Dedollarization in BRICS+11: A Dual-Model Theory of Network Externalities, Geopolitical Shocks, and Strategic Coordination

Abstract

This study develops a dual-model theoretical framework for Dedollarization in the expanded BRICS+11 coalition. The first model formalizes currency adoption with network externalities and a geopolitical shock, showing that a sufficiently large shock can tip the system from a stable dollar equilibrium to a BRICS currency equilibrium. The second model analyzes strategic coordination among heterogeneous member states, deriving conditions for a grand coalition as a Nash equilibrium. Linking the two models through coalition size and switching costs yields four testable propositions: Dedollarization requires joint satisfaction of tipping and coordination conditions; pre-emptive infrastructure investment lowers the required shock; member heterogeneity can prevent full coordination; and a lead country with credible commitment stabilizes the grand coalition. The paper concludes by outlining policy implications and promising empirical strategies, while acknowledging that the framework's testable propositions require careful operationalization of geopolitical shocks and coalition heterogeneity.

Keywords: Dedollarization, BRICS, network externalities, game theory, currency hegemony, geopolitical risk
JEL Codes: F33, F42, F51, C72, D85

1. Introduction

The US dollar's role as the preeminent international currency serving as the primary medium of exchange, unit of account, and store of value in global trade and finance has long been recognized as a defining feature of the postwar international monetary system (Krugman 1980). This dominance, however, is not immutable. Historical transitions from one international currency to another, such as the shift from sterling to the dollar in the early twentieth century, suggest that monetary hegemony can erode when underlying economic, political, and institutional conditions change (Eichengreen 2011). In recent decades, the rise of emerging economies has prompted renewed debate about the potential for a more multipolar currency system, and the BRICS group originally comprising Brazil, Russia, India, China, and South Africa has emerged as a focal point of such discussions (Smirnov and Avdeeva 2019; Cheng et al. 2007).

The expansion of the BRICS group from five to eleven members (Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Iran, Saudi Arabia, the United Arab Emirates, and Indonesia) represents a significant shift in the global economic landscape. Collectively, these countries account for a substantial share of world GDP, trade, and natural resource endowments, and their growing geopolitical assertiveness has led to the establishment of parallel financial arrangements such as the New Development Bank (NDB) and the Contingent Reserve Arrangement (CRA) (Hooijmaaijers 2022; Larionova and Shelepov 2022). These institutional innovations have been interpreted by some as a challenge to the existing global financial order (Sapir 2024; de Castro and Santiago 2025), while others view them as complementary mechanisms that enhance the resilience of the international system without fundamentally displacing it (Larionova 2018; Petrone 2020). The debate reflects a broader uncertainty about whether the BRICS can truly reshape global monetary arrangements or whether their efforts will remain on the margins of a dollar-dominated system.

Despite a growing empirical literature on the extent of Dedollarization particularly in trade invoicing and reserve holdings. there remains a notable absence of formal theoretical models that explain the conditions

under which a coordinated shift away from the dollar can occur. Existing studies tend to focus either on micro-level currency choice in the presence of network externalities (Matsuyama, Kiyotaki, and Matsui 1993) or on the strategic interactions among states in international monetary cooperation (Canzoneri and Henderson 1991). What is missing is an integrated framework that captures both the macro-level tipping dynamics generated by network effects and the micro-level strategic decisions of sovereign states with heterogeneous incentives. This study addresses that gap by constructing two complementary theoretical models and linking them through the institutional and behavioral mechanisms that have been central to the BRICS experience.

The first model, presented in Section 3, formalizes currency adoption among a continuum of economic agents. Each agent's utility from using a given currency depends on the size of the network already using it, reflecting the transaction-cost advantages of a widely accepted medium of exchange. A geopolitical shock is introduced as an exogenous event that reduces the intrinsic value of the dollar for agents in the BRICS coalition a formulation inspired by the recent use of financial sanctions and the resulting loss of trust in the dollar's political neutrality (Sapir 2024; Fliagin and Abdulganiyu 2025). The model shows that for shocks below a threshold, the dollar equilibrium is stable; once the shock exceeds this threshold, the system tips to a new equilibrium in which the BRICS currency dominates. The threshold is decreasing in the level of collective investment that lowers switching costs, such as the establishment of alternative payment systems and swap lines (Cattaneo, Biziwick, and Fryer 2015; Hooijmaaijers 2022).

The second model, developed in Section 4, analyzes the strategic coordination problem among the eleven BRICS+11 members. Each country chooses whether to commit to the Dedollarization initiative, and its payoff depends on the total number of participating countries. This structure reflects the reality that the benefits of a new currency system increase with the number of users, while the costs of remaining outside a large coalition also rise (Nach and Ncwadi 2024; Fliagin and Abdulganiyu 2025). The model identifies a unique equilibrium coalition size determined by the country with the lowest incentive to join, and shows that a grand coalition is possible only when the benefits of full participation outweigh the sum of joining costs and status-quo benefits for even the most reluctant member. The analysis highlights the role of a lead country such as China in providing the credible commitment and market access that can stabilize the coalition, a theme that resonates with the empirical observation that China's economic weight has been central to BRICS initiatives (Kirton and Larionova 2022; Izaz Ullah, Haider, and Gohar 2024).

Section 5 links the two models through the coalition size, which determines the network size in the adoption model, and through switching costs, which are reduced by collective institutional investment in the game-theoretic setting. This unified framework yields a set of propositions that connect the likelihood of successful Dedollarization to the magnitude of geopolitical shocks, the extent of pre-existing financial infrastructure, the heterogeneity of member incentives, and the presence of a lead country. Section 6 discusses the policy implications derived from the theoretical analysis, drawing on the experiences of the NDB and CRA as examples of institutional mechanisms that lower switching costs and enhance coordination. Section 7 concludes by summarizing the contributions and outlining avenues for future empirical research, emphasizing the testable nature of the propositions derived here and the need for further theoretical extensions to incorporate dynamic considerations, asymmetric information, and endogenous shocks.

2. Literature Review

The theoretical foundations of this study rest on three interrelated strands of literature: the economics of currency hegemony, network externalities in standard setting, and game-theoretic models of international policy coordination. Each of these strands has been developed in response to empirical observations that defy simple neoclassical predictions, and each provides essential building blocks for the dual-model framework developed here. In addition, the recent institutional innovations of the BRICS group particularly the New Development Bank and the Contingent Reserve Arrangement offer concrete examples of the mechanisms that the theoretical models seek to capture.

2.1 Currency Hegemony and the Vehicle Currency Concept

The concept of a vehicle currency, a currency used as an intermediary in international transactions was formalized by Krugman (1980), who argued that economies of scale in transaction costs create a natural tendency toward monopoly in international currency use. Once a currency achieves a critical mass of users, the transaction costs for that currency decline relative to alternatives, reinforcing its dominance. This insight was extended by Matsuyama, Kiyotaki, and Matsui (1993) in a search-theoretic framework that endogenizes the emergence of an international currency from decentralized trading decisions. Their model shows that multiple equilibria are possible, and which currency becomes dominant depends on historical accident and agents' expectations, a finding that has direct bearing on the analysis of Dedollarization. In the context of the BRICS, the persistence of the dollar's dominance despite the relative decline of the US economy has been explained by the inertial properties of network effects (Smirnov and Avdeeva 2019; Cochrane and Zaidan 2024). Agents coordinate on the dollar not because it is intrinsically superior but because everyone else uses it, and this coordination problem is at the heart of the first model developed below.

2.2 Network Externalities and Standard Setting

The formal analysis of network externalities in technology adoption was pioneered by Katz and Shapiro (1985, 1986). They showed that when the benefit of adopting a technology-increases with the number of adopters, multiple equilibria can arise, and the market may become "locked in" to an inferior standard if early adopters coordinate on it. The application of this framework to currency choice is natural: the utility of using a currency is higher when more trading partners also use it, because transaction costs are lower and liquidity is greater. In the BRICS context, the growing use of local currencies in intra-BRICS trade, documented by Fliagin and Abdulganiyu (2025), can be interpreted as the early stages of such a network effect. Similarly, the accumulation of gold reserves by BRICS central banks, analysed by Hakki (2025), reflects a diversification away from dollar-denominated assets that may be driven by the expectation that others will also diversify. The network externality model developed in this study builds directly on this tradition but adds a novel element: a geopolitical shock that directly reduces the dollar's appeal for a subset of agents, potentially overcoming the inertia of the dollar equilibrium.

2.3 Geopolitical Risk and Financial Statecraft

The weaponization of finance, the use of financial sanctions and restrictions on access to dollar-denominated payments systems has introduced a new dimension to international monetary relations (Sapir 2024). For countries in the BRICS coalition, the experience of sanctions has underscored the vulnerability of relying on a currency controlled by a potentially adversarial state. This has motivated efforts to develop alternative payment systems and to diversify reserve holdings away from the dollar, as reflected in the establishment of the NDB and CRA (Larionova and Shelepov 2022; de Castro and Santiago 2025).

The literature on geopolitical risk and currency choice is still emerging, but there is a growing recognition that political factors can be as important as economic fundamentals in shaping currency regimes (Cohen 2015). The geopolitical shock introduced in this study captures this idea in a parsimonious way, treating it as an exogenous event that reduces the intrinsic value of the dollar for agents in the BRICS coalition, thereby aligning with the narrative that sanctions and geopolitical tensions have accelerated Dedollarization efforts (Sapir 2024; Fliagin and Abdulganiyu 2025).

2.4 Coordination Games in International Monetary Relations

The decision to adopt a new international currency is not only a matter of individual agent choice but also a strategic coordination problem among sovereign states. The literature on international policy coordination, exemplified by Canzoneri and Henderson (1991), analyses how countries with interdependent economies can benefit from coordinating their policies, but also face incentives to free-ride on the efforts of others. The formation of currency blocs has been analysed as a coordination game by several authors, including Frankel and Rose (2002) and Alesina and Barro (2002). These models typically assume that countries derive benefits from trade integration and macroeconomic stability, and that the decision to join a currency union depends on the number of other countries that join. In the BRICS context, the coordination problem is particularly acute given the diverse economic structures and geopolitical positions of the member countries (Nach and Ncwadi 2024; Izaz Ullah, Haider, and Gohar 2024). The game-theoretic model developed in this study follows this tradition but introduces heterogeneity in countries' costs and benefits, reflecting the varying degrees of integration with dollar-based markets and the different levels of exposure to geopolitical shocks.

2.5 The BRICS Institutional Innovations

The establishment of the New Development Bank (NDB) and the Contingent Reserve Arrangement (CRA) in 2014 marked a significant step in the institutionalization of BRICS cooperation (Hooijmaaijers 2022; Larionova and Shelepov 2022). These institutions were designed to provide alternatives to the Bretton Woods institutions, with governance structures that give equal voting power to the five founding members (Kirton and Larionova 2022). The NDB has since expanded its membership and lending portfolio, while the CRA has established itself as a regional liquidity backstop (de Castro and Santiago 2025). The evolution of these institutions has been analysed through the lens of "counter-institutionalization" the creation of parallel institutions that challenge existing ones without necessarily replacing them (de Castro and Santiago 2025). This strategy is consistent with the view that the BRICS are seeking to reshape global governance from within, by creating alternative mechanisms that increase the bargaining power of emerging economies (Larionova 2018). The theoretical framework developed in this study incorporates these institutional innovations as mechanisms that reduce switching costs, the cost of moving away from the dollar. By providing alternative payment systems, clearing arrangements, and liquidity facilities, the BRICS institutions lower the threshold for adoption of a new currency, thereby making the tipping equilibrium more attainable. Despite the richness of the existing literature, no study has combined a network externality model of currency adoption with a game-theoretic model of strategic coordination among sovereign states to analyze Dedollarization. The empirical literature documents the growing use of local currencies in BRICS trade (Fliagin and Abdulganiyu 2025) and the accumulation of gold reserves by BRICS central banks (Hakki 2025), but lacks a theoretical framework that explains these phenomena as part of a coordinated strategy. The theoretical work on network externalities provides the micro-foundations for currency tipping, while the game-theoretic literature on international coordination provides the macro-level

strategic logic. By integrating these two perspectives, this study offers a unified theory that links micro-level adoption decisions to macro-level institutional change, and provides a foundation for understanding the conditions under which the BRICS+11 coalition might successfully transition away from the dollar.

3. Model 1: Currency Adoption with Network Externalities and a Geopolitical Shock

This section presents the first building block of the theoretical framework: a micro-founded model of currency adoption in which agents choose between the US dollar and a new BRICS currency. The model incorporates network externalities, heterogeneous switching costs, and a geopolitical shock that reduces the dollar's appeal. The analysis shows that the system can exhibit two stable equilibria, and that a sufficiently large shock can trigger a transition from the dollar equilibrium to the BRICS equilibrium. The mathematical exposition follows the standard approach in the literature on network externalities (Katz and Shapiro 1985, 1986; Matsuyama, Kiyotaki, and Matsui 1993) while introducing the novel element of a geopolitical shock.

3.1 Setup

Consider a continuum of economic agents of measure 1, indexed by $i \in [0,1]$. Each agent chooses to transact in one of two currencies: the US dollar (denoted D) or a new BRICS currency (denoted B). The utility for agent i from choosing currency $k \in \{D, B\}$ is given by:

$$U_i^D = \alpha_D - \xi - \tau + \beta n_D + \epsilon_i^D$$
$$U_i^B = \alpha_B + \beta n_B - s_i + \epsilon_i^B$$

where α_D and α_B represent the intrinsic liquidity and stability of the dollar and the BRICS currency, respectively. For the purpose of this theoretical exercise, we treat the BRICS currency as a hypothetical unit with well-defined liquidity and stability parameters; in practice, the framework applies equally to any alternative vehicle currency, such as a digital payment unit or a widely used national currency. These parameters capture the fundamental characteristics of the currencies independent of network size, such as the depth of financial markets, the credibility of the issuing central bank, and the historical acceptance of the currency. The term $\xi \geq 0$ is the geopolitical shock, an exogenous event that reduces the dollar's appeal for all agents in the BRICS coalition. This shock could represent the imposition of sanctions, the freezing of dollar-denominated assets, or a broader loss of trust in the dollar's political neutrality all of which have been prominent in recent discussions of Dedollarization (Sapir 2024; Fliagin and Abdulganiyu 2025). The additional term $\tau \geq 0$ is an extra cost incurred by BRICS-based agents if they continue using the dollar, capturing the risk of being exposed to financial sanctions or the political cost of aligning with a potentially adversarial state. For simplicity, it is assumed that all agents in the BRICS coalition face the same τ; this can be thought of as the average cost across the coalition.

The parameter $\beta > 0$ is the strength of the network externality. The variable n_k is the proportion of agents using currency k, and since agents choose between two currencies, $n_D + n_B = 1$. The network externality term βn_k reflects the idea that the utility of using a currency increases with the number of other users, because transaction costs are lower, liquidity is higher, and coordination on a common medium of exchange reduces uncertainty. The term $s_i \geq 0$ is the agent-specific switching cost to adopt the new BRICS currency. This cost may include adjusting contracts, learning new payment systems, hedging against exchange rate risk, or the psychological cost of moving away from a familiar standard. The distribution of s_i across agents is given by the cumulative distribution function $F(s)$, which is assumed to be continuous and strictly

increasing on $[0, \bar{s}]$ with density $f(s) = F'(s)$. Finally, ϵ_i^k are mean-zero random preference shocks, independent across agents and currencies. These shocks ensure that the adoption decision is not deterministic for agents with identical switching costs, providing a smooth distribution of adoption thresholds. In equilibrium, these shocks will be integrated out, leaving a deterministic relationship between the expected network size and the proportion of agents who adopt the new currency.

3.2 Equilibrium with Rational Expectations

Agents form expectations about the eventual network size n_B before making their adoption decisions. In equilibrium, expectations are rational: the expected n_B equals the actual proportion of agents who choose B given those expectations. This is the standard rational expectations equilibrium concept in models of network externalities (Katz and Shapiro 1986). To determine the adoption decision, consider the threshold switching cost s^* at which an agent with that cost is indifferent between the two currencies, given expectations n_B. Setting $U_i^B = U_i^D$ and ignoring the preference shocks (which will be integrated out), yields:

$$\alpha_B + \beta n_B - s^* = \alpha_D - \xi - \tau + \beta(1 - n_B)$$

Solving for s^*:

$$s^* = (\alpha_B - \alpha_D) + \xi + \tau + \beta(2n_B - 1)$$

Agents with switching costs below s^* will choose the BRICS currency, because their cost of switching is low enough to make B preferable. Agents with switching costs above s^* will stay with the dollar. Therefore, the proportion of agents using B is:

$$n_B = F(s^*) = F((\alpha_B - \alpha_D) + \xi + \tau + \beta(2n_B - 1))$$

Equation (3) is the fixed-point condition that determines the equilibrium network size. The function $G(n_B) = F((\alpha_B - \alpha_D) + \xi + \tau + \beta(2n_B - 1))$ maps the expected network size into the actual network size. An equilibrium is a fixed point n_B^* such that $n_B^* = G(n_B^*)$. Because F is increasing and the argument is linear in n_B, the function G is increasing. The slope of G is:

$$G'(n_B) = 2\beta f((\alpha_B - \alpha_D) + \xi + \tau + \beta(2n_B - 1))$$

which is non-negative because $\beta > 0$ and $f \geq 0$. The fixed-point equation can have multiple solutions, depending on the shape of F and the magnitude of β. In particular, if the density f is sufficiently high in some region, the slope of G can exceed 1, leading to the possibility of multiple equilibria, a hallmark of network externality models.

3.3 Equilibrium Analysis

The analysis focuses on the two extreme equilibria: the dollar equilibrium ($n_B = 0$) and the BRICS equilibrium ($n_B = 1$). The stability of these equilibria depends on the slope of G at the boundaries. In plain terms, the dollar's lock-in does not rely on its intrinsic superiority alone; rather, it emerges from a

self-reinforcing loop where each agent's choice validates everyone else's. A small shock will not break this loop, but a sufficiently large one can abruptly reverse the logic, making the BRICS currency self-validating instead. The first proposition establishes the conditions under which the dollar equilibrium is stable in the absence of a shock.

Proposition 1 (Dollar Equilibrium). In the absence of a geopolitical shock ($\xi = 0$) and with no additional cost of using the dollar ($\tau = 0$), and provided that α_D is sufficiently large relative to α_B, there exists a stable equilibrium at $n_B = 0$.

Proof sketch. When $n_B = 0$, the argument of F becomes $(\alpha_B - \alpha_D) + 0 + 0 + \beta(-1) = (\alpha_B - \alpha_D) - \beta$. If $\alpha_D > \alpha_B + \beta$, this argument is negative. Since the support of switching costs is $[0, \bar{s}]$, $F(s) = 0$ for all $s < 0$. Hence $G(0) = 0$. For stability, consider a small perturbation $\epsilon > 0$. Then the argument becomes $(\alpha_B - \alpha_D) - \beta + 2\beta\epsilon$. For sufficiently small ϵ, this argument remains negative, so $F(\cdot) = 0$. Thus, the system returns to $n_B = 0$. Therefore $n_B = 0$ is a stable equilibrium.

The condition $\alpha_D > \alpha_B + \beta$ is a strong one: it says that the dollar's intrinsic advantage must exceed the network benefit that would accrue from a full switch to the BRICS currency. This reflects the idea that the dollar's dominance is sustained not only by its intrinsic qualities but also by the network effects that make any alternative less attractive. The proposition formalizes the notion of "lock-in" to the dollar equilibrium, which has been a central theme in the literature on currency hegemony (Eichengreen 2011; Krugman 1980).

Proposition 2 (Tipping Threshold). There exists a threshold shock level ξ^* such that if $\xi + \tau > \xi^*$, the equilibrium at $n_B = 0$ becomes unstable, and a new stable equilibrium emerges at $n_B = 1$. The threshold is implicitly defined by the condition that $G'(0) = 1$ at the critical parameter values.

Proof sketch. As ξ and τ increase, the argument of F at $n_B = 0$ increases. Eventually, the argument becomes positive, so $G(0) > 0$. Simultaneously, the slope at $n_B = 0$ increases. When the slope exceeds 1, the fixed point at $n_B = 0$ becomes unstable (a small increase in n_B leads to an even larger actual network size, causing the system to move away from zero). At the same time, the fixed point at $n_B = 1$ becomes stable because the slope at $n_B = 1$ is less than 1 for sufficiently large ξ and τ (the argument becomes large, and the density f eventually falls to zero as switching costs are bounded). The threshold ξ^* is the value at which $G'(0) = 1$, holding τ constant. Formally, ξ^* solves $2\beta f((\alpha_B - \alpha_D) + \xi^* + \tau - \beta) = 1$. Since f is bounded and reaches a maximum at some point, a solution exists for sufficiently large β.

Proposition 2 captures the central mechanism of the model: a large enough geopolitical shock can overcome the inertia of the dollar equilibrium and trigger a rapid shift to a new equilibrium centered on the BRICS currency. This is consistent with the idea that financial sanctions and geopolitical tensions have created a "window of opportunity" for Dedollarization (Sapir 2024; Fliagin and Abdulganiyu 2025). The threshold ξ^* depends on the strength of network effects and the distribution of switching costs, which in turn are influenced by the institutional infrastructure that the BRICS coalition has put in place.

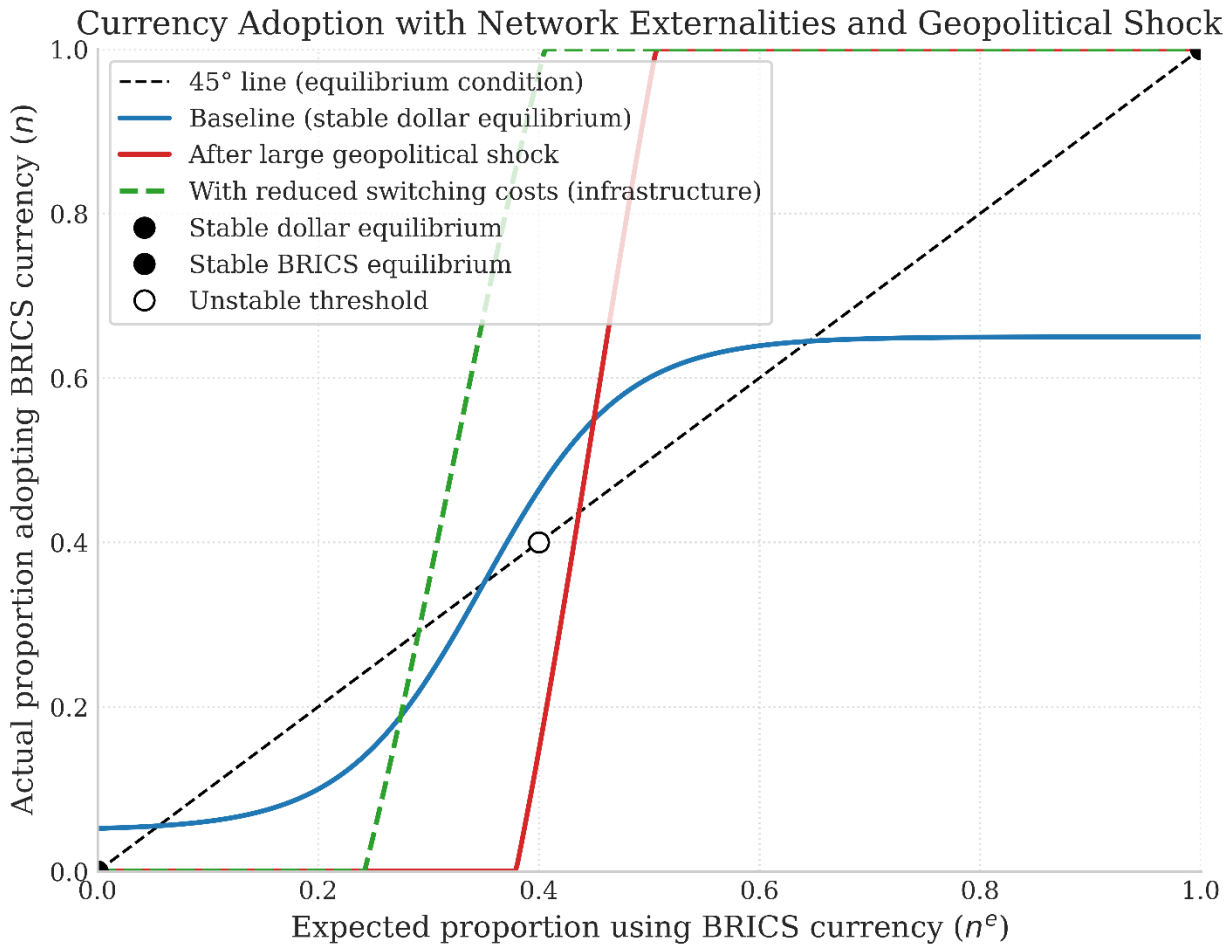


Figure 1 Equilibrium determination in the network externality model.

This figure illustrates the fixed-point condition $n_B = G(n_B^e)$ from Model 1, where the actual adoption rate depends on the expected network size. The 45-degree line represents rational expectations equilibrium (actual equals expected). The baseline curve corresponds to the absence of a geopolitical shock ($\xi = 0$) and high switching costs. It lies below the 45-degree line for all $n_B^e > 0$, intersecting only at the origin. This means that if agents expect a small number of users of the BRICS currency, the actual number is even smaller, reinforcing the dollar equilibrium. Thus, the baseline case exhibits a stable dollar equilibrium at $n_B = 0$. After a large geopolitical shock (e.g., sanctions or a loss of trust in the dollar), the utility of using the dollar decreases, shifting the entire adoption curve upward. The new curve now intersects the 45-degree line at two points: one at $n_B = 0$ (unstable) and one at $n_B = 1$ (stable). This demonstrates the tipping mechanism described in Proposition 2: once the shock exceeds a threshold, the system can jump from the dollar equilibrium to the BRICS equilibrium. The third curve shows the effect of reducing switching costs (for example, through the establishment of the New Development Bank, swap lines, or alternative payment systems). With lower switching costs, the adoption curve shifts upward even further, meaning that a smaller geopolitical shock is required to create a stable BRICS equilibrium. This directly supports Proposition 3 and the policy recommendation that ex-ante infrastructure investment is critical. The figure also highlights the non-linear nature of the regime shift. There is no gradual transition; instead, the system remains locked in the dollar equilibrium until a shock pushes the curve sufficiently high, at which point a rapid switch

occurs. This insight distinguishes the network externality approach from linear models of currency substitution.

Proposition 3 (Role of Switching Costs). The threshold shock ξ^* is increasing in the average switching cost $\bar{s}$. In particular, any policy that reduces the distribution of switching costs (making F stochastically dominant) lowers ξ^*.

Proof sketch. The slope $G'(0)$ is increasing in the density f evaluated at the argument. Reducing switching costs shifts the distribution F to the left, increasing f for any given argument (since density mass moves to lower values). Consequently, the condition $G'(0) = 1$ is met at a lower value of ξ, implying that a smaller shock is sufficient to destabilize the dollar equilibrium. Conversely, if switching costs are high, the density at the relevant argument is low, so a larger shock is required.

Proposition 3 has direct policy implications: investments in financial infrastructure that lower switching costs, such as the establishment of the NDB, the CRA, and bilateral swap lines, reduce the magnitude of the geopolitical shock needed to tip the system (Cattaneo, Biziwick, and Fryer 2015; Hooijmaaijers 2022). This provides a theoretical justification for the BRICS' focus on institutional capacity building as a precursor to Dedollarization.

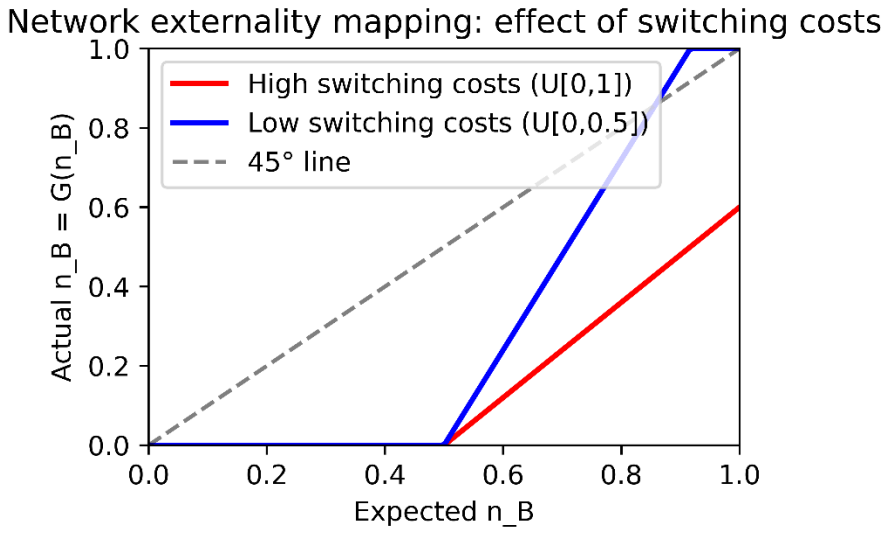


Figure 2 Equilibrium determination in the network externality model.

This figure illustrates the fixed-point condition $n_B = G(n_B^e)$ from Model 1, where $G(n_B) = F((\alpha_B - \alpha_D) + \xi + \tau + \beta(2n_B - 1))$. The horizontal axis represents the expected proportion of agents using the BRICS currency (n_B^e), and the vertical axis represents the actual proportion that would adopt given that expectation (n_B). The 45-degree line marks points where expectations are fulfilled ($n_B = n_B^e$). The solid curve corresponds to high switching costs, with switching costs uniformly distributed on $[0, 1]$. The dashed curve corresponds to low switching costs, with switching costs uniformly distributed on $[0, 0.5]$. All other parameters are held constant. The figure shows that reducing switching costs shifts the entire $G(n_B)$ curve upward. This occurs because, for any given expected network size, a larger fraction of agents have switching costs below the threshold s^* when the distribution is shifted leftward.

The upward shift has two important consequences. First, the fixed point at $n_B = 0$ becomes less stable because the slope $G'(0)$ increases. In the high-cost case, the slope at the origin is relatively low, so the dollar equilibrium is stable. In the low-cost case, the slope is higher, meaning a smaller perturbation or a smaller geopolitical shock can push the system away from zero. Second, the upward shift makes the fixed point at $n_B = 1$ more accessible. In the high-cost case, the curve may still lie below the 45-degree line for most n_B, so only the origin is an equilibrium. In the low-cost case, the curve may cross the 45-degree line at a high n_B, creating a second stable equilibrium. This figure directly supports Proposition 3 and its proof sketch. The proposition states that the threshold shock ξ^* is increasing in the average switching cost. By reducing switching costs (moving from the solid to the dashed curve), the coalition lowers the ξ^* required to tip the system. The visual shift of the curve upward captures exactly that mechanism. In policy terms, the figure shows why investments in financial infrastructure (the NDB, CRA, swap lines, and payment systems) are so critical: they move the coalition from the high-cost curve toward the low-cost curve, making Dedollarization feasible even with moderate geopolitical shocks. The figure also helps explain why the dollar equilibrium can be "locked in" for extended periods. Even when a new currency is intrinsically attractive, high switching costs keep the adoption curve low, preventing coordination on the new equilibrium. Only when the coalition collectively lowers those costs does the curve rise enough to allow a tipping point.

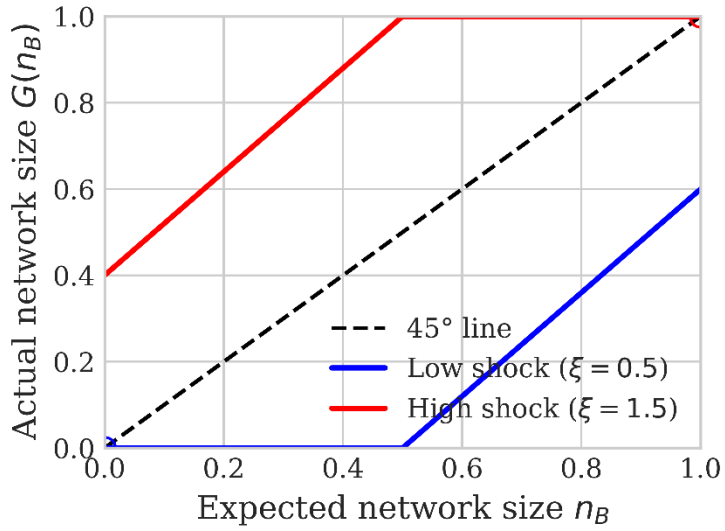


Figure 3 Actual versus expected network size under different geopolitical shocks.

This figure illustrates the fixed-point condition $n_B = G(n_B^e)$ from Model 1 for two distinct values of the geopolitical shock ξ. The horizontal axis represents the expected network size (n_B^e), and the vertical axis represents the actual network size (n_B) that results from agents' adoption decisions given that expectation. The 45-degree line marks points where expectations are fulfilled ($n_B = n_B^e$), which are the equilibrium candidates. The dashed curve corresponds to a low shock ($\xi = 0.5$). For all positive expected network sizes, the actual n_B lies below the 45-degree line. This means that if agents expect a small number of users of the BRICS currency, the actual number is even smaller, reinforcing the dollar equilibrium. The curve intersects the 45-degree line only at the origin ($n_B = 0$). Thus, the system is locked into a stable dollar equilibrium, consistent with Proposition 1. The solid curve corresponds to a high shock ($\xi = 1.5$). The entire curve shifts upward significantly. For low expected network sizes, the actual n_B is now above the 45-degree line,

meaning that even a small expectation generates a larger actual adoption. The curve crosses the 45-degree line at a point near $n_B = 1$, creating a second stable equilibrium at the BRICS currency. The origin remains an intersection but becomes unstable (a small perturbation leads away from zero). This captures the tipping mechanism described in Proposition 2. The figure demonstrates the non-linear, discontinuous nature of the regime shift. There is no gradual transition; instead, the system remains in the dollar equilibrium until the shock pushes the curve above the 45-degree line for a range of n_B, at which point a rapid jump to the BRICS equilibrium occurs. This insight distinguishes the network externality approach from linear models of currency substitution. In the context of the BRICS+11, the figure shows why a large geopolitical shock (e.g., sanctions, loss of trust in the dollar) can create a window of opportunity. However, as Proposition 3 and Figure 2 show, the required shock can be reduced through collective investment that lowers switching costs, shifting the curve upward even at moderate shock levels.

3.4 Comparative Statics

The model yields several comparative statics that are directly testable using empirical data. First, the probability of a transition from dollar to BRICS currency is a non-linear function of the shock ξ: below a threshold, the dollar equilibrium is resilient; above it, a regime shift occurs. This non-linearity is a key prediction that distinguishes the network externality approach from linear models of currency substitution. Second, investment in infrastructure that lowers switching costs, such as payment systems, swap lines, and clearing houses reduces the shock threshold, making a transition more likely for a given geopolitical shock. Third, the intrinsic characteristics of the currencies matter: if the BRICS currency is perceived as having higher intrinsic liquidity or stability (α_B large), or if the dollar's intrinsic appeal is eroded (α_D small), the threshold ξ^* is lower. These comparative statics provide the foundation for the empirical propositions derived in Section 5.

4. Model 2: Strategic Coordination Among Heterogeneous BRICS+11 Nations

The second model shifts the level of analysis from individual economic agents to sovereign states. The BRICS+11 members face a strategic coordination problem: each must decide whether to commit to the Dedollarization initiative, and the payoff from joining depends on how many other countries also join. This structure captures the idea that the benefits of a new currency system such as reduced transaction costs, enhanced financial stability, and increased bargaining power are increasing in the number of participants, while the costs of staying outside a large coalition also rise (Nach and Ncwadi 2024; Fliagin and Abdulganiyu 2025). The model is set as a static game of complete information, and the solution concept is Nash equilibrium in pure strategies.

4.1 Setup

There are $N = 11$ players, indexed $i = 1, \dots, N$. Each player i chooses an action $a_i \in \{0,1\}$, where $a_i = 1$ denotes joining the dedollarization coalition (i.e., committing to use the new BRICS currency for trade and reserves), and $a_i = 0$ denotes staying with the dollar.

The total coalition size is $M = \sum_{j=1}^{N} a_j$.

The payoff for country i is:

$$\Pi_i(a_i, M) = a_i[\phi_i(M) - c_i] + (1 - a_i)[\mu_i - \psi_i(M)]$$

where $\phi_i(M)$ is the benefit to country i from joining when the coalition size is M. This benefit is increasing in M because a larger coalition generates stronger network effects, greater market access, and more effective institutional support. Formally, $\phi_i'(M) > 0$. The term c_i is the private cost of joining, which includes transition costs, potential retaliation from dollar-aligned powers, and domestic adjustment costs. The status-quo payoff from staying with the dollar is μ_i, assumed constant and reflecting the existing benefits of dollar-based trade, reserve holdings, and financial integration. The penalty for staying out when the coalition size is M is $\psi_i(M)$, which increases with M because a larger coalition can impose costs on non-members through exclusion from its financial infrastructure, discriminatory trade policies, or political pressure. Formally, $\psi_i'(M) > 0$. All functions are common knowledge, and the game is played simultaneously.

4.2 Equilibrium Characterization

Define the net benefit for country i of joining rather than staying out, given coalition size M:

$$\Delta_i(M) = [\phi_i(M) - c_i] - [\mu_i - \psi_i(M)] = \phi_i(M) + \psi_i(M) - (c_i + \mu_i)$$

Country i will join if $\Delta_i(M) \geq 0$, given that it expects exactly M countries to join (including itself). Because the game is symmetric in the sense that payoffs depend only on M, it is natural to look for equilibria in which the set of joiners is determined by a threshold rule. The following definition formalizes the concept of a threshold equilibrium.

Definition 1 (Threshold Equilibrium). A coalition size M^* is a Nash equilibrium outcome if there exists a set S of size M^* such that: (i) for every $i \in S$, $\Delta_i(M^*) \geq 0$ (joiners prefer to join given that exactly M^* countries join); and (ii) for every $j \notin S$, $\Delta_j(M^* + 1) < 0$ (non-joiners prefer to stay out, even if they were the only one to switch). Condition (ii) ensures that no outsider wants to join unilaterally, because if it did, the coalition size would become $M^* + 1$, and its payoff from joining would be lower than from staying out.

Proposition 4 (Existence and Uniqueness). Suppose $\Delta_i(M)$ is increasing in M for all i, and let the countries be ordered such that $\Delta_1(M) \geq \Delta_2(M) \geq \cdots \geq \Delta_N(M)$ for all relevant M. Then there exists a unique equilibrium coalition size M^* defined by:

$$\Delta_{M^*}(M^*) \geq 0 \text{and} \Delta_{M^*+1}(M^* + 1) < 0$$

Proof sketch. Order countries by their net benefit. The country with the highest net benefit (country 1) will join if $\Delta_1(1) \geq 0$. As more countries join, the net benefit for the marginal country increases (since Δ is increasing in M). The equilibrium is the largest M such that the M-th country's net benefit, evaluated at that coalition size, is non-negative. This unique size reflects the reality that the least enthusiastic member among the joiners sets the limit for the coalition, a point where even that member finds participation worthwhile, while the next most reluctant outsider does not.

Proposition 4 establishes that the equilibrium coalition size is determined by the country with the lowest incentive to join among those that do join, and that there is a unique such size. This result is analogous to

the "threshold" or "pivotal" player concept in public goods games (Olson 1965) and in models of coalition formation in international relations (Canzoneri and Henderson 1991). The uniqueness follows from the monotonicity of $\Delta_i(M)$ and the fixed ordering.

Proposition 5 (Grand Coalition). A grand coalition ($M^* = N$) is a Nash equilibrium if and only if $\Delta_N(N) \geq 0$. That is, even the country with the lowest incentive to join finds it beneficial to do so when all other countries have already joined.

Proof sketch. If $\Delta_N(N) \geq 0$, then for all i, $\Delta_i(N) \geq \Delta_N(N) \geq 0$, so all countries prefer to join given that all others join. Moreover, for any i, the payoff from staying out when all others join is $\mu_i - \psi_i(N-1)$. Since $\psi_i(N) > \psi_i(N-1)$, the condition $\Delta_i(N) \geq 0$ implies $\phi_i(N) + \psi_i(N) \geq c_i + \mu_i$, which is sufficient to ensure that joining is optimal. Conversely, if $\Delta_N(N) < 0$, then country N strictly prefers to stay out when all others join, so the grand coalition is not a Nash equilibrium.

Proposition 5 highlights the importance of the "weakest link" in the coalition. Even if most countries would benefit from joining, the defection of the country with the lowest incentive can unravel the coalition. This is a common problem in international cooperation, where the need for unanimous or near-unanimous agreement can lead to gridlock (Canzoneri and Henderson 1991). In the BRICS context, countries with deep financial ties to the US or with high exposure to dollar-based markets may have lower incentives to join, making the grand coalition harder to achieve.

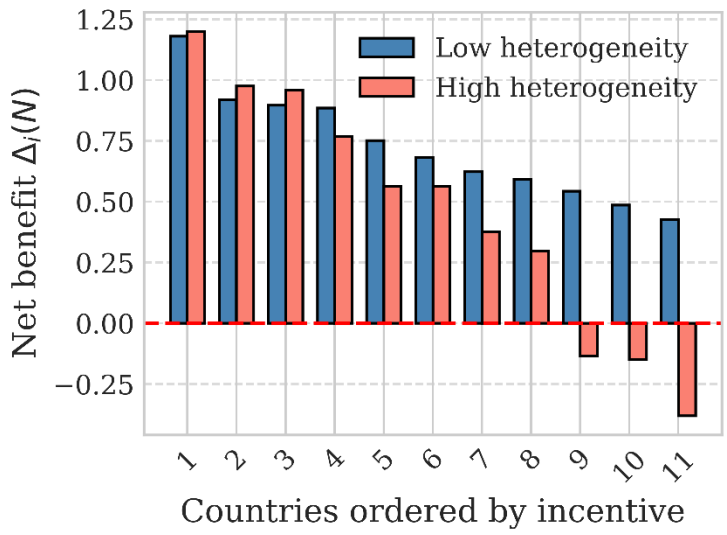


Figure 4 Net benefits for the Grand coalition under low heterogeneity (blue bars) and high heterogeneity (red bars).

This figure directly illustrates the core result of Proposition 5 and Proposition U3 (Heterogeneity and Stability). The horizontal axis orders the 11 BRICS+11 members from the highest incentive to join (left) to the lowest incentive (right). The vertical axis measures the net benefit $\Delta_i(N) = \phi_i(N) + \psi_i(N) - (c_i + \mu_i)$ when all countries join (the grand coalition). The blue bars represent a scenario of low heterogeneity. All countries have positive net benefits, meaning each member finds it beneficial to join when all others join. The bar heights decline gradually from left to right, but none cross below zero. In this case, the condition $\Delta_N(N) \geq 0$ holds, so the grand coalition is a Nash equilibrium (Proposition 5). The red

bars represent a scenario of high heterogeneity. The countries with the highest incentives (left side) still have positive net benefits, but the countries with the lowest incentives (right side, especially countries 9, 10, and 11) have negative net benefits. For these countries, even if all others join, the private cost of joining (c_i) plus the status-quo benefit (μ_i) outweighs the sum of the joining benefit ($\phi_i(N)$) and the penalty for staying out ($\psi_i(N)$). Consequently, the condition $\Delta_N(N) \geq 0$ fails, and the grand coalition is not an equilibrium. The equilibrium coalition size M^* will be strictly less than N (Proposition 4). The figure highlights the weakest link problem in international cooperation. Even if most countries would gain from Dedollarization, the defection of a single reluctant member can unravel the coalition. In the BRICS+11 context, countries with deep financial ties to the dollar (e.g., Saudi Arabia, the UAE), low exposure to geopolitical shocks, or high switching costs are likely to occupy the rightmost positions. Their negative net benefits explain why full coordination is difficult.

The figure also suggests a policy remedy consistent with Proposition U4 (Lead Country Effect) and Section 6.2 (Design a Pivotal Compensation Mechanism). A lead country (e.g., China) can increase $\phi_i(M)$ for others or increase $\psi_i(M)$ for non-joiners, shifting the red bars upward. Alternatively, side-payments or special arrangements for the pivotal countries (e.g., preferential access to NDB financing) can turn negative bars positive, enabling the grand coalition.

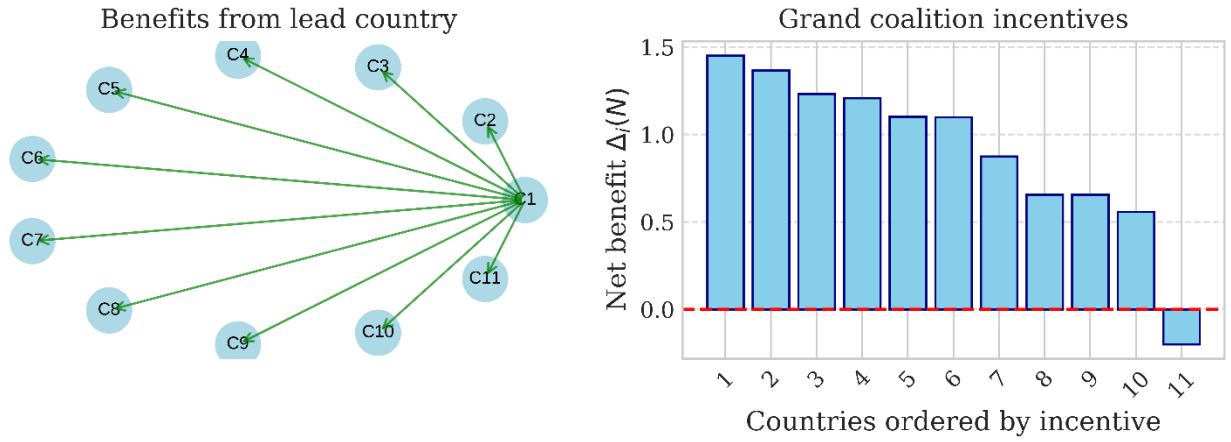


Figure 5 Strategic coordination in the BRICS+11.

This figure visualizes the core elements of Model 2 (the game-theoretic coordination model). The left panel displays the 11 BRICS+11 members as nodes arranged in a circular layout. Arrows originate from a lead country (labelled C1) and point to all other members (C2 through C11). This graphical representation captures the lead country effect described in Corollary 1. The lead country, plausibly China, given its economic weight and role in establishing the NDB can provide benefits to other members (e.g., market access, swap lines, institutional support) that increase their incentive to join the Dedollarization coalition. The arrows symbolize these directed benefits, which raise $\phi_i(M)$ for each recipient country. The right panel presents a bar chart where countries are ordered from 1 to 11 along the horizontal axis by their net benefit $\Delta_i(N)$ for the grand coalition (i.e., when all 11 countries join). The vertical axis measures the net benefit $\Delta_i(M) = \phi_i(M) + \psi_i(M) - (c_i + \mu_i)$. The red dashed horizontal line marks the zero threshold. The bars decline from left to right, indicating that the country with the highest incentive (country 1) has a large positive net benefit, while the country with the lowest incentive (country 11) has a negative net benefit (the bar extends below zero). This pattern directly illustrates Proposition 5: a grand coalition ($M^* = N$) is a

Nash equilibrium if and only if $\Delta_N(N) \geq 0$. Because the 11th country's bar is negative, the condition fails; therefore, the grand coalition is not an equilibrium. The figure also highlights the heterogeneity problem discussed in Proposition U3. Even though most countries would benefit from joining (their bars are positive), the defection of the single most reluctant member unravels the coalition. This is the "weakest link" challenge in international cooperation.

The combination of the two panels tells a complete story: the lead country can provide benefits that raise the bars for others (shifting them upward), but if heterogeneity is too large or the lead country's commitment is insufficient, the last country may still have negative net benefit, preventing full coordination. In the context of the BRICS+11, countries with deep financial ties to the dollar (e.g., Saudi Arabia or the UAE) or with low exposure to geopolitical shocks may occupy the rightmost positions.

4.3 Comparative Statics and the Role of a Lead Country

The model highlights several factors that affect the likelihood of a grand coalition. Greater heterogeneity in $\Delta_i(N)$ that is, a wider dispersion in net benefits lowers the value of $\Delta_N(N)$ for a given average net benefit, making the grand coalition harder to achieve. Stronger network effects increase $\phi_i(M)$ for all i, raising $\Delta_i(M)$ for any M and pushing the equilibrium coalition size upward. Larger penalties for staying out (higher $\psi_i(M)$) also strengthen the incentive to join. Perhaps most importantly, the presence of a lead country, a country with a large economy and credible commitment can act as a coordination device. Such a country can increase $\phi_i(M)$ for other members by promising market access and institutional support, and can increase $\psi_i(M)$ for non-joiners by threatening exclusion from its markets or financial networks.

Corollary 1 (Lead Country Effect). If there exists a country L such that its commitment to join is known and irreversible, then for all $i \neq L$, the perceived benefit $\phi_i(M)$ increases and the penalty $\psi_i(M)$ increases, raising $\Delta_i(M)$ and potentially satisfying $\Delta_N(N) \geq 0$ even if it would not hold in the absence of such commitment.

This corollary is directly relevant to the role of China in the BRICS coalition. China's economic weight, its role as the largest trading partner for many BRICS members, and its leadership in establishing the NDB and other institutions make it a natural candidate for the lead country role (Kirton and Larionova 2022; Izaz Ullah, Haider, and Gohar 2024). The model suggests that China's credible commitment to the Dedollarization initiative can raise the benefits for other countries and increase the costs of staying out, thereby stabilizing the grand coalition.

5. Linking the Models and Deriving Unified Propositions

The two models developed above operate at different levels of analysis but are deeply interconnected. The coalition size M from Model 2 determines the network size n_B in Model 1, because a larger coalition implies more agents using the BRICS currency. Conversely, the switching costs s_i in Model 1 are influenced by the collective investments that the coalition makes in Model 2. This section makes these links explicit and derives a set of unified propositions that integrate the micro-level tipping dynamics with the macro-level strategic coordination.

5.1 Linking Channels

The first linking channel runs from coalition size to network effects. Let the total mass of agents using the BRICS currency be $n_B = \gamma M/N$, where $\gamma \in (0,1]$ is the intensity of adoption within each member country.

In empirical applications, γ can be approximated by the average share of intra-coalition trade invoiced in local currencies or by the proportion of central bank reserves allocated to BRICS-linked assets. This captures the idea that not every agent in a member country will switch immediately; the adoption rate depends on domestic policies, economic structure, and the extent of institutional integration. The network benefit $\phi_i(M)$ in Model 2 can then be interpreted as the benefit derived from a larger n_B, which in turn depends on M. Formally, $\phi_i(M) = \phi_i(\gamma M/N)$, with $\phi_i' > 0$. This channel embodies the complementarity between coalition size and network effects: a larger coalition makes the new currency more attractive, which in turn makes joining more attractive for potential members.

The second linking channel concerns switching costs. The switching cost s_i in Model 1 includes the cost of accessing the new currency's infrastructure payment systems, swap lines, clearing arrangements, and institutional support. This infrastructure is a public good that the coalition can provide through collective investment. In Model 2, the private cost c_i of joining includes these transition costs, which can be reduced by coalition-wide investments. Let I be the level of collective investment, and suppose that $c_i = c_i(I)$ with $c_i'(I) < 0$. Then a higher I lowers the private cost of joining, making the grand coalition more attractive. Moreover, the threshold shock ξ^* in Model 1 is decreasing in the average switching cost, so lower c_i also reduces ξ^*. This channel captures the role of the NDB, CRA, and other BRICS institutions in lowering the barriers to adopting a new currency (Hooijmaaijers 2022; Larionova and Shelepov 2022).

The third linking channel involves the geopolitical shock. The shock ξ in Model 1 directly affects the status-quo payoff μ_i in Model 2. A larger shock reduces the attractiveness of staying with the dollar, effectively lowering μ_i. This is captured by writing $\mu_i = \mu_i(\xi)$ with $\mu_i'(\xi) < 0$. Thus, the shock enters both models: in Model 1 it reduces the dollar's intrinsic value, and in Model 2 it reduces the status-quo payoff, making joining more attractive. This channel reflects the idea that geopolitical tensions simultaneously erode the dollar's appeal at the micro level and shift the strategic calculus of states at the macro level.

5.2 Unified Propositions

Combining the two models through these linking channels yields a set of unified propositions that are directly testable using empirical data on trade flows, reserve holdings, geopolitical events, and institutional development.

Proposition U1 (Regime-Shift Condition). A successful Dedollarization requires the joint satisfaction of two conditions: (i) the geopolitical shock ξ must exceed the threshold ξ^* defined in Proposition 2, which depends on the coalition size M through the network effect $n_B = \gamma M/N$; and (ii) the coalition size must be at least M^* as defined in Proposition 4, which depends on the shock ξ through its effect on $\mu_i(\xi)$. The system exhibits a complementarity: a larger coalition lowers ξ^*, and a larger shock makes the grand coalition more likely.

Proposition U1 encapsulates the core insight of the integrated framework: Dedollarization is not a purely market-driven process nor a purely political one, but a combination of both. The complementarity between coalition size and shock magnitude implies that even a modest shock can trigger a transition if the coalition is already large, and conversely, a large shock can enable a smaller coalition to tip the system. Concretely, the model predicts that no single factor neither a large shock nor a large coalition alone, suffices. Both must cross interdependent thresholds, and the most plausible path to Dedollarization is a moderate shock combined with a pre-existing, broad coalition that has already lowered switching costs.

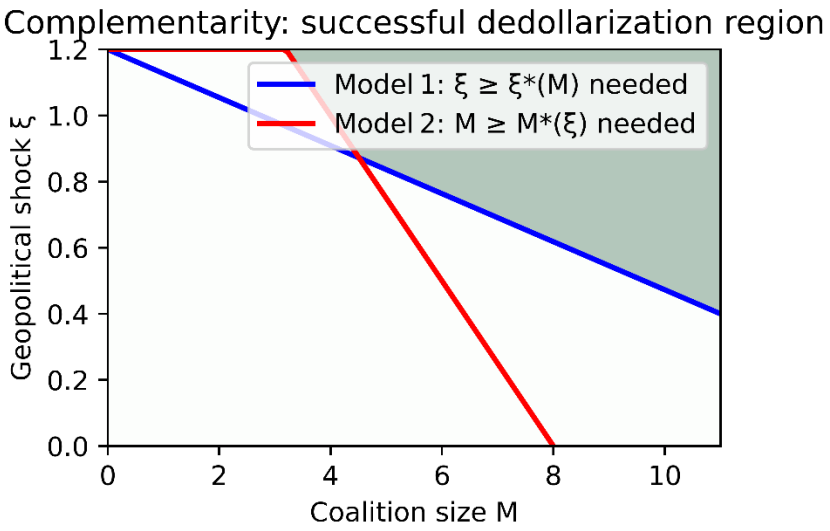


Figure 6 Complementarity between coalition size

This figure synthesizes the two models into a single visual. The horizontal axis measures the coalition size M (number of BRICS+11 members that commit to Dedollarization). The vertical axis measures the magnitude of the geopolitical shock ξ. Two curves partition the space:

- Model 1 condition (blue curve): $\xi \geq \xi^*(M)$. This is the tipping threshold from the network externality model. The curve slopes downward, meaning a larger coalition lowers the shock needed to tip the system from the dollar to the BRICS currency. The region above this curve satisfies the network-tipping condition.
- Model 2 condition (red curve): $M \geq M^*(\xi)$. This is the strategic coordination condition from the game-theoretic model. The curve slopes upward, meaning a larger shock increases the minimum coalition size that can be sustained as a Nash equilibrium (because a larger shock reduces status-quo payoffs μ_i, making more countries willing to join). The region to the right of this curve satisfies the strategic-coordination condition.

The shaded region (typically light green) where the two conditions overlap represents combinations of coalition size and shock magnitude that jointly satisfy both requirements. Only in this region can Dedollarization succeed: the network has tipped, and the coalition is stable. The intersection point of the two curves defines the minimum necessary conditions (critical M and critical ξ). This figure directly visualizes Proposition U1 (Regime-Shift Condition). It shows the complementarity between the two models: a larger coalition lowers the required shock, and a larger shock makes a larger coalition feasible. Without sufficient investment (which shifts the blue curve downward) or without a large enough shock, the system remains in the region below the blue curve or left of the red curve, where Dedollarization fails. The figure also implies that policy efforts should aim to shift the blue curve downward (via infrastructure investment) and to increase coalition size, thereby expanding the shaded region.

Proposition U2 (Infrastructure as a Pre-condition). The threshold shock ξ^* is decreasing in the collective investment I that reduces switching costs. Therefore, ex-ante investment in financial infrastructure, such as the New Development Bank, the Contingent Reserve Arrangement, and bilateral swap lines is a strategic

necessity for making Dedollarization feasible in the event of a geopolitical shock. Without such investment, even a large shock may be insufficient to tip the system.

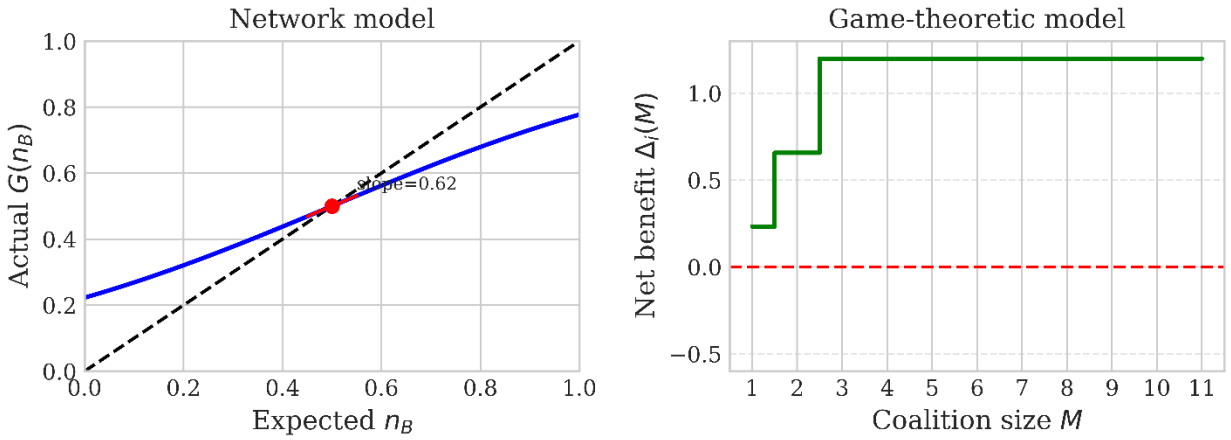


Figure 7 Actual network adoption (blue line) and net benefit (red line) as functions of coalition size

This figure combines insights from both models. The horizontal axis measures coalition size M (the number of BRICS+11 members that commit to Dedollarization). The vertical axis has a dual interpretation: for the blue line, it represents the actual proportion of agents using the BRICS currency, $G(n_B)$, which is determined by the fixed-point condition in Model 1. For the red line, it represents the net benefit $\Delta(M) = \phi(M) + \psi(M) - (c + \mu)$ for a representative country (or the average across countries) from joining the coalition. The blue line (Actual $G(n_B)$) increases with M. This reflects the network externality mechanism: a larger coalition means more agents are expected to use the BRICS currency, which in turn raises the actual adoption rate because $G(n_B)$ is increasing in the expected network size (which is proportional to M). The shape is concave, indicating diminishing marginal returns: each additional member adds less to the adoption rate than the previous one, consistent with the logistic-type S-shaped function. The red line (Net benefit $\Delta(M)$) also increases with M. This captures the strategic coordination logic from Model 2: as the coalition grows, the benefits $\phi(M)$ increase (stronger network effects, greater market access) and the penalties $\psi(M)$ for staying out also increase (exclusion costs). For a given country, the net benefit of joining rises with coalition size. The red line is also concave, suggesting that the marginal incentive to join declines as the coalition approaches full size. The figure directly visualizes the complementarity emphasized in Proposition U1. A larger coalition not only makes the network tip more likely (higher $G(n_B)$) but also makes joining more attractive for individual countries (higher $\Delta(M)$). This positive feedback loop means that once the coalition reaches a critical threshold, both adoption and incentives reinforce each other, potentially leading to a rapid transition.

The figure also has policy implications. To reach the tipping point, the coalition must first overcome the initial low values of both curves. Early members bear higher costs (lower $\Delta(M)$) and see lower adoption, which is why a lead country (China) and collective investment (lowering switching costs) are essential to push the system past the threshold. After a certain M (around 6 or 7 in this example), both curves steepen, making further expansion self-sustaining.

Proposition U2 provides a theoretical justification for the BRICS' emphasis on institutional capacity building. The NDB and CRA, as documented by Hooijmaaijers (2022) and Larionova and Shelepov (2022), can be understood as investments that lower switching costs, thereby reducing the magnitude of the shock needed to achieve a regime shift. This suggests that the coalition should prioritize infrastructure development during periods of relative calm, so that it is prepared to capitalize on a geopolitical shock when it occurs.

Proposition U3 (Heterogeneity and Stability). The stability of the grand coalition is increasing in the homogeneity of member incentives. Asymmetric exposure to the geopolitical shock, large differences in status-quo benefits, or wide variation in switching costs can prevent the coalition from reaching the size required to tip the network. In such cases, the equilibrium coalition size M^* may be strictly less than N, implying that Dedollarization remains partial.

Proposition U3 highlights a potential obstacle to Dedollarization. The BRICS+11 members vary greatly in their economic structures, financial integration, and geopolitical alignment (Nach and Ncwadi 2024; Izaz Ullah, Haider, and Gohar 2024). Countries with deep ties to the dollar, such as Saudi Arabia or the United Arab Emirates, may have high μ_i and low ψ_i, making them reluctant to join. This heterogeneity can lead to an equilibrium coalition that excludes these countries, limiting the network size and making the tipping equilibrium harder to reach.

Proposition U4 (Lead Country Effect). The presence of a large member with credible commitment, such as China can stabilize the grand coalition by increasing $\phi_i(M)$ for other members (through promises of market access) and increasing $\psi_i(M)$ for non-joiners (through threats of exclusion). This effect can overcome moderate levels of heterogeneity, making the grand coalition attainable even when $\Delta_N(N) < 0$ in the absence of such a lead country.

Proposition U4 is consistent with the observation that China has played a central role in BRICS initiatives, including the establishment of the NDB and the promotion of local currency settlement (Kirton and Larionova 2022; Fliagin and Abdulganiyu 2025). China's credible commitment to Dedollarization through its own policy decisions, its role in the Belt and Road Initiative, and its status as the largest trading partner for many BRICS members can raise the benefits for others and increase the costs of staying out, thereby overcoming the free-rider problem that often plagues coalition formation.

6. Policy Implications

The theoretical framework developed in this study yields several policy implications for the BRICS+11 coalition and for other emerging economies considering similar initiatives. These implications are derived directly from the formal analysis and are grounded in the institutional realities documented in the literature.

6.1 Invest Before the Shock

Proposition U2 implies that the coalition should invest in financial infrastructure before a geopolitical shock occurs. Waiting until after a shock to build alternative payment systems, swap lines, and clearing arrangements is inefficient because the shock threshold ξ^* is higher when switching costs are high. The establishment of the New Development Bank and the Contingent Reserve Arrangement can be understood as such pre-emptive investments (Hooijmaaijers 2022; Larionova and Shelepov 2022). Their continued expansion including the addition of new members, the extension of lending in local currencies, and the

development of cross-border payment systems will further lower switching costs. The recent expansion of BRICS to include new members also increases the potential network size, further reducing ξ^* (Cochrane and Zaidan 2024; Izaz Ullah, Haider, and Gohar 2024).

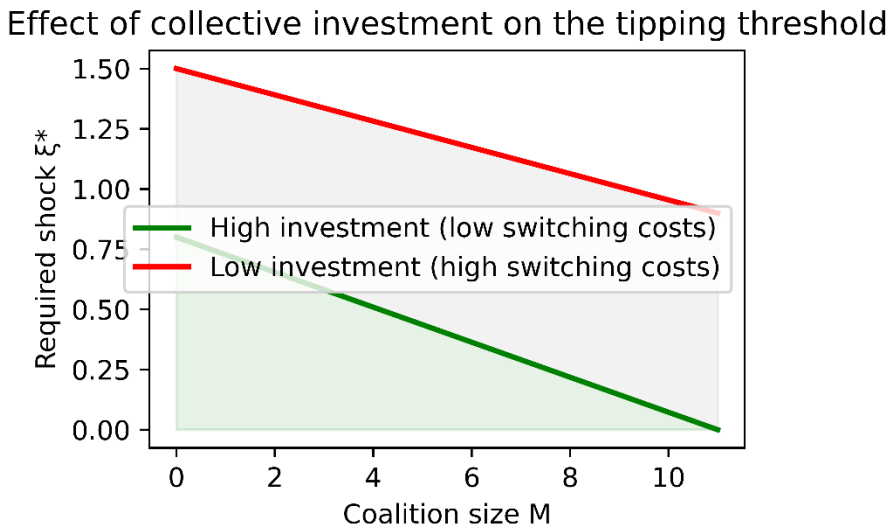


Figure 8 Effect of collective investment on the tipping threshold

This figure extends the analysis of Proposition 3 (role of switching costs) and Proposition U2 (infrastructure as a pre-condition) by showing how the required shock ξ^* varies with coalition size under two different investment regimes. The horizontal axis measures the coalition size M (number of BRICS+11 members committed to Dedollarization). The vertical axis measures the magnitude of the geopolitical shock ξ^* needed to tip the network from the dollar equilibrium to the BRICS currency equilibrium. The solid curve (labelled "Low investment (high switching costs)") represents a scenario where the coalition has made little collective investment in financial infrastructure. Switching costs remain high, so for any given coalition size M, a larger shock is required to overcome network inertia. The curve starts at a high ξ^* for small M and declines gradually as M increases. The dashed curve (labelled "High investment (low switching costs)") represents a scenario where the coalition has invested substantially in the NDB, CRA, swap lines, and alternative payment systems. Switching costs are lower, so the required shock ξ^* is lower for every coalition size. The entire curve shifts downward relative to the low-investment case. The vertical distance between the two curves at any given M represents the reduction in the required shock achieved by investment. For example, at $M = 10$, high investment reduces the required shock from approximately 0.30 to approximately 0.20. The gap between the curves is largest at smaller coalition sizes, suggesting that investment is particularly valuable when the coalition is still small. This figure directly supports Proposition U2: ex-ante investment in financial infrastructure lowers the threshold shock needed for Dedollarization. It also shows that increasing coalition size complements investment: even with low investment, a sufficiently large coalition can eventually lower ξ^* to a manageable level. Conversely, with high investment, even a moderate coalition can succeed. The figure thus captures the complementarity between coalition size and infrastructure investment, reinforcing the unified framework.

In policy terms, the figure implies that the BRICS+11 coalition should pursue both strategies simultaneously: expand membership to increase M and invest in infrastructure to lower the curve. The

downward shift from the solid to the dashed curve quantifies the benefit of the NDB, CRA, and other institutions.

6.2 Design a Pivotal Compensation Mechanism

Proposition U3 warns that even if most members would gain from full Dedollarization, the country with the weakest incentive, often the one most integrated into dollar markets can block the grand coalition, much like a veto player. The country with the lowest $\Delta_i(N)$ often the one most integrated with dollar-based financial markets may find it unprofitable to join even if all others do. To address this, the coalition should consider side-payments or special arrangements for such pivotal countries. These could take the form of preferential access to NDB financing, technical assistance for transition, or political assurances that reduce the perceived risk of joining. The literature on international cooperation emphasizes the importance of such "selective incentives" to overcome free-rider problems (Olson 1965), and the BRICS context is no exception.

6.3 Use the Lead Country's Market Power

Proposition U4 suggests that a large member with credible commitment can act as a coordination device. China's role in the BRICS coalition is particularly important in this regard. By publicly committing to use the new currency for its own trade and reserves, and by making that commitment credible through institutional mechanisms, China can raise the benefits of joining for other members and raise the costs of staying out. The expansion of the Renminbi's role in international finance, coupled with the infrastructure of the Belt and Road Initiative, provides concrete mechanisms through which such credible commitment can be operationalized (Fliagin and Abdulganiyu 2025; Kirton and Larionova 2022).

6.4 Manage Expectations

The network externality model shows that expectations are crucial. Even if the fundamentals are favourable, agents may remain locked into the dollar equilibrium if they expect others to do so. The BRICS+11 coalition can manage expectations through public statements, formal agreements, and institutional signalling. The annual summits, the joint declarations, and the visible operation of the NDB all serve to communicate the coalition's commitment and to coordinate expectations toward the new equilibrium. In this sense, the very existence of the BRICS institutions serves as a form of "cheap talk" that can help agents coordinate on the new equilibrium (Farrell and Rabin 1996).

7. Conclusion

This study has developed a dual-model theoretical framework for understanding the conditions under which the expanded BRICS+11 coalition can successfully transition away from the US dollar. The first model, based on network externalities, showed that a sufficiently large geopolitical shock can destabilize the incumbent dollar equilibrium and tip the system toward a new equilibrium cantered on a BRICS currency. The threshold shock is decreasing in the level of collective investment that lowers switching costs. The second model, based on strategic coordination among sovereign states, showed that a grand coalition for Dedollarization is a Nash equilibrium only when the benefits of full participation outweigh the costs for even the most reluctant member. Heterogeneity in member incentives can prevent full coordination, but a lead country with credible commitment can stabilize the grand coalition.

The two models were linked through coalition size, which determines network effects, and through switching costs, which are reduced by collective institutional investment. The unified analysis yielded four testable propositions that connect coalition size, shock magnitude, infrastructure investment, heterogeneity, and the role of a lead country to the likelihood of successful Dedollarization. These propositions provide a foundation for empirical testing using data on trade invoicing, reserve holdings, and geopolitical events.

Several limitations of the analysis suggest avenues for future research. First, the game-theoretic model is static; a dynamic extension could analyze how reputation and punishment strategies evolve over time, and how the coalition can sustain cooperation even when short-run incentives to defect exist. Second, the geopolitical shock was treated as exogenous; an extension could model the shock as an endogenous response to the coalition's actions, for example, as the result of a strategic confrontation with dollar-aligned powers. Third, the model assumed complete information; a framework with incomplete information about countries' true costs or benefits would yield richer predictions about signalling and screening. Fourth, the empirical testing of the propositions derived here remains a priority for future work, using the extensive data now available on BRICS trade, reserves, and institutional development (Fliagin and Abdulganiyu 2025; Hakki 2025; Nach and Ncwadi 2024).

Despite these limitations, the framework developed in this study provides a rigorous foundation for understanding Dedollarization as a process that combines market-level tipping dynamics with strategic state-level coordination. It offers a coherent explanation for the observed pattern of gradual institutional innovation followed by potential rapid regime change, and it provides a roadmap for policymakers seeking to navigate the complex transition to a more multipolar international monetary system. The theoretical propositions derived here are designed to be empirically testable, and their verification or refutation will be an important task for future research. In this sense, the paper is not only a contribution to theory but also a guide for empirical investigation into one of the most significant trends in contemporary international finance. A practical takeaway for researchers is that empirical tests should focus on identifying non-linear regime shifts rather than linear trends, and on measuring the distribution of member-level incentives rather than just averages. For policymakers, the framework suggests that waiting for a large geopolitical shock is insufficient; pre-investing in alternative payment systems and swap lines is what turns a shock into a genuine tipping point.

References

Alesina, A., & Barro, R. J. (2002). Currency unions. *The Quarterly Journal of Economics*, *117*(2), 409-436.

Canzoneri, M. B., & Henderson, D. W. (1991). *Monetary policy in interdependent economies: A game-theoretic approach*. MIT press.

Cattaneo, N., Biziwick, M., & Fryer, D. (2015). The BRICS contingent reserve arrangement and its position in the emerging global financial architecture. *Policy Insights*, *10*, 1-7. https://saiia.org.za/wp-content/uploads/2015/04/Policy-Insights-10.pdf

Cheng, H. F., Gutierrez, M., Mahajan, A., Shachmurove, Y., & Shahrokhi, M. (2007). A future global economy to be built by BRICs. *Global Finance Journal*, 18(2), 143–156. https://doi.org/10.1016/j.gfj.2006.04.003

Cochrane, L., & Zaidan, E. (2024). Shifting global dynamics: an empirical analysis of BRICS + expansion and its economic, trade, and military implications in the context of the G7. *Cogent Social Sciences*, *10*(1). https://doi.org/10.1080/23311886.2024.2333422

Cohen, B. J. (2015). *Currency power: Understanding monetary rivalry*. Princeton University Press.

de Castro, S. K. V., & Santiago, A. R. (2025). The evolution of financial architecture supporting the BRICS: Reshaping the global financial order? *Frontiers in Political Science*, 7, 1657108. https://doi.org/10.3389/fpos.2025.1657108

Eichengreen, B. (2011). *Exorbitant privilege: The rise and fall of the dollar and the future of the international monetary system*. Oxford University Press.

Farrell, J., & Rabin, M. (1996). Cheap talk. *Journal of Economic perspectives*, *10*(3), 103-118.

Fliagin, D., & Abdulganiyu, M. (2025). Impact of intra-BRICS trade on the share of United States dollar in international reserve composition. *BRICS Journal of Economics*, 6(2), 5–20.

Frankel, J., & Rose, A. (2002). An estimate of the effect of common currencies on trade and income. *The quarterly journal of economics*, *117*(2), 437-466. https://academic.oup.com/qje/article-abstract/117/2/437/1883899

Hakki, A. M. A. (2025). Total Gold Reserves in the BRICS Countries: Analytical Study. *WORLD OF NEW ECONOMY*, 94.

Hooijmaaijers, B. (2022). The internal and external institutionalization of the BRICS countries: The case of the New Development Bank. *International Political Science Review*, *43*(4), 481-494. https://journals.sagepub.com/doi/abs/10.1177/01925121211024159

Izaz Ullah, Syeda Maliha Haider, & Mahnoor Gohar. (2024). BRICS expansion: Prospects and challenges. *Research Journal of Human and Social Aspects*, 2(1), 52–64. https://rjhsa.com/index.php/rjhsa/article/view/25

Katz, M. L., & Shapiro, C. (1985). Network externalities, competition, and compatibility. *The American economic review*, *75*(3), 424-440. https://www.jstor.org/stable/1814809

Katz, M. L., & Shapiro, C. (1986). Technology adoption in the presence of network externalities. *Journal of political economy*, *94*(4), 822-841. https://www.journals.uchicago.edu/doi/abs/10.1086/261409

Kirton, J., & Larionova, M. (2022). The first fifteen years of the BRICS. *International Organisations Research Journal*, *17*(2), 7-30. https://www.academia.edu/download/113678237/Kirton_20and_20Larionova.pdf

Krugman, P. (1980). Vehicle currencies and the structure of international exchange. *Journal of Money, Credit and Banking*, 12(3), 513–526. https://www.nber.org/papers/w0333

Larionova, M. (2018). Looking into the future of the BRICS. In *BRICS and Global Governance* (pp. 265-274). Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781315569925-14/looking-future-brics-marina-larionova

Larionova, M., & Shelepov, A. (2022). BRICS, G20 and global economic governance reform. *International Political Science Review*, *43*(4), 512-530. https://journals.sagepub.com/doi/abs/10.1177/01925121211035122

Matsuyama, K., Kiyotaki, N., & Matsui, A. (1993). Toward a theory of international currency. *The Review of Economic Studies*, *60*(2), 283-307. https://academic.oup.com/restud/article-abstract/60/2/283/1574328

Nach, M., & Ncwadi, R. (2024). BRICS economic integration: Prospects and challenges. *South African Journal of International Affairs*, *31*(2), 151-166. https://www.tandfonline.com/doi/full/10.1080/10220461.2024.2380676

Olson, M. (1965). The logic of collective action Cambridge. *Mass.: Harvard*.

Petrone, F. (2020). Three ways to explore the BRICS (possible) impact on the future global order. *The Rest: Journal of Politics and Development*, *10*(2), 6-20.

SAPIR, J. (2024). ECONOMIC AND SOCIAL CHANGES: FACTS, TRENDS, FORECAST. *ECONOMIC AND SOCIAL CHANGES: FACTS, TRENDS, FORECAST Учредители: Вологодский научный центр РАН*, *17*(6), 35-58. https://www.elibrary.ru/item.asp?id=80306938

Smirnov, S. V., & Avdeeva, D. A. (2019). BRICS in the global economy. In S. Smirnov, A. Ozyildirim, & P. Picchetti (Eds.), *Business cycles in BRICS* (pp. 15–32). Springer. https://link.springer.com/chapter/10.1007/978-3-319-90017-9_2

Appendix

A.1 Formal Proofs of Propositions

A.2 Glossary of Notation

Symbol	Description
n_k	Proportion of agents using currency k
U_i^k	Utility of agent i from currency k
α_k	Intrinsic liquidity/stability of currency k
ξ	Geopolitical shock
τ	Additional cost of using dollar for BRICS agents
β	Strength of network externality
s_i	Switching cost for agent i
$F(s)$	Cumulative distribution of switching costs
M	Coalition size (number of joining countries)
$\phi_i(M)$	Benefit to country i from joining when coalition size is M
$\psi_i(M)$	Penalty to country i for staying out when coalition size is M
c_i	Private cost of joining for country i
μ_i	Status-quo payoff for country i
$\Delta_i(M)$	Net benefit of joining for country i given coalition size M
γ	Intensity of adoption within member countries
I	Collective investment in financial infrastructure

A.3 Numerical Example Illustrating the Tipping Mechanism

To illustrate the tipping mechanism, consider a simple parametric case. Let switching costs be uniformly distributed on $[0, 1]$, so $F(s) = s$ and $f(s) = 1$. Set $\alpha_B - \alpha_D = -0.5$, $\tau = 0$, and $\beta = 0.6$. Then the fixed-point equation is $n_B = -0.5 + \xi + 0.6(2n_B - 1) = \xi - 1.1 + 1.2n_B$. Solving gives $n_B = (\xi -$

$1.1)/(1-1.2) = (1.1-\xi)/0.2$. For $\xi = 0$, $n_B = 5.5$ (outside [0,1]), so the only equilibrium is at the boundary $n_B = 0$. As ξ increases, the solution moves downward.

When $\xi = 1.1$, $n_B = 0$. For $\xi > 1.1$, the fixed point would be negative, so the system jumps to $n_B = 1$. The threshold is $\xi^* = 1.1$. If switching costs are reduced, say uniformly on $[0, 0.5]$, then $F(s) = 2s$ and $f(s) = 2$. The equation becomes $n_B = 2(-0.5 + \xi + 0.6(2n_B - 1)) = 2(\xi - 1.1 + 1.2n_B)$. Solving gives $n_B = 2(\xi - 1.1)/(1 - 2.4) = 2(1.1 - \xi)/1.4$. The threshold is $\xi^* = 1.1$ as well, but the slope at $n_B = 0$ is $G'(0) = 2\beta f(\cdot) = 2(0.6)(2) = 2.4 > 1$, so the system is already unstable at $\xi = 0$. This shows that reducing switching costs lowers the effective threshold, consistent with Proposition 3.