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Mars or Mercury? The Geopolitics of International Currency Choice

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Mars or Mercury?
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Abstract

We assess the role of economic and security considerations in the currency composition of international reserves. We contrast the "Mercury hypothesis" that currency choice is governed by pecuniary factors familiar to the literature, such as economic size and credibility of major reserve currency issuers, against the "Mars hypothesis" that this depends on geopolitical factors. Using data on foreign reserves of 19 countries before World War I, for which the currency composition of reserves is known and security alliances proliferated, our results lend support to both hypotheses. We find that military alliances boost the share of a currency in the partner's foreign reserve holdings by about 30 percentage points. These findings speak to the implications of possible U.S. disengagement from global geopolitical affairs. In a hypothetical scenario where the U.S. withdraws from the world, our estimates suggest that long-term U.S. interest rates could rise by as much as 80 basis points, assuming that the composition of global reserves changes but their level does not.

Key words: international currencies, alliances, geopolitics

JEL classification: F30, N20

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1. Introduction

Scholarly work on the national currency used in international transactions distinguishes two views. One, familiar to economists, emphasizes pecuniary motives and the calculus of economic costs and benefits in decisions to use a particular unit. Safety, liquidity, network effects, trade links and financial connections explain why some currencies are used disproportionally as a medium of exchange, store of value and unit of account by governments and private entities engaged in cross-border transactions (see e.g. Krugman 1980, 1984, Matsuyama, Kiyotaki and Matsui 1993, Zhou 1997, Rey 2001 and Devereux and Shi 2013). We refer this as the "Mercury hypothesis."[1]

Another view, due principally to political economists and applied mainly to the choice of reserve currency or currencies, emphasizes broader strategic, diplomatic and military-power considerations.[2] Insofar as a country has such power, governments of other countries may see it as in their geopolitical interest to conduct the majority of their international transactions using its currency. That leading power will in turn possess political leverage with which to encourage the practice (see e.g. Kindleberger 1970, Strange 1971, 1988, Kirshner 1995, Williamson 2012, Cohen 1998, 2015, Liao and McDowell 2016). International currency choice is from Mars, in other words, rather than Mercury.[3]

This "Mars hypothesis," when added to the intellectual portfolio of economists, may help to explain some otherwise perplexing aspects of the currency composition of international reserves.[4] It may explain why Japan holds a larger share

[1] In ancient Roman religion and myth, Mercury was the god of commerce while Mars, which we discuss below, was the god of war.

[2] Strange (1971) pioneered this approach by noting that sterling's status partly derived from Britain's global geopolitical leadership, not least in British colonies but also among members of the sterling area, which backed sterling's role as part of a broad set of relationships with Britain (see also the discussion in Helleiner and Kirshner 2009). Norloff (2014) stresses that coercive power of the dominant power in an alliance makes it more likely that other partners will use its currency. Cohen (2015) argues that military power or reach may also affect the decision of private entities to rely on a foreign currency as a store of value, since such military prowess makes the issuer's currency a "safe asset."

[3] Courtesy of John Gray's book *Men Are from Mars, Women Are from Venus* (Gray 1992) and Robert Kagan's phrase "Americans are from Mars, Europeans are from Venus" (Kagan 2002). An episode epitomizing the importance of geopolitical motives in international currency choice is the so-called "Blessing Letter" (see Posen 2008). In the 1960s, West Germany's peg to the U.S. dollar was seen by German authorities as problematic because it led to significant imported inflation and overheating. However, the commitment of the United States to maintaining troops on German soil to deter threats from the U.S.S.R. was linked to Germany's maintenance of its U.S. dollar peg and continued investment in dollar reserves. Under U.S. pressure, Karl Blessing (Bundesbank president at the time) sent a confidential letter to the Chairman of the Board of Governors of the Federal Reserve System pledging to keep Germany's dollar reserves against its best economic interest as a quid pro quo for U.S. security guarantees.

[4] International relations scholars have looked at specific country cases, such as Spiro (1999) on the dollar holdings of countries in the Middle-East, or Zimmermann (2011) on those of West Germany in the period between 1950 and 1971.

of its foreign reserves in dollars than China (as illustrated in Figure 1). It may explain why Saudi Arabia holds the bulk of its reserves in dollars, unlike another oil and commodity exporter, Russia. It may explain why Germany holds virtually all of its reserves in dollars, unlike France.[5] Germany, Japan and Saudi Arabia all depend on the United States for security; they are U.S. allies and non-nuclear powers.[6] China, Russia, and France, on the other hand, possess their own nuclear weapons as deterrents against potentials threats. Comparing nuclear-weapon states and states dependent on the U.S. for their security, as in Figure 1, suggests that the difference in the share of the U.S. dollar in foreign reserve holdings is over 30 percentage points.[7] In the same vein, it has been argued that the euro is unlikely to displace the dollar from its global role so long as national security ties favor the dollar, while the single currency's international appeal is constrained by limits on Europe's ability to develop security relationships beyond its borders (Posen 2008).

[Figure 1 about here]

Testing the Mars and Mercury hypotheses is not easy. Causality between reserve-currency decisions and geopolitics may run in both directions. Not only may geopolitical alliances and security guarantees encourage a particular pattern of reserve holdings, but holding a country's currency may encourage governments to seek out geopolitical alliances and security guarantees.[8]

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[5] While Germany can't hold reserves in euros, before 1999 it could hold reserves in European currencies other than its own, and even today it can hold reserves in inter alia, Japanese yen and British pounds. Historically, France has been reluctant to hold a large share of its international reserves in dollars, since at least the 1960s when Charles de Gaulle and his finance minister, Valery Giscard d'Estaing, railed against the dollar's "exorbitant privilege." Similarly, France has been reluctant to participate in the U.S.-led North Atlantic Treaty Alliance (unlike Germany), where Germany hosts thousands of U.S. troops and important U.S. military bases (unlike France).

[6] Historically, the U.S. has guaranteed Germany's security mainly against Russia, Japan's mainly against China, and Saudi Arabia's mainly against Iran.

[7] States with nuclear capacity tend to scatter below the regression line shown in Figure 1, while nations dependent on the U.S. for their security scatter above. Switzerland, which is a neutral state, stands well below the regression line. This is not simply a reflection of the large-scale interventions of the Swiss National Bank (SNB) in the foreign exchange market aiming at pegging the Swiss franc against the euro up to 2015, insofar as the share of US dollar in the SNB's reserves was roughly one-third prior to the global financial crisis, as it is now.

[8] Examples from the distant and recent past epitomize the point. After World War II lending by the U.S. to Europe through the Marshall Plan paved the way for the creation of the North Atlantic Treaty Alliance (NATO) and buttressed the greenback's role amidst Cold War threats and a pervasive shortage of dollars on the old continent. Dollar liquidity swap lines between the Federal Reserve and foreign central banks created in the wake of the global financial crisis of 2007-09 were given to close U.S. allies like South Korea and helped solidify the dollar's international status, notwithstanding the fact that the crisis had started in the United States. In a similar vein, the People's Bank of China's network of swap lines is believed to serve the ambition to foster the renminbi's international role and China's geopolitical interests. Further evidence that the Mars hypothesis still influences international currency choice today is provided by the fact that countries traditionally hostile to the U.S., such as Iraq and Iran in the early 2000s, and Venezuela more recently, sought to replace the greenback with the euro or an oil-backed cryptocurrency; in the same vein, nations seen as competing with the U.S. for global leadership, such as Russia and China, have sought to replace the U.S. dollar with their national currency in bilateral oil transactions (see Eichengreen, Chiţu and Mehl 2016 for details). It has also

Addressing this endogeneity requires a measure of geopolitical leverage that is exogenous to currency choice and varies across time or space. It requires data on governments' decisions about currency choice, insofar as governments remain leading geopolitical players. The currency composition of official foreign reserves is one such variable, but central banks and governments regard such data as sensitive and generally treat them as confidential.[9] While information on the composition of reserves is publicly available for a handful of countries and can be estimated for others, it is difficult to build a large and representative sample for countries today.

But it is easier to build this kind of sample for earlier periods. Governments did not always regard data on the composition of reserves as sensitive and confidential and, even where they did, a more limited menu of options makes it easier for that composition to be inferred. In this paper we therefore assess the importance of pecuniary and geopolitical motives in international currency choice using the currency composition of foreign reserves prior to World War I. We measure geopolitical motives using data on military alliances, including defense pacts, non-aggression treaties, neutrality treaties, and ententes. Endogeneity is addressed with propensity score matching methods and an instrumental variable strategy where the instrument is the presence and rank of diplomats.

We make use of a panel data set providing detailed information on the foreign exchange reserves of 19 countries between 1890 and 1913. The data distinguish five reserve currencies: sterling, the French franc, the German mark, the U.S. dollar and the Dutch guilder.

The period we consider culminated in a full-blown military conflict, pointing to the salience of geopolitical considerations. Security alliances and defense pacts proliferated (Miller 2012).[10] Then, as now, trade and finance were global. From 1850

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been argued that the commitment of the Gulf Cooperation Council nations to the U.S. dollar and that of African nations of the CFA Franc zone to the French franc–and subsequently the euro–as exchange rate anchors is quid pro quo for the security guarantees offered by the U.S. and France, respectively (see e.g. Posen 2008).

[9] Data on the currency composition of international reserves are made available to the public by only a limited number of central banks, as Truman and Wong (2006) describe. The I.M.F. publishes only global aggregates and, recently, breakdowns between advanced economies and emerging and developing countries. These underlying data, known as the Currency Composition of Official Foreign Exchange Reserves (C.O.F.E.R.) data base, are confidential; the individual country data have been used only by two internal I.M.F. staff studies (Dooley, Lizondo and Mathieson 1989, and Eichengreen and Mathieson 2001). In robustness checks below we assembled a small cross-sectional data set on the share of the U.S. dollar in global reserves in the modern era.

[10] With the industrialization of significant parts of the European continent in the second half of the 19th century and the creation of a unified German Empire in 1870-1, the balance of power created by the Concert of Europe (made up of Austria, Prussia, Russia and Great Britain, the members of the so-called Quadruple Alliance that defeated France and restored the Bourbon monarchy) was cast into doubt. Tension among the principal European powers rose further as they came into conflict over the scramble for African colonies. Germany and Austria-Hungary reached an understanding about a defense pact, known as the Dual Alliance, in 1879. Germany, Austria-Hungary and Italy signed a secret agreement,

to 1913, commodities and factors flowed across borders to an unprecedented extent. Significant falls in transport and communication costs with the advent of e.g. steamships, railways and telegraphic cables, along with limited barriers to flows in capital and labor, buttressed international trade and financial transactions as well as migrations (O'Rourke and Williamson 1999). By some metrics, the global economy was as financially integrated in this earlier era as today (Obstfeld and Taylor 2003, 2004).

Moreover, then as now, emerging powers rose to challenge established ones. Germany and the US challenged Britain's economic leadership in the final decades of the nineteen century, with the German mark and–later–the US dollar rivaling sterling as leading international currency. This is not unlike how China is seen as challenging the US now, and how the Chinese renminbi may challenge the US dollar.

Finally, governments and central banks were accumulating significant foreign exchange essentially for the first time in this era, suggesting that pecuniary and geopolitical motives were not (perhaps yet) dominated by simple habit formation.[11] Although gold was the main reserve asset, foreign exchange played a significant and growing role.[12] This was an era when currency choice was, well, a choice. Sterling was the leading reserve unit but, as we show below, governments and central banks could also hold reserves in German marks and French francs, among other currencies, if they so chose.[13]

We estimate the influence of pecuniary and geopolitical motives using an array of methodologies. Our results lend support to both the Mars and Mercury hypotheses. In particular, we find a sizeable geopolitical or security premium in international currency choice.[14] By our estimates, military alliances boost the share of

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the Triple Alliance, in 1882, committing to support one another if any of them was attacked by either France or Russia, allowing Austro-Hungarian troops to be redeployed from the Italian to Russian borders. Partly in response, France and Russia negotiated their own pact, also known as the Dual Alliance, in 1894; this Dual Alliance was then expanded into the Triple Entente of Britain, France and Russia, achieved through negotiation of the Entente Cordiale between Britain and France in 1904 and the Anglo-Russian Entente in 1907, to counter the Triple Alliance of Germany, Austria and Italy. The traditional interpretation of these alliances is as an attempt to recreate a balance of power (Walt 1990). We will, of course, have to also consider the possibility that security alliances grow out prior of economic links (Jackson and Nei 2015).

[11] See Eichengreen, Mehl and Chiţu (2017) and de Vries (1988) for a discussion of habit formation in this context.

[12] Lindert (1969) estimates that foreign exchange accounted for 16% of official reserves held globally in 1913.

[13] The Dutch guilder and U.S. dollar played a role as foreign reserve currencies as well. See Lindert (1969) for an early account of multipolarity in the international monetary system in the 19th century and Eichengreen, Mehl, and Chiţu (2017) for a recent discussion.

[14] The term "security premium" is from Norloff (2010).

the currencies of alliance partners in foreign reserve portfolios by about 30 percentage points.[15]

This security premium has implications for the benefits accruing to the United States as issuer of the leading international currency. This status allows the U.S. government to place dollar-denominated securities at a lower cost because demand from major reserve holders is stronger than otherwise. The cost to the U.S. of financing budget and current account deficits is correspondingly less. Our findings thus suggest that the dollar's dominance as an international unit is buttressed by the country's role as a global power guaranteeing the security of allied nations. If that role were seen as less sure and that security guarantee as less iron clad, because the U.S. was disengaging from global geopolitics in favor of more stand-alone, inward-looking policies, the security premium enjoyed by the U.S. dollar could diminish.[16] Our estimates suggest, in this scenario, that over $800 billion worth of official U.S. dollar-denominated assets – equivalent to almost 6 percent of US marketable public debt – would be liquidated and invested into other currencies such as the yen, the euro or the renminbi, if the composition of global reserves changes but their level remains stable, an event that would presumably have significant implications for U.S. bond markets and the dollar exchange rate.

Section 2 presents our data. Section 3 reviews our empirical specification. Section 4 presents the basic results on the Mercury hypothesis. Section 5 turns to extended results on the Mars hypothesis, after which Section 6 considers the propensity score matching and instrumental variable estimates. Section 7 examines a scenario analysis, while Section 8 concludes and draws implications for policy.

[15] A related paper in political science is Li (2003), who studies the effect of security alliances on exchange rate regime choice in the Bretton Woods and post-Bretton Woods periods. Our focus is different, however, insofar as we aim to estimate a geopolitical risk premium, address endogeneity between currency choice and security alliances, and examine official foreign reserves in order to study the implications of our findings for America's "exorbitant privilege". Moreover, relative to earlier narrative accounts, such as Calleo (2009) our contribution is to use an identification strategy based on historical data which enables to quantify the dollar's security premium and simulate the impact of a hypothetical scenario in which the US withdraws from the world. Kirshner (2009) looks at the geopolitical implications of diminished US dollar standing rather than at the US dollar implications of diminished US geopolitical standing, as we do.

[16] Exemplifying the possibility that the U.S. might disengage from global geopolitics in favour of more stand-alone, inward-looking policies is the preface to the new National Security Strategy – a report to Congress prepared by the U.S. administration outlining its main security concerns and how they should be addressed – in December 2017. In it President Donald Trump stresses that the strategy "puts America first". As the report further argues, it is necessary for the U.S. to "rethink the policies of the past two decades, policies based on the assumption that engagement with rivals and their inclusion in international institutions and global commerce would turn them into benign actors and trustworthy partners" because "this premise turned out to be false" while "strengthening our sovereignty […] is a necessary condition for protecting [the U.S.] national interests." (White House 2017). Moreover, Germany's Chancellor Angela Merkel declared end-May 2017 that the "the times in which we can fully count on others [i.e. the U.S.] are somewhat over…We Europeans must really take our destiny into our own hands."

2. Data

Our data on the currency composition of foreign exchange reserves are taken from Lindert (1967). Lindert built on an earlier data set constructed by Bloomfield (1963), which provided foreign-exchange-reserve totals but no information on the currency composition of reserves. Lindert used year-end balance sheets of central banks, national treasuries, exchange stabilization funds, and commercial banks, and obtained some data from private correspondence with the institutions in question. The aggregates for the years 1899 and 1913 that he published in Lindert (1969) remain the best available estimates of the currency composition of foreign exchange reserves held globally prior to World War I.

For this paper we digitized country-level and currency-specific information in Lindert (1967). This yields annual observations for 19 countries (Australia, Austria, Brazil, Canada, Ceylon, Chile, Finland, Germany, Greece, India, Italy, Japan, the Netherlands Indies, Norway, the Philippines, Romania, Russia, Sweden, and Switzerland) for the apex of the classical gold standard era from 1890 to 1913. Official foreign exchange in five currencies are distinguished: sterling, French francs, German marks, U.S. dollars, and Dutch guilders.

The institution in charge of managing foreign exchange reserves in this period was not always the central bank, since in a non-negligible number of cases central banks were first established after World War I. In some countries without a central bank, the treasury held the foreign exchange reserves. In others, reserves were held in a special fund or account created to manage the currency's parity to gold. In still other cases other public-sector banks were involved, such as the Yokohama Specie Bank in Japan or the Caisse Générale d'Epargne et de Retraite in Belgium.[17] And in a few countries, such as Canada, South Africa and New Zealand, no official institution was in charge of managing the currency's parity to gold; instead the task was delegated to private commercial banks.

The holdings in question were liquid foreign assets, including commercial and financial bills drawn on foreign places, foreign treasury bills, deposits in foreign banks, current account balances with banking correspondents abroad, and current account credits with banking branches abroad.[18]

Figure 2 shows the global stock of foreign exchange reserves by currency in 1899 and 1913 (following Lindert 1969). The overall picture is clearly inconsistent with the "natural monopoly" view that one currency is in sole possession of this international-currency role at any point in time.[19] We see how circa 1899 sterling

[17] See the data appendix and Lindert (1967) for a discussion of these cases.

[18] Lindert (1967), pp. 14-15.

[19] We discuss estimation problems arising from measurement error below.

accounted for the majority (about 65%) of identified foreign exchange reserves.[20] But French francs and German marks accounted for nonnegligible shares of the total (15% and 17%, respectively). Sterling's dominance declined over the subsequent decade and a half, with gains mainly accruing to the French franc, which was held by Russia and a number of other countries. In 1913 the share of sterling had fallen to 48%, the share of the French franc had risen to 31%, and the share of the German mark had remained stable.

[Figure 2 about here]

Figure 3 shows the evolution of currency shares between 1890 and 1913. The sample of countries reporting data varies over time, complicating interpretation, but the pattern suggests that sterling's dominance peaked in the early 1890s.[21] Whether this is due to economic or geopolitical factors remains to be determined.

[Figure 3 about here]

Figure 4 shows the evolution between 1890 and 1913 of the currency composition of official foreign exchange holdings by country. Several economies, generally those with strong political or colonial ties to a major metropolitan center, held their reserves in a single currency: Australia, Ceylon and India held only sterling; the Philippines held only dollars; and the Netherlands Indies held only Dutch guilders. That the countries in question were colonies or dominions of the U.K., the U.S. or the Netherlands underscores the importance of such institutional arrangements in international reserve currency choice, as emphasized by inter alia Strange (1988).[22] We will control for colonial relationships in our estimations below.

The remaining countries held multiple currencies, suggesting that the aggregate evidence above against the natural-monopoly view is not due to one or a few large reserve holders. Moreover, the countries in question adjusted the currency composition of their holdings over the sample period. These changes are suggestive of geopolitical factors. The growing share of German marks in Austria-Hungary's reserves went hand in hand with the Triple Alliance, i.e. the secret agreement between Germany, Austria-Hungary, and Italy signed in 1882 and renewed periodically until World War I, committing each member to provide mutual support in the event of an

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[20] The dominance of sterling then consequently resembled the dominance of the U.S. dollar now, with the greenback accounting for roughly two-thirds of global foreign exchange reserves in 2017.

[21] This, too, is inconsistent with the view that international reserve currency status is a natural monopoly or that a currency's dominance cannot erode rapidly. Note that reporting practices varied, however, and that observations are missing in some years for some countries. Swings in currency shares in 1899 and 1900 are due to Russia, which reports data only for those years and for 1912-13. We seek to minimize measurement error in currency shares due to changes in reporting practices or in availability of data on reserve assets by obtaining estimates on the cross-sectional dimension of the sample (more on this below).

[22] Strange referred to currencies held under such circumstances as "master currencies."

attack by another great power. [23] The increasing importance of French francs in Russia's reserves in the years after the Franco-Russian alliance of 1894 highlights a similar point.

[Figure 4 about here]

3. Specification

Our basic specification follows previous literature (see e.g. Chinn and Frankel 2007, 2008; Li and Liu 2008; Chiţu, Eichengreen and Mehl 2014 and Eichengreen, Mehl and Chiţu 2016). It models the choice of reserve currency as:

$$share_{i,j,t} = \alpha_i + \alpha_j + \lambda_t + \beta_1 share_{i,j,t-1} + \beta_2 size_{i,t} + \beta_3 credibility_{i,t} + \boldsymbol{\beta}_4' \mathbf{X}_{\mathbf{i,j}} + \varepsilon_{i,j,t} \qquad (1)$$

where i, j, and t are the currency, country and time dimensions ($i = 1\ldots5$; $j = 1\ldots19$; $t = 1\ldots23$) and *share* is the share of currency i in country j's foreign exchange reserves in year t; **X** is a vector of control variables; λ a vector of time effects; ε is the residual; and the βs are the coefficients to estimate. We control for unobserved heterogeneity by including dyadic-fixed-effects $\alpha_{i,j}$ when **X** comprises variables that vary across both dyads and time, such as bilateral trade and financial depth. When the variables in question vary across dyads only, such as the proxies for international transaction costs discussed below, we include currency-fixed effects and country-fixed effects, denoted α_i and α_j, respectively, as shown in Equation (1).

We draw on analytical models emphasizing inertia, economic size, credibility, trade relations and financial depth as pecuniary determinants of international currency status that underpin the Mercury hypothesis. Triffin (1960) was among the first to emphasize persistence or inertia effects in international currency use by arguing that it took from 30 to 70 years, depending on the aspects of economic and international currency status considered, from when the United States overtook Britain as the leading economic and commercial power and when the dollar overtook sterling as the dominant international currency. Persistence or inertia effects also feature in the models of e.g. Krugman (1980, 1984), Matsuyama, Kiyotaki and Matsui (1993) and Rey (2001). We measure the persistence or inertia effects in question with a lagged dependent variable.

Economic size is another standard determinant of international currency choice. It captures the network effects discussed by e.g. Krugman (1980, 1984), who focused on the increasing returns that result from economies of scale. In his model, a

[23] Romania secretly joined the Triple Alliance in October 1883, which partly explains its significant holdings of German marks. See also below for more details.

collective choice to engage in trade using a particular unit reduces transactions costs associated with that unit, further encouraging the practice. Strategic complementarities and economies of scale also feature in the random matching model of Matsuyama, Kiyotaki and Matsui (1993), who model the choice of international currencies as a double-coincidence-of-wants problem, where the incentive of an agent to accept a nation's currency depends on how often he/she trades with a national from that country. Rey (2001) stresses the self-reinforcing effects on transaction costs of using a particular unit in foreign exchange markets arising from the pattern of bilateral trade (what she calls "thick market externalities").[24] Empirically, we measure economic size as the output of the country issuing reserve currency *i*, relative to global output, taking data from Maddison (2010).

Persistence and network effects are distinct, and one does not imply the other. Persistence can have other sources besides network effects giving rise to first-mover advantage. Examples include habit formation (see e.g. De Vries 1988) and the absence of low-cost alternatives to the dominant unit. Conversely, network effects may increase the attractions of a particular standard (in this case, a currency standard) at a specific point in time without preventing market participants from shifting to another standard at the next point in time, assuming that lock-in is weak and agents can coordinate their actions (as argued by David 1986, 1990). The success with which open standards for personal electronics have been developed in recent years, weakening lock-in and facilitating shifts between operating systems, illustrates the point (West 2007).[25]

The credibility term is motivated by models in which currency depreciation can make holding a unit unattractive and discourage its international use, as in Devereux and Shi (2013). Stability is important for credibility because reserve holders prefer reliable stores of value and may be reluctant to hold reserves in units that depreciate by too much or for too long. We measure credibility as time in years spent by reserve issuer *i* on the gold standard, using data from Reinhart and Rogoff (2011). This is in keeping with the observation that adherence to the gold standard served as a "good housekeeping seal of approval" strengthening country's credibility and access to foreign capital (Bordo and Rockoff 1996).

Trade relations may influence reserve currency status, insofar as commercial transactions are a source of information useful for informing foreign investment decisions (Antràs and Caballero 2007). Trade links may also make foreign investments more secure insofar as strategic default is deterred by the threat of

[24] Devereux and Shi (2013) take the argument to a dynamic general equilibrium model in which vehicle currencies enable agents to economize on the number of currency trading posts.

[25] There is an analogy between international currencies and operating systems for personal computers and other electronic devices, which we invoke in connection with the so-called "new view" of international competition in Eichengreen, Mehl and Chițu (2017). Insofar as gateway technologies reduce interchangeability costs between different technological systems or standards, network increasing returns associated with use of a particular standard are no longer as pronounced. In turn, first-mover advantage and the persistence of the established, dominant standard are no longer so strong.

commercial retaliation (Rose and Spiegel 2004). Aviat and Coeurdacier (2007), Lane and Milesi-Ferreti (2008a) and (2008b), Coeurdacier and Martin (2009), Forbes (2010) and Coeurdacier and Rey (2011) all provide evidence that trade in goods is an important determinant of trade in assets. We measure trade relations as the logarithm of the sum of bilateral exports between countries *i* and *j*, using data from Jacks, Meissner and Novy (2011).

Financial depth is a final pecuniary factor thought to be important in the choice of reserve currency (as in Portes and Rey 1998 and Papaioannou and Portes 2008). Eichengreen and Flandreau (2012) show that financial deepening was a key determinant of the rise of dollar-denominated trade credits in the 1920s. Chiţu, Eichengreen and Mehl (2014) show that financial deepening was the main factor helping the dollar overcome sterling's head start as an international financing currency in the interwar period. Following King and Levine (1993), we measure financial depth by the financial monetisation ratio (broad money to GDP), taking data from Jordà, Schularick and Taylor (2017).[26]

We include year effects throughout. These capture changes in the structure of the international monetary and financial system as well as other changes in the world economy for which we do not otherwise control. In addition, we estimate the resulting equations with dyadic effects to account for unobserved country-currency specific variation.

We implement Equation (1) using ordinary least squares and report standard errors robust to autocorrelation and heteroskedasticity and clustered by dyad (to control for possible residual correlation between country-currency observations in each year).[27] In robustness checks we report estimates obtained with a random effects estimator and with time-varying fixed effects. Given that a country's currency shares are bounded between zero and one, a tobit estimator might have been warranted. However, since our data are censored neither from above nor from below, this is not necessary. That said, we also report results using panel tobit and fractional logit estimators. Finally, insofar as the lagged dependent variable, our proxy for persistence or inertia, can also reflect serially correlated omitted variables, we report estimates using the Griliches (1961)-Liviatan (1963) and Hatanaka (1974) estimators, as well as with system GMM in the spirit of Blundell and Bond (1998).

4. Mercury Hypothesis

Table 1 presents the benchmark results, where the four pecuniary variables are entered first one-by-one and then together. Half of the adjustment to the long run in

[26] In robustness checks we also consider the financial intermediation ratio (private credit to GDP); see below.

[27] Instrumental variables estimates are also reported below.

international currency shares in global foreign reserves is estimated to occur in a single year, ceteris paribus, which is lower than the 0.9 estimate of Chinn and Frankel (2007, Table 8.4, p. 303) using reserve data for 1973-1998.[28]

Table 1 lends support to the Mercury hypothesis. To start, credibility matters: the share of a particular currency in foreign reserves increases significantly with the time spent on the gold standard, in line with the observation that the latter served as a "good housekeeping seal of approval."[29] The full model estimates (column 7 of Table 1) suggest that the short run (one year) effect of an additional year on the gold standard is an increase in the share of a particular reserve currency of about 0.5 percentage point.[30] That by 1899 Britain had been on the gold standard for 56 years longer than France explains a large part of the 48 percentage-point difference in their respective shares of global reserve portfolios, other things equal.

The coefficient on economic size is positive, in line with theory, and statistically significant at the 15% level (in columns 3 and 6). It may be that we lack sufficient heterogeneity to identify its effect with more precision, insofar as three of the five reserve issuers we consider (the U.K., France and Germany) were of roughly equal size (i.e. 9% to 14% of global output over the sample period, against 23% for the U.S. and 1% for the Netherlands).

Data are more limited for trade relations and financial depth.[31] Trade relations enter positively, in line with theory, and are significant at the 15% level (in column 4); the effect of financial depth is positive as well, in line with the findings of earlier studies mentioned above, and significant at the 10% level (in column 5).[32]

We also obtained estimates where standard errors are clustered for both the reserve currency and reserve holder (see columns 8 and 9). The coefficients capturing inertia and credibility remained statistically significant (in column 9), as well as that of economic size (in column 8). Finally, we obtained fractional logit estimates (see columns 1 and 2 of Table A3). The estimated effects for inertia, credibility, and economic size remained robust (in column 2).[33]

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[28] This need not mean that inertia was weaker and that the currency composition of foreign reserves could change more rapidly in this earlier era, however. When we control for the standard gravity covariates, we still obtain a coefficient on the order of 0.9. The difference in the two estimates is mainly due to how we control for unobserved heterogeneity with dyadic vs. country and currency fixed effects (see below).

[29] Again, this is in line with the estimates of Chinn and Frankel (2007), who also found evidence of significant credibility effects on reserve data for the modern era.

[30] That increase in the share is almost one percentage point in the long run.

[31] We lose about half of the observations (or more) in the estimates reported in columns (4) to (7).

[32] When we control for credibility and economic size as in columns (6) and (7), trade relations and financial depth are no longer statistically significant.

[33] Note that in the estimates of column (1) of Table A3, which use a smaller sample, the coefficient on credibility and economic size turned insignificant, while that on financial depth remained positive and significant.

[Table 1 about here]

We also re-estimated Equation (1) using currency shares adjusted for gold and silver holdings, the main component of official reserves.[34] The estimates are reported in Table A2 in the appendix. Again we find that inertia and credibility effects matter significantly. Magnitudes are smaller compared to the baseline estimates.[35]

Previous studies found that the dyadic covariates typically used in gravity models, such as common border, common language, common colonial relationship and geographic distance, influence the geography of international finance and affect bilateral patterns of cross-border financial flows and holdings.[36] These variables aim to capture transaction costs or information asymmetries that affect trade and financial relations between nations; they are sometimes described as picking up “familiarity” or “connectivity” frictions. We take data on these dyadic covariates from CEPII’s GeoDist data base.[37]

These are entered one-by-one and then together in Table 2. The estimates control for currency fixed effects, country effects and time effects. The results confirm the importance of pecuniary factors, in line with the Mercury hypothesis. Estimated persistence is now stronger, with the point estimate on lagged currency share reaching 0.9, while the coefficient estimates on credibility and economic size are smaller.

Conceivably, this reflects the fact that we can no longer control for dyadic fixed-effects as in Table 1 insofar as these would be collinear with the proxies for trade costs, which vary across dyads but not over time. Dyadic fixed effects cast a wider net as controls for unobserved heterogeneity, compared to the country fixed

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[34] Specifically we scale currency shares by the proportion of gold and silver in reserve holders’ total foreign reserves.

[35] The effects of economic size, trade relations and financial depth are no longer statistically significant, but the fact that we lose a large number of observations due to lack of data for gold holdings for several countries likely explains much of the loss in efficiency.

[36] See e.g. Portes and Rey (2005), Aviat and Coeurdacier (2007), Lane and Milesi-Ferreti (2008a) and (2008b), Forbes (2010).

[37] See Mayer and Zignago (2011). The data consist of binary dummy variables that equal 1 if two countries are contiguous (common border), share a common official language (common language), and were ever in a colonial relationship (common colony); distance is the logarithm of the simple distance (in kilometres) between the two most populated cities of a particular dyad. Gravity covariates have been used in other studies of international currency status using dyadic panel data, such as He et al. (2015).

effects and currency fixed effects used in Table 2, since there are three times as many dyadic effects as country plus currency fixed effects.[38]

When credibility effects are significant, an additional year on the gold standard is associated with an increase in the share of a particular reserve currency of about two percentage points in the long run. In addition, the currency composition of foreign exchange reserves tends to be tilted toward currencies issued by economies vis-à-vis which transactions costs or information asymmetries are low, i.e. which share a common border, a common language, a common colonial relationship with reserve currency issuers or are geographically near the issuers in question (see columns 1 to 4 of Table 2).

The full model estimates (column 5 of Table 2) suggest that these factors are economically important. Sharing a common border with a reserve currency issuer is associated with an increase in the share of the issuer's currency of more than 5 percentage points in the short run, while a common colonial relationship is associated with an increase of 7 percentage points.[39] Long-run effects are sizeable, on the order of 50-70 percentage points. We also report two-way clustering estimates in column (6) of Table (2). The estimates for inertia, credibility, contiguity, colonial relationship and distance remain statistically significant.[40]

[Table 2 about here]

Table 3 examines the robustness of the results to use of a linear random effects estimator (column 1), and a panel tobit estimator (column 2). Signs, magnitudes, and significance levels are broadly similar to those in our baseline model.[41] Note that our data are censored neither from above nor from below (see column 2 of Table 3, last row), which suggests that tobit estimation is not necessary.

Interpretation of the lagged dependent variable in terms of inertia will be problematic if the latter is simply picking up persistent error terms.[42] One treatment is to instrument the lagged dependent variable with its second lag and the first lags of the independent variables (see e.g. Griliches, 1961; Liviatan, 1963). This will yield

[38] Estimates not reported here to save space – but available from the authors – using only the dyadic and fixed effects in question substantiate the point. In turn, dyadic effects might better control for omitted variables that have a pair dimension, such as military alliances between countries, a variable to which we turn in our discussion of the Mars hypothesis below.

[39] The effect of common language is positive and statistically significant when entered individually (as in column 2), but not when it is entered together with the other gravity controls (as in column 5).

[40] At the 20% level for contiguity and the 15% level for distance, respectively.

[41] Distance loses statistical significance, however, while economic size becomes statistically significant (in column 1).

[42] The combination of serially correlated errors and the lagged dependent variable also introduces the possibility of biased coefficient estimates due to correlation between the lagged variable and the error term.

consistent, albeit inefficient, estimates.[43] Intuitively, including only the predicted component of lagged currency shares enhances the plausibility that the lag is picking up genuine inertia effects rather than persistent random errors. Another treatment is that of Hatanaka (1974), which includes both the fitted value and the residual from the first-stage regression in the second stage and yields estimates that are both consistent and efficient.

Results using these techniques (columns 3 and 4 of Table 3) are close to our earlier estimates in terms of economic magnitude and sign, but statistical significance of the estimated coefficients is weaker, with the exception of the coefficient on inertia. This suggests that there may be omitted variables leading to persistent errors picked up in the lagged dependent variable, such as geopolitical factors, an explanation to which we turn below.[44]

We report fractional logit estimates in column 5 of Table 3. The estimated effects of inertia and trade frictions are robust. We also obtained system GMM estimates (see column 6 of Table 3). The estimated coefficient on inertia remains on the order of 0.5. This buttresses the conjecture that differences in the inertia coefficient stem from inclusion of dyadic vs. country and currency fixed effects, as discussed above. We also obtained estimates with time-varying fixed effects (see column 7 of Table 3). The estimates for inertia, contiguity, colonial relationship and distance again remain robust. And we obtained estimates excluding the inertia variable (see column 8 of Table 3); the estimated effects of credibility and the gravity variables are larger, in line with the long-term effects previously discussed.

Finally, we replaced the monetization ratio with the credit intermediation ratio as our measure of financial depth and used alternative measures of common language distance.[45] We dummied out Germany insofar as it is the only country in our sample that is both a reserve currency issuer and holder. We controlled for the direction of trade using alternative data sources, including from the Correlates of War project (http://www.correlatesofwar.org/) and Mitchell (1998a, b, c). In all cases, our basic results remained unchanged.[46] We obtained estimates with the credibility measure fixed at 1890 levels and excluding currency fixed effects. The coefficient on credibility remained positive and statistically significant whether or not we controlled also for country fixed effects, and the estimates for the gravity covariates remained broadly unchanged.

[Table 3 about here]

[43] These estimates are inefficient since the adjustment does not correct for error autocorrelation.

[44] This is also argued by e.g. Posen (2008).

[45] We use a common language dummy equalling 1 if a language is spoken by at least 9% of the population in both countries within a dyad; and we use the simple distance (in kilometres) between the two capital cities within a dyad as well as a measure of weighted distance (where the weights are the shares of the cities in the respective country's population).

[46] The effects of the credit intermediation ratio and of trade on currency shares were not statistically significant using these alternative definitions, but the effects of the other variables remained robust.

5. Mars Hypothesis

To incorporate geopolitical factors, we modify equation (1) to the form:

$$share_{i,j,t} = \alpha_i + \alpha_j + \lambda_t + \beta_1 share_{i,j,t-1} + \beta_2 size_{i,t} + \beta_3 credibility_{i,t} + \boldsymbol{\beta}_4' \mathbf{X}_{i,j} + \beta_5 alliance_{i,j,t} + \varepsilon_{i,j,t} \quad (2)$$

where *alliance* is an indicator variable equaling 1 if a defense pact, non-aggression treaty, neutrality treaty or entente is in force between reserve currency issuer *i* and reserve holder *j* in year *t*, and 0 otherwise. We take data on formal military alliances among states between 1890 and 1913 from the Correlates of War Project.[47]

We can think of two potential channels through which the national security and foreign policy capabilities of reserve currency issuers could influence other countries' decisions to use their currency. One is that military alliances put pressure on both sides to link their pursuit of stability, including monetary stability. The other is a quid pro quo. Reserve currency issuers providing security guarantees may use them as leverage to obtain finance from security-dependent nations, or to be the financial center from which the nations in question borrow funds. This leverage results in the anchor country having its own-currency-denominated debt held as foreign reserves by the security-dependent economy.[48]

A related interpretation of the Mars hypothesis is in terms of commitment, in the spirit of Kindleberger (1970) and Farhi and Maggiori (2018). A nation strongly engaged with the rest of the world might be seen as paying a cost to signal its commitment to global stability. In turn, the rest of the world sees the debt of the country in question as safer, insofar as it is less likely to be inflated away, thereby tilting the composition of the global reserves towards the currency in question.

Interstate violence can also function as a tax on international trade. Blomberg and Hess (2006) find that terrorism, together with internal and external conflicts, place an effective 30% tariff on trade. Glick and Taylor (2010) find large and persistent impacts of wars on trade, national income, and global economic welfare. Insofar as war is a tax on trade, formal military alliances that aim at containing violence between signatory nations and fostering cooperation against external threats

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[47] See Gibler (2009) on the coding of formal alliances among states in the Correlates of War data base. Defense pacts are international agreements where the signatories promise to support each other militarily against a specific threat. A non-aggression treaty is an agreement between countries not to attack each other for a specified period of time. A neutrality treaty foresees that signatories observe neutrality if one of them is attacked. An entente is a friendly understanding or informal alliance between states. The panel correlation between the common colony dummy and military alliances dummy is low, on the order of -2 to -6%.

[48] That the euro area cannot at present compete with the U.S. or China in terms of "hard power" is seen by some observers (e.g. Posen 2008, Moss 2009) as weighing on the euro's international role.

can stimulate trade in goods and finance. This, in turn, helps to nudge reserve holders toward the unit of issuers which are members of the same alliance.[49]

If geopolitical considerations influence international currency choice, then we would expect the coefficient on *alliance* to be positive and significant.

Table 4 reports OLS estimates of Eq. (2) with standard errors that are robust to heteroskedasticity and clustered by dyad. The results in columns (1) to (4), controlling for transaction costs, support both the Mercury and Mars hypotheses. The estimated coefficients on inertia, credibility, contiguity, common language, common colonial relationship and distance are similar to the basic estimates of Table 2. The estimated coefficient on military alliances is positive and statistically significant at the 5% level, in line with the Mars hypothesis. The coefficient on its subcategories (defense pacts, entente) is also positive and statistically significant (at the 12% and 14% level, respectively).[50]

As discussed above, Equation (2) may be afflicted by a problem of mismeasuring currency shares, owing to changes in reporting practices and in the availability of data on reserves. If errors are correlated with the explanatory variables, the OLS estimate of β_5 will be biased and inconsistent.[51] We therefore also obtained estimates based on 5-year averages of the observations, which we report in columns 5 to 8 of Table 4. The effects of defense pacts and ententes are statistically significant at the 5% level, and at the 15% level for military alliances (see columns 5 to 8 of Table 4 below).[52] Magnitudes are broadly comparable. In the long-run, defense pacts boost the share of a currency in the partner's foreign reserves by 37 percentage points, according to the full sample estimates, against 26 percentage points, according to the estimates with 5-year averages.

[Table 4 about here]

[49] Of course, trade and military alliances can be endogenous. Causality could flow in the other direction, too, with trade influencing security considerations. We will address this possibility below.

[50] The exception is the coefficient on the neutrality dummy, which is positive but statistically insignificant.

[51] If the errors are not correlated with the independent variables, then the OLS estimate of β_5 will be unbiased and consistent but inefficient.

[52] The effect of neutrality treaties remains insignificant.

6. Causality

When estimating Equation (2) we also face an endogeneity problem. Causality between currency shares and alliances can run both ways.[53] Omitted variables could influence both currency shares and military alliances simultaneously. The bias may come, for instance, from the fact that some countries hold a portion of their reserves in a particular unit because of cultural, historical or still other reasons that we cannot fully capture, while also being part of an alliance with the issuer.[54]

We therefore used propensity score matching methods to estimate the treatment effect of military alliances, addressing the concern that there could be systematic differences between pairs which have an alliance relative to pairs that don't.

First, we obtained propensity scores i.e. the probability that a given pair has a military alliance (i.e. is treated) from a logit model. We used diplomatic presence and rank as covariates (more on this below) together with an array of variables posited by political scientists to be correlated with power and proximity and, in turn, military alliance formation (see e.g. Walt 1985): economic size, population, physical distance, genetic distance, military expenditure and military personal.[55] In the second step, we used four distinct algorithms (nearest neighbor, radius, kernel and stratification matching) to match treated pairs with control pairs (i.e. countries expected to have an alliance but that don't have one) based on their observable characteristics. The causal effect of military alliances was estimated by comparing outcomes between treated and matched control pairs, i.e. by computing the mean difference in shares between the two groups.

We assigned observations to three blocks in the overlap in probability values between the treated and control pairs (the region of common support). This ensured that mean propensity scores for treated and controls in each blocks were not different. The balancing property was satisfied as well, insofar as the hypothesis of similarity of covariates between the two groups was not rejected.

Table 5 below reports the results for the full sample. Military alliances boost the share of a currency in the partner's foreign reserve holdings by 20-30 percentage points (see Panel A of Table 5).[56] The estimated effect of defense pacts is higher still, at 30-50 percentage points (see Panel B of Table 5). Table A6 reports the results for

[53] There may be an upward bias in the OLS estimate of β_5 if forging an alliance encourages official investment in the unit of the reserve currency issuer that is part of the alliance in question, while at the same time the official investments make the alliance in turn more solid.

[54] There should be in this case a downward bias in the OLS estimate of β_5.

[55] The inclusion of genetic distance is motivated by the findings of Spolaore and Wacziarg (2016) that populations that are genetically closer are more prone to engage in international conflict with each other.

[56] The estimate obtained with the nearest neighbour matching method are based on just 1 observation in the control group and hence are not meaningful.

the sample based on cross-sectional averages, which aim to mitigate measurement problems and ensure that we match observations across different dyads, not different time observations within the same dyad. The treatment effect of military alliances and defense pacts is on the order of 30-40 percentage points, which is not very different from the long-run effect estimated with OLS.[57]

[Table 5 about here]

Next we sought to mitigate endogeneity problems by obtaining instrumental-variable estimates based on the cross-sectional dimension of the sample. We modify equation (3) to the form:

$$share_{i,j} = \alpha_i + \gamma_1 size_i + \gamma_2 credibility_i + \boldsymbol{\gamma'_3 X_{i,j}} + \gamma_4 \widehat{alliance}_{i,j} + u_{i,j} \qquad (3)$$

where observations for dyad (i, j) are now period averages over 1890-1913. Our instrument for *alliance* is diplomatic representation, i.e. the presence and rank of diplomats from a sending nation in the host nation. The presence of diplomats plausibly helps to forge or sustain international agreements and will therefore be positively correlated with *alliance*.[58] At the same time, diplomatic representation is unlikely to be correlated with currency shares for other reasons. Governments send or accredit diplomats based on broad foreign policy considerations, not to directly affect the currency composition of foreign reserve holdings. Expulsions or withdrawals of diplomats typically occur because of foreign policy incidents, not to otherwise influence the currency composition of foreign exchange holdings. This instrument plausibly satisfies the exclusion restriction, in other words.[59]

We take data on diplomatic representation from the Correlates of War project. This variable is a linearly increasing function of the level of diplomatic representation. It equals 0 if there is no presence of diplomats of country *i* in country *j* (and vice-versa); 1 if a chargé d'affaires of country *i* is present in country *j* (and vice-versa); 2 if there is a minister; 3 if there is an ambassador; and 4 if country *i* is a colony of country *j* (and vice-versa) implying that they cannot send or host diplomats in the traditional sense.[60]

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[57] The estimates in question are obtained with smaller treated and control groups than for the full sample estimates, however.

[58] The simple correlation coefficient between alliance and diplomatic representation stands at about 0.2.

[59] The first-stage regressions also include pecuniary factors as instruments, i.e. economic size, contiguity and distance which, as political scientists posit, are correlated with power and proximity and, in turn, with military alliance formation (see e.g. Walt 1985).

[60] For instance, Britain was represented by a Viceroy in India, and there was an India Office in the U.K. to oversee the administration of the provinces of British India. A chargé d'affaires is a head of mission accredited by his country's foreign minister to the receiving nation's foreign minister when the two nations have not agreed to exchange ambassadors. A minister is a head of mission accredited to the receiving country's head of state; he leads a legation rather than an embassy. An ambassador is a head

These data are available at 5-year intervals. This implies that we lose quite a number of observations from our original sample. The data are also highly persistent and offer limited heterogeneity in the time series dimension; presence and rank of diplomatic representation did not change quickly.[61] We therefore average out the dyadic observations over time. Assuming that the mean of the measurement errors in the dependent variable is zero, this also helps to mitigate biases arising from the measurement errors in question, as discussed above.

We include currency fixed effects to control for unobserved heterogeneity, leaving us with 38 degrees of freedom insofar as we have a sample of 50 observations and no fewer than 12 coefficients to estimate. Controlling for country fixed effects would reduce estimation efficiency more significantly still, as we would be left with only 23 degrees of freedom.

The estimates in columns 1 to 5 of Table 6 are obtained by OLS, while those in columns 6 to 10 are obtained by two-stage least squares. Standard errors are robust to heteroscedasticity. Pecuniary factors such as transaction costs (e.g. common colonial relationship and, to a lesser extent, contiguity) still matter, in line with the Mercury hypothesis (columns 6 to 10 of Table 6).[62] In addition, defense pacts have positive effects and are significant at the 13% level.[63]

Formal tests suggest that diplomatic representation is a valid instrument. The Hansen test of overidentifying restrictions is not rejected, suggesting that our instrument is uncorrelated with the error term. The Kleinberger-Paap test of underidentification is typically rejected, confirming that diplomatic representation is correlated with the endogenous regressor, although instrument power is weak as the *F*-statistical is below the rule of thumb of 10 or the critical values tabulated by Stock and Yogo (2005).

[Table 6 about here]

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of mission accredited to the receiving country's head of state who heads an embassy in the receiving country's capital city.

[61] A simple AR(1) model of the diplomatic-representation variable gives an autoregressive root on the order of 0.95.

[62] Other pecuniary factors have statistically insignificant effects, in contrast. In terms of explanatory power, when we include Mercury variables only in the OLS regressions (measured as the standard gravity frictions) the adjusted-R^2 reaches about 38%. This compares with about 4-7% when we include Mars variables only (measured as either military alliances or defense pacts); in other words, as much as almost one-fifth of the predicted variation in international reserve currency choices is due to Mars variables alone. Including both Mars and Mercury variables in the estimated equation increases the adjusted-R^2 to 40-45%; and adding currency fixed effects increases the adjusted- R^2 to about 60%.

[63] While this is lower than conventional significance levels, readers should keep in mind that we have only 38 degrees of freedom, which weighs on efficiency.

Another concern is reverse causality between trade and diplomatic representation. It has been argued for the modern era that foreign embassies and consulates have lost importance for foreign policy and intelligence gathering and increasingly market themselves as agents of export promotion (see e.g. Rose 2007). If diplomatic representation was motivated by trade-promotion goals, which would determine the direction of trade and, in turn, currency shares, results will be biased.

To address this issue, we calculated the residuals from a regression of diplomatic presence and rank as of 1884 (i.e. prior to the beginning of our sample) on distance, relative GDP, contiguity, common language and common colonial relationship, the standard arguments of the gravity model. This provides us with a measure of diplomatic representation that is both predetermined and orthogonal with respect to trade frictions, including trade potential, insofar as the latter is captured by the frictions in question. The results using this measure, in Table A5, are the same as in Table 6.[64]

Figure 5 shows the predicted shares of selected reserve currencies in the foreign reserve holdings of five countries that signed defense pacts with the issuer of those currencies prior to World War I. Predicted shares are computed using the model estimates in Table 6, column (2), i.e. including the effects of defense pacts (shown as dark grey bars) and, alternatively, excluding the effects of defense pacts (shown as light grey bars).[65] Actual currency shares are shown as black bars.

Consider the case of Japan, shown in the middle of Figure 4. The actual share of sterling in Japan's foreign reserve holdings prior to World War I was 96%. The predicted share in a model including only pecuniary factors is much lower, at 31%. That Japan signed a defense pact with the United Kingdom in 1902 to oppose Russia's expansion in Asia goes a long way toward explaining the difference.[66] The predicted share including defense-pact effects is 67%, much closer to the actual share. Defense pacts similarly explain much of the gap between actual and predicted shares of the Reichsmark and French franc for Italy, Romania and Russia.

In the absence of Mars effects, our equation under-predicts currency shares in countries with defense pacts. As Figure A1 makes clear, the forecast error for the

[64] One reason for this is that diplomatic representation in 1890-1913 was very similar to that in 1884. It was decided beforehand and, insofar as we removed trade considerations, by broad geopolitical motives. This suggests that trade promotion goals are unimportant for our results. An alternative approach would be to regress diplomats on bilateral trade and use the error term as an instrument. One advantage of the gravity variables is that the data in question are more widely available for this earlier era than data on bilateral trade, which strengthens the power of our tests.

[65] We used the OLS estimate here because it is closer in economic magnitude than the IV estimate to the results obtained with propensity score matching.

[66] A possible defense pact between the U.K. and Japan was first envisaged in the early 1890s, when it was in both nations' best interest to unite to contain Russia's growing influence, notably in China. In line with this, the U.K. declined to side with France, Germany and Russia against Japan's occupation of the Liaodong Peninsula in 1895 while a bilateral treaty of navigation of 1894 prepared the ground for a formal military alliance between Britain and Japan.

countries in question is negative. But under-prediction is not a systematic feature of a model without Mars effects. Such a model, in contrast, tends to over-predict currency shares (the forecast error is positive for almost 60% of the observations shown in the figure). This is additional evidence that the reserve allocation of countries with defense pacts is different from other countries.

Figure 6 illustrates the point with reference to five countries that depend on the US for their security (Germany, Japan, Korea, Saudi Arabia, Taiwan) in the modern era using our estimate of the geopolitical premium obtained for the earlier era. The importance of geopolitical factors in reserve currency choice is again readily apparent now, as before.[67] The figure suggests that the Mars hypothesis goes some way toward explaining the dominance of the US dollar in global reserves in the modern era, too.

[Figures 5 and 6]

Finally, we assembled a cross-sectional data set on the share of the US dollar in official foreign exchange reserves in the modern era. The sample is necessarily small, given the confidentiality of the currency composition of most modern central banks' reserve holdings. We have 38 observations mainly for 2004 (or 2007 or 2015, depending on the country); Table A7 provides an overview of the data set and the sources.

We regressed the share of the US dollar on pecuniary determinants of international reserve currency choice and Mars effects.[68] We measured Mars effects with a dummy that equals one if a country has a defense pact with the U.S. (and zero otherwise). As an alternative measure we used the number of U.S. military troops stationed in the respective country (in thousands), taking data from Kane (2006) which we updated using data from the Defense Manpower Data Center (various issues). Columns (2), (5), (7) and (10) of Table A8 control for year effects; columns (3) and (8) for the role of the US dollar as an exchange rate anchor and for the share of the U.S. in bilateral trade; and columns (4), (9) and (10) for the standard gravity covariates.

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[67] Transposing the model to the modern era is obviously a challenging task. One obvious limitation is that the euro did not exist then, which explains why the model with pecuniary factors does necessarily poorly for Germany by over-predicting its share of reserves in French francs (which have disappeared with the euro) and under-predicting those in dollars, as a result. Moreover, we measure credibility for the modern era with Moody's sovereign debt ratings. Since U.S. sovereign debt still enjoys the highest credit rating in the modern era, i.e. "Aaa", the rating in question was converted into a numeric variable as the average credibility of the most credible country for the earlier era, i.e. the U.K. A final challenge is that the currency fixed effects are not directly applicable to the modern era, since the U.S. did not benefit from its exorbitant privilege then. We hence used the model estimates in column 6 of Table 6, which are obtained with a constant term, to compute the predicted shares.

[68] Insofar as our data set is cross-sectional we did not include inertia in the equation; we did not include economic size and credibility either insofar as these variables are reserve-currency issuer specific and our data set is restricted to the US dollar.

The results again support to the Mars hypothesis. Defense pacts boost the share of the dollar in global foreign exchange reserve portfolios by up to 23 percentage points (see columns (1) to (5)), an amount slightly smaller than our estimates for the earlier era – though very much in the same ballpark. Estimates using a dummy variable for any formal military alliance produce the same result.[69] The alternative measure (number of troops) also suggests that Mars effects are strong and significant, with an estimated coefficient on the order of 0.5 (see columns (6) to (10)). For Germany, which had 76,000 US troops on its soil in 2004, these estimates suggest that the share of the US dollar in its official foreign exchange reserves was 38 percent points higher, all else equal. This is in line with the actual share of the US dollar in Germany's reserves, which is close to 100%, while the share of the US dollar in global reserves is on the order of two-thirds.

7. Scenario Analysis

Mars effects are economically large. Accounting for model uncertainty by averaging the estimates obtained with the various methodologies, we find that defense pacts boost the share of international units in foreign reserve holdings by 33 percentage points (see Table A9). This is not far from the 31 percentage point difference in dollar shares between nuclear-weapon states and states dependent on the U.S. for their security and integrity of Figure 1.

The international financial environment differed in important ways in the 1890s from today, rendering counterfactual inferences about the impact of current events extrapolated from our historical analysis necessarily heroic. But there were also important similarities between that environment and today's. For one thing, inflation rates were very low in both periods, in contrast to the higher trend inflation of the intervening period. In both periods there was a dominant international currency: the pound sterling then and the dollar now. But in both periods that dominance was less than complete: other currencies also played an important international role: the French franc and German mark then, the euro, yen and renminbi today. Then as now, as discussed above, emerging powers rose to challenge established ones. Germany and the U.S. challenged Britain's economic leadership in the final decades of the nineteen century, with the German mark and–later–the U.S dollar rivalling sterling as leading international currency. This is not unlike how China is seen as challenging the U.S. now, and how the Chinese renminbi may challenge the U.S. dollar.

So what would be the impact on US bond markets of a scenario in which the U.S. is no longer seen as a predictable guarantor of the security of its allies? Table 7

[69] The results in question are not reported to save space but are available upon request.

gives a sense of the impact by contrasting the share of the US dollar in the reserves of nuclear-weapon states, on the one hand, and states dependent on the U.S. for their geopolitical security, on the other hand.[70] It assumes, in other words, that the dollar's security premium disappears, while the level of reserves held globally remains unchanged. The result is a 33 percentage-point reduction in the share of the U.S. unit in the reserves of U.S.-dependent states, and an increase in the share of other reserve units such as the euro, yen and renminbi, taking the average of our estimates as baseline (see column 6 of Table 7).

The dollar assets liquidated in this scenario, as shown in column (7), total more than $800 billion. This is equivalent to 6% of the stock of U.S. marketable public debt, or 4% of U.S. GDP.[71] U.S. disengagement would thus have significant effects on bond markets. Adopting the elasticity estimate of Warnock and Warnock (2009), according to which 12-month foreign flows of 1 percent of U.S. GDP are associated with a 19 basis point reduction in US long-term interest rates, it would raise long-term U.S. interest rates by roughly 80 basis points. With public debt at more than $14 trillion end-2016, this would translate into roughly $115 billion in additional interest rate payments per annum. These benefits need to be compared with the costs of supporting the U.S.'s military presence overseas. One official estimate put these at $10 billion per year, some 70% of which being spent in Germany, Korea, and Japan (U.S. Senate 2013). One independent estimate is higher, at $100 billion per year (Vine 2015). Either way, US foreign involvement remains beneficial insofar as the geopolitical premium earned on the U.S. dollar is higher still.

The rise in U.S. long-term interest rates, in turn, would lead to depreciation of the U.S. dollar of about 5% after ten years, given the coefficient estimate of 0.6 on interest rate differentials obtained by Chinn and Meredith (2004) in long-horizon uncovered interest parity regressions.[72]

The last rows of Table 7 consider an upper and lower bound scenarios where the reduction in the share of the U.S. dollar in the reserves of U.S.-dependent states is assumed to reach 42 and 14 percentage points, respectively, corresponding to our largest and smallest estimates of the Mars effects. The impact on long-term U.S. interest rates remains substantial, at about 100 and 40 basis points, respectively.

[Table 7 about here]

[70] The table does not report nuclear-weapon states of which the currency composition of foreign exchange reserves is not known, such as Pakistan and North Korea, or which no longer possess nuclear weapons, such as South Africa. The table does not report major (non-N.A.T.O.) U.S. allies without nuclear weapons and with reserve holdings below $200 billion, such as Thailand, Poland, Egypt or Australia, but includes Germany.

[71] The former stands at $14.4 trillion, against $18.6 trillion for the latter, end-2016.

[72] The estimate is obtained with 10-year benchmark government bond yields on a panel of observations for 5 major exchange rates against the U.S. dollar over the period 1987-2000. Updated estimates in Chinn and Quayyum (2013) are similar. Of course, much would depend on the length of time required for the transition to the new regime, which could be slow.

What if the level of foreign reserves changes when the US withdraws from the world? If the world becomes a riskier place, countries may choose to increase their reserves holdings. Table 8 considers alternative scenarios where it is assumed both that the U.S. dollar loses its security premium and that the level of reserves held by states dependent on the U.S. for their geopolitical security rises by up to 30%. Two opposing effects now need to be considered. On the one hand, dollars need to be sold because their share in the reserves of U.S.-dependent states falls. On the other hand, dollars need to be purchased because countries increase their overall reserve holdings.

The net effect is shown in Table 8. Plausibly, the more the U.S.-dependent states increase their reserve holdings, the less they liquidate dollars, and the less is the impact on U.S. bond yields and the dollar exchange rate. Figure 7 shows that the impact in question declines linearly with the increase in the level of reserves assumed. That said, it remains economically large. Assuming an increase in the level of reserves of 30%, which is sizeable, US long-term interest rates would still increase by more than 40 basis points.[73]

[Table 8 and Figure 7 about here]

8. Conclusion

We have assessed the importance of pecuniary and geopolitical motives in international currency choice using data on foreign exchange reserves prior to World War I. Our results provide evidence of both motives. Specifically, they suggest that military alliances boost the share of international units in foreign exchange reserve holdings by about 30 percentage points.

Currently, the dollar's dominance as an international unit is supported, in part, by America's status as a global power, one that helps to guarantee the security of its allies. Our findings speak to current discussions on the future of the international monetary system, amidst concerns about possible American disengagement from the global geopolitics in favor of a more U.S.-first, isolationist role. If this status came to be seen as less predictable and secure, our results suggest that long-term U.S.

[73] Still another scenario would be that the Federal Reserve would ease monetary policy and that other countries might buy up now cheaper dollars. Such bottom-fishing behaviour is not evident in past episodes, however. In 1931, the liquidation of sterling by first France and then additional countries did not lead others to add the currency to their reserve portfolios (see Beyen 1949 and Eichengreen and Flandreau 2009). In 1971-73, when a few countries may have liquidated a portion of their dollar reserves, there was no fall in global dollar aggregates (as we show in Eichengreen et al. 2017), although it is hard to know whether this was due to the accumulation of dollars by petroleum-exporting countries following the first oil shock (as emphasized by McKinnon 2012) or the singular absence of alternatives in this period when most European countries and Japan still maintained capital controls.

interest rates would increase by as much as 80 basis points, according to our estimates.

Our findings also imply that China's growing self-confidence and assertiveness on the international stage could help to support the emergence of the renminbi as an increasingly important international unit. And they suggest that deeper European cooperation in certain domains, such as external security and defense, might not be irrelevant for the euro's global standing.

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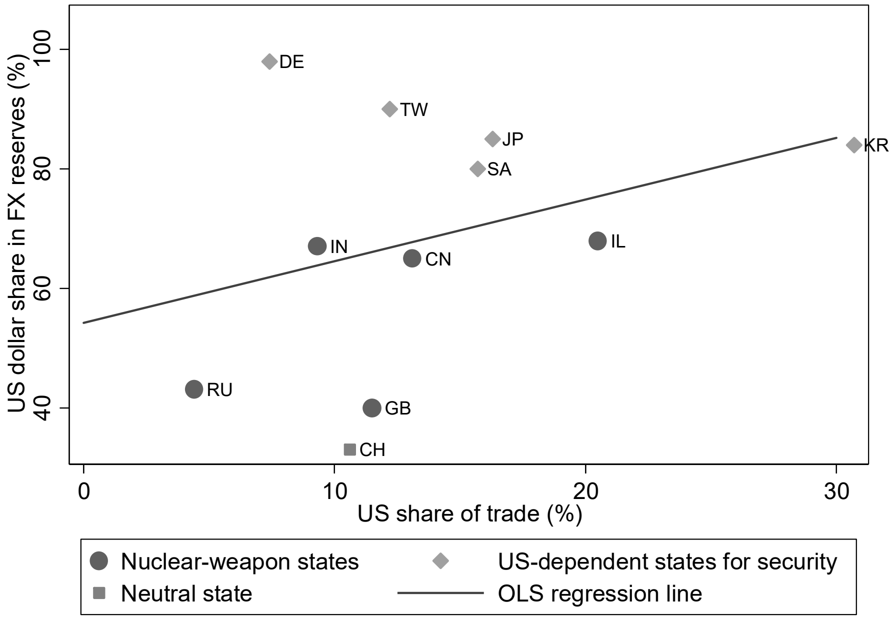
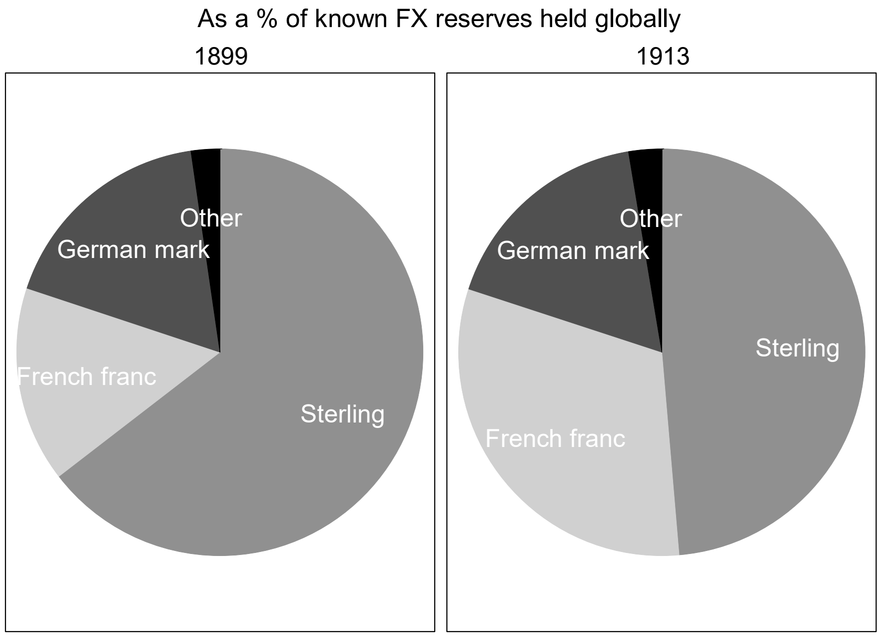
Figure 1: Share of the US dollar in the Foreign Reserves of Selected Countries in the Modern Era



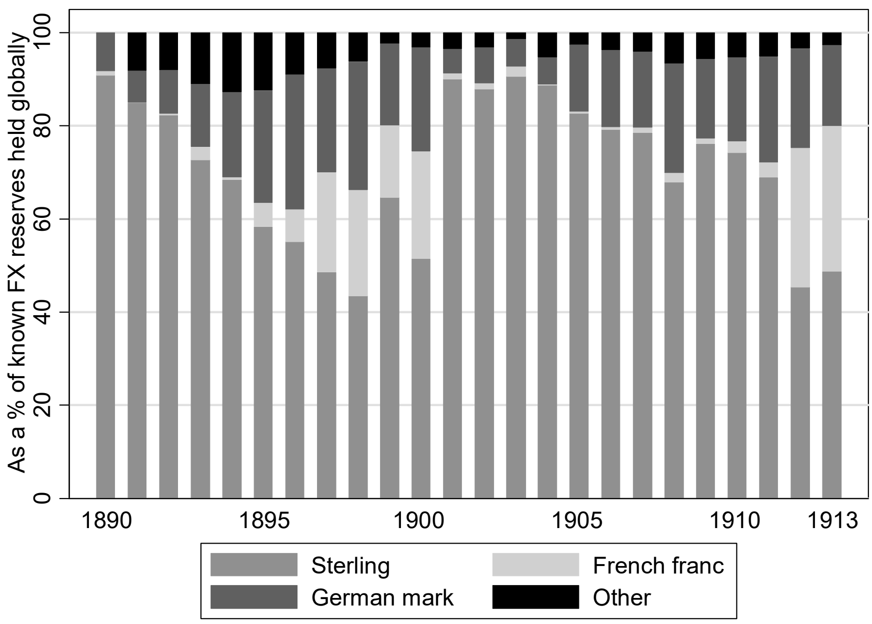
Note: The figure plots publicly available estimates of the share of the US dollar in the foreign exchange reserves of nuclear-weapon states (dark grey dot) and US-dependent states for security (light grey diamond) against the share of the US in the trade in goods (exports and imports) of the countries in question (see Table A1 for details and data sources). GB: United Kingdom (estimate for 2004); RU: Russia (estimate for 2016); CN: China (estimate for 2008); IL: Israel (estimate for 2015); IN: India (estimate for 2015); JP: Japan (estimate for 2006); KR: Korea (estimate for 1987); TW: Taiwan (estimate for 2016); SA: Saudi Arabia (guesstimate for 2007); DE: Germany (estimate for 2004); CH: Switzerland (estimate for 2016). France is not reported due to lack of data.

Figure 2: Currency Composition of Foreign Exchange Reserves – 1899 vs. 1913



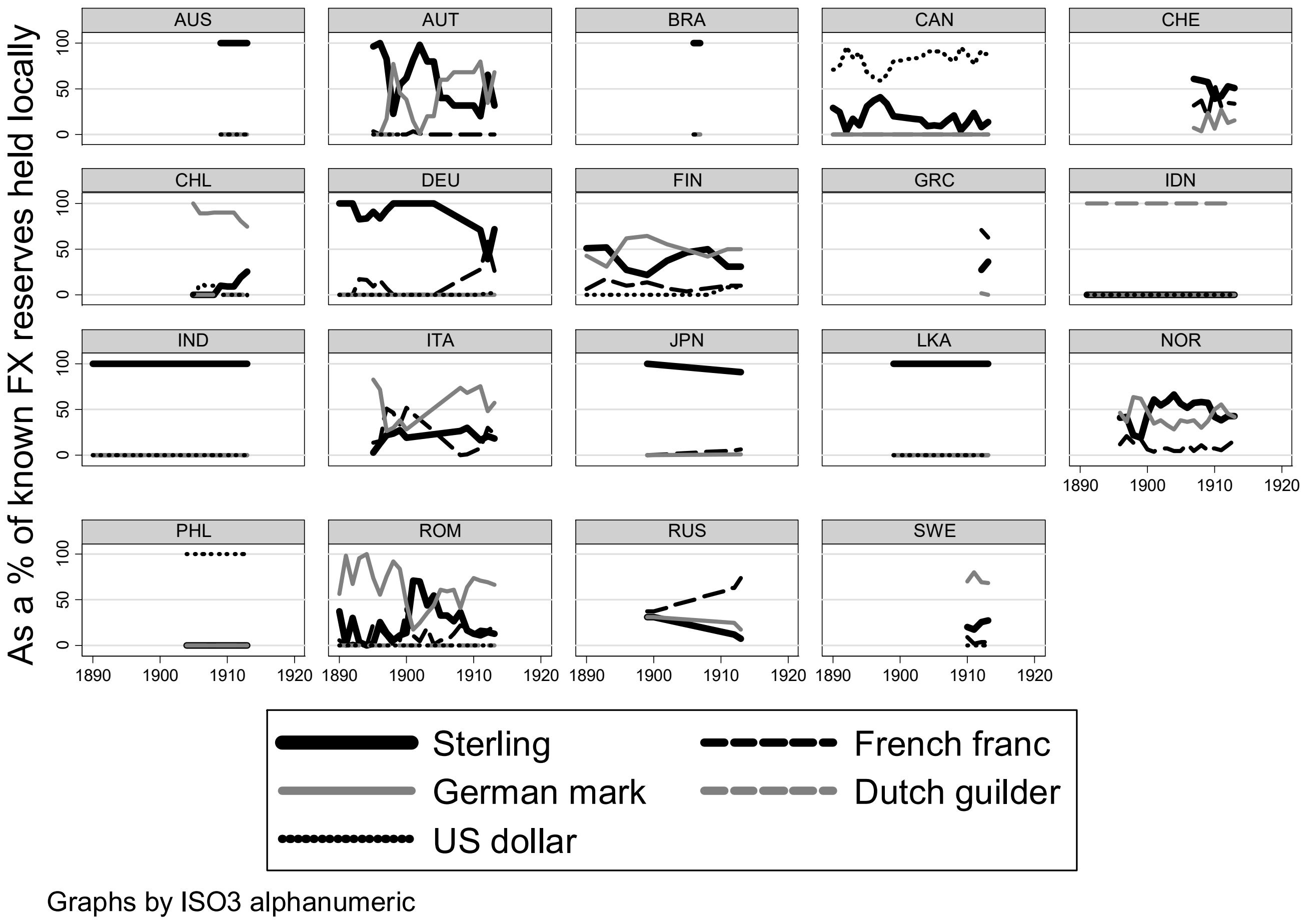
Note: The figure shows for 1899 and 1913 the global stock of foreign exchange reserves broken down by currency. Reserves held by the Canadian chartered banks are not included to be consistent with the data reported in Lindert (1969). Currency shares are calculated at market exchange rates. "Other" includes holdings in U.S. dollars and Dutch guilders.

Figure 3: Currency Composition of Foreign Exchange Reserves – 1890-1913



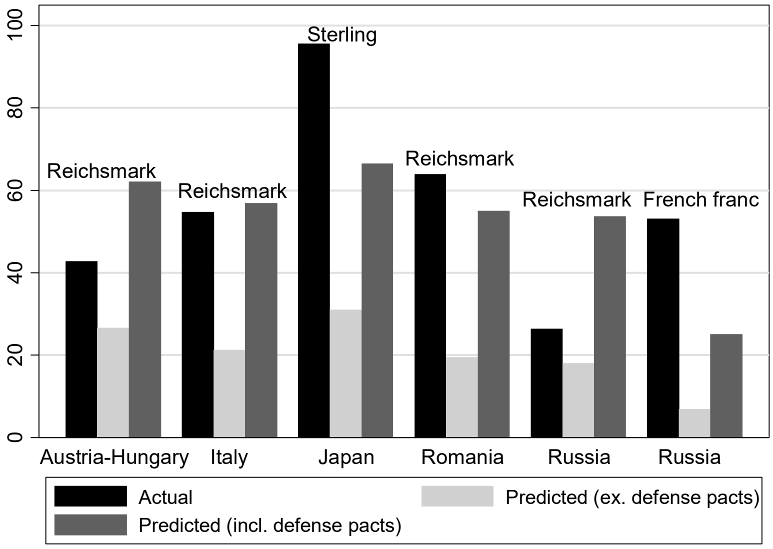
Note: The figure shows the evolution between 1890 and 1913 of the currency composition of the global stock of foreign exchange reserves. Currency shares are calculated at market exchange rates. "Other" includes holdings in U.S. dollars and Dutch guilders.

Figure 4: Currency Composition of Foreign Exchange Reserves – Breakdown by Reserve Holders



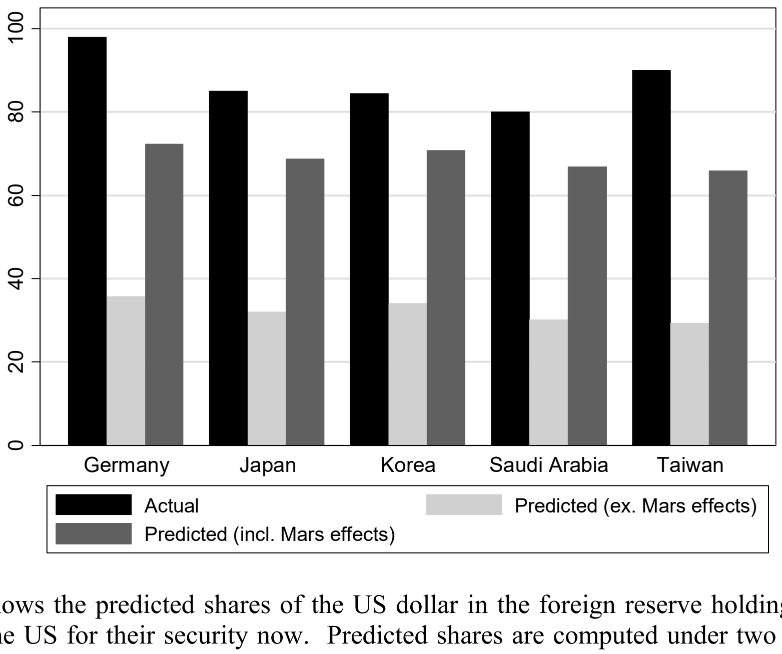
Note: The figure shows the evolution over time of the shares of sterling, the French franc, the German mark, the US dollar and the Dutch guilder in each of our sample's 19 countries (in % and at market exchange rates). Data are linearly interpolated between missing observations for ease of reading.

Figure 5: Importance of Geopolitical vs. Pecuniary Factors in Reserve Currency Choice – *Then*



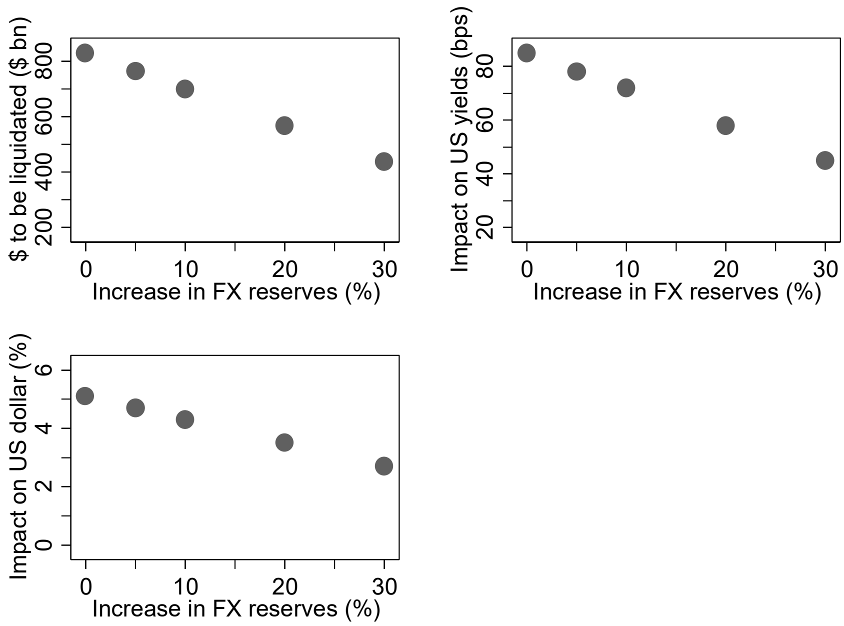
Note: The figure shows the predicted shares of selected reserve currencies in the foreign reserve holdings of five countries which had signed a defense pact with the issuer of the currencies in question prior to World War I. Predicted shares are computed under two scenarios: (i) using the model estimates reported in Table 6, column (2), i.e. including the effects of defense pacts (shown as dark grey bars); (ii) excluding the effects of defense pacts (shown as light grey bars). Actual currency shares are shown as black bars.

Figure 6: Importance of Geopolitical vs. Pecuniary Factors in Reserve Currency Choice – *Now*



Note: The figure shows the predicted shares of the US dollar in the foreign reserve holdings of five countries which depend on the US for their security now. Predicted shares are computed under two scenarios: (i) using the model estimates reported in Table 6, column (6), i.e. including the effects of defense pacts (shown as dark grey bars); (ii) excluding the effects of defense pacts (shown as light grey bars). Actual currency shares are shown as black bars. Credibility effects are measured using sovereign debt ratings.

Figure 7: Impact on Financial Markets of Loss of US Dollar's Security Premium



Note: The figure shows estimates of the impact on bond and exchange markets of hypothetical scenarios which assume that the U.S. withdraws from the world and the U.S. dollar loses its geopolitical/security premium, hence leading to a change in the composition of global foreign exchange reserves. The scenarios further assume that the level of the reserves in question increases by up to 30%. The top left-hand side chart shows the estimated amount of U.S. dollars to be liquidated conditional on the hypothesized increase in global foreign exchange reserves. The top right-hand side chart shows the estimated impact on long-term U.S. interest rates conditional on the hypothesized increase in global foreign exchange reserves. The bottom left-hand side chart shows the estimated U.S. dollar depreciation conditional on the hypothesized increase in global foreign exchange reserves.

Table 1: Baseline Estimates without Mars

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS estimates							2-way clustering	
Inertia	0.539***	0.539***	0.536***	0.507***	0.493***	0.497***	0.477***	0.497***	0.477***
	(0.023)	(0.023)	(0.023)	(0.036)	(0.013)	(0.038)	(0.026)	(0.045)	(0.040)
Credibility		0.921***				0.035	0.529***	0.035	0.529***
		(0.048)				(0.156)	(0.054)	(0.193)	(0.068)
Economic size			0.414+			0.555+	0.675	0.555*	0.675
			(0.256)			(0.363)	(0.481)	(0.298)	(0.619)
Trade relations				1.201+		0.866		0.866	
				(0.768)		(0.679)		(0.878)	
Financial depth					3.053*		1.847		1.847
					(1.753)		(1.762)		(2.437)
Observations	860	860	860	476	277	476	277	476	277
Dyadic effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.962	0.962	0.962	0.978	0.987	0.978	0.987	0.981	0.989
Log likelihood	-2971	-2971	-2970	-1551	-830.8	-1550	-828.5	n.a.	n.a.

Note: The table reports OLS estimates of Eq. (1) based on our sample of 73 dyads (19 countries/5 reserve currencies) over the period 1890-1913 including key pecuniary determinants of international reserve currency status (inertia, credibility, economic size, trade relations and financial depth) dyadic effects and time effects. The standard errors reported in parentheses are robust to autocorrelation and heteroscedasticity; they are clustered by dyad in columns (1) to (7) and by country and currency in columns (8) and (9); *** $p<0.01$, ** $p<0.05$, * $p<0.1$, $^{+}$ $p<0.15$.

Table 2: Estimates Controlling for Standard Gravity Covariates

	(1)	(2)	(3)	(4)	(5)	(6)
			OLS estimates			2-way clustering
Inertia	0.947***	0.948***	0.938***	0.949***	0.906***	0.906***
	(0.017)	(0.017)	(0.023)	(0.018)	(0.025)	(0.041)
Credibility	0.025	0.011	0.012	0.187**	0.252*	0.252**
	(0.059)	(0.062)	(0.062)	(0.090)	(0.130)	(0.127)
Economic size	0.099	0.115	0.127	0.077	0.009	0.009
	(0.135)	(0.119)	(0.122)	(0.125)	(0.147)	(0.094)
Contiguity	4.788***				5.627**	5.627#
	(1.574)				(2.644)	(4.001)
Common language		2.985**			-1.883+	-1.883
		(1.191)			(1.221)	(1.905)
Common colonial relationship			3.752*		7.239***	7.239**
			(2.189)		(2.427)	(3.617)
Distance				-1.334**	-1.606*	-1.606+
				(0.527)	(0.866)	(1.050)
Observations	860	860	860	860	860	860
R-squared	0.956	0.955	0.955	0.955	0.957	0.957
Currency effects	yes	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.953	0.953	0.953	0.953	0.954	0.957
Log likelihood	-3088	-3090	-3089	-3092	-3077	n.a.

Note: The table reports OLS estimates of Eq. (1) based on our sample of 68 dyads (19 countries/5 currencies) over the period 1890-1913. The estimates include key pecuniary determinants of international reserve currency status and control for currency fixed effects, country fixed effects and time effects. The standard errors reported in parentheses are robust to autocorrelation and heteroscedasticity; they are clustered by dyad in columns (1) to (5) and by country and currency in column (6); *** p<0.01, ** p<0.05, * p<0 .1, + p<0.15, # p<0.2.

Table 3: Estimates with Selected Alternative Estimation Methods

	(1) Random effects	(2) Panel tobit	(3) Griliches (1961) Liviatan (1963)	(4) Hatanaka (1974)	(5) Fractional logit	(6) System GMM	(7) Time-varying fixed effects	(8) No inertia
Inertia	0.929***	0.929***	0.935***	0.937***	5.250***	0.521***	0.909***	
	(0.021)	(0.012)	(0.049)	(0.030)	(0.220)	(0.096)	(0.025)	
Credibility	0.026*	0.026*	0.122	0.129	-0.471	-0.016		3.841***
	(0.015)	(0.015)	(0.229)	(0.127)	(0.388)	(0.197)		(1.196)
Economic size	0.049*	0.049	0.177	0.113	0.004	-0.006		-0.144
	(0.026)	(0.049)	(0.268)	(0.174)	(0.063)	(0.774)		(1.055)
Contiguity	4.566**	4.566***	3.184	3.611	1.034***	-1.185	5.084*	22.193
	(2.226)	(1.501)	(4.673)	(3.412)	(0.327)	(15.825)	(2.736)	(18.509)
Common language	-1.447	-1.447	-0.243	-0.394	-0.756*	-7.694	-1.019	-23.105**
	(1.159)	(1.125)	(2.216)	(1.455)	(0.439)	(13.169)	(1.235)	(9.544)
Common colonial relationship	4.676**	4.676***	4.666	4.372+	6.055***	2.110	6.939***	79.024***
	(2.022)	(1.423)	(4.715)	(2.921)	(0.359)	(21.669)	(2.395)	(11.086)
Distance	-0.335	-0.335	-0.988	-0.940	-2.202***	-0.663	-1.663*	-24.319***
	(0.321)	(0.351)	(1.537)	(0.876)	(0.220)	(5.351)	(0.873)	(8.843)
1st stage residual				0.686***				
				(0.043)				
Observations	860	860	776	769	860	476	860	994
R^2	0.938	n.a.	0.939	0.959	n.a.	n.a.	0.950	0.710
Random effects	yes	yes	no	no	no	no	no	no
Time effects	yes	yes	yes	yes	yes	yes	no	yes
Time-varying fixed effects	no	no	no	no	no	no	yes	no
Currency effects	no	no	yes	yes	yes	no	no	yes
Country effects	no	no	yes	yes	yes	no	no	yes
Right/left-censored observations	n.a.	0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Note: The table reports estimates of Eq. (1) based on our sample of 68 dyads (19 countries/5 reserve currencies) over the period 1890-1913 using alternative estimators: (1) random effects; (2) panel tobit; (3) Griliches (1961)-Liviatan (1963); (4) Hatanaka (1974); (5) fractional logit; (6) system GMM; and (7) time-varying fixed effects; and (8) a static model excluding the inertia variable. The estimates control for currency fixed effects, country fixed effects and time effects in columns (1) to (6) and (8). The standard errors reported in parentheses are robust to autocorrelation and heteroskedasticity and clustered by dyad, except in column (2); *** p<0.01, ** p<0.05, * p<0 .1, $^{+}$ p<0.15; n.a.: not available.

Table 4: Testing the Mercury vs. Mars Hypotheses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full sample				5-year averages			
Inertia	0.897***	0.897***	0.907***	0.899***	0.765***	0.754***	0.800***	0.772***
	(0.028)	(0.028)	(0.024)	(0.028)	(0.070)	(0.068)	(0.059)	(0.068)
Credibility	0.303*	0.298*	0.298**	0.290*	0.246	0.273	-0.098	0.189
	(0.153)	(0.151)	(0.148)	(0.150)	(0.397)	(0.342)	(0.340)	(0.347)
Economic size	0.001	0.017	0.002	0.001	2.347*	2.298*	2.496*	2.385*
	(0.151)	(0.149)	(0.140)	(0.151)	(1.354)	(1.351)	(1.390)	(1.366)
Contiguity	5.244*	5.425*	4.284	5.496*	7.421	9.778**	13.583**	9.148**
	(2.704)	(2.768)	(3.092)	(2.760)	(5.718)	(3.788)	(5.125)	(4.222)
Common language	-2.800**	-2.884*	-2.468**	-2.709*	-3.428	-5.673+	0.683	-4.104
	(1.369)	(1.452)	(1.064)	(1.442)	(3.569)	(3.495)	(3.796)	(3.570)
Common colonial relationship	8.042***	8.041***	7.402***	7.941***	16.678***	18.034***	13.586**	16.611***
	(2.708)	(2.717)	(2.361)	(2.743)	(6.114)	(5.883)	(5.417)	(5.869)
Distance	-1.938*	-1.910*	-1.950*	-1.848*	-5.039+	-5.065*	-2.334	-4.574+
	(1.007)	(1.000)	(1.034)	(0.981)	(3.418)	(2.890)	(2.607)	(2.878)
Any formal alliance	3.855**				9.133+			
	(1.933)				(6.090)			
Defense pact		3.760+				13.895**		
		(2.398)				(5.797)		
Neutrality treaty			3.999				-8.215	
			(2.819)				(9.628)	
Entente				3.224+				11.043**
				(2.177)				(5.227)
Observations	860	860	860	860	123	123	123	123
Currency effects	yes	yes	yes	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.954	0.954	0.954	0.954	0.887	0.890	0.885	0.887
Log likelihood	-3074	-3075	-3076	-3075	-481.8	-480	-482.6	-481.6

Note: The table reports OLS estimates of Eq. (2) obtained by OLS based on our sample of 68 dyads (19 countries/5 reserve currencies) over the period 1890-1913. The estimates include key pecuniary determinants of international reserve currency status and dummy variables which equal 1 for any formal alliances, defense pacts, neutrality treaties and ententes, respectively, for dyad *i*, *j* in year *t* and 0 otherwise (nonaggression pacts dropped out for reasons of collinearity). The estimates control for currency fixed effects, country fixed effects and time effects. Those of columns (1) to (4) are based on the full sample against 5-year averages for those of columns (5) to (8). The standard errors reported in parentheses are robust to autocorrelation and heteroskedasticity and clustered by dyad; *** p<0.01, ** p<0.05, * p<0 .1, $^{+}$ p<0.15.

Table 5: Treatment Effect (Full Sample)

A. Military Alliances

Matching algorithm	No. of treated pairs	No. of control pairs	Average treatment effect	Bootstrap-ped S. E.	*t*-stat
Nearest neighbour	27	1	-48.104	24.079	-1.998
Radius	7	40	30.938	19.425	1.593 +
Kernel	27	86	20.209	12.373	1.633 *
Stratification	27	86	20.215	10.662	1.896 **

Note: The table reports the average treatment effect (ATT) on treated pairs of military alliances when currency shares is the outcome variable. The estimates were obtained with four algorithms (nearest neighbour, radius, kernel and stratification matching) to match treated pairs with control pairs in the region of common support. The standard errors (S.E.) of the ATT were obtained with 100 bootstrap replications. Asymptotic standard errors are used for the radius methodology insofar as bootstrapped standard errors could not be obtained. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, $^{+}$ $p<0.15$.

B. Defense Pacts

Matching algorithm	No. of treated pairs	No. of control pairs	Average treatment effect	Bootstrap-ped S. E.	*t*-stat
Nearest neighbour	18	2	56.029	12.696	4.413 ***
Radius	2	41	51.608	31.686	1.629 *
Kernel	18	79	30.366	11.817	2.570 ***
Stratification	18	79	31.062	8.716	3.564 ***

Note: The table reports the average treatment effect (ATT) on treated pairs of defense pacts when currency shares is the outcome variable. The estimates were obtained with four algorithms (nearest neighbour, radius, kernel and stratification matching) to match treated pairs with control pairs in the region of common support. The standard errors (S.E.) of the ATT were obtained with 100 bootstrap replications. Asymptotic standard errors are used for the radius methodology insofar as bootstrapped standard errors could not be obtained. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, $^{+}$ $p<0.15$.

Table 6: Cross-Sectional IV Estimates using Diplomatic Representation as Instrument

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
			OLS estimates					IV estimates			
Credibility	0.696***	0.698***	0.788***	0.755***	0.676***	0.459**	0.179	0.258	0.790	0.110	0.127
	(0.106)	(0.112)	(0.099)	(0.092)	(0.115)	(0.168)	(0.598)	(0.579)	(0.674)	(0.577)	(0.606)
Economic size	1.926*	1.915*	2.547**	2.085*	1.822+	0.595#	0.113	0.215	0.306	0.188	0.120
	(1.101)	(1.016)	(1.120)	(1.116)	(1.071)	(0.404)	(0.401)	(0.392)	(0.400)	(0.407)	(0.404)
Contiguity	16.644	20.060	7.221	18.588	20.757	19.101	23.488#	27.418+	8.133	23.755+	27.813+
	(18.584)	(17.333)	(23.762)	(17.924)	(17.675)	(17.025)	(17.689)	(17.683)	(28.045)	(16.253)	(18.059)
Common language	-13.239	-17.018*	-13.210	-16.716*	-15.054+	-16.743*	-28.514+	-31.998*	-25.654	-33.902*	-31.382*
	(9.158)	(8.757)	(9.650)	(8.731)	(8.908)	(8.652)	(18.672)	(18.997)	(20.036)	(20.031)	(18.832)
Common colonial relationship	65.337***	66.638***	65.133***	65.342***	66.577***	66.083***	68.710***	70.475***	67.827***	70.294***	'0.807**
	(21.121)	(20.337)	(21.263)	(21.170)	(20.853)	(20.724)	(13.863)	(13.860)	(14.316)	(14.568)	(13.764)
Distance	-5.680**	-5.450**	-7.353**	-6.033**	-5.356**	-5.422**	0.161	-0.144	-1.762	0.328	0.274
	(2.590)	(2.500)	(2.802)	(2.662)	(2.540)	(2.393)	(1.829)	(1.752)	(1.932)	(1.864)	(1.865)
Any formal alliance	15.128*						8.217#				
	(8.292)						(6.177)				
Defense pact		35.545***				36.647***		14.395+			
		(8.936)				(7.447)		(9.502)			
Neutrality treaty			28.286						25.468		
			(22.711)						(29.723)		
Nonaggression pact				19.120+						31.979	
				(11.078)						(27.830)	
Entente					17.322**						8.999+
					(7.927)						(6.196)
Constant						36.334#					
						(25.441)					

Table 6: Cross-Sectional IV Estimates using Diplomatic Representation as Instrument (cont'd)

Observations	81	81	81	81	81	81	50	50	50	50	50
Currency effects	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes
Adjusted R^2	0.588	0.625	0.586	0.576	0.591	0.456	0.616	0.638	0.620	0.607	0.619
Log likelihood	-373.7	-369.9	-373.9	-374.8	-373.4	-370.1	-234.9	-233.4	-234.6	-235.5	-234.7
Kleibergen-Paap statistic							7.162	4.368	4.694	3.363	7.002
p-value							0.0278	0.113	0.0956	0.186	0.0302
F statistic							6.256	3.330	1.878	1.728	6.734
Hansen *J* statistic							0.240	0.101	0.413	0.0977	0.189
p-value							0.624	0.751	0.521	0.755	0.664

Note: The table reports cross-sectional estimates of Eq. (3); those in columns (1) to (6) are obtained by OLS while those in columns (7) to (11) are obtained by two-stage least squares using as instrument diplomatic representation at the level of chargé d'affaires, minister, and ambassador between states. Each cross-sectional unit represents a country/reserve currency dyad with time series observations averaged out over the period 1890-1913. The estimates control for currency fixed effects, except those of column (6). The standard errors reported in parentheses are robust to heteroskedasticity; *** p<0.01, ** p<0.05, * p<0 .1, $^{+}$ p<0.15, $^{\#}$ p<0.2.

Table 7: Scenario Analysis – Impact of US Disengagement and Loss of US Dollar's Security Premium
(Stable Reserves Level, Changing Composition)

	NATO member	Major non-NATO ally	FX reserves holdings as of end-2016 (USD billion)	Actual US dollar share	Year of estimate	US dollar share ex. geopolitical premium	US dollar reserves to be liquidated			
							In USD billion	As a % of US public debt held by the public	As a % of US GDP	Impact on long-term US interest rates (bps)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Nuclear-weapon states										
China			3,011	≈60-70?	2008	same				
India			337	67	2015	same				
Russia			308	43	2016	same				
United Kingdom	YES		107	40	2004	same				
Israel		YES	94	68	2015	same				
France	YES		39	n.a.		same				
U.S. dependent states for security										
Japan		YES	1,158	83-89	2006	52	382	2.6	2.1	39
Saudi Arabia		Proposed	526	80	2016	47	174	1.2	0.9	18
Taiwan		YES	434	≈90?	2016	57	143	1.0	0.8	15
Korea		YES	362	84	1987	51	119	0.8	0.6	12
Germany	YES		37	98	2004	65	12	0.1	0.1	1
Total (baseline)			**6,412**				**831**	**5.8**	**4.5**	**85**
Upper bound							1,057	7	6	108
Lower bound							352	2	2	36

Note: The table reports estimates of the impact on bond markets of hypothetical scenarios which assume that the U.S. withdraws from the world and the U.S. dollar loses its geopolitical premium, hence leading to a change in the composition of global foreign exchange reserves away from the dollar towards other units like the euro, yen or Chinese renminbi. NATO (the North Atlantic Treaty Organization) is a mutual defense pact established in 1949 that consists of 29 member states, including the U.S. Article 5 of the North Atlantic treaty foresees that if an armed attack occurs against one of the member states, it should be considered an attack against all members, and other members shall assist the attacked member, with armed forces if necessary. Major non-NATO allies have strategic working relationships with U.S. armed forces but are not NATO members. The baseline scenario assume security premium of 33 percentage points (mean of all estimates obtained), against 14 percentage points for the lower bound scenario and 42 percentage points for the upper bound scenario (see the overview of the estimates in Table A9).

Table 8: Scenario Analysis – Alternative Assumptions
(Higher Reserves Level, Changing Composition)

	FX reserves holdings as of end-2016 (USD billion)	USD reserves to be liquididated (USD billion)				
		Hypothetized increase in total (i.e. all currencies) level of FX reserves:				
U.S. dependent states for security		*0%*	*5%*	*10%*	*20%*	*30%*
Japan	1,158	382	352	322	262	202
Saudi Arabia	526	174	161	149	124	99
Taiwan	434	143	131	119	94	69
Korea	362	119	110	101	82	64
Germany	37	12	11	10	7	5
Total	**2,517**	**831**	**765**	**700**	**569**	**439**
As a percentage of US GDP		4.5	4.1	3.8	3.1	2.4
Impact on long-term US interest rates (bps)		**85**	**78**	**72**	**58**	**45**
Implied US dollar depreciation (%)		**5.1**	**4.7**	**4.3**	**3.5**	**2.7**

Note: The table reports estimates of the impact on bond markets of hypothetical scenarios which assume that the U.S. withdraws from the world and the U.S. dollar loses its geopolitical premium, hence leading to a change in the composition of global foreign exchange reserves. The scenarios further assume that the level of the reserves in question increases by up to 30%.

ONLINE APPENDIX

Primary Data Sources on Official Foreign Exchange Reserves

Argentina. Annual data on the liquid foreign official assets of the Banco de la Nación (established in 1891) are available from 1880 to 1913. They consist of balances with foreign correspondents.

Australia. Annual data on the liquid foreign assets of the Australian Treasury and the commercial banks are available from 1894 to 1913. They consist of funds deposited in London.[74] Data on known sterling holdings are available from 1894 to 1913. That there were no holdings in other currencies besides sterling could be inferred with certainty insofar as sterling holdings equaled total foreign assets.

Austria-Hungary. Annual data on the liquid foreign official assets of the Oesterreichische Nationalbank (OeNB established in 1816) are available from 1880 to 1913. They consist of foreign bills. Data on known sterling, French franc and German mark holdings are available from 1890 to 1913.

Belgium. Annual data on the liquid foreign official assets of the Belgian government, the Banque Nationale de Belgique (BNB, established in 1850) and of the Caisse Générale d'Epargne et de Retraite are available from 1880 to 1913.[75] They consist of foreign bills and balances.

Brazil. Annual data on the liquid foreign official assets of the Federal Treasury are available from 1905 to 1908. They consist of accounts with London. Data on known sterling holdings are available from 1905 to 1907. That there were no holdings in other currencies besides sterling could be inferred with certainty insofar as sterling holdings equaled total foreign assets.

Bulgaria. Annual data on the liquid foreign official assets of the Bulgarian National Bank (BNB, established in 1879) are available from 1905 to 1908. They consist of credit balances abroad of the BNB's foreign portfolio.

[74] The Commonwealth Bank of Australia, established in 1911, had ordinary functions of commercial and savings banking; it did not specifically have a central banking remit and was not responsible for the note issue. The gold standard was operated by the commercial banks, not by the official authorities.

[75] The Caisse Générale d'Epargne et de Retraite was a government-owned savings bank that held substantial foreign short-term assets; the assets in question are classified as part of Belgium's official foreign reserves in line with Bloomfield (1963).

Canada. Annual data on the liquid foreign assets of Canada's commercial banks are available from 1880 to 1913. They consist of claims on foreign correspondents, call and short loans abroad and balances of the Canadian's Finance Department balances with Bank of Montreal, London. The Canadian monetary system before 1914 was in effect a gold- (or U.S. dollar-) exchange standard operated, in the absence of a central bank, by the commercial banks themselves.[76] Data on known sterling and U.S. dollar holdings are available from 1890 to 1913.

Ceylon. Annual data on the liquid foreign official assets of Ceylon's government are available from 1899 to 1913. They consist of sterling securities in reserve. Data on known sterling holdings are available from 1899 to 1913. That there were no holdings in other currencies besides sterling could be inferred with certainty insofar as sterling holdings equaled total foreign assets.

Chile. Annual data on the liquid foreign official assets of Chilean Government's conversion funds in foreign banks are available from 1880 to 1913. They consist of deposits in foreign banks of the deposits in London of the Emission Office. Data on known sterling, German mark and U.S. dollar holdings are available from 1890 to 1913. That there were no holdings in French francs could be inferred with certainty insofar as sterling, German mark and U.S. dollar holdings equaled total foreign assets.

Denmark. Annual data on the liquid foreign official assets of Danmarks Nationalbank (established in 1818) are available from 1880 to 1913. They consist of foreign bills and balances with foreign correspondents.

Egypt. Data on the liquid foreign official assets of the Central Bank of Egypt are available for 1913. They consist of foreign bills and balances.

Finland. Annual data on the liquid foreign official assets of Suomen Pankki (established in 1812) are available from 1880 to 1913. They consist of foreign bills and balances with foreign correspondents. Data on known sterling, French franc, German mark and U.S. dollar holdings are available from 1890 to 1913 (with missing observations).

France. Annual data on the liquid foreign official assets of Banque de France (established in 1800) are available from 1880 to 1913. They consist of foreign bills.

Germany. Annual data on the liquid foreign official assets of the Reichsbank (established in 1876) are available from 1880 to 1913. They consist of foreign bills and balances with foreign correspondents. Data on known sterling, French franc and U.S. dollar holdings are available from 1890 to 1913 (with missing observations).

[76] Bank of Canada was established in 1934.

Greece. Annual data on the liquid foreign official assets of the National Bank of Greece (established in 1841) are available from 1890 to 1913. They consist of funds abroad. Data on known sterling and French franc holdings as part of the non-ordinary reserves are available for 1912 and 1913.[77]

India. Annual data on the liquid foreign official assets of the British Raj's government are available from 1880 to 1913. They consist of balances held in London. Data on known sterling holdings are available from 1890 to 1913. That there were no holdings in other currencies besides sterling could be inferred with certainty insofar as sterling holdings equaled total foreign assets.

Italy. Annual data on the liquid foreign official assets of the three note issue banks, including Banca d'Italia (established in 1893), and of the Italian Treasury, are available from 1881 to 1913.[78] They consist of foreign bills, bonds, current accounts, and of the Treasury's balances in foreign banks. Data on known sterling, French franc and German mark holdings are available for 1897 and 1913 (with missing observations).

Japan. Annual data on the liquid foreign official assets of the Bank of Japan (established in 1882), the Imperial government and the Yokohama Specie Bank are available for 1899 and from 1903 to 1913.[79] They consist of specie held abroad and of foreign balances. Data on known sterling, French franc, German mark and U.S. dollar holdings are available from 1903 to 1913 (with missing observations).

Netherlands. Annual data on the liquid foreign official assets of De Nederlandsche Bank (established in 1814) are available from 1889 to 1913. They consist of foreign bills and balances with foreign correspondents.

Netherlands East Indies. Annual data on the liquid foreign official assets of the Java Bank (established in 1826) are available from 1891 to 1913. They consist of foreign bills and contangos in Amsterdam.

Norway. Annual data on the liquid foreign official assets of the Norges Bank (established in 1816) are available from 1896 to 1913. They consist of foreign bills and balances with foreign correspondents, foreign bonds and net amounts due from Danmarks Nationalbank and Sveriges Riksbank. Data on known sterling, French franc and German mark holdings are available from 1896 to 1913.

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[77] The non-ordinary reserves were introduced by the so-called Gamma-Chi MB currency law bearing this abbreviation of 1910.

[78] The other two note issue banks were Bank of Naples and Bank of Sicily; they continued to issue notes after Banca d'Italia's establishment in 1893.

[79] The Yokohama Specie Bank was a special government-owned institution officially in charge of foreign exchange dealings. We include its assets as part of official foreign exchange reserves in line with Lindert (1967).

Philippines. Annual data on the liquid foreign official assets of the Gold Standard Fund (established in 1903) are available from 1880 to 1913.[80] That there were no holdings in other currencies besides the U.S dollar could be inferred with certainty insofar as sterling holdings equaled total foreign assets.

Romania. Annual data on the liquid foreign official assets of the Banca Națională a României (established in 1880) are available from 1880 to 1913. They consist of foreign bills and balances. Data on known sterling, French franc and German mark holdings are available from 1890 to 1913.

Russia. Annual data on the liquid foreign official assets of the State Bank (GosBank) of the Russian Empire (established in 1860) and the Finance Ministry are available from 1883 to 1913. They consist of "gold abroad", foreign drafts and balances in foreign banks.[81] Data on known sterling, French franc and German mark holdings are available for 1899 and 1900 as well as for 1912 and 1913.

Serbia. Annual data on the liquid foreign official assets of Narodna banka Srbije (established in 1884) are available from 1908 to 1913. They consist of foreign balances.

(Union of) South Africa. Annual data on the liquid foreign assets of South Africa's commercial banks are available from 1904 to 1913. They consist of foreign balances. Bloomfied (1963) observes that, unlike many other British overseas territories, gold played a much more significant role there in the reserves of the commercial banks and in currency circulation; and monetary gold movements were an important adjusting item in the balance of payments.[82] Data on known sterling holdings are available from 1904 to 1913.

Sweden. Annual data on the liquid foreign official assets of Sveriges Riksbank (established in 1668) and the national debt office are available from 1880 to 1913. They consist of foreign bills, foreign bonds and foreign balances. Data on known sterling, French franc, German mark and U.S. dollar holdings are available from 1910 to 1913.

Switzerland. Annual data on the liquid foreign official assets of the Swiss National Bank (SNB, established in 1906) are available from 1906 to 1913.[83] They consist of foreign bills and sight deposits abroad. Data on known sterling, French franc and German mark holdings are available from 1890 to 1913.

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[80] This fund was established in 1903 to maintain parity of the peso to gold. There were no foreign exchange reserves prior to 1903.

[81] The data compiled by Lindert do not provide a split between holdings of gold abroad and holdings of foreign exchange.

[82] The South African Reserve Bank was established in 1921.

[83] Before the SNB took it over in 1906 the right of note issue was shared by 36 different cantonal, state and commercial banks.

Table A1: Selected Indicators on a Sample of Foreign Reserve Holders in the Modern Era

	Share of the US dollar in FX reserves	Share of bilateral trade in goods with:					
		US	Japan	China	Euro area	Year	Source
Germany	98	7.4	2.1	3.8	46.2	2004	Truman and Wong (2006)
United Kingdom	40	11.5	2.8	3.7	50.9	2004	HM Treasury (2004)
Israel	68	20.5	1.5	7.0	24.6	2015	Bank of Israel (2015)
Russia	43	4.4	3.4	14.1	33.0	2016	Bank of Russia (2016)
Saudia Arabia	80	15.7	13.8	8.4	14.8	2007	Setser and Ziemba (2007)
China	≈60-70?	13.1	10.4	0.0	13.0	2008	Liu Pan and Zhu Junbo (2008)
India	67	9.3	2.2	10.8	10.2	2015	The Indian Express (2015)
Japan	83-89	16.3	0.0	17.7	9.8	2006	Truman and Wong (2006)
Korea	84	30.7	25.0	n.a.	10.5	1987	Dellas and Yoo (1991)
Taiwan	≈90?	12.2	11.8	23.1	8.8	2016	China Post (2016)
Switzerland	33	10.6	2.0	6.9	39.9	2016	Swiss National Bank (2016)

Sources: IMF Direction of Trade Statistics, Taiwan's Bureau of Trade, official publications, press reports and studies reported in the table, as well as authors' own calculations.
Notes: the share of the US dollar reported in the table is the latest figure publicly available to the authors' best knowledge; share of bilateral trade with the EU-15 for Taiwan.

Table A2: Estimates Using Shares adjusted for Gold Holdings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inertia	0.652***	0.652***	0.651***	0.672***	0.668***	0.670***	0.663***
	(0.041)	(0.041)	(0.040)	(0.044)	(0.034)	(0.043)	(0.033)
Credibility		0.269***				0.044	0.122*
		(0.035)				(0.243)	(0.060)
Economic size			-0.084			-0.181	-0.204
			(0.154)			(0.205)	(0.243)
Trade relations				-0.083		0.081	
				(0.910)		(0.853)	
Financial depth					-2.309		-1.854
					(2.026)		(1.703)
Observations	385	385	385	199	166	199	166
Dyadic effects	yes	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.943	0.943	0.943	0.955	0.955	0.955	0.955
Log likelihood	-999.1	-999.1	-999.1	-537.7	-446.8	-537.6	-446.6

Note: The table reports OLS estimates of Eq. (1) based on our sample of 73 dyads (19 countries/5 reserve currencies) over the period 1890-1913 including key pecuniary determinants of international reserve currency status (inertia, credibility, economic size, trade relations and financial depth) dyadic effects and time effects. The dependent variable is currency share adjusted for gold holdings. The standard errors reported in parentheses are robust to heteroskedasticity and clustered by dyad; *** p<0.01, ** p<0.05, * p<0 .1, $^{+}$ p<0.15.

Table A3: Estimates with Alternative Estimators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Fractional logit		System GMM		No inertia variable		
Inertia	2.594***	2.098***	0.466***	0.477***			
	(0.595)	(0.406)	(0.132)	(0.093)			
Credibility	-0.006	0.092***	0.331	0.167	1.900***	-0.152	0.479***
	(0.021)	(0.021)	(0.358)	(0.250)	(0.022)	(0.313)	(0.069)
Economic size	-0.038	0.118*	0.216	0.416	0.823*	1.154+	1.018*
	(0.078)	(0.065)	(1.063)	(0.908)	(0.492)	(0.688)	(0.526)
Financial depth	0.675+		3.007				0.779
	(0.438)		(8.117)				(3.118)
Trade relations		0.461		6.554+		1.595+	
		(0.461)		(4.438)		(1.010)	
Observations	277	476	277	476	994	532	487
Dyadic effects	yes	yes	no	no	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes	yes
Pseudo R^2/Adjusted R^2	0.767	0.701	n.a.	n.a.	0.951	0.972	0.973
Log likelihood	-158.7	-274	n.a.	n.a.	-3617	-1842	-1638
p- value of AR(1)	n.a.	n.a.	0.0343	0.0183	n.a.	n.a.	n.a.
p- value of AR(2)	n.a.	n.a.	0.755	0.572	n.a.	n.a.	n.a.
p- value of Hansen statistic	n.a.	n.a.	1	1	n.a.	n.a.	n.a.

Note: The table reports estimates of Eq. (1) obtained from alternative estimation methods, namely fractional logit in columns (1) and (2), system GMM in columns (3) and (4) and a static model excluding the inertia variable in columns (5) to (7). The standard errors reported in parentheses are robust to autocorrelation and heteroscedasticity. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, $^{+}$ $p<0.15$; n.a.: not available.

Table A4: Overview of Formal Alliances in the Pre-World War I Sample

Reserve currency issuer	Reserve currency holder	Defense pact	Neutrality treaty	Non-aggression treaty	Entente	Start year (in the sample)	Last year (in the sample)
France	Italy		Yes			1902	1913
France	Russia	Yes			Yes	1891, 1893	1913
Germany	Russia	Yes			Yes	1890, 1905	1905
Germany	Austria-Hungary	Yes	Yes	Yes	Yes	1890	1913
Germany	Romania	Yes			Yes	1890	1913
Germany	Italy	Yes		Yes	Yes	1890	1913
U.K.	Sweden				Yes	1890	1911
U.K.	Japan	Yes	Yes		Yes	1902	1913
U.K.	Italy				Yes	1890	1897
U.K.	Austria-Hungary				Yes	1890	1897
U.S.	Japan				Yes	1908	1910

Note: The column "Start year" and "Last year" indicate when military alliances among the dyads started and ceased to be in force, respectively, within our sample.

Table A5: Cross-Sectional IV Estimates using an Alternative Instrument Definition

	(1)	(2)	(3)	(4)	(5)
Credibility	0.179	0.258	0.790	0.110	0.127
	(0.598)	(0.579)	(0.674)	(0.577)	(0.606)
Economic size	0.113	0.215	0.306	0.188	0.120
	(0.401)	(0.392)	(0.400)	(0.407)	(0.404)
Contiguity	23.488#	27.418+	8.133	23.755+	27.813+
	(17.689)	(17.683)	(28.045)	(16.253)	(18.059)
Common language	-28.514+	-31.998*	-25.654	-33.902*	-31.382*
	(18.672)	(18.997)	(20.036)	(20.031)	(18.832)
Common colonial relationship	68.710***	70.475***	67.827***	70.294***	70.807***
	(13.863)	(13.860)	(14.316)	(14.568)	(13.764)
Distance	0.161	-0.144	-1.762	0.328	0.274
	(1.829)	(1.752)	(1.932)	(1.864)	(1.865)
Any formal alliance	8.217#				
	(6.177)				
Defense pact		14.395+			
		(9.502)			
Neutrality treaty			25.468		
			(29.723)		
Nonaggression pact				31.979	
				(27.830)	
Entente					8.999+
					(6.196)
Observations	50	50	50	50	50
R-squared	0.693	0.710	0.696	0.685	0.696
Currency effects	yes	yes	yes	yes	yes
Adjusted R^2	0.616	0.638	0.620	0.607	0.619
Log likelihood	-234.9	-233.4	-234.6	-235.5	-234.7
Kleibergen-Paap statistic	7.162	4.368	4.694	3.363	7.002
p-value	0.0278	0.113	0.0956	0.186	0.0302
F statistic	6.256	3.330	1.878	1.728	6.734
Hansen *J* statistic	0.240	0.101	0.413	0.0977	0.189
p-value	0.624	0.751	0.521	0.755	0.664

Note: The table reports cross-sectional estimates of Eq. (3) obtained by two-stage least squares using as instrument lagged diplomatic representation (as of 1884) orthogonalized with respect to trade determinants. Each cross-sectional unit represents a country/reserve currency dyad with time series observations averaged out over the period 1890-1913. The estimates control for currency fixed effects. The standard errors reported in parentheses are robust to heteroskedasticity; *** p<0.01, ** p<0.05, * p<0 .1, $^{+}$ p<0.15, $^{\#}$ p<0.2.

Table A6: Treatment Effect (Cross-Section)

A. Military Alliances

Matching algorithm	No. of treated pairs	No. of control pairs	Average treatment effect	Bootstrapped S. E.	*t*-stat
Nearest neighbour	11	4	36.723	10.767	3.411 ***
Radius	5	29	36.060	16.861	2.139 **
Kernel	11	5	38.450	8.844	4.348 ***
Stratification	4	12	43.648	18.803	2.321 **

Note: The table reports the average treatment effect (ATT) on treated pairs of military alliances when currency shares is the outcome variable. The estimates were obtained with four algorithms (nearest neighbour, radius, kernel and stratification matching) to match treated pairs with control pairs in the region of common support. The standard errors (S.E.) of the ATT were obtained with 100 bootstrap replications. Asymptotic standard errors are used for the radius methodology insofar as bootstrapped standard errors could not be obtained. *** p<0.01, ** p<0.05, * p<0 .1, $^{+}$ p<0.15.

B. Defense Pacts

Matching algorithm	No. of treated pairs	No. of control pairs	Average treatment effect	Bootstrapped S. E.	*t*-stat
Nearest neighbour	6	5	36.085	16.736	2.156 **
Radius	6	34	38.628	10.610	3.641 ***
Kernel	6	8	40.117	14.302	2.805 ***
Stratification	5	9	43.677	14.953	2.921 ***

Note: The table reports the average treatment effect (ATT) on treated pairs of defense pacts when currency shares is the outcome variable. The estimates were obtained with four algorithms (nearest neighbour, radius, kernel and stratification matching) to match treated pairs with control pairs in the region of common support. The standard errors (S.E.) of the ATT were obtained with 100 bootstrap replications. Asymptotic standard errors are used for the radius methodology insofar as bootstrapped standard errors could not be obtained. *** p<0.01, ** p<0.05, * p<0 .1, $^{+}$ p<0.15.

Table A7. Share of the US dollar in Official Foreign Exchange Reserves – Evidence for the Modern Era

	US dollar share	Year of observation		US dollar share	Year of observation
Australia	45	2004	New Zealand	57	2004
Bahrain	90	2007	Norway	35	2004
Bulgaria	6	2004	Oman	90	2007
Canada	48	2004	Peru	90	2004
Chile	63	2007	Philippines	83	2004
China	65	2008	Qatar	85	2007
Colombia	85	2004	Romania	36	2004
Croatia	16	2004	Russia	43	2016
Finland	30	2004	Saudi Arabia	80	2007
Germany	98	2004	Serbia	17	2007
Hong Kong	79	2004	Slovakia	22	2004
Iceland	40	2004	Slovenia	12	2004
India	67	2015	Sweden	37	2004
Israel	68	2015	Switzerland	34	2004
Japan	86	2006	Taiwan	90	2016
Korea	84	1987	Turkey	44	2007
Kuwait	90	2007	United Arab Emirates	95	2007
Latvia	38	2004	United Kingdom	40	2004
Lithuania	0	2004	Uruguay	82	2004

Note: The table reports (estimates of) the share of the US dollar in the official foreign exchange reserves of 38 countries in the modern era. The data for Australia, Bulgaria, Canada, Colombia, Croatia, Finland, Germany, Hong Kong, Iceland, Japan, Latvia, Lithuania, New Zealand, Norway, Peru, Philippines, Romania, Slovakia, Slovenia, Sweden, Switzerland, Uruguay are from Truman and Wong (2006); those for Bahrain, Kuwait, Oman, Qatar, United Arab Emirates and Saudi Arabia are from Setser and Ziemba (2007); those for Chile, Russia, Serbia and Turkey are from ECB (various issues) and national central banks; the sources of the estimates for the remaining countries are indicated in Table A1.

Table A8. Estimates for the Modern Era

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Defense pact	13.970+	20.821**	15.502+	22.260*	23.189*					
	(8.804)	(9.715)	(10.257)	(11.059)	(12.284)					
US military presence, 1000s						0.648***	0.557***	0.712***	0.564***	0.522**
						(0.090)	(0.143)	(0.173)	(0.133)	(0.205)
Constant	51.958***	67.000***	32.608***	406.610***	-180.952	52.683***	66.979***	30.715***	-292.565*	-80.779
	(6.394)	(8.922)	(5.115)	(139.627)	(171.670)	(4.901)	(8.930)	(4.346)	(155.789)	(207.376)
Observations	38	38	37	36	36	38	38	37	36	36
Adjusted R^2	0.0297	0.241	0.488	0.212	0.274	0.142	0.235	0.656	0.222	0.255
Year effects	no	yes	no	no	yes	no	yes	no	no	yes
USD anchor control	no	no	yes	no	no	no	no	yes	no	no
US trade share control	no	no	yes	no	no	no	no	yes	no	no
Gravity controls	no	no	no	yes	yes	no	no	no	yes	yes
Log likelihood	-180.1	-173.8	-162.3	-164.3	-160.9	-177.8	-173.9	-154.9	-164	-161.4

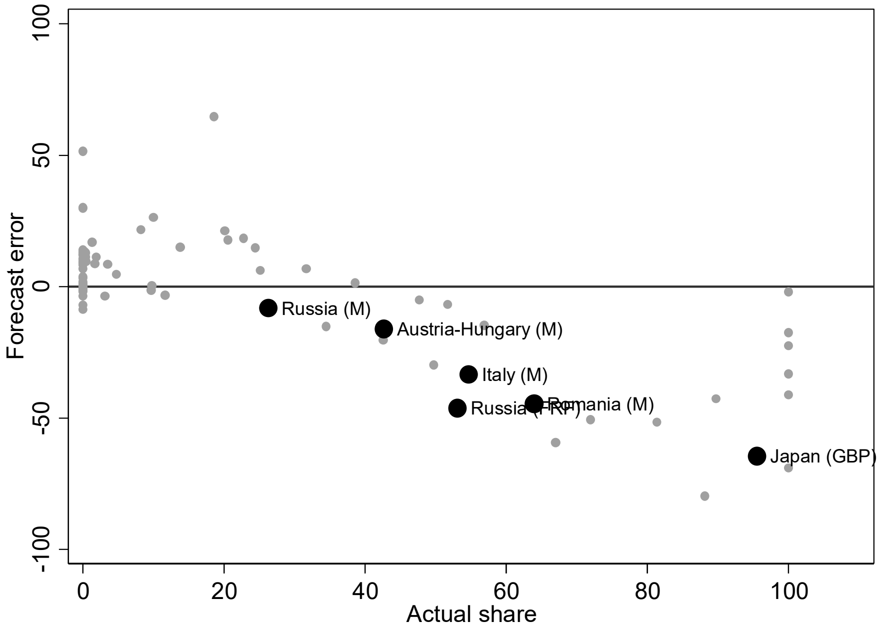
Note: The table reports estimates obtained on a cross-sectional sample for the modern era. The sample in question consists of up to 38 country-observations of the share of the US dollar in official foreign exchange reserves. The observations are mainly for the year 2004 (or 2007 or 2015, depending on the country). We measure Mars effects with a dummy that equals one if a country has a defense pact with the U.S. (and zero otherwise) in columns (1) to (5) as well as with the number of U.S. military troops stationed in the respective country (in thousands) in columns (6) to (10). The estimates of columns (2), (5), (7) and (10) control for year effects; those of columns (3) and (8) for the role of the US dollar as an exchange rate anchor and for the share of the US in bilateral trade; and those of columns (4), (9) and (10) for the standard gravity covariates. The standard errors reported in parentheses are robust to autocorrelation and heteroskedasticity. *** p<0.01, ** p<0.05, * p<0 .1, $^{+}$ p<0.15.

Table A9: Overview of the Estimated Effects of Defense Pacts

Method	Sample	Source	Notes	Estimated effect
OLS	Full sample	Table 4, col. 2	Long-run effect	37
	5-year averages	Table 4, col. 6	Long-run effect	26
	Cross-section	Table 6, col. 2		36
IV	Cross-section	Table 6, col. 7		14
PSME	Full sample	Table 5	Average	42
	Cross-section	Table A6	Average	40
			Mean	**33**

Note: The table reports the estimated effects of defence pacts on currency shares (in percentage points) obtained with various estimation methods as well as the average effect across methods.

Figure A1: Forecast Error of Estimated Model without Mars Effects



Note: The figure shows the forecast error (predicted minus actual currency shares in percentage points) using the full model estimates reported in Table 6, column (2) excluding the effects of defense pacts. M: German mark; FRF: French franc; GBP: pound sterling.