



# International Macroeconomics: From the Great Financial Crisis to COVID-19, and Beyond

Pierre Olivier Gourinchas<sup>1,2</sup> 

Published online: 3 August 2022  
© International Monetary Fund 2022

## Abstract

This Mundell–Fleming lecture reviews some of the main developments in international macroeconomics since the early 2000s. It highlights four important areas of progress: (a) on international pricing and invoicing; (b) on sectoral trade and production networks; (c) on the cross-border allocation of capital and the role of global financial intermediaries; (d) on cross-border externalities and prudential policies. It then explores three specific questions, relevant for future research and policy: (a) the implementation of optimal prudential policy via ‘basis control;’ (b) recent developments about the US external balance sheet and its ‘exorbitant privilege;’ and (c) the reform of the International Financial and Monetary System.

**JEL Classification** F3 · F31 · F32 · F33 · F38 · F4 · F41 · F42

## 1 Introduction

Twenty-one years ago almost to this day, my UC Berkeley colleague Maury Obstfeld gave the inaugural Mundell–Fleming lecture (Obstfeld 2001). Maury’s lecture started with a sweeping journey through much of the postwar intellectual developments in international macroeconomics. The journey reached a first milestone in the early 1960s with the separate analytical contributions of J. Marcus Fleming and especially Robert Mundell (Fleming 1962; Mundell 1961a, b, 1962, 1963). From this high vantage point, Maury’s lecture took in the vast expanse opened up by what

---

This paper was prepared for the 2021 ‘Mundell–Fleming’ keynote lecture given at the International Monetary Fund’s 2021 Annual Research Conference, while the author was affiliated with the University of California, Berkeley. I thank Maury Obstfeld and H el ene Rey for comments and Wenxin Du and Jesse Schreger for sharing data on SSA yields and CIP deviations.

---

✉ Pierre Olivier Gourinchas  
pog@berkeley.edu

<sup>1</sup> International Monetary Fund, Washington, DC, USA

<sup>2</sup> CEPR, London, UK



came to be known as the ‘Mundell–Fleming’ model, what was accomplished then, and what remained to be done.

Thanks to major breakthroughs in the treatment of dynamic models, of rational expectations and of nominal rigidities, the journey continued and reached a second milestone in the mid-1990s, with the ‘New Keynesian Open Economy’ (NOEM) synthesis.<sup>1</sup> As highlighted by Maury’s inaugural lecture, this synthesis yielded a bounty of major new insights, well beyond the original lessons of the Mundell–Fleming framework. Most importantly, it allowed for rigorous welfare-based policy evaluation in a general equilibrium framework and lent itself to serious quantitative analysis. Not surprisingly, this synthesis quickly became an essential part of the policymakers’ toolkit in international financial institutions and central banks around the world.

Stepping on the shoulders of giants, I will start where Maury stopped and aim to cover some of the major intellectual developments of the last twenty years. Beyond the internal intellectual trajectory of the field, that leg of the journey has been strongly influenced by the global financial crisis (GFC) of 2008 and its powerful aftershock, the 2010 Eurozone crisis. One can already anticipate that the second major economic convulsion of the new century, the COVID-19 pandemic, will also have long-lasting effects on the intellectual development of the field. Like the major financial crises that preceded them, both crises provide, in the words of Obstfeld, ‘the inspiration for new explorations’ (Obstfeld 2001, p2).

Financial frictions and linkages were always an important determinant of economic and financial outcomes in emerging and developing countries. The GFC powerfully highlighted their importance for advanced economies as well. The intellectual consequences of the COVID-19 crisis still lie ahead of us. Yet this crisis has already powerfully brought another important insight to the fore: the growing role of production frictions and linkages, both domestically and internationally. These two insights—the growing importance of both financial and production frictions and linkages—require fundamental adjustments to the NOEM synthesis, or, for that matter, the Mundell–Fleming framework. They matter for the propagation of shocks, the effectiveness of stabilization policies, and offer new perspectives on the required policy instruments.

This lecture will proceed in two steps. I will start with a review of the NOEM synthesis and discuss four important dimensions of progress: (a) on international pricing and invoicing; (b) on sectoral trade and production frictions and linkages; (c) on the cross-border allocation of capital and the role of global financial intermediaries; and (d) on externalities and prudential policies.

I will then turn to three specific areas where I think significant further progress can be made: (a) I will explore the role for what I will call ‘basis control’ in the implementation of optimal capital flow management in Emerging Markets with shallow currency markets; (b) I will review recent developments regarding the US external position and discuss whether the historical ‘exorbitant privilege’ that the USA has enjoyed is

---

<sup>1</sup> Maury, in joint work with Ken Rogoff, provided much of the impetus for this synthesis which parallels a similar effort to integrate dynamic and sticky price models in closed-economy macroeconomics.



coming to an end; (c) finally, I will offer some remarks and suggestions for strengthening the International Monetary and Financial System (IMFS). Specifically, I will argue that the IMF should play an important role as an *elastic provider of global liquidity* and offer a blueprint on how to do so.

## 2 Beyond the Mundell and Fleming/NOEM Models

Following Obstfeld and Rogoff (1995) seminal work, the NOEM synthesis quickly established itself as the dominant analytical framework to study open economy macro-questions, and as one of the favorite tools in the policymaker's toolkit. While adopting a tractable representation of nominal price and wage rigidities, NOEM models rested on explicit micro-foundations and allowed for dynamic optimization under rational expectations in complex stochastic general equilibrium environments. This allowed for rigorous welfare comparisons, which are particularly relevant for policy evaluation. The resulting framework managed the tour de force of clarifying many of the original Mundell–Fleming insights, providing a bounty of new insights, all the while retaining a simple and tractable aggregate representation.

This stylized and tractable representation can be seen most clearly in the three-equation canonical representation derived by Galí and Monacelli (2005) for the case of a small open economy with nominal price rigidities:

$$\pi_{H,t} = \beta E_t[\pi_{H,t+1}] + \kappa_\alpha \tilde{y}_t, \quad (\text{NKPC})$$

$$\tilde{y}_t = E_t[\tilde{y}_{t+1}] - \frac{1}{\sigma_\alpha} (i_t - E_t[\pi_{H,t+1}] - r_t^n), \quad (\text{IS})$$

$$i_t = \rho + \phi_\pi \pi_{H,t} + \phi_y \tilde{y}_t + v_t, \quad (\text{MP})$$

where

$$\begin{aligned} \kappa_\alpha &= \lambda(\sigma_\alpha + \phi), \\ \lambda &= \frac{(1 - \beta\theta)(1 - \theta)}{\theta}, \\ \sigma_\alpha &= \frac{\sigma}{1 + \alpha\Theta}, \\ \Theta &= (\sigma\gamma - 1) + (1 - \alpha)(\sigma\eta - 1), \\ \tilde{y}_t &= y_t - y_t^n. \end{aligned}$$

Equation (NKPC) refers to the ‘New Keynesian Phillips Curve’ for the open economy. It describes how domestic price inflation  $\pi_{H,t}$ , defined as the rate of change in the index of domestically produced goods, depends on expectations of itself as well as the domestic output gap  $\tilde{y}_t$  defined as the gap between (log) output  $y_t$  and its (log) ‘natural’ level  $y_t^n$ , obtained under flexible prices. The slope of this Phillips curve,  $\kappa_\alpha$ , is controlled, among other things, by the degree of openness of the



economy  $\alpha \in [0, 1]$ , the inverse Frisch elasticity of labor supply  $\phi$  and the coefficient  $\lambda$  that depends on the degree of price stickiness, defined as the fraction of prices that remain unchanged from one period to the next,  $\theta \in [0, 1]$ .

Equation (IS) refers to the ‘Dynamic IS Curve.’ It reflects the intertemporal consumption decisions of economic households located on their Euler equation. It states that output and consumption respond negatively to increases in the nominal interest rate  $i_t$ , with a sensitivity  $1/\sigma_\alpha$  that varies with the degree of openness  $\alpha$ , the elasticity of intertemporal substitution  $1/\sigma$  and the intratemporal elasticities of substitution  $\eta$  and  $\gamma$  (between domestic and foreign goods, and between foreign goods of different origins, respectively). In this expression,  $r_t^n$  refers to the economy’s endogenous ‘natural rate’ of interest, i.e., the real rate of interest rate that would obtain under a flexible price environment, itself influenced by domestic and foreign shocks.

Finally, Eq. (MP) summarizes the monetary policy rule and here assumed to take the form of a Taylor-type interest rate rule where the policy rate responds both to domestic price inflation  $\pi_{H,t}$  and to the output gap  $\tilde{y}_t$  with coefficients  $\phi_\pi$  and  $\phi_y$ , respectively.

This dynamic system is formally similar to that of a closed economy, which obtains in the limit where  $\alpha = 0$ , with the key parameters  $\kappa_\alpha$  and  $\sigma_\alpha$  encoding the importance of open economy channels. This formal similarity may give the impression that monetary policy works mostly through the IS curve and the intertemporal substitution associated with changes in the policy rate.

This view, however, would be incomplete for two reasons. First, in the shadow of the above three-equations system, changes in monetary policy also affect the nominal and real exchange rate, leading to a reallocation of aggregate demand between home and foreign goods. This *expenditure switching* effect is especially strong when nominal prices are sticky in the currency of the producer (Producer Currency Pricing, or PCP) as was often assumed in the early NOEM literature and in the Mundell–Fleming framework.

Precisely because of this powerful expenditure switching effect, monetary policy is especially potent via its impact on the nominal exchange rate. This can be illustrated in the above system by considering the limit  $\alpha = 1$  where the economy is fully open. In that limit  $\sigma_\alpha = 1/\gamma$ , and the sensitivity of output to the policy rate depends only on the elasticity of substitution between foreign goods of different origins,  $\gamma$ , and not on the elasticity of intertemporal substitution,  $\sigma$ .<sup>2</sup>

Second, unlike the baseline closed-economy New Keynesian model, there is generically no ‘divine coincidence’ when the economy is open, as was originally discussed by Corsetti and Pesenti (2001) and Benigno and Benigno (2003). The reason is that optimal monetary policy wishes to manipulate the terms of trade. Nevertheless, a central and very robust policy implication of the PCP paradigm, under a

<sup>2</sup> In that sense, NOEM models feature a more robust channel of transmission of monetary policy than their closed economy cousin. In fact, the recent ‘Heterogeneous Agent New Keynesian’ (HANK) models emerged from a desire to move away from substitution effects as the sole driver of monetary policy transmission and toward more realistic income effects. The NOEM models naturally feature income effects associated with change in the terms of trade.



variety of configurations, is that flexible exchange rates, accompanied by a domestic inflation targeting policy rule, provide a very good approximation to the optimal policy.

In the last twenty years, progress occurred along many important dimensions. I will, in this lecture, focus on four specific areas that I think are among the most important ones. First, I will discuss recent progress on the ‘real’ side: international pricing and invoicing, as well as trade and production frictions and linkages. Then I will discuss recent developments on the ‘financial’ side: on the modeling of global financial intermediaries, and on externalities and the use of prudential or capital flow management instruments. Two of these areas of progress (pricing and invoicing, as well as the role of global financial intermediaries) emerged from the internal intellectual momentum of the field. These are long-standing questions on which significant progress has been made recently. The other two areas (trade and production frictions, prudential and capital flow management instruments) are perhaps more linked to the two recent major crises that the global economy experienced. The Global Financial Crisis of 2008–2009 renewed interest in the potential for financial spillovers and the need for some regulation of capital flows and financial activity more broadly. The COVID-19 crisis illustrates the importance of global supply chains and trade linkages in propagating ‘real’ shocks.

## 2.1 International Pricing and Invoicing

As discussed above, the early NOEM models assumed that prices were sticky in the producer’s currency (PCP). This assumption coupled with the law of one price ensured that movements in the nominal exchange rate would transmit one-for-one to the destination currency price of exports, generating a strong expenditure switching channel.

The empirical evidence has never been too kind to this assumption. Beyond the body of evidence against the law of one price itself, the pathbreaking work of Goldberg and Tille (2008, 2009) and subsequently of Gita Gopinath (Gopinath 2015; Boz et al. 2021), documents extensively the use of a few ‘dominant currencies’ and especially the US dollar, for invoicing international transactions. This body of evidence led to an extensive revision of the way in which we think about the passthrough of exchange rate movements into prices and by extension of the transmission of monetary policy. Many of the implications of the Dominant Currency Paradigm are discussed in Gopinath et al. (2020), while Gopinath and Itkhoki (2021) provides a comprehensive and recent review of the literature.

Under this ‘Dominant Currency Paradigm’ (DCP), prices of both exports and imports are invoiced in a few dominant currencies—often the currency of a country that is neither the source nor destination of the international transaction. For instance, under DCP, exports from Brazil to Korea are invoiced in US dollars. A first important implication is that the expenditure switching effect will be more muted, at least on the export side. If Brazilian exports are invoiced in US dollars, a depreciation of the Real will have little short-run impact on the Korean demand for Brazilian goods whose price is set in dollars. The expenditure switching effect on imports



remains active; however, since a depreciation of the Won makes domestically produced Korean goods more attractive relative to foreign-imported goods. Of course, smaller relative price adjustment in the face of a given exchange rate movement implies larger movements in exporters' margins, which will affect firm profitability and income. These indirect 'income' channels will impact aggregate outcomes.

Second, and this is a direct corollary of the first result, countries will face a more adverse inflation-output trade-off under DCP. A given monetary impulse will generate a smaller stimulus because of the muted expenditure channel, for a given depreciation of the currency and the associated increase in inflation.

Finally, as shown by Egorov and Mukhin (2020), under a dominant currency paradigm countries are more likely to want to manage their dollar exchange rate, resulting in a global dollar monetary cycle which will affect global trade.

Importantly, the main prescription coming from the PCP framework, that small open economies should let their exchange rate float and adopt an inflation targeting rule, remains largely unchanged, even in a DCP paradigm. That result, established initially in Casas et al. (2017) and later substantially extended in Egorov and Mukhin (2020), may appear surprising at first since monetary authorities face a trade-off between stabilizing domestic demand and stabilizing terms of trade. Yet, under DCP, monetary authorities realize that, conditional on stabilizing domestic demand, there is nothing they can do to further stabilize the terms of trade. As a result, a domestically oriented monetary policy that stabilizes local prices already achieves the best possible results for the terms of trade. The logic is reminiscent of the 'divine coincidence' but is fundamentally different since the economy does not achieve the flexible price allocation.

Needless to say, further explorations on these questions are needed. For instance, while Egorov and Mukhin (2020) argue that optimal policy under DCP features flexible exchange rate and domestic inflation targeting, Corsetti et al. (2021) find that headline inflation targeting in a DCP world can lead to insufficient exchange rate adjustment, muting the insulation properties of flexible exchange rates.

## 2.2 Trade and Production Linkages

A second area where substantial progress has happened is on trade and production frictions and linkages. Of course, much foundational work was already taking place on this topic, emphasizing the importance of input-output structure for the aggregate production function and the transmission of shocks (Baqae and Farhi 2020a, b, 2021; Huo et al. 2019). The COVID-19 crisis provides an involuntary laboratory to analyze how granular sectoral shocks propagate and get potentially amplified through production and trade networks.

With Input-Output networks, what we typically think of as 'supply' or 'demand' shocks may have quite complex effects. Negative sectoral supply shocks—for instance when a sector is shut down because of a health-mandated lockdown—can morph into negative sectoral demand shocks in other parts of the economy, depending on the pattern of complementarities in demand or production. An illustration would be the negative impact of a ban on air travel on the demand for rental cars.



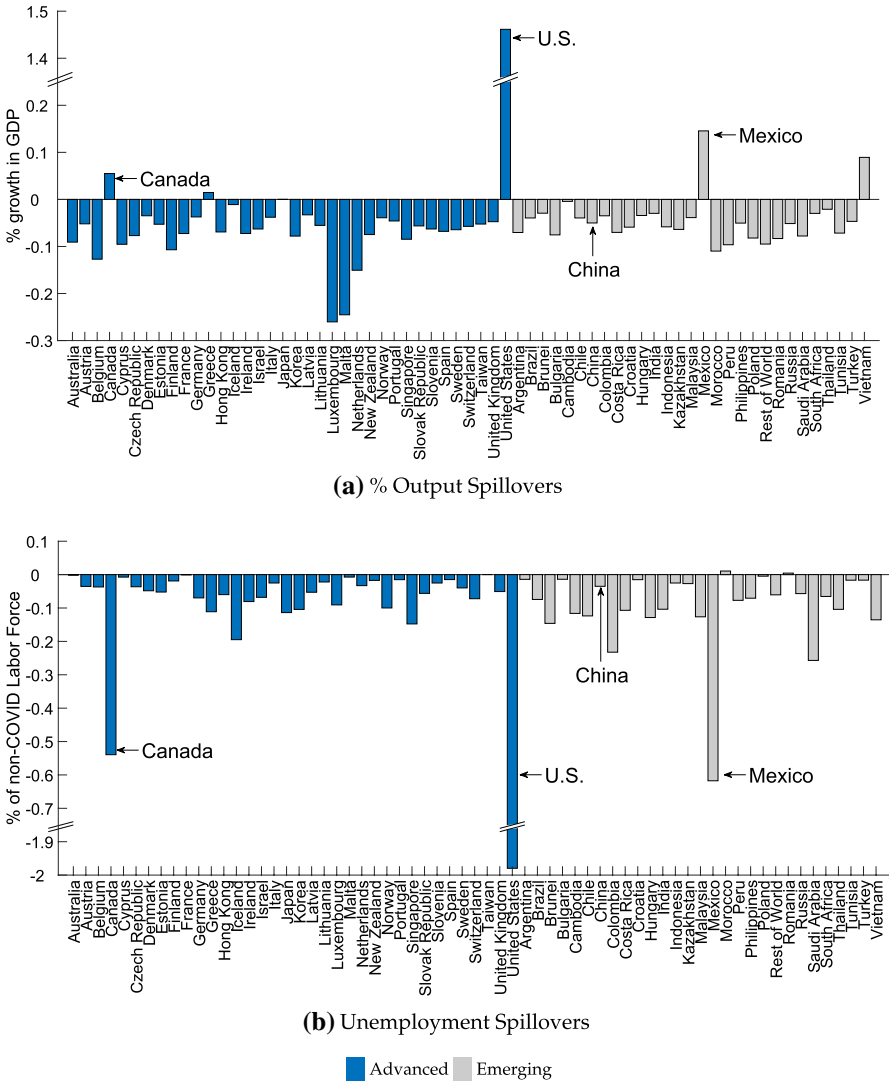
These ‘Keynesian supply shocks’ have been recently analyzed by Guerrieri et al. (2020), Bilbiie and Melitz (2020), Bilbiie (2020) and Woodford (2020). Similarly, sectoral demand shocks may morph into sectoral supply shocks somewhere else in the production chain. For instance, an increased demand for iPads and computers can cause a shortage of semi-conductors that negatively impacts the car industry. Similarly, a surge in demand in some sectors may increase demand for shipping services, creating supply bottlenecks elsewhere in the economy.

Broadly speaking, these complex patterns of transmission make policy formulation particularly challenging. Consider the case of monetary policy. It may be quite ineffective against supply-induced contractions in demand, since lowering interest rates may do little to stimulate activity in sectors with excess capacity. This point has been made in the context of recent theoretical models by Guerrieri et al. (2020), Woodford (2020), Baqaee and Farhi (2020b). By contrast, monetary policy may be quite effective in the case of a demand-induced supply shock: if the reason some sectors are experiencing bottlenecks and reduced activity is because of a surge in demand in other parts of the economy, this can generically be addressed via tighter monetary policy that would counteract the demand surges. In other words, what may look like a demand shock to the untrained eye may be quite unresponsive to monetary policy, while what may look like a supply shock may be quite responsive. In both cases, the key is to address the underlying supply and/or demand shock. Of course, this more nuanced understanding of the transmission of policy requires an accurate representation of the input–output linkages at fairly disaggregated level. This is an area where I have done some work together with Sebnem Kalemli-Ozcan, Veronika Penciakova and Nick Sander (Gourinchas et al. 2021a). Using a global trade and production network, we found that about 30% of global economic activity in 2020 was taking place in demand-constrained sectors.

Global and local Input–Output networks also force us to re-think our understanding of the transmission and effectiveness of fiscal policy. In Gourinchas et al. (2021a), we found that fiscal policy can help close the output gap in the demand-constrained sectors while simultaneously creating upward price pressure in supply-constrained sectors. This upward sectoral price pressure does two things. First, it further helps to reallocate overall demand away from supply-constrained sectors and toward demand-constrained one—in other words, it directs aggregate demand where it matters. At the same time, it also means that the aggregate stimulative effect of a given fiscal impulse can be quite limited. In our calibrated model, we find very low aggregate fiscal transfer multipliers, even if fiscal policy is quite effective at supporting overall employment. This suggests that fiscal policy has a more nuanced effect than in traditional one-sector models. Fiscal transfers may be better evaluated through their ability to support employment or prevent business failures in demand-constrained sectors, rather than their impact on headline GDP numbers.

Overall, this is a very fertile and active area of research where we have only started to scratch the surface. For instance, we have very few dynamic models with sectoral and trade linkages. Many of the existing models such as Bonadio et al. (2020) are static. This does not allow us to think about the impact of shocks or policies on the distribution of trade balances or on global interest rates. Gourinchas et al. (2021a) is a first attempt in this direction. We also have very few macromodels





**Fig. 1** The effect of US fiscal policy on the rest of the world. *Notes* From Gourinchas et al. (2021a), Fig. 7. Panel **a** reports the change in real value-added from the baseline (COVID without fiscal policy) to a counterfactual with only US fiscal policy. Panel **b** reports the change in the Keynesian unemployment rate from the baseline to a counterfactual with only US fiscal policy. Note that “//” indicates that the US is reported on a different scale

of the interaction between global supply chains and funding or invoicing choices (Kalemli-Ozcan et al. 2014). I suspect that some of these issues are critical to understand the global transmission of shocks.

To illustrate some of the issues that can be addressed with this type of models, Fig. 1 reports estimates of the spillovers of US fiscal transfers on the rest of the world, from Gourinchas et al. (2021a). In that paper we ask whether 2020 fiscal





transfers in advanced economies were a ‘tide that lifted all the boats.’ To answer that question, we built a simple intertemporal model with a global I–O network structure and nominal frictions. We calibrated the model to fiscal transfers implemented in the US in 2020 and looked at what the model predicted for the US and for other countries. Panel (a) reports the impact of the US transfer package on each country’s output, while panel (b) reports the impact on what we call ‘keynesian unemployment,’ that is the unemployment due to sectoral demand deficiencies. The figure illustrates that fiscal transfers in the US had a small but noticeable effect on US output. According to panel (a), US output was 1.5 percent higher. With a fiscal stimulus that amounted to about 25% of GDP, the multiplier was only 0.06, for the reasons explained above. Second, we observe that output spillovers to the rest of the world are very small, always less than 0.5 percent and mostly negative, except for close trading partners such as Canada or Mexico. In our simulations, this result largely reflects the impact that large US fiscal transfers have on global real interest rates. More fiscal stimulus in the USA tends to raise global real interest rates, reducing aggregate demand in other parts of the world. These findings invalidate the hypothesis that fiscal expansion in the USA, and other advanced economies, could substitute for a lack of fiscal stimulus in the rest of the world. Panel (b) nuances and qualifies that result. It shows that employment spillovers—while small—where positive, in the sense that unemployment declined in most countries as a response to the large US fiscal packages. The divergent response of output and employment is related to the argument made above: fiscal transfers help reduce overall demand deficiencies—both within and across borders—while at the same time failing to increase aggregate activity.

### 2.3 Cross-Border Capital Allocation and Global Financial Intermediaries

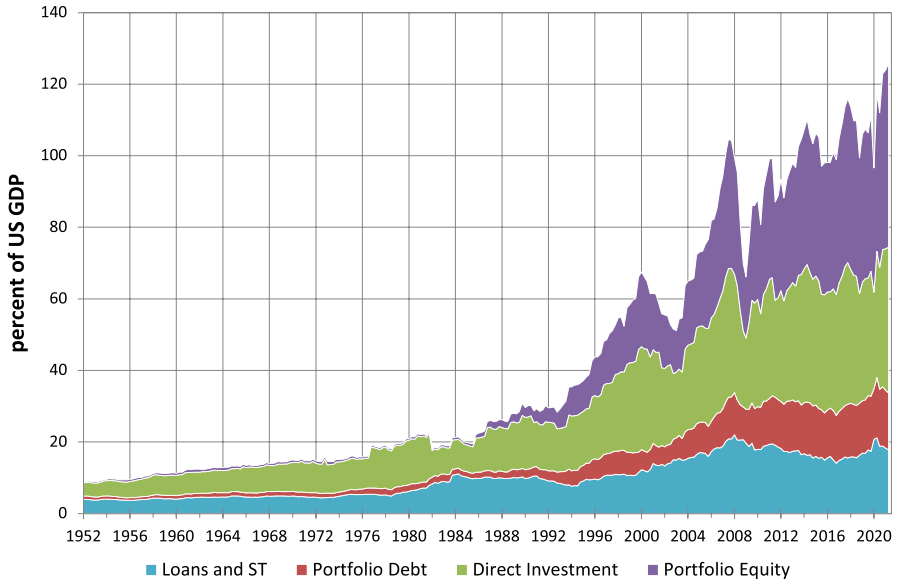
A third dimension of progress is in our understanding of cross-border capital flows and positions, and the role of global financial intermediaries. Three major stylized facts have emerged. First, we experienced in the last fifty years a massive increase in cross-border gross capital flows and positions. A lot of our knowledge on this question goes back to the seminal work of Phil Lane and Gian-Maria Milesi-Ferretti on the External Wealth of Nations, starting with Lane and Milesi-Ferretti (2001) and regularly updated over the years (Lane and Milesi-Ferretti 2007, 2018).

The second major stylized fact is the asymmetry at the heart of the international financial system, with US dollars and treasuries as the global safe assets. This asymmetry was already noticed by Despres et al. (1966) in an early and influential ‘minority’ assessment of the role of the dollar. H el ene Rey and I, in some of our early work, documented this asymmetry in greater detail and over a more recent period (Gourinchas and Rey 2007a).

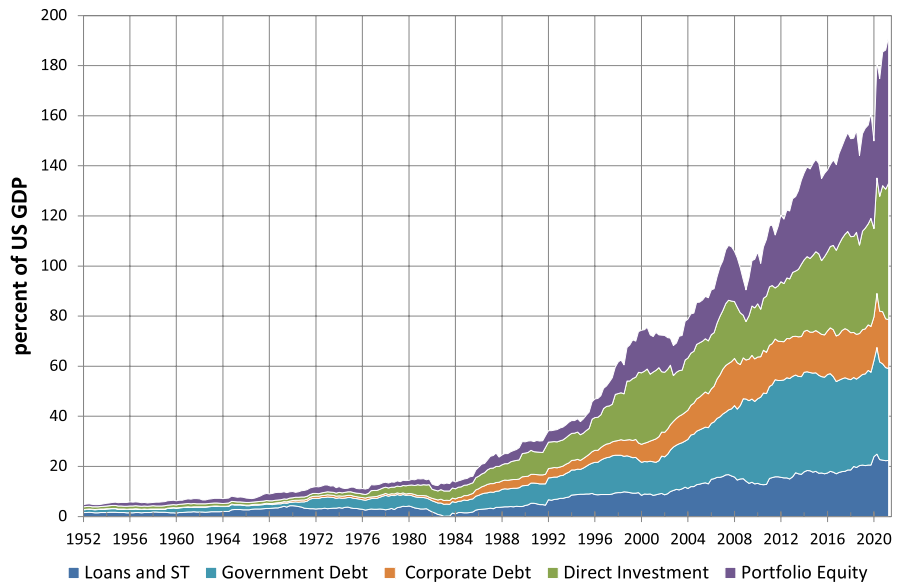
The third major stylized fact is the existence of a global financial cycle tied to the US monetary policy cycle as documented in the influential work of H el ene Rey (Rey 2013a; Miranda-Agrippino and Rey 2020).

To illustrate the first two stylized facts, Fig. 2 reports the gross external assets (panel a) and gross external liabilities (panel b) of the USA, scaled by US GDP





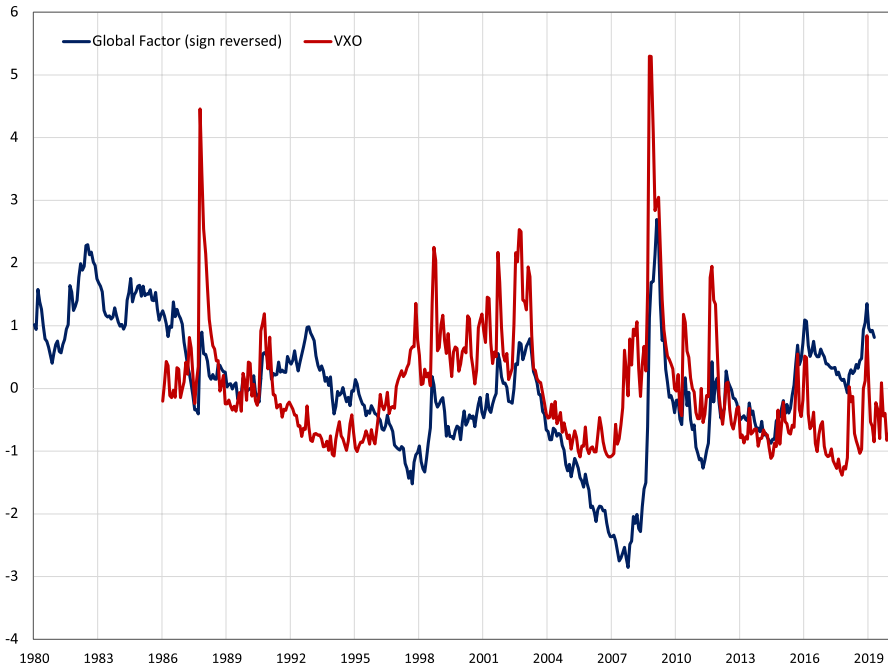
(a) U.S. Gross External Assets



(b) U.S. Gross External Liabilities

**Fig. 2** US external balance sheet, 1952–2021:2. *Notes* The figure reports US gross external assets and liabilities, as a percent of US GDP. Source: US Integrated Macroeconomics Accounts and author’s calculations





**Fig. 3** Global factor and VXO. *Notes* Global factor from Miranda-Agrippino and Rey (2020). VXO from CBOE

between 1952 and 2021. This figure is constructed using the BEA's Integrated Macroeconomic Accounts. Both figures show the rapid explosion of gross positions starting in the early 1970s (stylized fact 1) as well as the asymmetry in the composition of these gross external assets and liabilities, with US gross external assets weighted toward direct investment and equity and US gross external liabilities weighted toward government debt (stylized fact 2).

Figure 3 reports the global factor estimated by Miranda-Agrippino and Rey (2020) alongside the VXO, a measure of risk in financial markets.<sup>3</sup> The figure illustrates the strong co-movements between these two measures at least until the last five or six years.

Early NOEM models were somewhat ill-equipped to explain these facts for two reasons. First, these models typically assumed a representative household in each country, with excessively smooth stochastic discount factors. Second, the models would typically feature excessive amounts of risk sharing either through portfolio diversification, self-insurance or equilibrium movements in the terms of trade (Cole and Obstfeld 1991). Such amounts of risk sharing would certainly be in excess of

<sup>3</sup> The VXO is very similar to the better known VIX, but starts in 1986, unlike the VIX which starts in 1990. The VXO was discontinued in September 2021.



what we observe in the data, which is one way to think about the celebrated ‘Backus and Smith puzzle’ (Backus and Smith 1993; Kollmann 1995).

Research in this area has been making huge progress by taking a step back, then two steps forward. By this I mean that the theoretical literature on capital flows of the last six or seven years has gone back and rediscovered an old literature in international macroeconomics on portfolio balance models. This literature developed in the late 1970s and early 1980s and summarized in Branson and Henderson (1985). It offered rich insights but clothed in ‘old style’ reduced form models that went out of fashion forty years ago. They have now been brought back to the mainstream thanks to the insightful work of Gabaix and Maggiori (2015) that revives Kouri (1982). Maggiori (2021) offers a recent and comprehensive survey. A central insight is that global financial intermediaries are crucial pieces of the international financial architecture. These financial intermediaries have limited capital, face mandates and regulation coming from different authorities. They need to be compensated for the risk they absorb on their balance sheet. This compensation takes the form of intermediation rents or excess returns. That simple insight, at the heart of the portfolio balance models, connects asset prices and quantities and yields very different pricing relations than the one that emerges from a representative household’s stochastic discount factor.

These intermediation rents give rise to various deviations from arbitrage conditions that have long been central tenets of international finance, such as the Uncovered Interest Parity (UIP) or Covered Interest Parity (CIP) conditions (Ivashina et al. 2015; Du et al. 2018). At the same time, fluctuations in the overall risk-bearing capacity of the global intermediaries connect markets and generate a global financial cycle.

An additional implication of this framework, one that resonates well with the practical experience of many policymakers, is that quantities matter. They do because the outside supply of assets must be absorbed onto the global intermediaries’ consolidated balance sheet which determines the size of equilibrium intermediation rents. This implies that there is room for other, perhaps less orthodox, policies: sterilized foreign exchange interventions or quantitative easing can ripple through markets with an impact on interest rates, asset returns and currencies (Gourinchas et al. 2021b; Kojen and Yogo 2020; Jiang et al. 2020). As I have argued in my work with Dimitri Vayanos and Walker Ray this challenges one of the central tenets of the original Mundell-Friedman view that floating exchange rates provide sufficient insulation against foreign shocks. Instead, currencies and yields at different maturities in different countries remain deeply connected even under flexible exchange rates, an observation that is reminiscent of H el ene Rey’s core insight in her celebrated ‘Dilemma vs. Trilemma’ 2013 Jackson Hole paper (Rey 2013b; Gourinchas et al. 2021b; Greenwood et al. 2020; Lloyd and Marin 2020).

These insights are being gradually ported into more quantitative open-economy macromodels (Cavallino 2019; Fanelli and Straub 2021). At this stage, the message from these models is not that flexible exchange rates do not help, but that their insulation properties may be more limited than originally believed.

The observation that cross-border portfolios are very different in the cross-section is also important because it opens the door to asymmetric valuation effect:



movements in asset prices and currencies generate cross-country net wealth transfers. These net wealth transfers can potentially alter the dynamics of external adjustment. As I have already pointed out, the early evidence emphasizes the central role of the US and of asymmetric financial development (Caballero et al. 2008; Mendoza et al. 2009). The picture that emerges from this line of research is that some countries are net providers of ‘safe assets’ that are in high demand from the rest of the world. That naturally leads to an asymmetric structure in international wealth holdings and excess returns where net safe asset providers enjoy an ‘exorbitant privilege’ (Gourinchas et al. 2010). Of course, being a net provider of safe assets is an endogenous outcome and the excess return a country may earn could be eroded over time. This danger was originally analyzed by Robert Triffin in the 1960s in the context of the Bretton Woods system. Triffin’s concern was whether the USA could maintain its position at the center of the Bretton Woods system given its fixed holdings of gold and a growing demand for dollars. That concern has re-emerged recently, in the work of the late Emmanuel Farhi and others, suggesting that the fiscal space of the global safe asset provider is a natural limit (Triffin 1960; Farhi et al. 2011; He et al. 2019; Farhi et al. 2018; Mian et al. 2021).

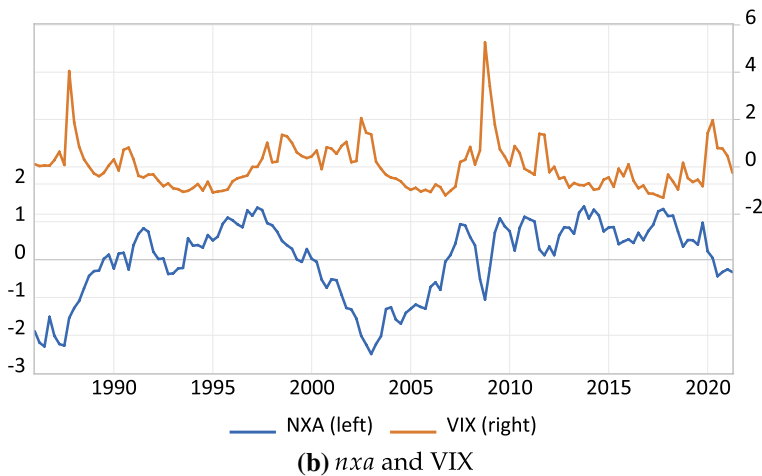
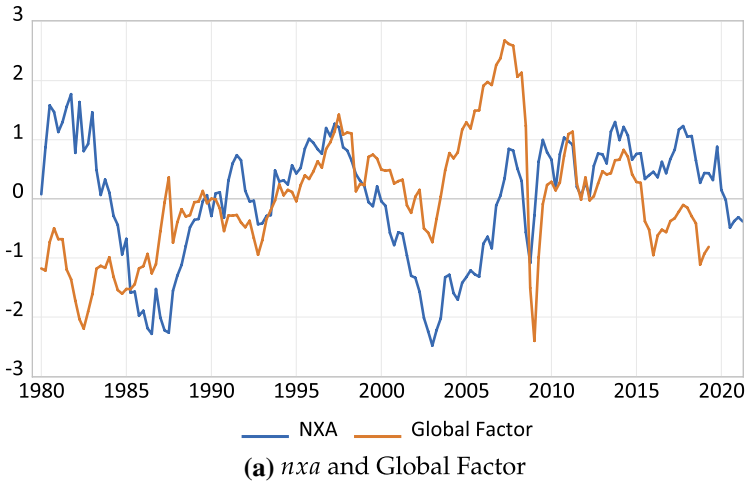
For the time being at least, it looks like the global insurance properties encoded in the US external balance sheet have remained fairly stable over time. Figure 4 plots a cyclical measure of US external imbalances,  $nxa$ , constructed by updating the methodology in Gourinchas and Rey (2007b), alongside Miranda-Agrippino and Rey (2020)’s global factor (panel a) and the VIX (panel b).  $nxa$  controls for trends in external balances that might be due to the process of trade and financial globalization. A negative value indicates that the USA is running an excessive trade deficit or is becoming more of a debtor country. The graph illustrates how, every time there is a spike in risk—at the time of the global financial crisis in 2008, of the Eurozone sovereign debt crisis of 2012, and more recently with the COVID-19 crisis—the net external position of the USA, as measured by  $nxa$ , deteriorates. In that sense, the US net external position still transfers wealth to the rest of the world in times of global stress.

## 2.4 Externalities and Prudential Policy

A fourth area of significant progress is in our understanding of macrofinancial frictions and externalities. The theoretical literature on these issues has identified two key externalities in addition to the more well-known terms-of-trade externality already discussed.

The first externality is a ‘fire-sale’ or pecuniary externality. It arises when domestic agents face a borrowing constraint that depends on the marked-to-market value of some asset. For instance, the borrowing capacity of a country may depend on the foreign currency value of its assets or output and therefore on the exchange rate. Suppose a negative funding shock triggers a downturn that lowers asset prices. This would tighten borrowing constraints and, in turn, further amplify the initial downturn, depressing prices further and causing a fire-sale. The externality arises because economic agents do not take into account how their individual decisions, through





**Fig. 4** The US external balance sheet provides insurance. *Notes nxa*: cyclical component of the US external balance, updated from Gourinchas and Rey (2007b). Global factor from Miranda-Agrippino and Rey (2020)

their impact on prices or exchange rates, impact collateral values and the borrowing constraint of other agents in the economy. This type of externality worsens with a depreciation of the currency. Pecuniary externalities have been closely studied by Enrique Mendoza, Javier Bianchi or Anton Korinek (Mendoza 2010; Bianchi 2011; Korinek 2018).

The second type of externality is an ‘aggregate demand externality.’ That externality is tied to the fact that, with rigid prices, demand expressed by some economic agents exhibits a multiplier—it creates more demand for other agents in the economy, something that is not taken into account in a decentralized equilibrium. Notice that unlike the fire-sale externality, the aggregate demand externality is alleviated when the currency



depreciates, since the depreciation stimulates aggregate demand. Aggregate demand externalities have been closely studied by Guido Lorenzoni, Emmanuel Farhi and Ivan Werning, and Stephanie Schmitt-Grohe and Martin Uribe (Lorenzoni 2009; Farhi and Werning 2016; Schmitt-Grohé and Uribe 2016).

As mentioned above, these two externalities generically work in opposite directions in response to currency movements. Borrowing some key ideas from public finance, the theoretical literature has characterized optimal policy in terms of optimal Pigouvian taxes (Farhi and Werning 2016). These often suggest ‘leaning against the wind,’ providing a rationale for macroprudential policies, ex-ante capital flow management measures or even foreign exchange interventions. That literature suggests a strict pecking order between capital flow management policies and foreign exchange interventions, mostly because of the quasi-fiscal cost induced by the latter (Bianchi and Lorenzoni 2021).

In those settings, floating exchange rates remain desirable, although fire-sale externalities can provide some justification for some ‘fear-of-floating,’ by which countries aim to limit movements in their currency (Calvo and Reinhart 2002; Gourinchas 2018).

The IMF has been at the vanguard of developing, distilling and converting many of these conceptual innovations into actionable policy through its work on the integrated policy framework (Basu et al. 2010; Adrian et al. 2020).

### 3 Looking Ahead

Let me now zoom in on three specific issues which I view as important going forward. The first one concerns the implementation of optimal policy in Emerging Markets with shallow currency markets. For reasons that will become clear shortly, I call this approach ‘basis control.’ The second issue revisits the question of the US ‘exorbitant privilege’ and whether we are getting closer to a Triffin moment. The third one will discuss possible avenues of reform of the Global Financial Safety system.

#### 3.1 ‘Basis Control’

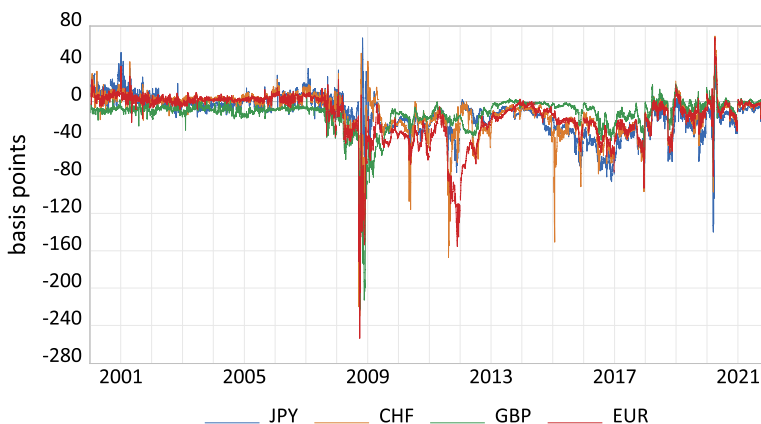
##### 3.1.1 Cross-Currency Basis

Let me start by defining the cross-currency basis,  $bs_t$ , which I will refer to as ‘the basis’ from this point onward:

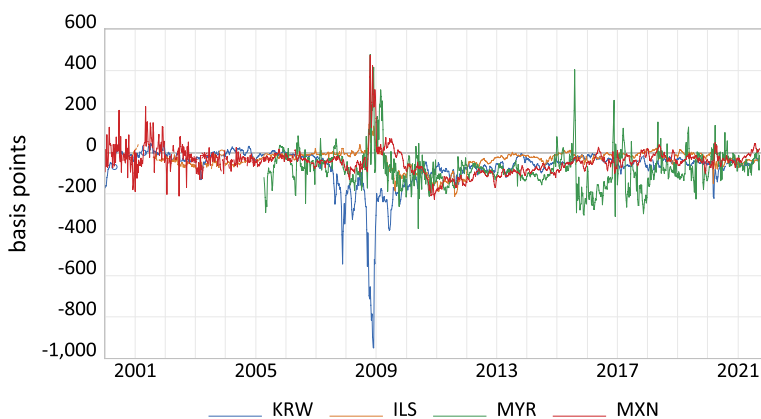
$$bs_t = i_t^{\$} - (i_t - (f_t - s_t)) \quad (1)$$

In this equation,  $i_t$  denotes the domestic nominal interest rate and  $i_t^{\$}$  the corresponding dollar interest rate.  $f_t - s_t$  denotes the forward premium, i.e., the difference between the (log) forward of the same maturity and the (log) spot rate. Hence, the basis is nothing more than the difference between the cash dollar rate and the synthetic dollar rate obtained by swapping the local currency rate into dollars. A negative basis  $bs_t < 0$  indicates that the synthetic dollar rate exceeds the cash dollar rate.





(a) Advanced Economies



(b) Emerging Market Economies

**Fig. 5** Three-month cross-currency basis: advanced vs. emerging. *Notes* The figure reports the 3-m cross-currency basis for a set of advanced (Japan JPY, Swiss franc CHF, British pound GBP and euro EUR) and emerging market (Korean won KRW, Israel shekel ILS, Malaysian ringgit MYR and Mexican peso MXN) currencies. Source: Bloomberg. Advanced economies basis using LIBOR rates. Emerging markets basis using local 3-m interbank rates and US LIBOR

More generally, a nonzero basis is an indication of a deviation from Covered Interest Rate Parity (CIP).

These CIP deviations were typically very small for Advanced Economies prior to the Global Financial Crisis and became subsequently much larger (Du et al. 2018). To illustrate, Fig. 5 panel (a) plots the basis for four advanced economies currencies (the yen JPY, the swiss franc CHF, the british pound GBP and the euro EUR) against the US dollar. The acute CIP deviations observed at the height of the Global Financial Crisis mostly reflected counterparty risk. However, the basis remained quite elevated even after market conditions normalized. The work of Wenxin Du, Alexander Tepper and Adrien Verdelhan convincingly establishes





that these continued CIP deviations reflect the shadow cost of dollar balance-sheet expansion for global financial intermediaries that are now facing tighter regulation. More generally, since the CIP trade is a riskless trade, any deviation must reflect the shadow cost of balance sheet expansion (Du et al. 2019). This shadow cost has become relative small again since the deployment of central bank swap lines between major currencies (Bahaj and Reis 2019).

As Cerutti et al. (2019) argue, a significant CIP deviation implies that a country potentially faces more than one local policy rates:  $i_t$  and  $i_t^{\$} + (f_t - s_t)$ . The two may be marching to different tunes, suggesting that it might become more difficult for monetary policy to be effective. For instance, suppose a central bank needs to raise the policy rate, but the basis becomes more negative as a result. The locally swapped dollar rate  $i_t^{\$} + (f_t - s_t)$  would remain lower than the policy rate  $i_t$  offering somewhat looser monetary conditions to some economic agents than desired. The key idea behind ‘basis control’ is precisely that the monetary authorities may wish to target the difference, i.e. the basis.

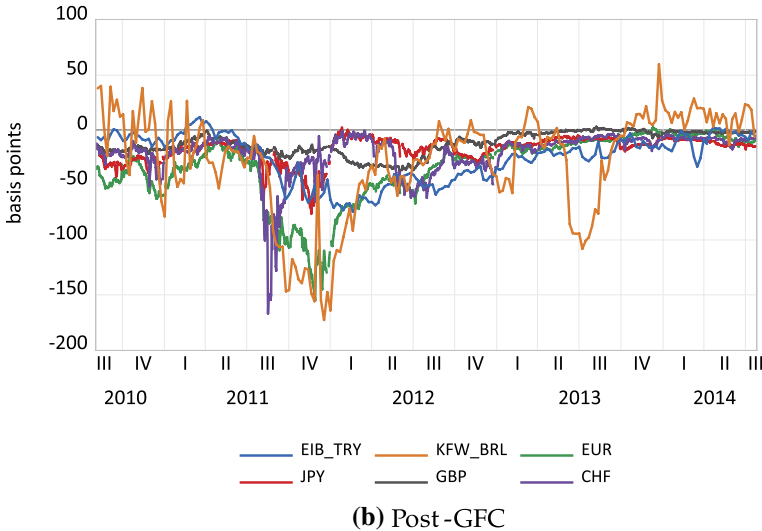
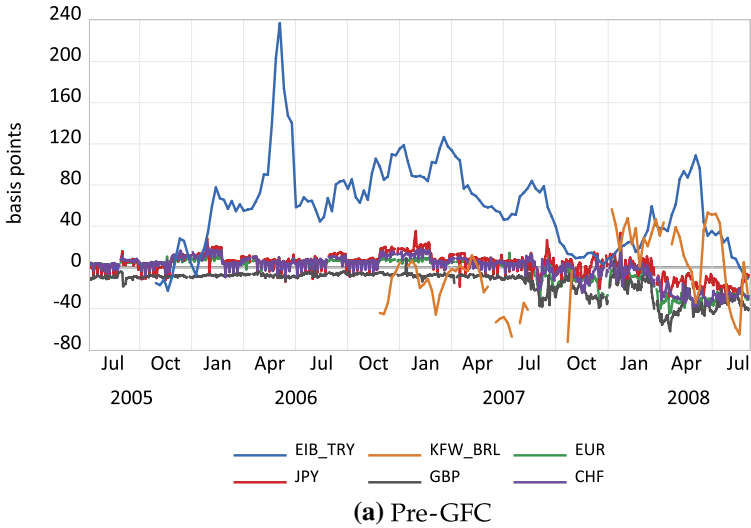
### 3.1.2 The Basis in Emerging Markets

As I will argue, this is especially relevant for Emerging Markets facing relatively shallow financial markets—where the basis may become large. Applying this idea to Emerging markets must first confront the fact that CIP deviations—defined as the shadow cost of balance sheet expansion of intermediaries on a risk-free arbitrage—may be harder to measure for these countries. The reason, as compellingly argued by Du and Schreger (2016), is that US and emerging markets face different levels of sovereign risk. The CIP deviation, then, would reflect the local currency sovereign risk, a risk premium.

To illustrate, Fig. 5 panel (b) plots the 3-month basis for four emerging market currencies: the Korean won (KRW), the Israeli shekel (ILS), the Malaysian ringgit (MYR) and the Mexican peso (MXN). Not surprisingly, this measured spread is much larger than for advanced economies: for EMs, the basis fluctuates between  $-1000$  basis points and  $400$  basis points, while for AEs, it never exceeds  $-300$  basis points. As indicated above, however, much of this could reflect local currency credit risk (panel (b) uses interbank rates, but these may also be reflecting local currency credit risk). Covering that credit risk is not easy to implement. For instance, sovereign credit default swaps (CDS) are usually only triggered in the event of a default on foreign currency debt, and not local currency debt. What one can do instead is to construct an estimate of the risk-less CIP deviation using the yields of supranational organizations borrowing in different currencies. In effect, this replaces  $i_t^{\$}$  and  $i_t$  by the equivalent yields at which supnationals borrow. Because these supranational entities do not face much, if any, credit risk, the supranational basis measures the risk-free basis for that currency.

Figure 6 reports estimates of this SSA-implied 5-year basis using data kindly provided by Wenxin Du and Jesse Schreger for the Turkish Lira—using yields from the European Investment Bank (EIB)—and the Brazilian real—using yields from the Kreditanstalt für Wiederaufbau (KfW) a German government-owned and backed state development bank. The figure also plots the 5-year basis for four





**Fig. 6** Supranational basis for the Turkish lira and Brazilian real. *Notes* EIB\_TRY and KFW\_BRL: basis on 5-year Zero Coupon bonds issued by supnationals; European Investment Bank for the Turkish lira and Kreditanstalt fur Wiederaufbau (KfW) for the Brazilian real. See Du and Schreger (2016)

advanced economies. Panel (a), for the pre-GFC period, illustrates that the basis was much larger for our two EMs relative to AEs. Panel (b) reports the basis after the GFC and documents how the basis is now of a similar order of magnitude for AEs and EMs.

Although more systematic work is needed, two important results emerge from these figures. First, Emerging Markets experienced large CIP deviations even before the GFC, although these were much smaller than the naive calculation



based on sovereign yields would suggest. Second, AEs and EMs have converged and now face similar levels of market segmentation.

### 3.1.3 A Simple Model of ‘Basis Control’

I am now in a position to describe what ‘basis control’ means and why it might be desirable to implement such a policy. I will make the basic point using a much simplified version of Bianchi and Lorenzoni (2021), itself building on Schmitt-Grohé and Uribe (2016) and presented more fully in Gourinchas (2021a).

Consider a two-sector small open economy. In the tradable sector, the country receives a constant endowment  $y^T$ . It produces a nontradable good  $y^N$  using a linear technology in labor  $L$ :  $y^N = L$ . We normalize the dollar price of the traded good to 1, so that its local price is  $S_t$ , the nominal exchange rate defined as the local price of dollars. The local price of nontraded goods is simply the wage  $w_t$ . For simplicity, I consider the case of inelastic labor supply, unit intra- and inter-temporal elasticities, and the limit of a patient household, with a discount factor  $\beta = 1$ .

The country borrows dollars from global financial intermediaries. As in Sect. 2.3, these global financial intermediaries have limited risk-bearing capacity and must be compensated for providing these dollars. I assume the following representation of the dollar supply from intermediaries:

$$d_{t+1}^* = \omega_t x_t. \quad (2)$$

In Eq. (2), the dollars supplied today  $d_{t+1}^*$  increase with the excess return on dollar lending  $x_t$ .  $\omega_t$  denotes the risk-bearing capacity of these foreign financial intermediaries and fluctuates exogenously. We will later consider a ‘sudden stop’ type of shock where  $\omega_t$  exogenously decreases. Equation (2) defines a supply of dollars from global financial intermediaries.

In equilibrium, and for the same arguments as in Bahaj and Reis (2019), the excess return  $x_t$  must equal the (opposite of) the basis  $bs_t$ :

$$x_t = -bs_t = i_t - (f_t - s_t) - i_t^{\$}. \quad (3)$$

With some abuse of language, I will refer to  $x_t$  as the basis instead of the opposite of the basis so that a positive basis means the local interest rate is higher than the dollar-swapped rate.

We can solve for the demand for dollars originating from domestic households. Dollar borrowing is needed to smooth the consumption profile of traded goods and, under our simplifying conditions, satisfies:

$$d_{t+1}^* = \frac{y^T}{R_t^{\$} + x_t} - (y^T - b_t^*). \quad (4)$$

In Eq. (4),  $b_t^*$  denotes the face value of the dollar debt to be repaid in period  $t$ , while  $R_t^{\$} = 1 + i_t^{\$}$  is the (exogenous) gross dollar interest rate. Equation (4) states that dollar demand is high when tradable income net of debt repayment today  $y^T - b_t^*$  is low,



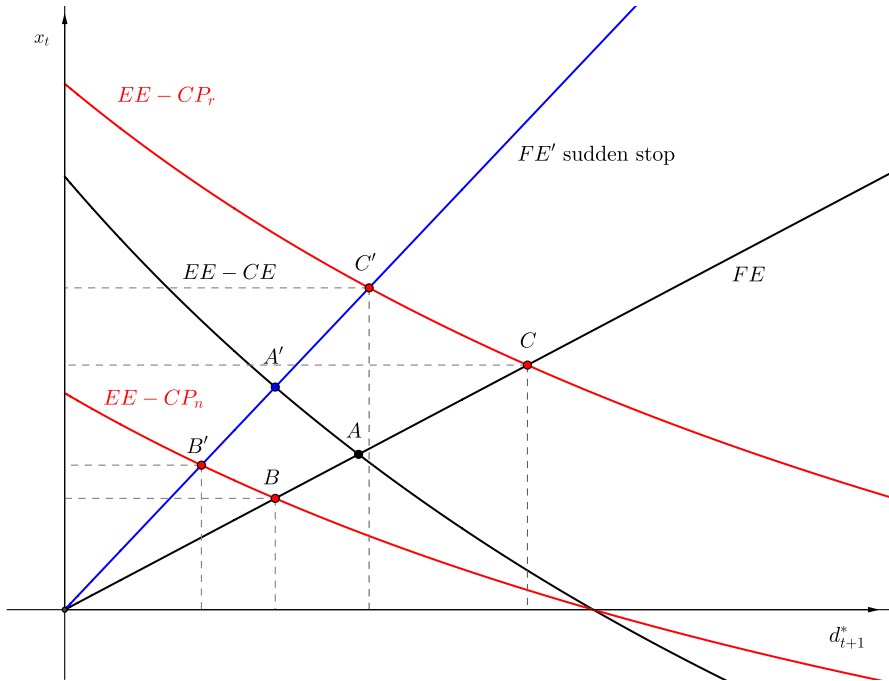


Fig. 7 Ex-post competitive and constrained Pareto allocations

compared to the discounted value of future income  $y^T / (R_t^S + x_t)$  where the discounting occurs at the gross interest rate the country faces,  $R_t^S + x_t$ .

Together, Eqs. (4) and (2) jointly determine the amount of dollar borrowing  $d_{t+1}^*(\omega_t, R_t^S, b_t^*)$ , the basis  $x_t(\omega_t, R_t^S, b_t^*)$  and the consumption of traded goods  $c_t^*(\omega_t, R_t^S, b_t^*)$ .

This simple model allows us to graphically illustrate the impact of a funding shock, i.e., a decline in  $\omega_t$ . Figure 7 plots the two equilibrium conditions, Eqs. (2) and (4) labeled  $FE$  and  $EE - CE$  for the competitive equilibrium, with dollar borrowing  $d_{t+1}^*$  on the horizontal axis and the basis  $x_t$  on the vertical axis.

A negative funding shock rotates the funding condition counterclockwise from  $FE$  to  $FE'$ , leaving the dollar demand of the household  $EE - CE$  unchanged. At the time of the shock, the equilibrium shifts from point  $A$  to point  $A'$ : the tightening of funding conditions is associated with a decline in the amount borrowed and an increase in the basis, as the economy moves along the dollar demand schedule  $EE - CE$ .

Since the country borrows fewer dollars, consumption of the traded good decreases. Given unit elasticities, this decline in the consumption of the traded good is going to reduce the demand for nontraded goods, at the initial relative price between traded and nontraded goods, given by the ratio of the nominal dollar exchange rate and the nominal wage:  $S_t/w_t$ . Maintaining full employment requires that this relative price increase, either because nominal wages decline or because the currency depreciates (an increase in  $S_t$ ). If nominal wages are downwardly rigid,



then monetary policy can still maintain full employment by letting the nominal exchange rate depreciate.

In our simple model, such a depreciation of the currency would have no effect on the basis  $x_t$ , which is entirely determined in the—separable—dollar market.<sup>4</sup> If, however, the exchange rate is constrained for some other reason, then the domestic economy may face a recession. Formally, this will be the case when

$$c_t^N = c_t^T \frac{S_t}{w_t} \frac{1 - \phi}{\phi} < \bar{L}, \quad (5)$$

where  $\phi$  is the share of expenditures on traded goods.

In such a situation, the domestic economy is facing two externalities. The first externality is the usual terms-of-trade externality: reducing borrowing reduces the basis, which improves the country's borrowing costs. The second externality is the aggregate demand externality described in Sect. 2.4: more borrowing increases traded consumption, which in turn (and this is the externality) increases demand and consumption of the nontraded good.

Figure 7 shows the optimal dollar demand of a constrained benevolent planner. The downward sloping line labeled  $EE - CP_n$  shows the dollar demand if the economy avoids a recession, while the downward sloping line  $EE - CP_r$  describes the dollar demand in a recession, i.e., when the nominal exchange rate is unable to depreciate sufficiently to restore full employment.

If the economy avoids a recession, only the terms of trade externality matters and the social planner will want to reduce borrowing to improve borrowing conditions. This is illustrated by the downward shift in the demand for dollars compared to the competitive equilibrium from  $EE - CE$  to  $EE - CP_n$ . This tends to reduce the basis from point  $A$  to point  $B$ . It also makes the country less vulnerable to a sudden stop since in that case the basis only increases to  $B'$ . One can show that the dollar demand schedule of the planner satisfies:

$$d_{t+1}^* = \frac{y^T}{R_t^S + 2x_t} - (y^T - b_t^*) \quad (6)$$

Such a policy can be implemented by imposing a tax

$$\tau_t = \frac{x_t}{R_t^S + 2x_t} \approx x_t > 0 \quad (7)$$

on capital inflows. Intuitively, the optimal policy requires that the country decides how much to borrow 'as-if' the basis  $x_t$  was twice as high. In equilibrium, this will deliver a relatively small basis, hence the name 'basis control.'

Interestingly, a capital inflow tax equal to the basis itself,  $\tau_t = x_t$ , is approximately sufficient to achieve the planner's allocation and keep the basis 'tight.'

<sup>4</sup> This is not true any longer in more complex settings where monetary policy can directly play a prudential role. See Coulibaly (2018).



Consider now the case where the economy cannot avoid a recession. In that case, the planner must balance the terms of trade externality—which pushes toward less borrowing—with the aggregate demand externality—which pushes toward more borrowing. In Fig. 7, we represent the case where the aggregate demand externality dominates and the demand for dollars increases on net, relative to the competitive equilibrium.<sup>5</sup> This captures the idea that, during the sudden stop, it becomes desirable to increase dollar borrowing to support aggregate demand. This suggests that, when the sudden stop hits and the economy enters a recession, the planner will want to switch from  $B$  to  $C'$ . Notice how this is now associated with a smaller decline or even an increase in dollar debt, while at the same time the planner will tolerate a sudden increase in the basis.

Formally, the planner's dollar demand in a recession satisfies

$$d_{t+1}^* = \frac{y^T}{\phi(R_t^S + 2x_t)} - (y^T - b_t^*) \quad (8)$$

which can be implemented with a tax/subsidy on capital inflows given by

$$\tau_t = -\frac{(1 - 2\phi)x_t + (1 - \phi)R_t^S}{\phi(R_t^S + 2x_t)} \approx x_t - (1 - x_t)\frac{1 - \phi}{\phi}. \quad (9)$$

$\tau_t$  may become negative if the tradable expenditure share is sufficiently small (i.e., the nontraded sector is large). Optimal ex-post policy tends to keep the basis tight in normal times, but relaxes it substantially when a sudden stop arises.

We can use the same framework to think about ex-ante policies. Figure 8 presents the corresponding graphical analysis when the economy is not in a recession in period  $t - 1$  but is expected to be in recession in period  $t$ . In that figure,  $EE - CE$  (resp.  $EE - CP$ ) represents the ex-ante dollar demand in the competitive (resp. planner) allocation. Ex-ante, the planner always wants to lean against more borrowing, since this also reduces the likelihood of a recession in the following period. In other words, the terms of trade and aggregate demand externalities pull in the same direction. Prudential policy leans against borrowing.

Faced with a higher likelihood that borrowing will be constrained tomorrow, dollar debt declines both in the competitive equilibrium (from  $A$  to  $A'$ ) and in the planner's allocation (from  $B$  to  $B'$ ). As before, the optimal policy can be represented in terms of an optimal tax on dollar borrowing that is a function of the current basis  $x_t$  but also the expected future basis  $E_t x_{t+1}$ . A higher likelihood of tighter funding markets would be priced in the term structure of CIP deviations (Du et al. 2019). The optimal capital inflow tax would reflect expectations about the basis in the future.

This suggests that it might be possible to formulate prudential policies that would supplement monetary policy rules, in terms of simple observables, with the caveat already noted that for emerging markets, we would need to extract the

<sup>5</sup> This is more likely the smaller the share of tradable good expenditures. For realistic values of the tradable share of expenditures, this condition is satisfied in our simple model.



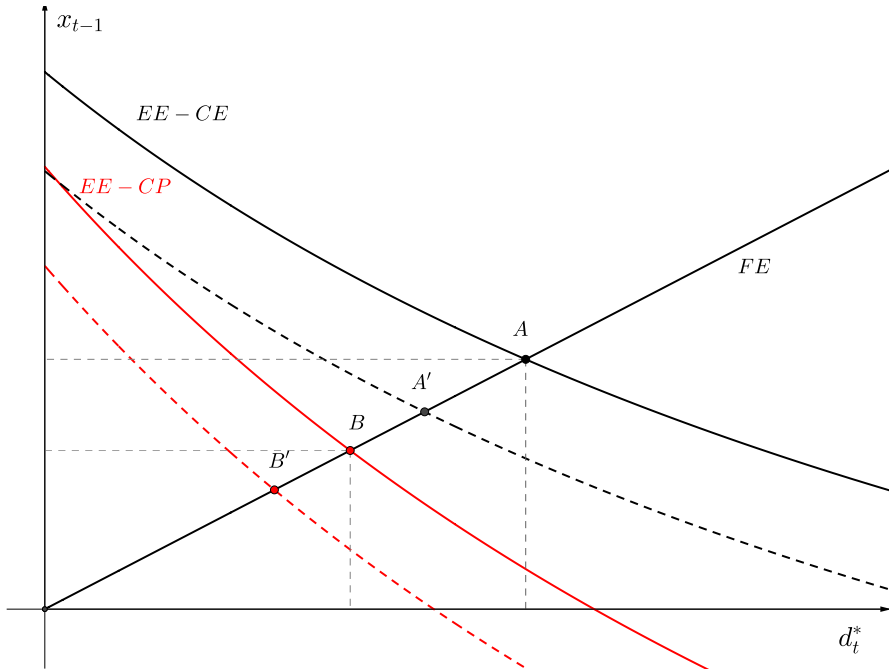


Fig. 8 Ex-ante competitive and constrained Pareto allocations

true value of the basis, uncontaminated by local credit risk. Information on the term structure of the basis, combined with the state of the economy, could help formulate the optimal CFM policy.

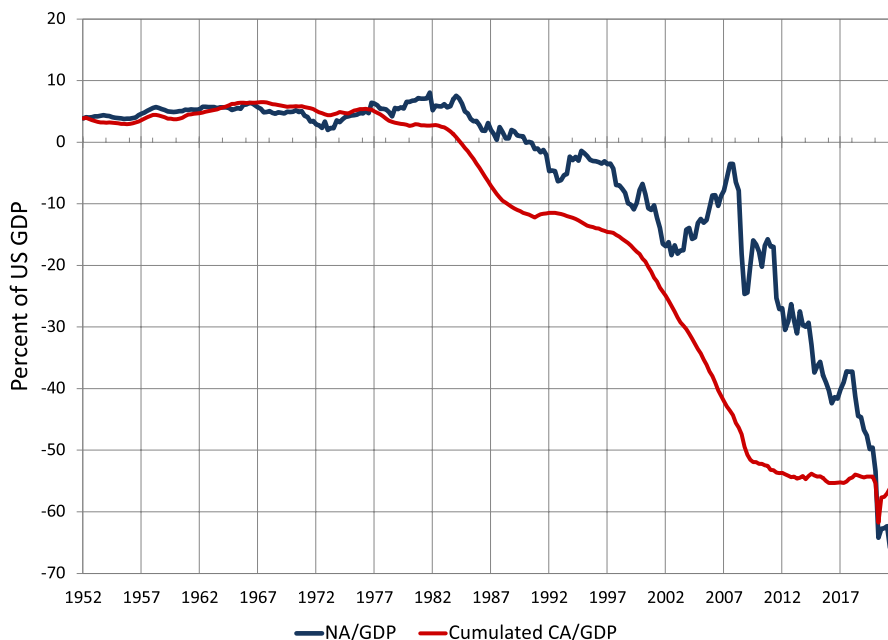
For instance, in our simple example, the general form of the optimal policy (both prudential and ex-post) can be expressed as a function of the current basis and expected future values of the basis, conditional on whether the aggregate demand externality is active or not:

$$\tau_t = \tau(x_t, E_t x_{t+1}, L_t, E_t L_{t+1}). \tag{10}$$

Exploring the potential of such simple rules seems a very fruitful area of further research.

As a final note, observe that policymakers might want to use foreign exchange interventions to implement the optimal policy. As has been noted in the literature, FX interventions are generically not optimal in a set-up such as ours since they carry a quasi-fiscal cost (Bianchi and Lorenzoni 2021). The simplest way to see this is to note that ex-ante reserve accumulation allows to reduce the basis ex-post—since it reduces the net dollar borrowing of the country—but at the cost of increasing the basis ex-ante, unlike basis control. Moreover, while it is still possible for reserve accumulation to improve welfare locally, there is a potential for negative externalities via the global dollar rate (Fornaro and Romei 2019).





**Fig. 9** US net foreign asset position and cumulated current account, 1952–2021. *Notes* % of US GDP. The difference between NFA and ‘cumulated CA’ represents the cumulated valuation effects on the US NFA. Source: BEA’s Integrated Macroeconomic Accounts. Author’s Calculations

### 3.2 Are We Getting Closer to a ‘Triffin Moment’?

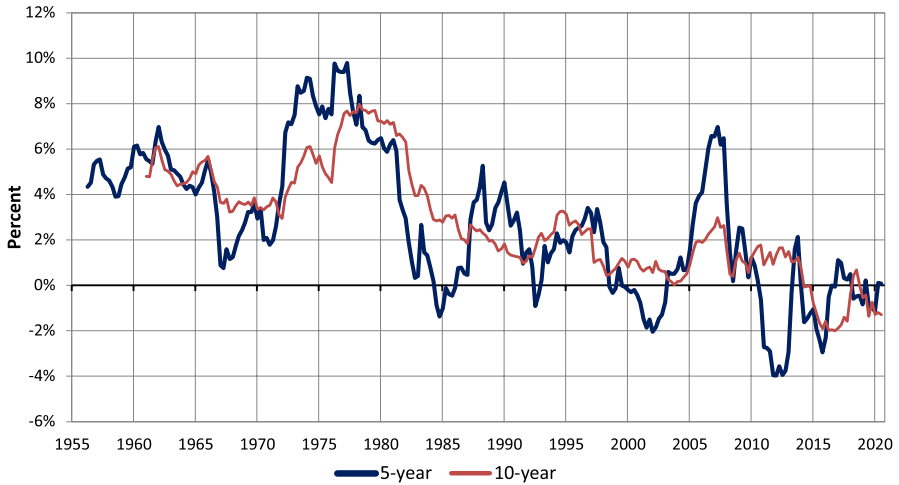
I now turn to my second forward-looking point: are we getting closer to a ‘Triffin moment’? This may be an odd question to ask given the recent literature abundantly documenting the increased centrality of the US dollar in the post-Bretton Woods International Monetary and Financial system (Ilzetzki et al. 2019; Eichengreen et al. 2017; Gourinchas et al. 2019; Gourinchas 2021b). As is well-known, the dollar plays a dominant role as an invoicing and funding currency, as a currency of issuance, in cross-border banking, as a reserve currency and as an anchor for monetary authorities.

A cornerstone of the global monetary system is the stability of the dollar and US government securities as global safe assets, generating a convenience yield and excess return (the price dimension) and relaxing the US external constraint (the quantity dimension). As I have described in Sect. 2.3, the cyclical movements in the US net foreign asset positions do suggest that the country’s external balance sheet still plays an important insurance part in the IMFS. I would like to argue, however, that both quantities and prices are showing some signs of stress.

To begin with, let us look at quantities. Figure 9 plots the US Net Foreign Asset position, as computed by the BEA’s Integrated Macroeconomic Accounts between 1952 and 2021 alongside the cumulated US current account. Both series are scaled by US GDP. The difference between the two series, as is well-known, represents the







**Fig. 10** The slow decline in excess returns on US gross external assets and gross external liabilities. *Notes* The figure reports the difference between the implicit return on gross external assets  $r^a$  and gross external liabilities  $r^l$ . Five-year and 10-year moving averages, centered on end-point. Source: US Integrated Macroeconomic Accounts and author's calculations

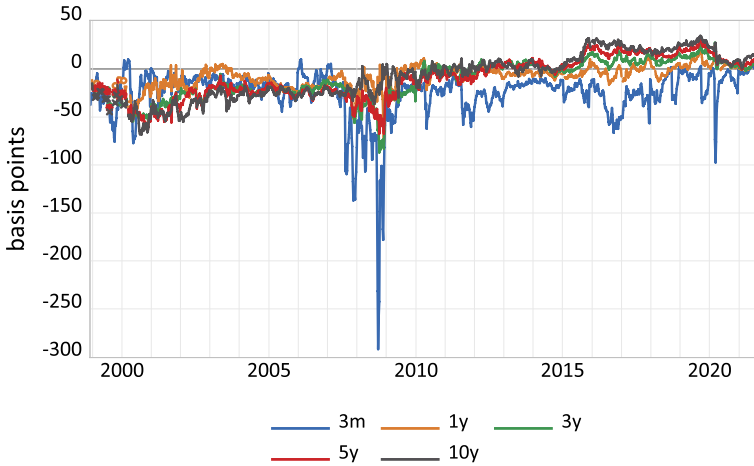
cumulated valuation gains and losses on the US external balance sheet since 1952. As H el ene Rey and I have documented in previous work, this cumulated valuation gain has generally been positive for the USA, and at times very large, reaching 40% of US GDP in 2007. The more recent data, however, indicate that this cumulated gains have disappeared. As of 2021, the valuation component has turned negative for the first time since 1977, equal to about  $-10\%$  of US GDP.

This fact was recently documented in a stimulating contribution by Atkeson et al. (2021). Mechanically, if we unpack the different components of the external balance sheet, these authors observe that much of the decline in the US net foreign position results from the very strong performance of US equities and direct investment liabilities in the last 10 years, relative to US equities and direct investment external assets. This generated a valuation gain for foreign holders of US equities and direct investment, and a corresponding valuation loss for the US.

Atkeson et al. (2021) interpret this recent ‘disappearance’ of the privilege as the consequence of a sequence of unexpected increases in the profitability of the US corporate sector since 2013, modeled as an increase in market power. This is an intriguing possibility, but I want to argue that this would be a relatively ‘good news’ from the perspective of the stability of the international monetary and financial system and the US’s position in it. The reason is that we cannot expect global investors will be repeatedly surprised by the outperformance of US equity markets—regardless of the source of the excess returns. Once expectations adjust, one would expect the external position to stabilize and start earning the—perhaps modest but real—convenience yield due to the provision of global safety and liquidity.

However, things are perhaps not as rosy as this sanguine interpretation would suggest. Instead, I want to take a somewhat longer perspective and argue that excess





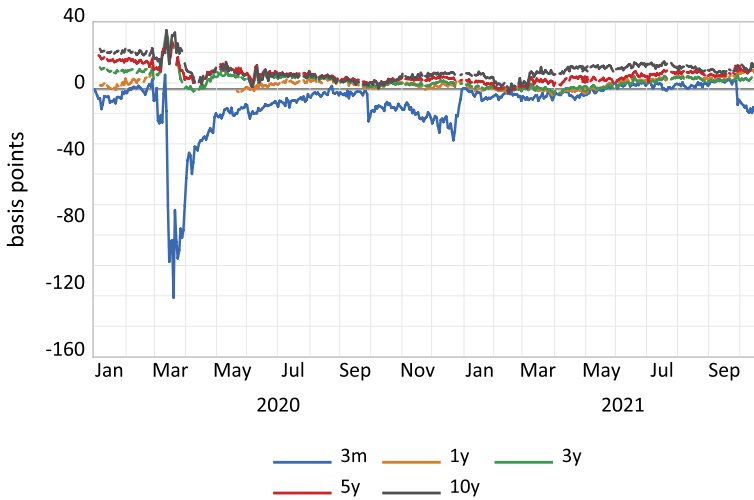
**Fig. 11** The disappearance of the US Treasury Premium, 2000–2021. *Notes* The figure reports the average US Treasury Premium, defined as  $i_m^{S, gov} - (i_m^{gov} - \rho_m)$ , where  $i_m^{gov}$  denotes the yields on government securities with maturity  $m$  and  $\rho_m$  the corresponding forward premium. The average is taken over Germany, Japan, Switzerland and the UK. Daily data are averaged weekly. Source: Bloomberg

returns on the US external balance sheet have been on a low-frequency downward trend for a longer time. To illustrate this point, Fig. 10 reports a 10-year and 5-year moving average of the return on US gross external assets minus the return on US gross external liabilities. This measure of excess returns is subject to the usual concerns about measurement and consistency between stocks and flows documented, for instance in Curcuru et al. (2008). With that in mind, the figure shows a strong downward trend in excess returns, one that substantially predates the recent period studied in Atkeson et al. (2021).

Excess returns now appear close to zero or even slightly negative. Because of concerns with such ‘top down’ estimates of returns from the valuation equation, one also wants to look at ‘bottom up’ estimates using individual securities and positions. This is difficult to do, in general. We can, however, easily look at ‘bottom-up’ estimates for government securities. Following the very insightful work of Du et al. (2018), Fig. 11 reports an estimate of the average US Treasury premium, defined as the difference between the yield on US government securities of different maturities against the swapped dollar return on securities of the same maturity from other advanced country issuers. The figure reports the average Treasury Premium against Germany, Japan, Switzerland and the UK, for maturities between 3 month and 10 year. A negative value on this graph indicates that the US enjoys lower borrowing rates. As the figure illustrates, the Treasury Premium was initially negative, but has gradually become positive, except perhaps for the 3-month tenor.

Figure 12 zooms in on the more recent period and focuses on a very interesting episode, the March 2020 so-called ‘dash for cash.’ Around the time where most advanced economies moved into lockdown, financial markets experienced severe stress and looked for safety. This flight to safety explains why, as in previous episodes, the yield on 3-month Treasury bills sharply decreased during that episode and





**Fig. 12** The March 2020 dash for cash: an inconvenience yield?. *Notes* The figure reports the average US Treasury Premium for Germany, Japan, Switzerland and the UK Weekly average. Source: Bloomberg

its convenience yield spiked. However, the opposite happened for longer maturities: the Treasury Premium increased markedly, reflecting a sudden loss of appetite for longer dated US Treasury securities. He et al. (2022) refer to the ‘inconvenience yield’ of Treasury securities during that episode. It is only after the US Federal Reserve implemented very aggressive purchases of Treasuries and offered quasi-unlimited repo financing for dealer Treasury position that the secondary market was able to regain its footing (Duffie 2020). One could ascribe these disruptions to ‘plumbing problems,’ in particular the absence of a central clearing facility as argued by Darrell Duffie. But a more ominous interpretation is also possible in light of the longer tendency for the excess return to decrease and for the US Treasury Premium to disappear. Viewed through that lens, the problem may be more structural.

This is not to say that US Treasury securities have become unsafe. It also does not mean that the world as a whole does not seek safe assets. Safe asset scarcity is still here, as evidenced by the total market value of negative-yielding securities, close to 14% of world GDP. These results, however, indicate that US Treasuries, especially at longer maturities, and the US external balance, may be losing some of their relative shine, a situation that may need to be monitored closely.

This brings an interesting tension. It is clear that Fed Reserves and the dollar itself remain in very high demand. Is it possible then, to have a significant convenience yield on short-term treasuries, or the dollar, but not on longer dated securities in the Treasury market? If, at some point, there is renewed tension in the Treasury market similar to the one we witnessed in March 2020, will a temporary backstop from the Federal Reserve be sufficient and what implications would this have for the dollar and its safe asset status?

Another source of worry is that, as other assets become more substitutable with Treasuries, there is an increased potential for large-scale rebalancing and repricing



which could trigger sharp adjustments. This is something that has been studied by Farhi et al. (2011), Farhi et al. (2018) and He et al. (2019). Overall, my sense is that we may be much closer to a ‘Triffin moment’ than we thought.

### 3.3 Directions for Reform of the IMFS

In my final remarks, I would like to take stock of the previous points and offer a few thoughts on ways in which we could strengthen the IMFS. Of course, the latest tremors could be false alarms. At the same time, the transition to a more multipolar system will eventually happen—this is the core insight behind the Triffin dilemma. The question is when, not if. This transition, when it happens, could be fast and disruptive, especially if the proper guardrails have not been carefully put in place.

The International Monetary Fund can and should play a central role in safeguarding the transition toward this new system, one that may require a more radical rethinking of its mission and resources, certainly beyond its current charter.

To understand what I have in mind, it is useful to start by observing that the Global Financial Safety Net (GFSN) represents a combined firepower of \$20 trillion dollars, consisting of \$16 trillion in foreign exchange reserves, \$1 trillion from the IMF and about \$3 trillion in additional resources (regional financing arrangements or swap lines). A core problem with the current system is that it relies heavily on self-insurance through the accumulation of official reserves which represent 80% of the total. This is costly, since reserves carry a quasi-fiscal cost, and self-defeating since demand for safe assets on such a large scale pushes down global interest rates toward the effective lower bound, depressing global demand and hampering the effectiveness of monetary policy (Fornaro and Romei 2019; Caballero et al. 2021). It also creates the conditions for the ‘Triffin dilemma’ to emerge since official reserves holdings tend to be concentrated in a few dominant currencies who may find themselves unable to accommodate.

The core idea is to empower the Fund as an *elastic provider of international liquidity*. This would allow countries to still control the quantity of safe assets they wish to hold, but elastically adjust its global supply to meet the demand. This would solve two problems at once. First, as I will argue, it would eliminate most of the quasi-cost of holding reserves. Second it will also eliminate the Triffin dilemma since, as we will see, the global demand for safe assets would not be concentrated on a few issuers.

A number of additional benefits would arise from the system I am about to describe. First, by adjusting elastically the supply of safe assets, it will effectively reduce the current elevated net demand for safe assets, releasing funds for productive investments. As a corollary, it will allow for higher natural real interest rates, reducing the likelihood of the effective lower bound and the associated problems for monetary policy, i.e., the occurrence of ‘safe asset traps’ (Caballero and Farhi 2018). Third, it will stabilize the IMFS ‘at scale,’ meaning that the convergence of emerging and developing economies will not increase the net demand of global safe assets. Finally, it will allow for shared benefits and costs of supplying global liquidity with



fewer of the coordination problems that might arise in an uncoordinated multipolar system otherwise.

In practice, this can be accomplished if the IMF were to offer a *Safe Reserve Deposit* (SRD, not to be confused with the Special Drawing Right, or SDR). The blueprint for this instrument would be as follows. First, as the name suggests, the SRD consists of a reserve account held at the IMF and redeemable at will. Countries would fund their SRD balance by transferring some of their official reserve holdings. From the perspective of member countries, the liquidity and safety of the SRD should be indistinguishable from official reserves.

The IMF, in turn, would pool these deposits globally (up to a liquidity buffer) and invest passively in global investable assets, according to their market capitalization. As a result, the IMF would be able to offer a higher return to countries than that on official reserve (typically advanced countries government securities). This would significantly reduce the quasi-fiscal cost of purchasing insurance.<sup>6</sup>

The liquidity buffer can be designed to withstand idiosyncratic shocks—when a single country faces an external shock and needs to redeem its SRD holdings. For global or systemic crises, this liquidity buffer would need to be supplemented with standing swap lines from the major currencies' central banks. These swap lines, unlike current arrangements, could be collateralized using the IMF's balance sheet of investable assets.

More demand for safe assets would translate into more deposits at the SRD window, effectively elastically adjusting the supply of global safe assets with the needs of the global economy. This is a major difference with the SDRs whose supply is fixed, infrequently adjusted and distributed in ways that do not necessarily reflect the needs of the global economy. This would significantly alleviate the safe asset scarcity and help stabilize the global natural rate away from the effective lower bound.

The option to hold SRDs does not eliminate the other core missions of the IMF: there will still be a need to surveillance, for country assistance and program lending, supplemented with conditionality and technical assistance, as is the case now. It does, however, bring up the question of the Fund's governance which may need to adjust to reflect the economic size of countries, as well as their status as liquidity suppliers in times of crisis.

Finally, one could even imagine that these SRDs could become traded instruments, used as a medium of exchange and a unit of account for private transactions, effectively completing the switch from a dollar-centered system to a system centered on a pool of reserve currencies provided elastically in times of crisis, the basis for a multipolar 'synthetic hegemonic currency' (Carney 2019).

---

<sup>6</sup> Incidentally, this also solves the structural funding problem of the IMF—which is currently countercyclical, relying on program revenues. Instead, the fund revenues would become procyclical based on the spread it would collect and the size of its balance sheet.



## 4 Conclusion

Twenty-one years after Maurice Obstfeld's inaugural Mundell–Fleming lecture, I believe that much progress has been accomplished. Economic theory is increasingly able to incorporate economic and financial granularity on networks, frictions and various dimensions of heterogeneity. Cross-border data collection efforts along these dimensions are essential to good theory and are under way by various organizations. They are an essential part of the research agenda going forward. The policy toolkit for Emerging, as well as Advanced, economies is being re-designed in important ways, and the Fund is at the vanguard of these efforts.

Lastly, a major transition of the IMFS may already be under way, with profound implications for the financial stability of the global economy. The fund has an important role to play in devising and implementing the right instruments to help us navigate this new environment.

## References

- Adrian, Mr Tobias, Christopher J. Erceg, Jesper Lindé, Pawel Zabczyk, and Ms Jianping Zhou. 2020. *A quantitative model for the integrated policy framework*. International Monetary Fund.
- Atkeson, Andrew, Jonathan Heathcote, and Fabrizio Perri. 2021. The end of privilege: A reexamination of the net foreign asset position of the united states. Manuscript, July.
- Backus, David K., and Gregor W. Smith. 1993. Consumption and real exchange rates in dynamic economies with non-traded goods. *Journal of International Economics* 35 (3–4): 297–316.
- Bahaj, Saleem, and Ricardo Reis. 2019. Central bank swap lines: Evidence on the effects of the lender of last resort. IMES Discussion Paper Series 19-E-09. Institute for Monetary and Economic Studies, Bank of Japan.
- Baqee, David R., and Emmanuel Farhi. 2020a. Nonlinear production networks with an application to the Covid-19 crisis. NBER Working Paper 27281.
- Baqee, David R., and Emmanuel Farhi. 2020b. Supply and demand in disaggregated Keynesian economies with an application to the Covid-19 crisis. CEPR Discussion Paper DP14743.
- Baqee, David R., and Emmanuel Farhi. 2021. Keynesian production networks and the Covid-19 crisis: A simple benchmark. *AEA Papers and Proceedings* 111: 272–276.
- Basu, Mr Suman S., Ms Emine Boz, Ms Gita Gopinath, Mr Francisco Roch, and Ms Filiz D. Unsal. 2020. *A conceptual model for the integrated policy framework*. International Monetary Fund.
- Benigno, Gianluca, and Pierpaolo Benigno. 2003. Price stability in open economies. *The Review of Economic Studies* 70 (4): 743–764.
- Bianchi, Javier. 2011. Overborrowing and systemic externalities in the business cycle. *American Economic Review* 101 (7): 3400–3426.
- Bianchi, Javier, and Guido Lorenzoni. 2021. The prudential use of capital controls and foreign currency reserves. Technical Report, National Bureau of Economic Research.
- Bilbiie, Florin O. 2020. The new Keynesian cross. *Journal of Monetary Economics* 114: 90–108.
- Bilbiie, Florin O., and Marc J. Melitz. 2020. Aggregate-demand amplification of supply disruptions: The entry-exit multiplier. Technical Report, National Bureau of Economic Research.
- Bonadio, Barthélémy, Zhen Huo, Andrei A. Levchenko, and Nitya Pandalai-Nayar. 2020. Global supply chains in the pandemic. NBER Working Papers 27224, National Bureau of Economic Research May 2020.
- Boz, Emine, Camila Casas, Georgios Georgiadis, Gita Gopinath, Helena Le Mezo, Arnaud Mehl, and Tra Nguyen. 2021. Patterns in invoicing currency in global trade. In *NBER International seminar on macroeconomics 2021*. *Journal of International Economics*. Elsevier



- Branson, William H., and Dale W. Henderson. 1985. The specification and influence of asset markets. *Handbook of International Economics* 2: 749–805.
- Caballero, Ricardo, and Emmanuel Farhi. 2018. The safety trap. *The Review of Economic Studies* 85 (1): 223–274.
- Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2008. An equilibrium model of global imbalances and low interest rates. *American Economic Review* 98 (1): 358–393.
- Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2021. Global imbalances and policy wars at the zero lower bound. *The Review of Economic Studies*.
- Calvo, Guillermo A., and Carmen M. Reinhart. 2002. Fear of floating. *The Quarterly Journal of Economics* 117 (2): 379–408.
- Carney, Mark. 2019. The growing challenges for monetary policy in the current international monetary and financial system. In *Remarks at the Jackson Hole symposium*, Vol. 23.
- Casas, Camila, Federico J. Diez, Gita Gopinath, and Pierre-Olivier Gourinchas. 2017. Dominant currency paradigm: A new model for small open economies. Technical Report, International Monetary Fund.
- Cavallino, Paolo. 2019. Capital flows and foreign exchange intervention. *American Economic Journal: Macroeconomics* 11 (2): 127–170.
- Cerutti, Eugenio M., Maurice Obstfeld, and Haonan Zhou. 2019. Covered interest parity deviations: Macroeconomic determinants. Technical Report, National Bureau of Economic Research.
- Cole, Harold L., and Maurice Obstfeld. 1991. Commodity trade and international risk sharing: How much do financial markets matter? *Journal of Monetary Economics* 28 (1): 3–24.
- Corsetti, Giancarlo, and Paolo Pesenti. 2001. Welfare and macroeconomic interdependence. *The Quarterly Journal of Economics* 116 (2): 421–445.
- Corsetti, Giancarlo, Paolo Pesenti, Keith Keuster, Gernot J. Müller, and Sebastian Schmidt. 2021. The exchange rate insulation puzzle.
- Coulibaly, Louphou. 2018. Monetary policy in sudden stop-prone economies.
- Curcuru, Stephanie E., Tomas Dvorak, and Francis E. Warnock. 2008. Cross-border returns differentials. *The Quarterly Journal of Economics* 123 (4): 1495–1530.
- Despres, Emile, Charles Kindleberger, and Walter Salant. 1966. The dollar and world liquidity: A minority view. *The Economist* 218(5).
- Du, Wenxin, Alexander Tepper, and Adrien Verdelhan. 2018. Deviations from covered interest rate parity. *The Journal of Finance* 73 (3): 915–957.
- Du, Wenxin, and Jesse Schreger. 2016. Local currency sovereign risk. *The Journal of Finance* 71 (3): 1027–1070.
- Du, Wenxin, Benjamin M. Hébert, and Amy Wang Huber. 2019. Are intermediary constraints priced? Technical Report, National Bureau of Economic Research.
- Du, Wenxin, Joanne Im, and Jesse Schreger. 2018. The US treasury premium. *Journal of International Economics* 112: 167–181.
- Duffie, Darrell. 2020. *Still the world's safe haven?* Redesigning the US Treasury market after the COVID-19 crisis', Hutchins Center on Fiscal and Monetary Policy at Brookings, available online at <https://www.brookings.edu/research/still-the-worlds-safe-haven>.
- Egorov, Konstantin, and Dmitry Mukhin. 2020. Optimal Policy under Dollar Pricing. Available at SSRN 3404660.
- Eichengreen, Barry, Arnaud Mehl, and Livia Chitu. 2017. *How global currencies work*. Princeton: Princeton University Press.
- Fanelli, Sebastian, and Ludwig Straub. 2021. A theory of foreign exchange interventions. *The Review of Economic Studies* 88 (6): 2857–2885.
- Farhi, Emmanuel, and Iván Werning. 2016. A theory of macroprudential policies in the presence of nominal rigidities. *Econometrica* 84 (5): 1645–1704.
- Farhi, Emmanuel, Iván Werning, and Matteo Maggiori. 2018. A model of the international monetary system. *The Quarterly Journal of Economics* 133 (1): 295–355.
- Farhi, Emmanuel, Iván Werning, Pierre-Olivier Gourinchas, and Hélène Rey. 2011. *Reforming the international monetary system*. CEPR.
- Fleming, J Marcus. 1962. Domestic financial policies under fixed and under floating exchange rates. *Staff Papers* 9 (3): 369–380.
- Fornaro, Luca, and Federica Romei. 2019. The paradox of global thrift. *American Economic Review* 109 (11): 3745–3779.



- Gabaix, Xavier, and Matteo Maggiori. 2015. International liquidity and exchange rate dynamics. *The Quarterly Journal of Economics* 130 (3): 1369–1420.
- Galf, Jordi, and Tommaso Monacelli. 2005. Monetary policy and exchange rate volatility in a small open economy. *The Review of Economic Studies* 72 (3): 707–734.
- Goldberg, Linda, and Cedric Tille. 2009. Macroeconomic interdependence and the international role of the dollar. *Journal of Monetary Economics* 56 (7): 990–1003.
- Goldberg, Linda S., and Cédric. Tille. 2008. Vehicle currency use in international trade. *Journal of International Economics* 76 (2): 177–192.
- Gopinath, Gita. 2015. The international price system. In *Jackson Hole symposium*, Vol. 27. Federal Reserve Bank at Kansas City.
- Gopinath, Gita, and Oleg Itskhoki. 2021. Dominant currency paradigm: A review.
- Gopinath, Gita, Emine Boz, Camila Casas, Federico J. Díez, Pierre-Olivier. Gourinchas, and Mikkel Plagborg-Møller. 2020. Dominant currency paradigm. *American Economic Review* 110 (3): 677–719.
- Gourinchas, Pierre-Olivier. 2018. Monetary policy transmission in emerging markets: An application to Chile. *Series on Central Banking Analysis and Economic Policies* (25).
- Gourinchas, Pierre-Olivier. 2021a. Capital flow management: basis control. *Series on Central Banking Analysis and Economic Policies* (31).
- Gourinchas, Pierre-Olivier. 2021b. The Dollar Hegemon? Evidence and implications for policymakers. In *The Asian Monetary Policy Forum: Insights for central banking*, 264–300. World Scientific.
- Gourinchas, Pierre-Olivier., and Hélène. Rey. 2007. From world banker to world venture capitalist: US external adjustment and the exorbitant privilege. In *G-7 Current account imbalances: Sustainability and adjustment*, ed. Richard Clarida, 11–55. Chicago: University of Chicago Press.
- Gourinchas, Pierre-Olivier., and Helene Rey. 2007. International financial adjustment. *Journal of Political Economy* 115 (4): 665–703.
- Gourinchas, Pierre-Olivier., Hélène. Rey, and Maxime Sauzet. 2019. The international monetary and financial system. *Annual Review of Economics* 11: 859–893.
- Gourinchas, Pierre-Olivier., Hélène. Rey, and Nicolas Govillot. 2010. *Exorbitant privilege and exorbitant duty*. Mimeo, UC Berkeley.
- Gourinchas, Pierre-Olivier, Hélène Rey, Nicolas Govillot Şebnem Kalemli-Özcan, Veronika Penciakova, and Nick Sander. 2021. Fiscal policy in the age of COVID: Does it ‘Get in all of the Cracks?’ Technical Report, National Bureau of Economic Research.
- Gourinchas, Pierre-Olivier, Hélène Rey, Walker Ray, and Dimitri Vayanos. 2021. A preferred-habitat model of term premia, exchange rates and monetary policy spillovers.
- Greenwood, Robin, Samuel G. Hanson, Jeremy C. Stein, and Adi Sunderam. 2020. A quantity-driven theory of term premia and exchange rates. Technical Report, National Bureau of Economic Research.
- Guerrieri, Veronica, Guido Lorenzoni, Ludwig Straub, and Iván Werning. 2020. Macroeconomic implications of COVID-19: Can negative supply shocks cause demand shortages? NBER Working Paper 26918.
- He, Zhiguo, Arvind Krishnamurthy, and Konstantin Milbradt. 2019. A model of safe asset determination. *American Economic Review* 109 (4): 1230–1262.
- He, Zhiguo, Arvind Krishnamurthy, Konstantin Milbradt, Stefan Nagel, and Zhaogang Song. 2022. Treasury inconvenience yields during the Covid-19 crisis. *Journal of Financial Economics* 143 (1): 57–79.
- Huo, Zhen, Andrei A. Levchenko, and Nitya Pandalai-Nayar. 2019. International comovement in the global production network. NBER Working Papers 25978, National Bureau of Economic Research June 2019.
- Ilzetzki, Ethan, Carmen M. Reinhart, and Kenneth S. Rogoff. 2019. Exchange arrangements entering the twenty-first century: Which anchor will hold? *The Quarterly Journal of Economics* 134 (2): 599–646.
- Ivashina, Victoria, David S. Scharfstein, and Jeremy C. Stein. 2015. Dollar funding and the lending behavior of global banks. *The Quarterly Journal of Economics* 130 (3): 1241–1281.
- Jiang, Zhengyang, Robert Richmond, and Tony Zhang. 2020. A portfolio approach to global imbalances. Available at SSRN.
- Kalemli-Ozcan, Sebnem, Se-Jik Kim, Hyun Song Shin, Bent E. Sorensen, and Sevcin Yesiltas. 2014. Financial shocks in production chains. In *American economic association meetings*.
- Koijen, Ralph S.J., and Motohiro Yogo. 2020. Exchange rates and asset prices in a global demand system. Technical Report, National Bureau of Economic Research.





- Kollmann, Robert. 1995. Consumption, real exchange rates and the structure of international asset markets. *Journal of International Money and Finance* 14 (2): 191–211.
- Korinek, Anton. 2018. Regulating capital flows to emerging markets: An externality view. *Journal of International Economics* 111: 61–80.
- Kouri, Pentti. 1982. Balance of payment and the foreign exchange market: A dynamic partial equilibrium model. In *Economic Interdependence and Flexible Exchange Rates*, ed. Jagdeep Bhandari and Bluford Putnam, 116–156. MIT Press.
- Lane, Philip R., and Gian Maria Milesi-Ferretti. 2001. The external wealth of nations: Measures of foreign assets and liabilities for industrial and developing countries. *Journal of International Economics* 55 (2): 263–294.
- Lane, Philip R., and Gian Maria Milesi-Ferretti. 2007. The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004. *Journal of International Economics* 73 (2): 223–250.
- Lane, Philip R., and Gian Maria Milesi-Ferretti. 2018. The external wealth of nations revisited: International financial integration in the aftermath of the global financial crisis. *IMF Economic Review* 66 (1): 189–222.
- Lloyd, Simon, and Emile Alexandre Marin. 2020. Exchange rate risk and business cycles.
- Lorenzoni, Guido. 2009. A theory of demand shocks. *American Economic Review* 99 (5): 2050–2084.
- Maggiore, Matteo. 2021. International macroeconomics with imperfect financial markets. SocArXiv z8g6r, Center for Open Science.
- Mendoza, Enrique G. 2010. Sudden stops, financial crises, and leverage. *American Economic Review* 100 (5): 1941–1966.
- Mendoza, Enrique G., Vincenzo Quadrini, and José-Víctor Ríos-Rull. 2009. Financial integration, financial development, and global imbalances. *Journal of Political Economy* 117 (3): 371–416.
- Mian, Atif, Ludwig Straub, and Amir Sufi. 2021. A goldilocks theory of fiscal policy.
- Miranda-Agrippino, Silvia, and Hélène Rey. 2020. US monetary policy and the global financial cycle. *The Review of Economic Studies* 87 (6): 2754–2776.
- Mundell, Robert A. 1961. Flexible exchange rates and employment policy. *Canadian Journal of Economics and Political Science/Revue canadienne de économiques et science politique* 27 (4): 509–517.
- Mundell, Robert A. 1961. The international disequilibrium system. *Kyklos* 14 (2): 153–172.
- Mundell, Robert A. 1962. The appropriate use of monetary and fiscal policy under fixed exchange rates. *IMF Staff Papers* 9 (1): 70–79.
- Mundell, Robert A. 1963. Capital mobility and stabilization policy under fixed and flexible exchange rates. *Canadian Journal of Economics and Political Science/Revue canadienne de économiques et science politique* 29 (4): 475–485.
- Obstfeld, Maurice. 2001. Mundell–Fleming lecture: International macroeconomics: beyond the Mundell–Fleming model. *IMF Staff Papers* 47.
- Obstfeld, Maurice, and Kenneth Rogoff. 1995. Exchange rate dynamics redux. *Journal of Political Economy* 103 (3): 624–660.
- Rey, Hélène. 2013a. Dilemma not trilemma: The global cycle and monetary policy independence. In *Proceedings—economic policy symposium—Jackson Hole*.
- Rey, Hélène. 2013b. Dilemma not trilemma: The global financial cycle and monetary policy independence. In *Proceedings of the Jackson Hole symposium Kansas City Federal Reserve*.
- Schmitt-Grohé, Stephanie, and Martin Uribe. 2016. Downward nominal wage rigidity, currency pegs, and involuntary unemployment. *Journal of Political Economy* 124 (5): 1466–1514.
- Triffin, Robert. 1960. *Gold and the dollar crisis; the future of convertibility*. New Haven: Yale University Press.
- Woodford, Michael. 2020. Effective demand failures and the limits of monetary stabilization policy. Technical Report, National Bureau of Economic Research.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Pierre Olivier Gourinchas** grew up in Montpellier, France. He attended Ecole Polytechnique and received his PhD in Economics in 1996 from MIT. He taught at Stanford Graduate School of Business and



Princeton University before joining UC Berkeley department of economics. Professor Gourinchas' main research interests are in international macroeconomics and finance. His recent research focuses on the scarcity of global safe assets, global imbalances and currency wars (with Ricardo Caballero and Emmanuel Farhi); on the International Monetary System and the role of the U.S. dollar (with H el ene Rey); on the Dominant Currency Paradigm (with Gita Gopinath); on the determinants of capital flows to and from developing countries (with Olivier Jeanne); on international portfolios (with Nicolas Coeurdacier); and on the global financial crisis (with Maury Obstfeld). Professor Gourinchas is the laureate of the 2007 Bern acer Prize for best European economist working in macroeconomics and finance under the age of 40, and of the 2008 Prix du Meilleur Jeune Economiste for best French economist under the age of 40. In 2012-2013, Professor Gourinchas was a member of the French Council of Economic Advisors to the Prime Minister. From 2009 to 2016 he was the editor-in-chief of the IMF Economic Review and from 2017 to 2019 the managing editor of the Journal of International Economics. Between 2019 and 2022, he was co-editor of the American Economic Review. From 2017 to 2022 he served as director of the NBER's International Finance and Macroeconomics Program. Pierre-Olivier Gourinchas is currently on-leave from UC Berkeley and serving as Economic Counsellor and Director of the Research Department at the International Monetary Fund.

