Currency dominance is not forever
Some stress tests with an IMS regimes switching model

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Abstract. History shows a succession of dominant currencies over long periods ranging from several centuries to several decades. All of them, however, eventually decline. Against a backdrop of multiple uncertainties surrounding the prospects for the dominance of the US dollar, we propose a theoretical multiple-regime model for modeling currency dominance and the causes of its regimes switchings. These are based on a multidimensional transition variable that includes shocks related to technology, development, monetary institutions, geopolitical forces and conflicts, and the regulatory environment. This transition variable determines, via conditional Markov chains, the dynamic structure of the IMS designed as a currency evolution graph. The model is calibrated for nine reference currencies for the period stretching from the beginning of the Classical Gold Exchange Standard to the present day. It can then be used to perform stress tests on currency dominance configurations based on scenarios relating to the components of the multidimensional transition variable.
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1. Objective and general framework

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

At a time of economic tensions between the United States and China, currency dominance is a hot topic. We propose a theoretical model of currency dominance over the long term using a method that allows for prospective analysis. Our approach is inspired by stress testing methods used in financial systems, which draw on historical data to develop hypothetical scenarios and simulate their application. The basis of our approach is the two-layer graph model of Bordo & Bastidon (2025). This model, built on an analogy between the Copernican heliocentric system and the tree graph structure of the International Monetary System (IMS) and the International Financial System (IFS), explains their joint regime switchings through a four-dimensional environmental transition variable (technology, institutions, geopolitics and conflicts, regulation).

On this basis, we develop an approach specifically tailored to modeling currency dominance. The model takes into account the IMS, excluding the IFS. Since calibration based on historical scenarios is the key step in ensuring the validity of prospective analysis, we describe a broad system comprising nine assets, as a proxy for a world system: the British pound, the US dollar, the euro, the Japanese yen, the Russian ruble, the Chinese renminbi, an archetypal other emerging market currency, an archetypal other advanced small open economy currency, and a cryptoasset. The IMS proxy composed of these nine currencies is described as a graph with three key features: the hub, the core, and distances (Figure 1a). The hub is at the center of the graph. It refers to the underlying asset of confidence in the IMS. During our study period, which spans from the first wave of contemporary globalization to the present day, this asset is gold until the end of the Bretton Woods period, and then it is the credibility of monetary policies. The core is located in the first circle of the graph around the hub. It consists of the dominant currency or currencies. Distances represent the extent of the graph, i.e. the length of edges between

currencies. They evolve with transaction costs on foreign exchange markets. They are linked in particular to the prevailing exchange rate regime. During periods of fixed exchange rates, transaction costs are lower and distances are shorter, and vice-versa. The use of a graph representation allows these three features to be conveniently modelled, as a single weighted adjacency matrix (Figure 1b).

2. 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 & Maggiori, 2018)

The model is based on the assumption that the three features of the IMS (hub, core, distances) are stable within each of the major institutional eras (classical gold standard, gold exchange standard, etc.) but shift between eras ((Figure 1c, Figure 2). The causes of regime switchings in the IMS structures widely remain *terra incognita* in the literature (Flandreau, 2005). Recent theoretical models focus on monetary regimes, rather than regime switchings. E.g., Farhi & Maggiori (2018) provide an IMS model based on reserve asset supply and demand in different patterns of currency dominance and different exchange rate regimes; and Fernandez & Villaverde (2023) a growth and inflation model of a small open economy under a gold standard regime. The model we propose focuses on the circumstances under which the IMF structures switch, and shows the system states before and after their occurrence.

We identify five components of a global environment event variable which may explain regime switchings. These components comprehensively take into account the shocks affecting the dominance of each asset, whether favorably or unfavorably, in the reference literature. These are: changes in technology, changes in development and access to resources; changes in monetary institutions, changes in geopolitical forces (including democracy and major conflicts); and changes in regulation. The environment variable thus has three dimensions: a time dimension, a currency dimension, and a dimension corresponding to the component of the global environment variable. The first step in the stress-testing procedure consists in coding the main historical events for the nine assets and five components, starting from the beginning of the Classical Gold Exchange Standard. These components then interact to determine changes in the features of the IMS: eg. the current dominance of USD will be affected if the country still holds dominant military 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 the fastest growth in its share of global foreign exchange transactions (BIS, 2025), 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 which remain autocratic. These interactions are taken into account by formulating conditional Markov chains involving different components of the environmental variable to determine successive states of the IMS system.

3. Calibration and prospective analysis

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

The sequence of the calibrated model, on which the stress-testing procedure of prospective analysis relies, is based on the four reference homogeneous periods: Classical Gold Standard; Gold Exchange Standards, Bretton Woods, and Managed Float. A "Contemporary Period" describing the 2000s to 2020s allowing us take into account the specific recent and ongoing shocks, and a "Prospective Period" allowing us to implement scenarios for the 2030s are added. To formally describe the persistence linked to network effects in monetary systems (see, e.g.; Eichengreen et al., 2016), we model a comprehensive range of states for the hub, core and distances features of the IMS. The hub, which represents the underlying asset of confidence in the IMS, has three possible states: 'hub', 'challenged' (e.g., gold during the Bretton Woods period), and 'non-hub'. The core, which represents currency dominance, has five possible states: 'core' and 'non-core' currencies, as well as 'ascending', 'descending', and 'challenger'

currencies. The dominant currency corresponds to 'core'. Currencies that were previously dominant or are likely to be dominant in the future respectively correspond to 'ascending core' and 'descending core'. Currencies that are not dominant but significant correspond to 'challenger'. The other currencies correspond to 'non-core'. Finally, distances, which represent transaction costs, have four possible states: 'long' and 'short', but also 'medium-high' and 'medium-low'. This choice allow us to take into account, in particular, the interaction between dominant exchange rate regimes (fixed vs. flexible), the technological environment, and the regulatory environment.

Regime switchings of the hub, core, and distances are determined by Markov chains associated with conditions on the environment variable (Figure 1b, Figure 1c). Regimes switchings of the hub are related to *'major' shocks*, as in the case of the two world wars, involving different currencies and different components of the environmental variable. When these 'major' shocks occur, the current hub status generally evolves from 'hub' to 'challenged', and from 'challenged' to 'non-hub'. Regarding core (dominant currencies) states, it is the individual characteristics of currencies that interact: We use the concept of a *'specific' shock*, i.e. a favorable (respectively, unfavorable) shock to a component of the environment variable when the majority of other currencies experience a shock in the opposite direction. For example, during the Gold Exchange Standard period, the United States is the only currency for which the geopolitical component takes on a positive value (end of World War I as a victor but not initial belligerent). Conditional Markov chains describing core status describe upward dynamics (from 'non-core' to 'challenger', then 'ascending core' and 'core') in the event of a specific favorable shock to development and/or monetary institutions, and downward dynamics (from 'hub' to 'descending core', then 'challenger' and 'non-core') in the opposite case. Finally, regarding the states of distances, which as for the hub are a common feature of the IMS, all currencies are taken into account. We use the concept of a *'common' shock* to several currencies, for the same component of the environment variable. The chains describe the convergence of distances states towards short distances, in the event of a favorable regulatory shock dominating any unfavorable shock to monetary institutions; and the convergence towards long distances in the opposite case. We also take into account convergence towards intermediate distances in the case of a dominant unfavorable regulatory shock offset by a favorable technological and/or regulatory shock.

Running large numbers of iterations of this system using Monte Carlo simulations allow us to reproduce the different states of the IMS features (Figure 2). 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 ascending core to core. In a second step, we apply a stress testing procedure, based on a set of shock scenarios on the component of the environment variable, and observe their impact on currency dominance.

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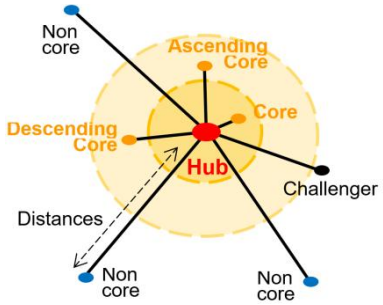
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Appendix

(a)



(b)

$$D_t = \underset{i=0,\ldots,n}{} \begin{array}{c} \\ \\ \gamma_t d_{1,0\ t} \\ \gamma_t d_{;2,0\ t} \\ \\ \\ \\ \gamma_t d_{;n,0\ t} \end{array} \overset{j=0,\ldots,n}{\begin{pmatrix} 0 & \gamma_t d_{0,1\ t} & \gamma_t d_{0,2\ t} & & & \ldots & \gamma_t d_{0,n\ t} \\ 0 & 0 & 0 & & & \ldots & 0 \\ 0 & 0 & 0 & & & & \\ & & & 0 & & & \\ & & & & 0 & \ldots & \ldots \\ \ldots & \ldots & & & \ldots & 0 & 0 \\ 0 & 0 & & & \ldots & 0 & 0 \end{pmatrix}}$$

(c)

$$S_t = \begin{bmatrix} Tech_t \\ Dev_t \\ Mon_t \\ Geop_t \\ Reg_t \end{bmatrix} \longrightarrow \gamma_t \,.\, \mathscr{D}_t = D_t$$

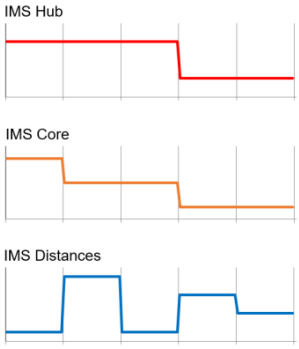


Figure 1 Summary representation of the model.
(a) The three features of the IMS graph consist of a hub, a core and other nodes connected to the hub by varying distances. **(b)** The graph is described by the symmetrical weighted adjacency matrix D_t where non-zero values correspond to the edges from the hub to the n currencies (in red), including the core currency (in orange). The global distance component γ_t is shown in blue. **(c)** These features are constant over institutional eras, with simultaneous jumps determined by the environment variable S_t with five components: technology, development, monetary institutions, geopolitics and regulation.

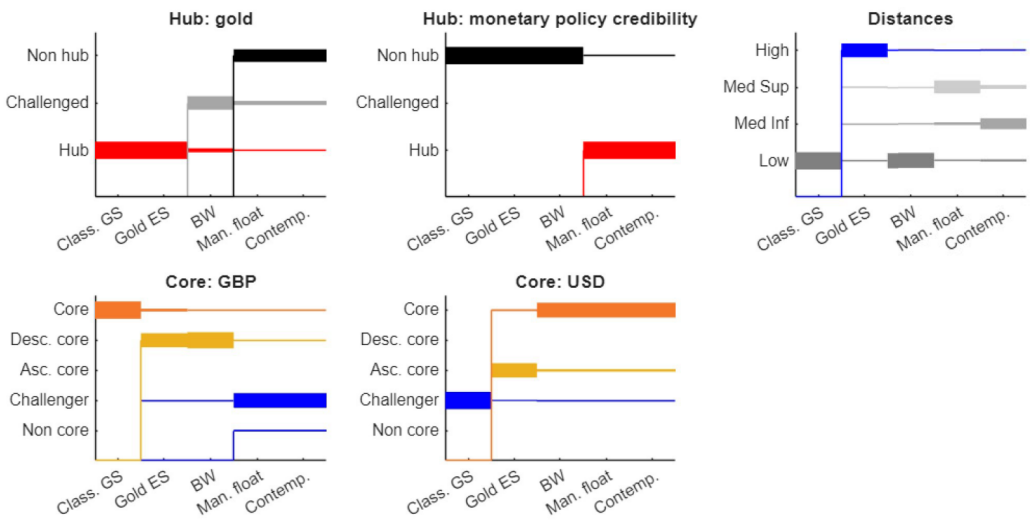


Figure 2 Simulation of the states of the IMS system for a subset of currencies.
Monte Carlo simulations, 1000 iterations. Width of lines is proportional to the frequency of the corresponding state in the simulations (as the Markov chain is a stochastic process, the result is in the form of frequencies rather than single states).