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Currency Dominance Is Not Forever: Some Insights from a Non-Linear Dynamic Model
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ABSTRACT

We propose stress tests based on an original International Monetary System (IMS) model with regime switchings. The model is calibrated for nine reference currencies from the beginning of the Classical Gold Standard to the present. Regime switchings in currency dominance are related to combinations of conditions on a multidimensional environment variable that includes five classes of shocks: technology; development; monetary, financial and fiscal institutions; democracy and conflicts; and the regulatory environment. We provide an original database of events for these five classes of shocks, which is used for calibration. The calibration highlights the important role of the democracy and conflicts component in regime switchings. The calibrated model is then used to perform stress tests on the current prospects of currency dominance for a broad set of scenarios. A salient result from the scenarios we tested is that the dominance of the US dollar is at most marginally affected. No other currency emerges as a major player, suggesting strong inertia in the system's current centripetal dynamics.

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Introduction

Objective and general framework

"There are many [...] reasons to believe the Pax Dollar era has peaked." (Rogoff, 2025)

At a time of high strains between the United States and China and ongoing instability in the Middle East, currency dominance is a hot topic. The current dominance of the US dollar could be affected if the country still holds dominant military, economic, financial and technological power, but faces problems with the rule of law and democratic accountability. Similarly, the future of the Chinese renminbi, which is currently seeing fast growth in its share of foreign exchange transactions (BIS, 2025), presumably depends on the ability of China to keep experiencing a favorable growth differential and assert increasing technological and military dominance, but also on its institutions remaining autocratic. The decline of the British pound and the rise of the US dollar as the dominant currency in the 20th century is frequently cited as evidence that currency dominance is not forever. We argue that this parallel should be viewed with caution. We propose an innovative non-linear modeling method that allows for prospective analysis, taking into account a broad set of fundamentals including geopolitics.

Our approach is inspired by stress testing methods used in financial systems, which draw on historical data to develop the hypothetical scenarios and to simulate their application. The basis of our approach is the two-layer graph model of Bordo and Bastidon (2025). This model describes the International Monetary System (IMS) and the International Financial System (IFS) as tree graph structures with joint regime switchings. In this paper we develop an approach specifically tailored to modeling currency dominance. The model focuses on the IMS, from the Classical Gold Standard to the present day. Since calibration based on historical scenarios is crucial in ensuring the validity of prospective analysis, we describe a broad system comprising nine currencies, as a proxy for the IMS: the British pound, the US dollar, the euro, the Japanese yen, the Russian ruble, the Chinese renminbi, an archetypal other emerging economy currency, an archetypal other advanced economy (small open economy) currency, and a digital asset. The IMS proxy composed of these nine currencies is described as a graph whose core corresponds to the dominant currency or currencies.

Modeling regime switchings in the IMS structure

"Even anchors of stability such as world providers of reserve currencies do end up sharply devaluating under bad enough circumstances." Farhi and Maggiori (2018)

In our proposed model, the IMS structure is globally stable within major institutional eras (Classical gold standard, Gold exchange standard, etc.) but may shift between eras. We describe the causes of these regime switchings. These causes widely remain "*terra incognita*" in existing studies, as emphasized by Flandreau and Jobst (2005) two decades ago. The latest theoretical works describe monetary regimes, i.e. eras of stability, rather than switchings between these regimes. E.g., Farhi and Maggiori (2018) model the IMS as based on reserve asset demand and supply in several configurations of exchange rate regimes and currency

dominance; Fernández-Villaverde and Sanches (2023) describe growth and inflation trajectories in a small open economy in the configuration of the Gold standard regime. Among the latest works, Abadi et al. (2026) propose a micro-founded theoretical model of currency competition based primarily on the characteristics of issued sovereign debt, with an advantage for large economies and a strong historical dependence. We focus on the circumstances under which the IMS structure switches, and the states of this structure before and after their occurrence.

We identify five components of a global environment event variable which may explain regime switching. These components comprehensively take into account the shocks affecting the dominance of each currency, whether favorably or unfavorably, in the reference literatures in Economic history, Monetary and Financial macroeconomics, and Political Science. These are: changes in technology; changes in development and access to resources; changes in monetary, fiscal and financial institutions; changes in geopolitical forces (including democracy and major conflicts); and changes in regulation.

The first step in the stress-testing procedure consists in coding the main historical events for the nine currencies of the IMS proxy and five components of the event variable, starting from the beginning of the Classical Gold Standard, thereby building an original events database. These components interact to explain switchings in the IMS structure.

Calibration and prospective analysis

"If questions continue to be raised about the strength and stability of US alliances, these [...] may be reflected in declining dollar shares" (Arslanalp et al., 2025)

The calibration, on which the stress-testing procedure relies, is implemented for five broad institutional eras: the Classical Gold Standard; the Gold Exchange Standard, Bretton Woods, the Managed Float, and a "Contemporary Period" spanning the 2000s to 2020s. This allows us to take into account the specific recent and ongoing shocks. Network effects in monetary systems (see, e.g., Eichengreen et al., 2016a) are modeled via a comprehensive range of states taking into account persistence. E.g., currencies shift between 'non-core' and 'core', via the intermediate states of 'ascending core', 'descending core', and 'challenger' currencies. Regime switchings are modeled via Markov chains conditional on the environment variable. The purpose of calibration is to identify these chains and their associated combinations of conditions. Based on the original events database, we find that regarding the states of the core (dominant currencies), combinations of conditions related to 'specific' shocks (i.e. major favorable or unfavorable shocks when the majority of other currencies experience a shock in the opposite direction) to development and geopolitics play a central role.

The calibration allows us to reproduce the dynamics of the system over the last 150 years. In particular, the successive states of the British pound and US dollar as cores are satisfactorily described: the British pound evolves from core to descending core then challenger. In parallel, the US dollar evolves from challenger to ascending core then core. We then apply our stress testing procedure, based on a set of country shocks scenarios on the environment variable that we combine to form global shocks scenarios, and observe their impact on currency dominance. The dominance of the US dollar is affected, but only in some scenarios,

and only marginally; that is, none of the scenarios suggest that it would be replaced by an alternative core currency in the coming decade. The current functioning of the system, which is essentially centripetal around the US dollar, is therefore largely inert.

Our contribution is threefold. First, our approach provides complementary insights to the existing literature on currency dominance, which often relies on portfolio models (e.g., Arvai et al., 2026) or panel data econometrics (e.g., Eichengreen et al., 2019 or Weiss, 2022). Secondly, it generalizes the traditional opposition between the economic vs. geopolitical factors, notably studied by Eichengreen et al. (2019) ("Mercury" vs. "Mars") or Seddon (2021) (sudden exogenous economic shocks vs. structural strategic choices of hegemons driven by historical-structural foundations). We propose an original events database including additional classes of factors, and model their interactions and the resulting non-linearities. Finally, the method is reproducible and allows for testing any scenario. In addition to the codes, an interface that allows users to quickly and easily select, test, and view scenarios is expected to be made freely available. Section 1 presents the reference literatures. Section 2 presents a chanelling of the IMS history in terms of the model. Section 3 presents the historical events database. Section 4 presents the calibration, currency dominance stress tests, and discusses the results.

1 The IMS as a currency graph with regime switchings: reference literatures and modeling principles

1.1 Currency dominance: currency graphs and network effects

The principle of modeling the IMS as a switching regime graph, introduced by Bordo and Bastidon (2025), is based on two observations. On the one hand, according to the existing literature in Monetary and Financial macroeconomics and Complex systems, networks and especially tree networks provide a relevant description of monetary and financial systems: see notably, for foreign exchange linkage networks, Flandreau and Jobst (2005), or for the modeling of financial networks by minimal spanning trees, Bastidon and Parent (2022).[1] On the other hand, IMS graph structures are essentially stable within broad institutional eras, and essentially different from one era to the next: see, for the identification of homogeneous eras of globalization by multivariate segmentation of graph descriptors, Bastidon et al. (2020); for the identification of major crises that delineate it using the same method, Bastidon et al. (2025).

Figure 1 represents the IMS as a tree graph model. The model has three features. The key feature is the core, i.e. the dominant currency or currencies. It is generally unique, based on the theory of hegemonic stability first formulated by Kindleberger (1973b) and reaffirmed in Kindleberger (1986) based on the superiority of leadership over alternative regimes in the provision of international public goods that may be affected by crises. The

[1] Kindleberger (1973a) is, to our knowledge, the first to justify the efficiency of centralized monetary and financial systems almost in terms of graphs: "N-1 conduits are needed instead of $N(N-1)/2$," i.e., the superiority of a star network, which is a special case of a tree network, over a complete network.

model can also account for milder forms of dominance, or even multipolarity, consistent with Keohane (2005)'s argument that the erosion of hegemony (in this case, that of the "post-Cold War" United States) makes cooperative regimes impossible. In the model, currencies have 5 possible states. The dominant currency corresponds to the 'core' (1st circle in Figure 1, in magenta). The currency or currencies that were previously dominant or are likely to be dominant in the future, correspond to the 'ascending core' and 'descending core' (2nd circle, in green), respectively. Currencies that are not dominant but represent a significant share of trade, correspond to 'challenger' (3rd circle, in blue). The other currencies correspond to 'non-core' (4th circle, in grey). Taking these five states into account, rather than a binary opposition between core and non-core, allows us to integrate "network effects" (see, in particular, Eichengreen et al., 2016a,b; Prasad, 2016). Network effects are a pillar of currency dominance: when the use of a currency as a unit of account and medium of exchange, in particular, becomes widespread beyond a critical threshold, it becomes costly for agents to change it.[2] These network effects do not preclude dominant currencies from changing over time in the event of a series of major shocks, but they do preclude such changes from occurring frequently.

The other two features of the IMS graph are the hub and distances, which are also characterized by non-binary states that take into account persistence phenomena. The hub represents the underlying asset of confidence in the system's currencies. For the period under study, two assets successively are hub: gold for the Classical gold standard to the end of the Bretton Woods period, then monetary policy credibility. Distances (i.e. the extension of the graph) represent transaction costs. During periods of fixed exchange rate regimes, technological progress and low regulation, transaction costs would tend to be low and distances to be short, and vice-versa. In the following subsection we detail the causes of regime switchings in the IMS graph structure.

1.2 Why do the IMS regimes switch?

The causes of currency dominance regime switchings have not been specifically studied so far (see, e.g., Flandreau and Jobst, 2005). The literature either describes monetary regimes (e.g., Farhi and Maggiori, 2018; Fernández-Villaverde and Sanches, 2023); examines the causes of dominance without specifically investigating the non-linearities of its dynamics (e.g., Abadi et al., 2026; Goodman and Goodman, 2012; Humpage, 2025; Keohane, 2005); or examines the consequences rather than causes of dominance (e.g., the ability to weaponize dominance, Farrell and Newman, 2019; James, 2025; or comovements in global cycles, Georgiadis et al., 2026.) Many studies focus on dominance from the specific perspective of international reserves. We draw on all of these works to propose a model that describes the causes and configurations of the IMS regime switchings. Based on the Economic history, Monetary and Financial macreconomics and Political science literatures, we identify five classes of causes which would explain regime switchings. These classes are: changes in technology; development including access to natural resources; changes in monetary, financial and fiscal

[2]It should be noted that "network effects" in the literature on currency dominance do not refer to the existence of currency networks *per se*, but to the structuring of monetary systems around a dominant currency. In terms of graph theory, these are "connectivity effects", rather than "network effects."

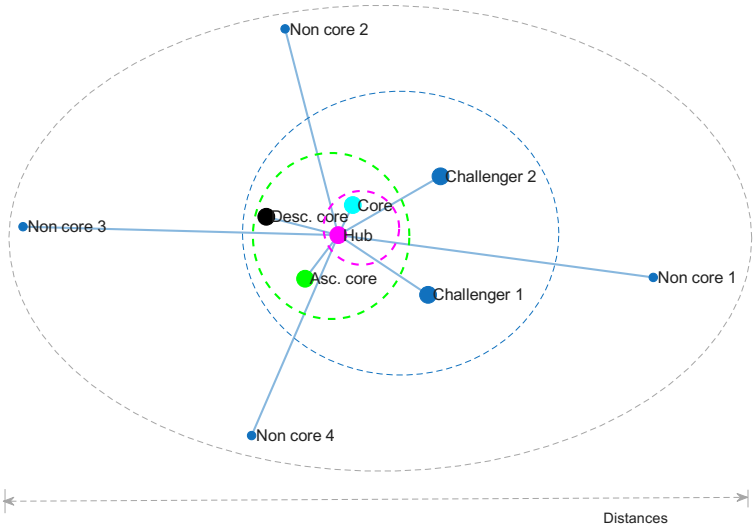


Figure 1: **IMS tree graph model, 3 features (hub, core, distances).** Currencies have 5 possible states describing emergence and decline dynamics ('non core', 'challenger', 'ascending core', 'core', 'descending core'). The hub (underlying asset of confidence in the IMS) and distances between currencies (transaction costs) also have multiple states.

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institutions; democracy and conflicts; and the crises-regulation cycle. These classes include, in particular, the economic "Mercury hypothesis" and the geopolitical "Mars hypothesis" of Eichengreen et al. (2019). In the model, these classes of causes are refered to as "components" of the environment variable.

The technological component refers to advances in technology and general economic growth, at the country and global level. Technological change in general, and financial revolutions in particular, are included in this component. For example, for the beginning of the period in which the model is calibrated, the literature highlights both the effects of the British Industrial Revolution on the country's economic and monetary dominance (Ward, 1994; Zueblin, 1897) and the essential prerequisite of the previous financial revolution. The latter observation is common to countries that have exercised economic and financial dominance over the last four centuries, notably the United Kingdom and the United States (Sylla, 2002). In more recent history, the relationship between technological dominance and monetary dominance, particularly in the case of China (Fratzscher and Mehl, 2014), also increasingly takes into account the rise of digital assets, especially the Chinese central bank's digital asset (Zhang et al., 2024).

The development component refers both to the processes themselves and access to the resources that contribute to them. Economic dominance as a necessary condition for currency dominance is well established (see, e.g., Abadi et al., 2026), including the possibility of double causality (see, e.g., Beckmann, 2024). Access to resources includes the possession and dismantling of colonial empires, as studied in particular by O'Rourke and Williamson (2002) or Ferguson (2012) for the British Empire. In general, there is much more literature

on the impact of colonization on the colonized countries than on the colonizers. However, Acemoglu and Robinson (2017)'s work on global income inequalities today, which comprehensively addresses the issue from both sides, is now considered a reference (for a synthetic review, see Nunn, 2020). Access to resources also includes the creation of economic areas or groups of countries within which privileged exchanges (particularly of energy commodities) develop. The establishment of the European Coal and Steel Community, in the early stages of European integration which culminated in the introduction of the euro as a single currency, is one example. Generally speaking, access to critical resources for current development processes influences economic and monetary dominance, in connexion with the theory of comparative advantage. An emerging literature studies the case of the recent "global rare earth competition" (see, e.g., Thibeault et al., 2023).

The monetary, financial and fiscal institutions component refers to major changes in the organization of these systems, at the international, regional, and national levels. At the international level, regime switchings are especially related to discussion and implementation of major reforms, notably during the Classical Gold standard. Some recommendations by e.g. Ricardo, Jevons, Marshall, Fisher, Wicksell and Keynes (Bordo, 1984) were partially implemented at the Genoa conference of 1922. During the Gold Exchange Standard, the adjustable peg, a proposal by Nurske (Nurkse, 1944) and then Keynes (1941) and White (1943), was adopted in Bretton Woods in 1944. At the end of the Bretton Woods regime, the floating regime proposal by Milton Friedman (Friedman, 1953) was ultimately implemented in 1973. At the regional level, the adoption of the euro as a single currency during a short "window of opportunity" identified by policymakers (Wyplosz, 2006) has enabled the currency to become the second most traded currency today. At the national level, a salient example of an institutional event was the establishment of the modern Federal Reserve System in 1913, which enabled the consolidation of national financial and banking markets and institutions (Bordo, 2014; Rousseau and Sylla, 2005). This innovation allowed the US financial and monetary system to catch up to its clear global real economic dominance that was achieved by 1900, and then to the dominance of the US dollar. Fiscal and financial institutions also influence monetary dominance. The influence of fiscal orthodoxy is based on the generalization of the principle that fiscal unorthodoxy is incompatible with exchange rate stability, as modeled in Krugman (1979). More generally, the risk and return of sovereign assets are an important criterion for dominance and its persistence (see, e.g., Abadi et al., 2026). Finally the influence of the overall level of financial development is exerted in particular, but not exclusively, through interactions with the transmission of monetary policy, see e.g. Aghion et al. (2000).

The democracy and conflicts component refers primarily to major conflicts and resulting economic and demographic costs, notably World Wars I and II. Kindleberger (1973a) and Cassis (2010) document that the two World Wars played a major role in the rise of the United States as a global banking and financial center. Before World War I, the rivalry was mainly between the United Kingdom and France (Cassis, 2010). However, the premisses of the expansion of US dominance began as early as the Franco-Prussian War of 1870 with loans from J.P. Morgan & Co. to the French government. The European extension of the US banking system then widened with the two world wars, against the backdrop of "British inability to serve as lender of last resort for Europe" (Kindleberger, 1973a). In general,

countries experiencing conflicts underperform in terms of production and consumption, due to reduced productivity, which is itself caused by the destruction of human and physical capital, and the proliferation of barriers to domestic and international trade (Thies and Baum, 2020).

The nature of political regimes is inextricably linked to the issue of conflicts: democracies are both less likely to declare war on each other and more likely to emerge victorious from conflicts with autocracies. This "powerful pacifism" can be explained by a microeconomic theory of the state, i.e., rent-seeking behavior that accentuates imperialist biases in foreign policy, particularly in autocratic states that face high costs of state control (Lake, 1992). As a result, Eichengreen (2021) notes that "every leading international and reserve currency in history has been the currency of a political democracy or republic", citing examples dating back to the Italian republican city-states of Genoa, Venice, and Florence. This relationship between political institutions and dominance also has an international dimension: for example, the sustainability of exchange rate regimes requires some form of coordination or even cooperation, the feasibility of which depends on national political systems (Broz and Frieden, 2001); conversely, a hegemon that weaponizes its dominant position risks future weakening reflecting fears that the scenario will repeat (Bordo and James, 2026).[3]

Finally, the crises-regulation cycle component refers to the interaction between major crisis events and their impact on financial regulation. Generally speaking, major crises are followed by increased regulation of financial transactions and/or higher transaction costs due to reduced market liquidity. This is true at the international level (e.g., the Global financial crisis, Litan, 2011), the regional level (e.g., the emerging market crises of the late 1990s, or the European sovereign debts crisis of 2011-2012, Lane, 2012), and the national level (e.g., the Japanese financial crisis of the late 1990s, Nakaso (2001)). It is widely accepted that this is a cyclical causality: deregulation shocks, notably those of the 1980s and 1990s, occur at the end of periods of financial stability associated with highly restrictive regulations. This mechanism is presumably affected by non-linearities: in a lightly regulated environment, financial innovation makes it possible to circumvent residual regulations (Calomiris, 2009). Outside of financial crises, adverse regulatory shocks can also result from the outcome of elections or referendums: for example, Brexit is disrupting the financial regulatory framework in the United Kingdom (Thompson, 2017); and Donald Trump's second term in the US is creating significant regulatory uncertainty (in addition to a possible decline in the independence of the Federal Reserve and widespread uncertainty about public policies in general, Gensler et al., 2025).

Combinations of conditions on these five components jointly explain regime switchings in our proposed IMS model. An important aspect is that, for each currency, the dynamics of the five components may have converging or, conversely, diverging effects. In the first case, the upward or downward regime-switching is straightforward. In the second, it is attenuated or

[3]Weaponization is the "unique privilege or advantage" of the hegemon (Bordo and James, 2026), as a result of a specific network topology generating asymmetries in the capacity to deny access to adversaries (Farrell and Newman, 2019). James (2025) states that this intertwinning of monetary systems, state systems and security issues can be viewed as a continuation of the historical predominance of debt-financed conflict in public spending, which influenced monetary policy.

even non-existent. A salient example is that of the US dollar, which is non core before WW1. The French Franc and Deutsche Mark were probably more important. The US dominated in growth by 1860. However, the country did not dominate in military power. Most US trade was still financed by Sterling bills before WW1 (Xu, 2022). Banking institutions were fragile in the nineteenth century, which is one of the reasons why the Federal Reserve was established, so that the US dollar's weight could reflect the country's economic weight.

2 A history of IMS regimes in graph terms

In this section, we present a reading of the historical evolution of the IMS since the Gold Exchange Standard in terms of the model, i.e. stable graph structures by broad institutional eras, delimited by regime switchings. A "Contemporary Period" describing the 2000s to 2020s is added to the Classical Gold Standard, Gold Exchange Standard, Bretton Woods, and Managed float periods. This allow us both to obtain eras of uniform length, and to integrate specific recent and ongoing shocks. The IMS is described by nine currencies including those that are dominant during one of the reference periods, and a broader set as a proxy for the world system: the British pound (GBP), the US dollar (USD), the euro (EUR), the Japanese yen (JPY), the Russian ruble (RUB), the Chinese renminbi (CNY), an archetypal other emerging economy currency (EME), an archetypal other advanced economy currency (small open economy, SOE), and a digital asset (STB). Together, these currencies (excluding the digital asset) account for 89% of transactions in the foreign exchange markets (BIS, 2025).[4] This guiding thread, summarized in a series of graph diagrams in Figure 2, provides an original and relevant comparative historical approach to the last 150 years of monetary and financial history, which are especially rich in structural events.

2.1 Classical Gold standard

The graph model of the Classical Gold Standard (Figure 2(a)) illustrates the importance of Sterling (IMS core), based on Gold (IMS hub). It also illustrates low transaction costs in foreign exchange markets (short distances), resulting from the absence of capital controls and radical technological advances in communications after the beginning of the deployment of transatlantic cables (Kavesh et al., 1978), followed by the widespread use of shortwave wireless radio.

This graph representation describes the status of Gold as money, with the properties

[4]It should be noted that many countries that are now developing and emerging economies were colonized during the period of study from the 19th century (Africa and Asia) until the 1940s-1950s (Asia) and 1960s-1970s (Africa), one consequence being the loss of monetary sovereignty. This is generally not the case for emerging economies whose currencies are the most commonly used today in the IMS. Among the BRICS, Brazil, like much of Latin America, was colonized much earlier since the early 16th century and gained independence in the early 19th, Russia has not been colonized in contemporary history, China has not been colonized except for "comparatively insubstantial" territorial enclaves (Goodman and Goodman, 2012), and South Africa became *de jure* independent in 1909. India is the only country in the group that was colonized during a notable part of the period under study. It was also one of the first countries to gain independence after World War II in 1947.

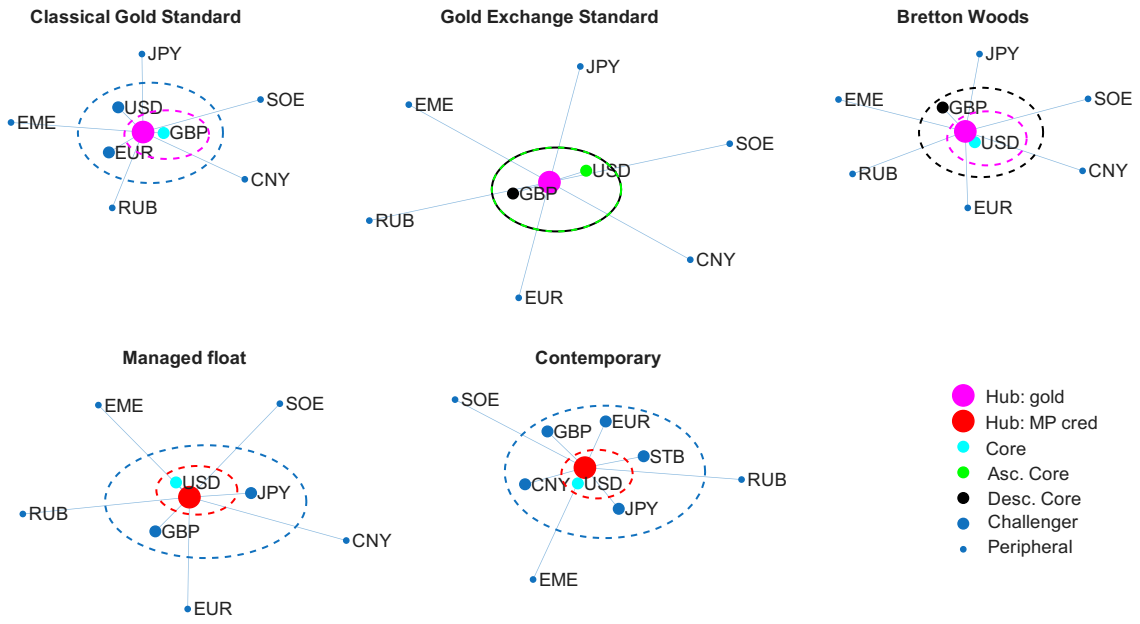


Figure 2: **Switching regime graph model, IMS. Restricted sample of 9 currencies.** USD: US dollar, GBP: Great Britain pound, EUR: euro (before Contemporary, main currencies of the euro basket, for detail see Section 3), JPY: Japanese yen, RUB: Russian ruble, CNY: Chinese renminbi, EME: other emerging market currency, Advanced SOE: other advanced small open economy, STB: digital asset. Node colors correspond to successive states: for the hub, Gold (magenta) then Monetary policy credibility (red); for currencies, Core (cyan blue) in the close neighborhood of the hub, then with decreasing closeness Ascending core (green) / Descending core (black), Challenger (blue, large dot) and Peripheral (blue, small dot).

of unit of account, means of exchange, and store of value. The Pound sterling, which was convertible into gold, evolved as core because of favorable development; technological; and monetary, financial and fiscal institutions conditions. These were reinforced over time by network effects (on network effects, see Section 1.1) for trade as invoicing for international trade, the standard of value property from the issuance of a riskless currency, and the stability of political institutions. The resulting networks were based on a path dependent process in which Sterling bills were the key financial instrument (Coppola et al., 2023). The dominance of the Pound sterling was strongly affirmed. The other currencies in the system occupied, at best, a challenger position in the graph. This was the case for the main currencies of continental Europe (the French franc and the Deutsche mark), and also for the US dollar. All other currencies occupied a peripheral position.

2.2 Gold exchange standard

The Gold exchange standard era graph (Figure 2(b)) mainly illustrates, at the core, the downfall since the 1920s in the dominance of the Pound sterling in favor of the US dollar. The Gold exchange standard era is marked by high transaction costs in foreign exchange markets, resulting in long distances, as a consequence of the shutdown of financial markets throughout World War I and the escalation of capital and exchange controls.

Gold is still the hub. The core now includes two currencies with distinct states: the Pound sterling, as descending core; and US dollar, as ascending core. These distinct states result from their respective proven track records in their continuation of convertibility into gold (Eichengreen and Flandreau, 2009). The Pound sterling declines with the loss of economic power experienced by the UK, in relation to the democracy and conflicts component of the environment variable. The US dollar is experiencing a symmetrical evolution, i.e. continued economic and geopolitical growth associated with a major institutional event, the creation of the modern Federal Reserve. All other currencies occupy peripheral positions: continental European currencies, previously the only challengers, fall back into the peripheral zone of the graph, under the impact of the geopolitical shock of World War I and its aftermath.

2.3 Bretton Woods

The Bretton Woods era is described in Figure 2(c). The graph mainly illustrates the ascent of the US dollar as the IMS core, grounded in gold which is still the IMS hub. The Bretton Woods era is marked by low transaction costs in foreign exchange markets, reflecting the fixed exchange rates regime. This is seen as short distances on the IMS graph.

The graph model captures the following main stylized facts. Gold, as the IMS hub; and thus the US dollar, as the IMS core, become increasingly dominant, albeit the Bretton Woods agreements originally stipulated two key currencies, i.e. the US dollar and the Pound sterling, with the Pound sterling viewed as a frontline defense for the dollar (Bordo et al., 2019). The dominance of the Pound sterling, seen in this graph as descending core, comes to an end following the 1967 devaluation (Schenk, 1998). The US dollar is widely utilized for international trade, but capital flows remain limited because of the capital controls. Over the

entire period the majority view, based on the Triffin dilemma (Triffin, 1960), was that the gold/US dollar standard was doomed. A contrary view was that the US acted as a financial intermediary (Despres et al., 1966) and that the gold/US dollar standard could have survived longer had it not been for the 1965 fiscal and monetary shocks associated with the Great Society program under President Johnson, and the growing involvement in the Vietnam war. As the dollar faced increasingly fierce attack, capital controls became less effective in the face of an acceleration of financial innovation, notably in trade invoicing and futures markets (Marston, 1997). Apart from the (asymmetric) bipolarity formed by the Pound sterling as descending core and the US dollar as core, all other currencies remain in peripheral positions in the graph.

2.4 Managed Float

In the Managed Float period (Figure 2(d)), the graph emphasizes the emergence of the US dollar as the only IMS core. The Pound sterling devolves as challenger. The emergence of the US dollar as the only IMS core takes place against the backdrop of the end of an official connection to gold (as the IMS hub) as stated in the Second Amendment of the International Monetary Fund's Articles of Agreement (1976); and the end of the fixed exchange rates system (1973). The US Dollar is dominant (IMS core) for both financial and trade flows, as extensively documented by, e.g., Ilzetzki et al., 2022, 2019; Ito and McCauley, 2019. With the demise of the fixed exchange rate regime, transaction costs rise in foreign exchange markets (increased distances). Monetary policy credibility becomes the underlying asset of confidence in the system (hub), in place of gold. The period is also marked by the rising importance of secondary financial centers (eg. in Tokyo, Hong Kong, Frankfurt, Paris). None becomes dominant in the IMS core, but the Japanese Yen accesses to the state of challenger.

2.5 The contemporary period

The most contemporary period, of the last three decades, is described in Figure 2(e). The US dollar remains dominant (core). The credibility of monetary policies remains the underlying foundation of confidence in the system. At the same time Gold's share of the global reserve system is increasing—as documented, for example, by Arslanalp et al. (2025), reflecting the geopolitical fragmentation in the demand for risk-free assets during periods of geopolitical tension (Arvai et al., 2026). The dominance of the US dollar does not preclude the emergence of locally dominant regional currencies including non-traditional reserve currencies (see, e.g., Arslanalp et al., 2025 or Humpage, 2025), i.e. challengers in the terms of the model (in addition to the Pound sterling and Japanese yen: the euro, the Chinese renminbi). The dynamics of transaction costs in foreign exchange markets is affected by both the adverse effects of currency risk (increasing IMS distances); and major technological shocks (shortening IMS distances). Digital currencies enter the graph as well, as challengers. Notably, the introduction of digital assets, especially based on the US dollar, opens up prospects for a decrease in foreign exchange transaction costs through improved cross-border interoperability (see, e.g., Brunnermeier et al., 2019).

The most widely debated question is that of the US dollar versus the Chinese renminbi, seen as a challenger. The US dollar currently remains overwhelmingly dominant in trading volumes, while the Chinese renminbi is experiencing rapid growth (BIS, 2025). Dollar dominance could be preserved (Ilzetzki et al., 2019, 2022; Ito and McCauley, 2019), as illustrated by the recent downward trend in the Chinese renminbi's share of the international reserve system (Arslanalp et al., 2025). The current dominance of the US dollar is supported by technological and geopolitical power, despite the decline in US economic power and adverse shocks to democratic and monetary governance. The rapid growth in the Chinese renminbi is commonly associated with the emergence at the beginning of the 21th century of an economic and military power comparable to that of the United States at the beginning of the 20th century. But unlike the rivalry between the British pound and the US dollar at that time, this is not a case of a more efficient rival with the same attributes, but rather the emergence of the currency of a very different type of country, whose democratic and monetary governance has significant shortcomings.

The rest of the system is also subject to uncertainties. A truly multipolar system still seems rather unlikely (Eichengreen et al., 2022; Abadi et al., 2026). The Euro's share remains limited, with Europe remaining for the moment a secondary geopolitical power despite its economic power (and Russia the opposite). The Pound sterling declines particularly rapidly. Emerging currencies gain ground (particularly the Indian Rupee), while advanced SOEs correncies (Canadian Dollar, Australian Dollar, etc.) are declining, with the exception of the Swiss Franc. Digital currencies like USD stablecoins are attracting considerable interest, this without much experience of the benefits and risks actually associated with their use. The model we propose offers answers to these questions. To this end, we reproduce the historical states of the system described in this section. We then conduct stress tests on its future behavior based on country and global scenarios involving the components of the event variable.

3 Environment variable events database

3.1 The methods of the events database

In this section, we present the method and content of the events database. We use the same broad institutional eras as in Section 2, each subdivided into three decades; and the same nine currencies. The archetype of emerging currency may be seen as an already existing currency, such as the Indian Rupee, or a possible future common currency of emerging economies such as the BRICS, which could be based on the blockchain technology. The digital asset may be seen as a USD stablecoin.

The events are based on the reference literature in the fields of Economic history and Political science (see Section 1.2). The selection of events follows the criteria of relevance, discrimination and parsimony, in line with financial models in the field of complex systems.

- *Relevance criterion*: This criterion ensures that each currency is indeed subject to events affecting its dominance and thus relevant in the stylized 9 currencies proxy of

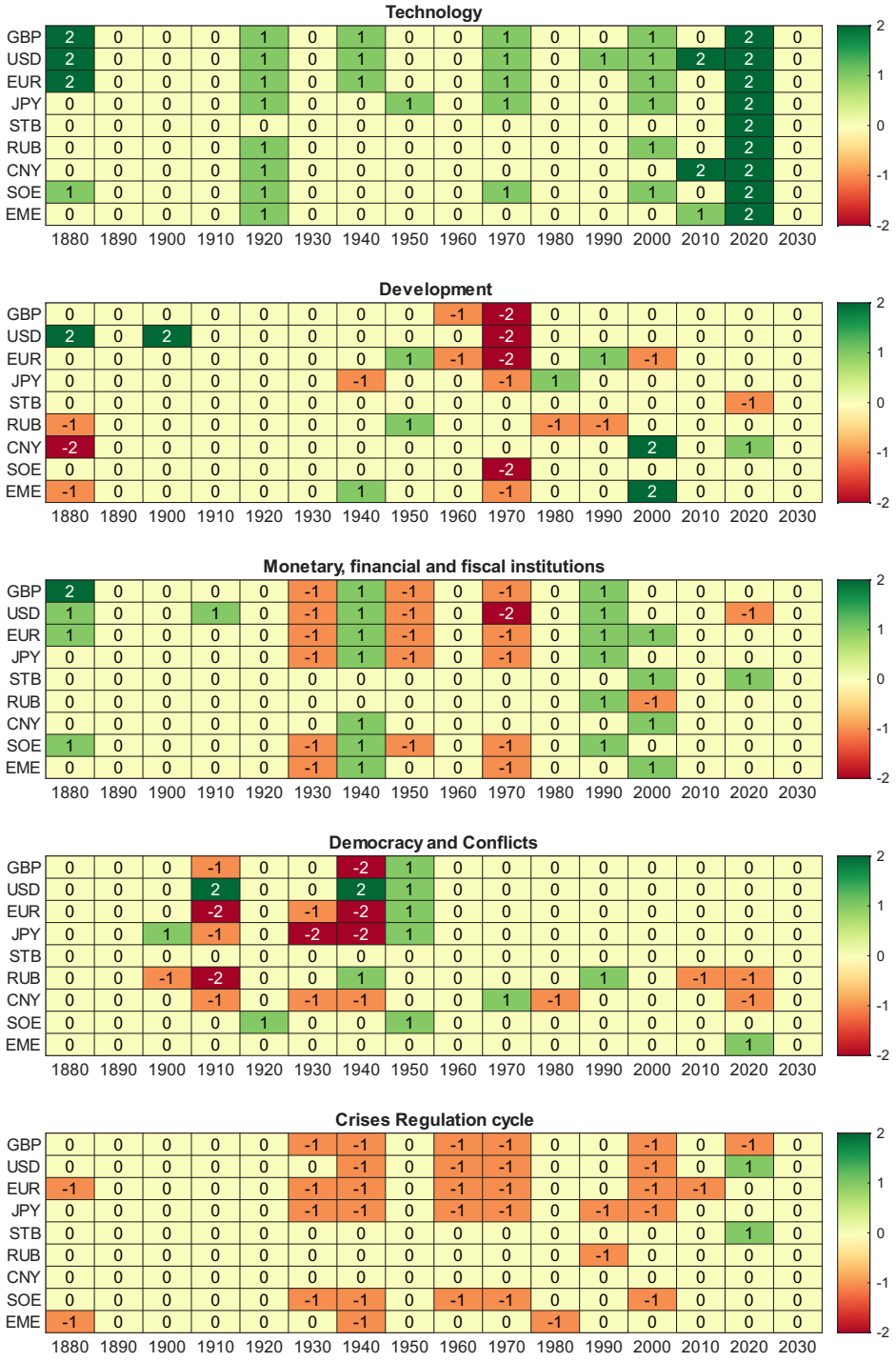


Figure 3: **Summary table of events, by components, currencies and decades.** Individual events are coded as (+1) (favorable) or (+2) (most exceptional favorable); (−1) (unfavorable) or (−2) (most exceptional unfavorable). (0) stands for no exceptional event. Possible multiple events are summed e.g., the sum of two favorable events coded as (+1) is coded as (+2).

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the IMS. For each component of the environment variable, each currency must thus exhibit at least one decade associated with a non-zero value, for at least four out of five components of the environment variable. E.g., the smallest countries currencies (SOE, EME), which experience the lowest number of major events, especially for the Democracy and conflicts component, still both exhibit one non-zero value.

- *Discrimination criterion*: This criterion ensures that events allow the dominant currency to be identified. Each currency thus has at least one idiosyncratic value which differentiates it from the others, for at least four out of five components of the environment variable. E.g., the Crises-regulation component is in large part driven by common events (Great Depression, Global Financial crisis etc.) but still includes at least one idiosyncratic value for eight out of nine currencies.
- *Parsimony criterion*: This criterion reflects the fact that events determining monetary dominance are rare. In other words, the coded events matrix has to be sparse (ie. mostly composed of zero values). E.g., one currency and component of the global environment variable with the highest number of events is the US dollar for Monetary and fiscal institutions, with eight non-zero values (and eight zero values).

The event matrix elements are integers ranging from -2 to $+2$. $+1$ represents a favorable exceptional event. -1 represents an unfavorable exceptional event. -2 and $+2$ represent the most exceptional individual events. In the absence of any exceptional event the element is coded 0. Some currencies do not exist throughout the entire study period. We consider two configurations. In the case of EUR, it is a single currency composed of a basket of currencies that previously existed. Before the EUR came into exclusive circulation on January 1, 2002, we take into account events affecting the currencies with the highest weightings within the basket, viewed as inherited features (in descending order: German mark, French franc, Italian lira, Dutch guilder, Belgian franc). By contrast, the digital asset is purely created *de novo*. Thus no events are taken into account (i.e. "0") before the 2000s. Finally, the dates mentioned and selected correspond in part to specific events (e.g., the creation of a central bank) and in part to processes (e.g., loss of colonial empires). In the first case, we present a single date in the tables; in the second case, we present the decade corresponding to the main part of the process. For each component we provide a summary table of events, separated into common events and specific events, and a brief discussion.

3.2 The events database: Technology

Regarding the Technology component (for detail see Table 1), common events are related to the main global technological shocks, sometimes with a lag between economies. Some events are common to most or all currencies, e.g. the deployment of transatlantic cables (1880s, GBP, USD, EUR and SOE) and then the generalization of the shortwave wireless radio (1920s, all); the widespread computerization of financial markets and institutions (1970s, all advanced); the rise of high-frequency trading and then the rise of blockchain and AI (respectively, 2000s for convertible currencies; 2010s for USD, then 2020s for all currencies; and 2010s for STB, then 2020s for all currencies). Other common events relate to technological advancement in general, including convergence. A crucial specific event in explaining the

Table 1: **A timeline of events of the environment variable : Technology**

Common events	
1880, GBP, USD, EUR Second industrial revolution	(+1)
1880s, GBP, USD, EUR, SOE Establishment of transatlantic cables	(+1)
1920s, all Shortwave wireless radio	(+1)
1940s, GBP, USD, EUR New industrialization in the West	(+1)
1970s, all advanced Computerization of financial transactions	(+1)
2000s, convertible currencies High-frequency technologies	(+1)
2020s, all Rise of blockchain	(+1)
2020s, all Rise of AI	(+1)
Specific events	
1950s, JPY New industrialization in Japan	(+1)
1990, USD Emergence of internet and the GAFAM (Google, Apple, Facebook, Amazon, Microsoft)	(+1)
2010, USD AI revolution	(+1)
2010, STB Blockchain revolution	(+1)
2010s, CNY, EME Leapfrogging enabled by the shift to mobile money	(+1)
2014, CNY Early starting of research on a future CBDC in China	(+1)

features of the system at the beginning of the study period is the Second Industrial Revolution (1980s, GBP, USD, EUR). The post war recovery boom in the Bretton Woods period (1940s, GBP, USD, EUR; 1950s, JPY) reflects the same principle.

Specific events, during the late Managed Float and Contemporary periods, concern the US and emerging countries. The US experiences the early emergence of the internet in the 1990s, then the early beginning of the AI revolution in the 2010s. Emerging countries became comparatively advanced in the shift to mobile money beginning in the 2010s (including CBDC in China), reflecting a leapfrogging in financial development. The rise of the digital asset is related to that of the introduction of the blockchain (2010s, STB). It should be noticed that, in the absence of a negative event of exceptional magnitude, the technological component of the environment variable exclusively exhibits null or positive values, from 0 to +2 (in the case of cumulation of two favorable events for the same currency and decade).

3.3 The events database: Development

The development component (for detail see Table 2) takes into account development processes as well as the resources that support them: in particular, a majority of common events is linked to the impact of colonization and decolonization, for both sides. Regarding the colonizers, possession of colonies is observed, for the Classical Gold Standard, for GBP, EUR (Germany, France, Belgium, Netherlands), and JPY (1880s, +1). Then the end of colonial empires is coded −1 (1940s for JPY, 1960s for GBP and EUR). Regarding the colonized,

Table 2: **A timeline of events of the environment variable: Development**

Common events

1880s, GBP, EUR, JPY Possession of colonial empires[a]	(+1)
1880s, USD Peak of admission of new states and purchase of territories[b]	(+1)
1880s, EME Colonization (ongoing or previous)	(−1)
1880s, CNY "Semi-colonization"	(−1)
1880s, GBP, EUR, JPY, RUB, CNY Migration flows to countries of new settlement	(−1)
1880s, USD Migration flows from labor and land intensive countries	(+1)
1940s, JPY End of colonial empire	(−1)
1940, EME Beginning of decolonization	(+1)
1960s, GBP, EUR End of colonial empires	(−1)
1970s, GBP, USD, EUR, SOE Beginning of the crisis of the Western steel industry	(−1)
1970s, all except STB, RUB and CNY First oil shock	(−1)

Specific events

1900s, USD US leading country in terms of GDP per capita	(+1)
1900s, USD Beginning of the oil era in Texas	(+1)
1950s, RUB Beginning of strong growth in the USSR	(+1)
1952, EUR European coal and steel community	(+1)
1980s, RUB End of GDP per capita growth in the USSR	(−1)
1980s, JPY Peak of the Japanese "miracle"	(+1)
1990s, RUB End of the USSR[c]	(−1)
1993, EUR Launch of the EU by the Maastricht Treaty	(+1)
2000s, EUR Widening of the GDP per capita gap relative to the US	(−1)
2000s, CNY, EME Accelerated growth, driven by coal resources	(+1)
2000s, CNY Peak of GDP growth at 14% in 2007	(+1)
2009, EME Launch of the BRICS	(+1)
2020s, CNY Possession and development of rare earth industries in China	(+1)
2020s, STB Energy crises[d]	(−1)

[a] Events related to colonization fall into the "common" category even when they only concern one currency in the model, as they are part of an overall process.

[b] The current list of US states was gradually established between 1787 (Delaware) and 1959 (Hawaii). During the period under study, 12 new states were admitted, with a peak in 1889 (4 new states) and then in 1990 (2 new states). In parallel 16 new territories were acquired, with a peak in 1898-1899 (5 new territories).

[c] The end of the Russian Empire in 1917 is not coded as −1 since it affects the regime but not resources (no reduction in national territory).

[d] On connectedness between the prices of digital assets more or less energy-intensive and global energy prices, see in particular Zhou et al. (2025).

colonization affects China and India during the Classical Gold Standard period (1880s, −1 for EME and CNY). In the case of the United States, the continued westward expansion and the aquisition of new territories during the 18th and 19th centuries was also a critical factor in subsequent dominance. This process is taken into account when the admission of new states and the acquisition of new territories peaked (1890s, +1). Mass migration to the United States in the Classical Gold Standard period is viewed as having been beneficial for the destination country (1880s, +1 for USD) and detrimental for the countries of origin (1880s, −1 for GBP, EUR, JPY, RUB, CNY). The component also takes into account the ownership or positioning in relation to critical resources, i.e. oil, coal, and steel resources. A notable example is the creation of the European Coal and Steel Community for EUR (1952, +1), which was the precursor to today's European integration. Another example for the Contemporary period is the possession and development of rare earth industries in China (2020s, +1).

In addition to the access to resources, specific events are mainly linked to changes in the global hierarchy of GDP per capita. E.g., for USD, the moment when the US became the leading country in terms of GDP per capita for the Classical Gold Standard (1900s, +1). For JPY, the peak of the "miracle" (1980s, +1). For RUB, the beginning of the period of strong growth in the USSR (1950s, +1), then the end of GDP per capita growth and the end of the USSR (1980s, −1; and 1990s, −1). For CNY, the peak of GDP growth at 14% per annum (2007, +1). For EME, the launch of the BRICS (2009, +1).

3.4 The events database: Monetary, financial and fiscal institutions

Common events for this component are linked to the general characteristics of national and international monetary and financial systems (for detail see Table 3). A deep underlying fundamental is long run fiscal balance and the related concepts of fiscal space and efficient tax systems, based on inherited fiscal orthodoxy and credible monetary institutions for the Western advanced economies for the Classical Gold Standard (1880s, +1). It also includes the early inherited financial development for the same currencies (1880s, +1). The other common events are linked to international monetary regimes and the global evolution of central banking: the end of the Gold Standard Exchange rate system (1930s, −1); the Bretton Woods exchange rate system and the end of the Bretton Woods system (1944, +1; and 1970s, −1); the generalization of inflation targeting in advanced economies (1990s, +1) and then emerging economies (2000s, +1).

Specific events are linked to the activities of national central banks: the creation; gain, deterioration, or loss of independence; the relevance of responses to major crises. E.g., for GBP, the inherited Bank of England endowed with its Lender-of-last-resort function for the Classical Gold Standard (Bordo and James, 2026) (1880s, +1). For USD, the modern Federal Reserve for the Classical Gold Standard (1913, +1) and the Banking Act of 1935 for the Gold Exchange Standard (1935, +1); but also the failures of the Great Depression (1930s, −1) and Great Inflation (1970s, −1). Sanctions to Russia after the invasion of Ukraine are coded as unfavorable for USD (2020s, −1) as detailed in Section 1.2 on the effects of weaponization for the country imposing the sanctions and the country subject to them (the damage experienced

Table 3: **A timeline of events of the environment variable: Monetary, fiscal and financial institutions**

Common events

1880s, GBP Inherited Bank of England with lender-of-last-resort function	(+1)
1880s, GBP, USD, EUR, SOE Inherited early fiscal orthodoxy[a], credible monetary institutions, and strong financial development	(+1)
1930s, all except RUB, CNY, STB End of the Gold Standard	(−1)
1944, all except RUB, CNY and STB Bretton-Woods exchange rate system	(+1)
1950, all advanced Keynesian diversion	(−1)
1970s, all except RUB, CNY, STB End of the Bretton-Woods exchange rate system	(−1)
1990s, all advanced Inflation targeting (NK models) in advanced economies	(+1)
2000s, EME Inflation targeting in emerging economies	(+1)

Specific events

1913, USD Establishment of the Federal Reserve in the USA	(+1)
1930s, USD Fed failure, Great Depression	(−1)
1935, USD Banking Act	(+1)
1949, CNY Creation of the Central Bank of China	(+1)
1970s, USD Fed failure, Great Inflation	(−1)
1990, RUB Independence of the Central Bank of Russia	(+1)
2001, EUR Launch of the single currency, following the launch of the ECB in 1999	(+1)
2001, CNY China joins the WTO and allows foreign banks to operate in local currency	(+1)
2002, RUB Loss of independence of the Central Bank of Russia	(−1)
2009, STB Creation of digital finance	(+1)
2022, USD Sanctions to Russia after the invasion of Ukraine[b]	(−1)
2020s, STB Generalization of accessibility devices for digital assets	(+1)

[a]Fiscal orthodoxy is the result of successive and combined effects of the British Glorious revolution, the Treasury view asserting that fiscal policy is neutral with regard to economic activity as budget deficits will always be offset by future surpluses, and the choice of a Gold Standard fixed exchange rate regime in advanced economies.

[b]This event is coded as (−1) for USD for Monetary, financial and fiscal institutions, and (−1) for RUB for Democracy and conflicts.

by Russia is coded in the Democracy and conflicts component). For EUR, the launch of the single currency, following the creation of the ECB in 1999 and the Mastricht treaty based on the three key criteria of debt-to-GDP ratio below 60%, deficit-to-GDP ratio below 3%, and an inflation target of 2% (2001, +1). For STB, for the Contemporary Period, the creation of Bitcoin (2009, +1); and then the widespread availability of digital assets (2020s, +1).

3.5 The events database: Democracy and Conflicts

The common events for this component (for detail see Table 4) are the two World Wars, respectively for the Gold Exchange Standard (1910s), and the Bretton Woods (1940s) eras. Both are coded as unfavorable for the first main belligerents (respectively −1 for GBP, JPY and RUB and −2 for EUR; and −2 for GBP, EUR, JPY); and favorable for the US (+2 for USD). In the case of RUB, World War II is coded as favorable (+1 for RUB). For the Bretton Woods era, the establishment of NATO is coded as positive for all advanced currencies (1950, +1).

Specific events generally concern other major conflicts, and political regime changes and consequences. For conflicts, we take into account in particular the Russia-Japan war of 1905 which marks Japan's entry as a major power (1905, +1 for JPY and −1 for RUB). For political regime changes, some main events are as follows: Russia and China in particular are affected by a series of major shocks over the 20th and 21th centuries, beginning for the Gold Exchange Standard for RUB from the end of the Russian Empire (1917, −1), and for CNY from the end of the Quing Empire (1911, −1). Apart from these two major players, an example of an event for emerging currencies and for the Contemporary Period is the expansion of the BRICS group from 5 to 11 members and the admission of 9 partner members in 2025 (+1), which represents a significant gain in influence.

3.6 The events database: Crises-Regulation cycle

This component (for detail see Table 5) codes major crises and the associated regulatory shocks. These regulatory shocks are viewed from the perspective of their effect on transaction costs: more (or less) restrictive regulations are therefore considered unfavorable (or favorable). Salient examples of common events are the restrictive shocks during the Gold Exchange Standard period following the Great Depression, and the capital controls of the Bretton Woods era (−1 for all currencies except RUB and CNY). From the perspective of crises, the recurrence of currency crises (beginning in the 1960s), then banking crises (beginning in the 1970s), and financial crises (beginning in the 1980s) has also had adverse effects (−1) on most currencies in the system. The component then takes into account deregulation in advanced economies for the Managed float period and deregulation in emerging economies for the Contemporary period, the emerging markets financial crises of the 1990s, and the Global Financial crisis and related unfavorable regulatory shocks.

Specific events concern crises at the national or regional level: e.g. for JPY for the Managed float period, the Japanese financial crisis of the 1990s (−1) ; for GBP for the Contemporary Period, Brexit (2020, −1); or for EUR for the Contemporary Period, the

Table 4: **A timeline of events of the environment variable: Democracy and conflicts.**

Common events	
1910s, GBP, EUR, JPY, RUB World War I[a]	(−1, −2 for EUR)
1910s, USD World War I	(+2)
1940s, GBP, EUR, JPY World War II[b]	(−2)
1940s, USD, RUB World War II	(+2,+1)
1950s, all advanced NATO[c]	(+1)
Specific events	
1900s, RUB Russia-Japan war	(−1)
1900s, JPY Russia-Japan war	(+1)
1911, CNY End of the Quing Empire and beginning of 3+ decades of instability [d]	(−1)
1917, RUB End of the Russian Empire	(−1)
1920, SOE Switzerland membership of the League of Nations	(+1)
1930, EUR, JPY Rise of fascism in Europe and Japan	(−1)
1930s, CNY, JPY Second Sino-Japanese war	(−1)
1949, CNY Proclamation of the People's Republic of China, followed by maoist reforms, the Great leap forward and the Cultural revolution	(−1)
1978, CNY Beginning of the "four modernizations" by Deng Xiaoping	(+1)
1989, CNY Repression of the Tiananmen Square	(−1)
1991, RUB End of the USSR[e]	(+1)
2012, RUB Vladimir Putin's third term	(−1)
2020s, CNY Prolonged lockdowns of the COVID pandemic	(−1)
2022, RUB International sanctions to Russia after the invasion of Ukraine	(−1)
2025, EME Expansion of the BRICS from 5 to 11, admission of 9 partner members	(+1)

[a]World War I is coded -2 for EUR due to the scale of the demographic shock affecting France and Germany simultaneously (10.5% and 9.8% of working-age men, respectively).

[b]World War I is coded -2 due to the scale of the demographic shocks and damage caused by advancements in defense technology.

[c]NATO was founded in 1949. It is coded for the 1950s, which allows us both to account for the decade in which its activities actually developed and to avoid cumulation with the 1940s, which was dominated by World War II.

[d]While the end of the Chinese Qing Empire may have been seen as a gain in democratic legitimacy by some observers at the time, it was not viewed as such by the actors in the international financial markets. The same observation applies to the end of the Russian Empire in 1917.

[e]This event is also taken into account, as an adverse shock on access to resources, in the Development component.

Table 5: **A timeline of events of the environment variable: Crises and regulation.**

Common events	
1880, EME, EUR Emerging markets debt crisis[a]	
1930s, all advanced Great Depression	(-1)
1940s, all except RUB and CNY Capital controls of the Bretton Woods period	(-1)
1960s, all advanced Beginning of repeated currency crises	(-1)
1970s, all advanced Beginning of repeated banking crises	(-1)
1980s, all except STB, RUB and CNY Beginning of repeated debt crises	(-1)
1980s, GBP, USD, EUR, JPY Deregulation, rise of the 2nd financial globalization	$(+1)$
1990s, EME Deregulation in emerging economies	$(+1)$
1990s, EME, RUB Emerging markets financial crises	(-1)
2008, USD, GBP, EUR, JPY, SOE Restrictive regulatory shocks following GFC[b]	(-1)
Specific events	
1930s, USD New Deal	$(+1)$
1990s, JPY Japanese financial crisis	(-1)
2011, EUR European Sovereign Debts Crisis	(-1)
2020, GBP Brexit	(-1)
2025, USD, STB Genius Act regulating the emergence of the stablecoin market	$(+1)$

[a] Also affecting advanced economies, especially Southern and Eastern European, see Bordo and Meissner (2006).

[b] Examples of regulatory schocks unfavorable to transactions costs in foreign exchange rate markets related to the Global Financial crisis include e.g. the Dodd Frank Act in the USA, or MIFIR in the European Union.

European Sovereign Debts Crisis (2011, -1). Another recent example of an event for STB and USD for the Contemporary period is the regulatory shock favorable to the use of stablecoins, in the US during Donald Trump's second term ("Genius Act", 2020s).

4 Calibration and stress tests

4.1 Calibration: IMS regimes switchings

Figure 3 provides an overview of the events database. In this Section, we calibrate the theoretical model presented in formal terms in Appendix (Section A) to replicate the behaviour of the IMS over the last 150 years, based on these events. Each feature (hub / core / distances) of the IMS tree graph has multiple states, between which transitions are described by Markov chains. These chains are conditional upon the validation of combinations of conditions relating to the five components of the environmental variable. Calibration involves defining the transition matrices between states, and the conditions that activate them. This definition is based on economic theory (Section 1), history (Section 2), and the event database (Section 3).

Hub states

The hub is described by one time series per potential underlying asset of confidence in the IMS i.e. Gold / Monetary policy credibility, taking three possible states i.e. 'Non hub' / 'Challenged hub' / 'Hub'. These states are determined by one conditional chain, presented in Figure 4(a) (the corresponding transition matrix P_h is presented in Appendix B). This chain mainly describes convergence from 'Hub' to 'Non hub'.

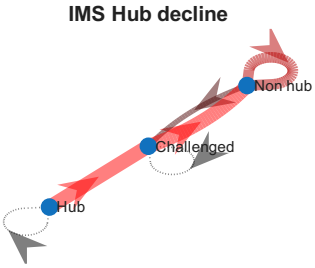
Based on the events database, in the case of Gold, this chain is activated when a major unfavorable aggregate shock, common to the different currencies and different components of the environmental variable, happens. This observation echoes the significance of speculative attacks in the 1910s and the 1930s, which led to the end of the Classical Gold Standard and Gold Exchange Standard (Bordo and James, 2026); and then in the early 1970s, which led to the end of the Bretton Woods system (Goldstein and Neumeyer, 2026). The major unfavorable aggregated shock activating the chain is identified, for a given institutional era, by a number of negative values at least equal to the number of currencies and superior to the number of positive values at the previous era, all components of the environmental variable combined, i.e.:

$$\text{card}(x_{i,I,T-1} < 0) > n \text{ and } \text{card}(x_{i,I,T-1} < 0) > \text{card}(x_{i,I,T-1} > 0) \quad \forall i, I \tag{1}$$

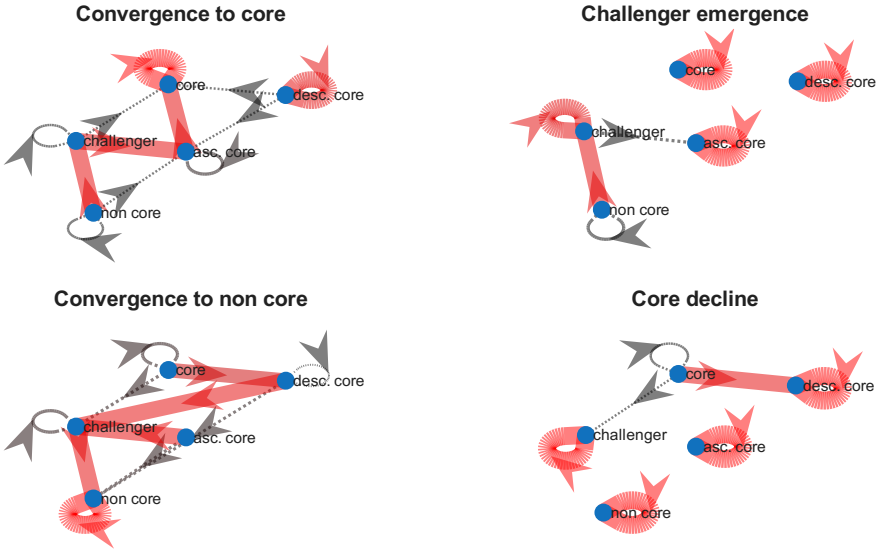
where x denotes elements of the event database indexed by i (currencies), I (components), and T (institutional eras). For all conditional Markov chains, for each component and currency, events are cumulated by institutional eras of three decades.

In the case of Monetary Policy credibility, the chain is activated when an unfavorable aggregated shock on the Monetary, financial and fiscal institutions happens, i.e.:

a. IMS hub regime switchings.



b. IMS core regime switchings.



c. IMS distances regime switchings.

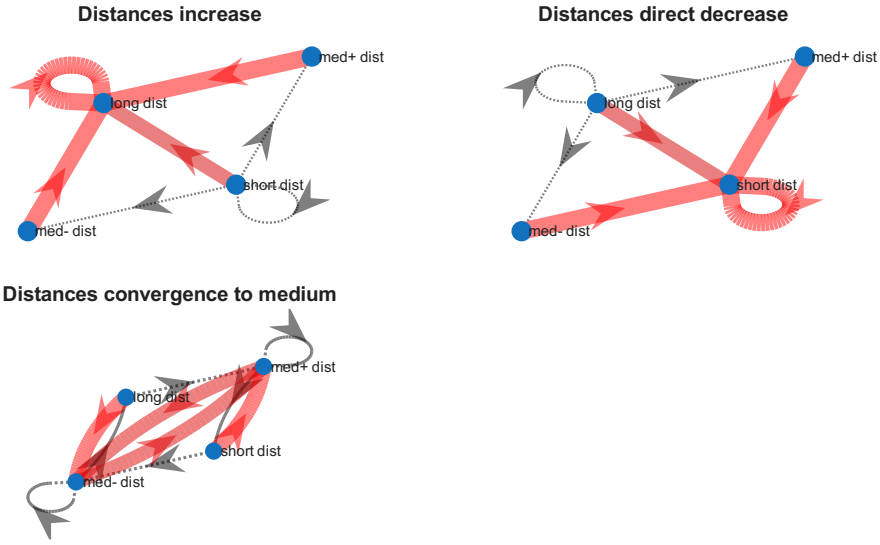


Figure 4: **Markov chains diagrams.** System states are represented as nodes. Transitions are represented as directed arrows. Probabilities of transition are represented by color and width, ranging from 0 (thin grey) to 1 (thick red).

$$\sum(Instit_{i,T}) < 0 \quad \forall i \tag{2}$$

When these unfavorable shocks occur, in the following period, the status generally changes from 'Hub' to 'Challenged' (marginally, remains unchanged), and from 'Challenged' to 'Non hub' (marginally, remains unchanged). If it was previously 'Non hub', the status remains unchanged (marginally, changes from 'Non hub' to 'Challenger' in order to take into account the growing attractiveness of gold in times of generalized strains, see e.g. Humpage, 2025). In the absence of such a major unfavorable aggregate shock, the hub remains unchanged.

Core states

The core is described by one time series per currency, taking five possible states: 'Non core' / 'Challenger' / 'Ascending core' / 'Descending core' / 'Core'. Several currencies may simultaneously be core, which allows us to take into account possible evolutions towards multi-polar forms of the IMS. More generally, the decline/rise of one currency does not mechanically lead to the emergence/decline of the other currencies. One example is that the recent weakening of the US dollar has not particularly benefited its main challengers, but rather "non-traditional" currencies (see, e.g., Arslanalp et al., 2025), or even gold as discussed above regarding the IMS hub. Using five different states including intermediary states (rather than just 'Core' vs. 'Non core') allows us to take into account the persistence caused by network effects in the use of international currencies (see Section 1). The core states are determined by four distinct conditional chains, presented in Figure 4(b). The corresponding transition matrices (P_{c1}, ..., P_{c4}) are presented in Appendix B.

The two chains in the upper panel describe favorable shocks. The upper left panel ('Convergence to core') describes the full transition from 'Non core' to 'Challenger' then 'Ascending core' and 'Core'. Based on the events database, that happens when the currency, denoted *co*, experiences a specific favorable geopolitical shock when a majority of currencies experience an unfavorable shock.

$$Demo_{co,T} > 1, \quad \text{card}(Demo_{i,T} < 0) \geq n/2 \tag{3}$$

The upper right panel ('Challenger emergence') describes the beginning of the ascending transition, from 'Non core' to 'Challenger'. That happens when the currency experiences a favorable development or institutions shock associated with a favorable technological shock:

$$\begin{array}{l} Dev_{co,T} \geq 0, \quad \text{card}(Dev_{i,T} < 0) \geq n/2 \quad \text{and} \quad Techno_{co,T} > 0) \\ \text{or} \quad Instit_{co,T} > 0, \quad Instit_{co,T-1} \geq 0 \quad \text{and} \quad Techno_{co,T} > 0) \end{array} \tag{4}$$

The two chains in the lower panel describe unfavorable shocks. The lower left panel ('Convergence to non core') describes the full transition from 'Core' to 'Descending core', then 'Challenger' and 'Non core'. Based on the events database that happens when the currency previously experienced an unfavorable geopolitical and development shock, or when it has experienced an exceptional unfavorable geopolitical shock:

$$(Demo_{co,T-1} < 0, \quad Dev_{co,T-1} < 0) \quad \text{or} \quad Demo_{co,T} < -1 \tag{5}$$

Finally the lower right panel ('Core decline') specifically describes the beginning of the process from 'Core' to 'Descending core'. Based on the events database, that happens when the currency is experiencing an unfavorable geopolitical shock which is neither combined with development, nor of the largest magnitude:

$$Demo_{co,T} = -1 \tag{6}$$

If no condition is validated, the states of currencies are unchanged.

Distances states

Distances are modeled using a single time series taking four possible states: 'High' / 'Medium superior' / 'Medium inferior' / 'Low', i.e. with also intermediary values. As for the previous features (hub and core), modelling sub-configurations allows us to take into account in a simple way the previous states of the system. The distances states are determined by three conditional chains presented in Figure 4(c) (the corresponding transition matrices are presented in Appendix B).

As for the hub of the system, distances are a common feature of the IMS. All currencies are taken into account for validation of the conditions. The chain in the upper left panel ('Distances increase') shows a convergence of system states towards long distances. Based on the events database, that happens in the case of unfavorable combinations of regulation, institutions and geopolitical shocks:

$$\max(Regul_{i,T}) \leq 0, \quad \max(Instit_{i,T}] \leq 0 \quad \text{and} \quad \text{card}(Demo_{i,T} < 0) > n/2 \quad \forall i \tag{7}$$

The chain in the upper right panel ('Distances direct decrease') shows the system states converging towards short distances in the absence of unfavorable major institutions and geopolitical shocks:

$$\min(Instit_{i,T}) \geq 0 \quad \text{and} \quad card(Demo_{i,T} < 0) < n/2 \quad \forall i \tag{8}$$

Finally the chain in the lower panel ('Distances progressive decrease') shows convergence to intermediate distances. Based on the events database, that happens in the case of a favorable institutions shock offset by an unfavorable regulatory shock, combined with a favorable technological shock. This chain illustrates the possibility that, despite conflicting institutional and regulatory factors, favorable technological shocks may lead to a convergence of the system toward intermediate transaction costs.

$$\text{card}(Regul_{i,T} < 0) > \text{card}(Instit_{i,T} > 0), \quad \text{card}(Techno_{i,T} > 0) > n/2 \quad \forall i \tag{9}$$

4.2 Reproductibility of the IMS system states and scenarios

We run 1,000 iterations of a Monte Carlo simulation on the conditional Markov chains described above, given the environment described by the event database. The result is shown in Figure 5, in the form of frequencies associated with each state. It has to be noted that most

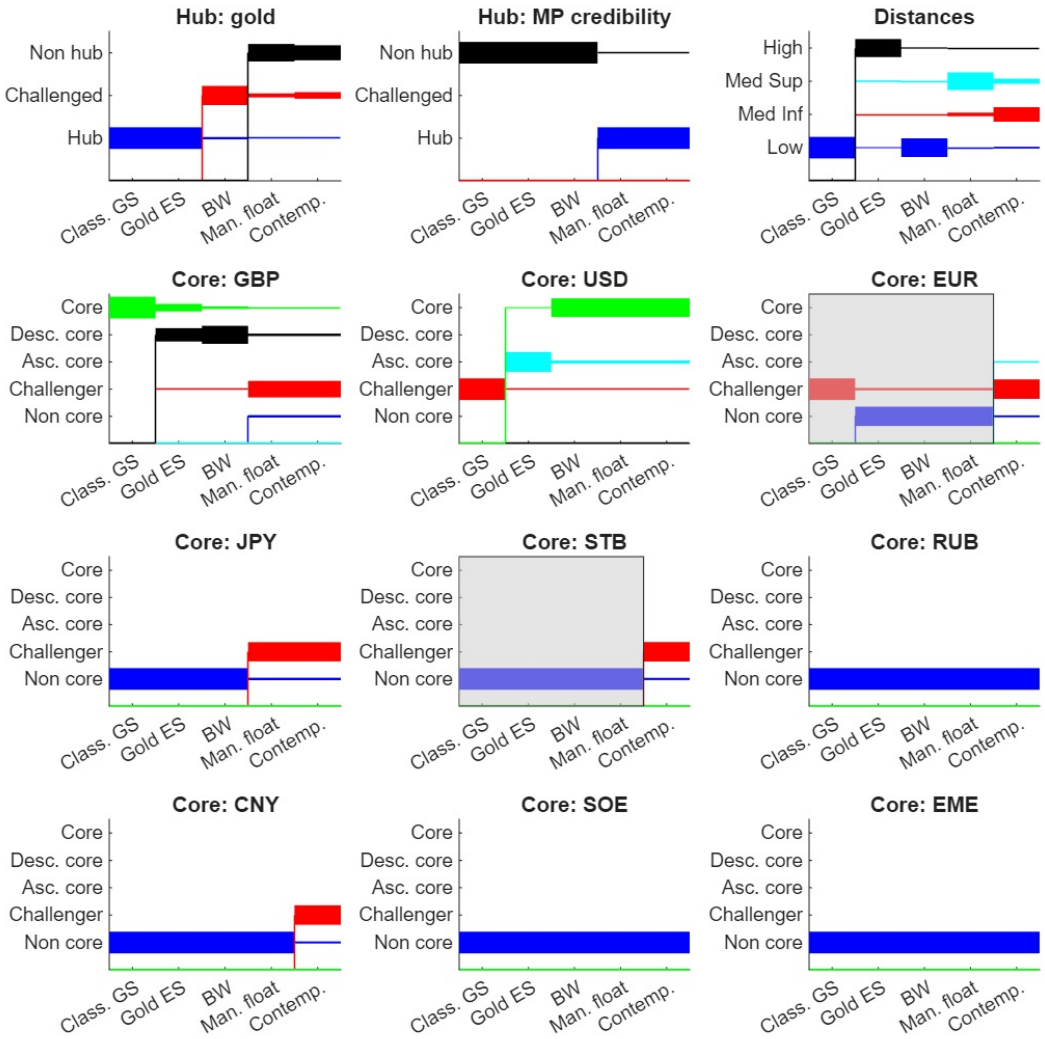


Figure 5: **Simulation of the states of the IMS system.** 1000 iterations, Monte Carlo simulations. x-axis: institutional eras. y-axis: states of the IMS features (hub, distances, core). Width of lines proportional to state frequencies.

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of the time, variables have several possible states at each time point, with a dominant state and marginal states. For example, during the Contemporary period, the EUR is primarily a challenger (the most probable state), and marginally a non core or ascending core (states with low but non-zero probabilities). This method allows us to account for the margin of uncertainty in the dynamics of the IMS system when faced with combinations of shocks. The exercise confirms that the calibration adequately captures the system's dynamics, which is a necessary condition for the validity of the stress tests. In particular, the states of the core are satisfactorily described. GBP evolves from the core in the Classical Gold Standard to descending core in the Gold Exchange Standard and Bretton Woods (marginally, remains the core or directly shifts to challenger), then a challenger during the Managed Float and Contemporary periods (marginally, remains the core or descending core, or to the contrary directly shifts to non core). In parallel, USD evolves from challenger in the Classical Gold Standard to ascending core in the Gold Exchange Standard (marginally, remains challenger or directly shifts to core), then core in later periods (marginally, remains challenger or ascending core).

Distances fluctuate under the conflicting effects of changes in exchange rate regimes, the regulatory and technological environment, and geopolitical events. They are at their lowest during the Classical Gold Standard and Bretton Woods periods. They rise again after the end of the Bretton Woods system, but to a lower level than during the Gold Exchange Standard, in a less strained geopolitical environment and a more favorable technological landscape. They then continue to decline during the most recent period, while remaining higher than under a fixed exchange rate system. The case of gold is also interesting: it is the hub during the Classical Gold Standard and Gold Exchange Standard periods, then challenged (marginally, hub) during the Bretton Woods period, and non-hub (marginally, challenged or hub) during the latest periods. During the most recent period, the non-hub state declines slightly in favor of the challenged state, reflecting gold's appeal in an environment marked by recurring crises.

4.3 Country scenarios, global scenarios

Having validated the calibration, we proceed in three steps. First, we develop and code country scenarios deemed most likely in the nearby future, in the same form than the events database, for the various currencies. Secondly, we combine these country scenarios to form global scenarios. Finally on this basis we simulate the calibrated model for the 'prospective' period, for each global scenario (Section 4.4). It should be noticed that the stress tests we propose are not restrictive: any prospective narrative can be tested, following its transcription into country scenarios and combination into global scenario. The country scenarios we propose should be viewed as archetypal: for each currency, they are constructed on the assumption that all components of the event variable move in the same direction (i.e., favorable, or unfavorable). They thus form the boundaries of an interval within which the components of the event variable may, in practice, move in opposite directions (for example, favorably for Development and unfavorably for Geopolitics).

The country scenarios used in the current version are presented in Table 6. They are

Table 6: **Country scenarios**

(-) USD
Democratic drift, decline in USA security influence
Fed failure to control inflationary pressures (capture of CB independence / fiscal predominance)
Digital currencies crisis.
USD: $\text{Confl} = [-1] + [-1], \text{Instit} = [-1], \text{Regul} = [-1]$.
STB: $\text{Regul} = [-1]$.

(+) USD
Smooth democratic transition
Fed successful management of inflation
Smooth development of US stablecoins following the Genius Act.
USD: $\text{Instit} = [1], \text{Regul} = [1]$.
STB: $\text{Regul} = [1]$.

(-) GBP
"Scotexit" (Scotland's exit) and/or "Niexit" (Northern Ireland's exit).
GBP: $\text{Dev} = [-1]$.

(-) EUR
Structural growth slowdown (demographic structure).
Escalation of the Russia/Ukraine war despite the EU support (existential threat)
Defensive regulatory response to US stablecoins
EUR: $\text{Dev} = [-1], \text{Confl} = [-1], \text{Regul} = [-1]$.
RUB: $\text{Confl} = [-1]$.

(+) EUR
Convergence towards fiscal union
Strengthening of European governance rules to uncooperative behaviors
Emergence of an effective European defense policy,
Partial transfer of artificial intelligence innovation to Europe.
EUR: $\text{Instit} = [1]$, $\text{Confl} = [1] + [1], \text{Techno} = [1]$.

(+) RUB
End of the Russia/Ukraine war under conditions allowing for the lifting of Western sanctions.
RUB: $\text{Confl} = [1]$.

(-) CNY
Growing internal political and external geopolitical tensions
Slowing growth
Structural difficulties in oil supply due to geopolitical tensions and intrinsic supply constraints.
CNY: $\text{Confl} = [-1], \text{Dev} = [-1]$.

(+) CNY
Accelerating technological progress and specialization in critical technology-intensive goods.
CNY: $\text{Techno} = [1]$.

(-) EME
Growing internal political and external geopolitical tensions
Materialization of major climate risks.
EME: $\text{Confl} = [-1], \text{Dev} = [-1]$.

(+) EME
Accelerating pace of technological convergence
Accelerating pace of macroeconomic convergence
Accelerating pace of monetary, fiscal and financial institutions convergence.
EME: $\text{Techno} = [1]$,$\text{Dev} = [1]$, $\text{Instit} = [1]$.

Table 7: **Global scenarios obtained by a combination of country scenarios.**

	1. Glob. (+) EUR	2. Glob. (+) USD	3. (3b.) Glob. (+) Emerg.	4. (4b.) Glob. (+) Adv.
H1. (-) USD	X		(X)	
H2. (+) USD		X		X
H3. (-) GBP	(X)	(X)		
H4. (-) EUR		X	(X)	
H5. (+) EUR	X			X
H6. (+) RUB			X	
H7. (-) CNY	X	X		(X)
H8. (+) CNY			X	
H9. (-) EME	X	X		(X)
H10. (+) EME			X	

listed in the same order as the currencies in the event database. Based on these country scenarios, we develop a set of global scenarios consisting of combinations of favorable or unfavorable hypotheses affecting multiple currencies simultaneously. The general approach to constructing scenarios involves assigning a favorable (respectively, unfavorable) scenario to a given currency, whilst assigning unfavorable (respectively, favorable) scenarios to competing currencies. Some scenarios include variants (in brackets). A summary of examples of global scenarios is presented in Table 7.

4.4 Stress tests results

A selection of results of the stress tests are shown in Figure 6. The full results are shown in Table 7 in Appendix C.

1. The "EUR favorable" global scenario (1.) combines the following country scenarios: adverse USD, favorable EUR, adverse CNY, adverse EME. A variant includes adverse GBP. The favorable EUR country scenario is largely inspired by the "Europe 2050" CEPR initiative (see, e.g., Blanchard, 2026). This initiative is a programmatic response to the EUR's "distant second-place" (Humpage, 2025). The unfavorable USD country scenario, in particular the double unfavorable shock on the Conflicts component, is inspired by the consensus among security scholars on the decline in USD international influence pointed to by Norrlof et al. (2020). The Fed failure to control inflationary pressures may be related to State interference with central bank independence during Donald Trump's second term.[5] The global scenario reveals two main outcomes. First, under the combined effect of shocks that are favorable for the euro and unfavorable for its main partners, the euro remains mainly challenger (with no additional shift toward

[5]Independence indicators are not yet available for the period concerned (see, in particular, for the most recent data on *de jure* independence, Romelli, 2024)

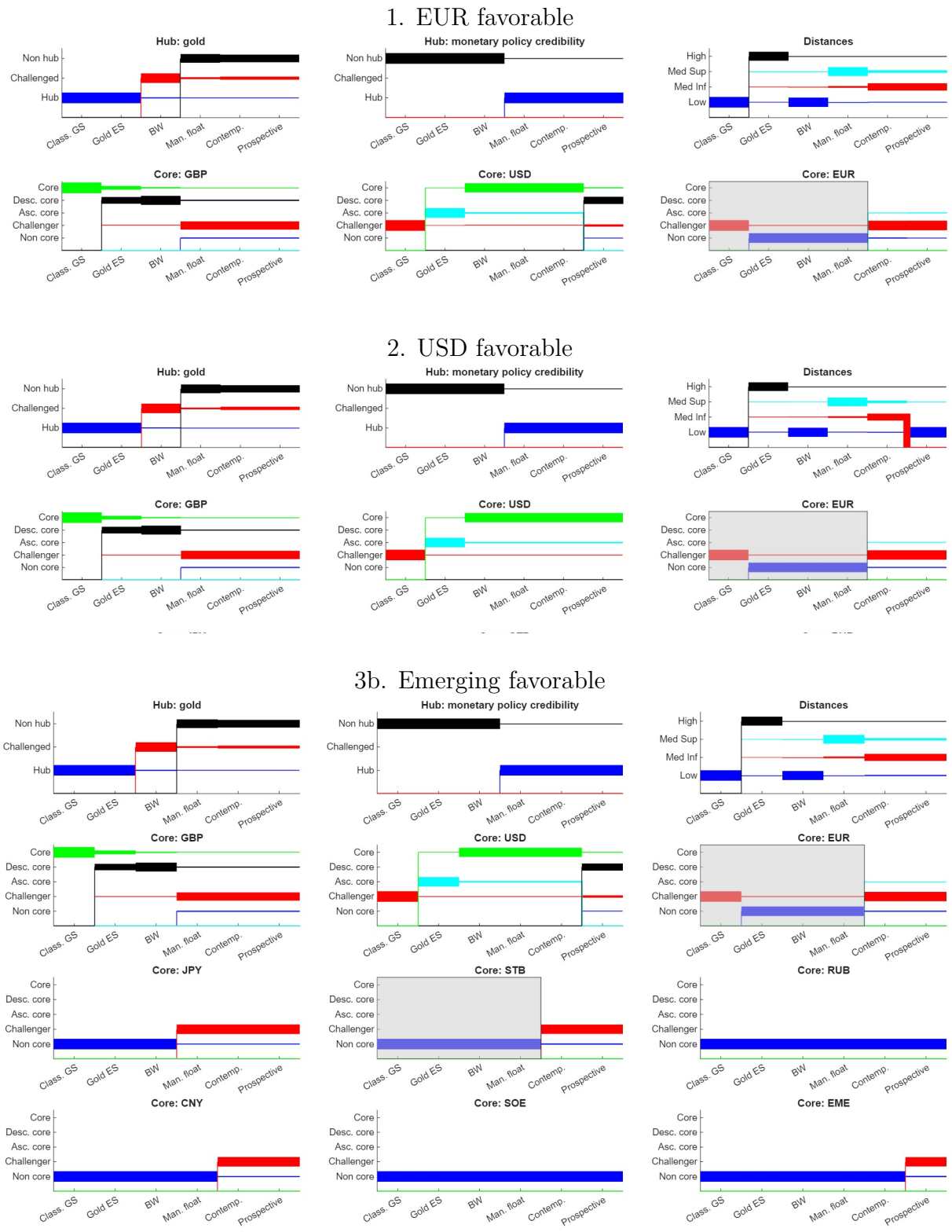


Figure 6: **Selection of results of stress tests.** (1) Global adverse USD, (2) Global favorable USD, (3b) Global favorable emerging. For scenarios 1. and 2., the JPY, STB, RUB, CNY, SOE, and EME panels are not reported, being neither primarily affected by the country scenarios nor impacted by the global scenarios.

ascending core or shift to core). The US dollar, on the other hand, shifts from core to descending core. The other currencies are unaffected. The currency hierarchy is therefore essentially preserved although US dollar dominance is weakened. Distances are unchanged, which is driven by the coincidence of favorable and unfavorable shocks on the main currencies. The credibility of monetary policies remains the underlying asset of confidence to the very same extent.

2. The "USD favorable" scenario (2.) combines the following hypotheses: favorable USD (including a smooth development of US stablecoins following the Genius act), adverse EUR, adverse CNY, adverse EME. A variant includes adverse GBP. This global scenario essentially reveals a stability of US dollar dominance. This result is in line with Bordo and Wilkins (2026) who analyze the smooth development of US stablecoins as unlikely to significantly increase the dominance of the US dollar, as network effects rely primarily on deep institutional fundamentals rather than financial technology. The euro remains primarily a challenger, with marginal ascending core and descending core status. The other currencies are unaffected. Under the influence of favorable shocks to the core currency and US stablecoins, distances shift from medium inferior to low. The credibility of monetary policies remains the underlying asset of confidence in currencies.

3. The "Emerging favorable" scenarios (3a. and 3b.) combine the following hypotheses: adverse USD, adverse EUR, favorable RUB, favorable CNY, favorable EME. They involve all emerging economies (EMEs, CNY, and RUB), assuming unfavorable conditions for advanced economies. Variant (3a.) assuming unchanged conditions for advanced economies is presented in Appendix C. In both cases, the dominance of emerging market currencies is marginally affected: the Chinese renminbi primarily remains a challenger, the archetypal emerging currency (EME) shifts to challenger, and the Russian ruble remains non core. In the case of 3a., the other currencies are not affected. In the case of 3b., the US dollar shifts mainly toward descending core. It is interesting to note that distances either decrease (3a.) or are unchanged (3b.), caused by greater integration of peripheral currencies, in part counterbalanced in the case of 3b. by disaggregation of the core.

4. Finally the "Advanced favorable" scenarios (4a and 4b.) involve the main advanced currencies (US dollar, euro), with (4a.) assuming unchanged conditions for emerging economies and (4b.) assuming unfavorable conditions. Variants 4a. and 4b. are presented in Appendix C). Both scenarios show similar results: the US dollar dominance is strengthening, euro remains challenger, and distances are decreasing.

Overall, these results highlight the system's strong resilience to the scenarios tested. This is an expected outcome: over the study period used to calibrate the model, shifts in dominance are the exception rather than the rule, and occur as a result of exceptionally favorable or unfavorable combinations of factors — which, moreover, must occur repeatedly. The US dollar is unfavorably affected in only two out of six scenarios, at the margin. Shifting from core to descending core, it remains dominant, however, with the euro (and other currencies) remaining primarily challengers in all cases. The most sensitive feature of the system is

distances. This is also an expected result: over the study period, it is the only feature that systematically shifts from one period to the next. Generally speaking, the previous global scenarios reduce (most global scenarios tested) or leave distances unchanged. Finally, none of the global scenarios tested — not even those combining adverse country scenarios affecting major currencies — affects the status of monetary policy credibility as the underlying asset of confidence in the system.

Conclusion

We propose stress tests on currency dominance analyzing a broad set of putative global scenarios. These stress tests are conducted based on a 'chanelling' of the history of the IMS, read here as a currency graph with regime switchings. Regime switchings are modeled using conditional Markov chains based on a five-component environment variable (technology; development and resources; monetary, fiscal and financial institutions; geopolitical forces; crises-regulation cycle). The model is calibrated from the 1880s to the 2020s period using a large database of events, by currencies and components, based on our reading of economic history. This database constitutes another original contribution. On the issue of currency dominance which receives so much attention, our approach provides additional insights to the existing literature, which primarily relies on panel data econometrics.

This novel approach places the long-term dynamics of currency dominance in a new perspective. In particular, it suggests that the parallel between the rise of the US dollar in the 20th century and that of the Chinese renminbi in the 21st century should be treated with extreme caution. Stress-tests including various scenarios show the resilience and centripetal operation of the current system: the dominance of the US dollar is affected in only a minority of cases, and never to a critical extent. In none of these cases does an alternative currency emerge as the dominant core. The growing prevalence of digital assets such as US stablecoins does not alter this finding: assuming that both the digital asset and the US dollar experience favorable shocks simultaneously, the dominance of the US dollar remains unchanged, and that of the USD stablecoin does not increase significantly.

More controversially we believe that the most likely successor to the US dollar could be the euro. This would necessarily involve a much greater completion of the EU project, especially a complete fiscal and financial union resulting in a convergence of the deep institutional and economic fundamentals of EU with the US. A military/diplomatic union is also a necessary condition. This assumes that negative developments that are threatening US dollar dominance today, including geopolitics, will continue into the future. The two hypotheses are not independent: as the most recent developments seem to show, the current geopolitical dynamics in the US provide a powerful incentive to accelerate progress toward a European defense policy. Another preliminary finding is that the single-core configuration of the 20th century does not rule out the possibility of greater regional diversification in the nearby future, in a context where the number of challenger currencies is both high and growing. One limitation of the analytical framework we propose is that we are only looking at two episodes of switches in monetary dominance.

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Appendix

A A theoretical non-linear model of the IMS

A.1 The environment transition variable of the regime-switching model

In this section we detail the regime-switchings graph model, the principle of which is presented in Section 1 and put in historical perspective in Section 2. Following the presentation of the event database in Section 3, an empirical application is provided in the form of a calibration and stress tests in Section 4.

The IMS consists of a tree graph. The nodes correspond to currencies. As described above, the graph has three distinctive features: the hub, the core, and the extension of the graph (distances). The states of these three characteristics are a function of a five-components environment variable, according to a non-linear relationship characterized by stable regimes over broad institutional eras. In the case of extreme events, the hub, core and distance features are affected by simultaneous regime switchings. In the case of no extreme event, no threshold is exceeded and no regime switching occurs.

The five-components environment variable is S_{it}. i corresponds to countries and t to time (in the calibration, one time point corresponds to one decade). The five components are technology (T_{it}), development and access to resources (D_{it}), monetary, financial and fiscal institutions (I_{it}), geopolitics and conflicts (W_{it}), and the crises regulation cycle (R_{it}), as follows:

$$S_{it} = \begin{bmatrix} T_{it} \\ D_{it} \\ I_{it} \\ W_{it} \\ R_{it} \end{bmatrix} \tag{10}$$

A.2 Adjacency matrix

The three features of the IMS (see Figure 1) are described by three matrices. The adjacency matrix A_M displays the structure of the unweighted graph, that is, identifies the hub and the edges; the hierarchical distance matrix $\mathscr{D}_{\mathrm{M}}$ displays the hierarchy of distances; and the final distance matrix D_M displays the common weight factor applied to all edges, and thus the extension of the graph. For n currencies in the IMS, all are square matrices of dimension $(n+1) \times (n+1)$. As the graph is undirected, they are all symmetrical.

The underlying asset of confidence in the IMS is denoted C_0. Indices $i = 1, \dots, n$ correspond to currencies $C_1, \dots, C_n$. The adjacency matrix A_M is structured as follows :

$$A_M = \begin{array}{c} \\ \text{i=0,...,n} \end{array} \begin{array}{c} j = 0, ..., n \\ \begin{pmatrix} 0 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & & & ... & 0 \\ 1 & 0 & 0 & & & & \\ 1 & & & 0 & & & \\ 1 & & & & 0 & ... & ... \\ 1 & ... & & & ... & 0 & 0 \\ 1 & 0 & & & ... & 0 & 0 \end{pmatrix} \end{array} \tag{11}$$

That is:

$$\begin{gathered} a_{M\,i,j} = 1 \text{ if } i = 0 \text{ or } j = 0,\ (i,j) \neq (0,0) \\ a_{M\,0,0} = 0 \\ a_{M\,i,j} = 0\ \forall\ i \neq 0 \text{ or } j \neq 0 \end{gathered} \tag{12}$$

We assume that there is only one asset $C_{M\,0,t}$ of underlying confidence in the IMS in each period t (see Section 1). Thus A_M is unchanged over time. Each currency is and remains solely connected to the sole hub. When there is a regime switching, it is the state of the hub, that is to say asset $C_{M\,0,t}$, which may change, as described below:

$$\begin{gathered} C_{M\,0,t} = f_M\left(T_t, D_t, I_t, W_t, R_t\right) \\ C_{M\,0,t} = \{G, MP, OT\} \end{gathered} \tag{13}$$

Over the period of study $C_{M\,0,t}$ has two states: gold (G) in the three first institutional eras, then monetary policy credibility (MP) in the two last. Since the model has to be as general as possible, a third possible state is included. It does not correspond to any of the states observed so far. This third possible state is denoted "other" (OT). It has to be noted that using different databases of events for the study of earlier systems would not modify the adjacency matrix: the asset of underlying confidence is always unique and it is always indexed 0. Function $f_M\left(T_t, D_t, I_t, W_t, R_t\right)$ describing how the dynamics of the five-variate environment variable drives in a non-linear way the states of $C_{M\,0,t}$ is detailed below.

A.3 Hierarchical distance matrix

The hierarchical distance matrix $\mathscr{D}_{\mathrm{M,t}}$ provides additional information since it is weighted, i.e. it describes the hierarchy of distances from the hub to the other nodes (currencies):

$$\mathscr{D}_{M,t} = \begin{array}{c} \\ \text{i=0,...,n} \end{array} \begin{array}{c} j = 0, ..., n \\ \begin{pmatrix} 0 & d_{M\,0,1\,t} & d_{M\,0,2\,t} & & & ... & d_{M\,0,n\,t} \\ d_{M\,1,0\,t} & 0 & 0 & & & ... & 0 \\ d_{M\,2,0\,t} & 0 & 0 & & & & \\ & & & 0 & & & \\ & & & & 0 & ... & ... \\ ... & ... & & & ... & 0 & 0 \\ d_{M\,n,0\,t} & 0 & & & ... & 0 & 0 \end{pmatrix} \end{array} \tag{14}$$

$\mathscr{D}_{\mathrm{M,t}}$ allows us to separate classes corresponding to the states of currencies, considering their distance to the core at time t. It has to be noted that the version which is presented here is restricted to two states ('core' vs. 'non-core').

$$\begin{gathered} d_{M\,i,0\,t} = d_{M\,1,0\,t} \\ d_{M\,i,0\,t} = g_M\left(T_t, D_t, I_t, W_t, R_t\right) \\ d_{M\,i,0\,t} = \left\{\underline{d}_M, \overline{d}_M\right\},\ \forall i \neq 0 \\ \underline{d}_M \in [\underline{d}_{Ml}, \underline{d}_{Mu}] \\ \overline{d}_M \in \left[\overline{d}_{Ml}, \overline{d}_{Mu}\right] \end{gathered} \tag{15}$$

$$\text{with } 0 < \underline{d}_{Ml} < \underline{d}_{Mu} < 1 < \overline{d}_{Ml} < \overline{d}_{Mu}$$

$\forall i \neq 0$, i.e. for any currency other than the hub, the distance to the hub $d_{M\,i,0\,t} = d_{M\,0,i\,t}$ has two possible states corresponding to two classes of distances. State $\underline{d}_M$ characterizes short distances, belonging to the class $[\underline{d}_{Ml}, \underline{d}_{Mu}]$. The currency or currencies characterized by these short distances compose the core, in other words are the dominant currencies. It has to be noted that during the period under study i.e. the last 150 years, there is generally only one dominant currency at a time, and at most two: during the Interwar and Bretton-Woods periods, co-dominance forms are observed for the Pound sterling and the US dollar. However, there is no restriction in the model on the number of currencies composing the core. There is no lower limit either, i.e. a truly multipolar system without any dominant currency is not excluded. State $\overline{d}_M$ corresponds to long distances, in the interval $\left[\overline{d}_{Ml}, \overline{d}_{Mu}\right]$. Currencies connected by distances belonging to this class are outside the core, which means that they are not dominant. When regime switchings happen, the hierarchy of distances, i.e. the dominant currency or currencies, may change. Outside of regime switchings, the hierarchical structure of distances is unchanged.

The principle of multiple distance classes characterizing core states can be generalized to more than two classes to take into account intermediate states or persistence ("network effects", see discussion in Section 1.1). This is modeled and detailed in the calibration of Section 4, which includes five classes. For the sake of brevity, we present here a two-class version that leaves the model structure unchanged.

A.4 Final distance matrix

The final distance matrix $\mathrm{D}_{\mathrm{M,t}}$ establishes the graph extension, i.e. edges lengths. These lengths depend, in addition to the hierarchy described by the hierarchical distance matrix $\mathscr{D}_{\mathrm{M,t}}$, on a common global distance coefficient γ_t. γ_t has multiple states. We present below the case of two states ('high' vs. 'low' distances). As for core states, distances states can also be modeled with any number of classes greater than two, which does not change the structure of the model. The calibrated model includes four states ('high' vs. 'low' distances but also 'medium superior' and 'medium inferior'). Generaly speaking, γ_t is high in times of high transaction costs, and low in times of low transaction costs, as described below.

$$\mathrm{D}_{\mathrm{M,t}} = \gamma_{Mt}\mathscr{D}_{\mathrm{M,t}} \tag{16}$$

$$
\mathrm{D}_{M,t} = \begin{array}{c} \\ \mathrm{i}=0,...,\mathrm{n} \end{array} \begin{array}{c} \begin{array}{cccccccc} & & & & j=0,...,n & & & \end{array} \\ \begin{pmatrix} 0 & \gamma_{Mt} d_{M\ 0,1\ t} & \gamma_{Mt} d_{M\ 0,2\ t} & & & ... & \gamma_{Mt} d_{M\ 0,n\ t} \\ \gamma_{Mt} d_{M\ 1,0\ t} & 0 & 0 & & & ... & 0 \\ \gamma_{Mt} d_{M\ 2,0\ t} & 0 & 0 & & & & \\ & & & 0 & & & \\ & & & & 0 & ... & ... \\ ... & ... & & & ... & 0 & 0 \\ \gamma_{Mt} d_{M\ n,0\ t} & 0 & & & ... & 0 & 0 \end{pmatrix} \end{array} \tag{17}
$$

$$
\begin{array}{c} \gamma_{Mt} = h_M \left(T_t, D_t, I_t, W_t, R_t \right) \\ \gamma_{Mt} = \left\{ \underline{\gamma}_{Mt}, \overline{\gamma}_{Mt} \right\} \\ \underline{\gamma}_{Mt} \in \left[\underline{\gamma}_{Ml}, \underline{\gamma}_{Mu} \right] \\ \overline{\gamma}_{Mt} \in \left[\overline{\gamma}_{Ml}, \overline{\gamma}_{Mu} \right] \\ \underline{\gamma}_{Ml} < \underline{\gamma}_{Mu} < \overline{\gamma}_{Ml} < \overline{\gamma}_{Mu} \end{array} \tag{18}
$$

Here, the γ_{Mt} coefficient has two states corresponding to two classes of values. $\underline{\gamma}_{Mt}$ corresponds to a lower distances class, within $\left[\underline{\gamma}_{Ml}, \underline{\gamma}_{Mu} \right]$. This lower range is associated in particular to lower transaction costs resulting from fixed exchange rates regimes, therefore corresponding to lower distances and a denser graph. $\overline{\gamma}_{Mt}$ corresponds to a higher distances class, within $[\overline{\gamma}_{Ml}, \overline{\gamma}_{Mu}]$. This upper range is associated in particular to higher transaction costs resulting from flexible exchange rate regimes, therefore corresponding to longer distances and a more extended graph. When regime switchings happen, the global distances coefficient γ_{Mt} and the hierarchical distances matrix $\mathscr{D}_{\mathrm{M,t}}$ may change at the same time. Outside of regime switchings, the states of γ_{Mt} and $\mathscr{D}_{\mathrm{M,t}}$ are unchanged.

A.5 Joint regime switchings

IMS regime switchings are therefore described as follows:

$$
\text{if} \quad S_t - S_{t-1} \geq S^* \quad \Rightarrow \begin{cases} C_{M\,0,t} = f_M(S_t) = f_M \begin{pmatrix} T_{it} \\ D_{it} \\ I_{it} \\ W_{it} \\ R_{it} \end{pmatrix} \\ \mathscr{D}_{M,t} = g_M\left(S_t\right) = g_M \begin{pmatrix} T_{it} \\ D_{it} \\ I_{it} \\ W_{it} \\ R_{it} \end{pmatrix} \\ \gamma_{Mt} = h_M\left(S_t\right) = h_M \begin{pmatrix} T_{it} \\ D_{it} \\ I_{it} \\ W_{it} \\ R_{it} \end{pmatrix} \end{cases} \tag{19}
$$

$$
\text{if} \quad S_t - S_{t-1} < S^* \quad \Rightarrow \quad \begin{cases} C_{0,t} = C_{0,t-1} \\ d_{M\,i,0\,t} = d_{M\,0,i\,t-1}, \ \forall i = 1, ..., n \\ \gamma_{M\,t} = \gamma_{M\,t-1} \end{cases}
$$

In general terms, crossing the threshold denoted S^*, related to the environment variable, triggers regime switchings. This is a general formulation: the event variable has five components, and in practice, the calibration generally identifies combinations of conditions associated with these components (involving more than one component in the case of the hub and distances, and more than one currency in the case of core).

When regime switchings happen, simultaneous jumps are possible in the reference asset $C_{0,t}$ i.e. the hub; the hierarchical distance matrix $\mathscr{D}_{M,t}$ i.e. the core currency or currencies; and the global distances coefficient γ_{Mt}, i.e. global transaction costs in foreign exchange markets. For each of $C_{0,t}$, $\mathscr{D}_{M,t}$ and γ_{Mt}, the next value taken depends on the environment variable. It may be unchanged, as is the case for the hub which remains gold for the first three eras, or for the core which remains the Pound sterling for the first and second eras. The technology T_t, development and resources D_t, monetary, financial and fiscal institutions I_t, geopolitics and conflicts W_t and crises and regulation R_t components condition the next values of $C_{0,t}$, $\mathscr{D}_{M,t}$ and γ_{Mt}. In the calibrated version, we use conditional Markov chains, associated with combinations of conditions on the components of the event variable, to describe regime switchings. These chains and the associated conditions are described in Section B. Outside of regime switchings, the three variables are unchanged.

B Transition matrices of conditional Markov chains

B.1 Transition matrix and condition: IMS hub

The transition Matrix P_h describing the Hub states is calibrated as follows:

$$P_h = \begin{bmatrix} 0.1 & 0.9 & 0 \\ 0 & 1 & 0 \\ 0 & 0.33 & 0.67 \end{bmatrix} \tag{20}$$

As a general rule, to minimize arbitrary choices as much as possible, all calibrations use only the values 0.9 vs. 0.1 (major destination state vs. one single marginal state), 0.9 vs. 0.05 vs. 0.05 (major destination state vs. two marginal states), 0.85 vs. 0.05 vs. 0.05 vs. 0.05 (major destination state vs. three marginal states), and 0.67 vs. 0.33 (two destination states with significant hierarchy in probabilities). The transition Matrix P_h is associated to condition 1 for Gold:

$$\text{card}(x_{i,I,T-1} < 0) > n \text{ and } \text{card}(x_{i,I,T-1} < 0) > \text{card}(x_{i,I,T-1} > 0) \quad \forall i, I$$

It is associated to condition 2 for Monetary policy:

$$\sum(Instit_{i,T}) < 0 \quad \forall i$$

B.2 Transition matrices and conditions: IMS core

Using the same rule of thumb as for the hub for values associated with major vs. marginal transitions, matrices P_{c2}, P_{c3}, P_{c4} and P_{c5} are calibrated as follows:

$$P_{c1} = \begin{bmatrix} 0.05 & 0.9 & 0.05 & 0 & 0 \\ 0 & 0.05 & 0.9 & 0 & 0.05 \\ 0 & 0 & 0.1 & 0 & 0.9 \\ 0 & 0 & 0.05 & 0.9 & 0.05 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}, \quad P_{c2} = \begin{bmatrix} 0.1 & 0.9 & 0 & 0 & 0 \\ 0 & 0.9 & 0.1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix},$$

$$\mathrm{P}_{c3} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0.9 & 0.1 & 0 & 0 & 0 \\ 0.1 & 0.9 & 0 & 0 & 0 \\ 0.05 & 0.9 & 0 & 0.05 & 0 \\ 0 & 0.05 & 0 & 0.9 & 0.05 \end{bmatrix}, \quad P_{c4} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0.05 & 0 & 0.9 & 0.05 \end{bmatrix} \tag{21}$$

P_{c1} is associated to condition 3:

$$Demo_{co,T} > 1, \quad \text{card}(Demo_{i,T} < 0) \geq n/2$$

P_{c2} is associated to condition 4:

$$\begin{array}{c} Dev_{co,T} \geq 0, \quad \text{card}(Dev_{i,T} < 0) \geq n/2 \quad \text{and} \quad Techno_{co,T} > 0) \\ \text{or} \quad Instit_{co,T} > 0, \quad Instit_{co,T-1} \geq 0 \quad \text{and} \quad Techno_{co,T} > 0) \end{array}$$

P_{c3} is associated to condition 5:

$$(Demo_{co,T-1} < 0, \quad Dev_{co,T-1} < 0) \quad \text{or} \quad Demo_{co,T} < -1$$

Finally P_{c4} is associated to condition 6:

$$Demo_{co,T} = -1$$

B.3 Transition matrices and conditions: IMS distances

Using the same rule of thumb as for the hub and core for values associated with major vs. marginal transitions, matrices P_{d1}, P_{d2} and P_{d3} are calibrated as follows:

$$P_{d1} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0.95 & 0.05 & 0 & 0 \\ 0.9 & 0.05 & 0.05 & 0 \\ 0.85 & 0.05 & 0.05 & 0.05 \end{bmatrix}, \qquad P_{d2} = \begin{bmatrix} 0.05 & 0.05 & 0.05 & 0.85 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix},$$

$$P_{d3} = \begin{bmatrix} 0 & 0.05 & 0.95 & 0 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0.05 & 0.9 & 0.05 & 0 \\ 0 & 0.95 & 0.05 & 0 \end{bmatrix} \quad (22)$$

P_{d2} is associated to condition 7:

$$\max(Regul_{i,T}) \leq 0, \quad \max(Instit_{i,T}] \leq 0 \quad \text{and} \quad \text{card}(Demo_{i,T} < 0) > n/2) \quad \forall i$$

P_{d1} is associated to condition 8

$$\min(Instit_{i,T}) \geq 0 \quad \text{and} \quad card(Demo_{i,T} < 0) < n/2 \quad \forall i$$

Finally P_{d3} is associated to condition 9:

$$\text{card}(Regul_{i,T} < 0) > \text{card}(Instit_{i,T} > 0), \quad \text{card}(Techno_{i,T} > 0) > n/2 \quad \forall i.$$

C Stress tests full results

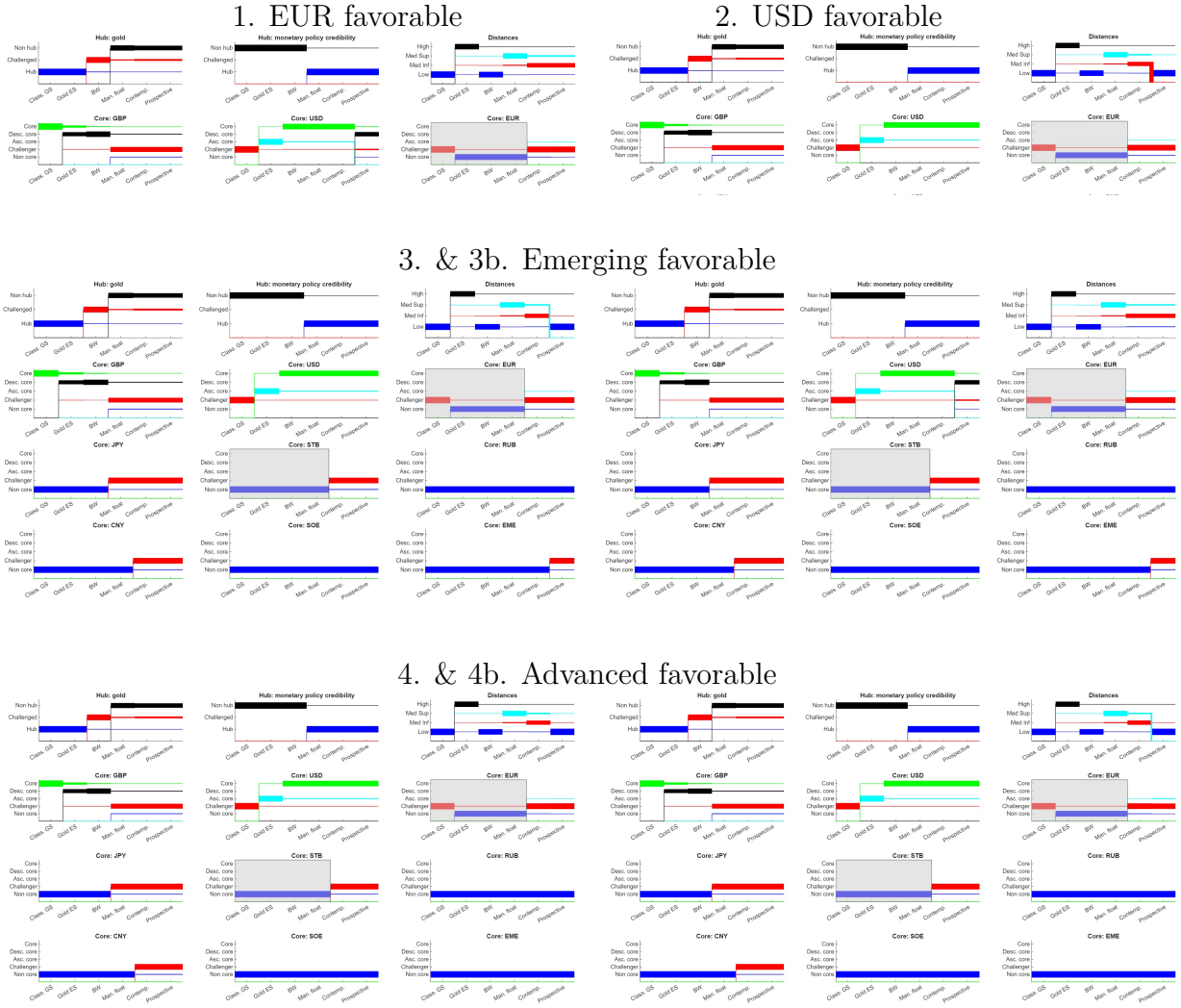


Figure 7: **Full results of stress tests.** (1) Global adverse USD, (2) Global favorable USD, (3a) Global favorable emerging, (4a, 4b) Global favorable advanced. For scenarios 1. and 2., the JPY, STB, RUB, CNY, SOE, and EME panels are not reported, being neither primarily affected by the hypotheses nor impacted.