. Section 2 reviews the literature on the GFSN and introduces the theoretical framework. Section 3 describes the data and methodology. Section 4 presents and discusses the results. The concluding section situates the findings within broader debates and identifies avenues for future research.

2. Theoretical Framework

2.1. Institutional Complexity and the GFSN

The GFSN refers to the "set of institutions and mechanisms that provide countries with insurance against shocks and crises" (IMF 2025). It offers financing when crises hit and encourages stable macroeconomic policies. The GFSN comprises four layers: international reserves, bilateral swap arrangements, regional financial arrangements, and IMF lending. Recent estimates suggest that the GFSN had at least US$4.2 trillion in collective lending capacity by the end of 2024 (Mühlich et al. 2025). While this represents a substantial expansion of resources since the collapse of the Bretton Woods system, critics argue that key shortcomings remain. In particular, they identify several challenges that undermine the coherence, accessibility, and overall effectiveness of the international financial architecture (Chari et al. 2025; IMF 2016, 2017, 2025; Kring and Gallagher 2019; Mühlich, Fritz, and Kring 2022; Mühlich et al. 2020; Stubbs et al. 2021; Volz 2022).

First, the GFSN provides uneven coverage, with sizeable financing gaps in emerging market and developing countries. Historically, the growth of GFSN resources has been concentrated in advanced economies with reserve currency status, leaving most countries reliant primarily on self-insurance and IMF support (IMF 2016, 2017, 2025). Second, differences in the objectives, rules, and policy frameworks of GFSN institutions raise coordination challenges that can delay or constrain the timely provision of financial resources (IMF 2016, 2017, 2025). Third, the availability of multiple arrangements creates outside options that countries may leverage to obtain financing on more favorable terms (Clark 2022; Hawkins, Rahman, and Williamson 2014; IMF 2016; McKay, Volz, and Wölfinger 2011). Because GFSN institutions attach different policy conditions to their lending, governments may engage in facility shopping and arbitrage, postponing or avoiding engagement with institutions that impose more demanding adjustment requirements. Differences in governance standards across funding instruments may also have political consequences, as stricter transparency requirements from some creditors may constrain rent-seeking, hurting leader survival (Kern, Reinsberg, and Shea 2024). Finally, the coexistence of multiple financing sources may increase the risk of moral hazard, as governments delay addressing balance-of-payments problems under the expectation that losses will be absorbed by the GFSN (Hawkins, Rahman, and Williamson 2014). Given the stigma often associated with policy conditionality (Weder di Mauro and Zettelmeyer 2017), governments may seek to offset costly adjustments through less rigorous policies (McKay, Volz, and Wölfinger 2011). Well-connected elites in borrowing countries may also exploit fungible bailout liquidity for personal gains (Reinsberg and Kern 2025).

Taken together, these critiques attribute the limitations of the GFSN to the fragmentation of global financial governance. Over recent decades, new arrangements have frequently emerged through ad hoc and weakly coordinated processes that lacked a shared purpose (Weder di Mauro and Zettelmeyer 2017). From this perspective, institutional complexity has undermined policy coordination, with negative implications for systemic stability (Chari et al. 2025; Hawkins, Rahman, and Williamson 2014; Henning 2017, 2019; IMF 2016, 2017, 2025; McKay, Volz, and Wölfinger 2011; Mühlich and Fritz 2018; Weder di Mauro and Zettelmeyer 2017).

In contrast, other scholars emphasize the potential benefits of institutional complexity. Grabel (2017, 2019), for example, argues that innovations in global financial governance have expanded opportunities for policy autonomy, particularly for emerging market and developing countries. In her account, the emergence of a more decentralized, heterogeneous, and multipolar system has widened the range of available resources and enhanced policy space. Diversification across financial arrangements has

fostered policy learning and experimentation, while competitive pluralism has increased pressure on Bretton Woods institutions to adapt to demands for institutional reform. Relatedly, Scheubel, Stracca, and Tille (2019) find that GFSN instruments can effectively mitigate crises, provided that policymakers deploy them in line with the types of shocks they are designed to address, such as IMF support for balance-of-payments crises.

Despite these divergent assessments, much of the literature evaluates the performance of the GFSN primarily through the lens of institutional density. Empirically, this density-based focus is reflected in a literature that largely examines elements of the GFSN in isolation or in partial combination. Research on individual layers has a long tradition in relation to the IMF (Dreher 2009; Payer 1974; Vreeland 2007), RFAs (Henning 2017, 2019; International Relations Committee Taskforce on IMF Issues 2018; Kring and Grimes 2019; McKay, Volz, and Wölfinger 2011; Mühlich and Fritz 2018, 2021; Ocampo 2006), and, more recently, BSAs (Aizenman, Ito, and Pasricha 2022; Bahaj, Fuchs, and Reis 2026; Goda et al. 2024; Koosakul and Miksjuk 2024; McDowell 2019; Pape 2022; Perks et al. 2021).

By contrast, literature that treats the GFSN as an integrated system remains relatively limited. Existing system-level studies typically aggregate information across layers and compare the total volume of available resources with potential demand (Denbee, Jung, and Paternò 2016; IMF 2016, 2017, 2025; Mühlich and Zucker-Marques 2023; Scheubel and Stracca 2019; Stubbs et al. 2021). While this approach sheds light on the overall scale and coverage of the GFSN, it obscures important structural and functional differences among its constituent arrangements. BSAs, for instance, involve only two countries and are generally designed to provide short-term liquidity during episodes of financial turmoil, whereas IMF financing engages a much broader membership and typically pursues collective and normative objectives through conditionality. Because such differences shape how GFSN instruments are used in practice, analyzing the system as a whole requires treating its various layers as analytically distinct yet interconnected components (Hollway and Koskinen 2016).

To address this gap, we examine the multitiered configuration of the GFSN and analyze whether institutional complexity has enhanced the robustness of the international financial architecture against global economic shocks using a multilayer network approach.

2.2. Institutional Robustness and the GFSN

Institutions created to fulfill a specific purpose may struggle to remain effective as circumstances change. To maintain functionality, they must adjust to unexpected shifts in their environment without losing the ability to deliver their intended governance outcomes—what Bednar (2016) and

North (1994) describe as adaptive efficiency. In institutional analysis, robustness refers to this capacity to continue functioning in the face of uncertainty and perturbations (Bednar 2016; Jen 2003). Applied to the GFSN, robustness can therefore be understood as the ability of the international financial architecture to absorb global economic shocks and crises.

Over the past three decades, a growing body of research has examined the conditions under which institutional and governance systems exhibit robustness. Drawing on both theoretical and empirical evidence, this literature identifies three structural features that enhance a system's ability to withstand disturbances: diversity, modularity, and redundancy (Bednar 2016; Biggs, Schlüter, and Schoon 2015b; Kharrazi et al. 2020; Levin 2019). These features shape how systems respond to shocks by influencing the availability of policy options, the containment of failures, and the continuity of core functions.

Diversity refers to the variety of elements present in a system, encompassing both the number and functional differentiation of institutions operating in a given policy domain (Kotschy et al. 2015; Page 2010). Diversity is widely regarded as a key determinant of robustness because it provides multiple options for responding to unanticipated change. Since different types of disturbances require different responses, a broad repertoire of strategies allows systems to adapt while continuing to function (Walker et al. 2023).

Within the GFSN, diversity is reflected in the range of instruments available to countries, including IMF lending, RFAs, BSAs, and international reserves. These instruments are designed to address different types of crises and operate under distinct conditions. IMF and RFA financing is typically deployed in response to balance-of-payments crises and is subject to policy conditionality, whereas BSAs and reserves are more commonly used to manage liquidity shocks and do not impose conditionality (Denbee, Jung, and Paternò 2016). Access to a diverse set of instruments can facilitate the complementary use of resources (Denbee, Jung, and Paternò 2016; ECB 2016; IMF 2025), enable more targeted responses to disturbances (Scheubel, Stracca, and Tille 2019), and enhance flexibility in crisis management (Grabel 2017).

The second key determinant of robustness, modularity, refers to the degree to which a system is organized into relatively independent components, or compartments (Biggs, Schlüter, and Schoon 2015b; Levin 2019). Modularity enhances robustness by limiting the pathways through which disturbances can propagate or cascade. When systems consist of loosely connected subunits, shocks are more likely to be contained locally rather than spreading across the entire structure (Dakos et al. 2015). The stabilizing role of modularity is well recognized by policymakers: during the global financial crisis, efforts to contain contagion involved a temporary

reversal of financial integration, including the segmentation of the international banking network along national lines (Enria 2020). Post-crisis regulatory reforms that quarantine high-risk trading from other banking activities, such as the Volcker Rule in the United States, reflect the same logic (Haldane and May 2011).

In the context of the GFSN, modularity captures the extent to which countries cluster into distinct communities based on shared participation in financial arrangements. High modularity is reflected in the presence of well-defined groups, which may emerge when countries selectively engage with specific instruments. For example, IMF and RFA lending may be prioritized during sovereign debt and balance-of-payments crises, while BSAs are used primarily to address liquidity shocks. Alternatively, countries may cooperate predominantly within regional or geopolitical blocs, as is often the case with RFAs. In such scenarios, shared participation across arrangements is limited and tightly-knit clusters are likely to form. By contrast, low modularity arises when a single institution occupies a focal position within the system. The IMF's near-universal membership, for instance, links a wide range of countries and can inhibit the formation of distinct communities.

Higher levels of modularity enhance the robustness of the GFSN by reducing exposure to institutional failures (Schoon et al. 2015). If an RFA experiences a funding shortfall during a systemic shock, the effects are largely confined to its members in a modular system, while countries in other clusters continue to access support through alternative arrangements. By limiting the spread of disturbances, modularity also creates opportunities for experimentation and learning, as governance failures in one component can inform adjustments elsewhere (Schoon et al. 2015).

The third determinant of robustness is redundancy. Redundancy refers to the presence of multiple elements that perform similar functions and can therefore act as backup mechanisms in the event of failure (Bednar 2016; Kotschy et al. 2015; Levin 2019). Redundant elements fulfill the same purpose but fail for different reasons, ensuring that the malfunction of one component does not compromise system-wide functionality (Bednar 2016). For example, when multiple institutions regulate a policy domain, oversight can continue even if one organization becomes ineffective (Kotschy et al. 2015).

Within the GFSN, redundancy arises when countries establish overlapping arrangements with the same partners, thereby creating alternative sources of financing. If two countries participate in both an RFA and a BSA, they retain access to liquidity even if one instrument becomes temporarily unavailable or ineffective. By increasing substitutability across layers, redundancy supports functional continuity and enhances robustness in the face of shocks.

Taken together, diversity, modularity, and redundancy constitute core structural features that enable systems to withstand disturbances (Bednar 2016; Biggs, Schlüter, and Schoon 2015b; Kharrazi et al. 2020; Levin 2019). In the context of the GFSN, diversity expands the range of policy options available to governments, modularity limits the spread of institutional failures, and redundancy provides buffers when specific forms of financial insurance falter. Against this backdrop, we assess whether the multilayered configuration of the GFSN exhibits these properties and whether institutional innovation has strengthened the robustness of the international financial architecture.

3. Analytical Framework

3.1. Data

To map the institutional configuration of the GFSN and its evolution over time, we consider the forms of financial insurance that countries had available over 1977–2024.[1] In particular, we focus on countries' *de jure* access to GFSN elements: we look at the set of resources that countries could potentially access, rather than the instruments they actually tapped (that is, countries' *de facto* access to GFSN tools). We adopt this approach for three main reasons. First, the literature on system robustness stresses the relevance of structural features in shaping the capacity of a system to withstand shocks and crises. From this perspective, the institutional configuration of the GFSN is itself a key determinant of robustness (Biggs, Schlüter, and Schoon 2015a; Hollway 2022; Kharrazi et al. 2020; Levin 2019). Second, the sheer possibility that countries could access some form of financial assistance may be enough to instill market confidence, reduce the impact of crises, or even reduce their likelihood (Scheubel, Stracca, and Tille 2019). Third, the absence of systematic and encompassing data on countries' use of GFSN resources limits our ability to assess robustness based on *de facto* access. Observed use of GFSN instruments reflects a complex interaction of need, eligibility, stigma, conditionality, and political constraints; accordingly, nonuse cannot be interpreted as evidence that available options were unnecessary or exhausted. Because our analysis focuses on countries' *de jure* access to GFSN elements, it does not capture informal coordination, discretionary decision-making, or political influence that may shape crisis outcomes beyond formal institutional access.

Against this backdrop, we consider four key elements of the GFSN: countries' membership in the IMF, their participation in RFAs, their

[1]We take 1977 as our baseline as it was the first year in which all GFSN elements were in place.

inclusion in BSAs, and their accumulation of international reserves. The first three elements represent mutual forms of financial insurance, as access to crisis support from the IMF, RFAs, and BSAs requires an agreement among participating countries (Scheubel and Stracca 2019). As such, these arrangements can be modeled as networks in which countries are connected through institutional ties. By contrast, reserves cannot be represented as a network because they constitute a form of self-insurance: they are readily available, prepaid, and highly liquid resources that can be deployed independently by national authorities (Scheubel and Stracca 2019).

In practice, this distinction means that we treat GFSN elements differently. We use countries' participation in the IMF, RFAs, and BSAs to construct a multilayer network. This allows us to analyze the configuration of the system and assess the impact of institutional changes on the robustness of the GFSN. We then consider countries' accumulation of international reserves to evaluate their contribution to system robustness. In particular, we examine whether countries' reserve accumulation appears to compensate for structural vulnerabilities in the system.

To compile data on GFSN elements over time, we rely on multiple sources. First, information on countries' membership in the IMF comes from the Fund's website.[2] Data on countries' participation in RFAs are obtained from an updated version of Scheubel and Stracca's dataset (2019), which covers the GFSN for 198 countries over 1960–2020. This is complemented with the Global Financial Safety Net Tracker (Mühlich et al. 2026), which considers 193 countries from 2018 to 2025. To harmonize these two datasets and maximize coverage, we hand-code missing information from official sources. Data on BSAs are drawn from Bahaj, Fuchs, and Reis (2026), which report all active arrangements over 2000–2025. For earlier periods, we combine this dataset with the updated version of Scheubel and Stracca's dataset (2019), Bordo, Humpage, and Schwartz (2015), and Swaminathan and Wiggins (2023). Finally, data on countries' accumulation of reserves also come from the updated version of Scheubel and Stracca's dataset (Scheubel and Stracca 2019). In aggregate, we collect and analyze data on up to 191 IMF members, 15 RFAs, and BSAs with 84 central banks (see Appendix).

3.2. A Multilayer Network Analysis

To analyze the evolution of the GFSN over time, we perform a multilayer network analysis. Formally, a network consists of two or more actors ("nodes") and the relations connecting them ("edges") (Barabási and Pósfai

[2] https://www.imf.org/external/np/sec/memdir/memdate.htm.

2016; Newman 2010). Actors may be individuals, countries, or other collectivities, while relations capture patterns of interactions among them (Boccaletti et al. 2014; Dickinson, Magnani, and Rossi 2016; Kivelä et al. 2014; Knoke et al. 2021). In most social, economic, and political contexts, actors are connected through multiple types of relations. For example, individuals may be linked by kinship, friendship, and professional ties, while countries may interact through economic, security, and cultural relationships (Boccaletti et al. 2014; Dickinson, Magnani, and Rossi 2016; Kivelä et al. 2014; Knoke et al. 2021).

To capture this relational complexity, network scholars have developed the framework of multilayer networks. Unlike traditional networks that represent a single type of relation, multilayer networks incorporate multiple layers, each corresponding to a distinct type of interaction among actors (Boccaletti et al. 2014; De Domenico 2022; Dickinson, Magnani, and Rossi 2016; Kivelä et al. 2014). In this framework, the same actor may appear in multiple layers, allowing researchers to model multiple patterns of connectivity across different relational domains (Magnani, Rossi, and Vega 2021).

As the GFSN comprises multiple, partially overlapping institutions, modeling it as a multilayer network is particularly appropriate. In our analysis, states constitute the actors of interest, while the different types of financial arrangements in which they participate define the network layers. Within each layer, an edge represents a relationship between two countries based on their joint participation in a given arrangement. We consider three such arrangements—IMF lending, RFAs, and BSAs—and accordingly construct a three-layer network.

The layer representing countries' membership in the IMF is modeled as an undirected network, as IMF membership entails reciprocal rights to request financial assistance to address balance-of-payments problems. The RFA layer is modeled as a directed network, reflecting the fact that participation in regional arrangements does not always imply reciprocal obligations. Under the European Union (EU)'s Macro-Financial Assistance, for example, EU member states may provide financial support to partner countries without a corresponding commitment by recipients. Finally, the BSA layer is also directed, as BSAs may involve unidirectional liquidity provision in which only one central bank commits to lend (Bahaj, Fuchs, and Reis 2026).

On the basis of this multilayer representation, we examine the institutional configuration of the GFSN using three network metrics implemented in the *multinet R* package (Magnani, Rossi, and Vega 2021). Each metric captures a structural feature that the literature identifies as central to system robustness. We focus on system-level structural properties rather

than actor-level centrality measures, which capture influence or hierarchy within networks and would shift the analysis toward questions of power concentration rather than the breadth, containment, and backup capacity of the GFSN. Accordingly, centrality measures are beyond the scope of the present analysis.

First, we measure the diversity of available financial instruments within the GFSN using a multilayer extension of the Jaccard index, which computes the overlap in country participation across the IMF, RFA, and BSA layers (Magnani, Rossi, and Vega 2021).[3] In practice, this metric captures the extent to which the same countries are embedded in multiple institutional networks, and thus the breadth of institutional arrangements to which they have potential access in times of crisis (Berlingerio et al. 2013; Magnani, Rossi, and Vega 2021). The resulting index ranges from 0 to 1, where higher values indicate that countries have a broader set of financial instruments potentially available within the system.

Second, we assess the modularity of the GFSN—that is, the extent to which countries cluster into relatively distinct communities within the multilayer network. Communities are defined as groups of actors that are more densely connected internally than with the rest of the network (Magnani, Rossi, and Vega 2021). Higher levels of modularity imply a more compartmentalized structure, which limits the pathways through which shocks can propagate across the system (Biggs, Schlüter, and Schoon 2015b). To identify the community structure of the GFSN, we apply the *Infomap* algorithm, which detects partitions by simulating how a random walker moves across the multilayer network (De Domenico et al. 2015).[4] The algorithm identifies groupings of countries in which the random walker tends to remain confined, reflecting dense patterns of connectivity within and across layers (Stella and Domenico 2021). We use the resulting partitions of the network to characterize the degree of modular organization of the GFSN over time. Modularity ranges from −1 to +1: it takes positive values if there are more connections between actors within the same communities than one would expect by chance, while negative values indicate fewer such connections (Newman 2010).

Third, we measure redundancy within the GFSN, defined as the extent to which countries maintain multiple institutional ties with the same partners. To do so, we rely again on a multilayer extension of the Jaccard

[3] We measure the extent to which countries overlap across different GFSN layers using the "jaccard. actors" method implemented in the "layer_comparison_ml()" function of the *multinet R* package. This metric captures the degree to which the same countries are present across multiple institutional layers.

[4] We identify community structures in the multilayer GFSN using the "infomap_ml()" function, which detects groups of countries that are more densely connected within and across layers based on the simulated movement of a random walker.

index, but this time we consider the overlap in country relations across the IMF, RFA, and BSA layers; in other words, we assess the extent to which countries are connected to the same partners across multiple arrangements (Dickinson, Magnani, and Rossi 2016; Magnani, Rossi, and Vega 2021).[5] As with diversity, this metric ranges from 0 to 1, with higher values indicating that countries rely on overlapping sets of partners across different GFSN arrangements, thereby creating potential backup channels in the event that one arrangement becomes unavailable or ineffective.

Importantly, these three metrics capture structural properties that the literature on institutional robustness identifies as central to a system's capacity to withstand shocks. To provide an empirical defense of their relevance, we examine pairwise correlations between diversity, modularity, and redundancy and standard indicators of debt sustainability, including the ratio of external debt to gross national income, the ratio of external debt to exports, and sovereign credit ratings.[6] These correlations are not intended to evaluate whether institutional changes have causally improved the ability of the GFSN to prevent or resolve crises. Rather, they serve as a construct-validity check, assessing whether our network metrics are systematically associated with macro-financial indicators that the institutional robustness literature suggests should be related to the effectiveness of the GFSN. Accordingly, these metrics capture the structural availability, modularity, and overlap of financial arrangements, but do not distinguish between coordinated, complementary use of GFSN instruments and substitution motivated by the avoidance of conditionality.

As shown in Table 1, higher levels of diversity, modularity, and redundancy are significantly associated with more favorable debt sustainability indicators. Given that a central objective of the GFSN is to prevent liquidity pressures from escalating into solvency problems (Denbee, Jung, and Paternò 2016), these associations lend support to the interpretation of our metrics as meaningful indicators of the structural features that underpin system robustness (Kharrazi et al. 2020; Martin-Breen and Anderies 2011).

[5] We measure the extent to which institutional ties overlap across different GFSN layers using the "jaccard.edges" method implemented in the "layer_comparison_ml()" function of the *multinet R* package. This approach computes the degree to which the same pairs of countries are connected across multiple layers, thereby capturing redundancy in cross-layer institutional relationships.

[6] We use (i) external debt stocks to gross national income (in percent) from the World Bank's World Development Indicators (2026b) over 1977-2024; (ii) external debt stocks relative to exports of goods, services, and primary income (in percent) from the World Bank's International Debt Statistics (2026a) over 1977-2024; and (iii) country credit ratings from Institutional Investor (1980-2015) over 1980-2015, the longest continuous series available. To obtain annual system-level measures, we averaged each indicator's values across available countries by year.

Table 1. Pairwise correlations between metrics and debt sustainability.

	Debt/GNI	Debt/Exports	Institutional Investor Ratings
Diversity	−0.34115** (0.01765)	−0.62896*** (0)	0.44566*** (0.00645)
Modularity	−0.43780*** (0.00186)	−0.66991*** (0)	0.53788*** (0.00072)
Redundancy	−0.43949*** (0.00178)	−0.62191*** (0)	0.48363*** (0.00281)
Diversity × Modularity	−0.43839*** (0.00183)	−0.67764*** (0)	0.54491*** (0.00059)
Diversity × Redundancy	−0.41117*** (0.00369)	−0.59738*** (0.00001)	0.47262*** (0.00361)
Modularity × Redundancy	−0.44160*** (0.00168)	−0.61785*** (0)	0.49765*** (0.00201)
Diversity × Modularity × Redundancy	−0.41390*** (0.00345)	−0.59077*** (0.00001)	0.48655*** (0.00262)

Note: *p*-values are shown in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

3.3. A Correlation Analysis

As the levels of diversity, modularity, and redundancy of the GFSN are not direct measures of institutional performance, we use correlation analysis to explore whether variation in the structural configuration of the system is systematically associated with changes in macro-financial stress around major global crises. This analysis is not intended to assess whether the GFSN causally mitigates crises or improves post-crisis outcomes. Rather, it examines whether pre-crisis structural features of the international financial architecture are empirically related to subsequent shifts in widely used indicators of external vulnerability.

To this end, we focus on six major crisis episodes over the period under analysis: the Latin American Debt Crisis (1982-89), the European Exchange Rate Mechanism Crisis (1992-93), the Asian Financial Crisis (1997-98), the Global Financial Crisis (2008-09), the Euro Area Sovereign Debt Crisis (2010-12), and the COVID-19 crisis (2020). For each episode, we construct two sets of measures. First, we calculate pre-crisis averages of diversity, modularity, and redundancy within the GFSN. These values capture the structural configuration of the international financial architecture immediately prior to each crisis, abstracting from crisis-specific policy responses or institutional use. Second, we compute the change between post-crisis and pre-crisis averages for the three debt sustainability indicators introduced earlier—external debt to gross national income, external debt to exports, and sovereign credit ratings. Following Kharrazi, Rovenskaya, and Fath (2017), this difference can be interpreted as a broad indicator of changes in external vulnerability associated with each crisis episode.

We then perform pairwise correlations between (i) pre-crisis levels of diversity, modularity, and redundancy and (ii) post-crisis changes in these macro-financial indicators. This approach allows us to assess whether structural features of the GFSN are systematically related to subsequent movements in external vulnerability during periods of global stress. Importantly, the analysis is exploratory in nature and does not imply that observed post-crisis outcomes can be attributed to the configuration of the GFSN alone.

4. Empirics

4.1. The Evolution of the GFSN

Since the demise of the Bretton Woods system, the GFSN has undergone significant change, growing to include almost all countries in the world and becoming increasingly complex as countries diversified their financial arrangements. In 1977, around 75% of the countries included in the GFSN could rely on only one institutional network (primarily the IMF), about 25% could draw on the resources of two (the IMF-RFA or IMF-BSA networks), and none had access to all three. At the time, the international financial architecture largely reflected the institutional setup of the Bretton Woods system: the IMF occupied a central position, while RFAs and BSAs were still limited in scope. The only active RFA was the Arab Monetary Fund, which originated in the oil crises of the 1970s: dissatisfied with the policy response of traditional institutions, Arab countries established this facility to secure financing that was free of conditionality and political stigma typically associated with IMF programmes (Weder di Mauro and Zettelmeyer 2017). As for BSAs, these were confined to arrangements that the United States had established with the central banks of its Group of Ten partners, as well as with Austria, Denmark, Mexico, and Norway.

By 2024, the global financial landscape had changed markedly. Compared with 1977, the share of countries that could rely on the resources of two or three GFSN layers had increased to 31% and 29%, respectively. This expansion in countries' insurance options reflected, in part, national and regional responses to repeated episodes of financial instability. In particular, many RFAs were created in response to balance-of-payments and currency crises associated with processes of regional economic integration (IMF 2013). For example, the Andean Reserve Fund (later the Latin American Reserve Fund) was established in 1978 to address financial instability linked to the Andean Community Integration process; the North American Framework Agreement between Canada, Mexico, and the United States was introduced in 1994 to support the North American Free Trade Agreement; the Chiang Mai Initiative of the Association of Southeast Asian Nations, China, Japan, and South Korea (ASEAN + 3) was created in 2000

following the currency crisis that spread across East and Southeast Asia in the late 1990s; and the European Union's Balance of Payments Assistance Facility was established in 2002 to provide financial assistance to non-Eurozone countries facing balance-of-payments difficulties (IMF 2013).

The global financial crisis of 2008 further shaped the evolution of the GFSN, as severe liquidity shortages on international markets prompted the creation and expansion of new backstop mechanisms. In 2009, ASEAN + 3 countries strengthened their regional lending capacity by transforming the bilateral swap agreements of the Chiang Mai Initiative into a multilateral framework. In the same year, several Central Asian countries formed the Eurasian Fund for Stabilization and Development. In 2010, countries in the Euro area established the European Financial Stability Facility and the European Financial Stabilization Mechanism[7] to provide financial support to distressed members. In 2014, Brazil, Russia, India, China, and South Africa (BRICS) pooled a portion of their international reserves and created the Contingent Reserve Arrangement (Weder di Mauro and Zettelmeyer 2017).

Since the global financial crisis, the scope of BSAs has also expanded substantially. In 2000, the network of liquidity lines was largely regional in nature, as illustrated by ASEAN + 3's Chiang Mai Initiative and its subsequent multilateralization. During the acute phase of the global financial crisis in 2008-09, pressures on funding markets intensified to such an extent that international banks increasingly relied on US dollar liquidity provided via national central banks. In response, the Federal Reserve (Fed) established an unprecedented number of swap lines with foreign central banks, giving rise to a global network of liquidity provision (Bahaj, Fuchs, and Reis 2026). Between 2010 and 2015, the European Central Bank (ECB) and the People's Bank of China (PBoC) also expanded their swap operations. The ECB's actions were closely linked to the outbreak of the Eurozone crisis in 2010, while the PBoC's engagement reflected China's efforts to promote the international use of the renminbi (Bahaj, Fuchs, and Reis 2026).

Mirroring these institutional developments, Figure 1 illustrates the evolution of diversity, modularity, and redundancy within the GFSN. Among the three metrics, diversity exhibits the most pronounced change over time, followed by redundancy and modularity. This pattern is consistent with the gradual accumulation of different forms of financial insurance, which expanded the range of resources available to countries. Two periods, in particular, coincide with notable shifts in the configuration of the international financial architecture.[8]

[7] These two instruments were combined in the European Stability Mechanism in 2012.

[8] To identify periods associated with unusually high or low values of the three metrics, we compute their mean and standard deviation over the 1977–2024 period and use these values to define simple

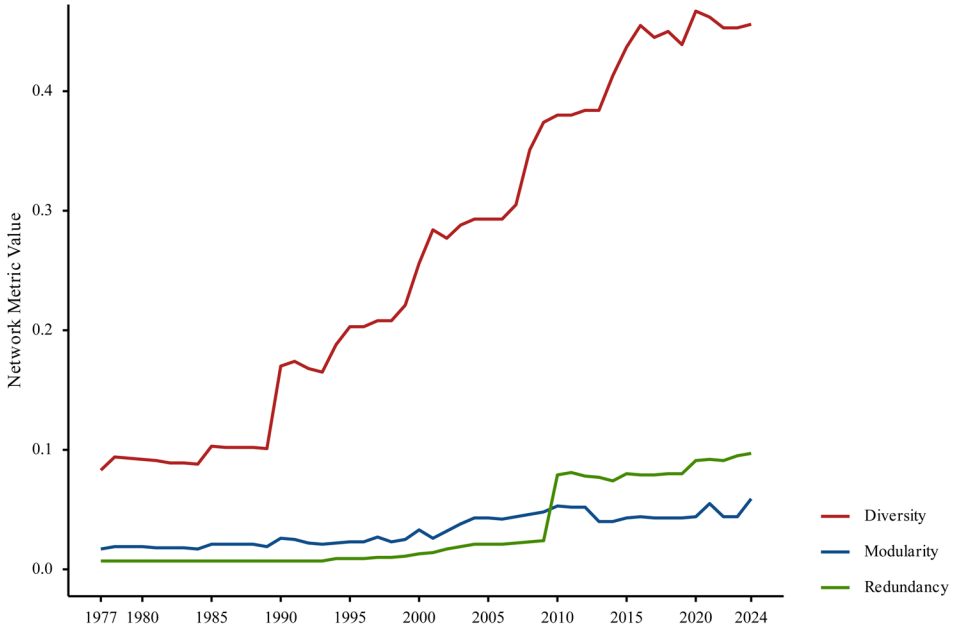


Figure 1. Historical evolution of diversity, modularity, and redundancy (1977–2024).
Note: Values represent network-based structural metrics, as defined in Section 3.2.

The first such juncture occurred around 1990, when diversity and modularity experience a marked increase. This period coincided with the prolonged economic stresses experienced by many developing countries during the 1980s, when a combination of external shocks—such as high world interest rates, adverse shifts in the terms of trade, and weak demand in industrial countries—and domestic policy weaknesses culminated in an international debt crisis lasting from 1982 to 1989 (Boughton 2001). The structural adjustment programmes implemented in response failed to restore sustained growth and access to finance, resulting in what is often described as a "lost decade" for much of the developing world (Boughton 2001). Against this backdrop, countries increasingly turned to regional cooperation. In 1977, Arab countries established the Arab Monetary Fund; in 1978, members of the Andean Community created the Andean Reserve Fund; in 1985, South Asian countries formed the South Asian Association for Regional Cooperation; and in 1990, members of the European Union introduced the Macro-Financial Assistance facility to support neighboring and prospective candidate countries facing balance-of-payments pressures.

descriptive thresholds. Values exceeding the mean by one standard deviation are classified as relatively high, while values falling below the mean by one standard deviation are classified as relatively low. This approach is used solely to highlight notable shifts in the time series and does not imply any normative benchmark.

During this early phase of the GFSN, the proliferation of regional arrangements played an important role in reshaping the system's configuration. On the one hand, it expanded the range of financial instruments available to countries during crises, contributing to higher diversity. On the other hand, it reinforced the geographic segmentation of the GFSN, as institutions created by distinct regional groupings increased the modularity of the system.

A second major shift occurred in the aftermath of the global financial crisis, when diversity, modularity, and redundancy all increased markedly over a short period. These changes coincided with the severity of the shock and with the rapid expansion of liquidity support mechanisms. At its peak, the Fed extended almost US$600 billion in foreign currency swaps to a range of counterpart central banks (Weder di Mauro and Zettelmeyer 2017). The ECB likewise expanded the scope and volume of its swap operations, including with central banks outside the Euro area. Together, these measures contributed to a sharp increase in the density and reach of the global BSA network, a trend that was reinforced by the Euro area sovereign debt crisis beginning in 2010. This process culminated in 2011, when the central banks of Canada, the Euro area, Japan, Switzerland, and the United States established an unlimited—though temporary—network of reciprocal liquidity lines. The growing role of BSAs as a standing policy instrument was also reflected in the significant extension of the PBoC's swap arrangements from 2010 to 2014.

In the years following the crisis, the RFA network also expanded. In 2009, Armenia, Belarus, Kazakhstan, Kyrgyzstan, Russia, and Tajikistan established the Eurasian Fund for Stabilization and Development, while in 2010 Euro area countries created both the European Financial Stability Facility and the European Financial Stabilization Mechanism. As with BSAs, these arrangements were explicitly designed to support member countries during periods of financial stress and to preserve regional financial stability.

Taken together, these developments were associated with notable changes in the structure of the GFSN after the global financial crisis. The expansion of BSAs broadened the set of liquidity backstops available to countries, contributing to higher diversity. The creation of new RFAs reinforced the partition of the system into regional clusters, increasing modularity. At the same time, the establishment of multiple arrangements among the same set of countries deepened cross-institutional ties, raising redundancy. Euro area stabilization efforts provide a clear example: financial support to member states was extended both through bilateral liquidity assistance and through regional facilities, introducing overlapping instruments with similar functions that could operate as institutional backups.

Overall, these patterns illustrate how the configuration of the GFSN has evolved in response to successive episodes of financial stress, with changes in diversity, modularity, and redundancy closely tracking major historical junctures in global liquidity crisis management. A central question remains, however: whether these structural changes have been associated with lower exposure to macro-financial stress during crises. The following sections explore this relationship empirically.

4.2. The Robustness of the GFSN

The historical evolution of the GFSN reflects sustained efforts by countries to expand the system's insurance capabilities and strengthen its resilience to global economic shocks. RFAs and BSAs have often emerged in response to perceived shortcomings in existing institutions, which were seen as inadequate to address evolving financial risks. Yet the expansion and diversification of the GFSN do not necessarily imply a commensurate increase in the system's capacity to absorb disturbances. As the literature on institutional robustness emphasizes, there may be tradeoffs between expanding the range of available instruments and maintaining effective coordination and responsiveness within complex governance systems (Kotschy et al. 2015).

In the context of the GFSN, this implies that increasing the volume and variety of financial resources may be insufficient to ensure robustness. Absent effective coordination mechanisms, the coexistence of multiple institutions can give rise to a fragmented or "patchwork" system in which it is unclear which institution should take the lead during crises or how adjustment and financing burdens should be allocated (Chari et al. 2025). Under such conditions, the aggregate financial capacity of the GFSN—while substantial—may be deployed inefficiently, limiting its stabilizing effects and potentially undermining global financial stability.

To examine these issues empirically, we analyze whether variation in the institutional configuration of the GFSN is systematically associated with changes in macro-financial vulnerability during major global crises. Specifically, we focus on six major crisis episodes over 1977–2024: the Latin American Debt Crisis (1982-89), the European Exchange Rate Mechanism Crisis (1992-93), the Asian Financial Crisis (1997-98), the Global Financial Crisis (2008-09), the Euro Area Sovereign Debt Crisis (2010-12), and the COVID-19 crisis (2020).

For each episode, we compute pairwise correlations between (i) pre-crisis averages of diversity, modularity, and redundancy, which reflect the structural configuration of the international financial architecture prior to each crisis; and (ii) changes in external vulnerability, measured as the difference

between post-crisis and pre-crisis averages for three indicators: external debt to gross national income, external debt to exports, and sovereign credit ratings. These changes are proxies for the impact of a crisis, capturing the extent to which countries' macro-financial position shifted relative to pre-crisis conditions. As discussed in Section 3.3, this analysis is exploratory in nature and does not seek to establish causal effects. Rather, it assesses whether pre-crisis structural features of the GFSN are systematically associated with subsequent movements in widely used indicators of financial stress.

As reported in Table 2, we find no evidence that higher pre-crisis levels of diversity, modularity, or redundancy are associated with systematically lower post-crisis vulnerability across these indicators. This finding holds across crises and measures, suggesting that changes in the institutional configuration of the GFSN have not been consistently associated with improved macro-financial outcomes during periods of global stress.

Table 2. Pairwise correlations between metrics and vulnerability indices.

	Debt/GNI	Debt/Exports	Institutional Investor Ratings
Diversity	−0.38040 (0.52761)	−0.36329 (0.54783)	0.79717 (0.20283)
Modularity	−0.37236 (0.53710)	−0.35880 (0.55316)	0.55417 (0.44583)
Redundancy	−0.00627 (0.99202)	−0.00213 (0.99729)	0.41075 (0.58925)
Diversity × Modularity	−0.25647 (0.67707)	−0.24181 (0.69514)	0.61245 (0.38755)
Diversity × Redundancy	−0.00609 (0.99224)	−0.00455 (0.99421)	0.50631 (0.49369)
Modularity × Redundancy	−0.01212 (0.98456)	−0.00921 (0.98827)	0.41316 (0.58684)
Diversity × Modularity × Redundancy	0.00530 (0.99325)	0.00590 (0.99249)	0.43562 (0.56438)

Note: *p*-values are shown in parentheses. Significance levels: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

These results are broadly consistent with historical patterns in sovereign debt distress.[9] As shown in Figure 2, the volume of debt in default tends to rise sharply following major crises and often remains elevated for prolonged periods. Given that a central objective of the GFSN is to prevent liquidity pressures from escalating into solvency crises (Denbee, Jung, and Paternò 2016), a more robust system might be expected to limit the

[9] Data on the amount of sovereign debt in default come from the Bank of Canada-Bank of England Database of Sovereign Debt Defaults (Beers, Ndukwe, and Berry 2025).

severity or duration of post-crisis default episodes. The persistence of elevated default levels therefore points to enduring vulnerabilities in the international financial architecture.

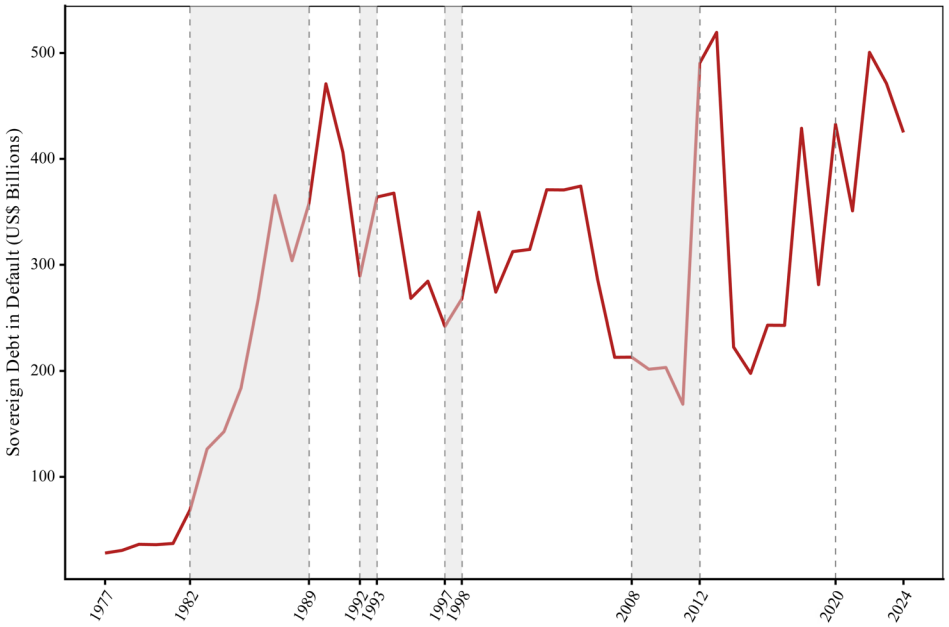


Figure 2. Historical evolution of sovereign debt in default, US$ billions (1977–2024).
Note: Vertical dashed lines and shaded areas indicate the years of six major crises considered in the analysis: the Latin American Debt Crisis (1982-89), the European Exchange Rate Mechanism Crisis (1992-93), the Asian Financial Crisis (1997-98), the Global Financial Crisis (2008-09), the Euro Area Sovereign Debt Crisis (2010-12), and the COVID-19 crisis (2020).

One explanation lies in the limited extent to which GFSN layers function as effective backup mechanisms. Most forms of crisis finance within the GFSN are time-bound and constrained in scale, requiring countries to rely on multiple instruments to meet financing needs during systemic shocks (IMF 2016). For many low-income countries, the resources available through non-IMF channels are insufficient to offset large external shocks (IMF 2025). In practice, this means that GFSN layers tend to operate as complements rather than substitutes: instead of providing redundancy, all major instruments are often required simultaneously to sustain system functionality. This limits the capacity of the GFSN to absorb shocks if one or more layers become constrained.

Evidence on the use of GFSN resources also highlights challenges associated with low levels of effective modularity. While participation in multiple institutional networks can, in principle, facilitate the reallocation of resources to where they are most needed, realizing this potential requires coordination across layers (ECB 2016; Scheubel, Stracca, and

Tille 2019). Historically, such coordination has been limited. During recent crises, interactions among IMF lending, RFAs, BSAs, and international reserves have largely been ad hoc, with no formal mechanisms to align responses or allocate responsibilities (ECB 2016; IMF 2025). As a result, most countries have continued to rely primarily on IMF resources and international reserves. Although BSA drawings have increased over time, they are typically short-lived, while RFA disbursements have generally been modest relative to other GFSN instruments (IMF 2025).

The centrality of the IMF became particularly evident during the global financial crisis and the COVID-19 crisis. While the GFSN effectively supported reserve-issuing economies, emerging market and developing countries faced limited access to RFAs and BSAs and received the bulk of crisis support through IMF loans (Iancu, Kim, and Miksjuk 2021; IMF 2016; Stubbs et al. 2021). As Figure 3 shows, even in 2024 approximately 40% of countries in the GFSN were not members of any RFA or BSA and could rely only on IMF financing. As discussed below, these countries are disproportionately concentrated in Sub-Saharan Africa.[10] These persistent coverage gaps underscore the continued de facto centralization of global crisis finance despite decades of institutional proliferation.

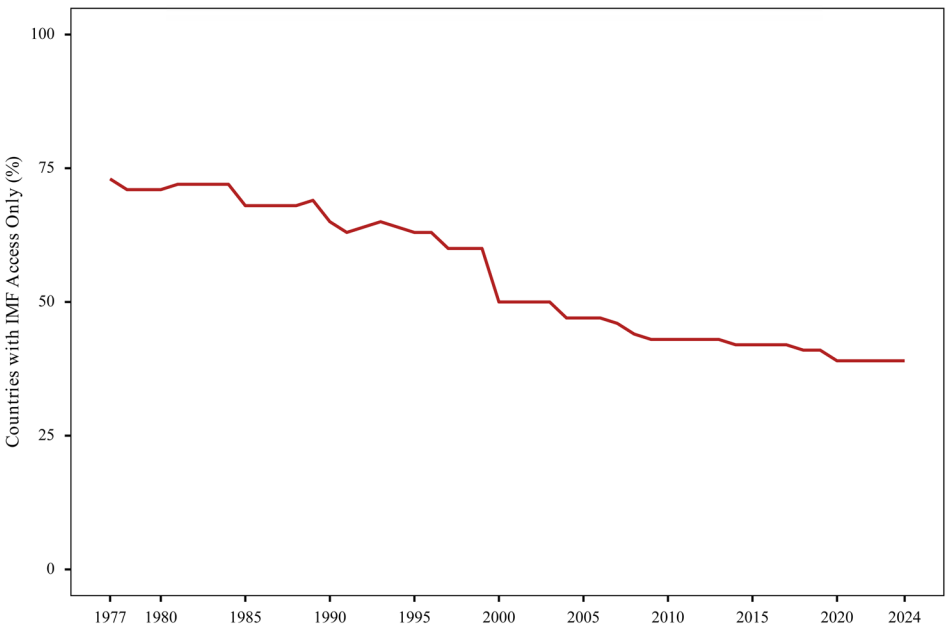


Figure 3. Percentage of countries with IMF layer only (1977–2024).
Note: Percentage of countries within the GFSN that have access to IMF financing but lack RFA or BSA arrangements in a given year.

[10] We measure the share of countries appearing exclusively on the IMF layer using the "xrelevance_ml()" function in the *multinet R* package.

Patterns of reserve accumulation and use reinforce this assessment. Between 1977 and 2020, countries in Sub-Saharan Africa exhibited some of the lowest levels of reserve adequacy yet experienced some of the largest drawdowns. This reflects heavy reliance on self-insurance in the context of limited access to other GFSN instruments, as shown in Table 3. While reserves provide an important first line of defense, large and procyclical drawdowns can deplete already scarce buffers and signal distress to markets, potentially amplifying sovereign risk and constraining access to external finance (IMF 2025). In this sense, reliance on self-insurance has not compensated for uneven GFSN coverage and may have reinforced existing vulnerabilities.

Table 3. Use of GFSN resources across Sub-Saharan Africa (1977–2020).

Global Financial Safety Net Layers	No. Drawings
One Instrument:	
International Monetary Fund	402
Regional Financing Arrangements	4
Bilateral Swap Arrangements	0
Reserves	174
Two Instruments:	
International Monetary Fund + Regional Financing Arrangements	0
International Monetary Fund + Bilateral Swap Arrangements	0
International Monetary Fund + Reserves	86
Regional Financing Arrangements + Bilateral Swap Arrangements	0
Regional Financing Arrangements + Reserves	1
Bilateral Swap Arrangements + Reserves	0
Three Instruments:	
International Monetary Fund + Regional Financing Arrangements + Bilateral Swap Arrangements	0
International Monetary Fund + Regional Financing Arrangements + Reserves	0
International Monetary Fund + Bilateral Swap Arrangements + Reserves	0
Regional Financing Arrangements + Bilateral Swap Arrangements + Reserves	0
Four Instruments:	
International Monetary Fund + Regional Financing Arrangements + Bilateral Swap Arrangements + Reserves	0
Total:	2112

Note: Adapted and updated from Scheubel and Stracca (2019).

Taken together, these findings suggest that institutional innovations within the GFSN have not been systematically associated with greater robustness of the international financial system. Uneven access to liquidity backstops, limited redundancy across instruments, and weak coordination among institutions continue to expose countries—particularly emerging market and developing economies—to macro-financial stress. These vulnerabilities are likely to be exacerbated by rising geopolitical fragmentation and growing dissatisfaction with existing governance arrangements, which may further undermine coordination and legitimacy (Chari et al. 2025). Strengthening the adaptive efficiency of the GFSN therefore remains a central challenge for global financial governance.

5. Conclusion

This article examined the multilayered network of arrangements that make up global financial governance. Leveraging underutilized data on key layers of the GFSN, it explored whether institutional innovations are systematically associated with greater capacity of the international financial architecture to withstand global economic shocks and crises. Our results suggest that this is not the case: while new forms of financial insurance have expanded the size and range of available resources, they have not been consistently associated with lower macro-financial vulnerability during periods of global stress.

Our findings advance research on global financial governance in several ways. First, we adopt a network approach that captures the multilayered configuration of the GFSN, moving beyond a literature that typically analyses individual components in isolation or aggregates information across layers. This perspective allows us to assess the structural properties of the GFSN as a system and to identify potential shortcomings in its insurance capacity. We show that the geographic coverage of the safety net remains uneven: countries in Sub-Saharan Africa are insufficiently protected against crises, and even in 2024 a substantial number of emerging market and developing countries could rely only on IMF financing.

This finding bears directly on debates about the Fund's relevance since the Asian Financial Crisis. Contrary to arguments that institutional proliferation has eroded the IMF's central role in crisis response (Grabel 2017), our results indicate that the Fund remains the primary source of external crisis finance for most countries. While RFAs and BSAs may provide meaningful support for reserve-currency-issuing and systemically important economies, they remain largely inaccessible to many low-income countries. Even where such arrangements exist, they appear to function as limited and uneven forms of insurance, given their restricted coverage, conditional availability, and relatively modest use to date (IMF 2016, 2025).

Second, we contribute to the literature by focusing on the institutional topology of the GFSN, rather than on its size or density alone. This enables us to evaluate whether the international financial architecture exhibits the structural features—such as diversity, modularity, and redundancy—that the institutional robustness literature associates with a system's ability to absorb shocks. Our results suggest that this is not the case. Although institutional innovations have altered the configuration of the GFSN, these changes have not been systematically associated with greater robustness or improved crisis outcomes. In this sense, our study joins a growing body of work showing that increased institutional complexity has not translated into stronger performance of the GFSN (Chari et al. 2025; IMF 2016, 2017, 2025; Kring and Gallagher 2019; Mühlich, Fritz, and Kring 2022; Mühlich et al. 2020; Stubbs et al. 2021). Similar insights have emerged in

studies of other economic networks, such as international trade, which show that highly uneven and hierarchical network structures shape countries' exposure to systemic risk (De Benedictis and Tajoli 2011).

Future research could productively explore why effective coordination mechanisms among GFSN arrangements have proven so difficult to establish. One promising avenue would be qualitative case studies of specific crisis episodes, which could examine how different GFSN instruments were combined in practice, how quickly support was mobilized, and how institutional interactions shaped outcomes. More generally, while inter-institutional cooperation is widely expected to enhance the insurance capacity of the system, it remains unclear why countries have been unable to agree on durable frameworks governing relations among GFSN institutions.

Future work could also extend our structural analysis by linking network properties of the GFSN to crisis-specific outcomes—such as the scale, timing, and coordination of financial support—where sufficiently comparable data on the use of individual instruments become available. Relatedly, emerging sources of systemic risk, including climate-related financial exposures, may interact with existing financial architectures in non-trivial ways, as suggested by recent network-based stress tests (Battiston et al. 2017).

Beyond these extensions, there remains a need to better understand the political and economic determinants of countries' uneven access to GFSN resources, as well as why governments have repeatedly opted to create new arrangements rather than strengthen existing ones. Given the costs associated with institutional fragmentation, clarifying these dynamics is essential for preventing the GFSN from evolving in sub-optimal directions. Incorporating political power, institutional trust, and informal coordination into such analyses would further enrich our understanding of GFSN robustness.

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The authors report there are no competing interests to declare.

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Data availability statement

Data and replication files for this article are available online at https://dataverse.harvard.edu/dataverse/internationalinteractions. Questions regarding replication should be directed to the authors.

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