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 U.S. financial system has come to play in the globalized economy. First, the U.S. financial system has become the main producer of safe assets for the global economy. Second, the U.S. 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 U.S. 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 safe asset shortage problem that has emerged within the past decade.

* The views expressed in this paper are those of the authors and do not necessarily reflect those of any Capula entity.

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I. 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 U.S. financial system has increasingly come to play in the globalized economy.

First, the U.S. financial system has become the main producer of safe assets for the global economy. It does this by acting a banker to world: it borrows short from foreigners and invest long abroad. In so doing, the U.S. 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 prompted investors’ substitution into riskier assets. Attempts by the U.S. 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 U.S. corporations now issue AAA-rated paper. 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 U.S. 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 the 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 U.S. financial system to get it right. The world depends on the U.S. financial system to provide an adequate amount 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 U.S. 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 consider a proposal that we believe could mitigate some of the problems that arise when the banker to world and monetary superpower roles interact. We also assess whether the U.S. 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 U.S. is able to perform these roles more effectively.

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1 Those corporations are Microsoft and Johnson and Johnson (Karian, 2016).
II. Banker to the World

One of the defining features of the U.S. 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 U.S. financial system provides safe, liquid assets to rest of the world while funding economic development abroad. This tendency was first observed by Kindleberger (1965) and Despres et al. (1966) who saw these activities as nothing more than the maturity transformation service of a bank. They therefore called the United States the “banker to the world.”

These early observations on the United States acting a banker to 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. This increased financial integration, though, was not matched by a similar deepening of financial markets in many parts of the world. Developing economies like 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 U.S. 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 United States financial system acting as banker to the world, it increasingly acting as a venture capitalist to the world. They note that over the past few decades an increasing share of U.S. foreign investments, funded by its short-term liabilities to foreigners, became directed toward riskier assets. They see this as the natural evolution of the U.S. banker to world’s role as the global financial system becomes increasingly integrated.

Figures 1 – 4 document this banker to the world role by looking at the consolidated external balance sheet of the United States. Figure 1, using data from the U.S. financial accounts, shows in absolute dollar amount the liabilities the U.S. owes the rest of the world. The blue categories include everything from cash to treasuries to repos 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 CDOs pre-2008. The sum of these categories was $16.1 trillion at the end of 2015Q4. This compares to $9.3 trillion of foreign direct investment (FDI) and equity foreigners owned in the United States at this time. U.S. liabilities are disproportionately weighted toward the safe asset type.

Figure 2 shows the other side of the balance sheet: U.S. assets owned abroad. Given the speculative nature of most U.S. assets owned abroad, we assume here that the derivatives category 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 U.S. assets of $19.8 trillion. U.S. assets are disproportionately weighted toward the riskier asset type.

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

3 That is, the combined assets and liabilities of both the public and private sectors.
Figure 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 U.S. 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 U.S. account for 63% of total external liabilities. Just as a bank earns income on its net asset position from the spread between safe liabilities and riskier assets, so the U.S. earns positive income on its Net International Investment Position (NIIP), as illustrated in Figure 4. That the U.S. 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 GDP.

To provide greater insight into how the U.S. is able to earn positive net returns on a negative net foreign asset portfolio, Figure 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. Overall net returns have been positive on average since 2007. The level effect is generally negative, reflecting the fact that the U.S.’s 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.

[Insert Figure 5 around here]

Broad composition effects are highly pro-cyclical 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 U.S. assets are skewed towards riskier equity while liabilities are skewed towards debt assets. Moreover, since U.S. liabilities are overwhelmingly in dollars (more than 80%) while assets are more likely to be denominated in foreign exchange (around two thirds), the U.S. is exposed to FX 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 U.S.’s net returns from positive to negative in 2008-09 illustrates another facet of the U.S. role, notably the provision of counter-cyclical “insurance” to global investors. Equivalent to 10-15% of U.S. GDP on an annualized basis, the net wealth transfer from the U.S. provided a useful stabilizing role during the global crisis. Initially the insurance was paid in the form of lower local currency returns on U.S. holdings of foreign assets, notably thanks to big drops in equity prices. Later much of the payment came in the form of U.S. dollar appreciation, as “flight to safety” concerns boosted

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4 Gourinchas and Rey (2007) find a similar pattern, hence their characterisation of the U.S. as a venture capitalist.
5 The levels effect applies the average return on all U.S. 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 U.S. 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. FX effects are estimated using the currency breakdown of U.S. assets and liabilities provided by Benetrix et al (2015), and show valuation effects attributable to changes in the USD effective exchange rate for assets and liabilities, where the latter is weighted by the currency composition of assets and liabilities respectively.
the U.S. currency and lowered the value of U.S. asset holdings abroad. This insurance role has been dubbed “exorbitant duty” by Gourinchas et al (2010).

The observation that the U.S. fulfils this “banker to the world” role has a number of implications. First, it suggests that the U.S. has a greater debt capacity than would otherwise be the case. The U.S.’s persistent current account deficit and resulting accumulation of liabilities is a result of global demand for “safe” USD assets, including demand for official reserves on the part of 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 U.S. 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 U.S.’s 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-U.S. residents faced with less developed financial markets at home. For instance, Mendosa et al (2009) develop a multi-country 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 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 U.S. 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 U.S. assets. Forbes (2009) 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 U.S. 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 U.S. current account deficit is not grudging or volatile, but reflects a fundamental desire by non-U.S. residents to build up stocks of safe assets, turning to the U.S. 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 U.S. assets. But the stickiness of this funding is also obvious when you consider if there is any other country that could fulfil this role. As Figure 6 shows, only the U.K. comes close in its share of global safe assets, but if the U.S. is run as a venture capital firm then the U.K. is arguably closer to a highly leveraged hedge fund, with 72 percent 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 U.S. dollar prompted by concerns about the U.S. current account deficit is unlikely. A number of authors noted concerns about the sustainability of the U.S. 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

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6 Tille (2003) also notes the important role of currency movements on the U.S. NIIP, thanks to the large gross positions that have build up and the differing currency composition of assets and liabilities.
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 world role played by the U.S. financial system. And while it possible to have a run on a bank, it is unlikely to have a run on the main banker to world when there are few good alternatives.

III. Monetary Superpower

Another defining feature of the U.S. 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.

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 U.S. 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. These ‘dollar bloc’ countries, in other words, have effectively set their monetary policies on autopilot, exposed to the machinations of U.S. monetary policy. 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 U.S. monetary policy can be seen in Figure 7. It shows the share of world GDP at purchasing power parity that is under the three largest currency blocs. As of 2015, the dollar bloc made up 41 percent of world GDP compared to 16 percent that comes from the U.S. 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 U.S. monetary policy would be similar in size to the euro bloc which accounted for 15 percent of world GDP in 2015. In a distant third, the yen bloc comes in at 5 percent 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.

The second reason for global reach of U.S. 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 FOMC’s talking up of interest rate hikes from mid-2014 through the end of 2015 that caused the dollar to appreciate over 20 percent also sharply added to the debt burden for many economies.

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7 Although, as we have argued elsewhere (Beckworth and Crowe, 2012), some of the demand for U.S. safe assets was recycled U.S. monetary policy and that proved to be distortionary. See the next section for more on this point.
8 Arbitrage in the foreign exchange markets leaves them no other choice but to follow U.S. monetary policy if they want to maintain the peg. This is the ‘impossible trinity’ or ‘macroeconomic trilemma’: countries can only do two of three goals: peg to another currency, allow free capital flows, or conduct independent monetary policy.
9 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.
10 Figure 7 is based on the de facto currency pegs in Ghosh et al. (2014). We are grateful to the authors for sharing their data.
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.
The extent of this influence can be seen in Figures 8 and 9. The first figure shows the BIS measure of global aggregate credit comprised of bank lending and debt securities that is denominated in the Yen, Euro, and U.S. 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 percent to 52 percent over the same period, as the growth of Euro and Yen-denominated credit failed to keep pace.

Figure 9 looks at credit extended to non-residents (i.e. U.S. dollar loans and debt securities issued to non-U.S. residents) and reveals the increasingly dominant role of the U.S. dollar. While credit to non-residents more than tripled overall, from $3.7 trillion to in 2000:Q1 to $13.0 trillion in 2015:Q3, the dollar share increased from 62 percent to 75 percent. This dominant share is why the Federal Reserve not only influences monetary but financial conditions for much of the world.

[Insert Figures 8 and 9 around here]

The third reason for the extended reach of U.S. 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. Too 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 U.S. monetary policy would be transmitted to the dollar bloc economies and cause their currencies, along with the U.S. 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 suggests that U.S. monetary policy may be amplified beyond the dollar bloc’s 41 percent 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 provide evidence that support this view. Belke and Gros (2005) and Beckworth and Crowe (2013) 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 12 central banks—9 of which are in advanced economies—and finds that all of them systematically respond to changes in the federal funds rate.13,14 McCauley et al. (2015) show that monetary conditions in both advanced economies and emerging economies were affected before and after the 2008 crash by U.S. monetary policy.15 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.16

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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.

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 percent.

14 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.

15 They specifically look at U.S. 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 10-year treasury yield. They also show that advanced economies dollar credit growth was faster before 2008, but still makes up around 50 percent of outstanding dollar-denominated credit held by non-U.S. residents.

16 Though in some cases the effect was bigger for the emerging economies.
Figure 10 provides evidence consistent with these findings. It shows the U.S. 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 OECD countries less the United States for the period of 1995:Q1—2015:Q4. This figure plots, in other words, the stance of U.S. monetary policy against aggregate demand growth in other mostly advanced economies. Given the discussion above, the strong positive relationship shown in the 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 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 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 its sets monetary policy for U.S. 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. 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 2002-2006, 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. As we discussed earlier, the pre-crisis critics were off since they missed the banker to the world role played by the U.S. financial system. The post-crisis 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 the collapse of Japanese asset values in the early 1990s and intensifying in the late 1990s as a result of the emerging market crises.

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17 The construction of this Taylor Rule is discussed in the next section.
18 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, United Kingdom
19 Some observers like Taylor (2009) and Sumner (2011) argue the Fed sometimes fail to get even U.S. monetary conditions right.
20 See Borio and Disyatat (2011) for a review of this argument and the literature behind it.
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 asset 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”.\(^\text{21}\) 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 U.S. safe assets.\(^\text{22}\) 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 U.S. monetary policy.

What made this monetary easing destabilizing was not just that it recycled monetary policy back into the U.S. economy, but 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.\(^\text{23}\) 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.\(^\text{24}\)

**Emerging Market Boom of 2010-2011**

Given the anemic U.S. 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 U.S. economy, they were too expansionary for most of the dollar bloc countries which had experienced faster recoveries. Then San Francisco Fed President Janet Yellen recognized this point in a 2009 speech she delivered during a trip to China:\(^\text{25,26}\)

> For all practical purposes, 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 U.S. dollar... Like Hong Kong, China pegs its currency to the U.S. 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 U.S. economy, current U.S. 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.

\(^{21}\) See, for example, Taylor(2009).

\(^{22}\) They also had to sterilize the increase in their own monetary base that resulted from buying up dollars in the foreign exchange market.

\(^{23}\) The U.S. productivity boom peaked between 2002 and 2004. See Selgin et al. (2015) for more on this development.

\(^{24}\) It arguably also encouraged easing in the Eurozone given the linkages described above.

\(^{25}\) Yellen (2010).

\(^{26}\) Then Fed Chair Ben Bernanke also acknowledged that U.S. monetary policy was too expansionary for China in a lecture given to George Washington University students in 2012. See Peterson and Derby (2012).
This tension was not limited to dollar bloc countries. Other emerging countries like 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, the Brazil’s finance minister at the time, Guido Manega, famously quipped in 2010 that an “international currency war” had broken out. These concerns were reinforced by the advent of QE2 in the same year and drew strong rebukes from other emerging market officials, including ones in China.

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 percent growth in 2009 to an average of 6.9 percent growth in 2010 and 2011. Inflation rose from a low 5.0 percent to a high of 7.1 percent in 2011. Accompanying this growth was the rapid expansion of dollar-denominated credit to the emerging world, which McCauley et al. (2015) show was driven by U.S. monetary policy. Unsurprisingly, the conversation in emerging economies shifted from currency wars to concerns about inflation.

**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 the QE3 program. Markets took this 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—10 year treasury yields increased from around 1.7 percent in May to about 3.0 percent 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 the following in 2014:

> I have been saying that the U.S. 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.”

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 build up 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 11 shows that the expected federal funds rate 12-months ahead increased from 0.29 percent in June 2014 to 0.89 percent in December 2015. This figure also shows that the sustained rise in the expected federal funds rate was accompanied by dollar rising over 20 percent. Presumably, this expected

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27 Wheatley and Garnham (2010).
28 Evans-Pritchard (2010).
29 Data taken from the April, 2016 IMF’s WEO database.
31 Dasgupta and Nam (2014).
tightening of U.S. monetary policy caused the sharp rise in the dollar. The sharp appreciation of the dollar, in turn, caused the semi-pegged renminbi to appreciate just over 15 percent during this time.

The vulnerable and exposed Chinese economy could not handle this sudden appreciation of the renminbi. Officials from the PBOC 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.\(^{32}\) 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 12 shows that the timing 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.

\[\text{Insert Figures 11 and 12 around here}\]

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.\(^{33}\)

What these three episodes all illustrate is the inordinate influence of U.S. 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 “global and financial developments continue to pose risks” and that policy would depend on, among other things, “financial and international developments.”\(^{34}\) While this is an interesting development, the Federal Reserve’s domestic mandate and the complexities of the global economy make it unlikely that U.S. policy-makers 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 rule-based approach to U.S. 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.

**IV. When Monetary Superpower Status Interacts with the Banker to World Role**

In the previous two sections we documented that the U.S. financial system acts a banker to the world and that the U.S. central bank is a monetary superpower. A natural corollary to consider is how these two features of the U.S. economy interact. Since the Federal Reserve can affect global monetary and financial conditions and therefore help shape global aggregate demand, it seems likely that U.S. 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 two, 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 U.S. monetary policy during the credit and housing boom period was recycled back into the U.S. economy via purchases of safe assets by periphery countries. If this is the case, what effect did U.S. monetary policy have on safe asset demand after the crash when many observers perceived U.S. monetary policy

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\(^{32}\) Bloomberg News (2016).

\(^{33}\) Mayeda (2015)

\(^{34}\) http://www.federalreserve.gov/monetarypolicy/files/monetary20160316a1.pdf
to be effectively too tight for the U.S. economy given the zero lower bound? Did it in any way contribute to worsening the safe asset shortage problem since 2008?

To answer these questions, we estimate a structural vector autoregression in this section that looks at the effect the stance of U.S. monetary policy has on the demand for U.S. 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 U.S. balance sheet that was shown in Figure 1. Figures 13 and 14 break these liquid assets out into publicly and privately-provided categories for the period 1990:Q1 – 2015:Q4.

[Insert Figures 13 and 14 around here]

Figure 13 shows that during the housing boom period the main growth in publicly-provided safe assets were in treasury notes and bonds and 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.\(^{35}\) Foreign holdings of GSEs sharply falls after 2008 going from about $1.6 trillion to almost $0.9 trillion.

Figure 14 shows the privately-provided liquid assets.\(^{36}\) The shortest-term category—the repos, commercial paper, mutual funds, and trade receivables—rapidly grow during the housing boom period, as do the mortgage back securities (MBS). As has been documented by Gorton (2007) and others, they began stumbling in 2007 and then entered free fall in 2008 as the run on the shadow banking ensued. The shorter term assets have since partially recovered while the MBS 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.

Given these findings, we group the safest public assets—treasuries, deposits, and currency—that continued to grow after the crisis into category and place all other public and private liquid assets into another category. These categories are shown in Figure 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 U.S. 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

\(^{35}\) We include deposits in this category since they are insured by the government.

\(^{36}\) Here we ignore the financial derivatives because data is only available on it bong back to 2005:Q4. It is also an aggregated series that gives no sense of the underlying financial derivatives.
The expected average short-term over the next five years after subtracting out the term premium.\textsuperscript{37} 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 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 IMF’s, OECD’s, CBO’s, and HP filter’s output gap measures 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 (NGDP) gap measure—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.

\begin{figure*}[!h]
\centering
\includegraphics[width=\textwidth]{Figure16.png}
\caption{Taylor Rule alongside the actual federal funds rate.}
\end{figure*}

\textbf{Empirical Methods}

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 17 our Taylor Rule gap against the U.S. 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 U.S. 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.

37 Put differently, this nominal risk free yield plus the term premium make up the observable 5-year treasury yield. The data can be found at https://www.newyorkfed.org/research/data_indicators/term_premia.html.
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.\footnote{That is, the Taylor gap reflects both passive changes in monetary policy (e.g. the Fed fails to respond to weakening economy) and active changes (e.g. the Fed tightens policy too much) and therefore provides a complete measure of monetary policy.}

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 interaction among the core variable is unaffected and stays 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 of 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 10-year treasury yield. We also plug in the U.S. industrial production index as another robustness check on the Taylor Rule Gap to see if it creates a response in U.S. 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 indicates this is an appropriate lag length and because that many lags are sufficient to whiten the residuals. A simple Cholesky decomposition of covariance matrix is used to identify the Taylor Gap shock given the 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.

**Empirical Results**

Figure 18 shows the impulse response functions (IRFs) from a standard deviation shock to the Taylor Gap. The positive monetary policy shock causes the Taylor Gap to increase upon impact, but only temporarily remains positive before returning to zero. Both U.S. and emerging market economic activity also temporarily increase, with the former persisting for longer. Unsurprisingly, the monetary easing causes the trade-weighted dollar to temporarily decline. All the results so far seem reasonable.

The important question of whether monetary policy affects the demand for safe assets as reflected by changes in the current account balance is answered in the affirmative in the next IRF. The Taylor Gap shock causes the current account to decline in statically significant manner for six quarters. This indicates that monetary easing by the Fed does, in fact, increase the overall demand for U.S. safe assets by foreigners.

The next two IRFs, reveal that while overall demand for U.S. safe asset 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 the causing the super safe treasuries, deposits, and currency to decline. This composition effect is borne out in the rising 10-year treasury yield. In other words, the monetary easing causes foreigners to substitute out of the public safe assets into themostly 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 super safe government assets.
To see whether these results are not just statistically significant, but also economically significant we present the variance decomposition (VDC) of the forecast error in Figure 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 19 shows that the Taylor Gap shock explains as much as 40 percent of the forecast error six quarters out. Thereafter, it slowly declines to about 25 percent. The Taylor Gap shock also explains about 34 percent of the ‘other liquid liability’ category three quarters out, thought it quickly declines afterwards. The Taylor Gap shock also explains about 37% of treasuries, deposits, and currency three quarters out. These VDCs indicate that that Taylor Gap shocks are both statistically and economically significant to the demand for safe assets provided by U.S. 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 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 happen had U.S. 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 the Figure 19 shows the outcome of this exercise. There are several interesting results. First, the U.S. current account deficit would have been smaller between 2004 and 2007. At its max, 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 10 year treasury yield starting in 2005. At its peak in 2006:Q3 it would have been almost 1 percent 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 U.S. monetary policy back into the U.S. 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 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 would have been slightly higher starting in 2010, but still would have been trending down.

These results suggest that the effectively tight U.S. 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, lowered the demand for super safe government assets while increasing the demand for privately produced liquid assets may have materialized.

V. Conclusion

We have shown in this paper that the United States is both a monetary superpower, influencing global monetary conditions, and banker to 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 U.S. 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 U.S. 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 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, etc. These developments, however, have been amplified by U.S. monetary policy that has been effectively too tight during this time. As we argued via our counterfactual exercises above, this monetary tightness has only increased the demand for super safe assets.

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. That is already happening, as seen in Figure 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, money-like and serve as a transaction asset for institutional investors as shown by Gorton (2009). 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 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 the 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 unfeasible as long as the US maintains its clear competitive advantage in issuing safe assets and political opposition within the US to a substantial increase in debt issuance remains. 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.

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39. New bank regulations since the crisis may also be increasing the demand for safe assets.
40. Of course it is partly because US political institutions and voter preferences are opposed to this that the US enjoys its advantage in issuing safe assets, relative to countries where there is greater debt tolerance.
41. 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 EUR and JPY as funding currencies for global carry strategies, meaning that both have tended to appreciate in “risk off” scenarios, adding a destabilising degree of pro-cyclicality to domestic financial conditions for these countries as well as complicating efforts to maintain weak currencies.
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 U.S. monetary policy comes into play.

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 2008-09 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 GDP 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 rule like 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 USD that could dethrone the US currency and displace the Fed as monetary superpower? So far, putative competitors, such as the Euro, Yen or Sterling, have largely fallen by the wayside. However, the rise of the Chinese economy and the increasing international role of the Renminbi (RMB) 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 PPP GDP) to the ‘dollar bloc’ is no longer the US itself, but China.

With the Chinese authorities increasingly pursuing a more flexible CNY-USD exchange rate and promoting the use of a number of broader reference baskets for determining the value of the Renminbi RMB, China’s membership of 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 RMB, the currency’s international role in asset markets is in its infancy, and overall the RMB accounts for less than 3% of global cross-border trade and financial transactions, and less than 2% of turnover in global FX markets and about 1% of global official FX reserves (Prasad, 2016). Moreover, China’s domestic financial system is still dominated by state-owned banks, the authorities’ commitment to liberalisation 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 USD-RMB exchange rate is still of central importance to Chinese policy-makers: during early 2016 a clear pattern emerged of opportunistic devaluation of the trade-weighted value of the RMB, with the Chinese authorities allowing the RMB to weaken alongside the dollar in trade-weighted terms when the latter moved lower, while weakening against the USD during periods of general USD 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 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:

\[
\ln(NGDP_t) - \ln(NGDP_{t}^{FE}) = \pi_t output\ gap_t, \quad (E1)
\]

where \(NGDP_{t}^{FE}\) is the full employment measure of NGDP and \(\pi_t\) is a time-varying parameter. Equation (E1) says the output gap is related to the NGDP Gap at time \(t\) via the parameter \(\pi_t\). Note that equation (E1) can be rearranged into the following:

\[
\ln(NGDP_t) = \ln(NGDP_{t}^{FE}) + \pi_t output\ gap_t. \quad (3)
\]

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

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

where the term \(B_{0,t} + B_{1,t} time_t + B_{2,t} time^2_t\) represents \(NGDP_{t}^{FE}\). The regression is estimated using quarterly data with a rolling window of 40 observations.

Figure A1: The Taylor Rule Gap and the NGDP Gap

![Graph showing the Taylor Rule Gap and the NGDP Gap](image-url)
The average of the Hodrick-Prescott 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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Figure 1: US Liabilities to the Rest of the World

Source: U.S. Financial Accounts

Figure 2: US Claims on the Rest of the World

Source: U.S. Financial Accounts
Figure 3: Composition of U.S. Balance Sheet

Source: U.S. Financial Accounts, Authors' Calculations

Figure 4: U.S. Investment Income

Source: BEA
Figure 5: Decomposition of U.S. Net Return on NFA

Source: Haver Analytics, Authors’ Calculations

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
Figure 6: Share of World's Safe Assets

Source: Lane and Milesi-Ferretti (2007), Authors’ Calculations
Figure 7: Share of World GDP at PPP for Currency Blocs

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

Figure 8: Currency-Denominated Lending
(Bank Lending and Debt Securities)

Source: BIS data on global credit aggregates; Haver Analytics
Figure 9: Currency-Denominated Lending Outside of Currency's Home Jurisdiction

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

Figure 10: Fed Policy & OECD less USA Nominal Spending Growth
1995:Q1-2015:Q4

Source: Fred Database, IMF WEO, OECD Statistics, CBO, Authors' Calculations
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.
Figure 15: Liquid U.S. Assets to Rest of the World

Figure 16: The Stance of Monetary Policy

Source: U.S. Financial Accounts, Authors’ Calculations

Source: Fred Database, IMF WEO, OECD Statistics, CBO, Authors’ Calculations
Figure 17: The Stance of Monetary Policy and Capital Flows
1995:Q1-2015:Q4

Source: Fred Database, IMF WEO, OECD Statistics, CBO, Authors’ Calculations
Figure 18: Impulse Response Function to Standard Deviation Taylor Gap Shock 1999:Q1-2015:Q4
Figure 19: Percent of Forecast Error Attributable to Standard Deviation Shock to Taylor Gap 1999:Q1-2015:Q4
Figure 20: Forecasted Path Given Neutral Monetary Policy

Forecast 2002-2007

Forecast 2008-2015

Note: The conditional dynamic forecast are made given the Taylor Gap is set equal to zero.
Figure 21: 10-Year Government Yields on Safe Assets

- Pre-Crisis Period
- Decline Period

Keys:
- Switzerland
- United Kingdom
- Germany
- Australia
- USA

Events:
- ECB Goes Negative
- SNB Goes Negative
- SRC Goes Negative
- BOJ Goes Negative