CHAPTER TWO

The International Impact of the Fed When the United States Is a Banker to the World

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ABSTRACT

The past few decades of globalization have seen a sharp rise in cross-border capital flows as the world has become more financially integrated. These changes have brought to light two important roles the US financial system has come to play in the globalized economy. First, the US financial system has become the main producer of safe assets for the global economy. Second, the US financial system's central bank, the Federal Reserve, has become a monetary superpower that to a large extent sets global monetary conditions. In this paper we document these two important roles of the US financial system and show how they have evolved over the past few decades. We then consider how the banker to the world and monetary superpower roles interact, specifically in light of the safe asset shortage problem that has emerged within the past decade.

1. Introduction

The past few decades of globalization have seen a sharp rise in cross-border capital flows as the world has become more financially integrated. Countries' gross external positions have ballooned, while net positions—referred to as global imbalances—have widened. These changes have brought to light two important roles the US financial system has increasingly come to play in the globalized economy.

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First, the US financial system has become the main producer of safe assets for the global economy. It does this by acting as banker to the world: it borrows short from foreigners and invests long abroad. In so doing, the US financial system creates the safe assets the rest of world craves but cannot create in sufficient volumes on its own. This global safe asset shortage has tended to push down yields and prompt investors' substitution into riskier assets. Attempts by the US private sector to create new types of safe assets (such as through mortgage securitization) or to issue existing safe assets in greater volumes (such as corporate bonds) have generally backfired: the securitization market collapsed, and only two US corporations now issue AAA-rated paper.[1] Safe asset supply is therefore increasingly concentrated in the safest public and publicly guaranteed assets, but the public sector has struggled to meet global safe asset demand amid political constraints on debt issuance. Meanwhile, the decline in yields globally has created new challenges for monetary policy.

Second, the US financial system's central bank, the Federal Reserve, has become a monetary superpower that to a large extent sets global monetary conditions. It, more than any other central bank, shapes the path of global nominal spending growth. Even though the Federal Reserve's mandate is domestic, its influence is increasingly global. In this paper we illustrate this global role through a number of channels: the increasing share of the global economy that uses or fixes its currency to the dollar; the dollar's increasing role in global credit flows; and episodes such as the "Taper Tantrum" and China's reserves sell-off that demonstrate how expectations of Fed policy changes quickly translate into a change in global financial conditions.

These two related roles mean that the world economy is very dependent on the US financial system to get it right. The world depends on the US financial system to provide an adequate amount

1. Those corporations are Microsoft and Johnson and Johnson (Karian 2016).

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of safe assets and needs the Federal Reserve to maintain stable global monetary conditions. Some, although by no means all, of the strains in the global economy in recent decades can be attributed to failures on this score.

In this paper we document these two important roles of the US financial system and show how they have evolved over the past few decades. Critically, we also spend some time considering how the banker to the world and monetary superpower roles interact. Looking at historical cases, vector autoregressions, and a counterfactual exercise, we show that these two roles do interact sometimes in a destabilizing manner. We specifically examine them in light of a global safe asset shortage problem that has become more pronounced within the past decade.

We then conclude the paper by considering a proposal that we believe could mitigate some of the problems that arise when the banker to the world and monetary superpower roles interact. We also assess whether the United States could face competition for its dual role in the global economy in the near future and conclude that this is unlikely—making it all the more critical that the United States is able to perform these roles more effectively.

2. Banker to the world

One of the defining features of the US financial system is the role it plays in providing financial intermediation to the global economy. The United States tends to borrow short-term at low interest rates from the rest of the world while investing long-term on riskier assets abroad that earn a higher yield. By doing this, the US financial system provides safe, liquid assets to the rest of the world while funding economic development abroad. This tendency was first observed by Kindleberger (1965) and Despres at al (1966), who saw these activities as nothing more than the maturity

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transformation service of a bank. They therefore called the United States the "banker to the world."

These early observations of the United States acting as banker to the world occurred under the Bretton Woods System where the dollar was the key asset in the global financial system. The banker to the world role, however, continued after the Bretton Woods System broke down and, as noted by Poole (2004) and Gourinchas and Rey (2007), even intensified as globalization led to a sharp rise in cross-border capital flows.[2] This increased financial integration, though, was not matched by a similar deepening of financial markets in many parts of the world. Developing countries such as China and India saw their economies rapidly grow but were unable to grow their capacity to produce safe stores of value at a similar pace. Even advanced economies had uneven growth in their financial deepness (Mendoza et al. 2009).

As a result, there was increased demand for global financial intermediation services, and the US financial system stepped up to fill much of this void. Its deep financial markets and relatively robust institutions gave the United States a comparative advantage in issuing safe assets. It was well suited to serve as a banker to the world.

Gourinchas and Rey (2007) argue that not only is the US financial system acting as banker to the world, it is increasingly acting as a venture capitalist to the world. They note that over the past few decades an increasing share of US foreign investments, funded by its short-term liabilities to foreigners, became directed toward riskier assets. They see this as the natural evolution of the United States' banker to the world role as the global financial system becomes increasingly integrated.

Figures 2.1–2.4 document this banker to the world role by looking at the consolidated external balance sheet of the United

2. See Lane and Milesi-Ferretti (2001) and (2007) for a thorough documentation of this development. Goldberg (2011) provides further analysis of the US dollar's continuing dominant international role.

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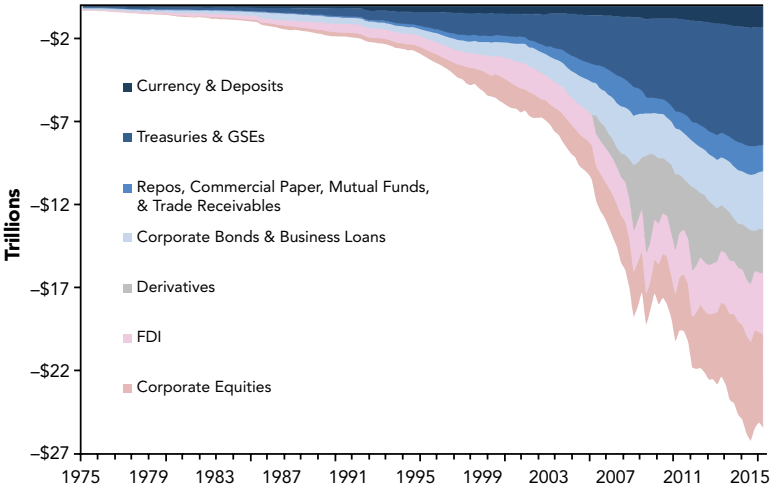

FIGURE 2.1. US Liabilities to the Rest of the World

Source: US Financial Accounts

States.[3] Figure 2.1, using data from the US financial accounts, shows in absolute dollar amount the liabilities the United States owes the rest of the world. The blue categories include everything from cash to treasuries to repurchase agreements and are generally considered safe assets. Derivatives issued by the United States to foreigners are arguably expected to be relatively safe assets, too—for example, recall AAA-rated Collateralized Debt Obligations pre-2008. The sum of these categories was $16.1 trillion at the end of 2015:Q4. This compares to $9.3 trillion of foreign direct investment (FDI) and equity foreigners owned in the United States at this time. US liabilities are disproportionately weighted toward the safe asset type.

Figure 2.2 shows the other side of the balance sheet: US assets owned abroad. Given the speculative nature of most US assets owned abroad, we assume here that the derivatives category

3. That is, the combined assets and liabilities of both the public and private sectors.

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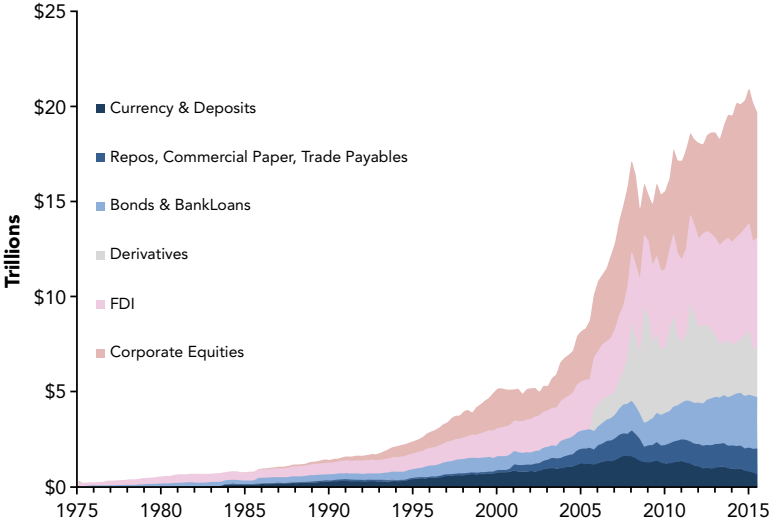

FIGURE 2.2. US Claims on the Rest of the World

Source: US Financial Accounts

represents higher-yielding riskier assets. If we add this to the FDI and equity categories, they make up $15.2 trillion out of a total US assets of $19.8 trillion. US assets are disproportionately weighted toward the riskier asset type.

Figure 2.3 summarizes these first two charts by showing the respective shares of risky assets and safe liabilities in terms of total assets and liabilities on the US balance sheet. The share of risky assets has trended upwards since the 1980s as financial globalization took root and now stands at 78% of total assets, while safe assets issued by the Unites States account for 63% of total external liabilities.[4] Just as a bank earns income on its net asset position from the spread between safe liabilities and riskier assets, so the United States earns positive income on its net international investment position (NIIP), as illustrated in figure 2.4. That the United States

4. Gourinchas and Rey (2007) find a similar pattern, hence their characterization of the United States as a venture capitalist.

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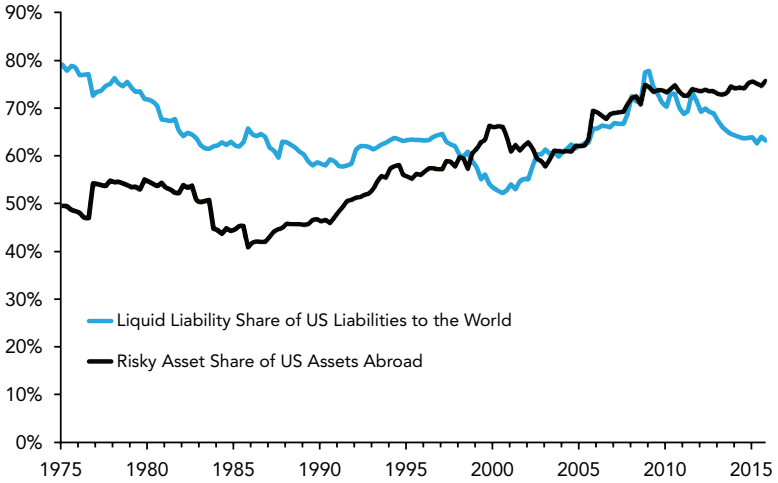

FIGURE 2.3. Composition of US Balance Sheet

Source: US Financial Accounts, Authors' Calculations

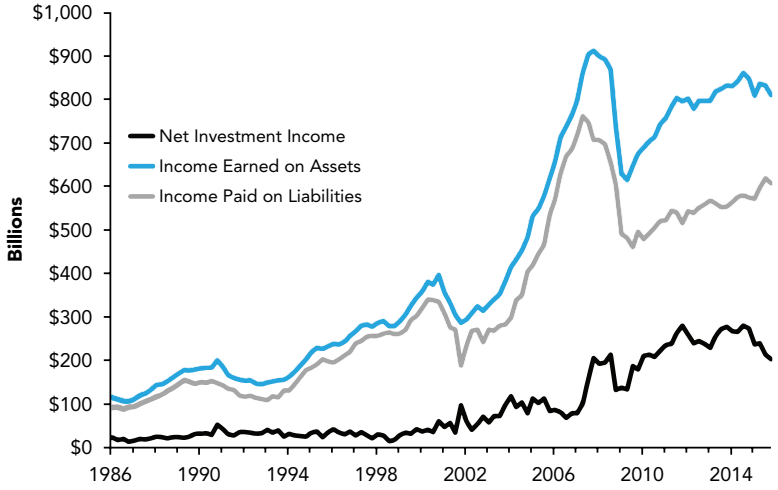

FIGURE 2.4. US Investment Income

Source: BEA

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is able to earn positive income is all the more surprising when one considers that its external liabilities outweigh its assets by around 40% of gross domestic product (GDP).

To provide greater insight into how the United States is able to earn positive net returns on a negative net foreign asset portfolio, figure 2.5 decomposes the twelve-month net return (including valuation effects from changes in asset values) into contributions from the overall size of the NIIP (the level effect), the broad composition of assets versus liabilities (FDI, portfolio, and "other" investment —mostly bank flows), valuation effects from changes in exchange rates, and the residual, which reflects return differentials within broad asset classes not due to currency moves.[5] Overall net returns have been positive on average since 2007. The level effect is generally negative, reflecting the fact that the United States' liabilities outweigh its assets. The exception is the period of the global financial crisis, when average returns were negative and so a negative NIIP translated into a positive return.

Broad composition effects are highly procyclical, thanks to the greater skew towards riskier portfolio assets on the liability side relative to the asset side, and are slightly negative on average. The skew towards riskier assets is more pronounced within broad asset classes. For instance, within portfolio investment, US assets are skewed towards riskier equity while liabilities are skewed towards debt assets. Moreover, since US liabilities are overwhelmingly in

5. The levels effect applies the average return on all US liabilities to the net asset position and so captures the portion of net returns that is attributable to the overall size and sign of the NIIP. The broad composition effect shows the share of the return differential that is attributable to differences in the relative composition of assets and liabilities across the three broad asset classes (FDI, portfolio, and "other" investment) and is calculated using the return on US liabilities for each asset class. The remaining differential is attributable to the difference in returns between assets and liabilities within each asset class. This differential is broken down into differences in returns that are attributable to changes in exchange rates and the residual. Foreign exchange effects are estimated using the currency breakdown of US assets and liabilities provided by Benetrix et al. (2015) and show valuation effects attributable to changes in the US dollar effective exchange rate for assets and liabilities, where the latter is weighted by the currency composition of assets and liabilities respectively.

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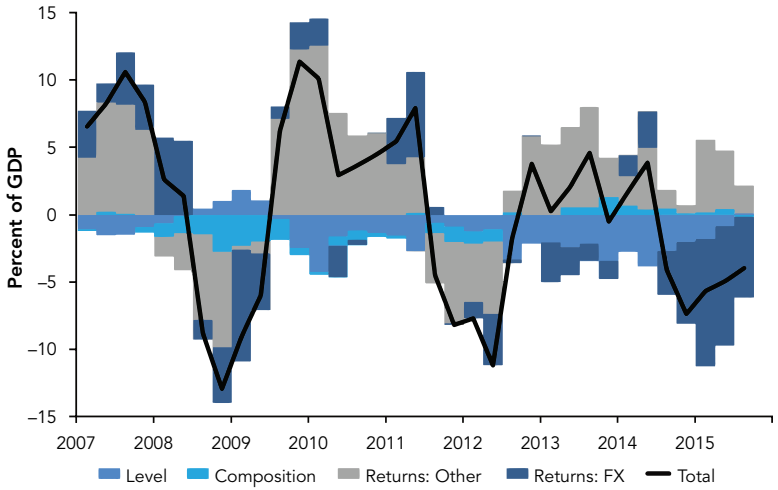

FIGURE 2.5. Decomposition of US Net Return on NFA

Notes: Annual (12m) returns on NIIP as % GDP Returns: FX: return thanks to differential returns on assets and liabilities thanks to FX moves. Assumes external assets denominated in foreign currencies with weights equal to WSJ USD index, while external liabilities denominated in USD Returns: Other: returns from coupon and valuation changes for assets vs liabilities, excluding impact of FX moves above Composition: returns thanks to differential composition of assets and liabilities Level: returns thanks to overall NIIP Total: total returns on NIIP

Source: Haver Analytics, Authors' Calculations

dollars (more than 80%) while assets are more likely to be denominated in foreign exchange (around 67%), the United States is exposed to foreign exchange risk. Both forms of risk exposure imply substantial returns volatility but also contribute to average returns, offsetting the negative contribution from running a negative overall NIIP.

The rapid swing of the United States' net returns from positive to negative in 2008–09 illustrates another facet of the US role, notably the provision of countercyclical "insurance" to global investors. Equivalent to 10% to 15% of US GDP on an annualized basis, the net wealth transfer from the United States provided a useful stabilizing role during the global crisis. Initially, the insurance was

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paid in the form of lower local currency returns on US holdings of foreign assets, notably thanks to big drops in equity prices. Later much of the payment came in the form of US dollar appreciation, as "flight to safety" concerns boosted the US currency and lowered the value of US asset holdings abroad. This insurance role has been dubbed "exorbitant duty" by Gourinchas et al. (2010).[6]

The observation that the United States fulfills this banker to the world role has a number of implications. First, it suggests that the United States has a greater debt capacity than would otherwise be the case. The United States' persistent current account deficit and resulting accumulation of liabilities is a result of global demand for "safe" US dollar assets, including demand for official reserves on the part of emerging market (EM) central banks as well as the savings needs of an ageing global population. As a number of authors have noted, the "exorbitant privilege" of issuing the global reserve currency allows the United States to fund a perennial current account deficit, just as a bank's role in the financial intermediation process allows it to perennially fund its assets and earn a spread through issuing cheap, less risky, debt (Gourinchas and Rey 2007).

One popular explanation for the United States' ability to adopt this role in the global financial system is that its deep and liquid financial markets endow it with a comparative advantage in issuing "safe" assets and in providing insurance against shocks for non-US residents faced with less-developed financial markets at home. For instance, Mendosa et al. (2009) develop a multicountry general equilibrium model with incomplete asset markets, where countries differ in their level of financial development (defined as the degree of enforceability of financial contracts). In their model, as globalization leads to greater financial integration of the countries with

6. Tille (2003) also notes the important role of currency movements on the US NIIP, thanks to the large gross positions that have built up and the differing currency composition of assets and liabilities.

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more- and less-developed financial sectors, the country with the greater degree of financial development sees its net asset position deteriorate as the less-developed country builds up riskless claims against it—matching the experience of the United States described above.

Caballero et al. (2008) come to similar conclusions, although in their model the collapse in domestic asset values associated with the 1990s EM crises, as well as ongoing processes of financial integration, help to account for the flows into less risky US assets. Forbes (2010) provides some further empirical support for this argument, noting that investors in countries with relatively poorly developed domestic asset markets are more likely to hold US assets. These effects are significant and robust, whereas more traditional diversification arguments for cross-country asset holdings receive little empirical support.

A second implication is that a rapid reversal of this position is unlikely. The funding for the US current account deficit is not grudging or volatile but reflects a fundamental desire by non-US residents to build up stocks of safe assets, turning to the United States as banker to the world given its demonstrated comparative advantage in this area. The fact that this funding is freely given is most obviously reflected in the relatively poor returns that foreigners earn on their US assets. But the stickiness of this funding is also obvious when you consider whether there is any other country that could fulfil this role. As figure 2.6 shows, only the United Kingdom comes close in its share of global safe assets, but if the United States is run as a venture capital firm then the United Kingdom is arguably closer to a highly leveraged hedge fund, with 72% of its liabilities in the form of liquid assets, a much smaller economy, lower debt capacity, and no ability to print the global reserve currency.

A corollary of this is that a run on the US dollar prompted by concerns about the US current account deficit is unlikely. A

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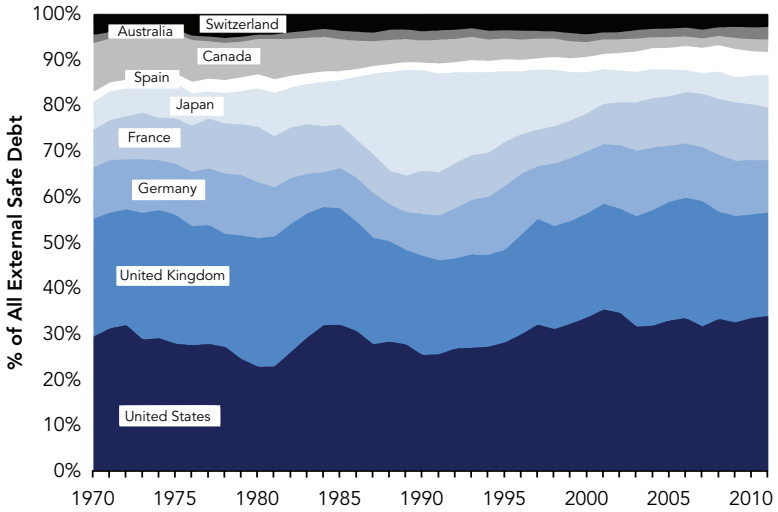

FIGURE 2.6. Share of World's Safe Assets

Source: Lane and Milesi-Ferretti (2007), Authors' Calculations

number of authors noted concerns about the sustainability of the US current account deficit in the run-up to the global financial crisis. Summers (2004) argued that "there is surely something odd about the world's greatest power being the world's greatest debtor," focusing on domestic savings-investment imbalances in the United States as the driver of the current account deficit rather than on the willing inflow of foreign capital that was its counterpart. Roubini and Setser (2005), Gros et al. (2006), and Krugman (2007) made similar arguments. These observers missed or failed to fully appreciate the banker to the world role played by the US financial system.[7] And while it is possible to have a run on a bank, it is unlikely to have a run on the main banker to the world when there are few good alternatives.

7. However, as we have argued elsewhere (Beckworth and Crowe 2012), some of the demand for US safe assets was recycled US monetary policy, and that proved to be distortionary. See the next section for more on this point.

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3. Monetary superpower

Another defining feature of the US financial system is that its central bank, the Federal Reserve, has inordinate influence over global monetary conditions. Because of this influence, it shapes the growth path of global aggregate demand more than any other central bank does.

This global reach of the Federal Reserve arises for three reasons. First, many emerging and some advanced economies either explicitly or implicitly peg their currency to the US dollar given its reserve currency status. Doing so, as first noted by Mundell (1963), implies these countries have delegated their monetary policy to the Federal Reserve as they have moved towards open capital markets over the past few decades.[8] These "dollar bloc" countries, in other words, have effectively set their monetary policies on autopilot, exposed to the machinations of US monetary policy.[9] Consequently, when the Federal Reserve adjusts its target interest rate or engages in quantitative easing, the periphery economies pegging to the dollar mostly follow suit with similar adjustments to their own monetary conditions.

The extended reach of US monetary policy can be seen in figure 2.7. It shows the share of world GDP at purchasing power parity that is under the three largest currency blocs.[10] As of 2015, the dollar bloc made up 41% of world GDP compared to 16% that comes from the US economy alone. This is approximately a 2.5-fold increase in the reach of Federal Reserve policy. If it were not for these dollar bloc countries, the scope of US monetary policy

8. Chinn and Ito (2006) document this trend using an index on capital market openness for 182 countries. They show advance economies began opening up their capital accounts in 1980s while emerging and developing economies began doing so more in the 1990s.

9. Arbitrage in the foreign exchange markets leaves them no other choice but to follow US monetary policy if they want to maintain the peg. This is the "impossible trinity" or "macroeconomic trilemma" where countries can only accomplish two of three goals: peg to another currency, allow free capital flows, or conduct independent monetary policy.

10. Figure 2.7 is based on the de facto currency pegs in Ghosh et al. (2014). We are grateful to the authors for sharing their data.

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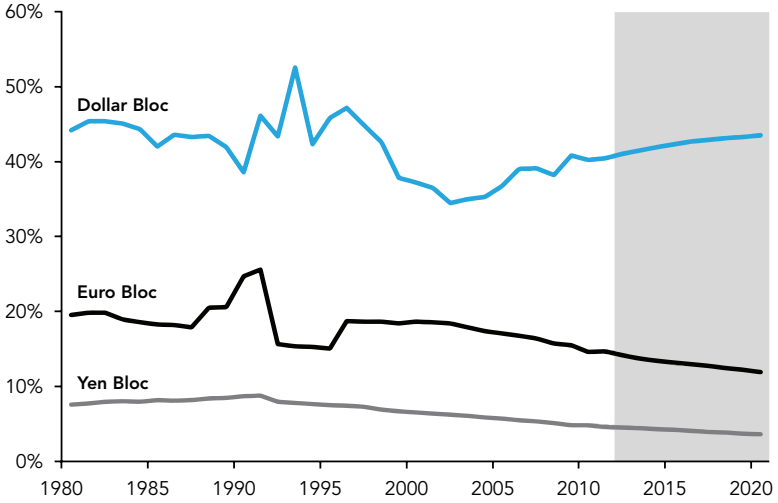

FIGURE 2.7. Share of World GDP at PPP for Currency Blocs

Note: De facto currency pegs based on Ghosh et al. (2014)
Source: PPP GDP data taken from IMF WEO database

would be similar in size to the euro bloc, which accounted for 15% of world GDP in 2015. In a distant third, the yen bloc comes in at 5% of world GDP. According to IMF estimates, this dollar bloc is expected to slightly grow as emerging economies become a larger share of the global economy.[11]

The second reason for the global reach of US monetary policy is that a large and growing share of global credit is denominated in dollars. That means the Federal Reserve's influence over the dollar's value gives it influence over the external debt burdens of many countries. For example, the Federal Open Market Committee's talking up of interest rate hikes from mid-2014 through the end of 2015 that caused the dollar to appreciate over 20% also sharply added to the debt burden for many economies.

11. This projection should be viewed with some caution as it assumes all dollar bloc countries will continue to maintain their dollar peg. Presumably, some of the emerging economies will eventually float their currencies.

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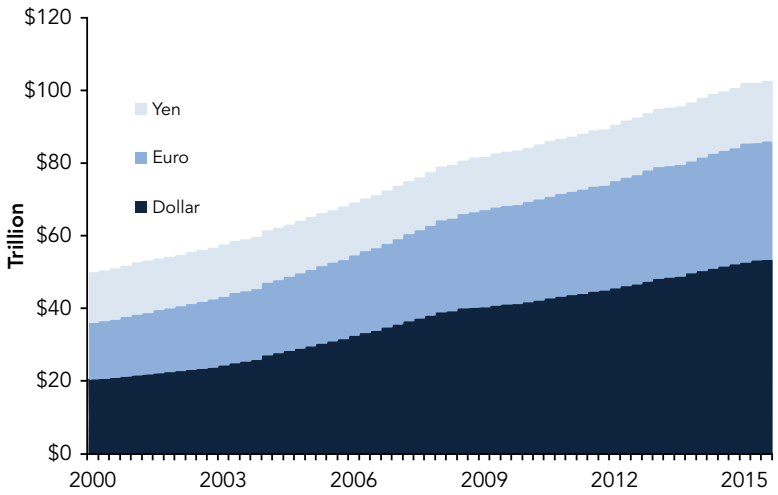

FIGURE 2.8. Currency-Denominated Lending (Bank Lending and Debt Securities)

Source: BIS data on global credit aggregates; Haver Analytics

The extent of this influence can be seen in figures 2.8 and 2.9. The first figure shows the Bank for International Settlements (BIS) measure of global aggregate credit comprised of bank lending and debt securities that is denominated in the yen, euro, and US dollar. The overall stock grew from $50 trillion in 2000:Q1 to $103 trillion in 2015:Q3. The dollar share of this measure grew from 41% to 52% over the same period, as the growth of euro- and yen-denominated credit failed to keep pace.

Figure 2.9 looks at credit extended to nonresidents (i.e., US dollar loans and debt securities issued to non-US residents) and reveals the increasingly dominant role of the US dollar. While credit to nonresidents more than tripled overall, from $3.7 trillion in 2000:Q1 to $13.0 trillion in 2015:Q3, the dollar share increased from 62% to 75%. This dominant share is why the Federal Reserve not only influences monetary but financial conditions for much of the world.

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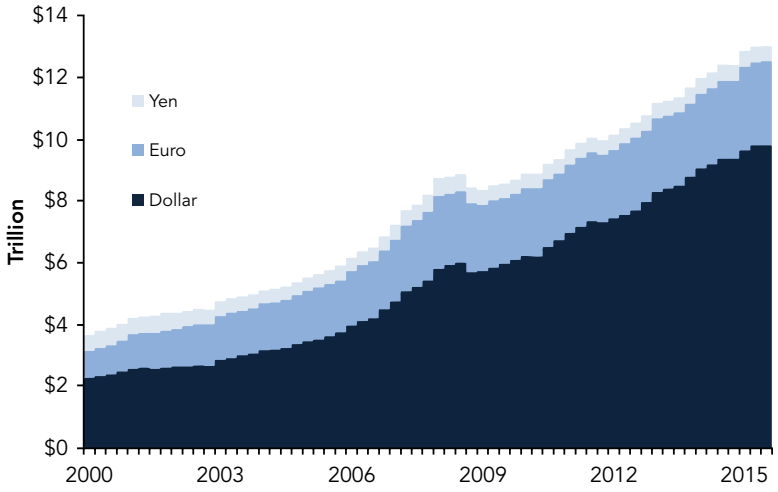

FIGURE 2.9. Currency-Denominated Lending Outside of Currency's Home Jurisdiction

Note: Lending includes bank lending and debt securities.
Source: BIS data on global credit aggregates; Haver Analytics

The third reason for the extended reach of US monetary policy is that other advanced-economy central banks are likely to be mindful of, and respond to, Federal Reserve policy given the large size of the dollar bloc. To see this, consider what could happen if the Federal Reserve decided to cut its interest rate target and engage in another round of quantitative easing. This easing of US monetary policy would be transmitted to the dollar bloc economies and cause their currencies, along with the US dollar, to depreciate relative to the yen and the euro. If the dollar bloc depreciation were big enough, it would force the Bank of Japan and the European Central Bank to begin easing monetary policy lest their currencies appreciate too much against the dollar bloc. Other advanced-economy central banks would follow suit. Other channels, such as the international risk-taking channel of Bruno and Shin (2014), may intensify this response.[12] This understanding

12. Bruno and Shin (2014) show how global banks are able to facilitate additional bank-funded leverage in other countries in response to easing by the Federal Reserve.

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suggests that US monetary policy may be amplified beyond the dollar bloc's 41% of world GDP. Moreover, it implies that central banks in other advanced economies may be limited in their ability to conduct independent monetary policy.

A spate of recent studies provides evidence that supports this view. Belke and Gros (2005) and Beckworth and Crowe (2012) show that exogenous shocks to the federal funds rate Granger-cause innovations in the European Central Bank's marginal refinancing rate but not the other way around. Gray (2013) estimates the reaction function of twelve central banks—nine of which are in advanced economies—and finds that all of them systematically respond to changes in the federal funds rate.[13] McCauley et al. (2015) show that monetary conditions in both advanced economies and emerging economies were affected before and after the 2008 crash by US monetary policy.[14] Similarly, Chen et al. (2016) and Georgiadis (2016) show that the Federal Reserve's large-scale asset-purchase programs affected both advanced and emerging economies.[15]

Figure 2.10 provides evidence consistent with these findings. It shows the US Taylor rule gap—the Taylor rule federal funds rate minus the actual federal funds rate—plotted against the year-on-year growth of nominal spending for the countries of the Organisation of Economic Co-operation and Development (OECD) less the United States for the period of 1995:Q1 to 2015:Q4.[16] This figure plots, in other words, the stance of US monetary policy against

13. The twelve countries are Australia, Canada, South Korea, United Kingdom, Norway, New Zealand, Denmark, Israel, Brazil, Eurozone, China, and Indonesia. He shows the reaction function coefficient on the federal funds rate goes as high at 0.75%. Along these same lines, Taylor (2012) provides an interesting example of an advanced economy central bank, the Norges Bank, which explicitly states its actions are contingent on what the Federal Reserve does with its monetary policy.

14. They specifically look at US dollar credit growth outside the United States and find that prior to the crisis it was driven by foreign interest rate spreads over the federal funds rate. Since 2008 it has been more influenced by the foreign interest rate spread over the ten-year Treasury yield. They also show that advanced economies dollar credit growth was faster before 2008 but still makes up around 50% of outstanding dollar-denominated credit held by non-US residents.

15. Though in some cases the effect was greater for the emerging economies.

16. The construction of this Taylor rule is discussed in the next section.

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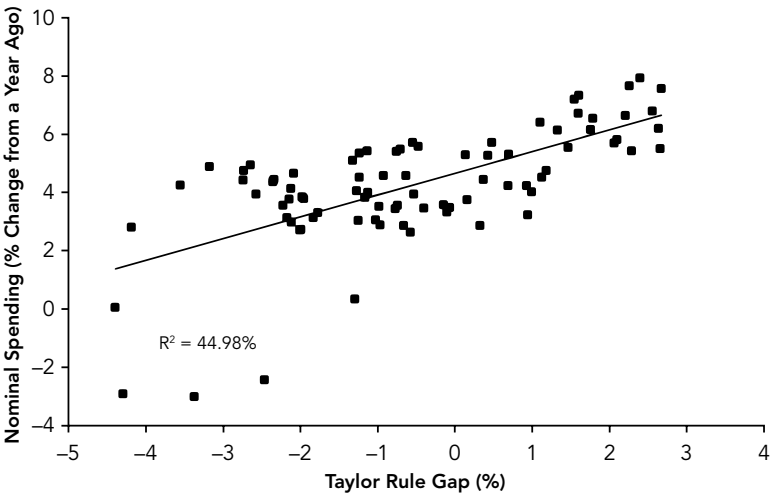

FIGURE 2.10. Fed Policy & OECD less USA Nominal Spending Growth (1995:Q1–2015:Q4)

Note: Nominal spending is measured by OECD's current price GDP (NGDP). The Taylor rule Gap equals the Taylor rule federal funds rate minus actual federal funds rate.
Source: Fred Database, IMF WEO, OECD Statistics, CBO, Authors' Calculations

aggregate demand growth in other mostly advanced economies.[17] Given the discussion above, the strong positive relationship shown in this figure indicates there is a strong linkage between Federal Reserve policy and monetary conditions in advanced economies.

These findings imply that even inflation-targeting central banks in advanced economies with developed financial markets are not immune from the influence of Federal Reserve policy. This has led Rey (2013, 2015) to argue that the standard macroeconomic trilemma view is incomplete. This trilemma says that in a financially integrated world with free capital flows a country can have an independent monetary policy and be insulated from external financial

17. The OECD countries less the United States are as follows: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, and United Kingdom.

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shocks if it has a flexible exchange rate. Rey contends that if there are key "monetary policy centers" that shape "global financial cycles" then a flexible exchange rate will not be enough. She provides evidence that the key monetary center is the Federal Reserve.

Because of this inordinate influence the Federal Reserve has over global monetary conditions, Beckworth and Crowe (2013) and Gray (2013) have called it a "monetary superpower." They note that a key challenge the Federal Reserve faces as a monetary superpower is that it sets monetary policy for US economic conditions not global economic conditions. Consequently, it may inadvertently cause changes in the global monetary conditions that are too loose or too tight for the rest of the world.[18] Three examples since the early 2000s illustrate how the Federal Reserve can unintentionally be a destabilizing force in the global economy: the growth of global economic imbalances from 2002 to 2006, the emerging market boom of 2010–2011, and the emerging market slowdown of 2013–2015.

Global imbalances 2002–2006

Between 2002 and 2006 global current account imbalances rapidly grew with many emerging economies, commodity exporters, and some advanced economies running large current account surpluses while many advanced economies, especially the United States, ran large current account deficits. Prior to the crisis, many observers viewed this development with alarm as it portended a dollar crisis. After the crisis, many viewed it as a key factor behind the financial crisis of 2007–2009 since it implied a large inflow of capital to advanced economies, which, in turn, fueled the credit and housing boom.[19] As we discussed earlier, the precrisis critics were off since

18. Some observers, such as Taylor (2009) and Sumner (2011), argue the Fed sometimes fails to get even US monetary conditions right.

19. See Borio and Disyatat (2011) for a review of this argument and the literature behind it.

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they missed the banker to the world role played by the US financial system. The postcrisis critics, however, also missed something. The world's demand for safe assets from the banker to the world during this time was partly an endogenous response to the actions of the monetary superpower.

To be clear, and as we alluded to earlier, there had been a growing demand for safe assets for some time. Caballero (2006) sees this "safe asset shortage" problem beginning with the collapse of Japanese asset values in the early 1990s and intensifying in the late 1990s as a result of the emerging market crises. These developments and the rapid growth of the emerging world had already increased the demand for safe assets. This structural shift in the demand for safe assets, however, was compounded by the actions of the Federal Reserve in the early to mid-2000s. This cyclical shift in the demand for safe assets happened, as argued by Borio and Disyatat (2011) and Beckworth and Crowe (2012), because of the Federal Reserve's monetary superpower status.

During this time the Federal Reserve engaged in a cycle of monetary easing that many considered excessive as it kept interest rates "too low for too long".[20] This easing put downward pressure on the dollar that the dollar bloc countries had to offset in order to maintain their dollar pegs. They did so by buying up dollars in the foreign exchange market and reinvesting most of them into US safe assets.[21] The demand, then, for the financial intermediation services of the banker to the world during this time was in part a response to the easing of Federal Reserve policy. Some of the global imbalance growth was simply recycled US monetary policy.

What made this monetary easing destabilizing was not just that it recycled monetary policy back into the US economy but

20. See, for example, Taylor (2009).

21. They also had to sterilize the increase in their own monetary base that resulted from buying up dollars in the foreign exchange market.

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that it was overly expansionary given the state of the global economy. During this period the world got buffeted by a series of large positive supply shocks from the opening up of Asia and the technology innovations in the early 2000s.[22] The opening up of Asia significantly increased the world's labor supply while the technology gains increased productivity growth. This rapid growth of the global labor force and productivity both raised the expected return to capital. These developments, in turn, put upward pressure on the global natural interest rates while putting downward pressure on global inflation rates. Consequently, as noted by Beckworth (2008) and Selgin et al. (2015), a more stabilizing response from the Federal Reserve during this time would have been to avoid holding interest rates low for so long and allow the benign disinflationary forces to emerge. By failing to do so, the Federal Reserve inadvertently helped fuel a global credit and housing boom during this time.[23]

Emerging market boom of 2010–2011

Given the anemic US recovery following the Great Recession, the Federal Reserve engaged in series of large-scale asset-purchase programs known as quantitative easing (QE). While these expansionary programs may have been appropriate for the weak US economy, they were too expansionary for most of the dollar bloc countries, which had experienced faster recoveries. Then San Francisco Fed president Janet Yellen (2010) recognized this point in a 2009 speech she delivered during a trip to China:[24] "For all practical purposes,

22. The US productivity boom peaked between 2002 and 2004. See Selgin et al. (2015) for more on this development.

23. It arguably also encouraged easing in the Eurozone given the linkages described above.

24. Then Fed chair Ben Bernanke also acknowledged that US monetary policy was too expansionary for China in a lecture given to George Washington University students in 2012. See Peterson and Derby (2012).

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Hong Kong delegated the determination of its monetary policy to the Federal Reserve through its unilateral decision in 1983 to peg the Hong Kong dollar to the US dollar. . . . Like Hong Kong, China pegs its currency to the US dollar, but the peg is far less rigid. . . . Because both the Chinese and Hong Kong economies are further along in their recovery phases than the US economy, current US monetary policy is likely to be excessively stimulatory for them. However, as both Hong Kong and the mainland are currently pegging to the dollar, they are both to some extent stuck with the policy the Federal Reserve has chosen to promote recovery."

This tension was not limited to dollar bloc countries. Other emerging countries, such as Brazil, felt the force of the Federal Reserve's QE programs as the resulting depreciation of the dollar created pressure among them to depreciate their currency, too. Because of this, Brazil's finance minister at the time, Guido Manega, famously quipped in 2010 that an "international currency war" had broken out (Wheatley and Garnham 2010). These concerns were reinforced by the advent of a second QE in the same year and drew strong rebukes from other emerging market officials, including ones in China (Evans-Pritchard 2010).

Ultimately, the global monetary stimulus from the Federal Reserve led to an overheating in emerging economies as shown by Chen et al. (2016). IMF data show GDP growth in emerging and developing economies increasing from a low of 3.0% growth in 2009 to an average of 6.9% growth in 2010 and 2011. Inflation rose from a low 5.0% to a high of 7.1% in 2011.[25] Accompanying this growth was the rapid expansion of dollar-denominated credit to the emerging world, which McCauley et al. (2015) show was driven by US monetary policy. Unsurprisingly, the conversation in emerging economies shifted from currency wars to concerns about inflation (Theunissen and McCormick 2011).

25. Data are taken from the IMF's World Economic Outlook database of April 2016.

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Emerging market slowdown of 2013–2015

In May and June of 2013, Fed chair Ben Bernanke raised the possibility of the Federal Reserve tapering its asset purchases under a third QE program. Markets took this as a sign of an imminent rise in interest rates by the Federal Reserve. As a consequence, Treasury yields sharply rose over the rest of 2013—ten-year Treasury yields increased from around 1.7% in May to about 3.0% in December—as the market priced in the anticipated rate hikes. This was an effective tightening of monetary policy, and emerging markets were hit hard with sudden outflows of capital, especially the "fragile five": Turkey, Brazil, India, South Africa, and Indonesia. The monetary superpower had struck again.

Once again, emerging market officials spoke out against what they saw as the Federal Reserve's indiscriminate use of its monetary superpower. Raghuram Rajan, the governor of the Reserve Bank of India, said in 2014, "I have been saying that the US should worry about the effects of its policies on the rest of the world. We would like to live in a world where countries take into account the effect of their policies on other countries and do what is right, rather than what is just right given the circumstances of their own country" (Dasgupta and Nam 2014).

Concerns over the fragile five were eventually trumped by economic developments in China. China's economy was already slowing down as it was transitioning from the high growth of a developing economy to the more modest growth of a middle-income country. In addition, China saw a rapid debt buildup in the years after 2008 as credit creation was ratcheted up to maintain robust economic growth after the crisis. Though China had weathered the Taper Tantrum relatively well, it met its match once the Fed began talking up interest rates hikes in earnest.

Figure 2.11 shows that the expected federal funds rate 12 months ahead increased from 0.29% in June 2014 to 0.89% in December

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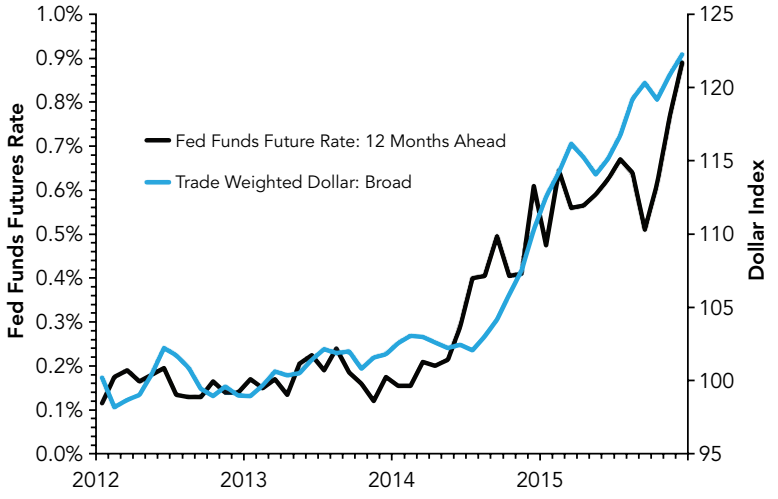

FIGURE 2.11. Expected Fed Policy and the Dollar
Source: Fred Data, Bloomberg

2015. This figure also shows that the sustained rise in the expected federal funds rate was accompanied by the dollar rising over 20%. Presumably, this expected tightening of US monetary policy caused the sharp rise in the dollar. The sharp appreciation of the dollar, in turn, caused the semipegged renminbi to appreciate just over 15% during this time.

The vulnerable and exposed Chinese economy could not handle this sudden appreciation of the renminbi. Officials from the People's Bank of China tried to offset this effective tightening of Chinese monetary conditions by cutting multiple times its benchmark lending rate and its required reserve ratio on banks. This attempt at domestic monetary easing plus the slowing growth created expectations that the renminbi was overvalued and would be devalued at some point. Consequently, investors began pulling capital at a rapid pace, with almost $1 trillion pulled out in 2015 (Bloomberg News 2016). Between June 2014 and December 2015, Chinese monetary authorities were forced to burn through almost $663 billion of foreign reserves to defend their peg. Figure 2.12 shows that the timing

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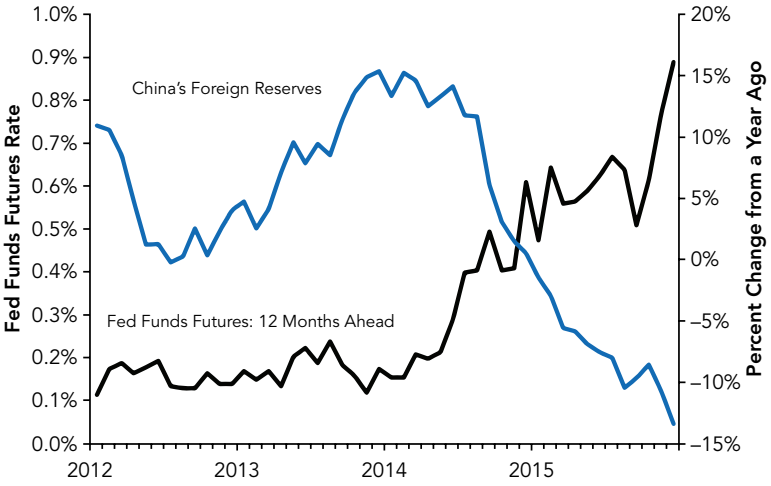

FIGURE 2.12. Expected Fed Policy and China's Foreign Reserves
Source: Fred Data, Bloomberg

of this capital exit and the increased fears of devaluation by China coincides closely with the talking up of interest rate hikes by the Federal Reserve.

The sharp rise in the dollar not only caused capital outflow problems for China, it arguably contributed to the financial turmoil in late August 2015 and early 2016. Moreover, some viewed it as weighing down global aggregate demand during this time, including the IMF (Mayeda 2015).

What these three episodes all illustrate is the inordinate influence of US monetary policy. The Federal Reserve is an unmatched monetary superpower. The March 2016 FOMC suggests the Fed is increasingly grappling with this reality. The FOMC believes that "global and financial developments continue to pose risks" and that policy would depend on, among other things, "financial and international developments."[26] While this is an interesting development, the Federal Reserve's domestic mandate and the complexities of

26. See www.federalreserve.gov/monetarypolicy/files/monetary20160316a1.pdf.

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the global economy make it unlikely that US policymakers will ever be willing or able to explicitly respond to global economic conditions in a consistently stabilizing manner. What we can hope for is a more rules-based approach to US monetary policy that will make it easier for other central banks to plan for and respond to the monetary superpower in rules-based fashion themselves. As Taylor (2013) shows, this approach could mimic the stabilizing properties of an internationally coordinated monetary system for the global economy.

4. When monetary superpower status interacts with the banker to world role

In the previous two sections we documented that the US financial system acts as banker to the world and that the US central bank is a monetary superpower. A natural corollary to consider is how these two features of the US economy interact. Since the Federal Reserve can affect global monetary and financial conditions and therefore help shape global aggregate demand, it seems likely that US monetary policy could affect the demand for safe assets. Its actions could therefore affect the demand for the financial intermediation services provided by the banker to the world.

As we noted in section 2, this is the argument made by Borio and Disyatat (2011) and ourselves in earlier work (Beckworth and Crowe 2012). Both studies provide evidence that the easy stance of US monetary policy during the credit and housing boom period was recycled back into the US economy via purchases of safe assets by periphery countries. If this is the case, what effect did US monetary policy have on safe asset demand after the crash when many observers perceived US monetary policy to be effectively too tight for the US economy given the zero lower bound? Did it in any way contribute to worsening the safe asset shortage problem since 2008?

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To answer these questions, we estimate a structural vector autoregression (VAR) in this section that looks at the effect the stance of US monetary policy has on the demand for US safe assets. Before doing that, though, it is useful to step back and take a closer look at the liquid assets on the liability side of the US balance sheet that was shown in figure 1. Figures 2.13 and 2.14 break these liquid assets out into publicly and privately provided categories for the period 1990:Q1 to 2015:Q4.

Figure 2.13 shows that during the housing boom period the main growth in publicly provided safe assets were in Treasury notes and bonds and government-sponsored-enterprise agency securities (GSEs). After the crisis in 2008, the growth in the world's demand for Treasury notes and bonds soars from holdings near $2.0 trillion in 2008 to roughly $4.5 trillion in 2015. Treasury bills have a sharp one-time demand spike and currency and deposits steadily grow after 2008.[27] Foreign holdings of GSEs sharply falls after 2008, going from about $1.6 trillion to almost $0.9 trillion.

Figure 2.14 shows the privately provided liquid assets.[28] The shortest-term category—the repurchase agreements, commercial paper, mutual funds, and trade receivables—rapidly grows during the housing boom period, as do the mortgage-backed securities (MBSs). As has been documented by Gorton (2010) and others, they began stumbling in 2007 and then entered free fall in 2008 as the run on the shadow banking system ensued. The shorter-term assets have since partially recovered while the MBSs continued to fall through 2013 and have remained flat since then. Corporate bonds also took a hit in 2008 but have fully recovered and returned to trend growth.

27. We include deposits in this category since they are insured by the government.

28. Here we ignore the financial derivatives because data is only available on it back to 2005:Q4. It is also an aggregated series that gives no sense of the underlying financial derivatives.

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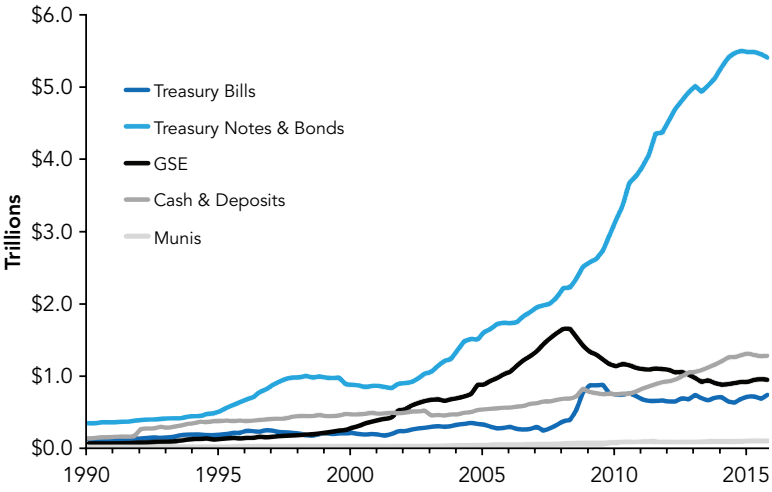

FIGURE 2.13. Public Liquid US Assets to Rest of the World

Source: US Financial Accounts, Authors' Calculations

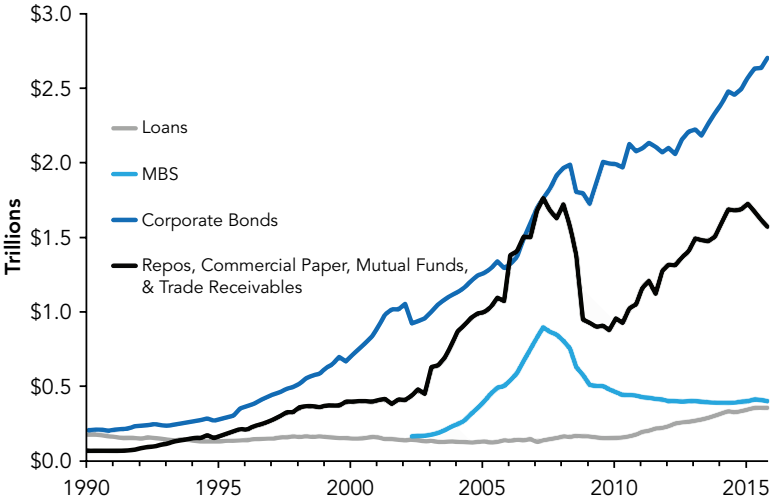

FIGURE 2.14. Private Liquid US Assets to Rest of the World

Source: US Financial Accounts, Authors' Calculations

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Given these findings, we group the safest public assets—Treasuries, deposits, and currency—that continued to grow after the crisis into one category and place all other public and private liquid assets into another category. These categories are shown in figure 2.15. Interestingly, it shows the pattern among safe assets reported by Borio and Disyatat (2011): the growth of the safest, government-supplied assets declined in the early 2000s while the growth of the other liquid assets—mostly privately provided ones—rapidly grew during this time. The growing demand for safe assets, then, was focused mostly on the private-label assets (other than agencies) during the boom years. Thereafter, the roles are reversed. Going back to our original question, this suggests that the stance of US monetary policy may not only affect the overall demand for safe assets but also the composition of safe asset demand. We consider this possibility in our VAR estimation.

The stance of monetary policy

Before estimating our VAR, we need to come up with a consistent measure of monetary policy that works across both conventional and unconventional monetary policy periods. We opt for the Taylor rule gap: the difference between the federal funds rate prescribed by the Taylor rule and the actual federal funds rate. We believe our approach can handle both periods for the following reasons. First, we allow the neutral federal funds rate term in the Taylor rule—the intercept—to be time varying. We specifically use the New York Federal Reserve's five-year nominal risk-free yield estimate. This is equivalent to the expected average short term over the next five years after subtracting out the term premium.[29]

29. Put differently, this nominal risk-free yield plus the term premium make up the observable five-year Treasury yield. The data can be found at https://newyorkfed.org/research/data_indicators/term_premia.html.

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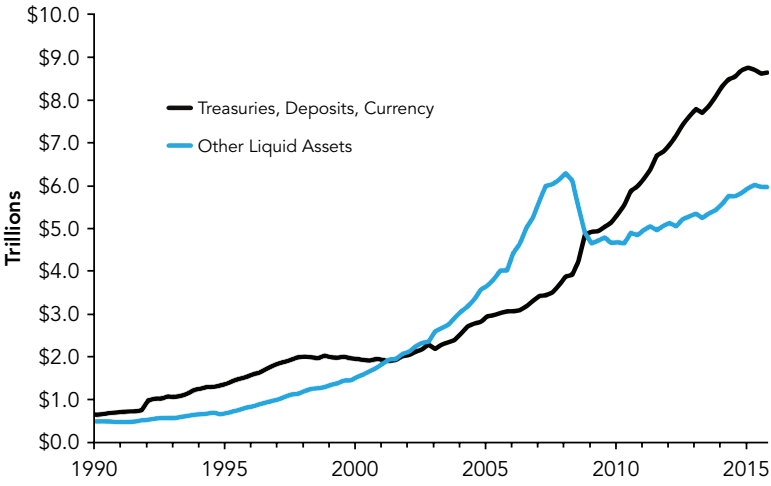

FIGURE 2.15. Liquid US Assets to Rest of the World
Source: US Financial Accounts, Authors' Calculations

The use of this time-varying neutral rate better allows the Taylor rule to reflect the changing state—including both boom and zero-lower-bound stages—of the economy. Second, to the extent the Federal Reserve's QE programs did meaningfully add monetary stimulus and change the economy, then it should affect both the time-varying neutral rate and the output gap and, consequently, be reflected in the Taylor rule gap. So whether it is during the boom period or the zero-lower-bound period, the Taylor rule gap should reflect the stance of monetary policy.

Figure 2.16 shows our Taylor rule alongside the actual federal funds rate. In addition to using a time-varying neutral rate, we also take the average of the output gap measures of the IMF, OECD, Congressional Budget Office (CBO), and Hodrick-Prescott (HP) filter to create a robust measure of the output gap. We use the GDP deflator for inflation and adopt the weights from the 1999 Taylor rule (Taylor 1999). As a robustness check on our Taylor rule, we estimated an aggregate demand (nominal GDP) gap measure—

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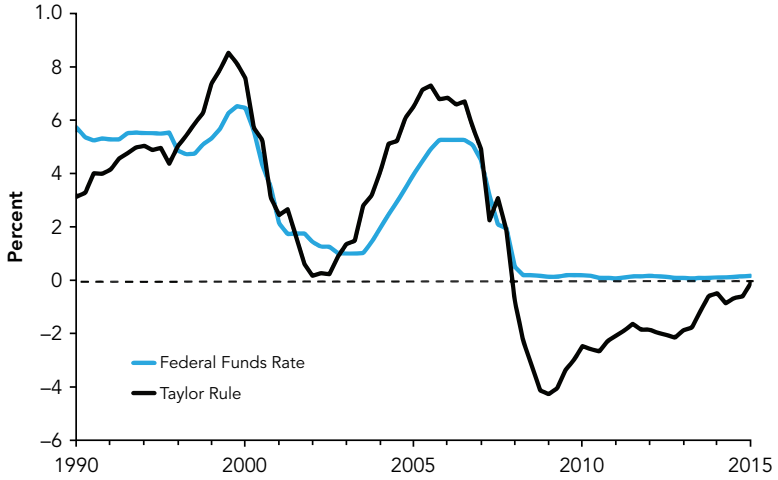

FIGURE 2.16. The Stance of Monetary Policy

Source: Fred Database, IMF WEO, OECD Statistics, CBO, Authors' Calculations

the difference between nominal spending needed to maintain full employment and actual nominal spending—for the same period and came up with a close fit (R^2 = 80%) as seen in figure A1 in the appendix. This suggests our Taylor rule gap measure is a reasonable measure of the stance of monetary policy.

The objective of this section is to examine whether Federal Reserve policy affects the rest of the world's demand for safe assets in the United States. As a first look at this question, we plot in figure 2.17 our Taylor rule gap against the US current account balance as a percent of GDP. Since the latter is just the flip side of the financial and capital account, it provides a summary measure of net capital flows into the US economy. Consistent with the arguments laid out in this paper, this figure shows a relatively strong and positive relationship between the stance of monetary policy and the current account balance. While suggestive, we need to better establish causality between Federal Reserve policy and capital flows. We do that next by estimating a VAR.

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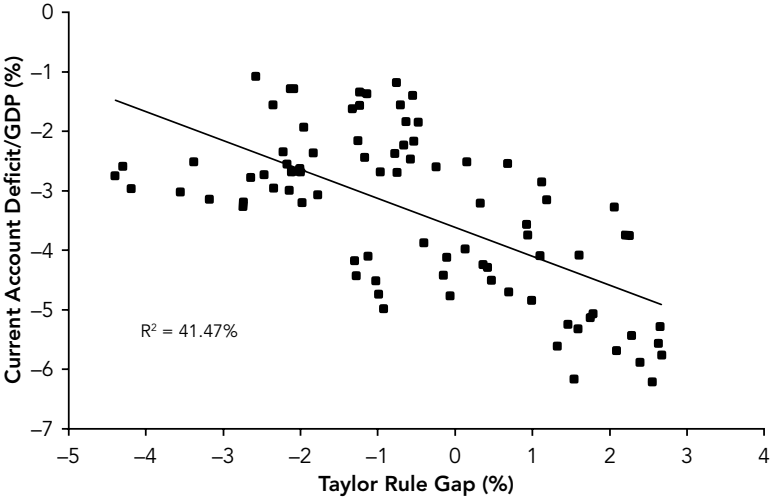

FIGURE 2.17. The Stance of Monetary Policy and Capital Flows (1995:Q1–2015:Q4)

Source: Fred Database, IMF WEO, OECD Statistics, CBO, Authors' Calculations

Empirical methods

Given the nature of our question and the relatively short sample period, one of the problems in estimating our VAR is ensuring there are adequate degrees of freedom. Consequently, we follow Lastrapes (2004, 2006), who shows how to estimate a VAR with a parsimonious set of core variables which can then be applied to a number of ancillary variables and thereby minimize the degrees-of-freedom problem. For us, this means estimating the following system of endogenous variables,

$$z_t = (TG_t, EM_t, USD_t, CA_t, A_t),$$

where TG_t is the Taylor Gap, EM_t is a real economic activity indicator for emerging markets, USD_t is the trade-weighted value of the dollar, CA_t is the current account deficit as a percent of GDP, and A_t

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is the ancillary variable, all at time period *t*. The first four variables make up our core model and are fully endogenous. The motivation for this core group is to see the dynamic effects the Taylor rule gap has on the current account balance after controlling for the effects emerging market economies and the dollar have on it. Including these latter two variables should account for some of the structural pressures on the current account deficits discussed earlier. Also, note that by using the Taylor Gap measure, we are able to see how the stance of monetary policy, regardless of its cause, affects the current account balance.[30]

The ancillary variable is one that is affected by the core variables but cannot affect the core variables either contemporaneously or with a lag (because of restrictions we impose on the model). Therefore, no matter what variable we put into $A_{t,}$ the interactions among the core variables are unaffected and stay the same. This not only reduces the degrees of freedom needed, but it also allows us to estimate the model multiple times with different variables standing in the A_t slot.

For the EM_t variable we use the emerging market industrial production index produced by CPB Netherlands Bureau for Economic Policy Analysis. We use the Federal Reserve's broad dollar index for USD_t . The primary ancillary variables we examine in the A_t slot are the Treasuries, deposits, and currency series, the other liquid liability series, and the ten-year Treasury yield. We also plug in the US industrial production index as another robustness check on the Taylor Gap to see if it creates a response in US economic activity consistent with standard economic theory.

The model is estimated for the period 1999:Q1–2015:Q4. All variables are transformed into logs except for those already in percent form. Eight lags are used since the likelihood ratio test indi-

30. That is, the Taylor Gap reflects both passive changes in monetary policy (e.g., the Fed fails to respond to a weakening economy) and active changes (e.g., the Fed tightens policy too much) and therefore provides a complete measure of monetary policy.

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cates this is an appropriate lag length and because that many lags are sufficient to whiten the residuals.

To estimate the structural impulse response functions to a Taylor Gap shock, we use a standard recursive decomposition of the covariance matrix for the variable ordering laid out above. This allows the Taylor Gap to have an immediate effect on the all the variables in the system, a reasonable assumption given the data are quarterly. As a robustness check against this ordering of the variables, we also estimate the generalized impulse response functions. This shows the dynamic response of a variable to a shock averaged over all recursive orderings. If the results were sensitive to the ordering, the generalized impulse response function should be significantly different from the structural impulse response function.

Empirical results

Figure 2.18 shows the structural impulse response functions (IRFs) from a standard deviation shock to the Taylor Gap. The figure also reports the generalized impulse response functions (GIRFs). Given the similarity of the IRFs and GIRFs, the results do not appear sensitive to the ordering of the variables.

The positive monetary policy shock causes the Taylor Gap to increase upon impact but only temporarily remains positive before returning to zero. Both US and emerging market economic activity also temporarily increase, with the former persisting for longer. The only surprising result is that the monetary easing has no immediate effect on the trade-weighted dollar and eventually causes it to rise. This result may be explained by Ammer et al. (2016), who find that the effects of stronger US demand and the loosening of foreign financial conditions from US monetary easing may outweigh any downward pressure it creates on the US dollar.

The important question of whether monetary policy affects the demand for safe assets as reflected by changes in the current

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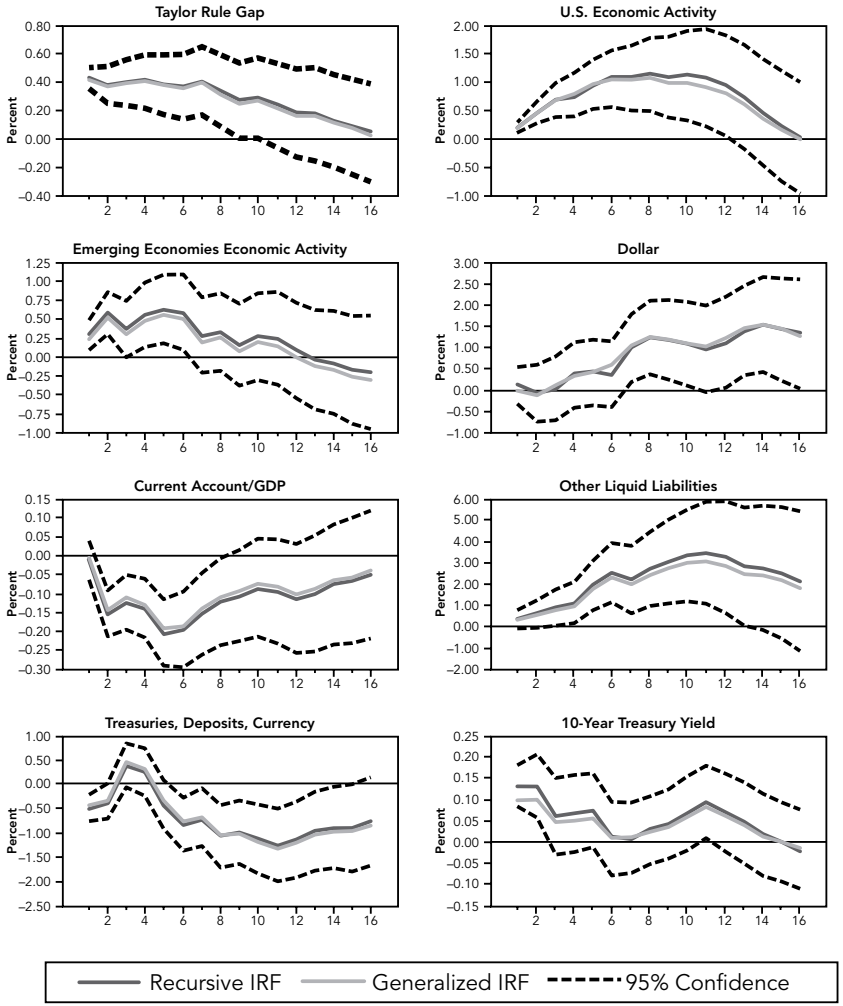

FIGURE 2.18. Impulse Response Function to Standard Deviation Taylor Gap Shock (1999:Q1–2015:Q4)

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account balance is answered in the affirmative in the next IRF. The Taylor Gap shock causes the current account to decline in a statistically significant manner for seven quarters. This indicates that monetary easing by the Fed does, in fact, increase the overall demand for US safe assets by foreigners.

The next two IRFs reveal that, while overall demand for US safe assets is raised by the Federal Reserve easing, there is a composition effect as well. The positive shock to the Taylor Gap causes the less safe "other liquid liabilities" category to rise while causing the supersafe Treasuries, deposits, and currency to decline. This composition effect is borne out in the rising ten-year Treasury yield. In other words, the monetary easing causes foreigners to substitute out of the public safe assets into the mostly private safe assets, and this raises (lowers) their yields (prices). Since the VAR is a linear model the opposite would be true, too: tight monetary policy should cause a substitution out of privately produced safe assets into the supersafe government assets.

To see whether these results are not just statistically significant but economically significant, we present the variance decomposition (VDC) of the forecast error in figure 2.19. This shows the percent of the forecast error for each variable that is attributable to the Taylor Gap shock. Of particular interest to us is the VDC of the current account deficit. Figure 2.19 shows that the Taylor Gap shock explains as much as 60% of the forecast error six quarters out. Thereafter, it slowly declines. The Taylor Gap shock also explains about 40% of both the Treasuries, deposits, and currency series and the other liquid liability series ten quarters out. These VDCs indicate that Taylor Gap shocks are both statistically and economically significant to the demand for safe assets provided by the US financial system during both the boom period and the zero-lower-bound period.

As a final check on the effect of the Fed policy on demand for the financial intermediation services provided by the banker to

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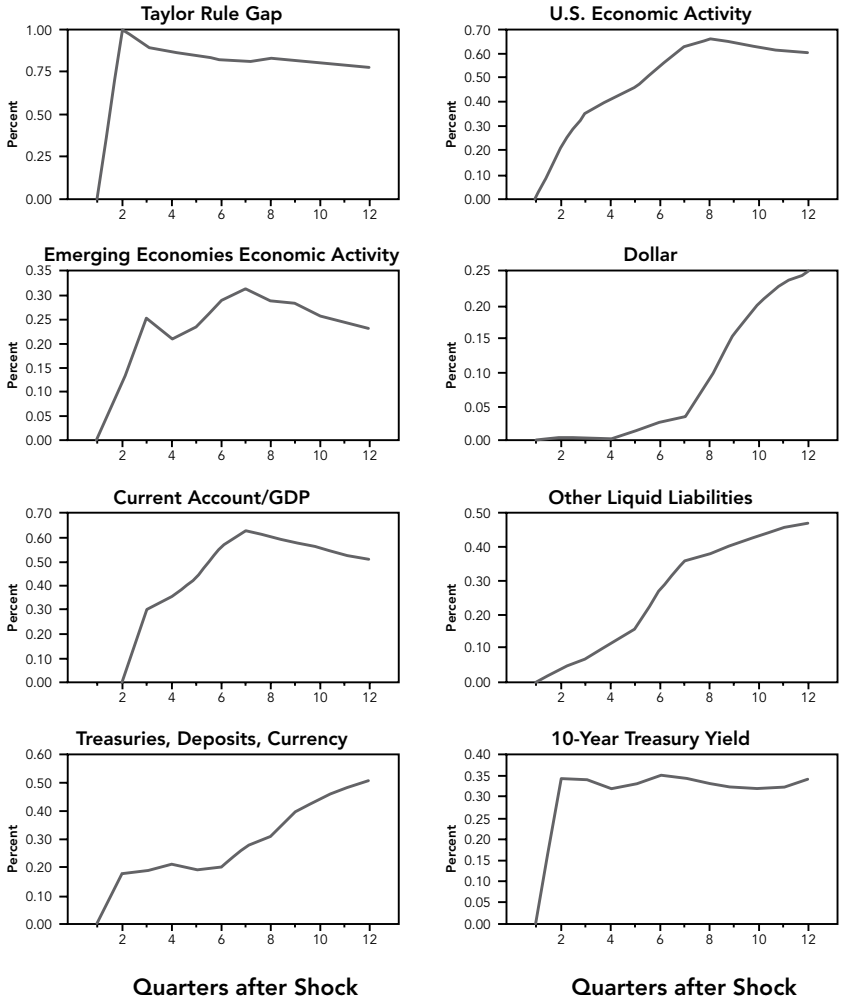

FIGURE 2.19. Percent of Forecast Error Attributable to Standard Deviation Shock to Taylor Gap (1999:Q1–2015:Q4)

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the world, we run two counterfactual dynamic forecasts. For the first one, we take the estimated VAR and dynamically forecast it forward starting in 2002:Q1 and run it through 2007:Q4. We run the forecast conditional on the Taylor Gap being zero. We want to see what the estimated VAR predicts would have happened had US monetary policy been neutral between 2002 and 2007. Taylor (2009) sees the Federal Reserve getting off track in 2002, so we pick this as our starting point.

The first column of figure 2.20 shows the outcome of this exercise. There are several interesting results. First, the US current account deficit would have been smaller between 2004 and 2007. At its maximum, the current account as a percent of GDP would have been 1.5 percentage points smaller in 2006:Q1. Starting in 2005, the demand for Treasuries, deposits, and currency would have been higher while the demand for the mostly private other liquid liabilities would have been lower. This increased demand for the government safe assets would have pushed down the ten-year Treasury yield starting in 2005. At its peak in 2006:Q3, it would have been almost 1% lower.

While this is a highly speculative exercise subject to all kinds of criticism, it does suggest the Federal Reserve helped fuel the demand for the AAA-rated private-label assets. The savings glut does, then, seem to be in part a recycling of US monetary policy back into the US economy.

For the second counterfactual exercise, we consider what would have happened had the Taylor Gap been zero beginning in 2008:Q1. In other words, what would have happened had the Fed been able to respond more appropriately to the economic crisis at that time? The first thing to note is the current account deficit would have been persistently smaller starting in 2009. The demand for safe government assets would have been lower starting in 2010, and the demand for the mostly private-label safe assets would have been higher starting in late 2009. Finally, the ten-year Treasury yield

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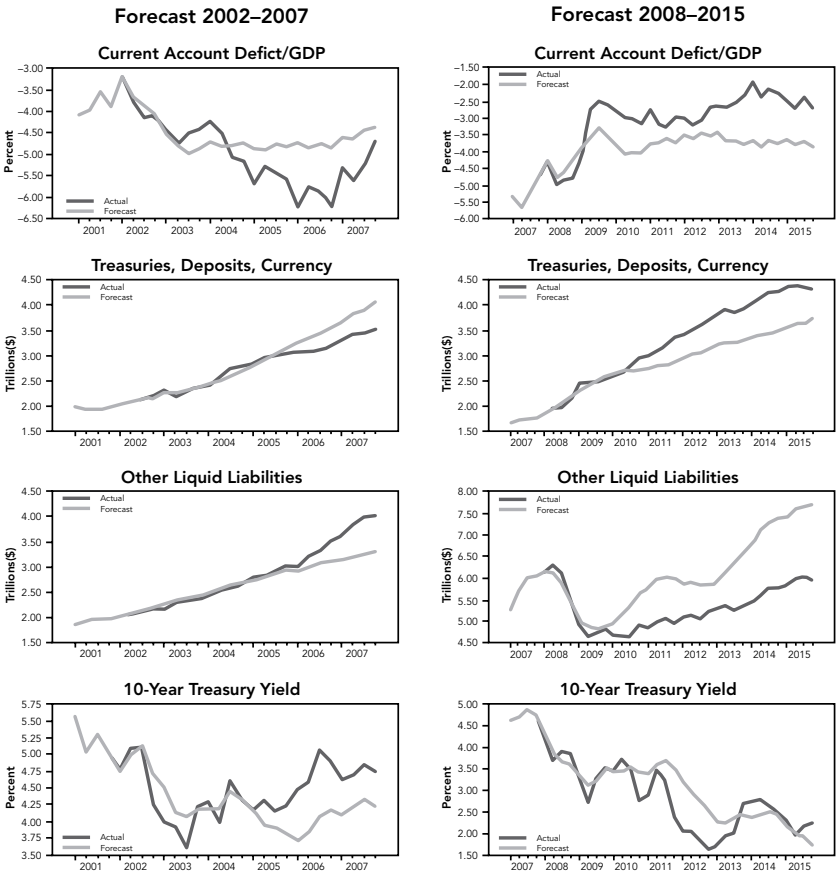

FIGURE 2.20. Forecasted Path Given Neutral Monetary Policy

Note: The conditional dynamic forecasts are made given the Taylor Gap is set equal to zero.

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would have been slightly higher starting in 2010 but still would have been trending down.

These results suggest that the effectively tight US monetary policy—due to the zero lower bound—may have prevented a quicker recovery in the safe asset market. That is, had monetary conditions been easier, then a more robust recovery that improved the economic outlook, lowering the demand for supersafe government assets while increasing the demand for privately produced liquid assets, may have materialized.

5. Conclusion

We have shown in this paper that the United States is both a monetary superpower, influencing global monetary conditions, and banker to the world, providing safe assets to the rest of the world. We have also shown how these roles can interact to the detriment of the global economy. During the housing boom the Federal Reserve's accommodative monetary policy got recycled back into the US economy via its banker to the world role and helped fuel the housing boom. Since the crisis in 2008, the Federal Reserve has erred the other way (constrained by the zero lower bound on rates) by effectively being too tight, and this has prevented the US financial system from adequately responding to the safe asset shortage.

As we noted earlier, the safe asset shortage first emerged because of structural reasons in Asia but more recently has intensified thanks to cyclical drivers. This can be seen in figure 2.21, which shows that since the financial crisis most government debt considered safe has seen its yield persistently drop. This global phenomenon has been driven, in our view, by a spate of bad news over the past eight years: the Great Recession, the Eurozone Crisis, China slowdown concerns, political uncertainty, fears of the Federal Reserve tightening too soon, and other issues. These developments, however, have been amplified by a US monetary policy that has been effectively too tight during this time. As we argued via our

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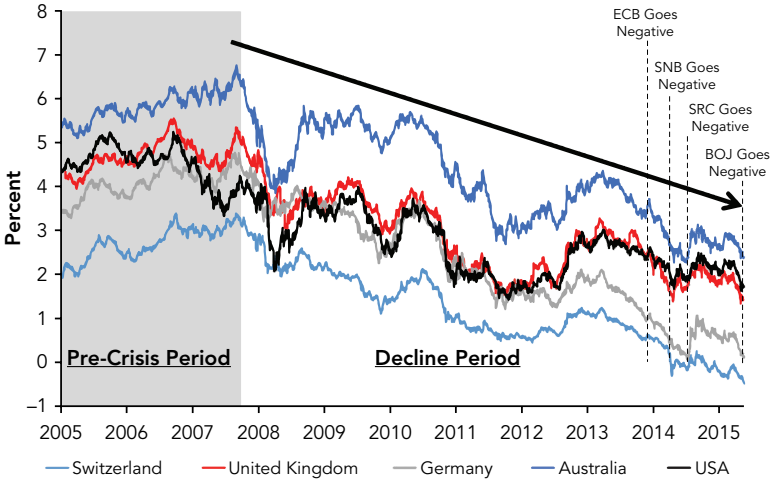

FIGURE 2.21. 10-Year Government Yields on Safe Assets

counterfactual exercises above, this monetary tightness has only increased the demand for supersafe assets.[31]

The safe asset shortage problem is not something with which to be trifled. As recently shown by Caballero et al. (2016), if the safe asset shortage problem is big enough, it will spread across countries and put downward pressure on global rates. This is already happening, as seen in figure 2.21. Moreover, it will keep global aggregate demand growth anemic. We see this, too, with the weak growth in Europe, Japan, and the emerging markets. Safe assets are important because they are the assets that are expected to be liquid and maintain their value. They are, in other words, moneylike and serve as a transaction asset for institutional investors as shown by Gorton (2010). Their shortage, therefore, means a shortage of money and of aggregate demand.

What makes the safe asset shortage problem such a tough challenge is that, if left unchecked, it will push the market-clearing or "natural" interest below zero. When that happens, the safe asset

31. New bank regulations since the crisis may also be increasing the demand for safe assets.

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market is not clearing—interest rates are too high, safe asset prices are too low—and problems get worse. Caballero et al. (2016) believe the advanced economies are at that place now. If they are correct, then there are three solutions to safe asset shortage.

The first option is to increase the supply of safe assets to the point that investors are satiated with them. The second is to decrease the demand for safe assets by improving the economic outlook. The third option is to try to break through the zero lower bound and have interest rates reach their market-clearing levels.

The first option seems infeasible as long as the United States maintains its clear competitive advantage in issuing safe assets and political opposition within the United States to a substantial increase in debt issuance remains.[32] The third option is arguably the one being attempted currently, particularly in Europe and Japan. Whether it is feasible is open to question: reaching the market-clearing interest rate may be infeasible given the existence of cash.[33]

This leaves the second option as the most plausible. The best outcome would be a return to more robust levels of global GDP growth, which would boost investment (held back by weak growth expectations) and improve risk appetite, reducing the cyclical demand for safe assets. The structural demand for safe assets would still be with us, but the cyclical uptick in safe asset demand since the crisis could be meaningfully addressed through this option. That is where a more appropriate US monetary policy comes into play.

32. Of course it is partly because US political institutions and voter preferences are opposed to this that the United States enjoys its advantage in issuing safe assets, relative to countries where there is greater debt tolerance.

33. Negative rates have other disadvantages. Concerns have been raised about bank profitability since negative rates are likely to lead to bank spread compression as long as negative rates are difficult to pass on to retail depositors. In addition, negative rates have increased the attractiveness of the euro and yen as funding currencies for global carry strategies, meaning that both have tended to appreciate in "risk off" scenarios, adding a destabilizing degree of procyclicality to domestic financial conditions for these countries, as well as, complicating efforts to maintain weak currencies.

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We believe one of the key reasons Federal Reserve policy has been effectively tight over the past eight years is its firm commitment to low inflation, which prevents the Fed from credibly committing to run policy sufficiently loosely to make up for the nominal demand shortfall that followed the deep 2008–2009 recession. All the Fed's tools—the setting of short-term interests, the buying and selling of government bonds, and the management of expectations—were handcuffed by its strict devotion to low inflation. They would never be allowed to generate the spending growth required to put the economy completely back to work. That is why Sumner (2011) and Woodford (2012) have called for nominal gross domestic product (NGDP) level targeting. This approach would anchor long-term inflation expectations but allow for temporary deviations in the inflation rate required to maintain aggregate demand on a stable growth path. Although not a panacea, and subject to some implementation challenges, NGDP level targeting could help solve the cyclical portion of the safe asset problem. At the same time, it would also commit the Federal Reserve to a more rulelike approach to monetary policy. As Taylor (2013) notes, such an approach would make it easier for other central banks to respond to the monetary superpower and therefore bring us closer to an internationally coordinated monetary system.

Are there alternatives to the US dollar that could dethrone the US currency and displace the Fed as monetary superpower? So far, putative competitors such as the euro, yen, or pound sterling have largely fallen by the wayside. However, the rise of the Chinese economy and the increasing international role of the renminbi raise the question of whether the Fed's reign as monetary superpower may be coming to an end. Indeed, one anomaly of the dollar's current dominance is that the largest single contributor (at purchasing power parity GDP) to the dollar bloc is no longer the United States itself, but China.

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With the Chinese authorities increasingly pursuing a more flexible Chinese-yuan-to-dollar exchange rate and promoting the use of a number of broader reference baskets for determining the value of the renminbi, China's membership in the dollar bloc is looking more tenuous. Over time it seems likely that the Chinese currency will take on a more important role as a reserve currency in its own right. However, while almost a quarter of China's international trade is settled in renminbi, the currency's international role in asset markets is in its infancy, and overall the renminbi accounts for less than 3% of global cross-border trade and financial transactions and less than 2% of turnover in global foreign exchange markets and about 1% of global official foreign exchange reserves (Prasad 2016). Moreover, China's domestic financial system is still dominated by state-owned banks, the authorities' commitment to liberalization is uncertain, and the path to capital account openness remains beset with risks and obstacles.

Finally, despite well-flagged moves towards greater currency flexibility, the US-dollar-to-renminbi exchange rate is still of central importance to Chinese policymakers: during early 2016 a clear pattern emerged of opportunistic devaluation of the trade-weighted value of the renminbi, with the Chinese authorities allowing the renminbi to weaken alongside the dollar in trade-weighted terms when the latter moved lower, while weakening against the US dollar during periods of general US dollar strength. In our view, China remains part of the dollar bloc—if less securely than before. Hence, the dollar's dominant international role seems unlikely to be seriously challenged in the foreseeable future.

Appendix

Here we show how we estimated our full-employment level of aggregate demand. We begin with the assumption that the output gap—the difference between the actual and full-employment level

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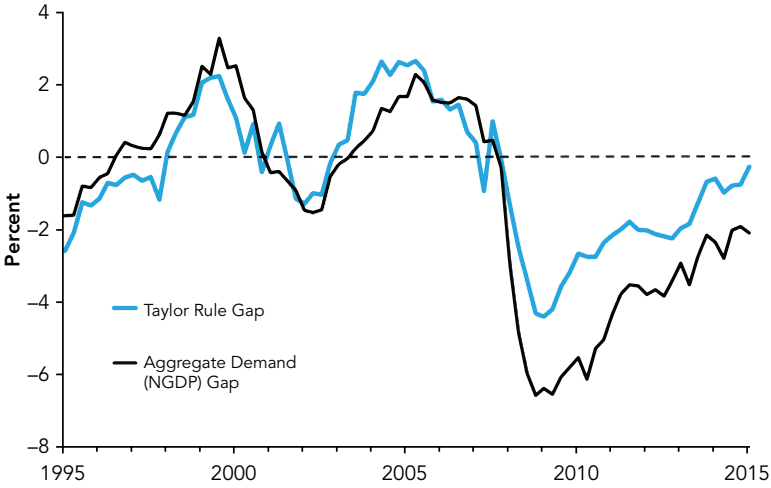

FIGURE 2A.1. The Taylor Rule Gap and the NGDP Gap

of economic activity—is a consequence of there being too much or too little aggregate demand. Since NGDP is a measure of aggregate demand, we can state this relationship as follows:

$$\ln(NGDP_t) - \ln(NGDP_t^{FE}) = \pi_t output\ gap_t, \qquad (1)$$

where $NGDP_t^{FE}$ is the full employment measure of NGDP and π_t is a time-varying parameter. Equation (1) says the output gap is related to the NGDP gap at time t via the parameter π_t. Note that equation (1) can be rearranged into the following:

$$\ln(NGDP_t) = \ln(NGDP_t^{FE}) + \pi_t output\ gap_t. \qquad (2)$$

Given sticky prices and the slow changing nature of potential real GDP, we do not expect $NGDP_t^{FE}$ to change quickly. Consequently, we can think of it as a relatively stable NGDP growth path that only gradually changes. This is in line with calls for NGDP level targeting from such folks as Sumner (2011) and Woodford

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(2012). Since it is a time-varying growth path, we can estimate it with a rolling regression of the form

$$\ln(NGDP_t) = B_{0,t} + B_{1,t}time_t + B_{2,t}time_t^2 + B_{3,t}output\ gap_t, \quad (3)$$

where the term $B_{0,t} + B_{1,t}time_t + B_{2,t}time_t^2$ represents $NGDP_t^{FE}$. The regression is estimated using quarterly data with a rolling window of 40 observations.

The average of the HP-filtered output gap, the IMF's output gap, the OECD's output gap, and the CBO's output gap measures is taken to get a robust output gap estimate. This average output gap is included with the natural log of NGDP and the two time trends in the rolling regression. The resulting $B_{0,t}$, $B_{1,t}$, and $B_{2,t}$ parameters can then be used to construct $NGDP_t^{FE}$.

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DISCUSSION BY CHRISTOPHER ERCEG

This paper by David Beckworth and Christopher Crowe focuses on two related themes. The first is that the Federal Reserve is a monetary superpower that exerts large effects on global interest rates and global output: in the words of the authors, the Fed "to a large extent sets global monetary conditions." The authors support this point both through case studies and also through a structural VAR, with a key empirical result that a more accommodative US monetary policy causes the US current account balance to deteriorate and foreign GDP to rise. The second and closely related theme is how Fed monetary policy affects the demand for safe assets, with particular attention to how the zero bound constraint following the global financial crisis may have exacerbated the global safe asset shortage.

I found this to be a very interesting paper insofar as it examines a wide range of transmission channels through which Fed policy may affect both foreign output and global asset yields. In my discussion, I will begin by focusing on the empirical VAR methodology that the authors use to assess spillovers from Fed policy and then present some complementary evidence suggesting that Fed policy easing (tightening) tends to boost (lower) foreign GDP on balance, rather than exerting "beggar-thy-neighbor" effects. I agree with the authors that the spillovers from Fed policy actions to foreign economies can be quite large for those foreign economies attempting to keep their exchange rates relatively stable against the dollar. However, I will argue that foreign economies with sound fundamentals and a credible monetary policy framework have considerable latitude to adjust their policy rate to achieve domestic stabilization objectives and thus to minimize the potential for undesirable spillovers.

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1. The spillover effects of Fed policy

While the authors use both case studies and an empirical VAR to gauge spillovers from Fed policy changes, my discussion will focus more on the latter given that the VAR-based evidence is the more novel contribution of the paper. To briefly recapitulate their methodology, the authors use a structural VAR to estimate the effects of a US monetary policy shock. The authors make two key assumptions to identify monetary policy shocks. First, they measure a monetary policy shock as the gap between the prescription of a modified form of the Taylor (1993) rule (i_t^{tay}) and the realized policy rate (i_t):

$$\tau_t = i_t^{tay} - i_t = r + \gamma_\pi \pi_t + \gamma_x x_t - i_t,$$

where the coefficient γ_x on the output gap x_t is set to unity rather than 0.5 as in the standard (1993) Taylor rule (with the coefficient γ_π on inflation set to 1.5 per usual). They call this monetary policy shock τ_t the "Taylor gap." Thus, rather than estimate the coefficients of the policy reaction function—the typical approach in the literature—the authors simply calibrate the coefficients, and back out the monetary policy shock as a residual.

The second key assumption is that the monetary policy shock is ordered first in the VAR and thus prior to the other variables (which include the industrial production of emerging market economies [EMEs], the trade-weighted dollar, the US current account, and long-term Treasury yields). This contrasts with the usual assumption in the VAR literature using timing restrictions to identify monetary policy shocks, which assumes that policymakers can react contemporaneously—within the same quarter—to domestic output and inflation (and hence orders the policy rate last or at least "further down" in the VAR). I'll return a bit later to discussing

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some of the consequences of these identifying restrictions, as well as the implications of estimating the model over a sample period (1999:Q1–2015:Q4) in which the zero bound was often binding.

The authors derive some interesting empirical results. First, they show that an expansionary monetary policy shock in their VAR causes the US current account deficit to deteriorate even though the dollar depreciates. Second, the expansionary US monetary policy shock raises EME real activity (i.e., industrial production) persistently. I regard these findings as potentially quite important, because they suggest that exchange rate changes are not the dominant transmission channel in accounting for spillovers from US monetary policy: if they were, the US current account balance would tend to improve in response to US monetary accommodation, and foreign GDP would decline. Given the prominent debates about how unconventional policy stimulus by the Fed and other central banks in recent years may exert "beggar-thy-neighbor" effects on trading partners, my sense is that the authors' countervailing results deserve heightened attention.

The authors' results appear reasonably consistent with my own findings in recent research on US monetary policy spillovers conducted with John Ammer, Michiel De Pooter, and Steven Kamin (2016). In this research, we use a large-scale open economy dynamic stochastic general equilibrium model (SIGMA) to assess how US monetary policy affects foreign activity. One key channel through which a, say, US monetary policy easing affects foreign activity is by causing the dollar to depreciate; a weaker dollar of itself should boost US exports while depressing imports and thus reduce foreign GDP. But US monetary easing also boosts US domestic demand—a second key trade channel that causes US real net exports to deteriorate and, correspondingly, strengthens foreign GDP. Finally, US policy easing reduces foreign bond yields through an array of financial linkages (including through affecting risk premiums on sovereign and private debt). While the trade channels

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nearly offset—consistent with perhaps a small deterioration in the US trade balance—our analysis suggests that US monetary easing provides a material boost to foreign GDP as the financial channels dominate (that is, although foreign net exports don't respond much because the effects of stronger US activity are offset by an appreciation of foreign currencies, foreign GDP rises because foreign interest rates decline).

I do have significant concerns with the identification assumptions used in the authors' VAR. My main concern is with the authors' choice to order the monetary shock (i.e., the "Taylor gap" τ_t) first in the VAR, consistent with the assumption that it does not respond contemporaneously (within the quarter) to other influences. While this assumption is often used in identifying fiscal shocks in a VAR framework following Blanchard and Perotti (2002)—on the premise that discretionary fiscal policy is not "nimble" enough to respond quickly to changes in economic conditions—this assumption seems less defensible in the case of monetary policy. To the extent that monetary policy responds quickly to economic and financial developments, the VAR under the authors' identification assumption will confound the effects of an "exogenous," say, easing of monetary policy with the effects of a rate cut in response to a deterioration in economic or financial conditions.

In normal times in which monetary policy is unconstrained by the zero lower bound, this identification strategy would tend to bias downward the estimated effects on output (possibly even implying that monetary easing would lower output, if the reaction to current conditions was strong enough); thus, as noted above, most of the literature using timing assumptions has followed Christiano, Eichenbaum, and Evans (1999) in assuming that monetary policy can react to contemporaneous developments. The zero lower bound poses added challenges and shifts the bias towards overstating the pure effects of monetary policy on output: in particular, while their VAR interprets the large negative Taylor Gaps in

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the Great Recession as exogenous policy tightenings, there is presumably a large endogenous component (as the deterioration in economic and financial conditions itself caused the Taylor Gap to widen).

To address these concerns, it certainly seems worth experimenting with different identifying restrictions and different sample periods in future work. Given the challenges posed by the Great Recession, it would be desirable to extend the estimation sample to earlier periods (say, the early 1980s). It would also seem desirable to utilize sign restrictions, which could allow monetary policy to simultaneously affect financial and even real variables contemporaneously (as in the current paper) without imposing the restriction that monetary policy itself only reacts with a lag.

Notwithstanding these caveats, I like the authors' general approach and think that they have made an important contribution to assessing the empirical channels through which spillovers arise. While there is a voluminous literature estimating financial spillovers abroad from US monetary policy actions, this literature typically adopts a high-frequency-event study methodology that isn't well suited to assessing dynamic effects on macro variables; thus, there is a comparative paucity of empirical research on how US policy actions affect both US trade and foreign GDP, and this paper helps fill this shortfall. In terms of policy implications, I interpret the authors' analysis as suggesting that policy discussions focused mainly on the exchange rate may miss other pivotal channels in accounting for spillovers from monetary policy.

2. Can foreign economies insulate themselves from monetary spillovers?

The accommodative policies of the Fed and other advanced economy central banks following the global financial crisis have often been criticized as having potentially undesirable effects on the rest

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of the world. An open question is whether foreign economies can insulate themselves from monetary spillovers. This paper—drawing on both VAR-based evidence and a number of case studies—suggests that the answer is probably no: Fed actions create a large wake that rocks even distant coastlines.

I agree with the authors that monetary policy spillovers can indeed be large under certain conditions. Spillovers are likely to be large to those foreign economies that put a high priority on keeping their exchange rate fairly stable against the dollar while also maintaining an open capital account. For these economies, a US monetary easing is stimulative both because it boosts US activity (helping their exports) and because it has a large effect in depressing their domestic bond yields. The induced rise in foreign activity may, of course, be undesirable from the perspective of the foreign economies if business cycle conditions were already strong prior to the easing of US monetary policy. A second group of economies likely to experience relatively large spillovers are those with weaker fundamentals, including lower inflation credibility and substantial dollar-denominated borrowing (Bruno and Shin 2015).

Nevertheless, recent analysis by Bernanke (2013, 2015) and my own research with Ammer, De Pooter, and Kamin (2016) highlight how foreign central banks may have considerable scope to insulate their economies from spillovers under certain conditions, so that spillovers from US monetary policy actions to foreign GDP are much smaller. First, spillovers are smaller if the foreign monetary authority's objectives involve domestic output and inflation, rather than exchange rates or exports. Second, spillovers are smaller if inflation expectations in the foreign economy are well anchored. And finally, spillovers can be mitigated through appropriate communication that helps markets better understand the (foreign) central bank's reaction function.

Applying these considerations to the case studies of monetary policy spillovers in the post-global-financial-crisis period, I would

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draw three key lessons. First, spillovers to foreign economies depend heavily on the monetary policy choices taken by those economies, rather than being simply determined by US policy. This point was emphasized by former Fed chairman Bernanke in his Mundell-Fleming lecture at the IMF last year. In the context of the 2010–2012 period, rapidly growing EMEs faced a tradeoff between keeping interest rate low—which would reduce upward pressure on their exchange rate—versus raising interest rates and allowing their exchange rates to appreciate by more. While the latter policy was better poised to keep output near potential and inflation near target, it would have hurt the export sector; hence, many EMEs preferred to maintain policies that were in some cases probably too accommodative to stabilize output and inflation and caused some overheating.

The second lesson is that the ability of foreign economies to insulate their GDP from spillovers depends heavily on macroeconomic fundamentals in those economies, including the credibility and transparency of the central bank's inflation target. This lesson seems clearly underscored by the Taper Tantrum experience of 2013. The EMEs with weak fundamentals, including those with high inflation and inflation expectations prior to this shock, experienced very large exchange rate depreciations and had to raise interest rate markedly to keep inflation from ratcheting up further. By contrast, spillovers were much smaller to EMEs with stronger fundamentals and stable nominal anchors, such as Mexico.

The third lesson—also underscored by the Taper Tantrum experience—is that central bank communication about their objectives and reaction functions can mitigate monetary policy spillovers, especially spillovers that arise through financial channels. Thus, although interest rates rose sharply in both the euro area and United Kingdom in the early summer of 2013, communication efforts by the European Central Bank and the Bank of England were effective

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in pushing rates down in those economies, thus supporting their efforts to achieve their inflation objectives.

3. Conclusion

To conclude, I think this is a very interesting and well-written paper, and it was a pleasure to read. There are a number of implications of the authors' analysis that seem quite important and worth pursuing in follow-up research. Most notably, I think the authors' empirical findings—that US monetary policy easing causes the US current account to deteriorate and foreign GDP to expand—highlights the importance of looking beyond the exchange rate as an international transmission channel. Further empirical analysis of the open economy transmission channels of monetary policy would seem very useful. Finally, I would reiterate that spillovers due to policy actions by major central banks depend crucially on monetary policy—and policy communication—in foreign economies.

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GENERAL DISCUSSION

DAVID BECKWORTH: I'll first speak to the VAR and let Chris Crowe answer some of the other questions. On the VAR, we thought about this issue, and Chris Erceg described it absolutely correctly. The way we ordered it is consequential. With that said, one thing we're trying to get at is that you have this identification problem with the VAR. If we have quarterly data, and one of the drawbacks with this identification procedure is if you order it last, you're going to force monetary policy to have a long, delayed effect. It may, in fact, have an immediate effect, for example, on the dollar. So that was one of our motivations. But it doesn't address the problem you brought up. I would note that the Taylor Gap itself has, of course, embedded in it GDP, inflation, and the neutral interest rate. To some extent, then, the Taylor Gap is going to capture some of those endogenous changes to the economy. It doesn't completely resolve your critique, though. We did estimate and generalize impulse response functions, did a robustness check, and they were similar. So I do think it's useful for us to go back and maybe report those, also different orderings, just to show that our growth results are robust. So I think that that's a great point.

CHRISTOPHER CROWE: I thought the point Chris Erceg made about focusing on our bringing out how it's not beggar-thy-neighbor is really interesting. I agree with that 100%. I think, in general, these effects on US aggregate demand are going to be more important for EM economies than any negative effect from a weaker dollar. As I understand it, the current state of the literature is that these particularly trade effects via exchange rate changes have been pretty small recently. Exchange rates seem to matter more for inflation than for output. I think that the argument that a US monetary loosening is basically good from

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an output point of view for the rest of the world seems to me fairly uncontroversial, which is maybe why we didn't emphasize it as much as we should have done. But I think it is interesting. I think it's also interesting when you think about the central bank valuation channel as well from exchange rates, because we have these huge gross positions on the international investment position. These effects from exchange rate moves can be pretty big, so you have the US dollar appreciating post . . . around 2009, that probably amounted to a sort of wealth transfer to the rest of the world of about 15% of US GDP. And so from my point of view, it's actually even more surprising that these effects are not as big. So maybe we should have emphasized this more.

And maybe one other thing; it's kind of related to the VAR stuff, and it's not so much related to this paper, but I have done other work where I've shown that the sample period is incredibly important. So you're able to identify shocks correctly, and you look at sort of conventional VAR-type identification schemes, which worked well in the past, and you sort of look at a more recent period, even precrisis but sort of 2000s or 1990s, and drop the seventies and eighties. You often find these conventional VAR identification schemes give you very odd-looking results. So I think probably experimenting with different sample sizes would be pretty important for robustness, but I would do it with trepidation, with the expectation that the result could be all over the place.

RICHARD CLARIDA: I have three quick points. Point one: I think this paper has a lot of virtues. One is that having toiled with this data for decades, I think I would strongly urge you, if you've got the RA talent, to regularly update charts one through sixteen, and that will save the rest of us a lot of time. You have a vested interest in keeping it up to date because those are hard to put together in the right way, and you've done a great job.

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And point two, more substantively, is I want to piggyback on something Chris Erceg said, which I think is important in all of these discussions, that when we look at Fed cycles, we can always identify EM countries that get hit. But we need to discipline ourselves. You rarely hear people talking about Australia or Canada or even Chile. There are a lot of countries that do quite well in these episodes where the Fed is hiking or easing. They have open economies, but they tend to have very credible exchange rates. They also have a lot of commodity exposure. So I think when making broad statements about the effect of US policy, you've got to look at the whole universe of countries, and a lot of countries actually don't enter the headlines. I think there's sample selection bias in a lot of these episodes.

And then the third point is on VAR identification. I think sign restrictions—as with the approach of Harald Uhlig right here—are really the way to go in a lot of these VAR exercises. There's no perfect identification scheme, but I think exclusion through timing is probably going to be enough in this case, so I urge you to use the sign restriction approach. Nice job.

DAVID BECKWORTH: Those are good points, and we will definitely look at sign restrictions as well when we tinker around with our VAR.

DAVID PAPELL: I've heard Fed policy since 2008 called many things, but "tight" is not one of them. What is the source of tight in this paper? There are two aspects. The first is the Taylor rule. If you'll use the original Taylor rule, which is the rule in John Taylor's 1993 paper, you're going to get something very different from what you get with what you call the Taylor 1999 rule. If you read John's 1999 paper, what you're calling the Taylor 1999 rule is the rule that John describes as the rule that others have used—particularly researchers from the Federal Reserve Board. So call it the Fed rule, call it the Rudebusch rule, call it the Yellen rule,

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call it the Taylor rule with a doubled coefficient on the output gap. But don't call it the Taylor 1999 rule.

The second aspect is that, by using the federal funds rate since 2009 as the measure of US monetary policy, you are implicitly assuming that unconventional monetary policy has had absolutely no effect on the economy. Forget QE1, QE2, QE3, and forward guidance because all that you are measuring is the fact that the federal funds rate was between zero and 0.025%. I think you really need to use a measure of the shadow federal funds rate. Cynthia Wu and Dora Xia have one that's on the Atlanta Fed website, and Michael Bauer and Glen Rudebusch of the San Francisco Fed have alternatives. But you need to get more stimulative effects than just reducing the federal funds rate to 0.025 or else you're assuming that the Fed did nothing else.

Now what happens if you do both of these things? The Taylor rule deviations switch from positive numbers from 2009 to now to large negative numbers throughout most of that period. And so my question on this is, If you flip the sign of the Taylor rule deviations over this large part of the sample, will it change your results? And if it doesn't, then I would worry about why.

DAVID BECKWORTH: I think we can have reasonable disagreements as to whether policy was purposefully tight. I'm not claiming that. But if you look at things like nominal demand, it collapsed in 2008 and never returned to a kind-of precrisis path. Output gaps, likewise, have been persistently negative. I know they aren't perfectly measured. Estimates of neutral rates have been very negative. All those are signs that monetary policy was effectively too tight. Again, not that Fed policy could easily have avoided this outcome. But we're seeing an effective stance of monetary policy.

On the QE point, we did tinker around with the shadow federal funds rate from the Atlanta Fed. But we were concerned when we were doing it that it would be like double counting.

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Because the Taylor rule has the ouput gap, it is already reflecting the effect of QE policies, to the extent they mattered. And if we have that, and we also use a shadow federal funds rate, which has kind of baked into it QE results, we believe it would be a case of double counting. So you're right. The federal funds rate doesn't change much. But the Taylor rule does. And that's reflecting the efforts of QE. That's reflecting the efforts of unconventional monetary policy.

HARALD UHLIG: I learned a lot from the paper. It's quite insightful. And my attention was drawn to the VARs naturally, and I sympathize with the struggle you are facing. As Richard Clarida said, there's no golden approach here, but there's just so many issues. I mean, sign restrictions, yeah, sure, I'd like to see those. There's also other ways of identifying monetary policy shocks. People have used these high-frequency measures, for example, FOMC dates, to try to tease out monetary policy shocks. You could just use those as an additional external series in the VAR as a constructive suggestion.

The VAR itself: there's a question of how far you want to go in really thinking about this, right? I mean, you've written the piece already. There's some nice results. Maybe you want to let it go. I highly sympathize with that. But there's just a long list of things one really ought to look into. So for one, the Taylor Gap, for example . . . I guess the output gap and inflation, they are contemporaneous in their Taylor Gap formula? So it strikes me as sort of a structure variable in some ways, where you fix the coefficient that the interest rate has on the innovation and the output gap and the inflation rate. That's one way of thinking about it. And then try to get the output reaction, and then the inflation reaction from what's above and beyond that. The problem with that is, you don't even have the output gap and inflation rate in the VAR, right? So at a minimum, I would like to see the inflation rate included in the VAR, in particular, since we

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know that many of the interest-rate-based VAR identifications of monetary policies run into this price puzzle, where price moves in the opposite direction. Since you're doing it structurally, using this Taylor Gap identification, it's possible that you don't get the price puzzle. That will be very, very nice. Right? But if you don't show me what prices do, what inflation does, I'm really not convinced that you got monetary policy in there.

The other issue is the output gap. The output gap is an average of a bunch of things. One of the things that you throw in there, for example, is what is HP-filtered out. Now the HP filter is two sided. So in essence, you're throwing in a variable that includes future variables already. So in the VAR context, that's really problematic. If you could find some way of constructing the output gap just based on present-past data, that would be avoided.

Also—and Christopher Erceg mentioned this—once you run into the zero lower bound, you really have to wonder whether a linear model is a good thing to use at all. At that point, in some ways the Taylor Gap becomes very, very predictable. You know the Taylor rule is way below zero. You know you're stuck at zero. You know the Taylor Gap has to be positive. And so you're treating this in the VAR as if agents are constantly surprised that the Fed yet again chose zero rather than going to –3%. It's hard knowing what to do with the zero lower bound. But there are all kinds of flags raised here. So the question is, What do you do with them? Do you want to go beyond what you have, or do you just want to list these flags as stuff for others to do? But it is interesting. It raises a lot of questions.

CHRISTOPHER CROWE: This issue of using high-frequency measures is something I've actually done in other work, for example, looking at using fed funds futures and identifying policy shocks that way, and it worked pretty well. I guess one of the reasons why we didn't use this even though I'm one of the people

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who's worked on it was just that the Fed's stuck at the zero lower bound. So it's probably reasonable to expect there won't be much news on every FOMC date in terms of the fed funds futures rate because we know that policy is not going anywhere. And so we come back to the issue of what to do at the zero lower bound. I guess the answer, as in a lot of times when you do empirical work and you sort of run into an intractable problem, is kind of a kitchen sink approach, where you just run a battery of robustness checks and hope that it all stands up to those. And that's maybe something we can do. We didn't do it yet for timing reasons, but it's probably something we should look at. And I guess on the HP filter, we could use a one-sided HP filter to estimate the output gap. What I would say, I suppose, is it's only one of the measures which we use. We can average over several, right? My guess is that the empirical size of it is probably not huge. That would be my prior. Also, I think we should look at inflation. In other work I did, when we were able to recover the decent impulse response functions for output, I still found the price puzzle. The price puzzle seems to be pretty pervasive. Maybe it's just real. Heretical thought.

SEBASTIAN EDWARDS: I want to comment on something Chris Erceg said referring to Mexico. And the point is related also to the previous discussion, and that is how some countries are able to withstand monetary shocks from the Fed. And what Chris said is if they have strong fundamentals, they can withstand in a much better way, which is a noncontroversial proposition. And then you brought in the case of Mexico in 2013, but what makes this more interesting is that Mexico had equally strong fundamentals in 2015 and 2016, and the Mexican peso went just through the floor, and it depreciated about 40%, to the surprise of everyone. And Agustin Carstens had to go out and not only raise interest rates to match but to overmatch the Fed but also intervene in the actual foreign exchange market. So there you

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have the same strong fundamentals with an overreaction over a period of two years, which adds an additional sort of a puzzle into this discussion.

And I want to make another comment. I think that this paper has two parts to it—the second part, which is the one most of the discussants have been focusing on, has to do with the VAR analysis, which is very interesting. But I found more interesting the first part about the undersupply of safe assets. I think that we have lost that part of the paper in the discussion, and I would like to urge everyone here to come back to this question. I think that an obvious solution to the shortage of safe assets is to increase the supply of safe assets. So let me throw out a proposition here, thinking about class A and class B shares. Would it be possible—I don't know what the answer is—would it be possible for the United States to issue two types of securities—class A and class B securities? These would be similar to what the British used to do by issuing those overseas passports that lots of people wanted to have, although they were not very useful. But there was a big demand for those. And I think that a question dealing with the safe asset supply is the notion that we would have—as we do in the equity market these two types of shares that have different voting rights—two types of securities that maybe would make easier the political problem of issuing more safe asset debt in the United States.

DAVID BECKWORTH: Sebastian, some people have proposed a sovereign wealth fund for the United States, which could do effectively the same thing. Sovereign wealth funds are based on a country's comparative advantage, if it's oil, put the wealth in that; if ours is issuing safe stores of value, use that. But again, there's all kinds of issues, as you know, that come up with that as well. But it is an interesting discussion for sure.

CHRISTOPHER ERCEG: Sebastian Edwards raises an interesting point about Mexico: while Mexico seemed to weather the Taper

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Tantrum quite well, the experience of the past several months—in which the Bank of Mexico has raised its policy rate by 75 basis points amidst a continued depreciation of the peso—may suggest that Mexico is experiencing more sizeable monetary policy spillovers. However, my sense is that much of the large depreciation of the peso that Sebastian noted isn't due to monetary policy spillovers but rather to the enormous fall in global commodity prices that has occurred since mid-2014 and that has weighed heavily on the currencies of all commodity-producers. Thus, Mexico's depreciation of over 30% is commensurate with that of Canada and that of Norway, both of which are economies with very well-anchored inflation expectations. Moreover, while the Bank of Mexico has raised its policy rate in recent months, it's important to keep in mind that the policy rate started at a historic low and that the rise from 3% to 3.75% has barely made it positive in real terms. These policy rate adjustments seem quite modest relative to the large hikes in policy rates in the more vulnerable emerging market economies that occurred during the Taper Tantrum. The upshot is that I agree that monetary policy spillovers remain consequential, but, nonetheless, I don't think Mexico's recent experience looks all that different from other commodity-producing economies with stable monetary policy frameworks.

CHRISTOPHER CROWE: I would just like to add that my sense is that having credible policies in a sort of stable policy framework can help to insulate you from having financial crises and big economic dislocations. But it doesn't insulate you from having big exchange rate movements. And it doesn't insulate your central bank from having to pay close attention to what the Fed's doing.

MICHAEL MELVIN: I was really taken by one of your conclusions, that hitting the zero lower bound pushes investors to safe assets. That certainly wasn't the intention of the policy, I think, because the policy suppressed risk premia, and investors searching for

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yield moved their portfolio compositions considerably. It seems to me that the evidence is pretty clear that, when you hit the zero interest rate, there's a big shift in investor demand toward risky assets. I mean, look at the yields on high yield bonds, for instance. So that was a very surprising conclusion to me, and I would like to hear some more elaboration on that.

DAVID BECKWORTH: We're not claiming this is a conscious effort by the Fed to have tight policy. The zero lower bound is a consequence of this collapse in demand; it's where the Fed found itself as it followed the natural interest rate down, and it got stuck at zero. The demand for safe assets is a consequence of the crisis itself. The zero lower bound is also a consequence of it. The Fed followed the natural interest rate down as far as it could. It couldn't go any farther, so policy effectively became tight. We didn't have a quick recovery. We mentioned in the paper there's a spate of other shocks, and the Eurozone keeps rearing its ugly head, concerns about China—all these things kept the demand for treasuries elevated. This is focusing on the emerging markets. Let me be very clear here, too, that according to the time series that we show, the demand just shot through the roof for Treasury notes and bonds and declined in all the other categories. I don't have an answer for the junk yield story.

CHRISTOPHER CROWE: I guess precrisis our story is that Fed policy was arguably too loose. The US current account deteriorated. There was a recycling of the current account surpluses in the rest of the world back into the United States, into what looks ex-post like fairly dodgy kinds of assets. I had to take a long flight over from London, so I had to watch a number of films, including *The Big Short.* And in retrospect, it's kind of crazy the stuff people were buying. But, you know, people were buying it. And they seemed safe, or they were packaged as safe. And so I guess that shows up in the data. You have this big surge precrisis in less safe so-called safe assets, and then the big drop. And then

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the big increase in Treasuries. So it certainly seems to be there in the data. Now whether it's understandable in terms of micro aspects of investor behavior is perhaps something we should look at in more detail.

ROBERT HALL: This paper embodies what I would call a Caballero view of the global capital markets—that there's a shortage of safe assets. And then a complement to that is the notion that the United States provides an intermediation service. I've worked on a different view. It comes to sort of the same thing. I view low world interest rates as a natural market outcome resulting from heterogeneity in risk aversion. The United States has risk tolerant investors, a lot of them very well off and presumptively risk tolerant. The rest of the world—China especially—is quite risk averse. And that's enough to give—easily—the market outcome, which is very low interest rates. The risk averse investors want to own safe bonds. Their demand drives down the yield of safe bonds. And that makes one think that interest rates will remain low. Interest rates aren't low for cyclical reasons. They're low because that's what happens when we borrow a lot of money and pay it back later, and therefore cushion risk averse investors against bad outcomes.

I'm very taken by this idea that we ought to be thinking about whether we can reduce the demand for safe assets, which would raise world interest rates and solve a lot of problems. And it seems like the best way to do that is to make the financial system more stable. Of course, the Fed is only one of the players in pushing for a stable financial system. But we certainly learned in 2008 how unstable, and therefore unsafe, the US economy was, and we really need to change that.

CHRISTOPHER CROWE: I guess my answer would be: yes. I agree. Certainly to the last part. Greater financial stability is part of the story, and more confidence in the growth potential for the economy would help, too, I think.

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