

Currency reserves

SUMMARY

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 US disengagement from global geopolitical affairs. In a hypothetical scenario where the United States withdraws from the world, our estimates suggest that long-term US interest rates could rise by as much as 80 basis points, assuming that the composition of global reserves changes but their level does not.

JEL codes: F30, N20

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Mars or Mercury? The geopolitics of international currency choice*

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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 disproportionately as a medium of exchange, store of value and unit of account by

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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 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

- 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). Norrlof (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 US 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 US dollar peg and continued investment in dollar reserves. Under US 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 US 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.
- 5 While Germany cannot 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, Valéry Giscard d’Estaing, railed against the dollar’s ‘exorbitant privilege’. Similarly, France has been reluctant to participate in the US-led North Atlantic Treaty Alliance (unlike Germany), where Germany hosts thousands of US troops and important US military bases (unlike France).

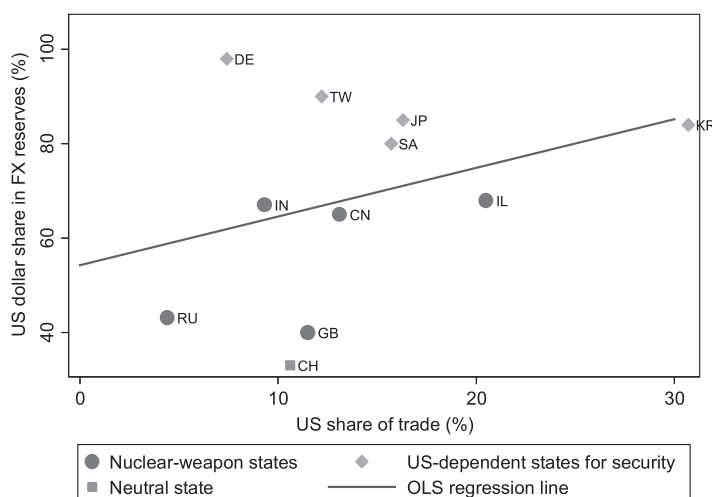


Figure 1. Share of the US dollar in the foreign reserves of selected countries in the modern era

Notes: 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 United States in the trade in goods (exports and imports) of the countries in question (see [Online Appendix 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.

security; they are US 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 United States for their security, as in [Figure 1](#), suggests that the difference in the share of the US 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 favour 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](#)).

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

6 Historically, the United States 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 United States 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 the US dollar in the SNB's reserves was roughly one-third prior to the global financial crisis, as it is now.

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

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 defence pacts, non-aggression treaties, neutrality treaties and

8 Examples from the distant and recent past epitomize the point. After World War II lending by the United States 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 2007–2009 were given to close US 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 United States, 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 United States for global leadership, such as Russia and China, have sought to replace the US dollar with their national currency in bilateral oil transactions (see [Eichengreen, Chitu and Mehl, 2016](#) for details). It has also been argued that the commitment of the Gulf Cooperation Council nations to the US 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 US 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 IMF 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 (COFER) data base, are confidential; the individual country data have been used only by two internal IMF 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 US dollar in global reserves in the modern era.

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 US 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 defence pacts proliferated (Miller, 2012).¹⁰ Then, as now, trade and finance were global. From 1850 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 labour, buttressed international trade and financial transactions as well as migrations (O'Rourke and Williamson, 2001). 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 nineteenth 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 United States 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

10 With the industrialization of significant parts of the European continent in the second half of the nineteenth century and the creation of a unified German Empire in 1870–1871, 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 defence pact, known as the Dual Alliance, in 1879. Germany, Austria-Hungary and Italy signed a secret agreement, 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 Chițu (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.

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 choose.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 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 US government to place dollar-denominated securities at a lower cost because demand from major reserve holders is stronger than otherwise. The cost to the United States 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 United States was disengaging from global geopolitics in favour of more stand-alone, inward-looking policies, the security premium enjoyed by the US dollar could diminish.¹⁶ Our estimates suggest, in this

13 The Dutch guilder and the US 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 nineteenth century and [Eichengreen, Mehl and Chitu \(2017\)](#) for a recent discussion.

14 The term 'security premium' is from [Norloff \(2010\)](#).

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 implications for the US dollar of diminished US geopolitical standing, as we do.

16 Exemplifying the possibility that the United States 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 US 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 United States 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'. And in its State of the Union Address on 12 September 2018, EU Commission President Jean-Claude Juncker stressed that 'Old alliances may not look the same tomorrow ... We must complete our Economic and Monetary Union to make Europe and the euro stronger'.

scenario, that over \$800 billion worth of official US 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 US 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.

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, US dollars and Dutch guilders.

As we explain in [Eichengreen, Mehl and Chițu \(2017\)](#), the practice by central banks of holding foreign exchange reserves developed in the mid-nineteenth century. The National Bank of Belgium was the first central bank that began accumulating foreign-currency-denominated assets that it used in foreign exchange market intervention and other operations. Where the National Bank of Belgium led, other central banks followed because safe and liquid assets denominated in a currency readily convertible into gold, such as sterling, the French franc or the German mark, offered advantages relative to gold itself: they enabled them to economize gold; their supply was not dependent on haphazard of mine discoveries; and they were remunerated. Foreign exchange reserves hence rose rapidly in the final years of the nineteenth century and early years of the twentieth. According to [Bloomfield \(1963\)](#) and [Lindert \(1969\)](#), the foreign assets of 18 leading banks of issue and national treasuries rose eight-fold from \$102 million at the

end of 1880 to \$814 million at the end of 1913. Their gold reserves, in contrast, rose from \$1 billion at the end of 1880 to \$4.9 billion at the end of 1913, a relatively modest five-fold increase. And whereas foreign exchange accounted for less than 10% of total reserves in 1880, it accounted for nearly 20%, if silver is excluded, and 16% if it is included. As Lindert stresses, this underscores the tenuous and arbitrary nature of the customary distinction between a prewar ‘gold standard’ and an interwar ‘gold-exchange standard’. Foreign exchange accounted for about 18% of global reserve holdings in 1925, not too far off the pre-World War I figure.

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. Then like now, both central banks and treasuries hence played important roles in determining foreign reserve allocation.¹⁷ 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.¹⁸ 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.¹⁹

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.²⁰ We see how circa 1899 sterling accounted for the majority

17 Today, central banks in large foreign reserve-holding countries, such as China, Russia and other emerging markets, hold foreign exchange reserves but are not fully independent. Whereas they act as the government’s agent in day-to-day management of the reserves in question, investment policy and strategic benchmarks used to allocate reserves are decided by governments. In some case, sovereign wealth funds – which are government-sponsored agencies – hold a significant share of official foreign assets. Even where central banks are independent, governments may still influence allocation of official reserves because central banks remain accountable for the management of the reserves in question. For instance, the Bank of England manages foreign reserves in accordance within a framework set out with HM Treasury where foreign currency allocation explicitly reflects Treasury investment policy. In Japan and the United States, interventions in the foreign exchange market – which alter the level and composition of foreign exchange reserves – are decided by the Treasury, not the central bank, which is responsible for their implementation (see Henning, 1994). In the euro area, the interventions in question are a joint competence of the ECB and the Eurogroup (the Council of euro area finance ministers).

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

19 Lindert (1967, 14–15).

20 We discuss estimation problems arising from measurement error below.

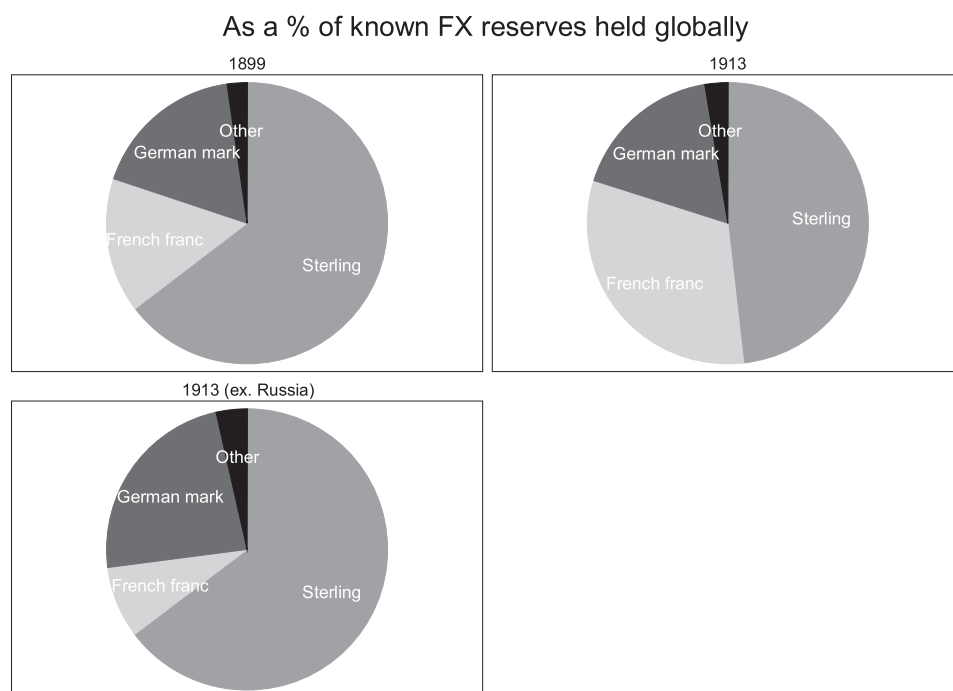


Figure 2. Currency composition of foreign exchange reserves – 1899 versus 1913

Notes: 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 US dollars and Dutch guilders.

(about 65%) of identified foreign exchange reserves.²¹ But French francs and German marks accounted for non-negligible 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.

The decline in sterling’s share between 1899 and 1913 is mainly due to Tsarist Russia’s rapprochement with France – which resulted in Russia using Paris as the financial centre from which it borrowed funds (‘emprunts russes’) and in a large build-up of official reserve holdings in French francs – in line with the Mars hypothesis. Excluding Russia’s holdings, the share of sterling in global foreign exchange reserves remained remarkably stable (contrast the top right panel of Figure 2 with the bottom left panel). As Lindert points out ‘The lion’s share of French liabilities to foreign central banks and governments after the turn of the century was taken by the official

21 The dominance of sterling then consequently resembled the dominance of the US dollar now, with the greenback accounting for roughly two-thirds of global foreign exchange reserves in 2017.

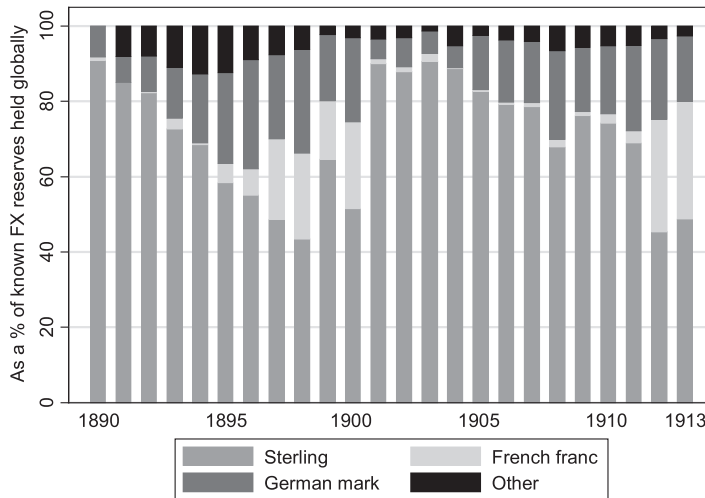


Figure 3. Currency composition of foreign exchange reserves – 1890–1913

Notes: 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 US dollars and Dutch guilders.

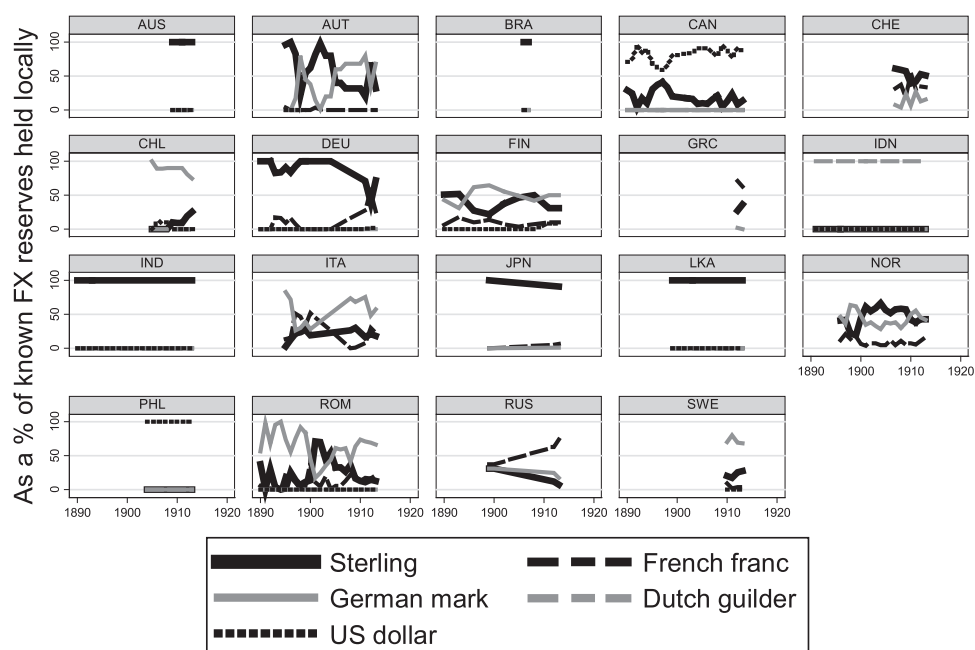
franc balances of Russia alone, while the use of marks as reserves was more widespread’ (Lindert, 1969, p. 25).

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.²² Whether this is due to economic or geopolitical factors remains to be determined.

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. The countries in question were colonies or dominions of the United Kingdom, the United States or the Netherlands. Earlier scholars (e.g., Shannon, 1952, Strange, 1971, De Cecco, 1984) pointed out that colonial relationships affected reserve currency practices importantly in this earlier era.²³ That metropolises used leverage to influence the reserve holdings of their colonies is the traditional interpretation of the Mars hypothesis, which we quantify

22 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 1912–1913. 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).

23 Strange referred to currencies held under such circumstances as ‘master currencies’.



Graphs by ISO3 alphanumeric

Figure 4. Currency composition of foreign exchange reserves – breakdown by reserve holders

Notes: 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.

by controlling for colonial relationships in our estimations below. Alliance politics is another interpretation of the Mars hypothesis; however, this is particularly relevant for the modern era insofar as colonies have become independent and policy discussions have focussed on the implications for the US dollar of evolutions in relations between the United States and its long-standing military allies.

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 attack by another great power.²⁴

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

The increasing importance of French francs in Russia's reserves in the years after the Franco-Russian alliance of 1894 highlights a similar point.

3. SPECIFICATION

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

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

where i, j , and t are the currency, country and time dimensions ($i = 1 \dots 5$; $j = 1 \dots 19$; $t = 1 \dots 23$) and $share$ is the share of currency i in country j 's foreign exchange reserves in year t ; $\mathbf{X}$ is a vector of control variables; λ a vector of time effects; ϵ is the residual; and the β s are the coefficients to estimate. We control for unobserved heterogeneity by including dyadic-fixed-effects $\alpha_{i,j}$ when $\mathbf{X}$ 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 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').²⁵ 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](#)).²⁶

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 commercial retaliation ([Rose and Spiegel, 2004](#)). [Aviat and Coeurdacier \(2007\)](#), [Lane and Maria Milesi-Ferreti \(2008a, b\)](#), [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](#)).

25 [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.

26 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 Chifu \(2017\)](#). 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.

Eichengreen and Flandreau (2012) show that financial deepening was a key determinant of the rise of dollar-denominated trade credits in the 1920s. Chitu, 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 monetization ratio (broad money to GDP), taking data from Jordà, Schularick and Taylor (2017).²⁷

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).²⁸ 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).²⁹

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

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

28 Instrumental variables estimates are also reported below.

29 The techniques we employ are comparable with those used in previous studies on international reserve currency choice. We did not obtain estimates with the fractional multinomial logit (fmlogit) model because it is not easily transposable to our context. Papke and Wooldridge (2008)'s fractional logit model for panel data is for univariate outcomes. This is different from our panel data set with multiple outcomes. Moreover, estimation here is particularly difficult because of the dyadic structure of our panel. Mullahy (2015) shows that in a panel of e.g. n countries ($i = 1 \dots n$) which choose between k currencies ($j = 1 \dots k$) in a given year t , estimation is feasible only if explanatory variables are of dimension i , not (i,j) (in other words they need to be sampled at the country level, not dyad level). But many of our measures of pecuniary motives, such as the standard gravity covariates, and geopolitical motives, such as military alliances, are dyadic, which in turn makes obtaining fmlogit model estimates not feasible.

international currency shares in global foreign reserves is estimated to occur in a single year, *ceteris paribus*, which is faster than the 0.9 estimate of Chinn and Frankel (2007, Table 8.4, p. 303) using reserve data for 1973–1998.³⁰

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’.³¹ 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.³² 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 United Kingdom, France and Germany) were of roughly equal size (i.e. 9–14% of global output over the sample period, against 23% for the United States and 1% for the Netherlands).

Data are more limited for trade relations and financial depth.³³ 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).³⁴

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 Online Appendix Table A3). The estimated effects for inertia, credibility, and economic size remained robust (in column 2).³⁵

30 This need not necessarily 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 versus country and currency fixed effects (see below).

31 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.

32 That increase in the share is almost one percentage point in the long run.

33 Hence if we lose about half of the observations (or more) in the estimates reported in columns (4) to (7) this is entirely due to the fact that data on bilateral trade or financial depth are not available.

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

35 Note that in the estimates of column (1) of Online Appendix 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. Baseline estimates without Mars

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS estimates							2-way clustering	
Inertia	0.539*** (0.023)	0.539*** (0.023)	0.536*** (0.023)	0.507*** (0.036)	0.493*** (0.013)	0.497*** (0.038)	0.477*** (0.026)	0.497*** (0.045)	0.477*** (0.040)
Credibility		0.921*** (0.048)				0.035 (0.156)	0.529*** (0.054)	0.035 (0.193)	0.529*** (0.068)
Economic size			0.414+ (0.256)			0.555+ (0.363)	0.675 (0.481)	0.555* (0.298)	0.675 (0.619)
Trade relations				1.201+ (0.768)		0.866 (0.679)		0.866 (0.878)	
Financial depth					3.053* (1.753)		1.847 (1.762)		1.847 (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	NA	NA

Notes: The table reports OLS estimates of Equation (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)–(7) and by country and currency in columns (8) and (9).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, + $p < 0.15$.

We also re-estimated Equation (1) using currency shares adjusted for gold and silver holdings, the main component of official reserves.³⁶ The estimates are reported in Table A2 in the Online Appendix. Again we find that inertia and credibility effects matter significantly. Magnitudes are smaller compared to the baseline estimates.³⁷

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.³⁸ 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.³⁹

36 Specifically, we scale currency shares by the proportion of gold and silver in reserve holders’ total foreign reserves.
37 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.
38 See, e.g., Portes and Rey (2005), Aviat and Coeurdacier (2007), Lane and Maria Milesi-Ferreti (2008a) and (2008b), Forbes (2010).
39 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

Table 2. Estimates controlling for standard gravity covariates

	(1) OLS estimates	(2)	(3)	(4)	(5)	(6) 2-way clustering
Inertia	0.947*** (0.017)	0.948*** (0.017)	0.938*** (0.023)	0.949*** (0.018)	0.906*** (0.025)	0.906*** (0.041)
Credibility	0.025 (0.059)	0.011 (0.062)	0.012 (0.062)	0.187** (0.090)	0.252* (0.130)	0.252** (0.127)
Economic size	0.099 (0.135)	0.115 (0.119)	0.127 (0.122)	0.077 (0.125)	0.009 (0.147)	0.009 (0.094)
Contiguity	4.788*** (1.574)				5.627** (2.644)	5.627# (4.001)
Common language		2.985** (1.191)			-1.883+ (1.221)	-1.883 (1.905)
Common colonial relationship			3.752* (2.189)		7.239*** (2.427)	7.239** (3.617)
Distance				-1.334** (0.527)	-1.606* (0.866)	-1.606+ (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	NA

Notes: The table reports OLS estimates of Equation (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).

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, + $p < 0.15$, # $p < 0.2$.

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 the 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 effects and currency fixed effects used in Table 2, since there are three times as many dyadic effects as country plus currency fixed effects.⁴⁰

been used in other studies of international currency status using dyadic panel data, such as He et al. (2015).

40 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

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 towards 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 1–4 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 five percentage points in the short run, while a common colonial relationship is associated with an increase of seven percentage points.⁴¹ 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.⁴²

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.⁴³ 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.⁴⁴ 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 consistent, albeit inefficient, estimates.⁴⁵ 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

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.

41 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).

42 At the 20% level for contiguity and the 15% level for distance, respectively.

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

44 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.

45 These estimates are inefficient since the adjustment does not correct for error autocorrelation.

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*** (0.021)	0.929*** (0.012)	0.935*** (0.049)	0.937*** (0.030)	5.250*** (0.220)	0.521*** (0.096)	0.909*** (0.025)	
Credibility	0.026* (0.015)	0.026* (0.015)	0.122 (0.229)	0.129 (0.127)	-0.471 (0.388)	-0.016 (0.197)		3.841*** (1.196)
Economic size	0.049* (0.026)	0.049 (0.049)	0.177 (0.268)	0.113 (0.174)	0.004 (0.063)	-0.006 (0.774)		-0.144 (1.055)
Contiguity	4.566** (2.226)	4.566*** (1.501)	3.184 (4.673)	3.611 (3.412)	1.034*** (0.327)	-1.185 (15.825)	5.084* (2.736)	22.193 (18.509)
Common language	-1.447 (1.159)	-1.447 (1.125)	-0.243 (2.216)	-0.394 (1.455)	-0.756* (0.439)	-7.694 (13.169)	-1.019 (1.235)	-23.105** (9.544)
Common colonial relationship	4.676** (2.022)	4.676*** (1.423)	4.666 (4.715)	4.372+ (2.921)	6.055*** (0.359)	2.110 (21.669)	6.939*** (2.395)	79.024*** (11.086)
Distance	-0.335 (0.321)	-0.335 (0.351)	-0.988 (1.537)	-0.940 (0.876)	-2.202*** (0.220)	-0.663 (5.351)	-1.663* (0.873)	-24.319*** (8.843)
1st stage residual				0.686*** (0.043)				
Observations	860	860	776	769	860	476	860	994
R ²	0.938	NA	0.939	0.959	NA	NA	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	NA	0	NA	NA	NA	NA	NA	NA

Notes: 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).

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, + $p < 0.15$; NA: not available.

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.⁴⁶

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 versus 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

46 This is also argued by e.g. Posen (2008).

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 and distance.⁴⁷ 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.⁴⁸ 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.

5. MARS HYPOTHESIS

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

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

where *alliance* is an indicator variable equaling 1 if a defence 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.⁴⁹

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 centre from which

47 We use a common language dummy equaling 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). We do not report these results and those discussed below for brevity.

48 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.

49 See Gibler (2009) on the coding of formal alliances among states in the Correlates of War data base. Defence 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%.

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.

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 can stimulate trade in goods and finance. This, in turn, helps to nudge reserve holders towards the unit of issuers which are members of the same alliance.⁵⁰

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 [Equation \(2\)](#) with standard errors that are robust to heteroskedasticity and clustered by dyad. The results in columns (1)–(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 (defence pacts, entente) is also positive and statistically significant (at the 12% and 14% level, respectively).⁵¹

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.⁵² We therefore also obtained estimates based on 5-year averages of the observations, which we report in columns 5–8 of [Table 4](#). The effects of defence pacts and ententes are statistically significant at the 5% level, and at the 15%

50 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.

51 The exception is the coefficient on the neutrality dummy, which is positive but statistically insignificant.

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

Table 4. Testing the Mercury versus Mars hypotheses

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

Notes: The table reports OLS estimates of Equation (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, defence pacts, neutrality treaties and ententes, respectively, for dyad i, j in year t and 0 otherwise (non-aggression pacts dropped out for reasons of collinearity). The estimates control for currency fixed effects, country fixed effects and time effects. Those of columns (1)–(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.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, + $p < 0.15$.

level for military alliances (see columns 5–8 of Table 4 below).⁵³ Magnitudes are broadly comparable. In the long run, defence 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.

We also obtained estimates excluding colonies. The effects of inertia, credibility and distance remain robust (see columns (1)–(5) of Table 5). The effects of military alliances, defence pacts and ententes are also robust (see columns (1), (2), (4) and (5) of Table 5).⁵⁴

53 The effect of neutrality treaties remains insignificant.
54 The coefficient on neutrality treaties is not statistically significant, just as in the estimates of Table 4.

In the long run, military alliances boost the share of a currency in the partner's foreign reserves by 37 percentage points, which is the same order of magnitude as the basic estimate of Table 4. Military alliances in this earlier era were forged between sovereign nations. Their effect on reserve currency composition did not depend on colonies. Moreover, many colonies held reserves only in their respective metropole, but some did not, such as Canada (a dominion in the British Empire, which held both sterling and dollars).

6. CAUSALITY

When estimating Equation (2) we also face an endogeneity problem. Causality between currency shares and alliances can run both ways.⁵⁵ 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.⁵⁶

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 do not.

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.⁵⁷ In the second step, we used four distinct algorithms (nearest neighbour, radius, kernel and stratification matching) to match treated pairs with control pairs (i.e. countries expected to have an alliance but that do not 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

55 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.

56 There should be in this case an upward bias in the OLS estimate of β_5 .

57 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.

Table 5. Testing the Mercury versus Mars hypotheses without colonies

	(1)	(2)	(3)	(4)	(5)
Inertia	0.854*** (0.040)	0.853*** (0.039)	0.872*** (0.032)	0.856*** (0.040)	0.854*** (0.039)
Credibility	0.331* (0.183)	0.327* (0.178)	0.300* (0.167)	0.316* (0.177)	0.320* (0.180)
Economic size	0.092 (0.182)	0.114 (0.183)	0.093 (0.169)	0.085 (0.182)	0.101 (0.180)
Contiguity	3.536 (2.994)	3.818 (3.090)	2.895 (3.384)	3.906 (3.066)	3.230 (2.568)
Common language	−0.630 (1.386)	−0.841 (1.513)	−0.138 (0.989)	−0.613 (1.505)	
Distance	−2.009* (1.199)	−1.988* (1.180)	−1.873+ (1.175)	−1.903+ (1.153)	−1.945+ (1.194)
Any formal alliance	5.418** (2.547)				5.284** (2.490)
Defence pact		5.510* (2.934)			
Neutrality treaty			3.909 (3.060)		
Entente				4.776* (2.763)	
Observations	748	748	748	748	748
Currency effects	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes
Adjusted R^2	0.916	0.916	0.915	0.915	0.916
Log likelihood	−2702	−2703	−2706	−2703	−2702

Notes: The table reports OLS estimates of Equation (2) obtained by OLS over the period 1890–1913 based on a sample of observations excluding colonies. The estimates include key pecuniary determinants of international reserve currency status and dummy variables which equal 1 for any formal alliances, defence pacts, neutrality treaties and ententes, respectively, for dyad i, j in year t and 0 otherwise (non-aggression pacts dropped out for reasons of collinearity). The estimates control for currency fixed effects, country fixed effects and time effects. The standard errors reported in parentheses are robust to autocorrelation and heteroskedasticity and clustered by dyad.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, + $p < 0.15$.

balancing property was satisfied as well, insofar as the hypothesis of similarity of covariates between the two groups was not rejected.

Table 6 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 6).⁵⁸ The estimated effect of defence pacts is higher still, at 30–50 percentage points (see Panel B of Table 6). Online Appendix Table A6 reports the results for 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

58 The estimates obtained with the nearest neighbour matching method are based on just 1 observation in the control group and hence are not meaningful.

Table 6. Treatment effect (full sample)

Matching algorithm	No. of treated pairs	No. of control pairs	Treatment effect	Bootstrap-ped S. E.	t-stat
<i>A. Military alliances</i>					
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**
<i>B. Defence pacts</i>					
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***

Notes: 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.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, + $p < 0.15$.

defence pacts is on the order of 30–40 percentage points, which is not very different from the long-run effect estimated with OLS.⁵⁹

Moreover, we obtained estimates using switches in military alliances as a source of variation for identification. We measure switches in military alliances with a dummy variable which equals 1 if a nation forges an alliance with another nation hostile to one if its former allies (e.g. Russia's rapprochement with France in the early 1890s, which was known to be hostile to Germany, Russia's ally since the 1873's League of Three Emperors), -1 if a nation terminates an alliance with another nation to move closer to a third nation hostile to its former ally (e.g. Austria–Hungary's termination of its entente with the United Kingdom to move closer to Germany, which was engaged in a naval arms race with the United Kingdom in the late nineteenth century); and 0 otherwise. Although there are few such switches in the sample, the results are suggestive.⁶⁰ The interacted coefficient between the switches in question and military alliances is positive, statistically significant and economically larger than the basic Mars effect estimate (see

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

60 They include the rapprochement of Russia with France in the early 1890s, which ends the entente of Russia with Germany; and the end of Austria–Hungary's entente with the United Kingdom in 1897, with Austria–Hungary moving closer to Germany. In addition, we considered the end of Italy's entente with the United Kingdom in 1897, with Italy moving closer to Germany under the Triple Alliance agreement; and the rapprochement of Japan (an ally to the United Kingdom to contain Russia's expansion in Asia) with the United States in 1911. We did not include the termination of Sweden's entente with the United Kingdom in 1912, as it is unclear as to whether this led to a reversal in alliance at all, since Sweden declared neutrality when World War I broke out.

Table 7. Using alliance switches to identify Mars effects

	(1)	(2)	(3)	(4)	(5)	(6)
Inertia	0.904*** (0.025)	0.896*** (0.029)	0.868*** (0.033)	0.852*** (0.042)	0.908*** (0.024)	0.903*** (0.027)
Credibility	0.263* (0.133)	0.305* (0.154)	0.268* (0.150)	0.332* (0.183)	0.233* (0.134)	0.255* (0.149)
Economic size	−0.005 (0.149)	−0.009 (0.153)	0.080 (0.179)	0.082 (0.184)	0.001 (0.142)	−0.000 (0.143)
Contiguity	5.746** (2.659)	5.420* (2.799)	4.331+ (2.838)	3.753 (3.085)	4.738** (2.040)	4.215* (2.277)
Common language	−1.984+ (1.238)	−2.753** (1.372)	0.407 (1.400)	−0.558 (1.374)		
Common colonial relationship	7.438*** (2.465)	8.122*** (2.816)			6.121*** (2.146)	6.266*** (2.308)
Distance	−1.660* (0.887)	−1.934* (1.015)	−1.585+ (1.005)	−2.005+ (1.212)	−1.461+ (0.898)	−1.609+ (0.987)
Switch × alliance	13.479*** (1.419)	10.538*** (2.209)	14.500*** (1.579)	10.802*** (2.486)	13.075*** (1.349)	10.905*** (2.314)
Any formal alliance		3.449+ (2.254)		5.209* (3.042)		2.623 (2.188)
Switch		−0.426 (1.689)		−1.165 (2.168)		−0.475 (1.701)
Observations	860	860	748	748	860	860
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	0.954	0.954	0.915	0.916	0.954	0.954
Log likelihood	−3075	−3074	−2705	−2701	−3076	−3075

Notes: The table reports OLS estimates of Equation (2) using switches in military alliances as a source of variation to identify the effect of geopolitical motives on foreign reserve currency choice. The estimates are obtained on the full sample in columns (1) and (2), excluding colonies in columns (3) and (4) and the common language dummy in columns (5) and (6). The estimates control for currency fixed effects, country fixed effects and time effects. The standard errors reported in parentheses are robust to autocorrelation and heteroskedasticity and clustered by dyad.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, + $p < 0.15$.

column (1) of Table 7, and column (2) where we also control for the direct effects of switches and alliances). Estimates excluding colonies and the common language dummy point to similarly stronger Mars effects (see columns (3)–(6) of Table 7).

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:

$$share_{i,j} = \alpha_i + \gamma_1 size_i + \gamma_2 credibility_i + \gamma_3' \mathbf{X}_{i,j} + \gamma_4 \widehat{alliance}_{i,j} + u_{i,j}, \tag{3}$$

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.⁶¹ 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.⁶²

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.⁶³

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.⁶⁴ 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 1–6 of Table 8 are obtained by OLS, while those in columns 7–11 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

61 The simple correlation coefficient between alliance and diplomatic representation stands at about 0.2.

62 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).

63 For instance, Britain was represented by a Viceroy in India, and there was an India Office in the United Kingdom 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 of mission accredited to the receiving country's head of state who heads an embassy in the receiving country's capital city.

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

Table 8. 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*** (0.106)	0.698*** (0.112)	0.788*** (0.099)	0.755*** (0.092)	0.676*** (0.115)	0.459** (0.168)	0.179 (0.598)	0.258 (0.579)	0.790 (0.674)	0.110 (0.577)	0.127 (0.606)
Economic size	1.926* (1.101)	1.915* (1.016)	2.547** (1.120)	2.083* (1.116)	1.822+ (1.071)	0.595# (0.404)	0.113 (0.401)	0.215 (0.392)	0.306 (0.400)	0.188 (0.407)	0.120 (0.404)
Contiguity	16.644 (18.584)	20.060 (17.333)	7.221 (23.762)	18.588 (17.924)	20.757 (17.675)	19.101 (17.025)	23.488# (17.689)	27.418+ (17.683)	8.133 (28.045)	23.755+ (16.253)	27.813+ (18.059)
Common language	-13.239 (9.158)	-17.018* (8.757)	-13.210 (9.650)	-16.716* (8.731)	-15.054+ (8.908)	-16.743* (8.652)	-28.514+ (18.672)	-31.998* (18.997)	-25.654 (20.036)	-33.902* (20.031)	-31.392* (18.832)
Common colonial relationship	65.337*** (21.121)	66.638*** (20.337)	65.133*** (21.263)	65.342*** (21.170)	66.577*** (20.853)	66.083*** (20.724)	68.710*** (13.863)	70.475*** (13.860)	67.827*** (14.316)	70.294*** (14.568)	70.807*** (13.764)
Distance	-5.680** (2.590)	-5.450** (2.500)	-7.353** (2.802)	-6.033** (2.662)	-5.356** (2.540)	-5.422** (2.393)	0.161 (1.829)	-0.144 (1.752)	-1.762 (1.932)	0.328 (1.864)	0.274 (1.865)
Any formal alliance	15.128* (8.292)						8.217# (6.177)				
Defence pact		35.545*** (8.936)			36.647*** (7.447)			14.395+ (9.502)			
Neutrality treaty			28.286 (22.711)						25.468 (29.723)		
Non-aggression pact				19.120+ (11.078)						31.979 (27.830)	

(continued)

Table 8. Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OLS estimates						IV estimates				
Entente											
Constant					17.322** (7.927)	36.334# (25.441)					8.999+ (6.196)
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

Notes: The table reports cross-sectional estimates of Equation (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 clustered by country;

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, + $p < 0.15$, # $p < 0.2$.

hypothesis (columns 6–10 of Table 8).⁶⁵ In addition, defence pacts have positive effects and are significant at the 13% level.⁶⁶

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 Kleibergen–Paap test of under-identification 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).⁶⁷

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 Online Appendix Table A5, are the same as in Table 8.⁶⁸

Figure 5 shows the predicted shares of selected reserve currencies in the foreign reserve holdings of six countries that signed defence pacts with the issuer of those

65 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 defence 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%.

66 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.

67 As an alternative instrument, we examined differences in military capabilities in the spirit of Benson and Clinton (2016), taking data from the Correlates of War data base. The *F*-statistic of the first-stage equation, at 6, remained below the rule-of-thumb of 10 or Stock and Yogo (2005)'s critical values, again pointing to weak instrument problems. This result seems to be due to the fact that differences in military capabilities are useful predictors of the scope and depth (i.e. intensive margin) of military alliances, as Benson and Clinton found, but not necessarily of the existence (i.e. extensive margin) of the alliances in question, which we consider here.

68 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.

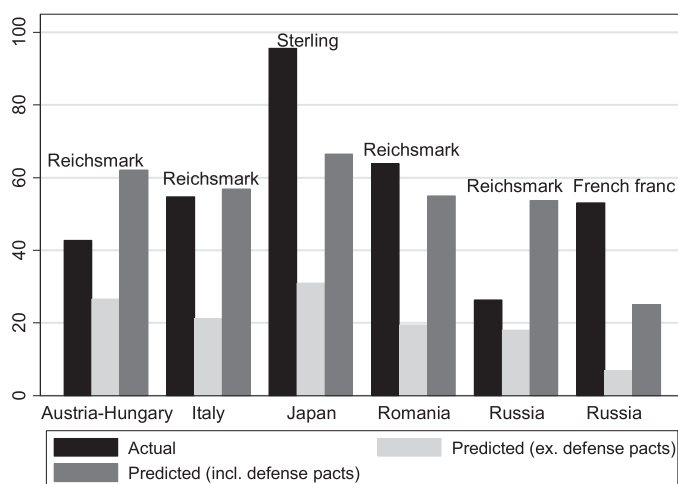


Figure 5. Importance of geopolitical versus pecuniary factors in reserve currency choice – then

Notes: The figure shows the predicted shares of selected reserve currencies in the foreign reserve holdings of five countries which had signed a defence 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 8, column (2), i.e. including the effects of defence pacts (shown as dark grey bars); (ii) excluding the effects of defence pacts (shown as light grey bars). Actual currency shares are shown as black bars.

currencies prior to World War I. Predicted shares are computed using the model estimates in Table 8, column (2), i.e. including the effects of defence pacts (shown as dark grey bars) and, alternatively, excluding the effects of defence pacts (shown as light grey bars).⁶⁹ 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 defence pact with the United Kingdom in 1902 to oppose Russia's expansion in Asia goes a long way towards explaining the difference.⁷⁰ The predicted share including defence-pact effects is 67%, much closer to the actual share. Defence 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 defence pacts. As Online Appendix Figure A1 makes clear, the forecast error

69 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.

70 A possible defence pact between the United Kingdom 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 United Kingdom 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.

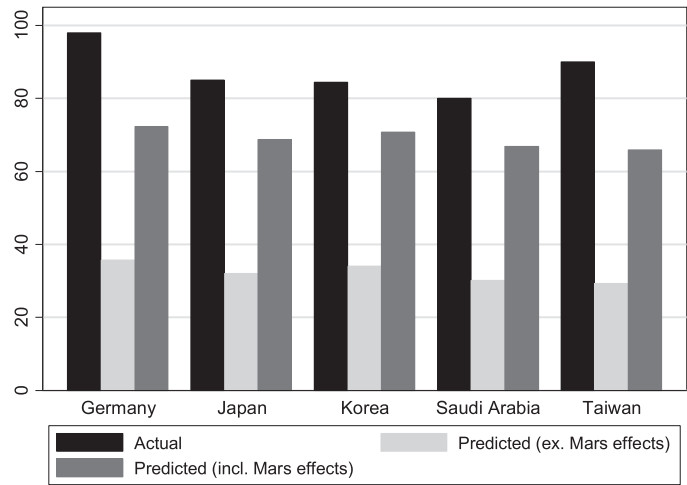


Figure 6. Importance of geopolitical versus pecuniary factors in reserve currency choice – now

Notes: 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 8, column (6), i.e. including the effects of defence pacts (shown as dark grey bars); (ii) excluding the effects of defence pacts (shown as light grey bars). Actual currency shares are shown as black bars. Credibility effects are measured using sovereign debt ratings.

for the 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 defence 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.⁷¹ The figure suggests that the Mars hypothesis goes some way towards explaining the dominance of the US dollar in global reserves in the modern era, too.

⁷¹ 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 US 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 United Kingdom. A final challenge is that the currency fixed effects are not directly applicable to the modern era, since the United States did not benefit from its exorbitant privilege then. We hence used the model estimates in column 6 of Table 8, which are obtained with a constant term, to compute the predicted shares.

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); Appendix 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.⁷² We measured Mars effects with a dummy that equals one if a country has a defence pact with the US (and zero otherwise). As an alternative measure we used the number of US 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 Online Appendix 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 US in bilateral trade; and columns (4), (9) and (10) for the standard gravity covariates.

The results again support to the Mars hypothesis. Defence pacts boost the share of the dollar in global foreign exchange reserve portfolios by up to 23 percentage points (see columns (1)–(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.⁷³ 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)–(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 percentage 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 defence pacts boost the share of international units in foreign reserve holdings by 33 percentage points (see Online Appendix Table A9). This is not far from the 31 percentage point difference in dollar shares between nuclear-weapon states and states dependent on the United States 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

72 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.

73 The results in question are not reported to save space but are available upon request.

extrapolated from our historical analysis necessarily heroic. One difference is that neither the gold standard nor colonies still exist today (although we gave evidence that foreign exchange reserves played an important role then; see above). 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 United States challenged Britain's economic leadership in the final decades of the nineteenth century, with the German mark and – later – the US dollar rivalling sterling as leading international currency. This is not unlike how China is seen as challenging the United States now, and how the Chinese renminbi may challenge the US dollar. Finally, there are growing parallels between the pre-World War I era, when multilateral institutions did not exist and relations between nations were mainly bilateral, and the modern era. This is epitomized, for instance, by the US administration's challenge to the multilateral order (within e.g. the WTO, NATO or the G7/G20) and new policy of bilateral engagement, as illustrated in e.g. the renegotiation of NAFTA with separate trade negotiations between the United States and Mexico on the one hand, and the United States and Canada, on the other.⁷⁴

So what would be the impact on US bond markets of a scenario in which the United States is no longer seen as a predictable guarantor of the security of its allies? Table 9 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 United States for their geopolitical security, on the other.⁷⁵ 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 US unit in the reserves of US 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 9).

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 US marketable public debt, or 4%

74 Moreover, Mars and Mercury motives might be increasingly intertwined in the modern era, as e.g. growing concerns about escalating 'trade wars' suggest, which echoes the endogeneity problems we discuss in the paper.

75 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-NATO) US allies without nuclear weapons and with reserve holdings below \$200 billion, such as Thailand, Poland, Egypt or Australia, but includes Germany.

Table 9. 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	Yes	94	68	2015	Same				
France	Yes		39	NA		Same				
U.S. dependent states for security										
Japan	Yes	Yes	1,158	83-89	2006	52	382	2.6	2.1	39
Saudi Arabia	Proposed	Yes	526	80	2016	47	174	1.2	0.9	18
Taiwan	Yes	Yes	434	≈90?	2016	57	143	1.0	0.8	15
Korea	Yes	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

Notes: The table reports estimates of the impact on bond markets of hypothetical scenarios which assume that the United States withdraws from the world and the US 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 defence pact established in 1949 that consists of 29 Member States, including the US 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 US armed forces but are not NATO members. The baseline scenario assumes 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 [Online Appendix Table A9](#)).

Table 10. 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)				
		<i>Hypothetized increase in total (i.e. all currencies) level of FX reserves:</i>				
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

Notes: The table reports estimates of the impact on bond markets of hypothetical scenarios which assume that the United States withdraws from the world and the US 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%.

of US GDP.⁷⁶ US 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% of US GDP are associated with a 19 basis point reduction in US long-term interest rates, it would raise long-term US 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 US’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 ([US 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 US dollar is higher still.

The rise in US long-term interest rates, in turn, would lead to depreciation of the US 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.⁷⁷

76 The former stands at \$14.4 trillion, against \$18.6 trillion for the latter, end-2016.
77 The estimate is obtained with 10-year benchmark government bond yields on a panel of observations for 5 major exchange rates against the US 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.

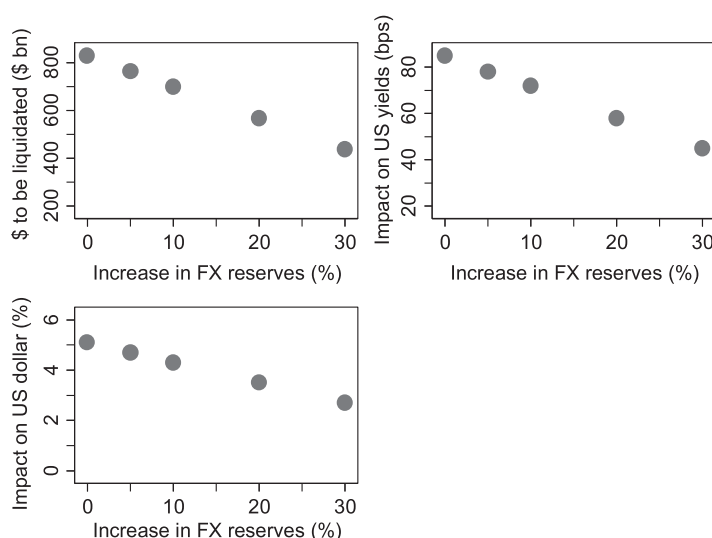


Figure 7. Impact on financial markets of loss of US Dollar's security premium

Notes: The figure shows estimates of the impact on bond and exchange markets of hypothetical scenarios which assume that the United States withdraws from the world and the US 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 US 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 US interest rates conditional on the hypothesized increase in global foreign exchange reserves. The bottom left-hand side chart shows the estimated US dollar depreciation conditional on the hypothesized increase in global foreign exchange reserves.

The last rows of [Table 9](#) consider an upper and lower bound scenarios where the reduction in the share of the US dollar in the reserves of US-dependent states is assumed to reach 42 and 14 percentage points, respectively, corresponding to our largest and smallest estimates of the Mars effects.⁷⁸ The impact on long-term US interest rates remains substantial, at about 100 and 40 basis points, respectively.

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 10](#) considers alternative scenarios where it is assumed both that the US dollar loses its security premium and that the level of reserves held by states dependent on the United States 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 US-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 10](#). Plausibly, the more the US-dependent states increase their reserve holdings, the less they liquidate dollars, and the less is the impact on US bond yields and the dollar exchange rate. [Figure 7](#) shows that the impact in question

78 The results based on the estimate with the small sample of observations for the modern era hence falls between the lower bound and the baseline estimates.

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.⁷⁹

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 favour of a more US-first, isolationist role. If this status came to be seen as less predictable and secure, our results suggest that long-term US interest rates would increase by as much as 80 basis points.

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 defence, might not be irrelevant for the euro's global standing.

Discussion

Ralph De Haas

EBRD and Tilburg University

This fascinating paper uses historical data (1890–1913) to explore what drove the currency composition of countries' international reserves in the period leading up to the

79 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 1971–1973, 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, Mehl and Chitu, 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.

First World War. The authors ‘horse race’ two sets of drivers: international trade and other economic determinants (the ‘Mercury’ hypothesis) versus geopolitical factors, in particular the presence of military alliances (the ‘Mars’ hypothesis). As it turns out, both economics and geopolitics matter(ed). As concerns the latter, the authors find evidence for a sizeable ‘security premium’. The presence of a military alliance boosts the proportion of the reserve currency in the portfolio of an alliance partner by about 30 percentage points.

The paper then moves from the past to the present and provides an interesting back-of-the-envelope exercise. The authors use their historical estimates to assess what would happen to the dollar and to US long-term interest rates in a scenario in which the United States systematically disengages from the world’s geopolitical stage. The historical data patterns suggest that the rest of the world will be less willing to hold the dollar as a reserve currency in such a scenario. The resulting disappearance of the dollar’s security premium would raise long-term US interest rates by up to 80 basis points.

There is a lot to like about this paper. It is well-written, informative and provides a plethora of robustness tests that enhance the credibility of the empirical results. The paper is also ambitious, as disentangling the Mars and Mercury hypotheses is far from straightforward due to endogeneity concerns and, more conceptually, the fact that both hypotheses are closely linked. The concept of a ‘trade war’ is, after all, the perfect amalgamation of Mercury (trade) and Mars (war).

I have three remaining comments on the paper, which I discuss in turn. First, of the 19 countries in the data set that the authors use, Australia, Ceylon, India, the Dutch East-Indies and the Philippines were at the time either colonies or dominions. As such, they were typically not affected by regular Mars-type security alliances. Importantly, in many cases, there was also no time variation in their currency composition (incidentally, the same holds for Brazil). Instead, they held 100% of their reserves in their ‘master currency’. These ‘countries’ hence provide little meaningful variation in terms of either security alliances or currency composition of reserves. Table 5, in which the authors exclude these colonies, is therefore particularly important as a robustness test.

A second issue concerns the use of diplomatic representation as an instrument for the presence of a military alliance between two countries (Table 8). This instrument is problematic for three reasons. First, it is weak, with F stats consistently below 10, which may reflect that diplomatic representation is largely ‘cheap talk’. Second, the exclusion restriction may not hold to the extent that diplomats can also be used to facilitate trade relationships. Third, diplomatic representation may be endogenous to political alliances. Countries that expect military hostility may break off diplomatic relationships due to concerns about the safety of diplomatic staff or simply to give a diplomatic ‘warning shot’ in response to unhappiness about another country’s actions (Kinne, 2014). While the instrumentation strategy thus lacks some credibility, concerns on this account are mitigated by estimates that exploit switching military alliances as an alternative type of identification (Table 7).

My third and final issue relates to the external validity of the empirical exercise. That is: to what extent can we take data from before World War I, derive estimates, and 'plug' these into a contemporary policy debate? The authors provide some credible arguments as to why their historical results continue to be relevant. For instance, both then and now were periods characterized by advanced real and financial globalization. And just like Germany and the United States were challenging Britain's economic dominance at the time, so is China currently challenging the economic role of the United States. But there are also good reasons why the historical estimates may be less applicable to today's world. Bilateral military alliances between countries have become much less important in an increasingly multilateral world (e.g. NATO). The gold standard has disappeared and so have virtually all colonies and dominions. And, as mentioned before, political and economic international relations have become more and more intertwined, with trade wars as a prime example.

Notwithstanding these caveats, and the fact that the scenario analysis requires a bit of a leap of faith, the paper makes a straightforward and convincing point. Any further political isolationism of the United States will come at a tangible economic cost to the country itself (in the form of higher long-term interest rates) and may, vice versa, benefit China as it helps to boost the global standing of the renminbi.

David Hémous

University of Zurich

At the end of 2018, 61.7% of allocated foreign reserves in the world were in US dollars (according to IMF data), making the US dollar by far the main reserve currency. Yet, the US dollar does not have a full monopoly: 20.7% of foreign reserves are in euros, 5.2% in Japanese yens and 4.4% in pounds sterling. In fact, the hegemonic position of the dollar has been somewhat contested in recent years. Its share of reserves was 10 percentage points higher in 2001. In his last state of the union speech, Jean-Claude Juncker has vowed to 'strengthen the international role of the euro'. China is trying to promote the renminbi as an international currency. To encourage the use of euros, Iran has started reporting foreign currency amounts in euros rather than US dollar since 2018. Russia has also increased its share of euros and renminbis to the detriment of the dollar. Geopolitical motives seem at the heart of these trends.

To assess the role of geopolitical (Mars) and economic (Mercury) motives in the choice of a reserve currency, Eichengreen, Mehl and Chitu look back in time and analyze how countries chose the composition of their foreign reserves between 1899 and 1913. This time period corresponds to the first globalization with high levels of international trade in goods and capital, but it also links to a period of international tensions with the formation of various military alliances, which culminated in World War I. The authors show that, at the beginning of the period, the pound sterling occupied a role similar to the US dollar today, but, by the end, its position had been weakened: it went from 65% of

international reserves to 48% (with gains mostly accruing to the French franc). The authors take advantage of historical panel data to quantify the Mercury and Mars motives and then use their estimates to evaluate the cost to the United States if they were to withdraw from the world and lose the extra demand for US dollars coming from their military alliances. In the following, I review the paper discussing in turn the Mercury motives, the Mars motives and the counterfactual exercise.

The authors present some evidence in favour of the Mercury motives in panel regressions with either dyad fixed effects and measures such as countries' economic sizes and trade relations (Table 1) or with country fixed effects and the typical regressors of gravity models in trade, distance, contiguity, common language, etc. (Table 2 and 4). First, the regressions clearly show that currency composition is a slow-moving variable and the lagged composition is highly significant. Second, they suggest that a more credible currency (measured as a currency which has been on the gold standard for longer) tends to get a bigger share. Empirical evidence in favour of trade relations or economic size playing a role are more mixed as the results are not very robust (the results disappear for instance when the currency shares are computed adjusting for gold holding—see Online Appendix Table A2). The gravity variables are a bit harder to interpret in this context: colonial relationships are also a 'Mars' variable and both distances and contiguity may play a role in military alliances. Common language tends to be associated with a negative effect on currency shares, which is counterintuitive. That Mercury's effects are relatively weak is not a big concern for the paper since their main goal is to highlight the importance of 'Mars' effects. Yet, it is possible that the weakness of Mercury motives is related to the presence of the gold standard at the time. Even though (as argued in the paper), there were some benefits from holding foreign currency directly instead of gold, one of the main motives to hold foreign reserves, namely the possibility to control exchange rates, was lacking at the time and, accordingly, 80% of reserves were held in gold instead of foreign currencies.

Evidence on Mars' motives are derived in panel regressions with country fixed effects (Table 4). The effects are robust and economically significant: a formal alliance increases the share of a currency in the partner's foreign reserves by 37 percentage points (one could also imagine building a discrete alliance index going from a non-aggression pact to a defence pact). There are, however, endogeneity concerns insofar as reserve currency choice itself or trade may be determinants of military alliances. To address them, the authors pursue three strategies. First, they carry a propensity score matching exercise, which deals with the reverse causality concern, but not so much with omitted variable bias insofar as the omitted variable is not included in the matching procedure. Second, they use diplomatic relations as an IV in a cross-section. This is an interesting strategy but it is limited by the fact that it can only be undertaken in a cross-section and that the strength of diplomatic relationships may also depend on trade. Third and perhaps most interestingly, they interact their measure of alliance with a measure indicating whether a country seems to be moving from one block to another by allying itself to a country hostile to its former allies. The interaction is positive and highly significant. Conditional on

an alliance, this switch variable is plausibly exogenous. When Russia becomes a closer ally to France, the alliance between Russia and Germany deteriorates and eventually breaks, and the end of this alliance is presumably uncorrelated to trade between Russia and Germany. Perhaps with a longer time period and more data, this approach could be further built on, and one could exploit the network of military alliances, for instance by instrumenting a country's alliances with those of its allies. Nevertheless, the paper makes a good case for an effect of military alliances on currency shares (maybe all the more so that the major possible confounder, trade, did not seem to have a large effect on its own).

The last part of the paper computes how much the United States would lose if the dollar stopped being used as a global currency for 'Mars' motives. To do this, the authors apply the regression coefficients they estimated with historical data. Of course, this is a somewhat heroic exercise but I think that it gives a good idea of the orders of magnitude involved – noting that reassuringly, the authors also found a Mars effect of a similar magnitude in a cross-section analysis based on current data but with a small sample. The main lesson is provocative and very topical: NATO pays off! The authors find that the costs to the United States would be 115 B\$ of annual interest rate payments while the costs of the US military presence overseas are estimated to be between 10 B\$ and 100 B\$.

To conclude, I believe that this is a nice paper which draws thoughts provoking parallels between the turn of the twentieth century and today. The authors show that the role of the pound sterling as the main global reserve currency was substantially weakened following the Franco-Russian alliance and the accumulation of French francs by Russia. It remains to be seen whether current geopolitical tensions may similarly lead to a weakened role for the US dollar.

Panel discussion

Andrea Ferrero raised concerns about the external validity of the results, observing that the authors' sample, being mostly gold standard, is effectively a fixed exchange regime to a first approximation. Thorsten Beck argued that the result of the paper would have implications for the euro, not just the US dollar. Referencing the statement by Jean-Claude Juncker on strengthening the role of the euro as a reserve currency, he wondered if this will only hold if the EU starts being more active in foreign policy, building up military and political alliances.

Atish Ghosh raised concerns about how much these factors mattered given that all currencies at the time were fixed to gold and FX reserves were a small proportion of total reserves. Noting the US dollar's importance for trade between third countries and for capital flows, he then questioned the extent to which there are viable alternatives. He highlighted the 1960s letter from Karl Blessing, stating that the Bundesbank would hold dollars rather than gold, as a clear example of a military alliance affecting reserve

holdings. He then wondered whether there was any concern about expropriation if a country ended up going to war with, or annoying, the country whose currency they are holding. He gave the example of the Spanish Civil War, where the government accounts at the Midland Bank were essentially blocked because the bank did not agree with the government's policies.

Vincent Vicard questioned how the reasons for reserve holdings, and the balance between Mars and Mercury, may change with the degree of conflict at the world level. He observed that the value of an alliance depends on the threats, so the premium in terms of reserves may also depend on the threats. He suggested that Trump is arguably increasing uncertainty at the world level which may increase the importance of the Mars variable.

Andrea Ichino inquired whether the historical decline of the UK's reserves in pounds from 70% to 50% could be better explained by Mercury or Mars factors. He also agreed with the concerns of the discussants relating to the IV strategy and encouraged the authors to follow up on David Hémous' suggestions of other identification methods.

Responding to Andrea Ichino, Arnaud Mehl argued that the UK decline is due to Mars effects. He highlighted that the absolute amount of sterling reserves was not reduced but rather it was the French reserves which increased because of the Franco-Russian Alliance. He further explained that, as a result of the alliance, Russia borrowed in France and part of this borrowing was held as reserves in France which led to the increase in the French share in reserves.

Arnaud Mehl agreed with the relevance of the Karl Blessing letter adding that Germany, against its own interest, stuck with the dollar. He went on to argue that the currency aspect did matter despite the gold standard since, for example, a lot of trade was in fact invoiced in sterling rather than gold. Regarding external validity, he made the case that many countries that are today dependent on the US for their security in fact have fixed exchange rate regimes and hence an interesting analogue can be drawn.

Responding to the discussants, Arnaud Mehl agreed that David Hémous' suggestion to build an index was a very good one. He also clarified that the authors could not calculate shares that also include gold holdings as they do not have the necessary data for a wide enough set of countries.

SUPPLEMENTARY DATA

[Supplementary data](#) are available at *Economic Policy* online.

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