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Abstract

This paper is a partial exploration of mechanisms through which global factors influence the tradeoffs that U.S. monetary policy faces. It considers three main channels. The first is the determination of domestic inflation in a context where international prices and global competition play a role, alongside domestic slack and inflation expectations. The second channel is the determination of asset returns (including the natural real safe rate of interest, r*) and financial conditions, given integration with global financial markets. The third channel, which is particular to the United States, is the potential spillback onto the U.S. economy from the disproportionate impact of U.S. monetary policy on the outside world. In themselves, global factors need not undermine a central bank's ability to control the price level over the long term -- after all, it is the monopoly issuer of the numeraire in which domestic prices are measured. Over shorter horizons, however, global factors do change the tradeoff between price-level control and other goals such as low unemployment and financial stability, thereby affecting the policy cost of attaining a given price path.

JEL Classification: E52, E58, F36, F41, G15

Keywords: monetary policy, open-economy Phillips curve, natural real interest rate, financial conditions, current account, spillbacks

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Under the postwar Bretton Woods system of fixed exchange rates that prevailed through the early 1970s, the external constraint of preserving official dollar convertibility into gold figured explicitly and importantly in U.S. monetary policymaking (Eichengreen 2013). The conflict between this commitment and the domestic macroeconomic policy priorities of successive U.S. administrations ultimately helped wreck the fixed exchange rate system. The move to pure fiat money and floating exchange rates did not insulate U.S. monetary policy (or other countries' monetary policies) from global factors, however. As became immediately clear through the first OPEC oil-price shock, foreign disturbances can feed through to U.S. prices and output over the medium term, perhaps posing more difficult tradeoffs for the Federal Reserve. If anything, the importance of global influences seems to have grown over time.

The Federal Reserve's legal policy mandate focuses explicitly on three domestic variables: U.S. employment, price stability, and long-term interest rates (although the last of these is hardly independent of the second, and the first two may be closely linked). That focus does not imply, however, that foreign events are not significant drivers of Fed actions. As a young New York Fed staffer, Charles P. Kindleberger, put it more than 80 years ago: "A monetary policy based entirely upon the requirements of the internal economy will be based at one remove on external factors."[1] Moreover, the Fed's leaders are hardly reticent about citing global events for their potential U.S. impacts. At a speech in Berkeley during the global financial turbulence of 1998, Chairman Greenspan memorably stated: "[I]t is just not credible that the United States can remain an oasis of prosperity unaffected by a world that is experiencing greatly increased stress" (Greenspan 1998). Later that month, the Fed cut rates.[2] Ferrara and Teuf (2018) find a systematic relationship between references to international factors in FOMC minutes and accommodative monetary moves.

This paper is a partial exploration of mechanisms through which global factors influence the tradeoffs that U.S. monetary policy faces.[3] It considers

[1] Kindleberger (1937, pp. 230-231).

[2] According to the accompanying FOMC explanation, "The action was taken to cushion the effects on prospective economic growth in the United States of increasing weakness in foreign economies, and of less accommodative financial conditions domestically."

[3] Some areas the paper does not discuss in detail are mentioned in context below. The

three main channels. The first is the determination of domestic inflation in a context where international prices and global competition play a role, alongside domestic slack and inflation expectations. The second channel is the determination of asset returns (including the natural real safe rate of interest, r^*) and financial conditions, given integration with global financial markets. The third channel, which is special to the United States, is the potential spillback onto the U.S. economy from the disproportionate impact of U.S. monetary policy on the outside world. In themselves, global factors need not undermine a central bank's ability to control the price level over the long term – after all, it is the monopoly issuer of the numeraire in which domestic prices are measured. Over shorter horizons, however, global factors do change the tradeoff between price-level control and other goals such as low unemployment and financial stability, thereby affecting the policy cost of attaining a given price path.

The paper is organized as follows. Section 1 presents some basic data on the U.S. economy's evolving economic integration with world product and asset markets. Section 2 explores the changing nature of consumer-price inflation, which is shown to depend importantly on import-price inflation but seems ever less dependent on domestic wage inflation since the early 1990s. I argue that it is unclear how important globalization is in explaining the apparently declining importance of domestic economic slack in the U.S. Phillips curve. In section 3, I explore how the global determination of rates of return matters for monetary policy. One lesson is that the determination of r^* is inherently global, and tied up with movements in current account balances, which therefore can offer important clues about the real natural rate. However, global markets also determine the returns on an array of risky assets. While events that create incipient imbalances in the foreign exchange market may be offset to some degree by exchange-rate adjustments, two-way gross cross-border flows can have important asset-market impacts – carrying macroeconomic and financial stability implications – without much impact on exchange rates. The last substantive section, section 4, explains how the dollar's singular international roles as an invoicing and funding currency, as well as a benchmark for currency stabiization, confer on the Federal Reserve

paper also does not attempt an evaluation of particular monetary policy frameworks, unlike the studies in Adrian, Laxton, and Obstfeld (2018).

a unique global amplification mechanism for its monetary policy actions. Even a purely self-oriented perspective must take into account the resulting potential spillbacks onto the U.S. economy. Section 5 offers concluding thoughts.

1 The U.S. economy in a global context

During the postwar period, the world economy has evolved in a context of ever-broader and deeper markets for good, services, and securities. At the end of World War II, the United States stood uniquely dominant as an economic and financial power. Over nearly 75 subsequent years, global recovery and development have left it embedded in a world of much more comparable economic powers, linked by interdependent and complex networks for trade and finance. That interdependence has far-reaching implications for U.S. monetary policy: its domestic effects, its impact on the rest of the world, and the range of shocks that it faces.

The evolution of U.S. interconnections with foreign economies, along with U.S. exposure to foreign shocks, could be measured in several ways. In this section I set out some basic quantity indicators of economic openness.

A first indicator is the sheer size of U.S. output relative to world GDP. Other things being equal, the smaller is the U.S. share in world GDP, the more exposed it is likely to be to macroeconomic shocks originating abroad. Figure 1a shows the shares of the United States and the emerging and developing economies (EMDEs) in world GDP measured at market exchange rates, starting in 1980. Perhaps surprisingly, while the EMDE share rises markedly over the period shown, from about 24 to 40 percent, the U.S. share remains roughly constant at around 25 percent (albeit with considerable fluctuations in between). Equally surprising, Maddison (2001, p. 263) reports a U.S. share for 1950 that is not much higher – 27.3 percent, although one might well question the data he uses for the USSR, Eastern Europe, and China. In contrast the U.S. share in 1913, on the eve of World War I, was only 19.1 percent.

The picture is very different when measuring national outputs at purchasing power parity (PPP), as Figure 1b does. Doing so, we see a marked decline since 1980 in the U.S. output share, while the EMDE share rises from under 37 to 63 percent. Although PPP-adjusted numbers are critical for relative welfare assessments, GDP comparisons at market exchange rates better account for the exchange rate's role in intermediating shock transmission between national economies. Thus, a fair conclusion is that the U.S. has not become more exposed to foreign disturbances simply through a fall in its relative economic size.

Size, however, is not the only thing that matters; so do the breadth and depth of market linkages with the outside world. Here, the United States does seem more exposed than in the past.

Take trade first. As is well known, and as Figure 2 reaffirms, the dollar values of U.S. exports and imports have risen substantially over time relative to dollar GDP, the most dramatic acceleration starting in the early 1970s as the industrial economies abandoned fixed exchange rates. These numbers mix valuation and volume effects – for example, the dollar's sharp depreciation in the 1970s boosted both export and import values relative to GDP – but over time there has clearly been an increase in trade volumes. Compared with other OECD members, and even most high-income countries, the U.S. remains relatively closed on the trade side. Increasingly around the world, for example, non-commodity exports depend on imported intermediate inputs, with resulting increases in trade volumes. But U.S. exports rank low in this respect (Figure 3). That being said, imported intermediate inputs do play an increasingly important role in overall U.S. production (not just in exports). Consider industrial supplies and capital goods. They made up about half of all U.S. goods imports in 2018, roughly the same share as in 1999; but imports have expanded by half as a share of GDP over the last 25 years, outpacing the growth of exports (Figure 2). The rising importance of intermediate imports implies a growing channel for foreign price developments to influence U.S. product prices.

If the United States looks closed on the trade side when compared with other countries, the same is not nearly as true of its international financial links. Figure 4 shows US gross external assets and liabilities relative to GDP. These grow sharply (but roughly commensurately) up until the Global Financial Crisis, reaching ratios to GDP in the neighborhood of 150 percent. Since then, assets have leveled off but liabilities have continued to grow.[4]

[4]Lane and Milesi-Ferretti (2018) survey international financial integration since the

The balance between assets and liabilities changes not only because of current account flows, but also because of asset-price developments that can sharply alter gross assets and liabilities. Specifically, U.S. foreign liabilities are mostly denominated in U.S. dollars, whereas assets are mostly in non-dollar currencies. In addition, U.S. foreign assets are more heavily skewed toward equity (portfolio equity and FDI) than are liabilities. An implication is that unexpected dollar strength tends to transfer wealth from the U.S. to foreigners, as do global stock-market declines (Gourinchas and Rey 2007). And with gross external positions so extensive, the wealth transfers can be very big.

Compared with the flow change in the NIIP due to the current account, the stock revaluation due to asset-price changes is indeed large and volatile (Figure 5). Over 2008, the U.S. sacrificed nearly 13 percent of GDP in wealth to the rest of the world, only to gain back 12 percent over 2009. These are very large economic shocks, though their macroeconomic impact may be muted if they are temporary and hit mostly deep-pocketed and lightly leveraged investors. On the other hand, changes in the current account reflect shifts in aggregate demand, and while these do not reach the upper levels of the wealth transfers shown in Figure 5, they can be macroeconomically quite significant, even for the United States (Figure 6). They represent another channel through which financial openness is both a source and transmitter of macro disturbances – though their implications for monetary policy depend on the nature of the shocks driving them.

The balance of this paper looks more closely at some macroeconomic implications of trade and financial openness.

2 Global aspects of the inflation process

It is well known that in recent years – and certainly predating the Global Financial Crisis – inflation has seemed less responsive to domestic economic activity gaps, in the United States and other industrial countries alike. For example, the IMF (2013) chronicled the limited downward response of inflation to the crisis and its aftermath. Conversely, even as activity has re-

crisis.

turned to or exceeded pre-crisis levels and monetary policies have remained accommodative, inflation has generally been slow to respond in advanced economies.

Numerous potential explanations have been offered (see Kiley 2015 for a survey). Potential explanations include better anchored inflation expectations (for example, Del Negro, Giannoni, and Schorfheide 2015; Jordà et al. 2019) or expectational shifts driven by commodity prices (Coibion and Gorodnichenko 2015); underestimation of economic slack (Yellen 2015); the domestic influence of global activity and labor-market conditions (IMF 2006, 2016; Auer, Borio, and Filardo 2017; Forbes 2018); and flatter price Phillips curves, albeit perhaps only at relatively low inflation rates (Blanchard, Cerutti, and Summers 2015; Gagnon and Collins 2019). While admittedly these factors are potentially interrelated – for example, better anchoring can itself potentially flatten the Phillips relationship, as can international competition, with mutually reinforcing spillovers among countries – a natural starting point for assessing the impact of global factors is to ask how the basic architecture of the price Phillips curve could change in an international context.

In standard closed-economy macroeconomic models, the expectations-augmented price Phillips curve links consumer-price inflation to expected future inflation and some measure of the output or employment gap. Compared with the hypothetical closed-economy case, an open-economy price Phillips curve adds two dimensions:

1. *The global competitive environment*: Firms' willingness to change prices as marginal cost changes can fall when they face more intense competition due to potential imports. At the same time, aspects of global competition may affect the responsiveness of marginal cost – especially wages – to economic slack.

2. *Foreign prices*: Consumer-level inflation will reflect not just the nominal cost of domestic value-added, but also nominal import prices, which affect consumer prices directly as well as domestic production costs. In turn, import prices are a mix of those set directly in the terms of local currency and those set in other currencies, translated using the domestic-currency prices of those currencies (i.e., exchange rates).

2.1 Global competition

Writing in the inflationary mid-1970s, Dornbusch and Krugman (1976) seemingly viewed the Phillips curve facing monetary policy in an open economy as being steeper under floating exchange rates. As they put it:

> The link between exchange-rate deterioration and domestic inflation takes on importance in the context of our earlier argument that an expansionary monetary policy leads to a fall in the exchange rate. The present line of argument establishes a direct, short-run link between monetary policy and inflation. The conventional case for stabilization policy, including monetary policy – that it acts promptly on quantities and only slowly on prices – is, therefore, lost.

Their account focuses on the inflation-activity tradeoff traced out by monetary shocks, and it depends on both of the open-economy dimensions listed above: the inflation responsiveness to costs and the effect of import prices based on the exchange rate response. It also brngs to mind another possible gap that I will not discuss – a credibility gap in monetary policy, such that wage settlements may respond rapidly and strongly to monetary policies. Leaving that last important topic aside, it is still helpful to break the first two mechanisms down, starting with the role of global competition.

Many international macromodels simplify by assuming that price-setting firms face demand curves with constant elasticities. In this case, markups of price over marginal cost do not vary, including in the face of more intense international competition. Allowing for demand elasticities that vary along the demand curve is one way to introduce strategic pricing complementarities for different firms, such that a firm's optimal price depends on what its competitors are charging. Various specifications can lead to this result (see Arkolakis and Morlacco 2017), and firm-level empirical evidence is supportive. When competing firms' prices are strategic complements, a firm will hesitate to maintain its full markup when its costs rise for fear of losing customers to competitors. The phenomenon is central to understanding exchange-rate pass-through (e.g., Gust, Leduc, and Vigfusson 2010) and other macroeconomic implications of globalization (e.g., Erceg, Gust, and López-Salido 2009).

Such models also imply a muted response of inflation to departures of real marginal cost from the "natural" or full-employment level. Sbordone (2009) offers a very instructive formalization of this effect. In New Keynesian models with Calvo pricing and constant firm markups, the response of domestic output-price inflation π to a deviation $\widehat{mc}$ of (log) real marginal cost from its natural value is given by

$$\pi_t = \xi \widehat{mc}_t + \beta \mathrm{E}_t \pi_{t+1}, \tag{1}$$

where $\beta < 1$ is a real discount factor. This equation leads to a price Phillips curve if activity gaps are closely associated with deviations of real marginal costs from full-employment levels. In Sbordone's model with variable markups, instead of the preceding equation, the approximate inflation equation is

$$\pi_t = \widetilde{\xi} \widehat{mc}_t + \beta \mathrm{E}_t \pi_{t+1},$$

where

$$\widetilde{\xi} = \frac{\xi}{1 + \overline{\theta}\overline{\varepsilon}} < \xi,$$

with $\overline{\theta}$ being the natural value of the firm's demand elasticity and $\overline{\varepsilon} > 0$ the elasticity of its markup with respect to its market share. The implication is that pricing complementarity flattens the Phillips curve compared with the constant-markup case.

The question of globalization's effect is a different one, however, and turns on whether more intense competition (including, specifically, more intense international competition) actually lowers $\widetilde{\xi}$ *further* relative to ξ. If so, we would have one mechanism through which increasing openness flattens the Phillips curve. However, while more foreign competition (as measured by a lower global market share, x) clearly raises the demand elasticity $\theta(x)$ (i.e., $\theta'(x) < 0$), it can lower the elasticity $\varepsilon(x)$.[5] The net effect depends on which effect is proportionally larger.

Therefore, even when more import competition lowers average markups, it also can lower the responsiveness of markups to competition – and the latter factor is also key for the slope of the Phillips curve. An additional contrary consideration is that more import competition could drive out smaller and

[5] Note that $\varepsilon(x) = x\theta'(x)/\theta(x)[1 - \theta(x)] > 0$.

less productive domestic firms, leaving in business firms with more market power that might be less inclined to shave markups when costs rise.[6] All told, there is little clear evidence yet that international price competition is behind the flatter U.S. Phillips curve.[7]

A related hypothesis about the Phillips curve's flattening is an increasing economic role for those goods, primarily tradable goods, that might be less cyclically sensitive due to competitive pressures (Stock and Watson 2018). A recent IMF study (IMF 2018a, Box 1.2) looks at the behavior of broad aggregates of core goods and services prices across 16 advanced economies, before and after the crisis. The U.S. data (Figure 7a) are similar to the 16-country average data (Figure 7b), and seem somewhat consistent with the Stock-Watson decomposition, in that it is the post-crisis average level of services core inflation, not goods core inflation, that is lower since the crisis (indeed, the latter is slightly higher). But there are also significant short-run fluctuations in both inflation series in response to known macroeconomic shocks. The IMF authors conclude that "disaggregated inflation trends suggest that enhanced tradability and global competition are unlikely to have been the main culprits behind the sluggishness in inflation in recent years." Furthermore, given the secular upward trend in the weight of services in consumption, enhanced output tradability over time (even allowing for the enhanced tradability of services) seems an implausible explanation for a flatter Phillips curve.

Some New Keynesian models imply another potential reason for a flatter Phillips curve. This mechanism centers on the relationship between real

[6] Feenstra and Weinstein (2017) argue that trade has reduced markups in U.S. tradable industries. Their indirect method of measuring demand elasticities via concentation indexes, however, yields results that are seemingly different from more direct approaches such as the one in IMF (2019). In any case, the overall effect of trade competition on the Phillips curve's slope depends not only on how much it reduces *the level* of markups. It also depends on the effect on the *responsiveness* of markups to costs – that is, on the pass-through of costs into prices – and without such responsiveness ($\varepsilon(x) \equiv 0$), the pro-competitive effect of imports leaves the slope of the Phillips curve unchanged. For evidence on trade and markups in the EU, see Chen, Imbs, and Scott (2009).

[7] This is not, of course, to deny that a one-time surge in import competition could depress inflation over a limited horizon. But the latter effect is at most a necessary, not a sufficient condition, to establish global competititon as a potential cause of a flatter Phillips curve.

marginal cost and the output gap. A bigger output gap will depress the terms of trade if a country's exporters must lower their prices to sell more of their output on global markets. This development, however, both raises the product wage (pushing firms toward raising prices) and lowers real income (compared with the situation in a closed economy), encouraging labor supply and thereby a *lower* real product wage. If the second effect dominates, then the New Keynesian Phillips curve will be flatter (Clarida 2009). The empirical relevance of this effect has not been studied. In the open economy, the relation between output and inflation may be decoupled to the extent that spending can diverge more readily from output (Razin and Yuen 2002).

An important caveat regarding some of the preceding arguments is that they hold constant the degree of price stickiness as the economy becomes more open. It seems plausible, however, that one way global competitive pressures (and greater exposure to global risks) might work is by leading firms to adjust prices more frequently. If this happens, the Phillips curve will steepen. This possibility deserves more empirical attention. Looking at one extreme, we certainly believe that price flexibility is relatively high in smaller, very open economies (which is why economies like Hong Kong can do well with pegged exchange rates).

2.2 Wage behavior

Wage behavior is a key underlying determinant of inflation, and provides another potential reason for a flatter price Phillips curve. A typical *wage* Phillips curve might take the form

$$\widehat{w}_t = \phi GAP_t + A(L)\pi_t, \tag{2}$$

where $\widehat{w}$ is the change in the (log) nominal wage, the output gap GAP (however measured) is negatively related to unemployment via Okun's Law, and $A(L)$ is a lag-operator polynomial.[8] The positive relation between the gap and wage growth, coupled with the influence of wages on marginal cost, provides the channel through which the gap also drives price inflation, as in

[8] See Galí (2011) for derivation of a similar expession in a New Keynesian dynamic model.

equation (1). If globalization reduces ϕ in equation (2), it will likely also reduce the slope of the price Phillips curve.

A common hypothesis is that globalization has eroded the bargaining power of labor – outsourcing is more widespread than was the case several decades ago, and the intensified engagement with world markets by China, the ex-Soviet bloc, and India and other reforming EMDEs may have doubled the world's effective labor force in the early 1990s. There is not much micro-level evidence; an exception is the study of French manufacturing firms by Kramarz (2017) concluding that "strong unions caused offshoring which in turn caused employment and wage losses ...." It nonetheless seems plausible that reduced bargaining power in a more global environment would work to the disadvantage of workers.

Once again, however, establishing that an aspect of globalization has reduced wages does not directly establish that it also reduces the *response* of wages to slack. The latter effect must also be present if we are to conclude that growing globalization has flatened the wage Phillips curve over time.[9]

There is some evidence that the U.S. wage Phillips curve has flattened, but probably not as much as the price Phillips curve. Gali and Gambetti (2019), for example, report moderate flattening, although they do not link their results to globalization. Other research suggests that the recent apparent flattening of the wage Phillips curve may be a phenomenon common to other recession aftermaths (see, e.g., Daly and Hobijn 2014), and therefore possibly temporary. Hong, Koczan, Lian, and Nabar (2018) attribute the low nominal wage growth in advanced economies after the Global Financial Crisis to expectations of continuing low inflation, low productivity growth, and mismeasured slack. Stock and Watson (2018, p. 12) conclude: "Unlike core PCE inflation, the correlation between wage inflation and contemporaneous slack measures falls only slightly, and for some slack measure does not fall at all, from the pre-2000 period to the post-2000 period." The same applies comparing 1960-1983 (when globalization was less advanced) with subsequent data.[10] All in all, the conjecture that globalization has flattened

[9] A fall in wages could *indirectly* reduce the impact of wages on overall consumer inflation if it leads to a decline in the share of wages in production costs (for example, owing to inelastic business demand for labor). The result could manifest as a muted response of consumer inflation to labor-market slack.

[10] Other evidence consistent with this view includes that of Hooper, Mishkin, and Sufi

the U.S. wage Phillips curve remains just that – a conjecture. More study is needed.

2.3 Foreign prices

Import prices directly affect CPI inflation through two main channels: they (i) enter into consumer prices and (ii) enter production costs for domestic producers, and hence into the marginal cost term in equation (1).[11] If the roles of imports in consumption and production rise over time, as they have for the U.S., the Phillips curve will very likely flatten – in the sense that the response of consumer inflation to domestic slack will fall.

There are several ways to formalize this argument, but to be concrete, I adopt a less formal but flexible approach.[12] Let $\widehat{p}_{PM}$ denote the change in (log) *producer* prices of intermediate imports and $\widehat{p}_{CM}$ the same concept for *consumer* imports. Let us suppose that domestic output is produced out of labor (which I assume tentatively to be the source of all domestic value-added) and intermediate imports. In this case, and assuming a Cobb-Douglas production function for simplicity, the change in the log nominal marginal cost of producing home goods is (up to an additive constant)

$$\alpha\widehat{w} + (1-\alpha)\widehat{p}_{PM} - g,$$

where g reflects growth in input productivity (for example, through technical progress). The change in the nominal price of final home output, now denoted π_H, will be the change in marginal cost plus the markup change, $\widehat{\mu}$, so that

$$\pi_H = \alpha\widehat{w} + (1-\alpha)\widehat{p}_{PM} - g + \widehat{\mu}.$$

This equation is an identity, because the markup term is just a catch-all residual that will incorporate all the effects implied by the specific underlying dynamic pricing model – possibly a New Keynesian model, but possibly something else. In reality, of course, the term $\widehat{\mu}$ incorporates a competitive cost of capital as well as rents to firms' owners.

(2019) and of Knotek and Zaman (2014).

[11] Over time, they can also influence wage growth through their effect on expected future inflation and wage demands, but this channel is likely to be weak when expectations are well anchored.

[12] See Monacelli (2009) for a more structured approach.

Assume, in addition, that consumer imports are delivered to retail outlets from the dock with the help of labor. Assuming perfect competition in distribution and a Cobb-Douglas weight γ on the labor input, inflation in consumer import prices, π_M, is equal to

$$\pi_M = \gamma\widehat{w} + (1-\gamma)\widehat{p}_{CM}$$

(up to an additive constant).

Overall consumer-price inflation is denoted $\pi_C \equiv \theta\pi_H + (1-\theta)\pi_M$, where θ is the CPI weight of domestically produced goods and $1-\theta$ that of consumer imports. Combining the preceding equations for π_H and π_M yields consumer-price inflation,

$$\pi_C = [\theta\alpha + (1-\theta)\gamma]\,\widehat{w} + \theta(1-\alpha)\widehat{p}_{PM} + (1-\theta)(1-\gamma)\widehat{p}_{CM} - \theta g + \theta\widehat{\mu}. \quad (3)$$

As it is likely that α (the share of labor in final output) exceeds γ (the share of labor in consumer imports), the implication is that the sensitivity of consumer inflation to wage pressures – and thus to the output gap, via equation (2) – will very likely decline as θ (the consumption share of domestic goods) and α (the weight of domestic factors in final production) decline. Thus, the more open the economy, the lower the sensitivity of overall inflation to domestic slack, other things being equal. Of course, it is also possible that greater domestic slack discourages markup growth $\widehat{\mu}$, and as we have seen, while it is possible that this effect increases with openness, further flattening the Phillips curve, it is not inevitable. One additional implication of equation (3): higher slack abroad may affect domestic inflation through import prices or though $\widehat{\mu}$, even conditional on domestic slack, as suggested by Auer, Borio, and Filardo (2017) and Forbes (2018). These mechanisms are in principle *relative* price effects, and the strength and time-pattern of any impact on inflation depends on the reaction of the exchange rate and the nature of pass-through to domestic-currency import prices. There is an associated conceptual problem of interpreting the statistical significance of an external slack measure in a causal sense. However, an independent external driver of domestic inflation, not directly controllable by monetary policy, could make it less likely that there is a "divine coincidence" in monetary policy, whereby the best policy for price stability is also the best for stabilizing the output gap. Instead, the central bank would face a harsher policy tradeoff.[13]

2.4 Marginal cost correlates of U.S. consumer price inflation

Discussion of the Phillips curve and its evolution often draw inferences about the implications for monetary policy tradeoffs. But conventional Phillips curve estimates are not structural relationships and can shift over time for reasons not directly related to exogenous factors such as globalization – for example, due to changes in the monetary policy reaction function (McLeay and Tenreyro 2019). For this reason, an assessment of the impact of globalization on the policymaker's predicament is hard to deduce from the so-called Phillips curve "tradeoff." More reliable approaches (albeit more laborious) would evaluate expected policy loss under different degrees of openness, or the impact on tradeoffs between competing objectives (for an example of the latter approach, see Erceg, Gust, and López-Salido 2009). These metrics depend on taking a stand on a particular dynamic model, and I will not attempt such an exercise here.

Rather than reporting Phillips curve estimates – a ground amply covered in other studies – I instead will report the partial correlations suggested by the pricing relationship (3), with the markup-term being considered as a regression error. Of course, that error is correlated with the included regressors, and therefore the resulting estimates do not have a structural interpretation. They certainly do not describe a policy-invariant constraint in a central-bank optimization problem. The findings are suggestive, however, and do furnish a set of empirical regularities that theories of an evolving inflation process should explain.

Table 1 reports ordinary least squares regressions over 1964-2018 of quarterly U.S. CPI inflation on three variables: nominal wage growth (measured by average hourly earnings of production and nonsupervisory employees in the nonfarm private sector, as reported by the BLS); growth in overall import prices (as measured by the IMF's aggregate import price index); and the growth in labor productivity in the nonfarm business sector (real output per

[13] Ihrig et al. (2010) and Mikolajun and Lodge (2016) find no evidence that foreign activity variables directly enter domestic Phillips curves.

hour of all persons, as reported by the BLS). The BLS reports disaggregated U.S. import price indexes starting in 1992, and Table 2 will use those data to separate total import price growth into consumer and producer goods. However, Table 1 gives an indication of very long-term changes in the inflation process. All variables are four-quarter trailing moving averages, to eliminate any seasonality, and the table reports Newey-West standard errors.

Over the entire 1964-2018 period (Table 1), wages have a substantial and highly significant positive correlation with inflation, import prices are important, and inflation tends to fall when labor productivity rises. However, the coefficients appear unstable over time. Most notably, the role of wages falls dramatically over time, as (to a somewhat lesser degree) does that of labor productivity. The role of overall import prices fluctuates, possibly trending downward until the post-crisis period. This pattern seems contrary to the idea of import prices playing a growing role in U.S. inflation.

In qualitative terms, the results are remarkably similar when instead of average hourly earnings, the labor-cost measure is the growth in compensation per hour. (That measure allows an extended sample starting in 1957. I do not report those results here.)

Table 2 focuses on the post-1992 period and breaks import prices into consumer and producer goods. I construct import price indexes for those two categories by defining consumer goods (admittedly, approximately) as those the U.S. Census classifies in the categories food, feeds, and beverages; automotive vehicles, parts, and engines; and consumer goods. Imported producer goods are those falling under the categories industrial supplies and materials; and capital goods, except automotive. The overall inflation rates for consumer and producer imports, $\widehat{p}_{CM}$ and $\widehat{p}_{PM}$, are then constructed from disaggregated index changes using import-value shares as weights.

Table 2, like Table 1, shows a declining importance of wage growth over time, but within the 1992-2018 sub-sample, a growing importance of productivity growth (also seen in Table 1). In these estimates, it is the prices of imported producer goods rather than consumer imports that show the more consistent correlation with CPI inflation, with imported consumer goods becoming significant only in the post-crisis period. This finding echoes that of Auer, Levchenko, and Sauré (2018) on the role of input-output linkages in propagating PPI inflation globally. When compensation per hour is the labor-cost variable, the results (not reported) are generally similar.

Returning to the U.S. Phillips curve, these findings would be consistent with a declining role for labor-market slack over time in explaining overall inflation. The finding that wages and productivity have become less correlated with inflation over time is consistent with the finding of King and Watson (2012) that unit labor costs have become less important in explaining prices, although their study did not explicitly consider import prices; see also Peneva and Rudd (2015) and Bidder (2015). The role of import-price inflation does not seem to have grown over time, in line with the findings of Ihrig et al. (2010).

The several-trillion dollar question is to understand what explains the residual $\widehat{\mu}$ in equation (3) – which captures compensation of non-labor productive factors as well as non-competitive rents. More research on the apparently reduced role of labor costs is needed, including possible links to globalization through a secular fall in the U.S. income share of labor (IMF 2017a). Answering this question has important implications for inflation forecasting and monetary policy.

2.5 The monetary transmission mechanism

Coming back to Dornbusch and Krugman (1976): if import prices respond strongly to exchange depreciation and firms have little capacity to absorb higher costs in markups, then the overall inflation response to monetary expansion may well be greater than in a hypothetical closed economy. For this reason, Dornbusch and Fischer (1986, p. 493) stated: "Theory suggests and empirical evidence supports the notion that under flexible exchange rates the Phillips curve is much steeper." But to say that the inflation response to a positive monetary shock is greater in an open economy is not the same as saying that the response of inflation to the output gap is greater — indeed, it very likely will be smaller.[14] Furthermore, the conditions of high pass-

[14]That is probably why Dornbusch and Krugman (1976, p. 573) distinguish between a "conventional" short-run Phillips curve and a Phillips curve "in terms of market prices." Their concept seems related to what Barnichon and Mesters (2019) call the "Phillips multiplier." Different understandings of what a "steep" Phillips curve means may explain some confusion in the literature. Thus, Rogoff (2006, p. 269) writes that "globalization creates [a] favorable milieu for maintaining low inflation by steepening the output-inflation

through that Dornbusch, Fischer, and Krugman assumed do not well describe the U.S. economy today (Gopinath 2016).

This is not to deny that the broader issue these authors addressed – the monetary transmission mechanism in the open economy – is of central importance. In the closed economy, monetary policy directly impacts domestic aggregate demand. Three main qualitative differences apply to any open economy, however:

1. The aggregate-demand effects on market interest rates and asset prices will be intermediated by the exchange rate and depend on global financial market conditions.

2. Some aggregate demand will spill onto imports while some output is sold abroad, with the effects again intermediated by the exchange rate.

3. The pass-through of exchange rates to import prices will be a critical determinant of the inflation response.

There are several illuminating studies of these mechanisms and their quantitative impact, for example, the one by Erceg, Gust, and López-Salido (2009). Since that ground has been ably covered by others, I will be selective and focus next on an aspect of item #1 above, the influence of international financial markets.

Later on, however, I will look at one further global dimension of monetary that applies primarily to the United States: the outsized global impact of U.S. monetary policy due to the unique international roles of the dollar and of U.S. financial markets. This channel is an important additional transmission mechanism.

(Phillips curve) tradeoff faced by central banks." His discussant, Bean (2006, p. 308), finds this remark puzzling and observes: "I am less convinced ... that globalization will result in a steepening of the short-run output-inflation tadeoff. Extant analyses of the tradeoff in open economies instead suggest that the increased specialization resulting from globalization *reduces* the response of inflation to the domestic output gap and makes it more sensitive to the world output gap, leading to a flatter tradeoff ...." They are likely both right ... but they are talking about different things.

2.6 Summary

The U.S. price Phillips curve has flattened over time – a development not confined to the United States. The reason for this is unclear – the Phillips relationship between inflation and slack is not structural, but is policy-dependent through multiple mechanisms The evidence is weak that increasing globalization, as opposed, say, to better anchored expectations (something common to many countries), is responsible. The evidence of a flatter wage Phillips curve is more tenuous.

Import prices are a robust correlate of U.S. CPI inflation and could provide a mechanism (along with markup changes) for foreign slack measures to correlate with U.S. inflation over some time spans. The policy implication of such a correlation is not obvious (Woodford 2009). Ultimately, though (once sticky-price and pricing-to-market rigidities have been worked through), exchange-rate changes induced by monetary shocks will feed proportionately into import prices, ensuring domestic monetary policy long-run control over domestic prices (except in implausible circumtances). The process could be relatively lengthy, however, confronting the central bank with harsher medium-term tradeoffs.

One strong pattern in the data is a weaker correlation of U.S. wage changes with CPI inflation. The reasons behind this also are unclear. They could be related to globalization, to the extent that the mechanism lowering labor's GDP share depends on global factors (for example, low-wage imports or firms' capacity to move labor-intensive operations offshore).

3 International financial linkages and monetary policy

Because U.S. financial markets are closely intertwined with markets abroad, developments in those markets will buffet the U.S. economy and could call for monetary policy responses – either through interest-rate changes or balance-sheet adjustments. Sometimes those responses serve to offset or temper shocks, sometimes to accommodate global trends that could destabilize U.S. inflation if not properly reflected in the monetary-policy reaction function. The range of potential policy issues is broad, so here I will limit my discussion to two main transmission channels for global influences: the natural real rate of interest and financial factors more broadly construed.

Connections with foreign financial markets complicate the central bank's quest for financial stability, with potential monetary policy implications (see, for example, Obstfeld 2015). However, I will touch on financial stability considerations only in passing, as they are the focus of a separate paper at this conference.

3.1 The natural real interest rate

The "natural" or "neutral" real rate of interest r^*, a concept that has been central to monetary theory from Wicksell (1898) to Woodford (2003) and beyond, provides a key benchmark for monetary policy. It is typically defined as the real rate of interest consistent with full employment in a hypothetical world with perfectly flexible prices and wages. The general precept most inflation-targeting central banks follow approximates the following approach: set the nominal policy interest rate less forecast inflation – the expected *real* policy rate – above r^* when inflation is forecast to be above target, and below r^* in the opposite case. Because r^* is not directly observable as the actual market return on any instrument, central banks face a challenge in estimating it, and especially so when r^* is not stable, as changes can be hard to detect in real time (even when there is inflation-indexed government debt). In any financially open economy, interest rates are determined in part by global market forces, and so developments abroad can exert a decisive force on domestic r^*. This dependence is a two-edged sword for policymakers: purely domestic factors that might move r^* will be muted, but by the same token, foreign factors that could be much harder to monitor will play significant roles.

Figure 8 illustrates the coherence of long-term real rates for a sample of industrial countries.[15] Del Negro et al. (2018) develop a methodology for estimating trend real interest rates, which likewise show remarkable convergence over recent decades.

[15] Figure 8 adjusts for the temporary inflation effects of Japanese increases in consumption tax in April 1997 and April 2014. In the figure, expected inflation is proxied by inflation over the preceding 12 months.

3.1.1 Global determination of real interest rates

Popular methodologies for estimating r^*recognize potential global interdependence, but largely proceed on a national basis, as if each economy were a self-contained unit (e.g., Holston, Laubach, and Williams 2017). Even such exercises tend to yield r^* estimates which, like market real interest rates, are highly correlated across countries – unsurprisingly, because the underlying real data inputs are generated in a market setting that enhances comovement among national macroeconomic variables, including interest rates.

A simple textbook diagram based on Metzler (1968) can elucidate the main forces at play. It uses the same underlying model that informs Bernanke's (2005) account of a global saving glut starting in the late 1990s.

Figure 9 illustrates the global determination of the full-employment real interest rate in a hypothetical world with two regions, Home (think of it as the United States) and Foreign (the rest of the world). In each region, saving is increasing, and investment decreasing, with the real interest rate. In the simplified case shown in Figure 9, there is a homogenous world output – said differently, PPP holds – so that with an integrated world financial market, the real interest rates prevailing in Home and Foreign will be fully equalized by net international capital flows. Importantly, there is also only a single asset available – the real bond indexed to the single output – and no other asset returns influence economic behavior. Moreover, countries' consumption and investment opportunities are constrained only by their full-commitment intertemporal budget constraints – there is no question of asymmetric information or default.[16]

Global equilibrium means that *world* saving equals *world* investment – not that saving and investment coincide country by country. Figure 9 show the equilibrium world natural rate of interest as $r^*_H = r^*_F$. In this equilibrium, Home's deficiency of saving compared with investment – its current account deficit – must be precisely offset by Foreign's excess of saving over investment – its current account surplus.

Figure 9 also indicates the hypothetical *autarky* natural rates of interest, r_H^{aut} and r_F^{aut}, that would prevail in Home and Foreign, respectively, if they were excluded from international borrowing and lending. These real interest

[16] For micro-foundations of the Metzler model, see Obstfeld and Rogoff (1996).

rates force saving to equal investment in each country. Notice how the equilibrium world interest rate necessarily falls between the two autarky rates: Home, with the higher autarky rate, has a current account deficit and thus capital inflows, whereas Foreign, with the lower autarky rate, has a current account surplus and thus capital outflows.

3.1.2 Role of the current account balance

Figure 9 makes the key point that the natural real rate of interest is intimately tied to the current account. Albeit simplified, the model has an important immediate implication: because the global equilibrium interest rate is a weighted average of national autarky rates, shocks to autarky rates anywhere will affect current account balances and the natural real rate everywhere.

Advanced countries no longer focus directly on the current account balance (or other balance of payments flows) when setting monetary policy – the Reserve Bank of Australia placed a heavy emphasis on the current account deficit at one time, and of course, U.S. official liabilities were a major consideration for monetary policy throughout the 1960s and until 1971. There are thus relatively few formal studies of the interaction between the current account and monetary policy, notable exceptions being Ferrero, Gertler, and Svensson (2009) and Corsetti, Dedola, and Leduc (2018). Those central banks for which the current account remains an important consideration tend to be in emerging market economies, which are more vulnerable to capital-flow sudden stops. Even in those countries, provided the exchange rate is flexible, the simultaneous preservation of internal and external balance is in principle the joint responsibility of monetary and fiscal policy, with monetary policy ideally focusing relatively more on the internal balance, at least outside of crisis situations.

There are at least two reasons why monetary policy may be more effective if central banks monitor current-account developments closely, however. First, changes in natural real rates therefore are likely to have current-account implications, so significant sustained current-account shifts will give clues about changes in the natural rate.

Second, significant sustained current-account shifts may be driven by developments with implications for financial stability. These can have dramatic impacts on output and prices down the road, as the events preceding the Global Financial Crisis illustrate (Obstfeld and Rogoff 2009; Obstfeld 2012). To begin, I take up the first of the preceding motivations for attention to the current account.

As an initial illustration, consider Bernanke's (2005) account of how a rise in East Asian saving after the late-1990s regional crises changed the United States' external equilibrium. If we identify Foreign with Asia, Figure 10 shows the effects of an outward shift in the Asian saving schedule from S_F to $S_F^{'}$. That shift lowers the autarky interest rate in Asia, raising its desired current account surplus. At the same time, the natural real rate in the United States necessarily falls, swelling its full-employment current account deficit. Had the Federal Reserve (in the real world with sticky prices and wages) not accommodated this fall in the natural rate, the result would have been currency appreciation, deflationary pressure, an incipient rise in the real rate of interest, and a slump.

3.1.3 Role of the real exchange rate

Of course, PPP (as assumed in Figure 10) does not hold in reality: real exchange rates, which I will define for my purposes as the ratios of national consumer price levels when measured in a common currency, are quite variable. Their variability reflects a range of factors including trade impediments in merchandise and services markets; moreover, changes in relative goods prices can drive real exchange rate changes when national CPI baskets differ in composition. The framework's basic qualitative insights still hold when PPP fails, however, but with quantitative modifications.[17]

To extend the model, let q denote the log price of the Foreign consumption basket in terms of the Home basket – the Home-Foreign *real exchange rate* – so that a rise in q (the Foreign basket becomes relatively more expensive) is a real depreciation of the Home currency. The uncovered interest parity

[17] Clarida's (2009, 2017) New Keynesian framework elucidates the influence of global forces on natural real rates in a setting that allows for PPP deviations. But his closed-form model solution makes several special assumptions that obscure some of the forces at work in the interest of algebraic tractability. (For example, his model does not permit current account imbalances in equilibrium.) His discussion is, however, fully consistent with mine.

condition linking countries' *nominal* interest rates is equivalent to a real interest parity condition linking their *real* interest rates, of the form

$$r_H^* = r_F^* + \mathrm{E}\Delta q$$

under conditions of full employment. The validity of this condition relies on risk neutrality and an absence of differential liquidity benefits attached to safe national debt instruments (Del Negro et al. 2018).

The expected rate of relative Home currency depreciation, $\mathrm{E}\Delta q$, effectively drives a wedge between the Home and Foreign real rates of interest. Figure 10 shows how this change alters the effect of a rise in Foreign saving, which Figure 10 illustrated earlier for the PPP case. Figure 11 relies on two assumptions. First, it assumes that a rise in Foreign saving will lead to a real appreciation of Home currency, which is necessarily also a depreciation of Foreign currency. Generally a country's consumers have a home bias in favor of home-produced goods, so a rise in their saving will depress the price of their preferred consumption basket relative to those of consumers elsewhere. Second, the figure assumes, consistent with a large body of empirical research, that real exchange rates are mean reverting (see also Del Negro et al. 2018). Thus, a rise in Foreign saving is most likely to produce an immediate fall in q coupled with an expected future increase, that is, with a rise in $\mathrm{E}\Delta q$ – just as Figure 10 shows. (The assumed behavior of q can be rationalized even under flexible prices.)

In the absence of any real exchange rate change, the (unique) global real interest rate would settle between $r_H^{*\prime}$and $r_F^{*\prime}$ as in Figure 10, implying a bigger Home deficit and counterpart Foreign surplus. A positive value of $\mathrm{E}\Delta q$, however, pushes equilibrium natural rates closer to autarky rates, reducing the size of the current-account changes. Obstfeld and Rogoff (2001) explored how goods-market impediments can mute the response of capital flows to shocks.

In the case that Figure 11 shows, a bigger U.S. deficit is a signal of a fall in foreign autarky interest rates, necessarily bringing down the U.S. natural real rate in response to global deflationary pressure. The appropriate policy response is to cut U.S. nominal rates. But the U.S. current account deficit may rise for other reasons. Figure 12 shows the effects of an outward shift in the U.S. investment schedule (from I_H to I_H'). That change raises the U.S.

autarky rate, raises the foreign level of real rates by less, and thereby results in a larger U.S. deficit. The implication is that if the initial position is one of full employment, the central bank may well wish to tighten monetary policy – if it does not, then despite the currency's appreciation, the result will be a positive output gap followed eventually by inflation.[18]

3.1.4 The current account and financial imperfections

I have presented Figures 11 and 12 as reflecting independent developments, but in the case of the United States in the 2000s, they were not: the first promoted the second. Low U.S. interest rates (coupled with forward guidance) early in the 2000s arguably encouraged a house-price and residential investment boom, coupled with symbiotic financial innovation in mortgage securitization. The result could well have been an outward shift in the U.S. investment schedule (as in Figure 12) and a further deterioration in the U.S. external balance. This is essentially the story that Obstfeld and Rogoff (2009) and Obstfeld (2018) tell. Figure 13 shows the time series of U.S. investment and the current account, highlighting the strong "second leg" of current-account deterioration from roughly 2003-2006.

This brings me back to the financial-stability motivation for central banks to be aware of the current account. In retrospect, the sharp drop in the current account starting around 2003 may have been signaling a domestically-driven rise in the natural real rate, and a need for monetary tightening. The lesson is that monetary policy, perhaps especially at low nominal interest rates, cannot be divorced from financial evolutions that not only impinge on financial stability, but also can generate structural shifts in the saving and investment schedules that determine the natural rate r^*. Thus, notable current-account developments can furnish clues to perhaps dangerous financial-sector developments.

Indeed, recent research has shown how financial development can itself be a further determinant of autarky interest rates, not captured in the preceding simple model. In the model of Caballero, Farhi, and Gourinchas (2008), an

[18] In discussing Figures 11 and 12, I do not sketch out the subsequent dynamics, driven by the evolution of the NIIP and the need for countries to service their foreign debts in the long run. Those developments will require long-run shifts in the saving and investment schedules (for the deficit country, for example, toward more saving and less investment).

enhanced ability of a country's financial markets to securitize income flows into a tradable form directly raises the autarky interest rate and thus, the country's current account deficit. A challenge for central bank policy is that such financial innovation may itself be endogenous to the monetary stance, and may promote instability down the road.[19]

3.1.5 Low global real rates: Implications for monetary policy

As Del Negro et al. (2018) illustrate, trend real interest rates (and the trend real "world" rate, which they estimate) have moved sharply downward since the 1980s, and in concert among advanced economies. Synchronicity is expected in a world of internationally integrated capital markets, but their work and that of others points to a range of common factors driving interest rates lower, including aging work forces, slower productivity growth, and relative scarcity of safe assets (see, e.g., IMF 2014; CEA 2015; Yi and Zhang 2016; Rachel and Smith 2017; Brand, Bielecki, and Penalver 2018; Rachel and Summers 2019).[20]

The long-term forces that these papers document, complemented by the recent work of Gourinchas and Rey (2018) documenting the historical tendency for low consumption-wealth ratios to predict future low real interest rates, suggest that low values of r^* could remain on the global scene for some time, especially in the advanced economies. The global determination of real interest rates implies that, given their inflation targets, foreign events may drive central banks to their effective lower bounds (ELBs) on policy interest rates, making it impossible for monetary policy to respond with further interest cuts to deflationary shocks from abroad (see Caballero, Farhi, and Gourinchas 2016). With medium-term inflation targets at around 2 percent per year, a central bank that relied only on *conventional* monetary tools would be unable to counter a shock that drove r^* to -2 percent or below, even in the favorable case that inflation expectations remained anchored at 2 percent rather than declining. As a result, the possibility of monetary policy being constrained when faced with either domestic or foreign deflationary shocks is higher – perhaps even higher than Kiley and Roberts (2017) esti-

[19] On the long-run relationship between business-cycle develoments and financial evolution, see Jordà, Schularick, and Taylor (2017).

[20] For a longer-term perspective, see Jordà et al. (2017).

mate – and clearly justifies a re-think of policy frameworks to reduce potential ELB episodes and, thereby, to expand monetary policy space.

3.2 Broader financial forces

In standard models, the real rate of interest r is a safe rate, set in markets to equate the *flows* of saving and investment at the global level. As has been especially evident in the recent era of large scale asset purchases, monetary policy also works in part by altering the relative prices of a range of generally risky assets, where prices are determined to equate global investors' portfolio demands for particular assets to the *stocks* that are available worldwide. The perspective of an integrated stock-flow equilibrium with multiple assets, due in its essentials to Tobin (1961), draws attention from the *net* flow of international lending measured by the current account balance, and toward the *gross* two-way flows which, in equilibrium, finance that balance and which in turn derive from desired changes in stock positions given global changes in asset prices, in wealth, in financial constraints – and, importantly, in investor preferences and sentiment.

Shifts in foreign asset demands are therefore a potential source of disturbances with monetary policy implications, as are domestic residents' shifts between domestic and foreign assets. At the same time—as the next section takes up in greater detail—financial-market structures imply that Federal Reserve actions are likely to propagate powerfully abroad, much more so than for other central banks, with important potential spillbacks onto the U.S. economy itself.

3.2.1 Dollar "liquidity" shocks

As I will discuss further in the next section, the U.S. dollar has a unique role in the international monetary system as an official reserve currency, a funding currency, an invoicing currency for trade, and a vehicle currency in the foreign exchange market. As a result, safe dollar assets (including U.S. Treasury securities, but not necessarily restricted to those) are thought to offer convenience yields over and above their pecuniary returns (see, for example, Krishnamurthy and Vissing-Jorgensen 2012; Canzoneri, Cumby, and López-Salido 2013; Jiang, Krishnamurthy, and Lustig 2018).[21] These liquidity yields are variable and rise in periods of global stress as the dollar plays the role of a safe haven. Conversely, a big sell-off of dollar assets (for example, due to political factors) could pose particular challenges for monetary policy if the result is a U.S. spending decline coupled with higher depreciation and inflation (as modeled by Canzoneri, Cumby, and López-Salido 2013).

Figure 14 takes a first look at a rise in the global demand for U.S. dollar assets within the simplified flexible-price theoretical framework of the last subsection. The underlying modeling assumption is that in each region, the rate of return primarily influencing saving and investment is the nominal home-currency bond rate less the expected rate of domestic consumer-price inflation, notwithstanding the possibility that some actors transact in foreign securities.[22] If initially current accounts are balanced, the emergence of a liquidity premium λ on Home bonds creates a gap between the two countries' natural real rates with the U.S. rate falling to r_H', the Foreign rate rising to r_F', the Home current account moving into deficit, while Foreign generates the counterpart surplus. The driving mechanism in this example is not the effect of asset demand shifts on the exchange rate, but the movement in interest rates necessary to reflect the gap λ, which, in turn, moves the countries along their saving and investment schedules. Were the real exchange rate variable, however, as in Figures 11 and 12, the Home currency would appreciate in the short turn, leading to an expected future depreciation which, in turn, would require a somewhat higher r_H' and lower r_F' in equilibrium, and, overall, a smaller short-run home Home deficit and Foreign surplus.

[21] Recent applications in asset-pricing models include Del Negro et al. (2018) (interest rates) and Engel and Wu (2018) (exchange rates).

[22] Even if dollar interest rates are low due to a liquidity factor, foreign dollar borrowers will pay the same foreign-currency rate as through home borrowing if they hedge those dollars in the FX swap market and covered interest parity holds (CIP). Otherwise, they will bear currency risk. Since the Global Financial Crisis, substantial deviations from CIP have, however, become commonplace (Cerutti, Obstfeld, and Zhou 2019). Nonetheless, for most currencies, most issuers are unable to arbitrage that "dollar basis" by borrowing dollars and swapping into their domestic currencies. For example, the difference between lower-medium-grade corporate bond yields and Treasury yields, often taken as a measure of the dollar liquidity yield, wipes out much or all of the dollar basis.

Once source of the Treasury liquidity premium is the U.S. dollar's status as the world's premier reserve currency. Warnock and Warnock (2009), Krishnamurthy and Vissing-Jorgensen (2012) and others have documented effects of foreign official demand on US Treasury yields. Of USD 10.7 trillion of 2018:Q4 allocated foreign exchange reserves covered in the IMF's COFER database, USD 6.6 trillion (62 percent of global reserves) were held in dollars. Foreign official reserve behavior thus could be a significant source of shocks to U.S. bond markets. Another source of the U.S. dollar liquidity premium is the dollar's unique role as a vehicle currency in FX markets. The last (2016) Triennial Central Bank Survey of Foreign Exchange and OTC Derivatives Markets showed the U.S. dollar share in daily FX turnover to be 88 percent (out of 200 percent, given that every deal involves two currencies).

The structurally low required return on U.S. Treasuries may also be related to the U.S. global safe haven role – which, in turn, may owe to the greater liquidity of dollar assets and the depth of U.S. financial markets. Gourinchas, Rey, and Govillot (2017) observe that when the dollar appreciates unexpectedly in an environment of global distress, the resulting decline in the U.S. NIIP is a transfer of wealth to foreigners that effectively acts as an insurance pay-out when the world economy is in turmoil (Figure 5). If dollar securities have higher real payouts when global wealth takes a hit, however, then average dollar yields should be lower. On this theory, the "exorbitant privilege" of low dollar borrowing costs is matched by an "exorbitant duty" to transfer wealth to foreign holders when global financial conditions tighten. If so, changes in foreign risk aversion or perceptions of risk would impinge on U.S. interest rates.

Consistent with this "exorbitant duty" view, the 1980-2018 correlation coefficient between the Fed's broad nominal dollar index and the IMF's measure of real global growth is -0.53, meaning that the dollar does have a meaningful tendency to appreciate when global growth is low.[23]

[23] The IMF weights countries' growth shares in world GDP growth using their PPP-adjusted income levels. Using market exchange rate GDP weights instead, the preceding correlation is -0.25. It is lower because when global growth slows and the dollar appreciates, non-U.S. countries' weights in global growth get systematically down-weighted when evaluated at market exchange rates.

3.2.2 Other global influences over financing conditions

Federal Reserve control of the policy interest rate is meant to influence the entire term structure, as well the prices of other risky assets, in order to steer inflation and employment. Financial impulses from abroad can, however, weaken the links between the policy interest rate, other asset prices, and activity, and in this case, confront the Fed with harsher policy tradeoffs – for example, whether to tighten policy, even though inflation is quiescent, in order to deter financial excesses in some markets. This type of dilemma is present even in a closed economy, of course, but financial openness increases the United States' exposure to foreign financial influences, for example, via shifts in foreign demand for U.S. assets, driven by changing portfolio preferences or by financial conditions abroad.[24]

Figure 15 illustrates the potential divergence between Fed interest-rate policy and overall financial conditions. Both of the major hiking cycles since the early 2000s show overall financial conditions lagging well behind interest-rate tightening. The cycle beginning in June 2004 featured a much-noted failure of longer-term interest rates to respond commensurately – the "Greenspan conundrum," which many attributed to the influence of foreign demand for safe U.S. longer-term securities. The cycle that began in December 2015 is followed by a similar failure of U.S. financial conditions to adjust in the same direction – instead, financial conditions loosen through the end of December 2018. Again, foreign conditions certainly played some role – whether through the European Central Bank's asset purchase program, foreign appetite for U.S. corporate debt, or other factors.

Caballero, Farhi, and Gourinchas (2017) offer an integrated framework for thinking about the evolution of rates of return in a world of multiple assets, traded in world markets. They argue that, especially since 2008, a global shortage of safe assets (driven in part by higher risk aversion) helps to explain the non-trending rate of return on U.S. capital coupled with a declining risk-free rate and rise in the equity premium. While this account is stylized, it

[24] Adrian, Stackman, and Vogt (2019) operationalize this tradeoff in a particular way, as a tradeoff between average growth and growth volatility. They argue that empirically, countries with greater exposure to global financial-market sentiment (as represented by the VIX) face a steeper tradeoff (i.e., more extra output growth volatility for each additional percentage point of growth).

does illustrate the potential role of global financial conditions beyond the interest-rate channel featured in the Metzler model. Moreover, these factors will shift saving and investment rates *given* the risk-free rate of interest, and thereby move the natural rate r^* consistent with full employment. There is no general "divine separability" under which policy interest rates can be set independently of other financial conditions.

Financial conditions and, through them, economic activity thus will be influenced by a range of financing terms and conditions beyond any single measure of the interest rate. This fact has implications for thinking about about international capital flows. For a given *net* capital account balance, the volume and nature of *gross* inflows – the gross financing that foreign markets make available – is also critical in determining relative asset prices and the availability of credit. In general equilibrium there can be an effect on the current account balance, of course, but that net balance does not by itself reveal the underlying gross flows, which are all-important for economic activity and financial stability.[25] Another way to express this is to think about the role of a floating exchange rate. In advanced economies, at least, a floating exchange rate can help buffer economic shocks by automatically maintaining balance-of-payments equilibrium. However, compositional mismatches between gross capital outflows and inflows can have important impacts on financial markets without the changes in incipient *net* capital flows that are more likely to move exchange rates.

Bernanke et al. (2011), for example, document how European banks recycled outflows from U.S. money-market mutual funds (MMFs) back into U.S. markets in the mid-2000s, pushing down yields on mortgage-backed securities (and other substitutable assets) and helping to fuel the U.S. housing bubble. Consistent with my earlier claim that such inflows may have materially raised U.S. housing investment, Bernanke et al. (2011) suggest that:

> The strong demand for apparently safe assets by both domestic and foreign investors not only served to reduce yields on these

[25] On this point, see Borio and Disyatat (2015) and Obstfeld (2012). Forbes and Warnock (2012) document surges and retractions in gross flows, and their correlation with risk aversion (as measured by the VIX). For a simple model of how foreign investor preferences can determine the macroeconomic impact of capital inflows, see Blanchard et al. (2017); but the types of effects they highlight can arise even from gross, not just net, inflows.

> assets but also provided additional incentives for the US financial services industry to develop structured investment products that "transformed" risky loans into highly-rated securities.

These flows also helped set up a potentially destabilizing nexus of financial interconnection among U.S. MMFs, European banks, and the U.S. housing market.[26]

3.2.3 Links among long-term nominal yields

Global influences over long-term interest rates may reflect forces beyond global current account imbalances or reserve accumulation by EMDEs, including investor sentiment, central-bank large-scale asset purchases, and government financing needs. Not just long-term *real* interest rates, but also long-term *nominal* interest rates, are surprisingly highly correlated across countries.

At one level this may not be so surprising. Even EMDEs have converged in recent years toward lower inflation rates (IMF 2018b; Ha, Kose, and Ohnsorge 2019), real exchange rate changes are eventually mean reverting, and there is are strong global common factors driving countries' real interest rates and likely also, term premia.[27] Moreover, other things being equal, the exchange-rate movements necessary to allow substantial changes in long-term interest differentials are very big. In a world of uncovered interest-rate parity, for example, a relatively small expected exchange rate change can allow big international differences in one-month interest rates; but by the same token, a very large cumulative expected change would be needed to support big differences in ten-year rates.

One way to illustrate the coherence of long-term rates is through regressions of interest-rate changes on changes in a base-country interest rate – either the United States, or an alternative "natural" anchor currency. Table 3, which updates through early 2016 some of the results in Obstfeld (2015),

[26] See also Acharya and Schnabl (2010).

[27] Cohen, Hördahl, and Xia (2018) review alternative term premium models and conclude that U.S. and euro area term premia are more correlated than are the components of long-term rates explained by expected interest rates. See also Hellerstein (2011) and Jotikasthira, Le, and Lundblad (2015).

reports quarterly pooled nominal interest-rate regressions of the change in country j's nominal interest rate on the change in its base country's rate,

$$\Delta R_{jt} = \alpha + \beta \Delta R_{bt} + \gamma' X_{jt} + \varepsilon_{jt},$$

where the controls X_{jt} are current and lagged output growth and in inflation in country j, variables suggested by the Taylor rule. The table reports regressions with only the United States as a base country–columns 1 and 5–as well as regressions in which countries are allowed to have distinct base partners–columns 2–4 and 6–8. The latter setup allows panel regressions in which a time fixed effect can soak up common global shocks to interest rates, as well as regressions that control explicitly for likely common shocks–in Table 3, the change in the VIX (columns 4 and 8).

The message in Table 3 is that global long-term interest rates co-move closely with their base-currency rates (usually the dollar or euro long-term rates), and much more so than short-term rates. The correlation appears even higher when controlling for the VIX, rises in which have a significant positive impact on global long-term nominal rates. This shift could reflect the safe haven roles of the main reserve currencies. Other authors find high correlations for long-term rates with U.S. rates, and higher correlations than these for short-term rates, even controlling explicitly for U.S. macroeconomic and the VIX. Those results are consistent with a causal impact of U.S. rates on foreign rates (Hofmann and Takáts 2015).

The correlations of long-term interest rates with center-country rates raise the question of how strongly changes in foreign long-term rates spill over to U.S. rates, and in particular, how U.S. rates have responded to specific foreign shocks, such as the ECB's unconventional policies, including large-scale asset purchases. There is considerable evidence of significant spillover from U.S. quantitative easing to foreign asset prices, particularly in EMDEs (Bauer and Neely 2014; Bowman, Londono, and Sapriza 2015; Rogers, Scotti, and Wright 2014, 2018). In their initial roll-outs (for example, through 2012), ECB unconventional policies appear to have had a more limited effect on bond yields outside of the euro area, certainly when compared with the external effect of Fed policies (Rogers, Scotti, and Wright 2014; Fratzscher, Lo Duca, and Straub 2016). The evidence for more recent ECB quantitative easing seems more mixed (Coeuré 2018), although the ECB Asset Purchase Programme that started in March 2015 has not prevented U.S. 10-year Treasury yields from rising, nor the gap between those and yields on 10-year Bunds from growing.

A growing literature points to the dollar's unique global role as a likely factor in the asymmetrically strong global response to U.S. unconventional measures. The dollar's role has other far reaching implications for U.S. monetary policy, to which I now turn.

4 Implications of the dollar's global role

The last section documented the U.S. dollar's unique global position as a reserve currency and a vehicle currency. Those roles are intimately tied to the two additional roles in which the dollar occupies first rank: invoice currency and funding currency. Parallel to section 2 of this paper, the dollar's invoice-currency role affects the international price mechanism by influencing how U.S. monetary policy will move real exchange rates, inflation, and export competitiveness throughout the world. Parallel to section 3, the dollar's funding currency role mediates the transmission of U.S. monetary policy to global financing conditions.

The U.S. dollar also stands out from other currencies as the prime "anchor" or "base" currency for exchange rate stabilization. In other words, the many (mostly emerging and developing) countries that intervene to limit their currencies' foreign-exchange flexibility often see their bilateral U.S. dollar exchange rate as the most appropriate benchmark for stability. Ilzetzki, Reinhart, and Rogoff (2017) reckon that for about 60 percent of the world's countries (even more on a GDP-weighted basis), the dollar is the anchor currency. Thus, to the extent that these countries value exchange stability and intervene in the foreign exchange market to limit fluctuations, Federal Reserve policy, more than the monetary policies of other major central banks, will have an immediate impact on domestic financial conditions.

Through these mechanisms, U.S. monetary policy has an outsized impact on global economic activity – consistent with the evidence on unconventional policy spillovers that the last section reviewed. The Federal Reserve, even more than other central banks, has grounds to consider spillbacks from the global economy as a relevant transmission mechanism for its policies.[28]

4.1 Dollar invoicing

Much international trade is invoiced in U.S. dollars, even when the United States is not a party to the trade. Only the euro is at all a rival in this respect, but the share of world trade invoiced in euros is much lower. And for the United States, of course, the dollar dominates for both imports and exports, with 93 percent of imports and 97 percent of exports invoiced in dollars (Gopinath 2017).

A large literature has focused on how the choice of invoice currency affects the exchange-rate adjustment mechanism, given that import and export prices tend to be set, and typically are at least somewhat sticky, in invoice currencies (see the survey by Corsetti, Dedola, and Leduc 2011). As pointed out by Goldberg and Tille (2006, 2008) and Gopinath (2016), invoicing in a dominant international currency will imply that exchange-rate changes can have unexpected relative-price effects on trade flows. For example, if a country's imports and exports are both largely invoiced in dollars, a depreciation of its currency against the dollar will sharply raise the price of imports, but will not in itself make its exports cheaper for foreign buyers, who will face unchanged dollar prices for those goods. As a result, all near-term trade adjustment will take place on the import side. (Exporters' domestic-currency profits per unit sold will, however, rise, but while that might induce expansions of export supply and employment over time, the process is likely to be slower than an export expansion powered by external demand.) The United States' singular invoicing pattern implies, in contrast, that a dollar depreciation means lower prices worldwide for U.S. exports, but little near-term increase in the import prices that U.S. buyers face. Gopinath (2016) documents the low pass-through of exchange-rate change into U.S. import prices.

Invoicing patterns seem broadly not too different from 25 years ago, with the main structural change being the advent of euro use for intra-euro area trade since 1999. But even a look at the euro area's 2016 trade with partners outside of the EU gives a sense of the dollar's disproportional importance,

[28] Carney (2019) stresses the spillback channel of advanced-economy policies.

with 32.2 of extra-EU exports and 52.9 of extra-EU imports invoiced in dollars (Figure 16).[29] These numbers compare with the EU's trade shares with the United States in 2017, which were 20 percent of exports and only 13.8 percent of imports, according to Eurostat.[30]

From the standpoint of U.S. monetary policy, a key need is to understand how fluctuations in the dollar's exchange rate may affect activity in countries, many of them emerging markets, that extensively use the dollar to invoice exports, or that face dollar-denominated import prices in their trade with non-U.S. partners. A U.S. monetary tightening that generally strengthens the dollar will raise domestic-currency import prices for countries with imports invoiced in dollars. But if its exports are invoiced in dollars as well, the prices of those exports will rise against goods priced in other currencies – for example, competing exports invoiced in euros, or countries' domestic products in general.[31] For such countries, the net trade effects of a stronger dollar could therefore be contractionary – adding to the contractionary financial effects that I will discuss below.[32] Related to this possibility, dollar strengthening also can reduce the volume of world trade by switching demand toward domestic goods and away from dollar-priced imports, without offsetting global export promotion for countries that invoice exports in nondollar

[29] Energy imports, heavily invoiced in U.S. dollars, account for about 16 percent of total extra-EU imports. Subtracting these from total extra-EU imports invoiced in dollars leaves a share roughly comparable to extra-EU exports invoiced in dollars, and still far above the EU import share originating in the United States.

[30] These aggregate numbers conceal considerable diversity across EU member countries. To understand the patterns, we need much more analysis of micro-level data, along the lines of Goldberg and Tille (2016) and Corsetti, Crowley, and Han (2018). For monetary policy analysis, a major question is to what degree invoice currencies are chosen to minimize ex post deviations from efficient pricing, given the distribution of possible shocks.

[31] An open question is the extent to which invoicing choices reflect firms' desire that their pre-set prices approximate ex post optimal levels on average, so as to avoid the menu costs of frequent price change. Particular shocks, however, could leave planned prices far from the ex post optimum, leading firms to deviate from ex ante price intentions. In general, therefore, the response of nominal prices and markups to exchange rate changes could reflect the nature or size of the shocks that drive the exchange rate.

[32] In a two-country DSGE model, Canzoneri, Cumby, and López-Salido (2013) find a magnified effect of a key currency's monetary policy abroad, owing to multiple channels. Akinci and Queralto (2018) also model an especially strong foreign spillover from U.S. monetary policy owing to dollar invoicing.

currencies. Boz, Gopinath, and Plagborg-Møller (2017) show that empirically, a U.S. dollar appreciation leads rapidly to a decline in the volume of global trade between other countries (conditioning on the world business cycle, in case safe-haven appreciations and declining trade are both driven by global output contraction). However, an alternative interpretation may be that dollar appreciation tightens global financial conditions, with a direct impact on trade. An emerging literature indeed suggests that dollar appreciation is associated with tighter global financial conditions.

4.2 Dollar funding

The U.S. dollar's dominance as a funding currency (and a currency for corporate borrowing) is another key channel through which Federal reserve monetary actions (and U.S. financial conditions more generally) are communicated disproportionately to the world outside U.S. borders. As discussed above, the U.S. economy is subject to financial forces from abroad, with significant implications for monetary policy. On the other hand, U.S. monetary policy has a distinctively powerful impact on financial conditions in the outside world – indeed, much of the comovement in global financial indicators is may be a reflection of U.S. policy's foreign impacts. Recent research has documented the United States' driving role.

As Gopinath and Stein (2019) emphasize, the U.S. dollar's financial dominance, its vehicle currency role, and the safety and liquidity of dollar assets– far from being independent–are all inter-related and mutually reinforcing. For example, dollar invoicing makes dollar assets "safer" in real terms, lowering their yields and promoting dollar funding; at the same time, dollar-denominated export revenues are more easily collateralized to take advantage of lower dollar interest rates, leading to more dollar invoicing in equilibrium. Beyond their model, the unique depth and breadth of U.S. financial markets also play a role. All of these factors also help explain the dollar's dominance as an anchor currency (while that role reinforces the tendency to invoice and fund in dollars, as well as to hold dollar reserves, in a positive feedback loop).[33]

[33] Theoretically speaking, a government need not trade dollar reseves to manage its currency's exchange rate against the dollar. For example, because the dollar/euro cross

Figures 17 and 18 give some indication of the footprint of dollar-denominated financial transactions in global banking and in global credit markets. Figure 17 shows BIS data on cross-border dollar and euro bank claims and liabilities. Dollar aggregates are much higher and are large even relative to the size of the U.S. economy. Cross-border dollar banking in both currencies grew very quickly in the financial cycle leading up to the Global Financial Crisis, and while dollar balance sheets have continued to grow in nominal terms since – albeit much more slowly – euro balance sheets have retracted. Figure 18 looks at a different metric, offshore credit to non-banks in dollars, euros, and yen, comprising bank loans and debt securities, and thus, corporate borrowing. Offshore credit to non-banks in dollars as a share of total credit to *resident* non-financial borrowers (including households and central government) has continued to rise for the dollar, been roughly stable for the euro, and fallen for the yen. The dollar ratio is consistently and by far the highest over the past two decades.

Recent research papers (for example, Rey 2014; Bruno and Shin 2015; IMF 2017b; Avdjiev, Koch, and Shin 2017; Jordà et al. 2019; Miranda-Agrippino and Rey 2019) point to a global financial cycle in asset prices, bank leverage, and cross-border dollar lending related to the dollar's foreign exchange value and U.S. monetary policy shocks. U.S. monetary policy and dollar exchange rate changes can work through both the supply and demand for offshore credit. For borrowers with dollar liabilities, a dollar depreciation can enhance net worth, easing informational frictions that impede the flow of credit. Particularly when firms' export revenues are in dollars, and dollar depreciation enhances profitability in domestic-currency terms, the demand for dollar credit will rise. Changes in borrowers' financial strength also affects banks' willingness to lend through a risk-taking channel, for example, by reducing default risks perceived by banks that operate subject to a value-at-risk constraint (Adrian and Shin 2013).

The dollar's unique status makes U.S. monetary shifts uniquely power-

rate is exogenous to a small country, arbitrage could in principle ensure that the authorities hit a desired dollar exchange rate target by intervening with euros to manage its currency's bilateral euro exchange rate. In view of exchange-market frictions and the variability of the euro/dollar rate, however, it is more efficient for a country that wishes to manage flexibility against the dollar to hold dollar reserves and to intervene in dollars.

ful to affect global financial conditions. Avdjiev, Koch, and Shin (2017) document the role of U.S. dollar strength (both on a bilateral and nominal effective basis) in discouraging cross-border dollar lending. In other work, they suggest knock-on negative effects on investment. Empirical work claiming a causal role for the dollar's exchange rate faces the challenge that negative global shocks can drive the dollar higher through safe-haven effects. Miranda-Agrippino and Rey (2019) show that a high-frequency measure of U.S. monetary policy surprises has important effects globally, even for countries with floating exchange rates. They find that a contractionary U.S. shock reduces global asset prices, induces global financial intermediaries to delever, and reduces cross-border credit flows and domestic credit. This is a powerful multiplier amplifying U.S. monetary shock effects globally, and additionally to any effects related to dollar invoicing. Given the size and scope of international financial transactions, it is hard to believe that these effects do not swamp the more conventional net export effects of the associated dollar movements.[34]

The prevalence of cross-border dollar funding has an important implication for Federal Reserve balance sheet policy: the need possibly to act as a global lender of last resort in dollars (Obstfeld 2009; Farhi, Gourinchas, and Rey 2011). The Fed's swap lines played a key stabilizing role in the Global Financial Crisis and could well need to be extended again should global financial tensions emerge anew. Unfortunately, the central bank's freedom of action looks likely to be more constrained in the future.

5 Concluding remarks

This paper has explored key avenues through which the global economy impinges on the policy landscape facing the Federal Reserve, possibly altering the tradeoffs among different policy objectives its leaders face. These ob-

[34] The financial spillovers can be especially destabilizing for emerging markets. There, higher global liquidity can lead to a buildup of financial fragilities that are revealed when capital inflows reverse. See, for example, Aoki, Benigno, and Kiyotaki (2009) and Diamond, Hu, and Rajan (2018). Durdu, Martin, and Zer (2018) find that for emerging market economies with substantial U.S. trade links or a large share of dollar-denominated liabilities, U.S. monetary tightening raises the likelihood of a banking crisis.

jectives include, of course, the "dual mandate" objectives of price stability and full employment, but also the more subjective goal of financial stability, which we know to have an immense impact on inflation and activity in the longer term. In a complex world made even more complex by global influences and linkages, there is unlikely to be a "divine coincidence" according to which monetary policy can attain all goals at once without tradeoffs, nor a "divine separability" such that monetary policy should be set with reference to a hypothetical natural real interest rate r^* independently of other considerations – even leaving aside ELB constraints.

More policy tools obviously can help, including effective macro-prudential tools; and in some cases their effectiveness can be enhanced by multilateral international cooperation among central banks and other regulators. I have not explored that important dimension of policy here, except to mention (briefly) one aspect that explicitly deploys the Fed's balance sheet, the use of central-bank currency swaps to enable lender-of-last resort operations abroad.

My three areas of focus were the role of global factors in the U.S. inflation process; the role of international financial integration on U.S. financial conditions; and the role of the dollar's pre-eminence as a global currency in amplifying the cross-border impact of Fed actions. The discussion has perhaps made most clear how much we still have to learn about all of these channels. For example, there remains fundamental uncertainty as to the U.S. inflation process and possible longer-term structural drivers; about the global determinants of financial conditions and their implications for U.S. activity; and about the strength of the U.S. policy impact on the rest of the world: how much of the documented common trends in global macroeconomic time series simply reflect U.S. policy dominance?

That is not to deny substantial research progress in understanding key aspects of the global policy environment the United States faces. But advances often occur in distinct sub-literatures that do not always communicate with each other. An integrated picture of this "elephant" remains elusive and so scholars rightly continue to toil in search of a synthesis.

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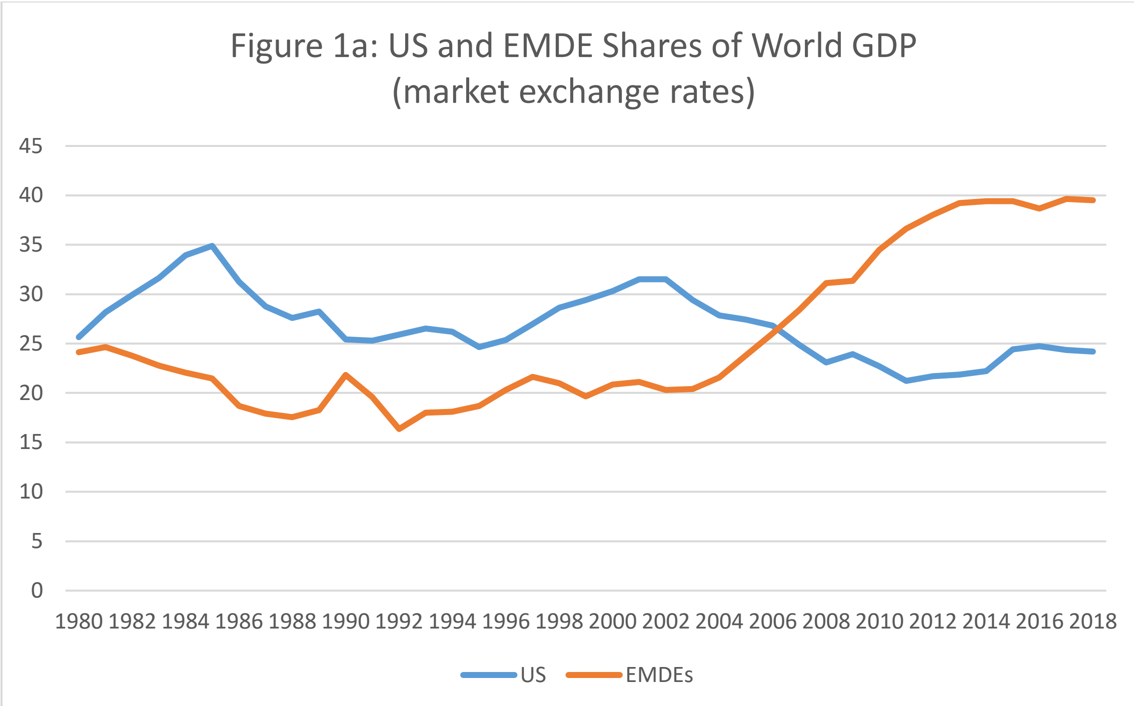


Figure 1a: US and EMDE Shares of World GDP
(market exchange rates)
45
40
35
30
25
20
15
10
5
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
US
EMDEs

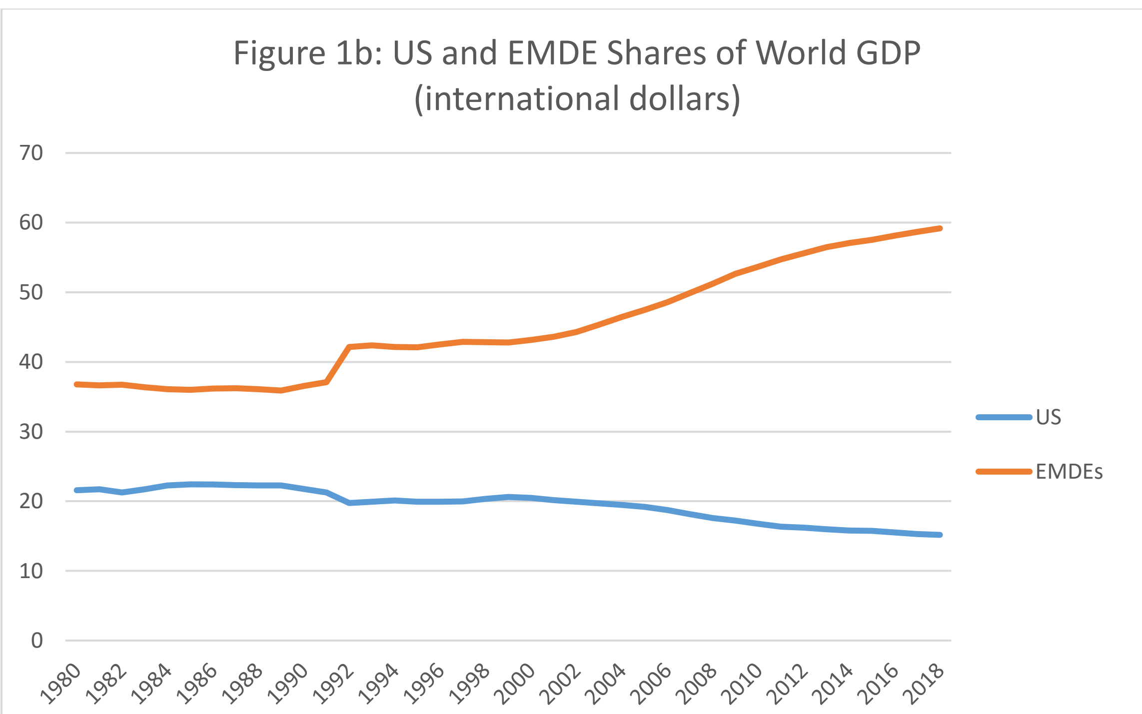


Figure 1b: US and EMDE Shares of World GDP
(international dollars)
70
60
50
40
30
20
10
0
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
US
EMDEs

Source: BEA

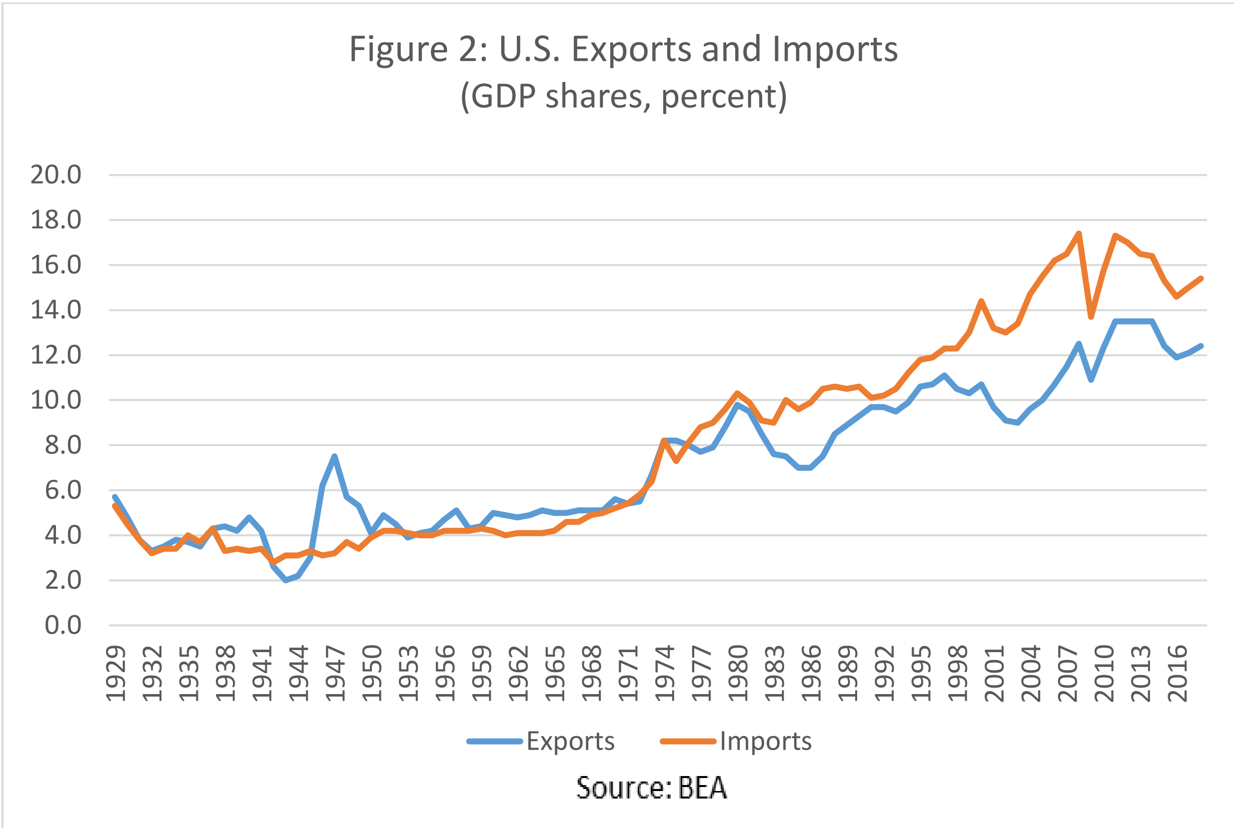


Figure 2: U.S. Exports and Imports
(GDP shares, percent)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
2016
Exports
Imports
Source: BEA

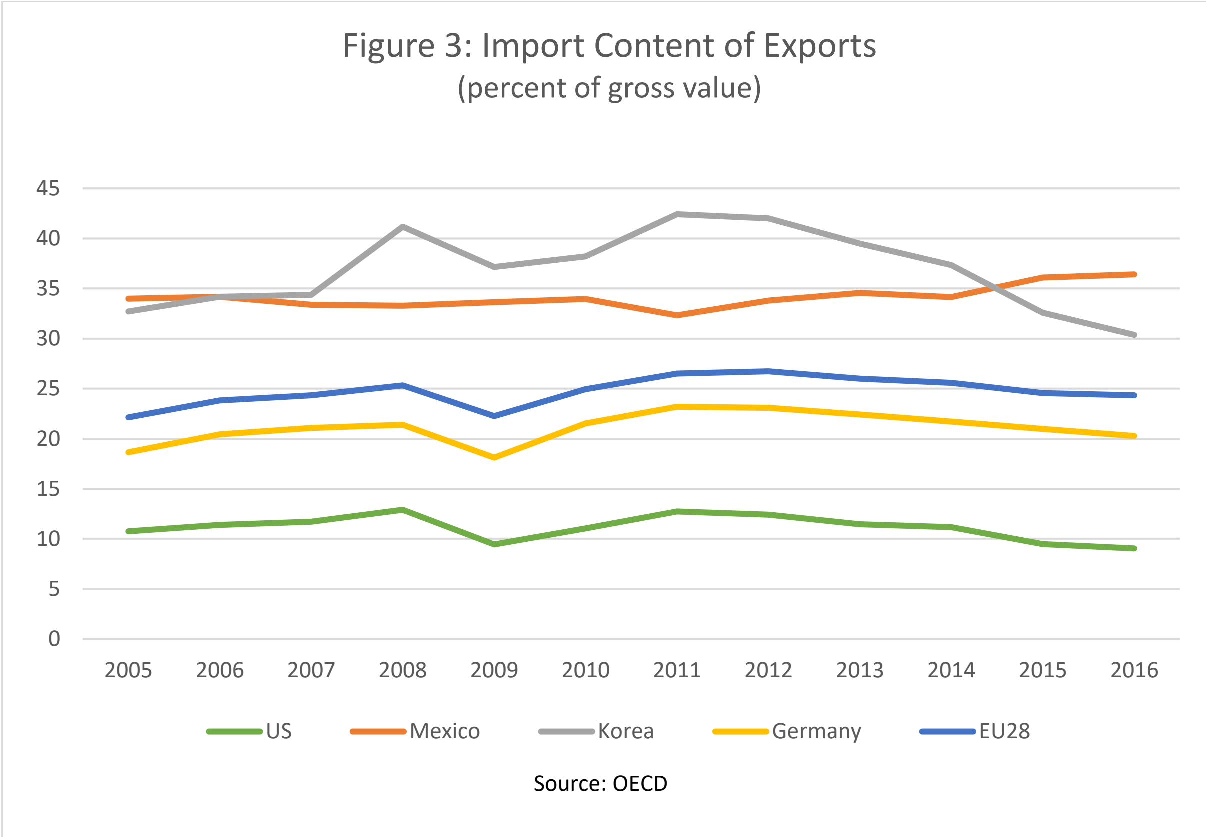


Figure 3: Import Content of Exports
(percent of gross value)
45
40
35
30
25
20
15
10
5
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
US
Mexico
Korea
Germany
EU28
Source: OECD

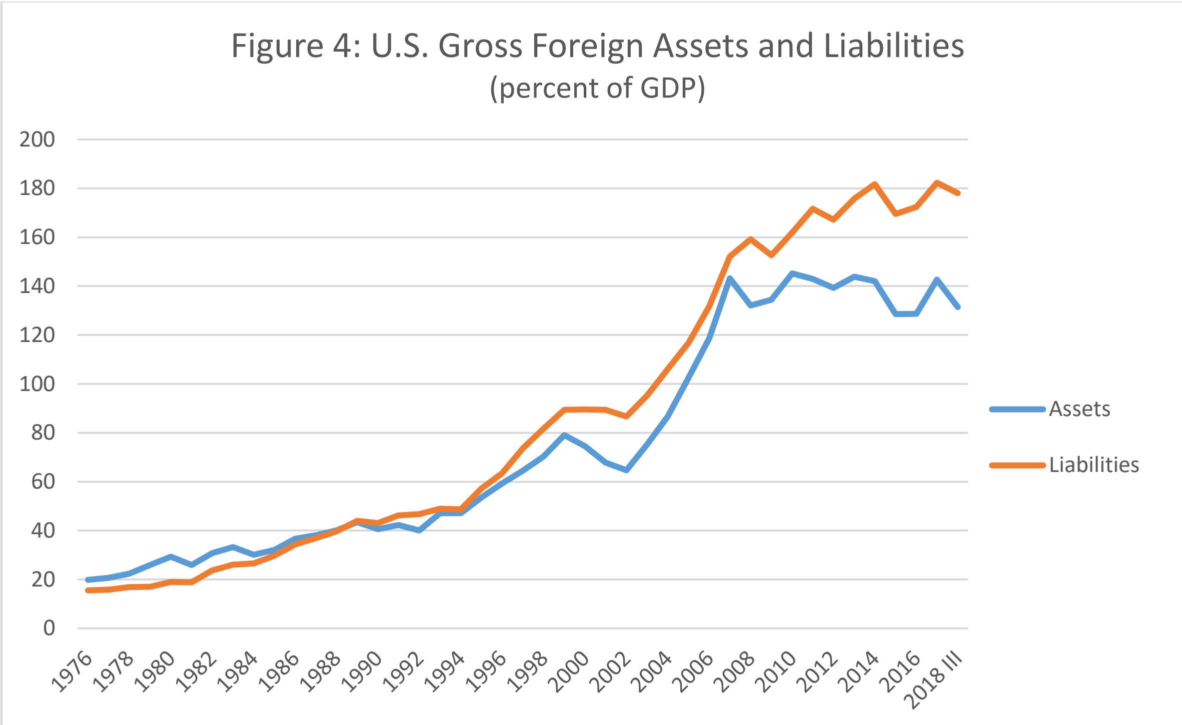


Figure 4: U.S. Gross Foreign Assets and Liabilities
(percent of GDP)
200
180
160
140
120
100
80
60
40
20
0
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018 III
Assets
Liabilities

Source: BEA

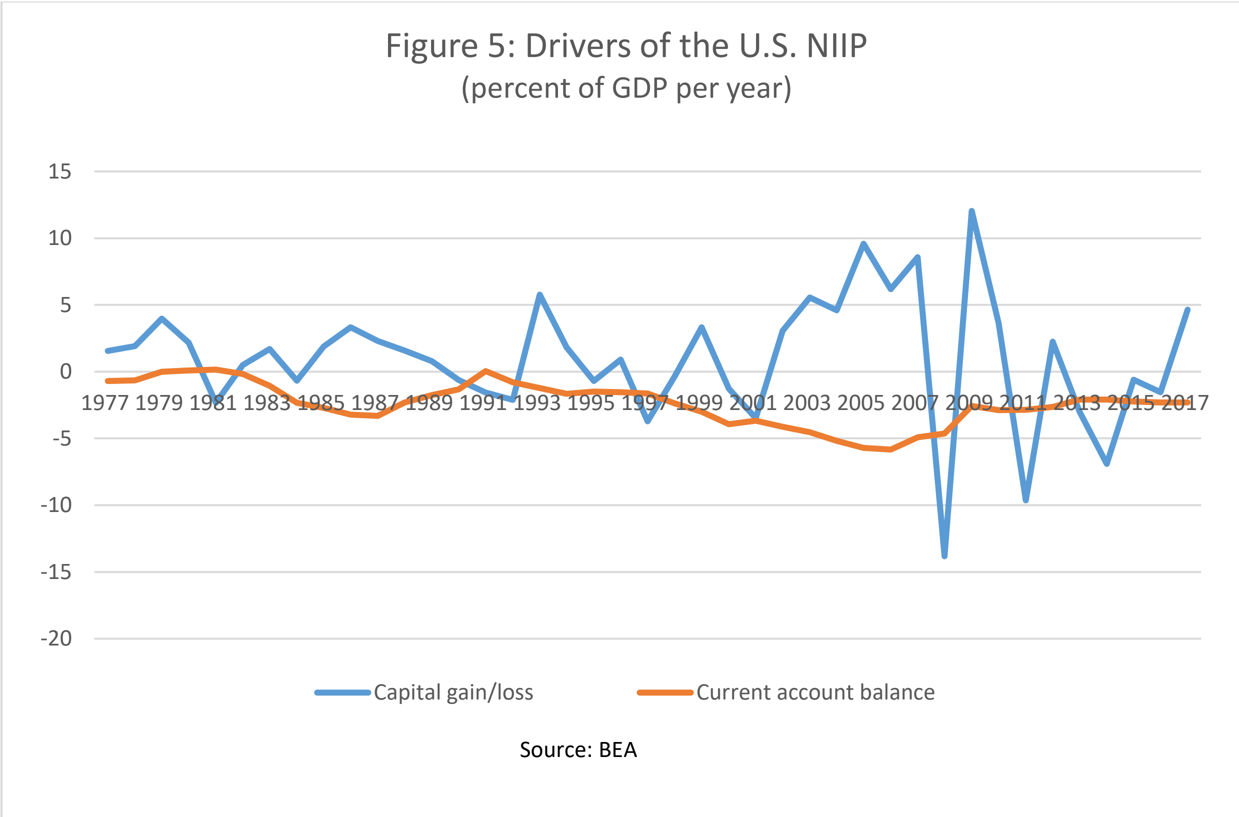


Figure 5: Drivers of the U.S. NIIP
(percent of GDP per year)
15
10
5
0
-5
-10
-15
-20
1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Capital gain/loss
Current account balance
Source: BEA

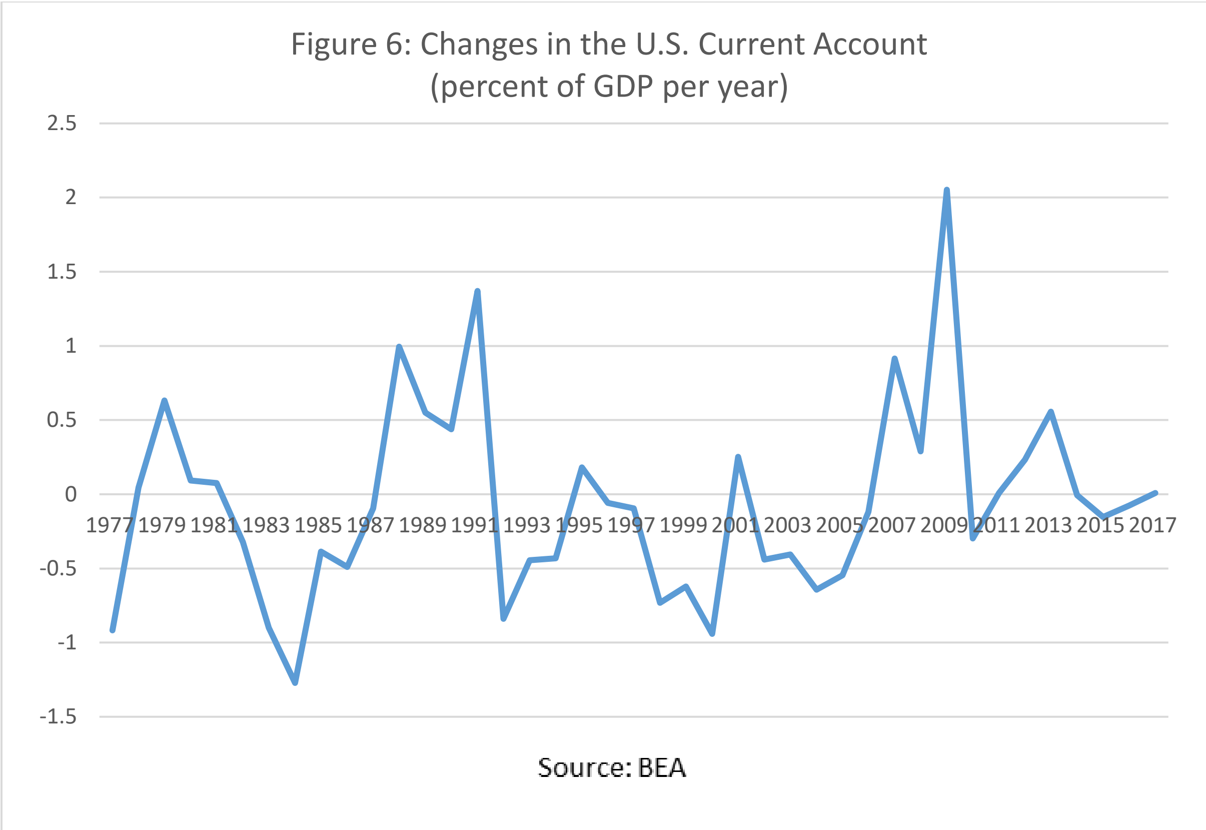
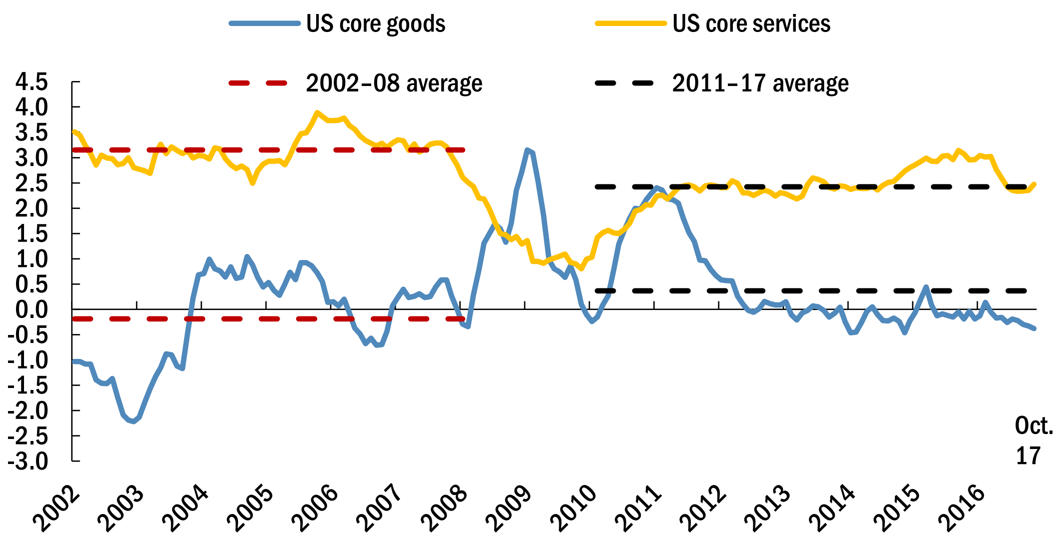


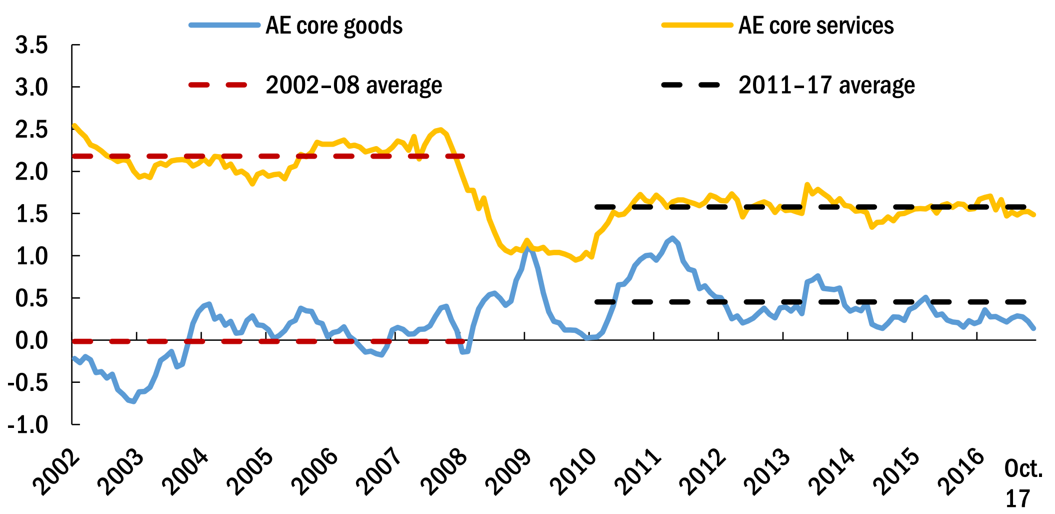
Figure 6: Changes in the U.S. Current Account
(percent of GDP per year)
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Source: BEA

Figure 7a: U.S. Core Goods and Core Services Consumer Price Inflation
(Year-on-year; percent)



Source: IMF staff calculations.

Figure 7b: Advanced Economy Core Goods and Core Services Consumer Price Inflation
(Year-on-year; percent)



Source: IMF staff calculations, as reported in IMF (2018a).

Note: The sample includes 16 advanced economies: Australia, Austria, Canada, Denmark, Finland, France, Germany, Japan, Italy, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom and United States.

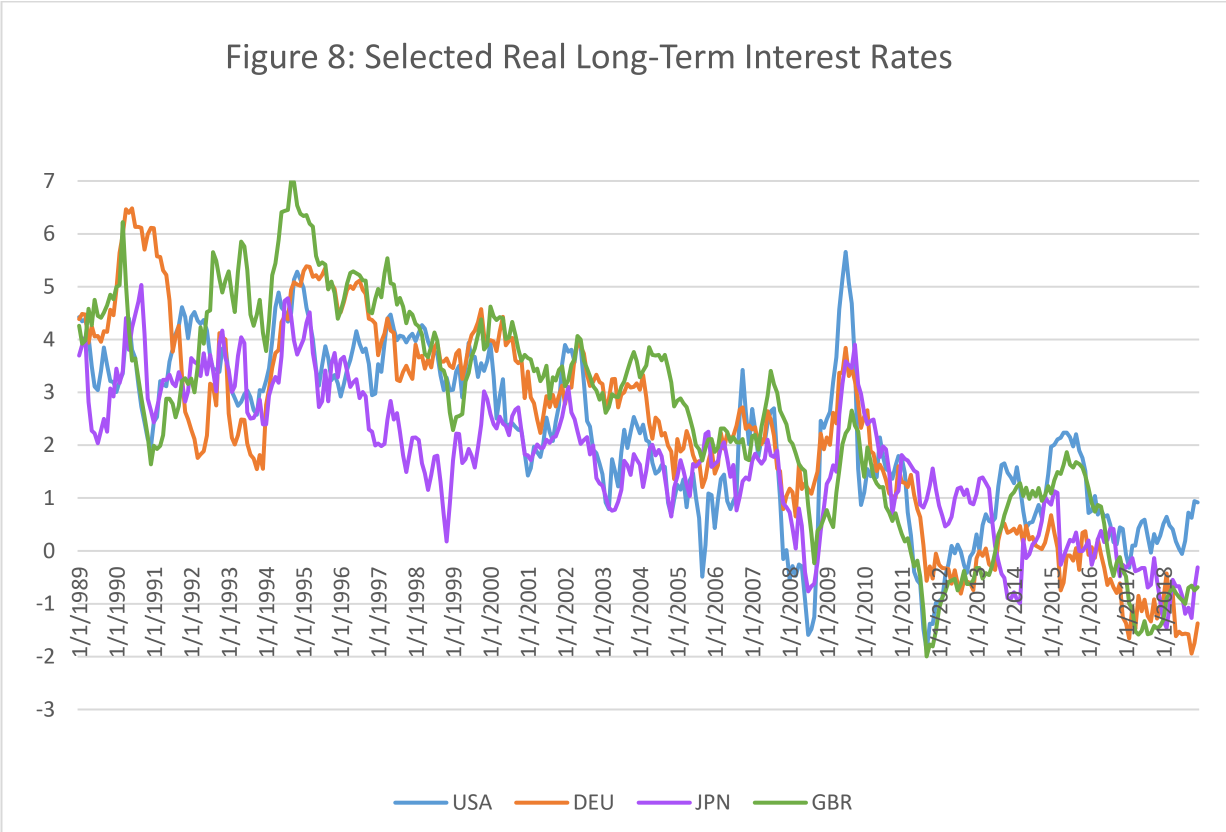


Figure 8: Selected Real Long-Term Interest Rates
7
6
5
4
3
2
1
0
-1
-2
-3
1/1/1989
1/1/1990
1/1/1991
1/1/1992
1/1/1993
1/1/1994
1/1/1995
1/1/1996
1/1/1997
1/1/1998
1/1/1999
1/1/2000
1/1/2001
1/1/2002
1/1/2003
1/1/2004
1/1/2005
1/1/2006
1/1/2007
1/1/2008
1/1/2009
1/1/2010
1/1/2011
USA
DEU
JPN
GBR

Figure 9: Global Equilibrium Interest Rate and Current Accounts

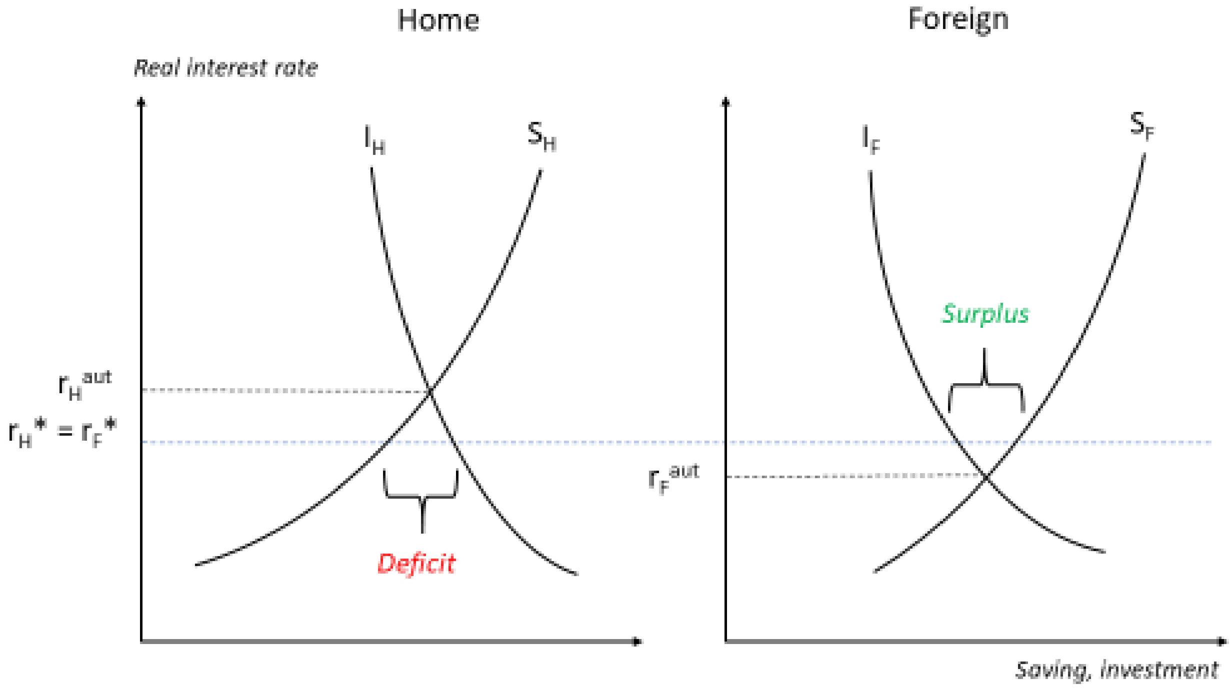


Figure 10: An Increase in Foreign Saving

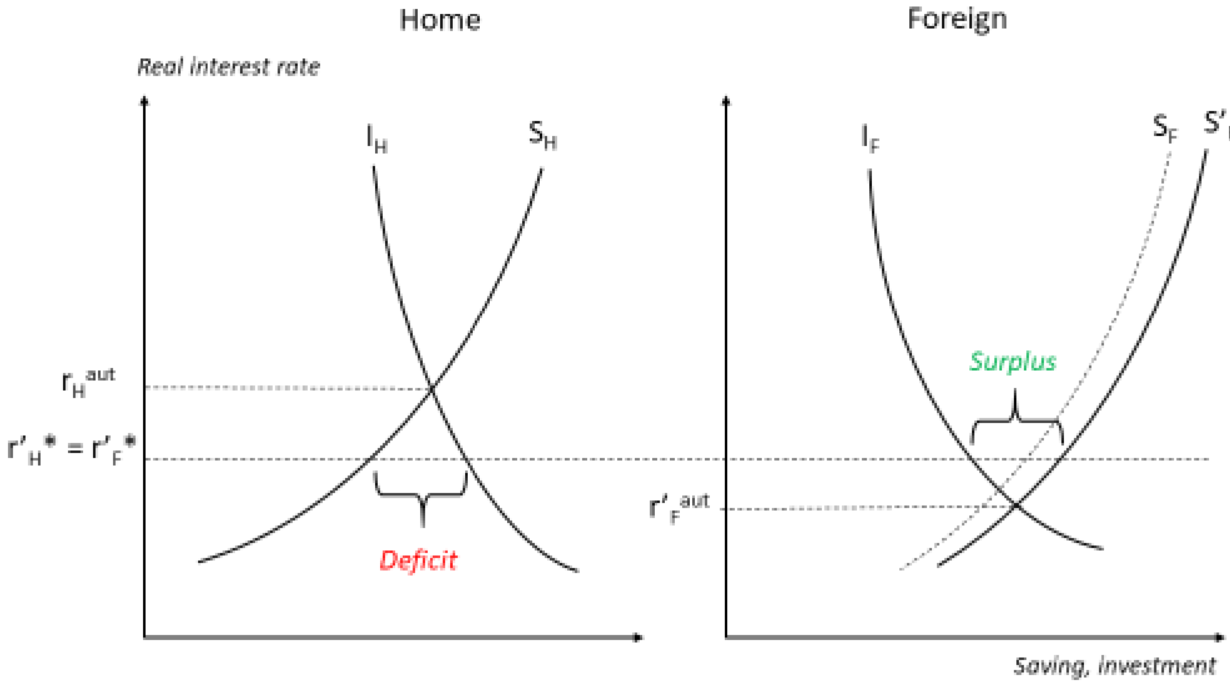


Figure 11: Allowing for Exchange Rate Expectations

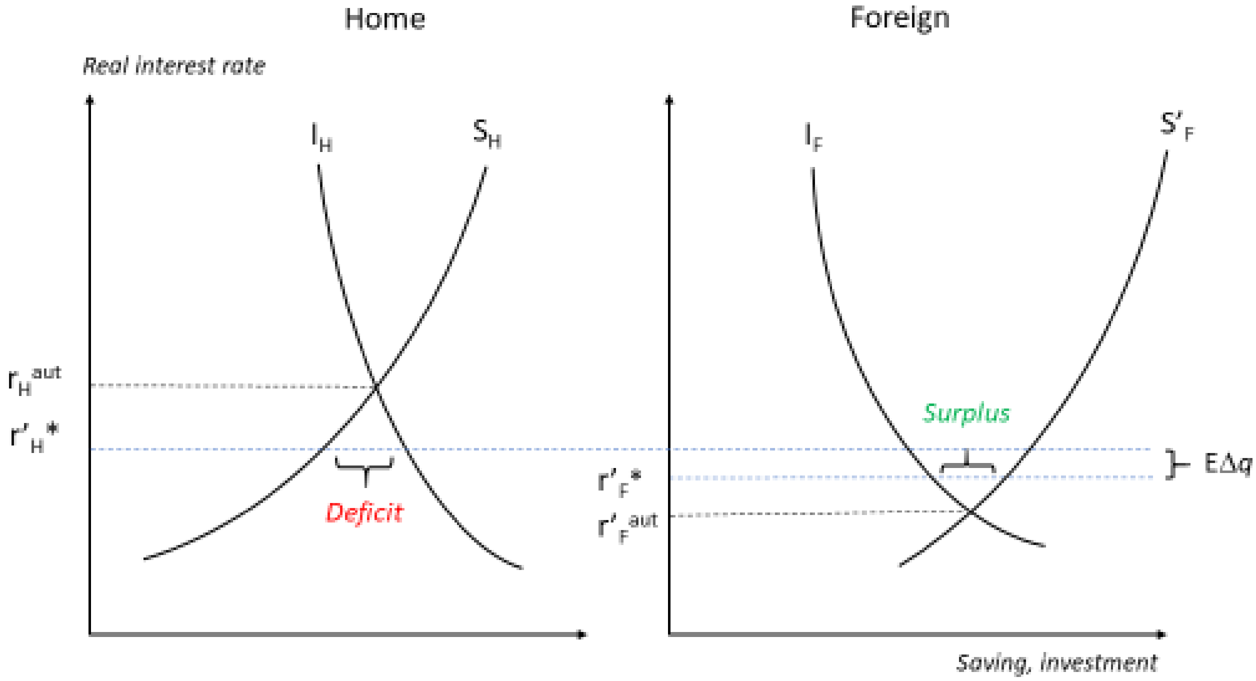
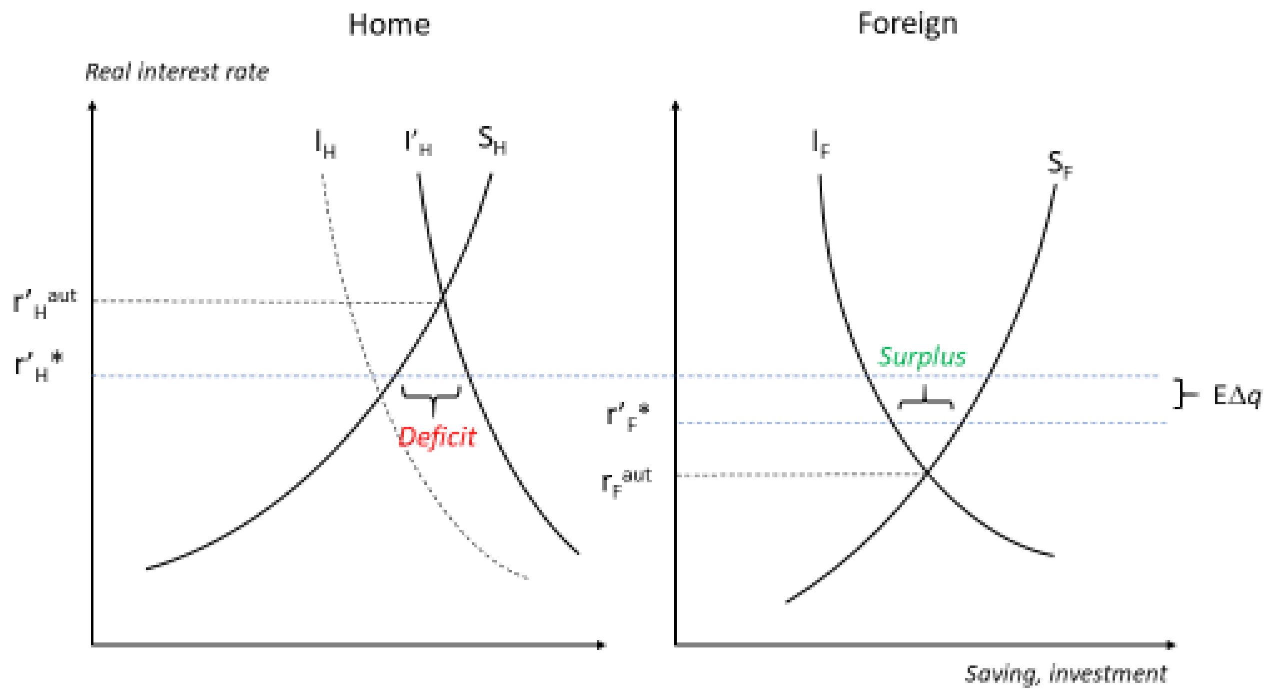


Figure 12: An Increase in Home Investment



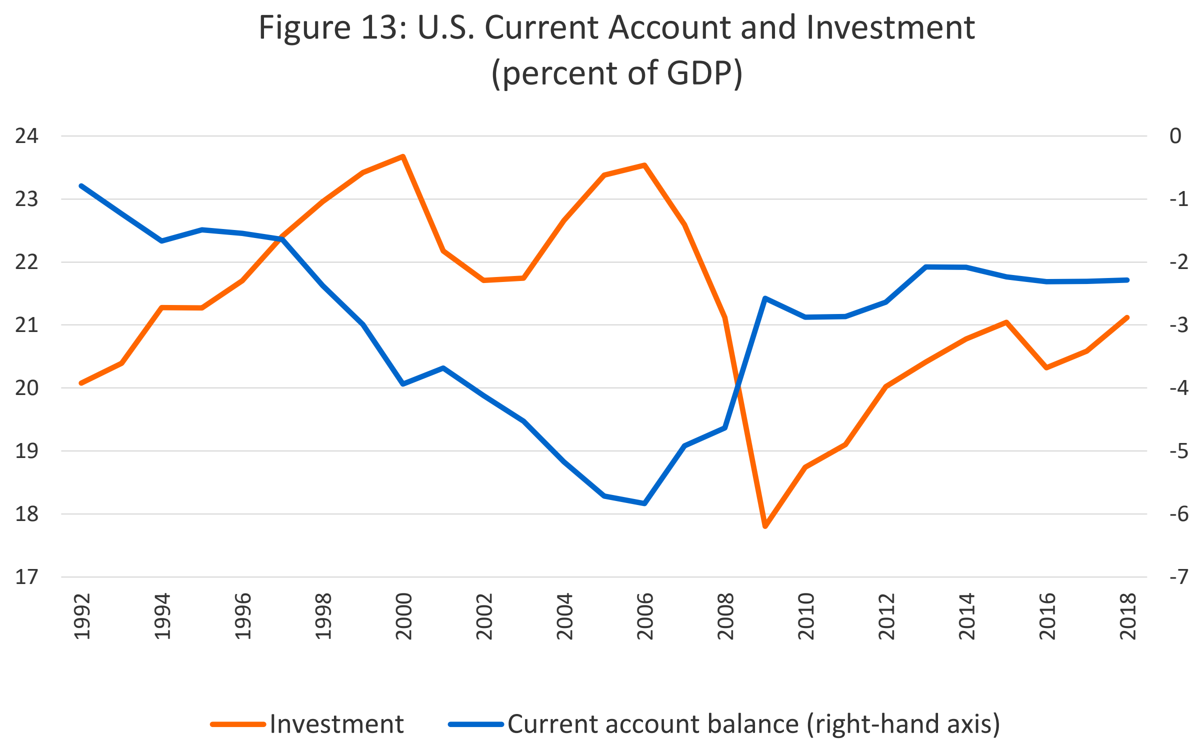


Figure 13: U.S. Current Account and Investment
(percent of GDP)
24
23
22
21
20
19
18
17
0
-1
-2
-3
-4
-5
-6
-7
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Investment
Current account balance (right-hand axis)

Figure 14: A Rise in Perceived Liquidity of Home Assets

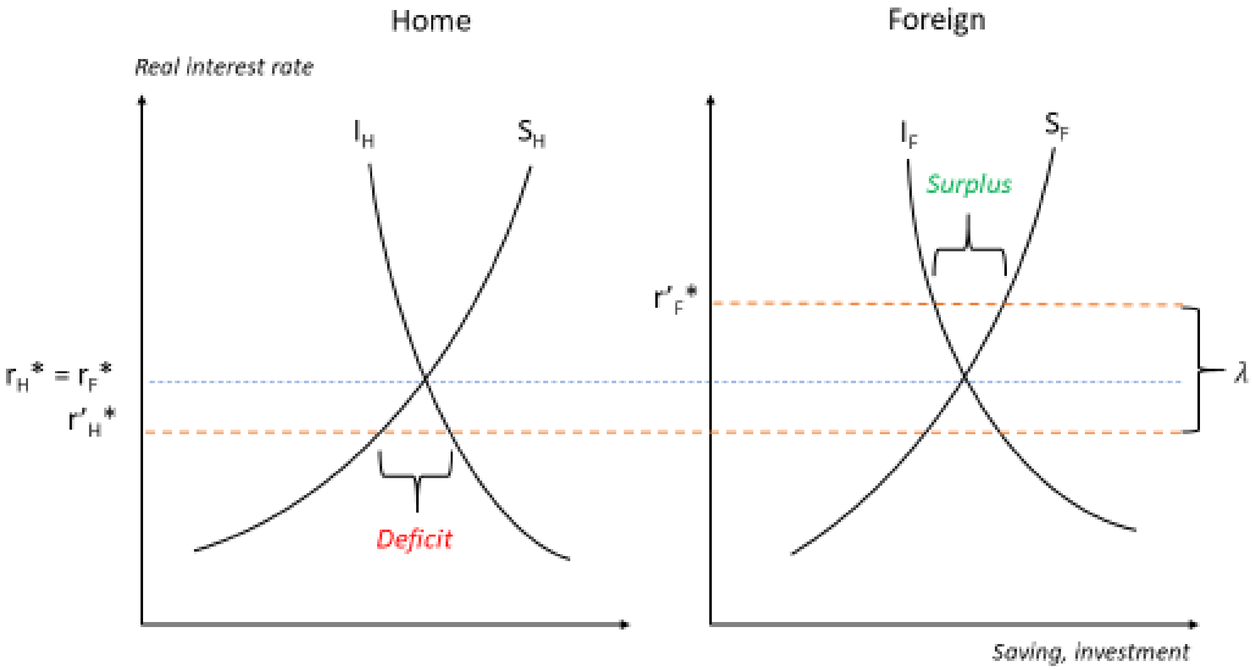
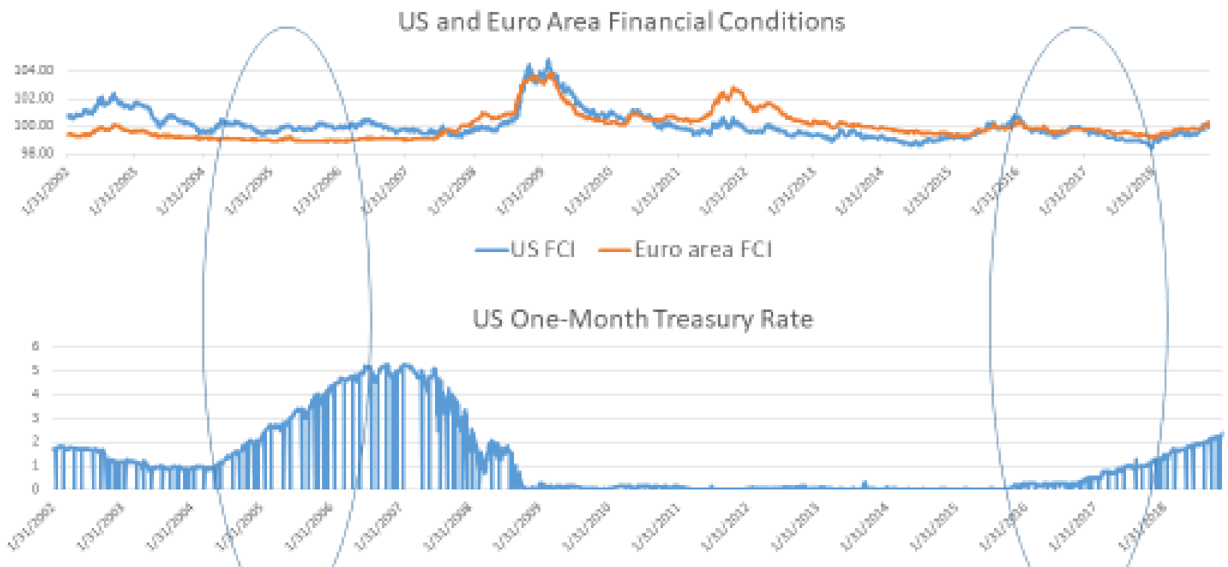
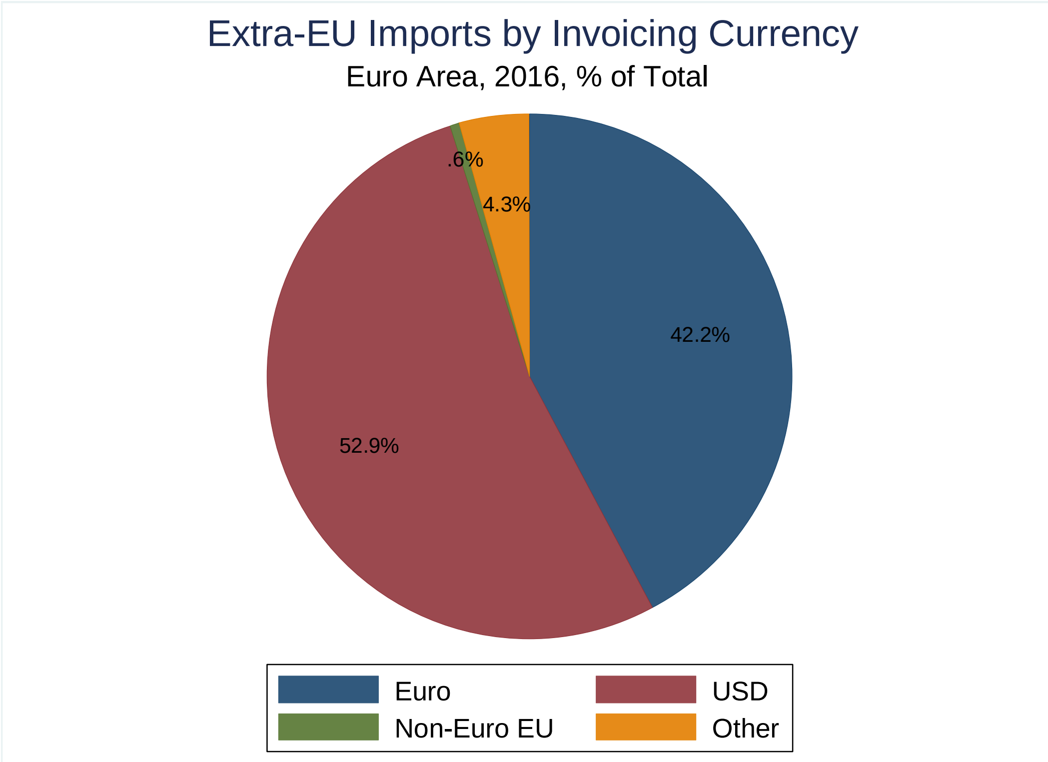


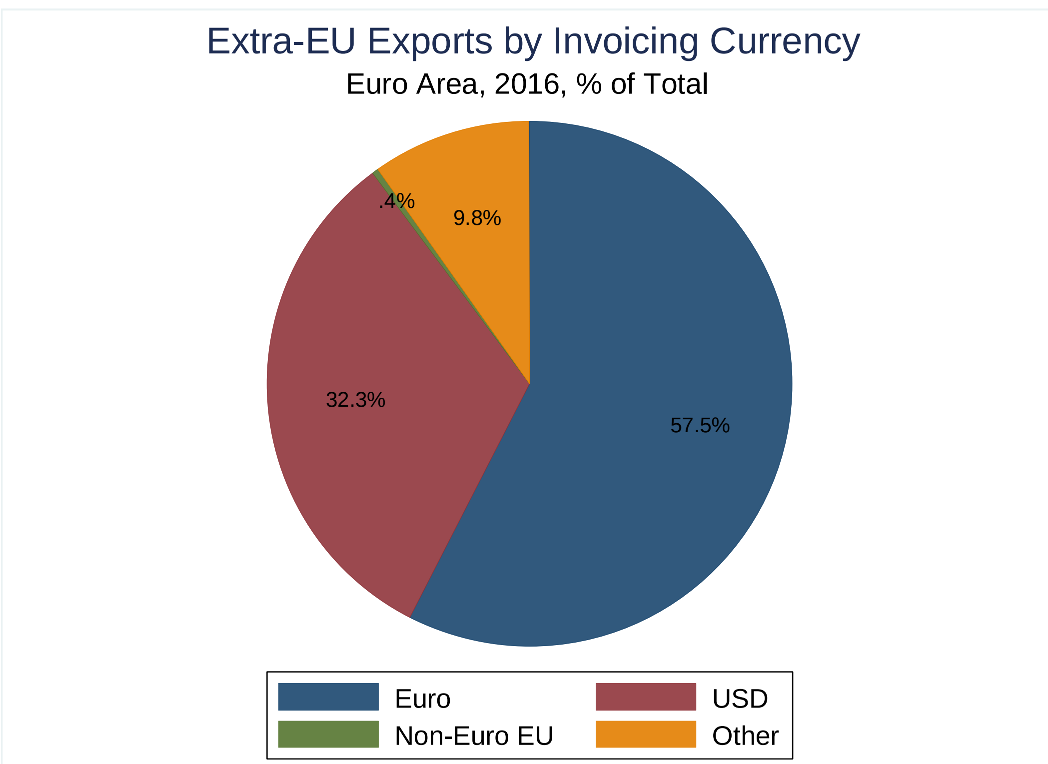
Figure 15: Overall Financial Conditions May Diverge from Monetary Policy



Source: BIS, *Quarterly Review*, December 2018, box A; Federal Reserve historical data. The BIS FCI comprises short- and long-term interest rates; corporate spreads; equity prices; and trade-weighted exchange rate.

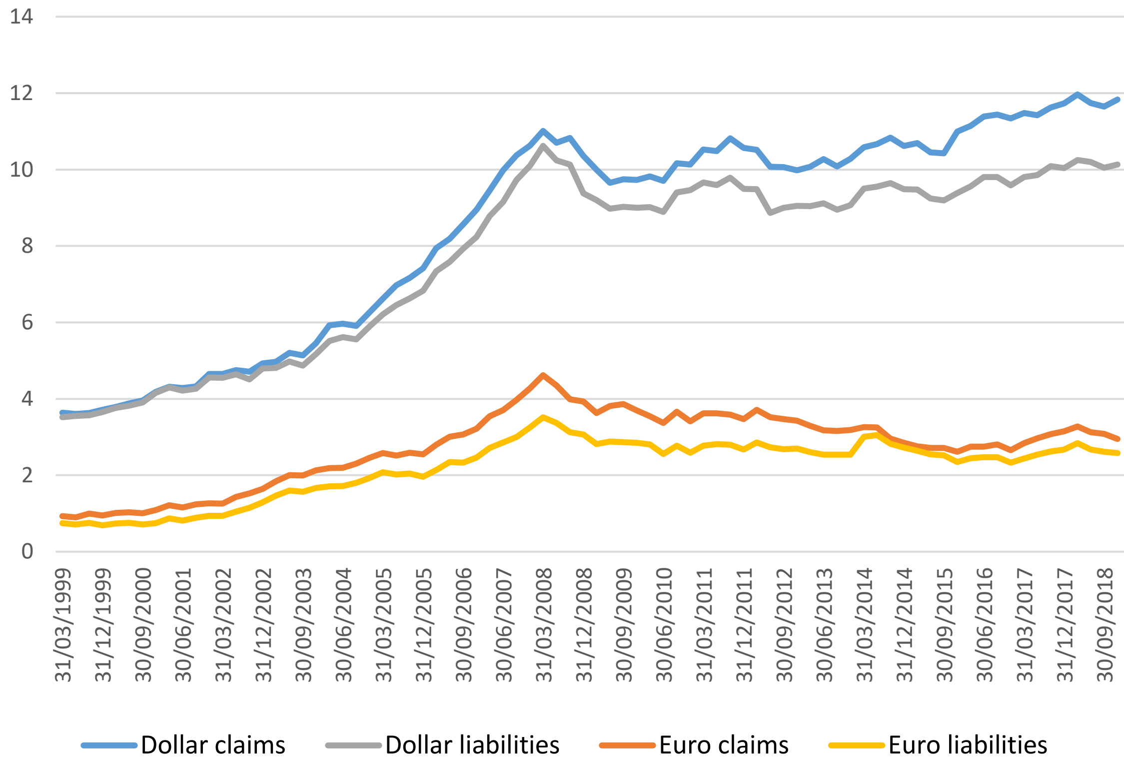
Figure 16: Invoicing Patterns for the Euro Area's Extra-EU Exports and Imports





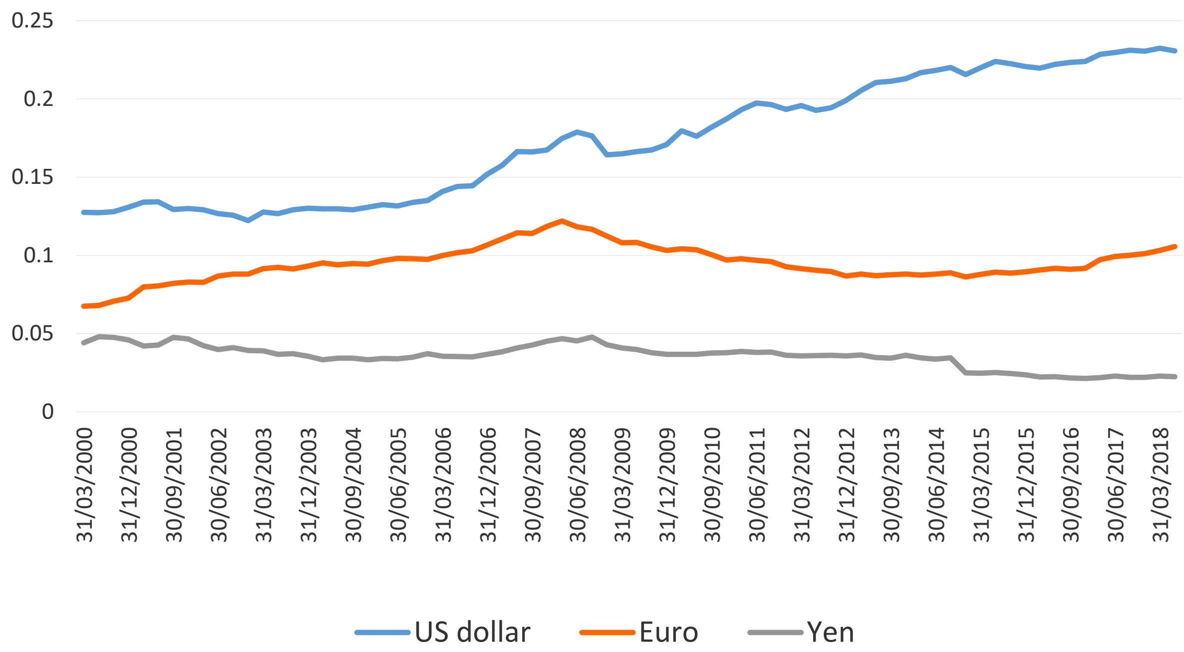
Source: Eurostat

Figure 17: Cross-Border Dollar and Euro Bank Positions
(USD trillions, all BIS reporting banks)



Source: BIS Locational Banking Statistics

Figure 18: Offshore Credit to Non-banks in Major Currencies
(share of total credit to resident non-financials)



Source: BIS

Table 1: Correlates of CPI Inflation, 1964-2018

	(1) 64Q1-18Q4	(2) 64Q1-92Q1	(3) 64Q1-73Q1	(4) 73Q1-92Q1	(5) 92Q1-18Q4	(6) 92Q1-08Q1	(7) 08Q1-18Q4
Wage growth	0.856***	0.792***	0.444	0.940***	0.399***	0.118	0.245*
	(0.118)	(0.154)	(0.291)	(0.127)	(0.114)	(0.141)	(0.141)
Import price growth	0.128***	0.099***	0.111	0.080***	0.140***	0.109***	0.144***
	(0.021)	(0.030)	(0.139)	(0.028)	(0.012)	(0.012)	(0.007)
Productivity growth	-0.255***	-0.454***	-0.347***	-0.328**	-0.045	-0.088*	-0.199***
	(0.088)	(0.133)	(0.112)	(0.132)	(0.066)	(0.051)	(0.033)
Constant	0.001	0.004**	0.005	0.003**	0.003***	0.006***	0.003***
	(0.001)	(0.002)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	216	108	32	76	108	64	44
R^2	0.822	0.766	0.536	0.856	0.766	0.610	0.923

Newey-West standard errors (four lags) in parentheses.
* p<0.10 , ** p<0.05 , *** p<0.01.

Table 2: Correlates of CPI Inflation, 1992-2018

	(1) 92Q1-18Q4	(2) 92Q1-08Q1	(3) 08Q1-18Q4
Wage growth	0.419***	0.251**	0.231
	(0.116)	(0.113)	(0.164)
Consumer import price growth	0.006	0.004	0.082**
	(0.033)	(0.040)	(0.034)
Producer import price growth	0.051***	0.046***	0.065***
	(0.008)	(0.014)	(0.008)
Productivity growth	-0.111**	-0.139***	-0.226***
	(0.049)	(0.035)	(0.041)
Constant	0.003***	0.005***	0.004***
	(0.001)	(0.001)	(0.001)
Observations	104	60	44
R^2	0.805	0.698	0.902

Newey-West standard errors (four lags) in parentheses.
* p<0.10 , ** p<0.05 , *** p<0.01.

Table 3: International Coherence of Nominal Interest-Rate Changes (Quarterly data)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	US-base SR	Multi-base SR	Multi-base SR with Time Effects	Multi-base SR with VIX Percent Change	US-base LR	Multi-base LR	Multi-base LR with Time Effects	Multi-base LR with VIX Percent Change
US-base SR change	0.0571							
	(0.158)							
Multi-base SR change		0.202	0.0457	0.240				
		(0.171)	(0.229)	(0.177)				
US-base LR change					0.354***			
					(0.0594)			
Multi-base LR change						0.548***	0.430***	0.631***
						(0.0668)	(0.136)	(0.0616)
VIX Percent Change				0.00236*				0.00291***
				(0.00139)				(0.000663)
Constant	-0.00166**	-0.00151**	0.000171	-0.00150**	-0.000791***	-0.000624***	-0.00113**	-0.000635***
	(0.000746)	(0.000751)	(0.000713)	(0.000745)	(0.000174)	(0.000165)	(0.000438)	(0.000165)
N	3273	3273	3273	3273	3076	3076	3076	3076
adj. R^2	0.034	0.036	0.061	0.036	0.048	0.084	0.138	0.094
Optimal Lags	5	5	5	5	0	0	0	0
p-value for F Test that growth and inflation change variables (and their lags, where applicable) = 0	2.81911E-12	5.34395E-12	2.29415E-07	2.31095E-11	0.07240475	0.17723405	0.04280572	0.13447361