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The International Monetary and Financial System

Pierre-Olivier Gourinchas,[1,2,3] Hélène Rey,[2,3,4] and Maxime Sauzet[1]

[1]Department of Economics, University of California, Berkeley, California 94720, USA; email: pog@berkeley.edu, msauzet@berkeley.edu

[2]Centre for Economic Policy Research, London EC1V 0DX, United Kingdom

[3]National Bureau of Economic Research, Cambridge, Massachusetts 02138, USA

[4]Department of Economics, London Business School, London NW1 4SA, United Kingdom; email: hrey@london.edu

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Abstract

International currencies fulfill different roles in the world economy, with important synergies across those roles. We explore the implications of currency hegemony for the external balance sheet of the United States, the process of international adjustment, and the predictability of the US dollar exchange rate. We emphasize the importance of international monetary spillovers and of the exorbitant privilege, and we analyze the emergence of a new Triffin dilemma.

1. INTRODUCTION

The intimate links between the rise and fall of great powers and the international monetary and financial system are what make studying the latter so fascinating. As analyzed by Kindleberger (1976, p. 32),

> In the 19th century, Britain was the leader of the world economic system. Sterling was international money. The public goods consisted of a market for distress goods, provided by British free trade; a countercyclical flow of capital, produced by the City of London; coordination of macroeconomic policies and exchange rates provided by the rules of the gold standard, legitimized and institutionalized by usage; a lender of last resort in the Bank of England, after the Bank Act of 1844 was suspended in the crisis. The United States took over leadership after World War II.

For Kindleberger (1976), it was essential that the country at the center of the system, the hegemon, stabilize the workings of the international monetary system. In this view, periods of transitions between great powers, such as the 1930s, when the economic influence of the United Kingdom diminished, while that of the United States was still not fully established, are considered to be especially dangerous for economic stability. Furthermore, the economic leadership of the hegemon rarely goes uncontested. As the United States became the center country of the international order in the post–World War II Bretton Woods system, France became increasingly aware of, and frustrated by, the asymmetries inherent in that new international monetary arrangement. In a press conference on February 4th, 1965, General Charles de Gaulle stated,[1]

> The fact that many states accept, on principle, dollars just as much as gold to compensate, if need be, the deficits of the US balance of payments means that the United States can issue external debt freely. Indeed, when the US owe something, they can pay for it, at least in part, with dollars that they can issue, instead of using gold, whose value is real and has to be earned and which one cannot transfer to others without risk and sacrifice. This unilateral facility that the United States has means that the dollar is not an impartial means of international exchange, since it is a means of issuing credit for one state.

On February 16th, 1965, Valéry Giscard d'Estaing, de Gaulle's finance minister, echoed the words of the General and famously summarized them by saying that the country issuing the reserve currency enjoyed an "exorbitant privilege": In the case of a deficit, the United States does not have to take restrictive measures.[2] De Gaulle and Giscard d'Estaing seized on what may be one of the most consequential implications of being the hegemon of the international monetary and financial system: the ability to issue securities that are always in high demand by the rest of the world. This has profound implications for the process of external adjustment, for international monetary spillovers, and ultimately for the stability of the international monetary and financial system. This review explores these issues.

The roles of a dominant international currency, i.e., a currency used outside the borders of its country of issuance, are multifaceted and involve the three classical functions of money: medium of exchange, store of value, and unit of account. As Krugman (1984) clearly describes, there are many interactions and synergies among the international uses of a currency in its different roles (see also Portes & Rey 1998, Eichengreen et al. 2017). These complementarities reinforce the dominance

[1]This quotation has been translated by the authors. We are extremely grateful to Georges-Henri Soutou for providing us with the transcript of the press conference. The French version is available at **https://fresques.ina.fr/de-gaulle/fiche-media/Gaulle00105/conference-de-presse-du-4-fevrier-1965.html**.

[2]As pointed out by Gourinchas & Rey (2007a), the expression exorbitant privilege has been traditionally attributed to de Gaulle but is nowhere to be found in de Gaulle's speeches. It appears, however, in a press conference of Giscard d'Estaing as reported by Raymond Aron for *Le Figaro* on February 16, 1965 (see Aron 1994, p. 1475). We thank Georges-Henri Soutou for showing us this text.

of the hegemon's currency and make it long lasting. Incumbent international currencies are hard to displace.[3]

One of the key facts underpinning the architecture of the international monetary and financial system is that the hegemon provides safe assets to the rest of the world. As shown by Gourinchas & Rey (2007a), the United States is a world banker, long in risky foreign assets and short in risk-free liquid dollar liabilities, which are in high demand by foreign officials and private sectors (see also Despres et al. 1966). This advantage of issuing the reserve currency spills over into other realms, such as the large amounts of private debt issued in US dollars in international markets (Maggiori et al. 2019) and the large share of trade invoiced in US dollars, which stabilizes the terms of trade of the hegemon (Gopinath et al. 2018). It also goes hand in hand with the monetary policy of the Federal Reserve having an important effect on the global financial cycle, in particular by affecting the balance sheet of large global financial institutions and their risk appetites (Miranda-Agrippino & Rey 2018). The dollar exchange rate is a key relative price in the world economy, whether in goods markets or in international financial markets. Furthermore, issuing the international currency confers to the hegemon excess returns on its net foreign asset position, thus easing the process of international adjustment (Gourinchas & Rey 2007b). These excess returns in normal times are, however, associated with net wealth transfers to the rest of world in global crisis times, when the value of US safe assets appreciate, while risky asset prices plummet. These wealth transfers reflect the provision of insurance by the hegemon to the rest of the world in times of global turmoil, a process that Gourinchas et al. (2017) call exorbitant duty.

Finally, the asymmetry inherent in a hegemonic system may also create financial fragilities that can ultimately lead to the system's demise. In the early 1960s, Yale economist Robert Triffin (1961) noted that the United States would not be able to simultaneously provide the international liquidity needed by the global economy and maintain the value of the dollar in terms of a fixed supply of gold—as required under the Bretton Woods system. Ultimately, either the world would face a growing shortage of international liquidity, or confidence in the value of the dollar would plummet with an unavoidable run on the currency. This is Triffin's well-known dilemma. His analysis proved prescient. US policy makers, confronted with growing dollar liabilities in excess of their gold backing, experienced a run on the dollar and were eventually forced to abandon the link between dollar and gold. Triffin's analysis, however, was incomplete because, despite the abandonment of the dollar–gold parity, the dominance of the dollar has increased since the collapse of the Bretton Woods system. Paradoxically, once free from the shackle of a fixed gold parity, the use of the US dollar as an international currency soared to unprecedented levels. Yet, as we argue, the financial fragilities inherent in a hegemonic system have not disappeared: The Triffin dilemma is still with us, albeit in a subtly different form (Gourinchas & Rey 2007a, Obstfeld 2011, Gourinchas et al. 2017, Farhi & Maggiori 2018).

Section 2 provides a brief description of the international monetary system, emphasizing the characteristics and functions of international currencies and their synergies. It discusses the interactions among the monetary policy of the hegemon, international trade, and the global financial cycle. Section 3 focuses on the current hegemon, the United States. It analyzes closely the properties of its external balance sheet and how its characteristics influence the process of external adjustment. Section 4 focuses on the implications for the US dollar, a key relative price in the world economy. Section 5 explores several possible interpretations of the exorbitant privilege. Section 6 discusses the possible risks for financial stability of the organization of the international economic and financial system around a hegemon. Section 7 concludes.

[3]In this review, we use the terms international currency and dominant currency to characterize the currency of the main economic power (the hegemon), bearing in mind that some other regional currencies may also circulate internationally at the same time.

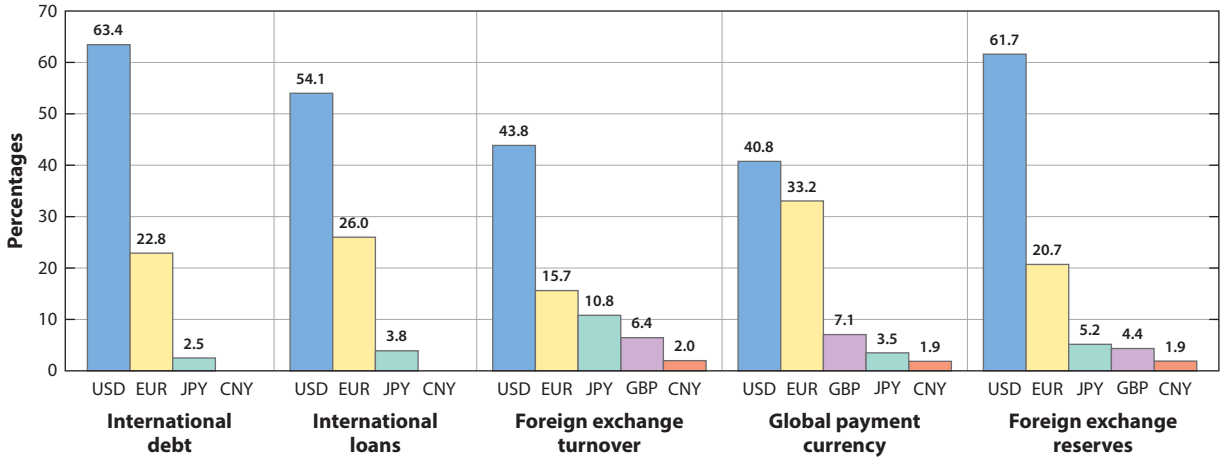

Figure 1

The dominance of the dollar, updated from the European Central Bank (Eur. Cent. Bank 2019, chart 2) and Eichengreen & Xia (2019). Figure constructed using data from BIS, ECB, IMF COFER, and SWIFT.

2. THE DIFFERENT ROLES OF INTERNATIONAL CURRENCIES

It has long been recognized that the more people use a certain medium of exchange, the more useful is that medium of exchange. In that sense, money and languages have similar characteristics, and the US dollar is the lingua franca for today's international monetary system. Barter economies face the well-known problem of the double coincidence of wants (Jevons 1875), a problem that money solves naturally. Monetary theorists have used random matching models to analyze the emergence of money as a way to overcome the trading frictions inherent to barter economies (Kiyotaki & Wright 1989, Matsuyama et al. 1993, Zhou 1997, Lagos & Wright 2005). In these models, the belief that many people will accept a certain currency unit sustains the equilibria in which those monetary units circulate. As a result, welfare is improved: Money puts oil in the mechanism of exchange and decreases bilateral trading frictions.

The history of money shows that, over time and space, very special objects, particularly those difficult to counterfeit, have played the role of money: Shells, rare stones, and precious metals are but a few examples. Trust in the medium of exchange is paramount, so it has to be recognizable and stable in value. In modern days, this implies that it has to be backed by a credible fiscal authority. In turn, stability also makes it a good unit of account.[4] Thus, there are clear strategic complementarities across the different functions of money. The logic extends to the various roles of an international currency with similar force. **Figure 1** shows the strength of these complementarities. It exemplifies the current dominance of the US dollar in all domains: international debt issuance, international loans, foreign exchange turnover, global payment, and foreign exchange reserves. The euro, a more regional dominant currency, comes a distant second (for analyses of the rivalry between the euro and the dollar and the future of the dollar order, see Alogoskoufis & Portes 1991, Kenen 2003, Papaioannou et al. 2006, Chinn & Frankel 2007, Eichengreen 2011).

Building on the typology of Kenen (1983), **Table 1** presents a summary of the different roles of an international currency in the private and official sectors (see also Cohen 1971, Kindleberger 1981, Krugman 1984). The next sections review these different roles in more detail.

[4]Note that, to date, cryptocurrencies are clearly not meeting these standards.

Table 1 International currency

Sector	Roles		
	Medium of exchange	Store of value	Unit of account
Private sector	Vehicle currency Liquid and safe asset markets	Nominal securities issuance Banking and cash hoarding	Denomination of securities Trade invoicing
Official sector	Intervention currency Lender of last resort	Reserves	Exchange rate pegs

Table adapted from Kenen (1983).

2.1. Vehicle Currencies, Currency of Issuance, Intervention, and Peg

Let us first consider the role of an international currency as a medium of exchange. As a consequence of strong network externalities, market forces endogenously select a small number of currencies to become vehicle currencies, i.e., favored means of exchange, through which most of the bilateral exchanges in international markets with many different countries take place. For example, on foreign exchange markets, the Malaysian ringgit is rarely exchanged directly against the Mexican peso. Instead, two transactions take place with the dollar in the middle: Ringgit are exchanged into dollars, and dollars are exchanged into pesos. The bilateral exchange rates verify triangular arbitrage, yet only the more liquid bilateral markets involving the dollar are used to perform transactions. The dollar is the dominant vehicle currency. According to the last triennial survey of the Bank for International Settlement (Bank Int. Settl. 2016), the US dollar was involved in 87.6% of all transactions in the foreign exchange market in 2016 (out of a total of 200% due to a currency being on both side of a trade). The second most-used currency was the euro, at 31.3%.

This vehicle currency role, closely linked to the liquidity and safety properties of markets in different currencies, has been studied by Krugman (1980), Hartmann (1998), and Rey (2001). Private actors around the globe use dollars to transact and invest their short-term funds because they are viewed as the safest and most liquid instrument. Liquidity, i.e., the ability to transact large quantities without an adverse price movement, is central to the quality of a medium of exchange. Safety is essential as well, as it preserves the purchasing power of the currency. It is associated with trust in the issuer, difficulty of cheating or counterfeiting currencies, and overall macroeconomic stability in the value of the currency. It is no mystery that, in countries lacking basic macroeconomic stability, the national legal tender often gives way to an international currency—usually the dollar. Dollarization followed many episodes of severe domestic monetary instability in Latin America in the 1970s and 1980s and, more recently, in Zimbabwe and Venezuela.[5]

The currency of issuance of internationally traded assets is therefore a key determinant of the private sector's demand for stores of value. Using a finely disaggregated data set of $27 trillion in security-level investment positions, Maggiori et al. (2019) show that investor holdings are biased toward securities denominated in their own currencies, even when issued by foreign borrowers. This currency bias is very strong. Canadian investors, for instance, mostly hold securities issued in Canadian dollars. Conversely, most Canadian firms issue only in Canadian dollars, and their liabilities are held locally. The pattern is different, however, for international currencies like the dollar. Since most investors are willing to hold dollars, this means that even relatively small US firms have little difficulty borrowing from abroad. This reflects the liquidity and depth of US dollar asset markets, amplified by the vehicle currency role described above. It also reflects one aspect of the exorbitant privilege described by Giscard d'Estaing, an aspect to which we return in Section 5.

[5] Rogoff (1998) documents the important use of dollar notes outside US borders, whether for tax evasion or currency substitution purposes. Rogoff (2017) makes a strong case for the elimination of cash to help eradicate corruption, terrorism, the drug trade, human trafficking, and the rest of a large global underground economy.

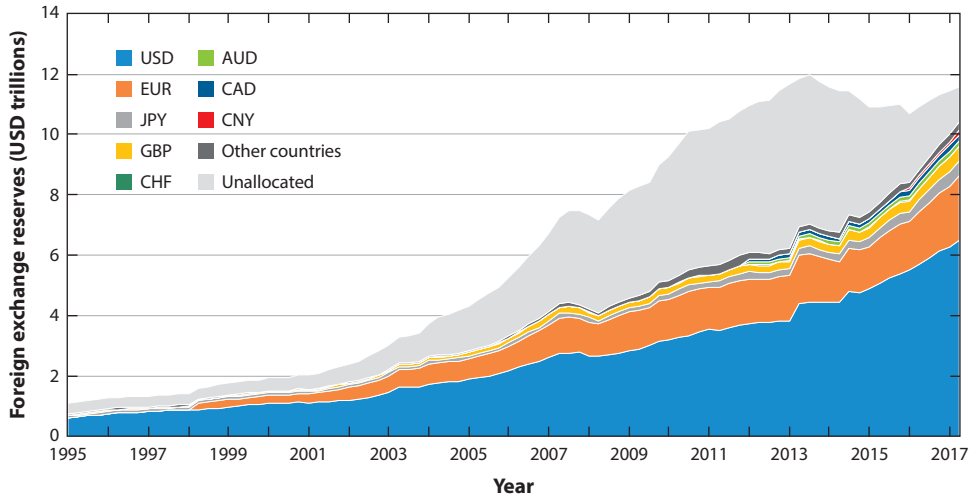

Figure 2

Currency composition of foreign exchange reserves for the world, in trillions of US dollars. The date indicates the last quarter of each year. Figure constructed using data from IMF COFER.

In the official sector, Central Bank intervention in foreign exchange markets will use the dominant currency, i.e., the currency in which most market players transact and may need to obtain emergency financing. Therefore, the vehicle currency will also be the intervention currency. Naturally, this intervention currency is also the currency in which most reserves, i.e., the stores of value for the official sector, are held. **Figure 2** illustrates this point by showing how the distribution of Central Bank reserves by currency evolved over time: The US dollar constitutes the lion's share of Central Bank reserves, with the euro a distant second. These strategic complementarities are further amplified in cases where a country is pegging, de jure or de facto, its own currency to a dominant currency. To stabilize its own currency, a Central Bank will need to actively buy and sell the dominant currency. Ilzetzki et al. (2017) show that the US dollar is by far the world's dominant anchor currency. Surprisingly, its use is even wider currently than it was during the Bretton Woods system, in which most countries formally pegged their currency to the US dollar.

Above, starting with the importance of liquidity and safety for international currencies, we discuss important synergies between the role of money as medium of exchange and store of value in the private sphere (vehicle currency role and nominal securities issuance) and its role as intervention currency and exchange rate anchor in the official sector. We now turn to another set of powerful interactions linking trade and securities invoicing (unit of account role) with banking and the lender of last resort role of Central Banks.

2.2. Trade Invoicing, Banking, Reserves, and Lender of Last Resort

An important facet of an international currency is its extensive use for trade invoicing.[6] As Goldberg & Tille (2009) and Gopinath (2016) discuss, a disproportionate number of international trade transactions are invoiced in US dollars. To emphasize this point, we use the data from

[6]Trade invoicing is linked to the unit of account role of money. Most of the time, the currency of invoicing is also the currency of transaction, although there are some historical episodes in which they differed. Note that, conceptually, they are distinct.

Gopinath (2016) for all available countries and show in **Figure 3** the sum of the share of imports and exports invoiced in dollars and in euros. A sum equal to 2 means that 100% of imports and exports are invoiced in dollars (euros). We observe a strong positive correlation between the shares of imports and exports invoiced in dollars (euros).

Several countries (besides the United States) have a large share of their trade invoiced in dollars. They tend to be emerging markets in Latin America and Asia, but also neighboring countries such as Canada. India has a combined share of approximately 1.75 in dollar exports and imports. In contrast, European countries invoice largely in euros, which for several of them is the domestic currency. Overall, there is a clear pattern of dominance of the dollar in the global economy, while the euro is an important regional invoicing currency around Europe. Invoicing currencies would be largely irrelevant if prices were flexible. It is, however, well documented that prices are nominally rigid in the currency in which they are invoiced. As a result, the choice of invoicing currency also affects the pass-through of exchange rate movements into exports and import prices, as analyzed by Gopinath et al. (2018).

There are important complementarities between the use of a currency as a unit of account and its use as a store of value. For instance, the more trade invoicing is done in a dominant currency, the more likely it is that firms will prefer to hold liquid funds and issue liabilities in that currency. Gopinath & Stein (2018a) explore the complementarities between trade invoicing and the currency denomination of liabilities in a model where banks are the issuers of safe deposits. A financial claim is only meaningfully safe if it can be used to buy a certain consumption basket at a future date, which depends on the currency in which goods are priced. If imports are invoiced in dollars, and these dollar prices are nominally rigid, then firms and households will tend to prefer to hold liquid funds (deposits, cash, liquid securities) denominated in dollars to finance future consumption or purchases of intermediate goods. This demand for dollar deposits depresses the dollar interest rate, which in turn induces local financial institutions to intermediate dollar liabilities. As a result, the expected return on dollar deposits is on average lower, in violation of uncovered interest parity. This is one interpretation of the exorbitant privilege associated with the dollar.[7] Gopinath & Stein (2018b) also note that there are some natural synergies between the dollarization of intermediaries, as described above, and Central Banks' holdings of dollar reserves to perform their lender of last resort function. For many emerging markets, maintaining financial stability requires owning enough reserves in dollars to cover the liquid dollar liabilities of the domestic financial system (Gourinchas 2012, Obstfeld et al. 2010).

Overall, this suggests that the role of the dollar in invoicing (unit of account) associated with price stickiness may lead to the dollarization of bank deposits and steer the Central Bank to hold dollar reserves to backstop the financial system. These interactions, like the ones described above among the vehicle currency role (medium of exchange), issuance, and exchange rate pegs, illustrate some of the possible synergies among the various roles of an international currency. Recent research has only started to explore these interrelated dimensions and the complementarities that sustain the dollar as a dominant currency, even in a world without formal nominal anchors, and there is no doubt that there are more complementarities between the roles illustrated in **Table 1**. We now, however, turn to another aspect of the dollar's role as a dominant currency and examine how the existence of a hegemonic currency affects the functioning of international goods markets, and of international financial markets, through the monetary policy of the hegemon.

[7] Chahrour & Valchev (2018) build a model of international trade as a search process and show the existence of a similar price effect for the currency emerging as the international medium of exchange.

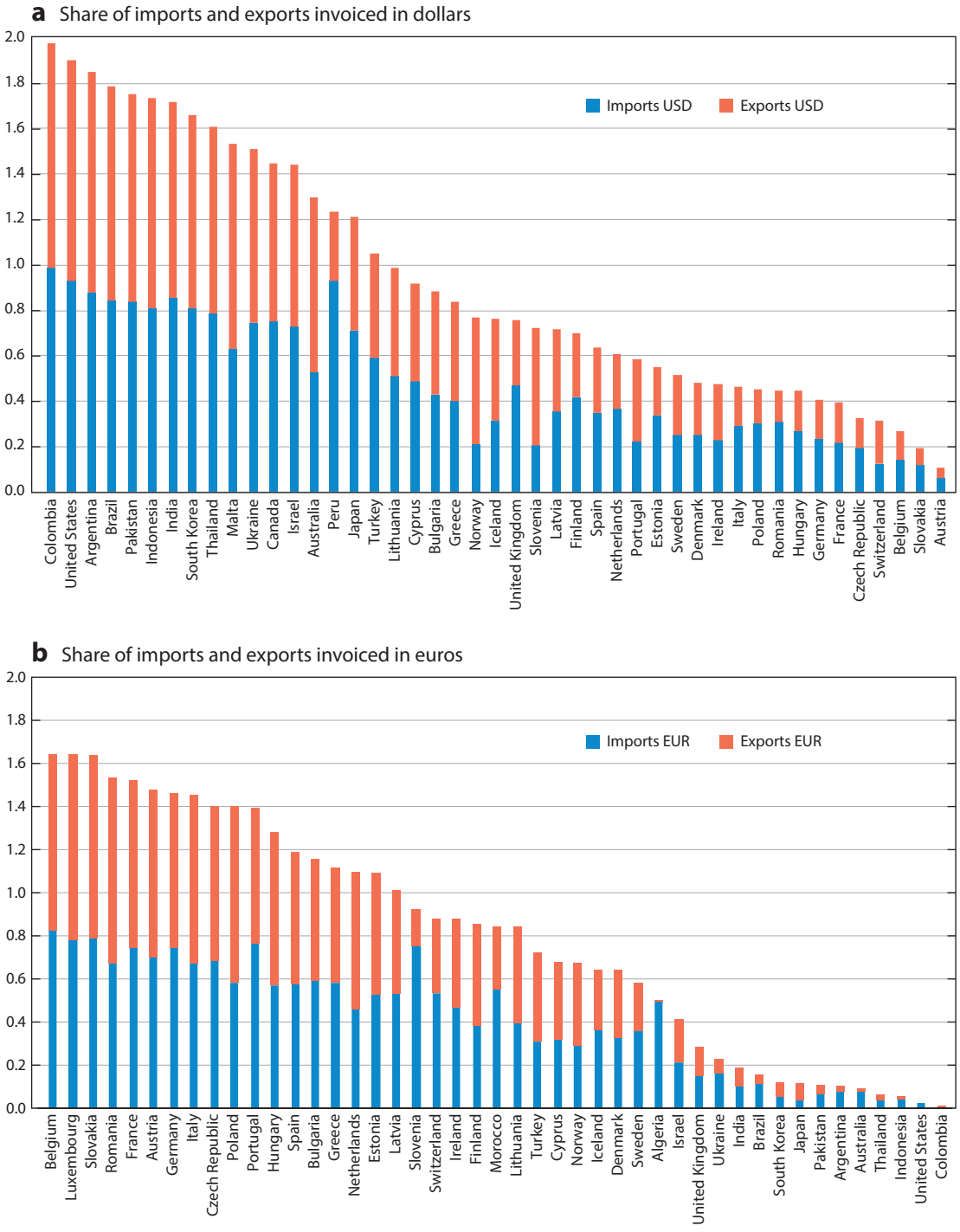

Figure 3

Sum of the share of imports and exports invoiced in (*a*) US dollars and (*b*) euros, each as a fraction of total imports or exports. We include all the countries for which data on exports and imports are available. The only exception is the United States, which we include in the second graph even though the share of US exports in euros was not available. Figure constructed using data from Gopinath (2016).

2.3. Hegemon Monetary Policy, Global Trade, and Global Financial Cycle

We conclude this section with a discussion of the interactions among the monetary policy of the hegemon, global trade, and the global financial cycle. There are many reasons why currency dominance matters beyond those described above. Some are geopolitical—which we do not discuss—and others are economic. Our focus in this section is on the potential spillovers associated with the macroeconomic policies of the hegemon.

To begin with, a large literature has shown the importance of different trade invoicing practices for the transmission of monetary policy and, more generally, of relative price movements across borders. The first generation of New Keynesian (NK) models assumed that prices were sticky in the currency of the producing country (producer currency pricing), as in the work of Obstfeld & Rogoff (1995). A second generation assumed instead that prices were sticky in the currency of the destination market (local currency pricing), as in the work of, e.g., Betts & Devereux (2000; for a survey, see Corsetti et al. 2010). However, a third pricing assumption seems more realistic: dominant currency pricing (DCP), in which countries price their products in the dominant currency in the international system. The implications of DCP have been explored recently by Gopinath et al. (2018) in a small economy setup with strategic complementarities in pricing and imported intermediate inputs. The authors show how the dollar (dominant) exchange rate pass-through into export and import prices is high, regardless of the destination or origin of the goods. It follows that movements in the dollar exchange rate transmit into local consumer prices (via imported prices) and imported quantities, while leaving the United States largely insulated. Another interesting implication of DCP is that a strengthening of the value of the dominant currency relative to nondominant ones can negatively impact global trade. In support of this prediction, Gopinath et al. (2018) document that a 1% US dollar appreciation against all other currencies in the world predicts a 0.6% to 0.8% decline within a year in the volume of total trade between countries in the rest of the world, controlling for the global business cycle.

Relatedly, Bruno et al. (2018) underline the importance of the US dollar in global value chains (GVCs). Because, on the balance sheet of firms, inventories enter as assets that must be financed, the authors show that supply chains entail financing needs, mostly provided in dollars, financing needs increasing in a nonlinear way with the length of the supply chain. The interaction between the prevalence of dollar invoicing and the extensive use of the dollar as a financing currency for working capital in GVCs therefore also tightly links dollar movements with fluctuations in international trade. This latter channel works through a tightening of the financing constraints as opposed to an aggregate demand channel.

Another strand of the literature emphasizes the spillovers of the hegemon's monetary policy via asset markets. The importance of international monetary spillovers and of factors such as the world interest rate in driving capital flows is pointed out in the classic work of Calvo et al. (1996). Dollar dominance in banking and the dollarization of cross-border claims (see, for example, Avdjiev et al. 2015, 2016) imply that US monetary policy impulses get transmitted beyond US borders in international financial markets. Rey (2013) documents the existence of a global financial cycle and the fact that US monetary policy is one of its drivers. Miranda-Agrippino & Rey (2018) present evidence that US monetary policy gets transmitted across borders via its effect on asset prices, risk premia, credit creation, credit flows, and leverage. They find that one global factor, influenced by the Federal Reserve monetary policy, explains approximately one-quarter of the variance of risky asset prices around the world. Jorda et al. (2018) study the synchronization of financial cycles across 17 advanced economies over the past 150 years. They find that the comovement in credit, house prices, and equity prices has reached historical highs in the past three decades, and again estimate an important role of US monetary policy in driving risk premia. Cecchetti et al. (2017)

find that US monetary policy easing has effects of roughly similar magnitude on the risk-taking behavior of foreign financial firms and on those of US firms. Rey (2016) and Gerko & Rey (2017) show that US monetary policy affects financing conditions even in countries with flexible exchange rate regimes, such as Canada or the United Kingdom. This accumulation of evidence calls into question the well-known monetary policy trilemma, according to which a flexible exchange rate regime should enable monetary policy independence. In addition, Bruno & Shin (2015) show that a strong dollar is associated with tighter credit conditions worldwide. This link between currency appreciation and leverage implies that global liquidity conditions are sensitive to the dollar exchange rate (see also Borio & Zhu 2008, Cohen et al. 2017). Verdelhan (2018) also emphasizes the importance of a dollar factor in pricing bilateral exchange rates. Finally, Bernanke (2017) provides a thorough discussion of the international spillovers of the policy of the US Federal Reserve.

An interesting recent empirical literature uses detailed bank-level data to further investigate the international transmission of monetary policy. A few important examples include Cetorelli & Goldberg (2012), who use balance-sheet data to study the role of global banks in transmitting liquidity conditions across borders; Morais et al. (2018), who exploit credit registry data of the Mexican Central Bank and study the effect of foreign monetary policy on loan outcomes in Mexico; and Baskaya et al. (2017), who use finely disaggregated Turkish data on bank loans and highlight the importance of bank heterogeneity in the transmission of capital flow shocks to Turkish credit.

On the theoretical front, work on international monetary transmission and the global financial cycle has built on NK models. For example, Mukhin (2017) uses a model with endogenous currency choice and an analysis of monetary policy spillovers, Gourinchas (2018) uses an analysis of monetary policy spillovers from the United States to Chile, and Gertler et al. (2007) use a small open economy model with a financial accelerator. A fruitful research agenda could be to take into account the risk-taking channel of monetary policy. This could in turn provide a theoretical basis for the analysis of macroprudential policy for countries faced with large capital flows.

In summary, a growing body of evidence documents the dominance of the dollar in all of the classical functions of an international currency. Surprisingly, the dominance of the dollar has increased, not decreased, over time. This dollar dominance has critical implications for the transmission of monetary policy from the center to the periphery, whether by shaping export and import price and quantity responses or by affecting the balance sheet of large global financial institutions, their risk appetite, and the global synchronization of credit and financial cycles.

3. EXTERNAL BALANCE SHEETS AND EXTERNAL ADJUSTMENT

The previous section describes the importance of the US dollar in the international monetary and price system and how it shapes the spillovers from monetary policy at the center. This section focuses on the United States and analyzes how dollar dominance affects the external adjustment process of the hegemon itself.

The process of external adjustment, i.e., the economic mechanisms through which deficit or surplus countries satisfy their intertemporal budget constraints, has always been deeply intertwined with the organization and workings of the international monetary and financial system. By studying the empirical properties of the former, we can hope to learn about the latter.

According to Hume's (1752) classical price-specie flow theory, the settlement of trade imbalances under a gold standard proceeds more or less automatically via shipments of gold reserves. In the postwar era, the International Monetary Fund, created in 1944 as one of Bretton Woods' multilateral organizations, was designed specifically to facilitate the external adjustment process of deficit countries in a system of fixed but adjustable exchange rates. It provided member

countries with medium-term borrowing facilities, assorted with various forms of macroeconomic conditionality. That system suffered from two important asymmetries. First, as Keynes noted with some concern at the time of the Bretton Woods negotiations, surplus countries faced little or no pressure to reduce their external balances: Countries could choose to transform their trade surpluses into persistent reserve accumulation. Second, the United States, as the country at the center of the international monetary system, faced little external constraint given its ability to issue the world's reserve currency.

From this perspective, the external accounts and adjustment process of the United States are of particular interest. While the Bretton Woods system crashed de facto in 1971 when the link between the US dollar and gold was severed, the dollar has remained the undisputed world anchor and reserve currency since then, as discussed above (see also Ilzetzki et al. 2017). A critical question is whether and how the US external adjustment process has changed over time.

As issuer of the main reserve currency and global provider of liquidity, the United States' external balance sheet exhibits very specific characteristics, described in detail by Gourinchas & Rey (2007a, 2014). First, gross cross-border positions are large, reflecting the important role of the US dollar in international portfolios and in underpinning international transactions.[8] Second, the United States has a long position in risky securities, investing abroad in the form of foreign direct investment (FDI) and equity.[9] It has a short position in safe securities, issuing a large quantity of bonds, in particular US Treasuries, which are held by the rest of the world as safe assets (for discussions and models of the role of the demand for safe assets, and the ability of the United States to provide them, see Caballero et al. 2008, 2016, 2017). Thus, being long risky and short safe, the United States has historically played the role of a world banker. Furthermore, almost all of its external liabilities are denominated in dollars, whereas a sizable portion (approximately two-thirds) of its external assets are in foreign currencies.

To illustrate these balance sheet asymmetries, **Figure 4** shows the net positions in risky assets and safe liabilities for the United States and the rest of the world. The data are taken from Lane & Milesi-Ferretti (2018) and cover 1970–2015 at the annual frequency. We obtain the net risky position by adding portfolio equity and direct investment assets and subtracting portfolio equity and direct investment liabilities, and we obtain the net safe position by adding debt (portfolio debt and other investment) and reserve assets and subtracting debt liabilities. Those measures are then normalized by the total gross domestic product of each country or group. The contrast shown in the figure is striking: The rest of the world, which includes emerging markets but also Europe and Japan, have been long safe and short risky since the Asian financial crisis of 1997, while the United States is increasingly long risky and especially short safe. Within the rest of the world, emerging markets in particular have been rapidly accumulating safe assets (with a special appetite for US Treasuries) to insure against crises, while financial liberalization has enabled the United States—and other advanced economies—to invest in direct investment and portfolio equities abroad.

This asymmetric balance sheet provides both an intermediation margin to the United States and a differential valuation response to different types of shocks with important implications for the process of external adjustment. The United States earns an intermediation margin in the form of an excess return on its assets (risky) compared to its liabilities (safe). Gourinchas & Rey (2007a), getting some inspiration from the famous Giscard d'Estaing quote, call this excess return the exorbitant privilege. They estimate this excess return at approximately 2% a year in real terms

[8]Lane & Milesi-Ferretti (2001, 2007) provide seminal contributions on the gross external asset and liability positions of a large number of countries.

[9]Interestingly, this long risky position has declined since 2008 and the onset of the Global Financial Crisis.

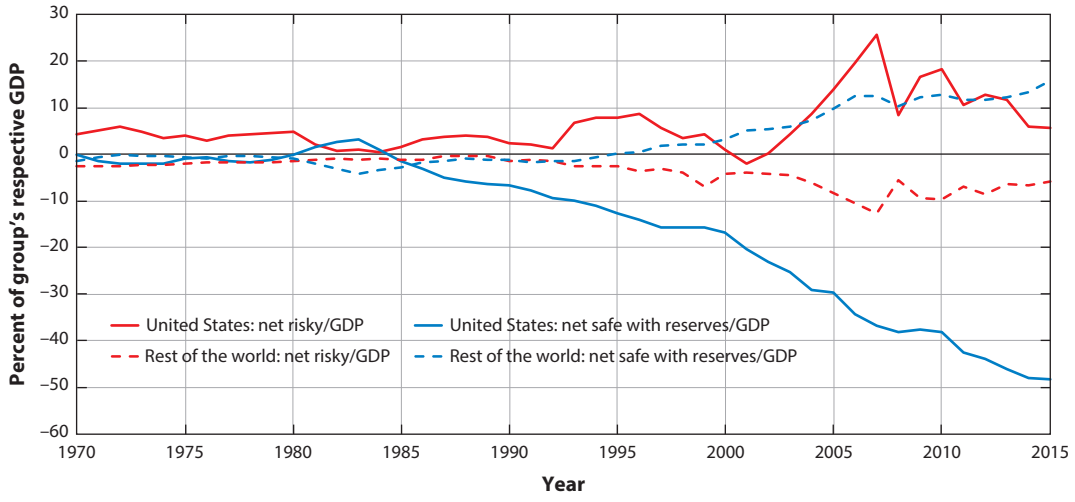

Figure 4

Net positions in risky assets and safe liabilities for the United States and the rest of the world. Data are from Lane & Milesi-Ferretti (2018) and cover 1970–2015 at an annual frequency. Net risky position is equal to portfolio equity assets + FDI assets − (portfolio equity liabilities + FDI liabilities). Net safe position is equal to reserve assets + debt assets − debt liabilities. Debt includes portfolio debt and other investment. Both positions are summed for all countries of each group, i.e., the United States and the rest of the world, and normalized by the GDP of the group in the given year. Abbreviation: FDI, foreign direct investment.

for the period 1952–2016 (see also Gourinchas et al. 2017). This enables the United States to run higher external deficits on average. In addition, the asymmetry in currency composition between assets and liabilities means that exchange rate fluctuations tend to be stabilizing. Everything else equal, a depreciation of the dollar increases the value of US external assets, while the dollar value of its liabilities remains constant. The net effect is an improvement in the US net external asset position.

This last observation suggests an additional channel of external adjustment, in addition to the standard trade channel emphasized in the literature: Because of the composition and size of its external balance sheet, the US external adjustment can operate via future valuation gains or losses. The latter represents what Gourinchas & Rey (2007b) call the valuation channel of adjustment.

The nature of the US external adjustment process and how it has changed over time were initially explored by Gourinchas & Rey (2007b). The remainder of this section revisits and updates their results using more recent data. Crucially, we are now in a position to explore the impact of the Great Recession. We establish three main empirical results. First, the valuation channel has been quite stable or even increasing in importance over time. Second, the trade channel has become markedly less important. These two findings highlight the increasing importance of gross financial flows and positions for the process of external adjustment. Third, the overall forecasting power of—properly measured—external imbalances for external returns or the trade balance remains strong, especially at longer horizons, even through the recent crisis. Taken together, these results indicate that an increasingly large share of the US adjustment process occurs through systematic convenience (safety or liquidity) yields earned on its external liabilities, relative to its external assets. This confirms that the United States and its currency occupy an increasingly central place in the international financial system, despite the relative decline of the US economy relative to world GDP.

3.1. External Adjustment

We build on the approach of Gourinchas & Rey (2007b), who find that valuation effects represent approximately one-third of the cyclical external adjustment of the United States over the 1952Q1–2004Q1 period.

The intuition for their approach is easy to grasp using a simplified framework. Consider the following log-linearized accumulation equation for the US net foreign asset position:

$$\Delta na_{t+1} \equiv na_{t+1} - na_t \approx r_{t+1} + (R-1)(na_t + nx_t). \qquad 1.$$

In this equation, na_t represents the cyclical component of the net foreign asset position, constructed from estimates of gross external assets and liabilities; nx_t represents the cyclical component of the trade balance, constructed from exports and imports; r_{t+1} is the (log) return on the net foreign asset position, i.e., a weighted return on gross external assets and gross external liabilities; and $R > 1$ is the steady-state gross return on the net foreign asset position.[10] Equation 1 states that the US net foreign asset position improves ($\Delta na_{t+1} > 0$) either when the United States runs a larger trade surplus ($nx_t > 0$) or when the United States earns higher returns on its assets than its liabilities ($r_{t+1} > 0$).

One can define a measure of cyclical external imbalances, $nxa_t = na_t + nx_t$; manipulate and iterate Equation 1 forward; impose a no-Ponzi condition; and take expectations to obtain

$$nxa_t \approx -\sum_{j=1}^{+\infty} \frac{1}{R^j} \mathbb{E}_t \left[r_{t+j} + \Delta nx_{t+j} \right] \equiv nxa_t^r + nxa_t^{\Delta nx}. \qquad 2.$$

Equation 2 is the key empirical equation for our analysis. It shows that movements in the cyclical trade balance and net foreign asset position encoded in nxa_t must forecast future external portfolio returns, future net export growth, or both.

An important advantage of this approach is that it imposes only minimal theoretical restrictions: a dynamic accumulation equation, a no-Ponzi condition, and a log-linearization. The first restriction is an accounting relation that must be satisfied. The second restriction could be violated if, for instance, markets incorrectly expect some external bailout or fail to anticipate a default on external debt. As for the log-linearization, its accuracy depends on the size of the underlying shocks. Consequently, Equation 2 provides a natural way to let the data speak about which channel of adjustment is most important in practice. A finding that the US external balance condition needs to be satisfied entirely via future trade surpluses (the trade channel), as encoded in $nxa_t^{\Delta nx}$, would indicate that the US position at the center of the international monetary system does not grant the country much additional flexibility. By contrast, a finding that the US external balance position can be satisfied via future expected valuation gains (the valuation channel), as encoded in nxa_t^r, would indicate that the United States extracts a substantial benefit from its position at the center of the international monetary system, relaxing the need to generate future trade surpluses. Importantly, adjustments through returns can occur via changes in the dollar exchange rate, as described above.

To estimate Equation 2, we construct nxa_t from quarterly estimates of the US gross external asset and liability positions at market value, as well as exports and imports, between 1952Q1 and 2015Q4. In the spirit of Campbell & Shiller (1988), we use a simple reduced-form vector

[10] For details on how to obtain this log-linearized accumulation equation, we refer the reader to Gourinchas & Rey (2007b). The cyclical components of the net foreign asset position and the trade balance are extracted using a very smooth Hodrick-Prescott filter with the smoothing parameter set so that the frequency gain of the filter is equal to 70% at the frequency corresponding to a 50-year cycle.

auto-regression (VAR) to decompose nxa_t into its different subcomponents, namely nxa_t^r, the part related to valuation adjustments, and $nxa_t^{\Delta nx}$, the part related to net exports.[11] Furthermore, nxa_t^r is decomposed into asset and liability return components nxa_t^{ra} and nxa_t^{rl}, and both are in turn decomposed into equity, FDI, debt, and other (bank loans and trade credit) components. We denote them nxa_t^{ria}, nxa_t^{ril} for $i \in \{e, f, d, o\}$. The data and methodology closely follow the work of Gourinchas & Rey (2007b), to which we refer the reader for details.

3.2. Trade and Valuation Channels of Adjustment: Quantification

Figure 5*a* reports the decomposition of the cyclical imbalance measure nxa_t into future valuation adjustment nxa_t^r and future net export adjustment $nxa_t^{\Delta nx}$. The second panel breaks down the return component into an asset part and a liability part.[12]

To get a sense of the long-run properties of nxa_t, we also report in **Table 2** a variance decomposition into each subcomponents, following Cochrane (1992). **Table 2** presents the decomposition for different values of the discount rate R^{-1} and for both our extended sample (1952Q1–2015Q4) and the original sample of Gourinchas & Rey (2007b) (1952Q1–2004Q1).[13]

Several features are noteworthy. First, the overall fit of the decomposition is good, as evidenced by the fact that predicted nxa_t, equal to $nxa_t^r + nxa_t^{\Delta nx}$, closely tracks actual nxa_t. More precisely, **Table 2** shows that together, nxa_t^r and $nxa_t^{\Delta nx}$ explain approximately 75% of all nxa_t variations for our benchmark value of $R^{-1} = 0.95$. Although this does not match the 91% explained in the original sample, we find these results to be surprisingly good given that the sample is now longer and includes periods of extreme variations with the Great Recession and euro area crisis. Second, as in Gourinchas & Rey (2007b), nxa_t^r and $nxa_t^{\Delta nx}$ are positively correlated, i.e., the valuation and trade effects are mutually reinforcing. This underlines the stabilizing role of capital gains in the external adjustment of the United States. In particular, dollar depreciations can be associated with both an improvement in net exports and a capital gain on the net foreign asset position. Third, valuation effects continue to be particularly important, as they explain approximately 34% of the cyclical external adjustment of the United States, which is higher than the 30% found by Gourinchas & Rey (2007b). In relative terms, the results are even more striking, with valuation effects explaining almost as much as trade adjustments (34% versus 41%), while they were less than half as important for 1952Q1–2004Q1 (30% versus 63%). This reflects to some extent the deterioration of the overall fit but also suggests that valuation changes have been particularly substantial during the recent crisis period. To gain further insights into those changes, we estimate the same unconditional variance decomposition on a rolling basis with 15-year windows.[14] This exercise is reported in **Figure 6**, with $\beta_p = \beta_r + \beta_{\Delta nx}$ representing the overall quality of the fit. While net exports account for a large share of the variance until the collapse of the dot-com bubble, their influence subsequently declines substantially, while the influence of valuation effects gradually rises. As a result, while the overall fit of the decomposition declines, the deterioration remains limited.

We attribute the decrease in the overall fit to the large fluctuations in asset prices occurring during the Global Financial Crisis of 2008 and the subsequent Eurozone debt crisis of 2010.

[11] The VAR includes r_t, Δnx_t, and nxa_t. We choose the order of the VAR, $p = 1$, according to standard lag-selection criteria.

Supplemental Material >

[12] The subcomponents by investment type are reported in **Supplemental Figure A1**.

[13] Specifically, we decompose the variance as follows: $1 = [\text{cov}(\text{nxa}, \text{nxa})]/[\text{var}(\text{nxa})] = [\text{cov}(\text{nxa}^{\text{r}}, \text{nxa})]/[\text{var}(\text{nxa})] + [\text{cov}(\text{nxa}^{\Delta\text{nx}}, \text{nxa})]/[\text{var}(\text{nxa})] \equiv \beta_{\text{r}} + \beta_{\Delta\text{nx}}$. In practice, βs are equivalent to the coefficients from regressing each part independently on nxa_t. We proceed similarly to obtain each detailed subcomponent.

[14] For this exercise, we reconstruct our estimate of nxa_t for each rolling window. This ensures that there is no look-ahead bias: The decomposition at time t does not incorporate information from time $s > t$.

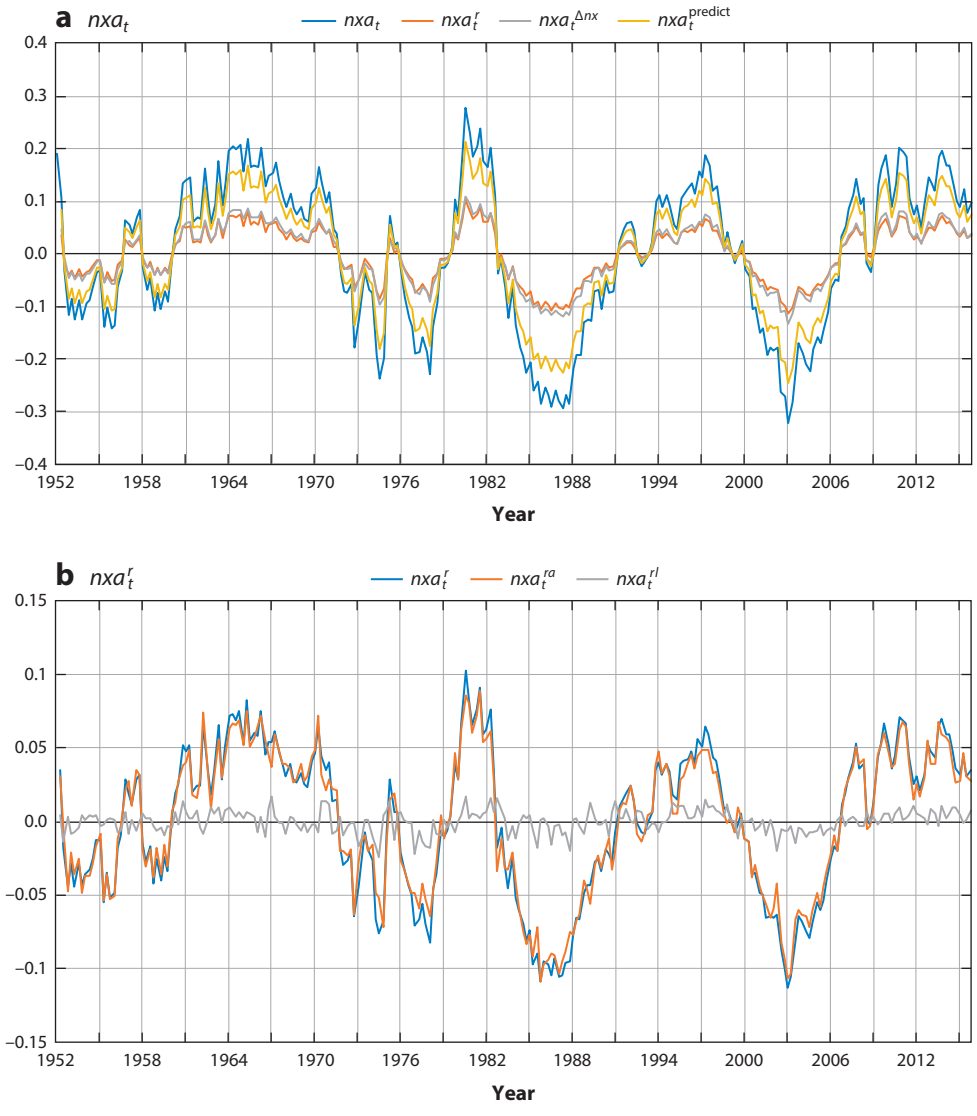

Figure 5

(*a*) Decomposition of nxa_t into return nxa_t^r, net exports $nxa_t^{\Delta nx}$, and total predicted $nxa_t^{predict}$ components. (*b*) Decomposition of nxa_t^r into asset return nxa_t^{ra} and liability return nxa_t^{rl} components.

We observe in particular a dramatic but temporary drop in the overall fit (β_p) after the collapse of Lehman Brothers in 2008, when the dislocation in financial markets was most severe. This episode is associated with extreme movements in asset prices and with a negative comovement of the net export growth component with nxa_t (for further discussion, see Gourinchas et al. 2017). It is likely that the quality of the log-linearization behind Equation 1 deteriorates significantly when asset markets experience a severe adjustment. Nevertheless, our methodology indicates an increased importance of the valuation component in an environment of increasingly large cross-border holdings.

Table 2 Unconditional variance decomposition of *nxa*

	Extended sample (1952Q1–2015Q4)			Original sample (1952Q1–2004Q1)		
Discount factor (R^{-1})	**0.96**	**0.95**	**0.94**	**0.96**	**0.95**	**0.94**
$\beta_{\Delta nx}$	50.47	40.72	33.39	70.78	62.67	55.60
β_{r}	31.33	34.03	34.87	26.40	30.18	32.37
β_{ra}	25.96	27.13	27.04	18.14	18.43	17.90
β_{rda}	0.62	0.63	0.62	0.15	0.09	0.04
β_{rea}	8.79	9.17	9.12	7.27	7.57	7.51
β_{rfa}	13.30	14.18	14.34	10.62	11.15	11.15
β_{roa}	3.24	3.14	2.95	0.10	−0.38	−0.81
β_{rl}	5.37	6.90	7.83	8.26	11.75	14.47
β_{rdl}	1.05	1.46	1.72	2.56	3.42	4.04
β_{rel}	2.09	2.48	2.68	1.73	2.64	3.38
β_{rfl}	2.20	2.55	2.71	1.84	2.68	3.35
β_{rol}	0.03	0.41	0.72	2.14	3.02	3.70
Total (β_p)	81.80	74.76	68.26	97.18	92.85	87.96

$\beta_{\Delta nx}$ (β_r) represents the share of the unconditional variance of *nxa* explained by future net export growth (future excess returns). β_{ra} (β_{rl}) represents the share of the unconditional variance of nxa^r explained by future returns on gross external assets (liabilities). β_{ria}, β_{ril} are the share of the unconditional variance explained by each subcategory of external assets (liabilities): $i \in$ {debt, equity, FDI, other}. Results for the original sample differ slightly from Gourinchas & Rey (2007b) because we reestimate coefficients at the more detailed level using each subcomponent of nxa^{ra} and nxa^{rl}. Abbreviation: FDI, foreign direct investment.

Note that, for both samples, the asset side is driving the vast majority of valuation changes. For instance, as shown in **Table 2**, nxa_t^{ra} explains approximately 27% of the overall variations in nxa_t in the extended sample, versus 7% for nxa_t^{rl}. This is also clear from **Figure 5*b***. Lastly, in terms of investment types, FDI and equity explain the bulk of valuation changes on the asset side (14% and 9%, respectively), while the other category, which includes in particular bank loans and trade credits, accounts for the remaining 3%, and debt is small. For liabilities, equity and FDI contribute an equal amount (2.5%), debt contributes slightly less (1.5%), and other liabilities are negligible. These findings are consistent with the composition of the US external balance sheet being highly asymmetric in terms of both risk taking, as it is long in risky assets (equity and FDI) and short in safe assets (debt and other), and currency composition, assets being mainly denominated in foreign currency and liabilities in dollars.

In conclusion, our empirical analysis of Equation 2 reveals that the valuation channel of adjustment has increased over time, even while the global economy and financial markets experienced substantial dislocation. If anything, this points to an increased dominance of the US dollar as the international reserve currency and store of value.

3.3. Predictability of the Trade and Adjustment Channels

According to our results, a substantial share of the adjustment process operates via future valuation gains. A direct implication is that the US external imbalances, as measured by nxa_t, must forecast future external portfolio returns r_{t+j}, future net export growth Δnx_{t+j}, or both, at least at some horizons. Evidence of return predictability would confirm that the US external adjustment process has profound implications for global asset markets as well as currency markets (we explore the latter specifically in Section 4).

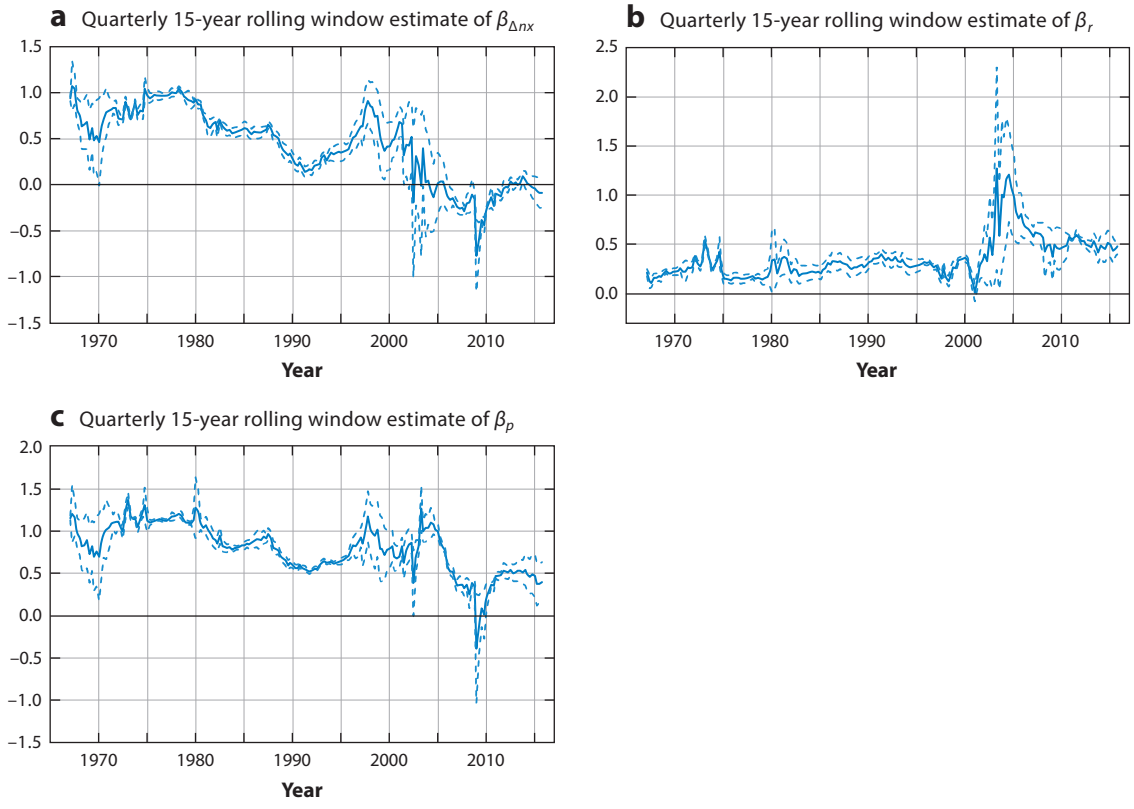

Figure 6

Rolling regressions equivalent of **Table 2**. In panels *a* and *b*, $\beta_{\Delta nx}$ and β_r represent the share of the unconditional variance of *nxa* explained by future net export growth and future excess returns, respectively. They are estimated by regressing $nxa^{\Delta nx}$ and nxa^{r} on *nxa* over 15-year rolling windows. In panel *c*, β_p captures the overall quality of the fit. Bands are 95% confidence intervals based on Newey-West standard errors. The full sample is 1952Q1–2015Q4. The date is the end of each rolling window.

To test this empirical prediction, we run short-term predictive regressions for returns on the US net external position. These regressions take the following form:

$$y_{t+1} = \alpha + \beta nxa_t + \delta z_t + \epsilon_{t+1}, \qquad 3.$$

where y_{t+1} is a quarterly return between t and $t+1$, z_t represents additional controls used in the literature, and ϵ_{t+1} is a residual. **Table 3** presents the results for both samples.

The most striking result is that, despite the fact that our extended sample includes the very turbulent recent economic period, the predictive power of nxa_t for the returns on the US external portfolio remains very strong. This is true if we look at both r_{t+j}, the future returns on the net foreign asset portfolio defined by Gourinchas & Rey (2007b), and $\Delta r^e_{t+j} = r^{ae}_{t+j} - r^{Je}_{t+j}$, the equity returns differential. The adjusted R^2 of the regression is 7–8%, and the negative and significant coefficients indicate that a positive deviation from trend ($nxa_t > 0$) predicts a decline in net portfolio return that is qualitatively consistent with Equation 2. Adding controls—lagged values, relative dividend–price ratios, and the stationary component of the trade balance—makes virtually no difference, and nxa_t remains a very strong predictor.

Table 3 Forecasting quarterly returns

z_t:	Total real return (r_{t+1})					Real equity differential (Δr^e_{t+1})			
		r_t	$\frac{d_t}{p_t} - \frac{d^*_t}{p^*_t}$	xm_t			Δr^e_t	$\frac{d_t}{p_t} - \frac{d^*_t}{p^*_t}$	xm_t
Extended sample (1952Q1–2015Q4)									
$\hat{\beta}$	**−26.31**	**−24.24**	**−33.45**	**−21.46**		**−11.22**	**−11.14**	**−14.63**	−6.41
	(5.49)	(5.00)	(6.97)	(9.84)		(2.15)	(2.15)	(2.74)	(3.50)
$\hat{\delta}$		**13.18**	−129.31	−8.60			1.43	−65.20	−8.53
		(6.38)	(146.18)	(13.66)			(6.02)	(58.31)	(4.93)
$\bar{R}^2$	0.08	0.09	0.11	0.08		0.07	0.07	0.12	0.08
Number of observations	255	254	137	255		255	254	137	255
Original sample (1952Q1–2004Q1)									
$\hat{\beta}$	**−35.73**	**−32.78**	**−45.99**	**−36.66**		**−13.46**	**−13.63**	**−16.64**	−7.27
	(7.26)	(7.26)	(8.42)	(15.87)		(3.01)	(3.14)	(3.30)	(5.80)
$\hat{\delta}$		8.87	−142.96	1.31			−0.85	−63.49	−8.72
		(7.30)	(159.58)	(18.59)			(6.90)	(61.08)	(6.82)
$\bar{R}^2$	0.10	0.10	0.15	0.10		0.07	0.07	0.12	0.08
Number of observations	208	207	136	208		208	207	136	208

Regressions are of the form $y_{t+1} = \alpha + \beta nxa_t + \delta z_t + \epsilon_{t+1}$, where y_{t+1} is the total real return (r_{t+1}) or the equity return differential ($\Delta r^e_{t+1} = r^{ae}_{t+1} - r^{le}_{t+1}$). $d_t/p_t - d^*_t/p^*_t$ is the relative dividend price ratio (available from 1970Q1 to 2004Q2), and xm_t is the stationary component from the trade balance. Robust standard errors are in parentheses. $\bar{R}^2$ is the adjusted R^2. Boldface entries are significant at the 5% level. All coefficients and standard errors are multiplied by 100. Standard errors are in parentheses.

Most importantly, the predictive power of the variable is not only significant, but also economically large: A 1-standard-deviation increase in nxa_t (13.97%) predicts a decline in the net external portfolio return of 368 basis points ($0.1397 \times 26.31/100$) over the next quarter, or approximately 15.53% in annualized terms, and a decline in the real equity returns differential of 157 basis points ($0.1397 \times 11.22/100$), or 6.42% in annualized terms. Thus, nxa_t turns out to have a remarkably robust predictive power for the excess returns on the external balance sheet of the hegemonic country throughout the post–World War II period and across multiple exchange rate regimes.

Another way to observe the resilience of the predictability relationship through time is to run our predictive regressions on a rolling basis. The result of this exercise is presented in **Figure 7**. Each panel shows the coefficient β_t of a regression similar to Equation 3 run on a 15-year rolling window.[15] We take as y_{t+1} the future returns on the net foreign asset portfolio r_{t+1} (**Figure 7*e***) and take the future differential returns for equity (Δr^e_{t+1}) (**Figure 7*a***) as in **Table 2**, but we also add the future differential returns for FDI (Δr^f_{t+1}) (**Figure 7*b***), debt (Δr^d_{t+1}) (**Figure 7*c***), and other investment (Δr^o_{t+1}) (**Figure 7*d***).

The **Figure 7** confirms the results of **Table 2**. Except for brief periods around the collapse of the Bretton Woods system and the burst of the dot-com bubble, the coefficients for net returns and equity returns differential stay of roughly the same magnitude. **Figure 7*a,d*** is also consistent with **Table 2** and the variance decomposition results: Most of the predictability seems concentrated on equity and FDI returns, with weaker predictability for debt and other investment returns. Two additional facts are notable. First, nxa_t did seem to negatively predict returns differential on debt and other investments from around 1985 to 1995. This period is characterized by large debt and bank flows in international capital flows, as many emerging markets liberalized their risky asset markets around the 1990s or later. Second, we emphasize that, when there is predictability, we

[15] For simplicity, we use the regression without controls for this exercise. Adding controls makes virtually no difference, as suggested by the results in **Table 2**.

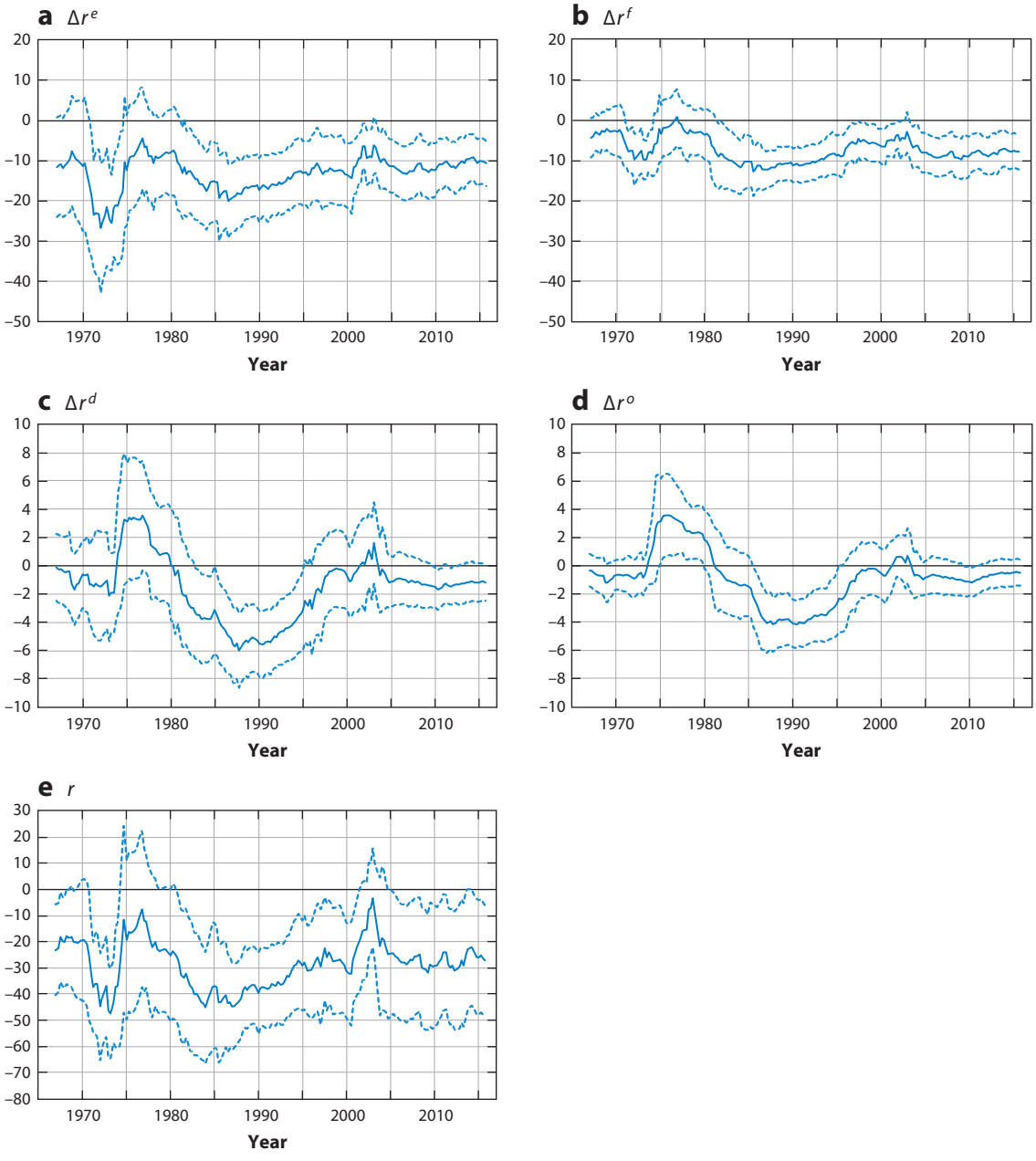

Figure 7

Rolling regressions equivalent of **Table 3**. We run regressions of the form $y_{t+1} = \alpha + \beta nxa_t + \epsilon_{t+1}$ on 15-year rolling windows. y_{t+1} is the total real return on the net external position (r_{t+1}), or return differentials for equity, FDI, debt, and other investment ($\Delta r^i_{t+1} = r^{ai}_{t+1} - r^{Ji}_{t+1}$ for $i \in \{e, f, d, o\}$). Bands are 95% confidence intervals based on Newey-West standard errors. The date is the end of each rolling window. All coefficients and standard errors are multiplied by 100.

Table 4 Long-horizon regressions

	Forecast horizon (quarters)							
	1	2	3	4	8	12	16	24
Extended sample (1952Q1–2015Q4): real total net portfolio return $r_{t,k}$								
nxa_t	**−26.31**	**−26.88**	**−27.26**	**−26.28**	**−18.94**	**−14.07**	**−11.30**	−4.85
	(5.49)	(5.20)	(5.07)	(4.86)	(4.32)	(3.77)	(3.47)	(2.52)
$\bar{R}^2(1)$	[0.08]	[0.14]	[0.21]	[0.24]	[0.24]	[0.20]	[0.18]	[0.06]
$\bar{R}^2(2)$	[0.11]	[0.20]	[0.29]	[0.34]	[0.36]	[0.32]	[0.29]	[0.14]
Extended sample (1952Q1–2015Q4): net export growth $\Delta nx_{t,k}$								
nxa_t	**−4.60**	**−4.38**	**−4.03**	**−3.86**	**−3.44**	**−3.43**	**−3.65**	**−3.52**
	(1.70)	(1.62)	(1.48)	(1.34)	(1.01)	(0.86)	(0.71)	(0.42)
$\bar{R}^2$ (1)	[0.02]	[0.04]	[0.05]	[0.07]	[0.12]	[0.19]	[0.29]	[0.46]
$\bar{R}^2$ (2)	[0.02]	[0.05]	[0.09]	[0.12]	[0.28]	[0.39]	[0.50]	[0.68]
Original sample (1952Q1–2004Q1): real total net portfolio return $r_{t,k}$								
nxa_t	**−35.73**	**−35.02**	**−35.04**	**−32.97**	**−21.86**	**−14.12**	**−9.88**	−3.48
	(7.26)	(6.90)	(6.76)	(6.60)	(6.38)	(5.26)	(4.66)	(3.66)
$\bar{R}^2(1)$	[0.10]	[0.17]	[0.23]	[0.26]	[0.21]	[0.12]	[0.08]	[0.02]
$\bar{R}^2(2)$	[0.14]	[0.24]	[0.34]	[0.38]	[0.35]	[0.24]	[0.19]	[0.16]
Original sample (1952Q1–2004Q1): net export growth $\Delta nx_{t,k}$								
nxa_t	**−7.84**	**−7.81**	**−7.48**	**−7.35**	**−6.64**	**−5.99**	**−5.58**	**−4.21**
	(2.26)	(2.18)	(1.96)	(1.72)	(1.04)	(0.79)	(0.65)	(0.54)
$\bar{R}^2$ (1)	[0.05]	[0.10]	[0.13]	[0.17]	[0.31]	[0.44]	[0.53]	[0.58]
$\bar{R}^2$ (2)	[0.04]	[0.08]	[0.12]	[0.17]	[0.38]	[0.55]	[0.66]	[0.79]

Regressions are of the form $y_{t,k} = \alpha + \beta nxa_t + \epsilon_{t+k}$, where $y_{t,k}$ is the k-period real total net portfolio return ($r_{t,k}$), or net export growth ($\Delta nx_{t,k}$). Newey-West robust standard errors are in parentheses with $k-1$ Bartlett window. Adjusted R^2 is in brackets. $\bar{R}(1)$ reports the adjusted R^2 of the regression on nxa_t, while $\bar{R}(2)$ reports the adjusted R^2 of the regression on ϵ_t^x, ϵ_t^m, ϵ_t^a, and ϵ_t^l, the stationary components of each variable. Boldface entries are significant at the 5% level. All coefficients and standard errors are multiplied by 100.

predict relative returns. In contrast, we find very limited evidence of predictability for the level of returns on gross assets (gross equity and gross FDI assets), and no evidence of predictability for returns on gross liabilities.

Finally, from Equation 2, the predictability has no reason to be limited to the next quarter. We conclude this discussion by turning to long-horizon regressions, in which we regress k-horizon average returns, $y_{t,k} \equiv k^{-1} \sum_{i=1}^{k} y_{t+i}$, on nxa_t. **Table 4** presents the results for horizons ranging from 1 to 24 quarters for net total portfolio returns ($r_{t,k}$) as well as net export growth ($\Delta nx_{t,k}$). We postpone the discussion of the latter up to this point because adjustment through the trade channel is likely to be taking place at horizons longer than one quarter. Note that the table reports results for two regressions, one regressing each $y_{t,k}$ on nxa_t directly and the other regressing $y_{t,k}$ on the components of nxa_t, i.e., the cyclical components of exports, imports, gross assets, and gross liabilities denoted ϵ_t^x, ϵ_t^m, ϵ_t^a, and ϵ_t^l, respectively. The regression results vary little between the two versions of the regression.

Table 4 shows that in-sample predictability for $r_{t,k}$ increases up to an adjusted R^2 of 24% at four- and eight-quarter horizons (34% and 36% with separate regressors) before decreasing back to 6% (14%) at a 24-quarter horizon. This confirms the findings of Gourinchas & Rey (2007b), as seen for the original sample, that external adjustment through the financial channel operates at short- to medium-term horizons (one quarter to two years).

The picture for net export growth is very different. A positive cyclical external imbalance predicts low future net export growth to restore equilibrium, which is consistent with Equation 2, but

this channel is active at longer horizons. In the short to medium term, in-sample predictability is low, while it increases substantially as the horizon lengthens, culminating in an adjusted R^2 of 46% at 24 quarters (68% with separate regressors). Therefore, the standard trade channel of external adjustment is also present, but it operates at longer horizons.

In summary, our analysis illuminates the type of mechanisms through which the center country of the international monetary system adjusts to external imbalances. Unlike in Hume's specie-flow, there is no mechanical adjustment in gold reserves. Contrary to the predictions of standard macroeconomic models, there is little evidence of adjustment via domestic macroeconomic policies that would shape future net exports, at least in the short to medium run. Instead, an increasing share of the adjustment takes place via predictable changes in the return on the US net foreign asset position. Adverse movements in the US net foreign asset positions predict positive future excess returns. These excess returns include (but are not limited to) convenience (liquidity or safety) yields on US external liabilities, relative to US external assets.[16] The stabilizing role of these excess returns highlights the unique position that the United States continues to occupy at the center of the international financial system and transcends any exchange rate regime arrangement in place since the early 1950s.

4. THE DOLLAR EXCHANGE RATE

A natural question to investigate is the role of the dollar exchange rate in the adjustment mechanism, especially in the post–Bretton Woods era of floating exchange rates. As discussed above, the asymmetry in the currency composition of external assets and liabilities of the United States implies that movements in the dollar exchange rate mechanically affect the external balance. Are these dollar exchange rate fluctuations systematically tied to our measure of cyclical imbalances? We turn to this question in this section. Predicting nominal exchange rates is notoriously difficult, as has been shown for instance by Froot & Rogoff (1995).[17] Our updated results reaffirm the findings of Gourinchas & Rey (2007b) that cyclical external imbalances are good predictors of the dollar exchange rate: nxa_t forecasts future exchange rate changes from one quarter ahead to long horizons (up to 24 quarters). We also compare our results with the recent literature exploring the explanatory power of the convenience yield on US Treasuries for dollar exchange rates (see Jiang et al. 2018a).

We begin by considering predictability at the one-quarter horizon. In **Table 5**, we run regressions of the form $y_{t+1} = \alpha + \beta nxa_t + \delta z_t + \epsilon_{t+1}$, with y_{t+1} being exchange rate changes. We use both an FDI-weighted measure (Δe_{t+1}) and the Federal Reserve trade-weighted multilateral exchange rate for major currencies (Δe^T_{t+1}). The sample covers the post–Bretton Woods period, from 1973Q1 to 2015Q4.

The results show that nxa_t has a strong predictive power for both measures. The coefficient is negative and significant, which is consistent with positive cyclical external imbalances predicting a depreciation of the dollar one quarter ahead. The effect is economically substantial, with a 1-standard-deviation decrease in nxa_t (13.97%) predicting a 95 basis-point ($0.1397 \times 6.83/100$) increase (3.87 percentage points in annualized terms) in the expected rate of depreciation.

[16] Because of the rapidly growing cross-border positions, in relation to the size of the economy over that period, even a small convenience yield can translate into substantial wealth transfers that alter the external adjustment dynamics.

[17] We focus mostly on in-sample predictability. In their classic paper, Meese & Rogoff (1983) show that predicting exchange rate out of sample is particularly difficult. Indeed, very few models are able to beat the prediction of exchange rates following a simple random walk at short horizons. Gourinchas & Rey (2007b) discuss the ability of nxa_t to predict exchange rate changes out of sample and show that it beats the random walk benchmark.

Table 5 Forecasting quarterly depreciation rates

	FDI-weighted (Δe_{t+1})					Trade-weighted (Δe^T_{t+1})			
z_t :		Δe_t	xm_t	$i_t - i^*_t$			Δe^T_t	xm_{t-1}	$i_t - i^*_t$
Extended sample (1952Q1–2015Q4)									
$\hat{\beta}$	**−6.83**	**−6.75**	**−6.85**	**−7.15**		**−6.73**	**−6.15**	−4.83	**−5.80**
	(1.59)	(1.65)	(2.90)	(1.78)		(1.84)	(1.74)	(2.46)	(1.70)
$\hat{\delta}$		1.33	0.04	29.53			10.84	−3.51	**−84.46**
		(6.80)	(4.50)	(31.36)			(6.80)	(4.05)	(33.25)
$\bar{R}^2$	0.07	0.06	0.06	0.07		0.08	0.08	0.08	0.10
Number of observations	172	172	172	172		171	170	171	171
Original sample (1952Q1–2004Q1)									
$\hat{\beta}$	**−8.42**	**−8.68**	**−9.99**	**−8.97**		**−9.01**	**−8.79**	**−8.02**	**−7.81**
	(1.95)	(2.20)	(3.64)	(2.30)		(2.26)	(2.34)	(3.23)	(2.19)
$\hat{\delta}$		−3.69	2.35	31.79			2.14	−1.46	−67.43
		(7.06)	(5.49)	(32.02)			(7.27)	(5.46)	(34.26)
$\bar{R}^2$	0.09	0.08	0.08	0.08		0.11	0.10	0.10	0.13
Number of observations	125	124	125	125		124	123	124	124

Regressions are of the form $y_{t+1} = \alpha + \beta nxa_t + \delta z_t + \epsilon_{t+1}$, where y_{t+1} is the FDI-weighted depreciation rate (Δe_{t+1}) or the trade-weighted depreciation rate (Δe^T_{t+1}). xm_t is the stationary component from the trade balance, and $i_t - i^*_t$ is the short-term interest rate differential (in %). Robust standard errors are in parentheses. $\bar{R}^2$ is the adjusted R^2. Boldface entries are significant at the 5% level. All coefficients and standard errors are multiplied by 100.

Several aspects are noteworthy. First, nxa_t does particularly well even at relatively short horizons. This is noteworthy given the typical difficulty in predicting exchange rates in standard empirical models. In that respect, the adjusted R^2 are quite high (approximately 7–10%). Second, adding control variables such as the interest rate differential or lags makes little difference. Third, when comparing results with those of the original sample of Gourinchas & Rey (2007b), the stability of the relationship is quite remarkable given that the Great Financial Crisis of 2008 and the euro area sovereign debt crisis are now included in the sample.

Let us turn to longer horizons. **Table 6** presents the same predictability results but for horizons ranging between 1 and 24 quarters. In-sample predictability increases with the horizon, with adjusted R^2 reaching an impressive 52% 12 quarters ahead (60% 16 quarters ahead if we use separate ϵ^zs as regressors). In other words, nxa_t is able to predict in-sample exchange rate changes in the short, medium, and long term. This suggests that two dynamics are at play. In the short to medium term, valuation effects are the main adjustment channels, and exchange rate changes participate by impacting the return on the net external portfolio. In the medium to long term, the valuation channel is mostly inactive, and returns are not predictable. However, the trade channel of adjustment becomes more relevant. We hypothesize that exchange rate changes remain predictable precisely because of their role for trade flows at longer horizons.

The most vivid way to visualize the predictive power of cyclical external imbalances for exchange rate changes is to look at **Figure 8**, which plots the FDI-weighted nominal effective depreciation rate from 1 to 12 quarters ahead against its fitted values using nxa_t and independently with ϵ^z as regressors. The increase in predictive power as the horizon grows is particularly striking. The figure also emphasizes that the nxa_t variable is able to pick up both the general tendencies in exchange rate changes and their turning points.

Table 6 Long-horizon regressions

	Forecast horizon (quarters)							
	1	**2**	**3**	**4**	**8**	**12**	**16**	**24**
FDI-weighted effective nominal rate of depreciation $\Delta e_{t,k}$: extended sample (1952Q1–2015Q4)								
nxa_t	**−6.83**	**−6.94**	**−6.93**	**−6.71**	**−6.44**	**−5.56**	**−4.64**	**−2.55**
	(1.59)	(1.50)	(1.40)	(1.31)	(1.00)	(0.81)	(0.71)	(0.67)
$\bar{R}^2$ (1)	[0.07]	[0.14]	[0.23]	[0.28]	[0.47]	[0.52]	[0.48]	[0.23]
$\bar{R}^2$ (2)	[0.06]	[0.14]	[0.23]	[0.29]	[0.49]	[0.59]	[0.60]	[0.41]
FDI-weighted effective nominal rate of depreciation $\Delta e_{t,k}$: original sample (1952Q1–2004Q1)								
nxa_t	**−8.42**	**−8.16**	**−8.09**	**−7.80**	**−6.96**	**−5.58**	**−4.20**	**−1.96**
	(1.95)	(1.84)	(1.75)	(1.64)	(1.40)	(1.10)	(1.02)	(1.00)
$\bar{R}^2$ (1)	[0.09]	[0.16]	[0.27]	[0.31]	[0.41]	[0.41]	[0.33]	[0.12]
$\bar{R}^2$ (2)	[0.10]	[0.21]	[0.35]	[0.40]	[0.52]	[0.55]	[0.55]	[0.38]

Regressions are of the form $y_{t,k} = \alpha + \beta nxa_t + \epsilon_{t+k}$, where $y_{t,k}$ is the k-period FDI-weighted depreciation rate ($\Delta e_{t,k}$). Newey-West robust standard errors are in parentheses with $k-1$ Bartlett window. Adjusted R^2 is in brackets. $\bar{R}(1)$ reports the adjusted R^2 of the regression on nxa_t; $\bar{R}(2)$ reports the adjusted R^2 of the regression on $\epsilon_t^x, \epsilon_t^m, \epsilon_t^a$, and ϵ_t^l, the stationary components of each variable. The sample is 1973Q1–2015Q4. Boldface entries are significant at the 5% level. All coefficients and standard errors are multiplied by 100.

We next turn to a comparison of our results with those of Jiang et al. (2018a), who also emphasize the specific features of dollar assets in the international financial system. In that paper, the authors propose a theory of dollar exchange rate determination based on the convenience yields offered by US safe securities. Specifically, US Treasuries and US deposits offering the LIBOR rate provide a convenience yield to investors both in the United States and abroad. This convenience yield measures the nonpecuniary value that investors impute to the safety and liquidity properties of US safe assets (see also Krishnamurthy & Vissing-Jorgensen 2012). When an episode of global financial instability occurs, the flight to the safety and liquidity of US securities drives up their convenience yield. A transitory flight to safety results in a surge in demand for US assets and is reflected in a contemporaneous appreciation of the US dollar, followed by an expected depreciation over subsequent periods. This theory suggests that movements in convenience yields can predict movements in the dollar exchange rate. In a recent paper, Engel & Wu (2019) also explore the link between liquidity yield and exchange rate movements and conclude that liquidity yields are an important determinant of exchange rates for all the G10 countries.

In this section, we compare the information contained in convenience yields constructed by Jiang et al. (2018a) and those contained in our measure of cyclical imbalances nxa_t for the dollar exchange rate predictability. Jiang et al. (2018a) proxy the convenience yield with the Treasury basis, i.e., the yield difference between onshore and offshore Treasuries of identical maturity, denoted x_t^{Treas}. The predictability of nxa_t for excess returns (the valuation channel of adjustment) is consistent with, but is not limited to, the existence of a convenience yield on US external liabilities relative to US external assets, both broadly defined. Our approach does not take a specific stance on which asset pair, if any, will exhibit an excess return in equilibrium. More broadly, it captures the equilibrium global banker and insurer functions of the hegemon. For instance, our approach is valid whether onshore Treasuries are cheaper than offshore ones [the convenience yield of Jiang et al. (2018a)] or whether the excess return manifests itself in the asymmetric composition of the external balance sheet, with more risky assets on the asset side and more safe liabilities on the liability side (for an early discussion of within and between excess returns on the US external balance sheet, see Gourinchas & Rey 2007a).

We adopt an empirical specification similar to that of Jiang et al. (2018a) and regress the rate of depreciation of the dollar on the Treasury and LIBOR bases, x_t^{Treas} and x_t^{LIBOR}, respectively,

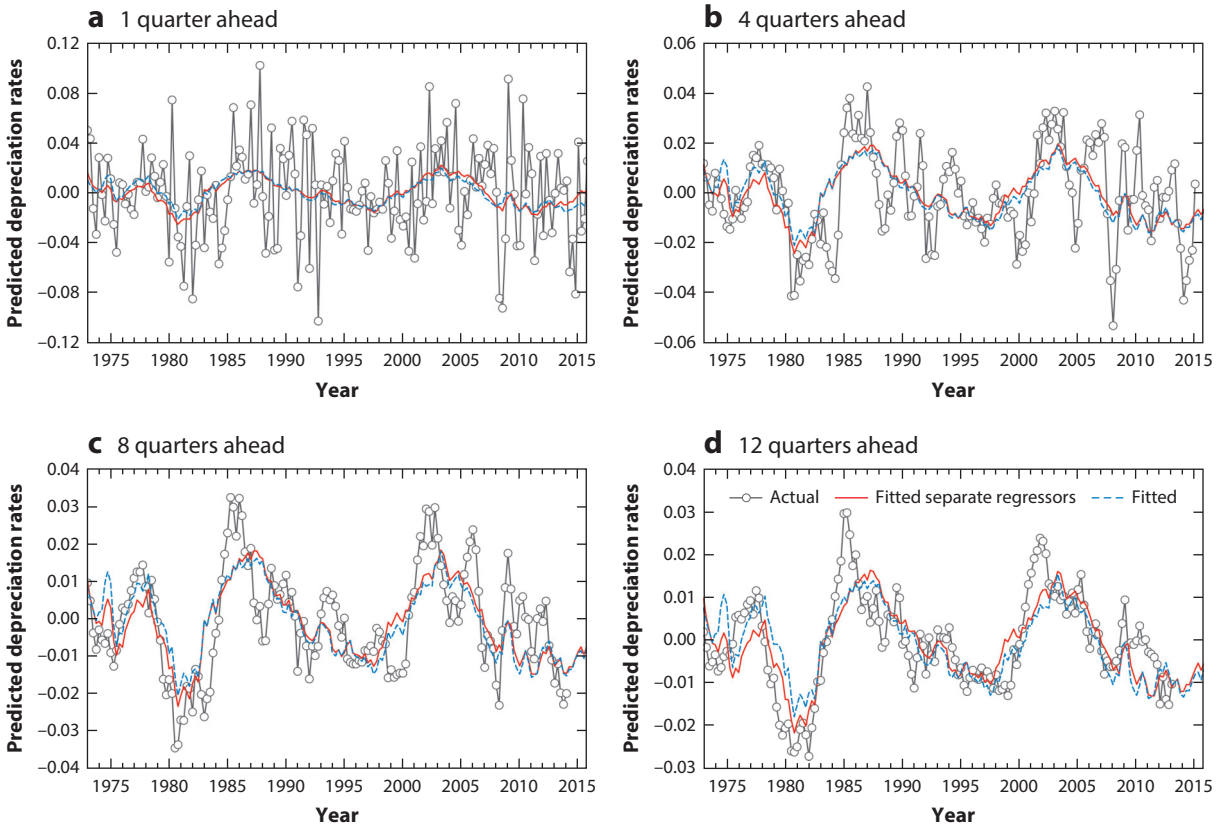

Figure 8

Predicted depreciation rates 1 to 12 quarters ahead. Each graph reports the realized depreciation rate at the 1- to 12-quarter horizons (*dotted black line*), the fitted depreciation rate using *nxa* (*dashed blue line*), and the fitted depreciation rate using ϵ^x, ϵ^m, ϵ^a, and ϵ^l as separate regressors (*solid red line*).

alongside nxa_t.[18] In their paper, and our results below, the basis is defined such that a decrease corresponds to an increase in convenience yields and should be associated with an immediate appreciation of the dollar exchange rate, followed by a subsequent depreciation.[19] We run both univariate predictability regressions, in which exchange rate changes are regressed on each measure separately, and multivariate ones, in which we include all variables as regressors.[20] Results are presented in **Table 7**.[21]

[18]As in Jiang et al.'s paper, we also add the innovations to change in the bases, obtained as the residual $\varepsilon_t^{\text{Treas}}$ from the following regression: $x_t^{\text{Treas}} - x_{t-1}^{\text{Treas}} = \alpha + \beta_1(i_{t-1}^{\$} - i_{t-1}^{*}) + \beta_2 x_{t-1}^{\text{Treas}} + \varepsilon_t^{\text{Treas}}$. Innovations to the LIBOR basis are obtained in a similar fashion.

[19]The only additional difference from previous regressions is that the sample is now limited to 1988Q1–2015Q4 due to the availability of the basis measures.

[20]Note that for univariate regressions, the innovations to Δx_t and Δx_{t-1} are always included as controls alongside the basis in level. As suggested by Jiang et al. (2018a), we also run the univariate regressions using the interest rate differential di_t both as independent regressor and as control. Results are mostly unaffected, and these are omitted in the interest of space. We keep the interest rate differential as a control in the multivariate regressions.

[21]We use the FDI-based exchange rate measure extended from Gourinchas & Rey (2007b). Results are similar if we use the measure of Jiang et al. (2018a), although the basis measure has a stronger predictive power at

Table 7 Predictability at several horizons with nxa_t and basis measures of Jiang et al. (2018a)

		Forecast horizon (quarters)							
		1	2	3	4	8	12	16	24
Univariate regressions									
nxa_t	Coefficient	**−5.22**	**−5.64**	**−6.03**	**−5.82**	**−5.96**	**−4.92**	**−4.50**	**−3.13**
	p-value	(0.03)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Adjusted R^2	[0.02]	[0.07]	[0.14]	[0.18]	[0.43]	[0.51]	[0.56]	[0.37]
x_t^{Treas}	Coefficient	7.41	5.48	1.46	−0.99	−0.74	−1.59	−1.36	−0.79
	p-value	(0.06)	(0.06)	(0.60)	(0.71)	(0.65)	(0.25)	(0.30)	(0.47)
	Adjusted R^2	[0.04]	[0.00]	[−0.02]	[−0.01]	[−0.03]	[−0.01]	[−0.01]	[−0.02]
$\Delta x_t^{\text{Treas}}$	Coefficient	−4.80	−5.54	−0.82	2.02	0.90	1.73	1.44	0.68
	p-value	(0.26)	(0.06)	(0.79)	(0.47)	(0.56)	(0.20)	(0.22)	(0.52)
	Adjusted R^2	[0.04]	[0.00]	[−0.02]	[−0.01]	[−0.03]	[−0.01]	[−0.01]	[−0.02]
$\Delta x_{t-1}^{\text{Treas}}$	Coefficient	**−6.60**	−3.40	−0.34	0.74	0.13	0.52	0.45	0.16
	p-value	(0.00)	(0.09)	(0.86)	(0.60)	(0.88)	(0.41)	(0.34)	(0.75)
	Adjusted R^2	[0.04]	[0.00]	[−0.02]	[−0.01]	[−0.03]	[−0.01]	[−0.01]	[−0.02]
x_t^{LIBOR}	Coefficient	2.39	−2.55	−1.89	−1.44	0.80	2.31	0.72	2.82
	p-value	(0.65)	(0.52)	(0.61)	(0.66)	(0.75)	(0.30)	(0.70)	(0.07)
	Adjusted R^2	[0.02]	[−0.01]	[−0.01]	[−0.03]	[−0.02]	[0.00]	[−0.01]	[0.03]
$\Delta x_t^{\text{LIBOR}}$	Coefficient	2.39	4.10	2.73	1.78	−0.81	−1.99	−0.15	−2.60
	p-value	(0.69)	(0.36)	(0.48)	(0.60)	(0.75)	(0.37)	(0.94)	(0.10)
	Adjusted R^2	[0.02]	[−0.01]	[−0.01]	[−0.03]	[−0.02]	[0.00]	[−0.01]	[0.03]
$\Delta x_{t-1}^{\text{LIBOR}}$	Coefficient	−2.62	0.25	−0.20	0.48	−1.06	−1.04	−0.15	−1.36
	p-value	(0.47)	(0.93)	(0.93)	(0.77)	(0.42)	(0.32)	(0.88)	(0.09)
	Adjusted R^2	[0.02]	[−0.01]	[−0.01]	[−0.03]	[−0.02]	[0.00]	[−0.01]	[0.03]
Multivariate regressions									
nxa_t	Coefficient	**−6.20**	**−6.69**	**−7.06**	**−6.88**	**−6.57**	**−5.28**	**−4.72**	**−3.49**
	p-value	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
x_t^{Treas}	Coefficient	**9.95**	**7.89**	1.82	−0.81	−1.24	**−2.18**	−1.54	−1.76
	p-value	(0.03)	(0.01)	(0.47)	(0.76)	(0.30)	(0.02)	(0.09)	(0.05)
x_t^{LIBOR}	Coefficient	−3.02	−5.91	−1.89	−0.87	0.59	1.99	0.59	**3.34**
	p-value	(0.63)	(0.16)	(0.57)	(0.76)	(0.72)	(0.17)	(0.62)	(0.01)
$\Delta x_t^{\text{Treas}}$	Coefficient	−8.06	**−7.80**	−0.67	2.80	2.00	**2.69**	1.64	1.60
	p-value	(0.13)	(0.03)	(0.83)	(0.33)	(0.10)	(0.01)	(0.07)	(0.08)
$\Delta x_t^{\text{LIBOR}}$	Coefficient	5.82	7.19	1.70	−0.68	−1.65	−2.63	−0.64	**−3.24**
	p-value	(0.45)	(0.15)	(0.64)	(0.82)	(0.38)	(0.10)	(0.61)	(0.02)
$\Delta x_{t-1}^{\text{Treas}}$	Coefficient	**−7.87**	−3.86	0.94	1.33	1.15	**1.19**	0.68	0.80
	p-value	(0.03)	(0.10)	(0.59)	(0.42)	(0.11)	(0.04)	(0.12)	(0.11)
$\Delta x_{t-1}^{\text{LIBOR}}$	Coefficient	2.97	2.49	−1.48	−0.60	−1.66	−1.37	−0.35	**−1.66**
	p-value	(0.51)	(0.36)	(0.45)	(0.72)	(0.17)	(0.11)	(0.58)	(0.02)
	adj.-R^2	[0.07]	[0.12]	[0.17]	[0.21]	[0.47]	[0.57]	[0.59]	[0.50]

The dependent variable is the FDI-weighted depreciation rate, $\Delta e_{t,k} = e_{t+k} - e_t$, extended from Gourinchas & Rey (2007b). The sample is 1988Q1–2015Q4. nxa_t weights are computed on the full sample (1952Q1–2015Q4). The first section presents the results for univariate regressions of the form $\Delta e_{t,k} = \alpha + \beta v + \epsilon_t$ with $v \in \{nxa_t, x_t^{\text{Treas}}, x_t^{\text{LIBOR}}, di_t\}$. For the univariate regressions, on each x_t, the corresponding Δx_t and Δx_{t-1} are also included as controls. The second section presents the results for multivariate regressions of $\Delta e_{t,k}$ on all variables together, also controlling for interest rate differential. Standard errors are computed using Newey-West with Bartlett windows of $k - 1$ quarters, and p-values are reported in parentheses. Boldface entries are significant at the 5% level. All coefficients are multiplied by 100, and basis measures are expressed in percentage points to make the magnitude of the coefficients broadly comparable (in terms of the effect of a 1-standard-deviation change).

We focus first on the univariate regressions. For short horizons, one to two quarters ahead, nxa_t and the US Treasury basis x_t^{Treas} are significant at the 5% and 10% level, respectively, and the coefficients are of similar magnitude. Note that the coefficient on the basis measure is positive, i.e., a higher convenience yield (associated with a lower basis) is associated with a subsequent appreciation of the dollar exchange rate, not a depreciation. These results are consistent with Jiang et al.'s (2018a) own findings, which they attribute to momentum in currency markets. Similarly, an increase in nxa_t corresponds to a future appreciation of the dollar exchange rate, delivering negative excess returns, also as suggested by theory. Both effects are economically large: A 1-standard-deviation lower basis (0.2482%) predicts an annualized 7.56-percentage-point decrease in the depreciation rate one quarter ahead (5.55 percentage points two quarters ahead), while a 1-standard-deviation decrease in nxa_t (13.97%) predicts an annualized 2.95-percentage-point increase one quarter ahead (3.19 percentage points two quarters ahead). At one quarter, both variables do roughly as well in terms of adjusted R^2 (4% for x_t^{Treas} versus 2% for nxa_t), but from two quarters ahead onwards, the adjusted R^2 for nxa_t becomes significantly larger. The LIBOR basis does not do as well, with the coefficient being smaller and insignificant. This is also documented by Jiang et al. (2018b), who show that the LIBOR basis helps mostly on the most recent part of the sample, after the Great Recession. Finally, note that the effect of the innovations to the Treasury basis measure Δx^{Treas} have roughly the same magnitudes, albeit with a flipped sign and varying significance levels. Innovations to the LIBOR basis are mostly insignificant.

As the horizon extends, the picture changes. First, the coefficient on the Treasury basis changes sign, as in the work of Jiang et al. (2018a), so that it now becomes consistent with the authors' prediction: An increase in convenience yield is associated with a dollar depreciation in the future. However, in the univariate regressions, the predictive power of the basis measures decreases sharply, with very small adjusted R^2. Using the exchange rate measure from Jiang et al. (2018a) as in **Supplemental Table A1** does not alter the results, except at the 3-year horizon for which the coefficient on x_t^{Treas} becomes larger (roughly on par with nxa_t) and significant (p-value = 2%). By contrast, the predictive power of nxa_t grows strongly with the horizon, with coefficients staying broadly stable. This is the case for both measures of exchange rate changes.

Supplemental Material >

The results from the multivariate regressions also prove informative. Interestingly, using both nxa_t and the basis in the regression appears to help x_t^{Treas} achieve stronger significance and slightly larger coefficients. At the 12-quarter horizon, a 1-standard-deviation lower basis (0.2482%) does predict an annualized 2.18-percentage-point increase in the depreciation rate, with a p-value of 2%, versus an annualized 2.98-percentage-point increase for a 1-standard-deviation decrease in nxa_t (p-value $\approx$ 0%). At long-term horizons (16 and 24 quarters), x_t^{Treas} remains significant (p-values of 9% and 5%, respectively), but with coefficients becoming significantly smaller. The coefficient for nxa_t remains broadly stable from one to 24 quarters ahead, and always strongly significant (p-value $\approx$ 0% for all horizons).

Taken together, those results suggest that, first, x_t^{Treas} and nxa_t capture complementary channels: a flight-to-safety channel for convenience yields and a broader valuation channel, including a convenience yield, for nxa_t. Combining the two measures leads to striking predictive power at all horizons, with adjusted R^2 ranging from 7% to 59%. Further documenting this complementarity is an interesting avenue that we leave for future research. Second, controlling for additional variables, such as the interest rate differential, makes little difference. Third, the fact that nxa_t stays important at most horizons, even when controlling for basis measures and other variables, suggests that it captures more than just the short-term demand for safe assets. Indeed, this emphasizes that

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the three-year horizon (roughly on par with nxa_t). Those results are reported in **Supplemental Table A1**. In addition, the weights for the nxa_t measure are based on the full extended sample (1952Q1–2015Q4), but results are unchanged if we reestimate them on the limited sample (1988Q1–2015Q4).

nxa_t also includes cyclical adjustments through trade, as well as valuation effects on other assets such as equity and FDI, and that these are also important in predicting exchange rates. This is consistent, for instance, with the last leg of the portfolio rebalancing model developed and tested by Hau & Rey (2004, 2006) and Camanho et al. (2018). In this model, return changes on assets held in other countries, particularly equities, lead to a change in currency exposure that investors want to counterbalance. This leads to portfolio rebalancing, which in turn affects the exchange rate.

5. EXORBITANT PRIVILEGE

The country at the center of the international monetary system, the hegemon, issues the dominant currency. There are important interrelated functions of international currencies in goods and asset markets. The implications of the process of international adjustment for the hegemon depends on the rules of the games of the international monetary system. Under Bretton Woods, dollar balances were held abroad to perform international payments. In our fiat currency system, being the hegemon confers a specific ability to issue large amounts of nominally safe liabilities (dollar securities), which are happily absorbed by the rest of the world. Thus, the view is that, in case of a deficit, the United States does not have to take restrictive measures, so that the dollar is not an impartial means of international exchange. This is the essence of the exorbitant privilege. Different aspects of this exorbitant privilege have been characterized in different ways by a series of papers in the literature. Gourinchas & Rey (2007a) construct estimates of external assets and liabilities of the United States at market value at the quarterly frequency for the entire postwar period. They emphasize that the characteristics of its balance sheet make the US akin to a world banker or even a world venture capitalist due to the asymmetry between risky assets and safe liquid liabilities. They compute the first estimates of the excess returns on the US net foreign asset position (see also Curcuru et al. 2008, Lane & Milesi-Ferretti 2009): These are sizable, approximately 2% per year in real terms. Those excess returns and the associated valuation channel of adjustment (Section 3) (see Gourinchas & Rey 2007b) ease the process of external adjustment for the United States. This is precisely what Gourinchas & Rey (2007a) call the exorbitant privilege. Gourinchas et al. (2017) go a lot further. They derive the external balance sheet of the United States as an optimizing problem in general equilibrium when the United States has a comparative advantage in risk taking. The key assumption is that the United States is less risk averse as a country than the rest of the world. Maggiori (2017) shows that this asymmetry in risk aversion can be microfounded from differences in degrees of frictions in capital markets in the United States versus the rest of the world. In his model, a tighter constraint in the banking system of the rest of the world looks like a higher aggregate degree of risk aversion of the rest of the world.[22] Maggiori (2017) derives the implications of these financial imperfections on external asset positions, while Gourinchas et al. (2017) draw the implications of their risk-sharing model. In global crisis times, the United States, which is less risk averse, insures the rest of the world, which receives a substantial wealth transfer. The value of the risky external assets of the United States collapses, while the value of its liabilities (mostly reserve assets) goes up, and an insurance transfer is made from the United States to the rest of the world (for a detailed empirical analysis of bilateral gains and losses during the 2008 financial crisis, see Gourinchas et al. 2012). Therefore, in the work of Gourinchas et al. (2017), the United States is the world insurer, and the exorbitant privilege is an insurance fee being paid in normal times in exchange for an insurance transfer—the exorbitant duty—being implemented in global crisis times via the structure of the external portfolio of the United States.

[22]Another possible microfoundation can be found in the work of Mendoza et al. (2009), where it is a better ability to share idiosyncratic risk within the United States, which enables the United States to be long in risky assets internationally.

In contrast, Farhi & Maggiori (2018) interpret the exorbitant privilege as a monopoly rent that the United States can extract as the sole issuer of the international currency.[23] In their model, the center country is the sole issuer of reserve assets demanded by the rest of the world, and it faces a commitment problem. Ex post, in bad states of the world, the hegemon faces a tradeoff between inflating away the debt to limit real repayments and incurring the cost of default. Ex ante, the center country chooses how much debt to issue before interest rates are determined. This allows for the possibility of self-fulfilling confidence crises as defined by Calvo (1988), where the hegemon depreciates its currency when expectations of investors are adverse. In this setting, the hegemon obtains monopoly rents in the form of a positive endogenous safety premium on reserve assets. He et al. (2019) investigate why US debt appears to have high valuations relative to the debt of other countries with similar fundamentals (see also Krishnamurthy & Vissing-Jorgensen 2011, 2012; Hassan 2013). He et al. (2019) interpret the safety property of a reserve currency as being the result of a coordination game of investors buying that currency and propping up its value. In their model, for a country's bond to be safe, the number of investors who invest in the bond must exceed a threshold, which is decreasing in the country's fundamentals and increasing in the size of the debt. Thus, the safety of an asset and the exorbitant privilege are linked to the complementarities in the strategy of investors. In a model with complementarities between invoicing and banking, Gopinath & Stein (2018a) interpret the deviation of interest rate parity due to the large demand for dollars as an exorbitant privilege. Finally, several authors, including Maggiori et al. (2019), have emphasized the specific liquidity properties of US dollar bond markets, which enable easier access to funds for corporations—even including small companies—issuing in dollars. All of these factors represent some facets of the exorbitant privilege enjoyed by the hegemon.

6. THE NEW TRIFFIN DILEMMA

Observers of the gold standard and Bretton Woods systems have long noted the tension between the international liquidity provision function of the hegemon and the net asset position backing the gold-like liquidity being issued. Triffin (1961) points out that, for the United States to issue enough reserve assets to lubricate payment adjustment, it must run balance of payments deficits under official settlements as it accumulates liabilities to foreign officials without increasing official assets like gold. In a context where the dollar value is fixed against gold, this could decrease foreign confidence in the dollar, and there would be an unavoidable run on the dollar. If, on the contrary, the United States were to limit its provision of liquid reserve assets to the world, then as the world economy grew, so would liquidity demand, and there would be a shortage of reserve assets, which would impede international transactions. This is the Triffin dilemma.[24] Kenen (1960) addresses this issue with a formal model of the dynamics of the balance of payments of the reserve currency country in the context of the gold standard when new gold production is not enough to satisfy the increase in world liquidity demand. He shows that the system can become unstable, especially in a context where there are swift increases of private dollar holdings abroad. Despres et al. (1966), labeling themselves as the minority view given the influence of the position of Triffin at the time, question the unavoidability of a run on the dollar and emphasize the role of the United States

[23] Farhi & Maggiori (2018) also consider the oligopolistic case of several suppliers of the reserve assets and study the stability of this case.

[24] Triffin thought that this situation would lead to the collapse of Bretton Woods and to a deflation. The first of these two implications turned out to be correct. According to Eichengreen (1992), Feliks Mlynarski made a parallel observation in 1929, arguing that once outstanding liabilities to the rest of the world exceeded the US monetary gold stock, there would be a run on the dollar, a tightening of monetary policy, and depression (see Mlynarski 1929).

as a financial intermediary in a world where US markets had more breadth and liquidity than European ones. They argue that there is nothing ominous in the balance of payments deficits of the United States, as they reflect the activity of a world banker lending long term and borrowing short term, just as New York banks lent to the rest of the United States. They dismiss the possibility of a run on the dollar as reflecting purely the nervousness of some Central Bankers and academic economists. As should be clear from the above description, and as has been noted, e.g., by Portes (2012) and Bordo & McCauley (2018), the Triffin dilemma has nothing to do with the current account deficits of the United States (those are net flows). Fundamentally, the Triffin dilemma is about the magnitude of the gross stock of liquid dollar liabilities held abroad (necessary to lubricate the international payment system) and the possible loss of confidence in the value of the dollar by foreign investors, whether due to policies, sentiment, or fundamentals (e.g., relative size of the hegemon in the world economy). This is the reason why the Triffin dilemma has not lost its relevance, even in an international monetary system that lacks a formal anchor.

Gourinchas & Rey (2007a, p. 35) write:

> Triffin saw that in a world where the fluctuations in gold supply were dictated by the vagaries of discoveries in South Africa or the destabilizing schemes of Soviet Russia, but in any case unable to grow with world demand for liquidity, the demand for the dollar was bound to eventually exceed the gold reserves of the Federal Reserve. This left the door open for a run on the dollar. Interestingly, the current situation can be seen in a similar light: in a world where the US can supply the international currency at will, and invests it in illiquid assets, it still faces a confidence risk. There could be a run on the dollar not because investors would fear an abandonment of the gold parity, as in the seventies, but because they would fear a plunge in the dollar exchange rate. In other words, Triffin's analysis does not have to rely on the gold-dollar parity to be relevant.

Thus, Gourinchas & Rey (2007a) argue that even under our post-1973 flexible exchange rate regime, the international monetary and financial system faces a new Triffin dilemma. This point is also emphasized by Farhi et al. (2011), Obstfeld (2011), and Farhi & Maggiori (2018).

The ability of the United States to be a global insurer and act as a global liquidity provider hinges on the capacity of the country to credibly issue safe assets, chiefly government bonds, private sector safe assets having shown their nonrobustness during the 2008 crisis.[25] During times of global crisis, US government bonds are, at present, the only assets able to provide insurance on a large scale (see Gourinchas et al. 2017). These are backed by the fiscal capacity of the US government. Although the gold value of the dollar is no longer fixed, as it was in the Bretton Woods system, there is a growing asymmetry between the fiscal capacity of the United States (the backing of US Treasury bills and bonds) and the stock of liquid dollar debt held abroad (for further discussions on the fiscal side of the Triffin dilemma, see Obstfeld 2013). In other words, the sheer size of the gross liquid external debt of the United States may at some point threaten the ability of the United States to act as a world banker or insurer. In the work of Gourinchas et al. (2017), an increase in the demand for safe assets by the rest of the world relative to the decreasing size of the US economy translates into a decrease in the real rate of interest. One can think of many crisis models where fundamentals in extreme regions support only one equilibrium (crisis with probability one, when fundamentals are bad, or no crisis with probability one at the other extreme), while when fundamentals are in an intermediate region, self-fulfilling crises are possible. In our specific case, the decline in the relative size of the United States over time (or destabilizing US macroeconomic policies) may shift the economy from the no-crisis zone to the self-fulfilling

[25] For an analysis of governments as liquidity provider, we refer the reader to the seminal work of Holmström & Tirole (1998). Gorton (2017) provides an excellent account of the history and economics of safe assets both public and private.

crisis zone. The work of Farhi & Maggiori (2018) shares some of these features. They model the hegemon as a world banker issuing safe assets with limited commitment and a propensity to inflate in crisis times. The preference of the rest of the world for US safe assets is exogenous, so that the role of the dollar in international payments is left unmodeled. They emphasize that banking is a fragile activity that is subject to self-fulfilling runs in an intermediate region of the parameters. Runs in their model are all the more likely to have no lender of last resort with a sufficient fiscal capacity to back the hegemon.

To sum up, there is a new Triffin dilemma. Just as the Bretton Woods system collapsed with a run on the dollar, the international monetary and financial system could witness a loss of confidence in the value of US debt. As the demand for dollar liquidity keeps growing, but the relative size of the United States shrinks in the world economy, a new run on the dollar into one or several alternative reserve currencies could be possible. On the one hand, large stocks of dollar liquidity held abroad relative to the size of the United States may lead to a loss of confidence in the dollar; on the other hand, too little international dollar liquidity would fail to lubricate the functioning of international financial markets. "Gold or not, the specter of the Triffin dilemma may still be haunting us" (Gourinchas & Rey 2007a, p. 35).

7. CONCLUSIONS

There are multiple complementarities in the functions of the currency of the hegemon in the international monetary system, from private sector use (invoicing, banking, vehicle currency, bond issuance) to official sector use (peg, reserves, intervention) and vice versa. An essential role of the hegemon is to provide liquidity to lubricate the wheels of international transactions in goods and asset markets. Another related key role is to provide insurance in crisis times to the world economy. The hegemon issues large amounts of nominally safe securities denominated in its currency to perform these two vital tasks. Those liabilities are happily absorbed by the rest of the world most of the time. This implies that the external constraint of the hegemon is relaxed, and that its process of external adjustment is greatly facilitated by this large demand for its external liabilities. This is the essence of the exorbitant privilege. A close look at the current hegemon, the United States, in the context of the Bretton Woods system and the post–Bretton Woods system of flexible exchange rates shows that its external balance sheet reflects its role as a world banker or insurer. It benefits from an important valuation channel of adjustment to ensure external solvency, a channel that has increased in power in the past decade. Interestingly, because of the key role that the dollar exchange rate plays in the valuation and trade channels of adjustment, it is possible to use measures of external imbalances of the United States to predict future returns on the net foreign asset positions; future export growth; and, importantly, future exchange rate changes at horizons ranging from a quarter to several years for the post–Bretton Woods sample.

A growing literature has provided different interpretations and measures of the exorbitant privilege in the context of the United States, from sizable excess returns on the net foreign positions, to deviations from interest rate parity, to liquidity premium and convenience yields or ease of access to capital markets. Several recent papers highlight that US monetary policy is an important factor driving international trade and the global financial cycle, i.e., comovements in credit creation, capital flows, and risky asset prices around the globe. These monetary policy spillovers matter for the conduct of domestic monetary and macroprudential policies. However, as dollar liquidity is omnipresent in international markets, it becomes increasingly obvious, with the decline of the relative size of the United States in the world economy, that a new Triffin dilemma may emerge. One solution, proposed by several authors, such as Farhi et al. (2011) and Eichengreen (2011), is the emergence of a more multipolar international monetary and financial system where multiple

governments would issue reserve currencies. While this system would help in overcoming the new Triffin dilemma, its stability properties are hard to assess ex ante. As pointed out by Farhi et al. (2011), increased substitutability across key currencies may stabilize relative prices, but it may also lead to massive portfolio shifts whenever confidence in one of the key currencies is eroded. This aspect is also pointed out by Nurkse (1944), who underlines the instability of the international monetary system when two countries (in that case, the United States and the United Kingdom) were in competition for the top spot in the interwar period (see also Farhi & Maggiori 2018, He et al. 2019). More research on these issues—and the many others raised in this review—would be desirable.[26] The reader will have noticed the many interfaces between the subject of this review and some of the most intriguing and important themes in macroeconomic research: External imbalances, macroeconomic adjustment via fiscal and monetary policy, exchange rate dynamics, currency use, capital flows, international spillovers, financial crises, and safe assets are just a few examples. The beauty of studying the international monetary and financial systems lies also in realizing their all-encompassing relevance for our economic lives.

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[26]Insights from the political science, legal, and international relations literatures are crucial to understanding more fully the geopolitical implications and power associated with the issuance of a hegemonic currency. We unfortunately cannot cover these in this review.

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