

**Financing U.S. Debt:**  
**Is There Enough Money in the World – and At What Cost?**

John Kitchen\*

and

Menzie Chinn\*\*

August 12, 2010

The views contained herein are solely those of the authors and do not necessarily represent those of the institutions with which the authors are associated.

\* U.S. Department of the Treasury, Washington, DC 20220. Email: [john.kitchen@do.treas.gov](mailto:john.kitchen@do.treas.gov)

\*\* Robert M. La Follette School of Public Affairs; and Department of Economics, University of Wisconsin, 1180 Observatory Drive, Madison, WI 53706-1393. Email: [mchinn@lafollette.wisc.edu](mailto:mchinn@lafollette.wisc.edu)

## **ABSTRACT:**

This paper examines the potential role for foreign official holdings of U.S. Treasury securities and the associated implications for Treasury security interest rates, international portfolio allocations, net international income flows, and the U.S. net international debt position, using a baseline outlook of current and projected U.S. budget deficits and growing debt. The analysis applies empirical results regarding the role of U.S. structural budget deficits and foreign official holdings of U.S. Treasuries in determining Treasury security interest rates. Although initial review of information suggests that the world portfolio could potentially accommodate financing requirements over the intermediate horizon, substantial uncertainty remains about the relationships among foreign official holdings, exchange rates, and trade; the potential effects of “crowding out” in the international portfolio; and how and whether world portfolio allocations would adjust to accommodate higher shares of U.S. assets.

# **Financing U.S. Debt: Is There Enough Money in the World – and At What Cost?**

## **1. INTRODUCTION**

The United States and many other advanced economies have long faced fundamental budget and external imbalances that, under current policy configurations, are unsustainable in the long run. Recent sovereign debt concerns in Europe, while not directly comparable in nature to those facing the United States, have heightened the attention devoted to public finances in the U.S. In the short to medium run, the key relationships involve the nexus between the rising domestic and international financing costs of debt service, and the interactions with the current account deficit and net international debt position. The international funding sources for U.S. government debt are of particular importance, and such funding has in recent history depended heavily on the behavior of foreign official holdings. Analysis of prospects for financing the budget deficit is complicated because foreign official holdings, the foreign exchange value of the dollar, and the U.S. trade deficit and net international debt position are all intertwined. In this paper, we assess the importance of foreign financial flows – and notably foreign official holdings of U.S. Treasury securities – not only for financing the U.S. net export and current account deficits but also for funding U.S. government borrowing and affecting U.S. long-term Treasury interest rates.

This work adopts and extends the framework used by Kitchen (2007). Using consensus projections for the U.S. economy, net exports, and exchange rates, that analysis found that the outlook for the U.S. international debt position and net international income flows was generally less dire and more sustainable than had been typically assumed given the persistence of U.S. current account imbalances. With the drastic change in economic prospects in recent years, it is clear that a re-examination is in order. The financial crisis and the recession – and policy actions to mitigate both – have resulted in large increases in the U.S. Federal budget deficit and the publicly held debt, with an outlook for continued deficits and growing debt. The deterioration in public finances has then brought an immediacy to the previously existing concerns regarding the sustainability of the nation's public finances (Auerbach and Gale (2009)). The situation is further complicated by the large share of U.S. Treasury debt held by foreigners.

Within the setting of current and projected budget deficits and debt, this paper examines the role of foreign official holdings of U.S. Treasury securities and the implications for Treasury security interest rates and relative international portfolio allocations. The analysis presents estimates of the impact of U.S. structural budget deficits and foreign official holdings of U.S. Treasuries on U.S. Treasury security

interest rates. Using that information and baseline economic and budget projections, the implications of alternative assumptions about the projected behavior of foreign official holdings are examined for: (1) the implied/required international portfolio adjustments for foreign holdings of U.S. international debt and other assets; (2) the projected U.S. international net debt position and net income flows, including the role of U.S. government payments on foreign official holdings; (3) the effects of budget deficits and foreign official holdings on U.S. Treasury interest rates; (4) the potential feedback effects to and from interest rates to the U.S. budget deficit; and (5) a scenario with higher growth in Federal Reserve holdings of Treasuries and partial monetization of the debt. The prospects for crowding out of international capital flows – under the assumption of a growing international portfolio share for foreign official holdings – are also addressed. Questions remain regarding the potential trade-offs the United States could face under these relationships and whether, under the current fiscal policy outlook, the high level of foreign official holdings implied by the interest rate projections of most current public and private economic forecasts could ever be considered reasonable or attainable. The results therefore provide information regarding Meltzer’s (2009) claim that “There isn’t going to be enough money in the world in the years to come to finance the U.S. budget deficits.”

The results and scenarios presented in this paper are not “forecasts” per se, but rather projections that illustrate some fundamental relationships for the U.S. fiscal outlook in an international setting, and specifically the role of international financial flows and portfolio adjustments. The analysis is intended to provide a baseline case and alternative scenarios that are descriptive of the relationships involved, and to aid in better understanding those relationships and the implications for the U.S. fiscal outlook. Further, the analysis doesn’t address issues or questions associated with varying views of short-run policy or cyclical behavior, but looks ahead to the relationships and pressures that would occur at an intermediate horizon beyond those short-run transitions.

Section 2 provides a brief review of some prior research and literature, providing background for the analysis of the paper. Section 3 presents data and information on U.S. government debt and the base outlook as projected by the Congressional Budget Office (CBO). Section 4 examines an empirical specification and estimation results for U.S. Treasury interest rates and the role of budget deficits and foreign official holdings of Treasuries. Section 5 presents the base case projections, including an explicit accounting for the large change in foreign official holdings of U.S. Treasury securities (and other implied foreign portfolio allocations) required to meet the base case economic assumptions for interest rates. The resulting outlook under the base case for the U.S. international debt position, net international income flows, and U.S. government payments to foreign holders of Treasury securities is also presented. Section

6 examines two alternative scenarios to the base case: the first alternative considers how the projected outlook would change if foreign official holdings of Treasuries were fixed as a percent of U.S. GDP (a declining share of total Treasury securities outstanding); the second alternative presents the effects on the projections from assuming the Federal Reserve (Fed) implements a sustained increase in the rate of growth for its holdings of U.S. Treasury securities (including assumed pass-through to inflation, nominal interest rates, and the exchange value of the dollar from such a partial monetization of the debt). Section 7 provides closing discussion.

## **2. SOME BACKGROUND AND SELECTED LITERATURE**

Questions about the sustainability of the U.S. current account and the outlook for U.S. international debt have received growing interest in recent years; the recent experience with and outlook for higher U.S. budget deficits and debt have raised further questions regarding the international implications. The theoretical and empirical literature examining the relationships among budget deficits, international trade, current account sustainability, and the outlook for U.S. international debt and international net income flows is large.<sup>1</sup> The traditional literature ascribes a fairly direct role between the budget balance and the current account balance. Increases in government spending or reductions in taxes lead to increased aggregate demand, some of which spills over into increased imports. Fiscal shocks of this nature then induce a positive correlation between budget deficits and current account deficits – with international financial flows helping to fund domestic investment, in contrast to a prior view that budget deficits would “crowd out” investment. This “twin deficits” view dominated policy analysis during the 1980s, when tax rates were sharply reduced under the Reagan Administration and the exchange value of the dollar increased; empirical evidence appeared to buttress this view (Feldstein (1986)).<sup>2</sup> The improvement in the trade balance as the budget deficit shrank also provided additional confirmation of the twin deficits view.

This approach fell out of favor during the 1990s as public finances improved throughout the decade yet the current account deteriorated. This episode highlighted the fact that alternative multiple shocks – either private demand, monetary, or supply side – can reverse the implied correlation. Various explanations were forwarded. The most prominent ones ascribe the enhanced growth prospects for the United States, as information and communication technologies raised productivity growth (e.g., Pakko (1999)). In this intertemporal approach, in the presence of an upward revision in permanent income,

---

<sup>1</sup> The theoretical literature linking budget deficits and trade balances, and stocks of government debt include the portfolio balance models of Kouri (1976) and Branson and Henderson (1985). Recent treatments of the portfolio balance model have not explicitly modeled government, as opposed to private, assets. See for instance Blanchard, Giavazzi and Sa (2005).

<sup>2</sup> The “twin deficits” view is a straightforward application of the Mundell-Fleming model of the open economy.

running larger current account deficits would help smooth consumption. Engel and Rogers (2009) have shown that the U.S. current account deficits throughout the 1990s and 2000s were consistent with expectations of future growth. During the early- to mid-2000s, however, interest in the “twin deficits” hypothesis re-emerged as both budget and current account deficits widened (Chinn (2005)).

In recent years questions concerning the “sustainability” of the U.S. current account deficit and the U.S. international debt position more generally have received much attention. Mann (1999), Roubini and Setser (2004), Cline (2005), Higgins, Klitgaard, and Tille (2005), Eichengreen (2006), and Kitchen (2007) are among those who have examined the challenging outlook for U.S. international trade and financial imbalances, and the varying views as to whether the outlook is sustainable or manageable. In this paper, we focus on particular aspects of the relationship between budget deficits and the current account. Specifically, we examine the role of changes in foreign official holdings – one part of the international financial asset portfolio – as a key international financial flow for funding U.S. budget deficits (given the outlook for the U.S. fiscal imbalance and growing debt), and against the backdrop of the outlook for continued U.S. international imbalances. A related question that arises is the potential for “crowding out” to occur within the international portfolio flows if a greater share is devoted to U.S. Treasuries. Several other researchers have conducted research on issues similar to those addressed here, notably Bergsten(2009), Cline (2009), and Mann (2009). Mann (2009) and Bertaut, Kamin, and Thomas (2009) examine the world financial asset portfolio and the question of available international funding to meet prospective U.S. international imbalances; we discuss their findings in more detail further below.<sup>3</sup> The roles of alternative sources of funding for U.S. budget deficits – international and domestic – for the determination of U.S. interest rates are also key issues in this analysis and will also be discussed further below.

---

<sup>3</sup> Ideally, one would want to use a portfolio balance model based on asset stocks to determine the impact of budget deficits on interest rates, exchange rates, and current account balances. Unfortunately, the empirical literature on estimating these relationships is largely unsuccessful.

### 3. U.S. GOVERNMENT DEBT: HISTORICAL DATA, TRENDS, AND THE BASE OUTLOOK

This section provides background information and historical data on publicly-held U.S. government debt, including Treasury debt securities in particular, but also for U.S. agency and government sponsored enterprises (GSEs). Information is also provided on who holds the debt, including distinguishing between domestic and foreign owners, as well as private and official. The assumptions used in the analysis regarding GSE debt holdings are addressed. The base case outlook for the analysis – economic and budget projections from CBO’s baseline and President’s budget projections – is presented and discussed.<sup>4</sup>

#### 3.1. Treasury debt and foreign official holdings

U.S. Treasury debt held by the public is held by domestic and foreign holders, and private and official holders:

$$\begin{aligned} (1) \quad T_{TOT} &= T_D + T_F \\ &= (T_{D,P} + T_{D,O}) + (T_{F,P} + T_{F,O}) \end{aligned}$$

where  $T_{TOT}$  is the total supply of Treasury debt held by the public, and for the other variables, the first subscript represents domestic (D) or foreign (F), and the second subscript represents private (P) or official (O).<sup>5</sup>

Historical data show growing U.S. Treasury debt held by the public ( $T_{TOT}$ ) and growing foreign official ( $T_{F,O}$ ) holdings and shares for U.S. Treasury securities outstanding – and especially for the recent period associated with and following the recession and financial crisis (see Chart 1). Particularly noteworthy is the large and growing role for foreign official holdings, rising from just over \$600 billion (17 percent of total Treasury debt securities outstanding) at the end of 1999 to about \$2.8 trillion (36 percent of total outstanding) by the end of 2009. Domestic official ( $T_{D,O}$ ) amounts in (1) above are those held by the Federal Reserve, which over the past two-and-a-half decades, generally have accounted for about 10 to 15 percent of total outstanding Treasuries (and also generally in the range of about 4 percent to 6 percent of GDP). During the financial crisis, however, the Federal Reserve share fell sharply (to as low as 7 percent of Treasuries outstanding) as the Federal Reserve used its portfolio of Treasury securities as part of its implementation of the various lending facilities, and reflecting its portfolio shift (and expansion) to other

---

<sup>4</sup> The estimates and projections of this analysis were made prior to the July 2010 annual revision of the NIPAs.

<sup>5</sup> Treasury debt held by the public is the net debt and does not include the amounts owed within the U.S. government across accounts (e.g., social security and other trust fund accounts) that are included in measures of the “gross” debt.

assets (including government sponsored enterprise (GSE) debt securities). More recently, the Federal Reserve's share of Treasuries has increased back to around 10 percent of the total outstanding.

### **3.2. GSEs, Fannie and Freddie, and the Fed's large-scale asset purchase program**

Following the decline in housing and mortgage markets and the ensuing financial crisis, much attention has been directed at U.S. agency and GSE debt and securities – notably for the Federal National Mortgage Association (Fannie Mae) and the Federal Mortgage Guarantee Corporation (Freddie Mac). Chart 2 shows historical data for agency, GSE, and GSE-backed securities by holder.<sup>6</sup> During the financial crisis, the U.S. government undertook direct actions to provide backing for Fannie Mae and Freddie Mac, including direct purchases of GSE-backed debt. As described in OMB's *Analytical Perspectives*, Treasury acted to acquire GSE securities under temporary authority provided by the Housing and Economic Recovery Act (HERA) of 2008:

Treasury initiated a temporary program to purchase MBS [mortgage-backed securities] issued by Fannie Mae and Freddie Mac, which carry the GSEs' standard guarantee against default. ... Treasury purchased \$226 billion in MBS from September 2008 to December 31, 2009, when the statutory authority for this program expired. In addition, the Federal Reserve engaged in GSE MBS purchases over this period totaling \$1 trillion through the end of 2009. (OMB (2010), p. 350)

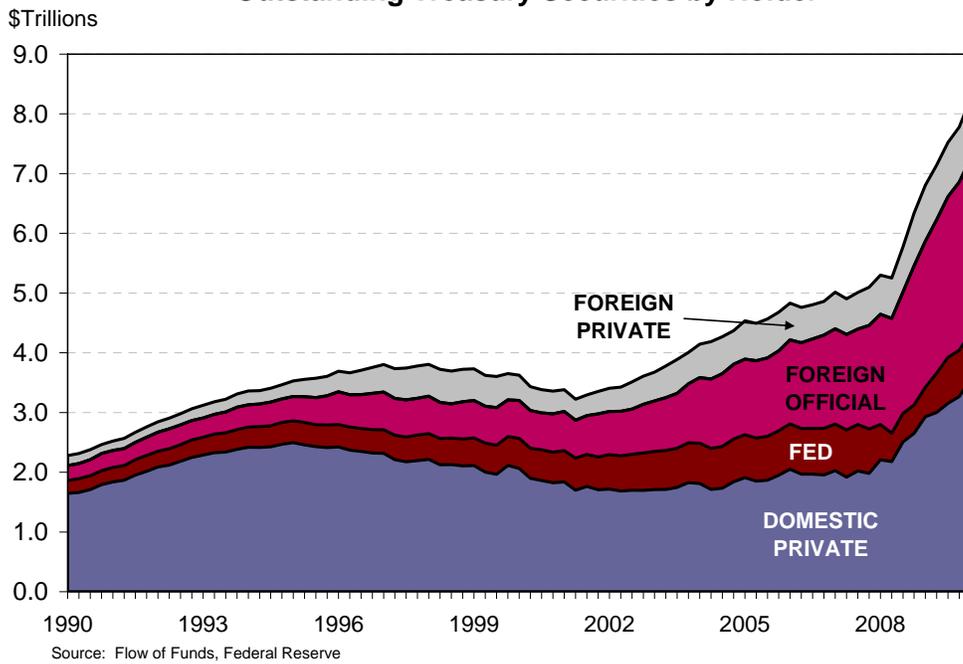
The Federal Reserve's purchases and holdings of agency and GSE-backed securities – through its balance sheet expansion and purchase of mortgage-backed securities – has attracted much attention because of the more-than-doubling of the Fed's balance sheet (and, hence, the monetary base) since the end of 2007, with much of that increase held in GSE-backed debt securities. In early 2009 the Federal Reserve implemented a plan to expand credit and support aggregate demand through purchases of longer-term assets – described by Kohn (2009) as the large-scale asset purchases (LSAP) program. The Fed increased purchases of GSE and agency debt, mortgage-backed securities, and longer-term U.S. Treasury securities. FOMC statements announced that the program would include purchases of up to \$200 billion of agency debt, up to \$300 billion in longer-term U.S. Treasury securities, and up to \$1.25 trillion in agency mortgage-backed securities.<sup>7</sup>

---

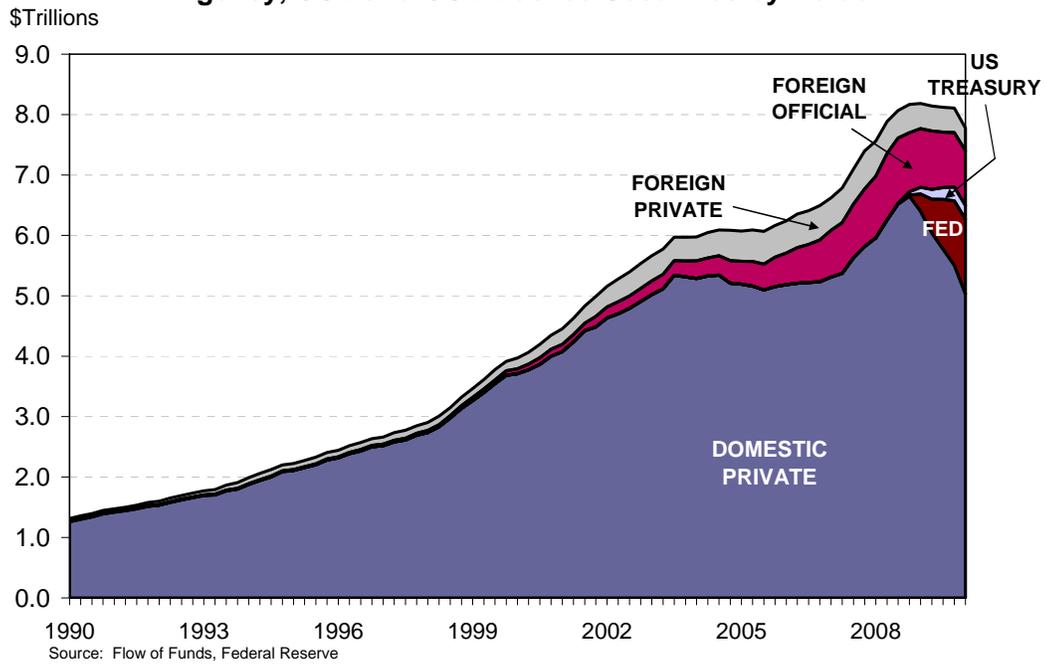
<sup>6</sup> Beyond Fannie Mae and Freddie Mac, the total amounts in Chart 2 include the Federal Home Loan Banks and other agencies.

<sup>7</sup> At the end of 2009, agency and GSE-backed securities accounted for about 50 percent of the total assets on the Federal Reserve balance sheet, and Treasury securities accounted for about 30 percent. (See the H.4.1 release of the Federal Reserve Board of Governors.)

**Chart 1**  
**Outstanding Treasury Securities by Holder**



**Chart 2**  
**Agency, GSE and GSE-Backed Securities by Holder**



The data show the U.S. government role – although substantial in absolute dollar amounts and as a share of the Fed’s balance sheet – has been a relatively small fraction of the total agency and GSE debt (Chart 2). Also, the portfolio changes have been effectively, on net, domestic in nature with private domestic holdings declining with the increase in Treasury and Fed holdings. How the Federal Reserve and Treasury unwind their GSE positions will be an important policy issue going forward – especially for monetary policy interactions. Nonetheless, the large increase in borrowing for housing that fueled the prior excessive increase in GSE debt securities is a thing of the past.

For the analysis of this paper, benign assumptions are made in the base projections regarding Federal Reserve holdings of GSE securities and Federal budget exposure, as well as foreign portfolio holdings of GSE and other U.S. government agency debt. The intent of the analysis is not to focus on the cyclical and short-run transitions that will occur, but rather on the implications at the intermediate-run horizon (i.e., 5 to 10 years) when the economy has returned to its long-run trend or potential performance – as in the underlying economic assumptions. As such, the analysis for the base case has an implicit assumption that Federal Reserve policy will gradually and successfully unwind its portfolio holdings of GSE securities and return to its pre-crisis position of a balance sheet comprised primarily of Treasury securities, and at a level consistent with the sustained growth and low inflation of the economic projections. Analogously, foreign portfolio holdings of GSE and agency securities are assumed in the base projection to be consistent with the gradual unwinding and trend economic projections. Hence, the analysis reflects general funding and portfolio pressures and not specific pressures associated with speculative scenarios regarding GSE securities.<sup>8</sup> Regarding the Federal budget exposure, the CBO’s treatment of Fannie Mae and Freddie Mac as government entities in its budget accounting and estimates explicitly includes the net expected Federal budget exposure by including “a subsidy equal to the shortfall between the current value of the mortgages and the liabilities used to fund them” (CBO (2010(b))). Although CBO estimates in

---

<sup>8</sup> This approach is consistent with CBO baseline assumptions (CBO 2010(a)), p. 91) and the information presented in the minutes of the meeting of the Federal Open Market Committee (Federal Reserve Board of Governors (2010)), as in the following excerpts:

“... Committee participants had expressed support for steps to reduce the size of the Federal Reserve’s balance sheet over time and return the composition of the SOMA to only Treasury securities. ... Meeting participants agreed broadly on key objectives of a longer-run strategy for asset sales and redemptions. The strategy should be consistent with the achievement of the Committee’s objectives of maximum employment and price stability. In addition, the strategy should normalize the size and composition of the balance sheet over time. Reducing the size of the balance sheet would decrease the associated reserve balances to amounts consistent with more normal operations of money markets and monetary policy. Returning the portfolio to its historical composition of essentially all Treasury securities would minimize the extent to which the Federal Reserve portfolio might be affecting the allocation of credit among private borrowers and sectors of the economy. ... sales of agency debt and MBS should be implemented in accordance with a framework communicated in advance and be conducted at a gradual pace that potentially could be adjusted in response to changes in economic and financial conditions.”

2009 included the implicit subsidy cost of the existing business as well as new business, the budget estimates for 2010 did not include the subsidy for prior/existing business in the deficit and debt projections. The analysis presented here proceeds using the baseline CBO projections, albeit a fuller accounting of the implied exposure to Fannie and Freddie could potentially suggest an expected debt effect of perhaps another couple hundred billion dollars in addition to that used here.

### **3.3. The base case and CBO projections**

The base case of this paper uses CBO's baseline economic assumptions (CBO 2010(a)) and budget and debt projections from CBO's estimates of the President's Budget, (CBO (2010(c)). The CBO economic projections assume the U.S. economy will rebound from the recession and return over several years to its potential growth path. Output and unemployment gaps are expected to steadily decline and interest rates and inflation rates are assumed to reflect the return to an environment of sustained real growth at potential with low inflation. The budget projections used in the analysis reflect the CBO's baseline budget outlook adjusted to include the President's policy proposals. Although various alternative policy and budget outlooks are possible, the use of the CBO's projections for the President's budget policies provides a benchmark that generally incorporates policies that should be included in a true baseline policy outlook, including key tax provisions that are set to expire but that have broad political support for extension.<sup>9</sup>

Regarding the international economic outlook, both the Administration and the CBO – based on language in their outlook discussions – implicitly have an improving net export outlook in their economic assumptions. For example, for the Administration:

As the U.S. economy recovers from the current crisis, it is unlikely to return to current account deficits as large as those in the mid-2000s. ... The specific path of the current account as the economy exits the crisis will depend on whether government and private saving rise ahead of, or along with, a rebound in private investment. But in the long run,

---

<sup>9</sup> As this paper was being completed, CBO (2010(e)) released updated long-term budget projections including an alternative scenario that included policies – and resulting deficit and debt projections – similar to those of the President's budget; for example, debt held by the public was projected to rise to 87 percent of GDP in 2020 under the alternative scenario compared to 90 percent of GDP under the President's budget estimates used in this analysis. In that report, CBO acknowledged some of the issues addressed in this paper: "In fact, CBO's projections understate the severity of the long-term budget problem because they do not incorporate the significant negative effects that accumulating substantial amounts of additional federal debt would have on the economy: Large budget deficits would reduce national saving, leading to higher interest rates, more borrowing from abroad, and less domestic investment—which in turn would lower income growth in the United States." (CBO 2010(e), p. xi) CBO also released a study (CBO (2010(f)) as this analysis was being completed with more discussion of the risk of fiscal crisis from higher Federal debt.

the current account deficit is likely to be smaller than it was before the crisis. ... Given that the current account deficit has already narrowed to roughly 3 percent of GDP—less than half its peak—the crucial challenge will be to avoid a reversion to a high-spending, low-saving economy. A successful shift toward a more balanced world growth model generated by increased consumption in nations with current account surpluses could improve net exports even more. This could bring the current account deficit toward its mid-1990s level of roughly 1 to 2 percent of U.S. GDP. (Council of Economic Advisers (2010), pp. 132-133)

For the CBO, in addition to the outlook for improving U.S. trade balance, the outlook for a continued long-term downward trend for the value of the dollar is also described:

CBO expects that net exports will increase next year as growth in foreign economies begins to outpace that in the United States and as the value of the dollar continues its long-term downward trend. (Congressional Budget Office, 2010(a), p. 34)

Similarly, the average for the private Blue Chip forecasters' projections (Blue Chip Economic Indicators (2010)) of real net exports shows a slight downward trend over the 2012-2016 period with further small decline into the 2017-2021 period. Such a projection would indicate a steady projected improvement in the U.S. trade balance as a percentage of GDP. Hence, to reflect the general "consensus" among public and private forecasters, the base case projection includes a gradual trend improvement in U.S. net exports.

The outlooks for U.S. government debt, interest rates, net exports, and other economic variables are all intertwined and the interactions are not always fully understood and accounted for. Public and private forecasts generally do not have explicit information on assumptions about international holdings of U.S. Treasury securities, U.S. net international debt or net international income flows, or the portfolio allocations for international debt. The analysis of this paper helps to illustrate the importance of recognizing and accounting for those relationships and effects.

#### **4. U.S. GOVERNMENT DEFICITS, FOREIGN OFFICIAL RESERVES AND INTEREST RATES**

It is commonplace to attribute effects of budget deficits and international financial flows on interest rates. Interestingly, however, the recent literature regarding the nature and magnitude of these effects in the era of large deficits and large flows is not particularly extensive, nor definitive. This section presents an empirical specification and results for estimating the role of budget deficits and changes in foreign official holdings of Treasury securities in the determination of U.S. Treasury interest rates. The estimated relationships are then used to analyze what the base case projections implicitly require for foreign official holdings of U.S. Treasuries.

The estimated relationships presented here essentially describe how long-term Treasury rates adjust to induce *private* holdings of Treasuries – given the outlook for budget deficits and the behavior of *official* domestic and foreign holdings of U.S. Treasuries. The specification is also based on the assumption that the Federal Reserve implements monetary policy through open market operations on Treasury securities in order to set the short-term interest rate. In line with the extant literature, we assume the Fed sets the target rate as a function of the output and inflation gaps, as described by Taylor (1993).

##### **4.1. Empirical specification for U.S. Treasury rates**

The approach taken here draws from various studies in a growing literature. Gale and Orszag (2002, 2005) surveyed the literature on budget deficits and interest rates, primarily in a closed economy setting, and highlighted the significant role of Federal debt and budget deficits in determining long-term interest rates. Kitchen (2003) presented a framework based on short-term interest rates being determined by a Taylor rule and with the structural Federal budget deficit determining the term spread for long-term Treasury interest rates relative to short-term rates. Canzoneri, Cumby, and Diba (2002) also observed a significant role for the Federal budget deficit for the long- to short-term spread for Treasury interest rates. The advent of the “conundrum” – that is surprisingly low long-term interest rates relative to short rates – inspired research introducing an international dimension. Warnock and Warnock (2006) and Chinn and Frankel (2007) augmented conventional bond pricing specifications with international variables, namely foreign official purchases of U.S. Treasuries. More recently, Laubach (2009) examined the response of long-horizon forward rates to increases in the projected deficit- and debt-to-GDP ratios.

The specification employed here is based on that presented in Kitchen (2003), augmented to include the role of foreign official reserves as highlighted in Warnock and Warnock (2006) and Chinn and

Frankel(2007). Kitchen (2003) derived an equation of the following quasi-reduced form for the term structure spread between the long- and short-term Treasury interest rates:

$$(2) \quad i_{t,k} - i_{t,j} = -\gamma(\pi_t - \bar{\pi}) - \phi(y_t - \bar{y}_t) + \sigma_t + \varepsilon_t$$

where  $i_{t,j}$  is the nominal interest rate on a j-period Treasury security in period t,  $\pi_t$  is the inflation rate,  $y_t$  is a (log) measure of aggregate output, and the “bar” variables represent the target or full employment levels of the corresponding variables. The term premium  $\sigma_t$  is assumed to be comprised of (1) a liquidity premium and (2) a risk premium associated with uncertainty about interest rates generally, as well as uncertainty about the structural Federal budget deficit, specifically. For the purposes of this paper, the role of foreign official holdings of Treasury securities is also included in affecting the term premium, affecting the relative demand-supply relationship over time, and thereby the market price and yield for Treasury securities. The working assumption underlying equation (2) is that short-term interest rates are determined by the monetary policy rule; external changes in relative supply and demand for longer-term Treasury securities would therefore show up across the term structure beyond the short-term interest rate. We focus on the yield for 10-year Treasury securities, but observed effects occur in shorter-term regions of the term structure as well.<sup>10</sup> The role of increased Fed holdings of U.S. longer-term Treasuries as part of the large scale asset purchases (LSAP) program is also included in the estimation.<sup>11</sup>

The empirical specifications used in regression analysis are based on:

$$(3) \quad \text{SPREAD}_t = \beta_0 + \beta_1 \text{UNGAP}_t + \beta_2 \text{INFL}_t + \beta_3 \text{STRSURP}_t + \beta_4 \text{FOROFFICIAL}_t + \beta_5 \text{FEDLT} + \varepsilon_t$$

where SPREAD is the term spread for longer-term Treasury yields relative to short-term Treasury rates (the 10-year yield minus the 3-month Treasury bill rate); UNGAP is the deviation of the unemployment

---

<sup>10</sup> The estimation used is an approach that implicitly includes the well-known relationship of the term spread as a signal of economic activity across the business cycle – including as a key measure for recession probability estimation (e.g., Stock and Watson (2003), Wright (2006), among many others) – combined with information on key factors that affect the outlook, risk, and relative supply and demand for longer-term Treasury securities beyond the business cycle relationships for real activity and inflation. The structural budget deficit is a supply shifter for longer-term Treasuries; foreign official holdings a demand shifter. The relationships presented in this analysis therefore provide information for why the term spread isn't always a clear predictor for subsequent economic activity.

<sup>11</sup> Gagnon, Raskin, Remache and Sack (2010) find evidence that the LSAP reduced U.S. long-term yields during its implementation.

rate from the natural rate (as estimated by the CBO)<sup>12</sup>; INFL is the difference between the inflation rate (the percentage change in the personal consumption expenditure price index of the NIPAs) and targeted inflation (here assumed at 1.8 percent)<sup>13</sup>; STRSURP is the structural, or cyclically-adjusted budget surplus/deficit as a percent of potential GDP (as estimated by the CBO); FOROFFICIAL is the change in foreign official holdings of U.S. Treasury securities as a percent of potential GDP; and FEDLT is the change in Fed holdings of long-term (more than 5 years) Treasuries as a percent of potential GDP.

Chart 3 shows foreign official holdings of U.S. Treasury securities as a share of total outstanding Treasury securities; Chart 4 shows foreign official holdings of U.S. Treasury securities as a percent of U.S. potential GDP. Both charts show the rising importance of foreign official holdings. The variable used in the empirical analysis – the change in foreign official holdings of Treasuries expressed as a percent of potential GDP – is similar to that used in Warnock and Warnock (2006).<sup>14</sup>

The coefficient on the UNGAP variable,  $\beta_1$ , is expected to be positive, and the coefficient on the INFLDEV variable,  $\beta_2$ , is expected to be negative, reflecting their roles in the monetary policy rule and the resulting relationship to short-term rates.<sup>15</sup> That is, with well-anchored long-run expected inflation, as output rises relative to potential, and unemployment falls relative to the NAIRU, the Federal Reserve would raise the short-term interest rate relative to the long-term interest rate and the term spread would decline. Similarly, as inflation increased relative to the target level of inflation, the Federal Reserve would raise the short-term interest rate relative to the long-term rate and the term spread would decline. The coefficient on the structural surplus variable,  $\beta_3$ , is hypothesized to be negative; an increase in the structural budget surplus (a fall in the deficit) would reduce the relative supply of Treasury securities and reduce risk and uncertainty for longer-term Treasury securities, leading to a lower long-term yield relative to short-term (short-run-policy-determined) rates. The coefficient on the change in foreign official holdings of U.S. Treasuries is posited to be negative; an increase in foreign official holdings is interpreted to be an exogenous demand shift that would keep longer-term yields lower than otherwise.

---

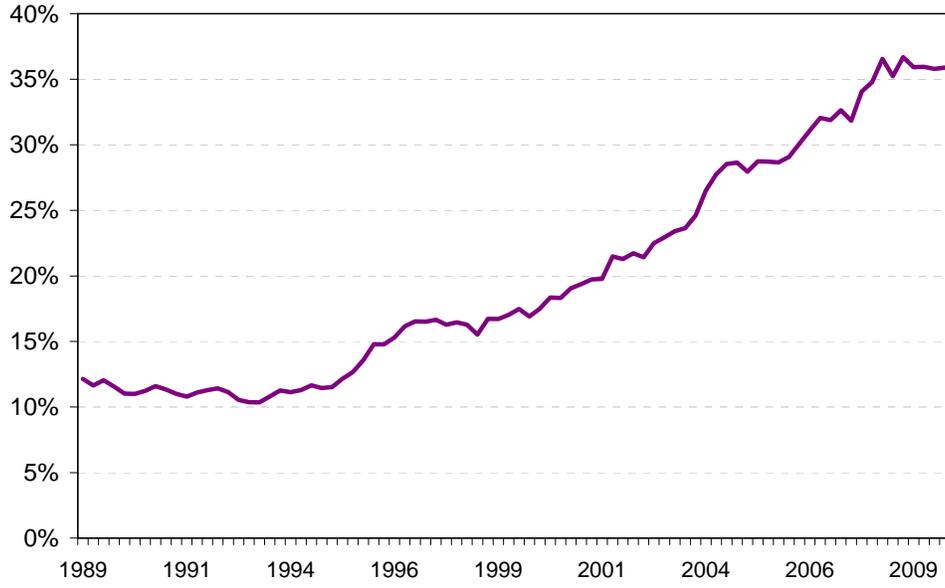
<sup>12</sup> The unemployment gap and the output gap are roughly interchangeable measures (a la Okun's law) of the relative cyclical position of the economy, the relative slack that exists in the economy.

<sup>13</sup> The rate of inflation as measured by the PCE price index tends to be several tenths of a percentage point lower than the CPI inflation rate; the 1.8 percent target rate use here is hence roughly equivalent to a CPI inflation rate of around 2 percent or just over.

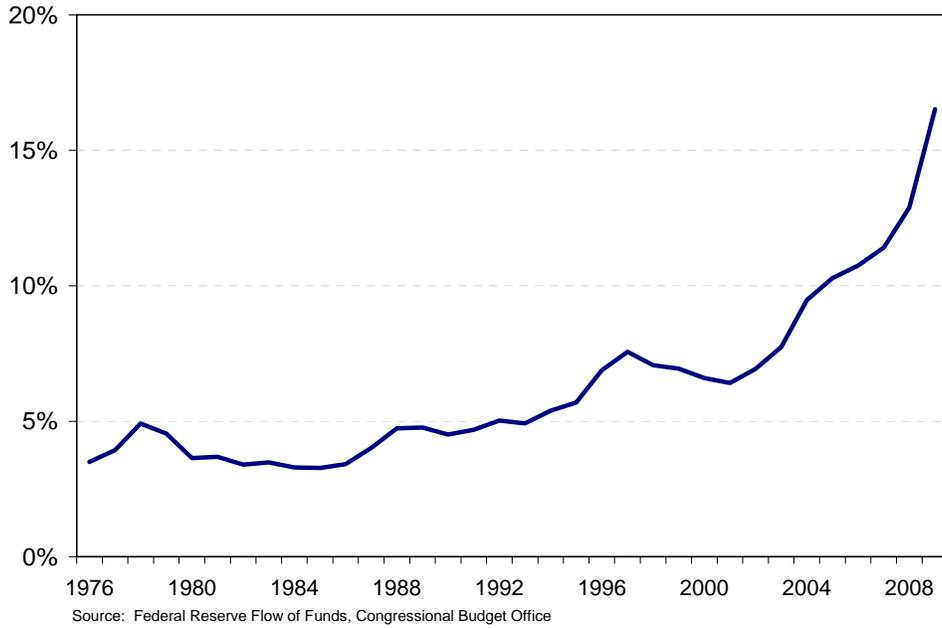
<sup>14</sup> This specification based on the variables expressed relative to potential GDP follows that for the structural budget deficit being expressed as a percentage of potential GDP. The data for foreign official holdings of Treasuries is taken from the Federal Reserve's Flow of Funds accounts; the data for the structural budget deficit is from CBO (2010(d)). Warnock and Warnock (2006) used a specially constructed variable for foreign official flows.

<sup>15</sup> Note that the specification doesn't "require" and is not based on any *specific* values for policy coefficients on the gap and inflation variables, only that the policy rule in practice would adjust short-term rates in accordance with the expected direction.

**Chart 3**  
**Foreign Official Treasury Holdings as Share of Total Outstanding Treasuries**



**Chart 4**  
**Foreign Official Holdings of Treasuries as Percent of Potential GDP**



## 4.2. Estimation results

Estimation of specifications from equation (3) above were conducted using annual data, reflecting the fact that key variables – budget projections and the international asset position – are only available at that frequency.<sup>16</sup> The regression results are reported in Table 1; they confirm the hypothesized relationships included in equations (2) and (3) above. The results in lines 1 through 3 build to the full specification. Line 1 shows the results using the variables affecting short-term policy (UNGAP and INFL) and the structural budget surplus as a percent of potential GDP (STRSURP). Line 2 includes the variable for the change in foreign official holdings of Treasuries as a percent of potential GDP (FOROFFICIAL). Note that while a large proportion of the variation in the spread is explained by the specification reported in line 1, the serial correlation indicated by the Durbin-Watson statistic suggests that important factors are omitted. This buttresses the economic motivation for re-examining the basic specification.

The results in lines 2 and 3 generally conform to the hypothesized relationships for the specification, reflecting the policy relationships underlying the determination of short-term rates and confirming the importance of the structural budget deficit and the change in foreign official holdings as determinants of the long- to short-term Treasury yield spread. The results in line 3 show a significant negative coefficient for the FEDLT variable, conforming to the view that the Fed's purchases of longer-term Treasury securities as part of the LSAP program lowered long-term yields and relative to short-term rates. The FEDLT variable – the change in Fed holdings of Treasury securities with more than 5 years to maturity as a percent of potential GDP – had a value of about 0.45 percentage point for 2009, so the coefficient value of -3.1 indicates that the estimated impact on the term premium is approximately 140 basis points for that year. This estimate is larger than that obtained by Gagnon, et al. (2009), who estimated that the effect of the LSAP was in the range of 38 to 82 basis points (although a 95% confidence interval easily encompasses the upper end of Gagnon et al.'s estimates). Further, Gagnon, et al.'s (2009) specification included all asset purchases, including GSE securities, as the relevant debt change measure.<sup>17</sup>

The coefficient on FOROFFICIAL is not statistically significant in line 3. A high degree of multicollinearity between STRSURP, FOROFFICIAL, and FEDLT variables is likely the cause, with correlations in the 0.54 to 0.75 range. Since it is reasonable to expect that exogenous relative supply and

---

<sup>16</sup> Quarterly data are available for historical data used in the specification (including recent CBO data for a NIPA-equivalent quarterly cyclically-adjusted budget deficit); estimations were also performed on a quarterly basis and results were observed generally consistent with those using annual data. We use fiscal year consistent data.

<sup>17</sup> It is possible that the LSAP variable in our regression estimates serves as a proxy for other unidentified variables or effects that could boost its estimated coefficient – for example, a safe haven effect (discussed further below). Our primary focus here is on the estimated effects for the structural surplus and the foreign official holdings terms.

demand effects in the Treasury market have identical effects on interest rates, we chose to impose and test the restriction of equal coefficients on STRSURP and FOROFFICIAL. The estimates of the resulting specification are reported in line 4 of Table 1. Our conjecture is borne out by the results; an F test for testing the restriction of equality of the coefficients shows that equality cannot be rejected.

The results in the estimated equation of line 4 generally conform to prior estimates in the literature for the effects of the budget deficit on long-term Treasury yields – and for the effect of the change in foreign official holdings, as well. The estimated effect is 27 basis points on the 10-year yield relative to the short-term yield for each one percentage point of GDP for the structural budget deficit – a result that lines up relatively closely with the estimates from Gale and Orszag (2002, 2005) at 25 to 35 basis points and Laubach (2009) at 20 to 30 basis points. Also, as observed in Warnock and Warnock (2006) and in Chinn and Frankel (2007), the results confirm the importance of foreign official holdings of Treasuries as a determinant of the long-term Treasury yield (here expressed relative to the short-term yield). Warnock and Warnock, for example, showed estimated effects for the budget deficit (relative to GDP) of 19 to 31 basis points and for foreign official flows (measured relative to GDP) of 24 to 61 basis points; Chinn and Frankel (2007) observe estimates in the range of 52 to 71 basis points (for real and nominal Treasury rates, and for a sample extending to September 2004).<sup>18</sup> The summary regression statistics for the line 4 equation are also generally good, with an adjusted R-squared of 0.673, a Durbin-Watson of 1.96, and a standard error of the regression of about 0.7 percentage point. Throughout the Table 1 results, the declining Akaike information criterion values verify the use of the additional variables in each line and the restriction imposed in line 4. Testing for heteroskedasticity produced test statistics that did not reject the null hypothesis of homoskedasticity for the line 4 equation. Chart 5 shows the actual 10-year to 3-month Treasury spread compared to the fitted values from the full specification in line 4 of Table 1.<sup>19</sup> The results presented here are consistent with short-term rates being determined according to a Taylor rule with budget deficits boosting long-term yields. The results also conform to a view that foreign official flows from abroad kept long-term rates lower than otherwise, contributing to an environment in which financial flows and interest rates exacerbated the housing and financial boom and bust.<sup>20</sup>

---

<sup>18</sup> Because of estimation and specification differences, the coefficient estimates are not all directly comparable, but nonetheless give references for relative magnitudes.

<sup>19</sup> Note that no explicit “safe haven” demand for Treasuries is identified in the empirical specification. As more data become available, such a relationship may become clearer for describing Treasury interest rate behavior over recent periods. At this time, using annual data, the relationship would effectively be a one-period observation. Although safe haven effects could keep borrowing costs lower during short-run periods, the intent of this analysis and the projections presented ultimately is not on short-run temporary relationships, but rather on persisting general relationships and pressures underlying relative supply and demand effects – domestic and foreign – for Treasuries.

<sup>20</sup> These observations are similar to those of Greenspan (2009) regarding foreign financial flows and of Bernanke (2005) regarding a global saving glut, with the observed relationship here pointing to the (foreign) policy-

**Table 1**

Regression Results for the Treasury Interest Rate Term Spread, 10-Year - 3 Month  
Ordinary Least Squares, Sample 1979-2009

	C	UNGAP	INFL	STRSURP	FOROFFICIAL	FEDLT	Adj. R2	DW	SE	AIC	F
1	1.375** (0.264)	0.516** (0.151)	-0.314** (0.071)	-0.206* (0.102)			0.585	1.48	0.785	2.48	
2	1.434** (0.257)	0.561** (0.148)	-0.405** (0.087)	-0.292** (0.111)	-0.398* (0.234)		0.612	1.83	0.760	2.43	
3	1.517** (0.243)	0.599** (0.140)	-0.428** (0.082)	-0.270** (0.104)	-0.203 (0.236)	-3.307** (1.509)	0.661	1.92	0.709	2.32	
4	1.544** (0.224)	0.614** (0.128)	-0.439** (0.073)	-0.271** (0.102)		-3.128** (1.375)	0.673	1.96	0.697	2.26	0.53

Standard errors in parentheses; \*\* denotes significant at the 0.05 level; \* denotes significant at the 0.10 level.

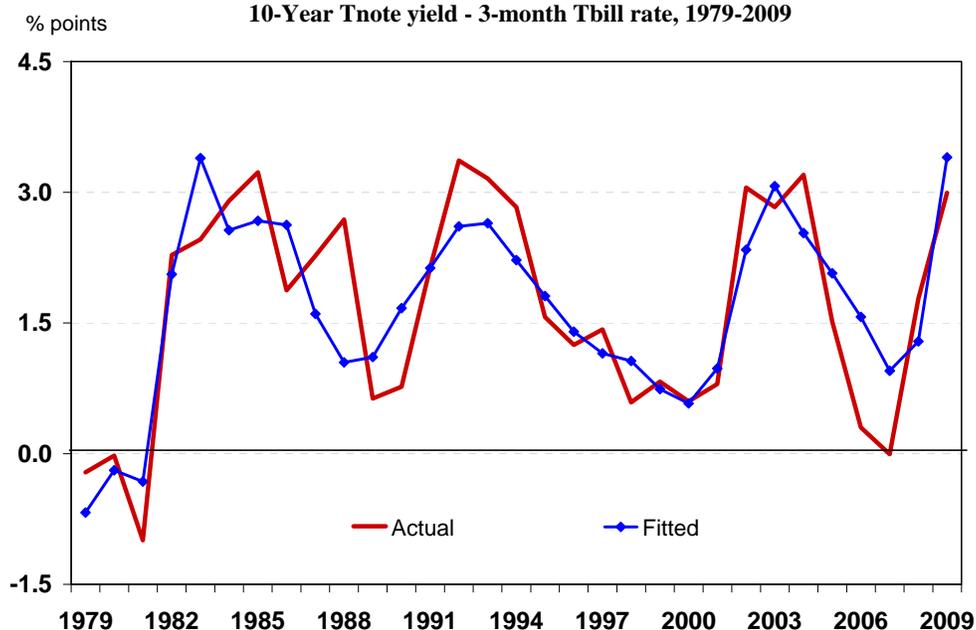
DW is Durbin-Watson statistic; SE is standard error of the regression.

AIC is the Akaike information criterion

F is the test value for the Wald test for the null hypothesis of equality of the coefficients on STRSURP and FOROFFICIAL.

**Chart 5**

**Actual and Fitted Treasury Term Spread  
10-Year Tnote yield - 3-month Tbill rate, 1979-2009**



determined flows via foreign official holdings. Warnock and Warnock (2006) also discuss this observation. Bergsten (2009) stated: "... the crisis occurred at least partly because the rest of the world was *too* willing to finance US current account deficits rather than becoming unwilling to do so."

## **5. IS THERE ENOUGH MONEY IN THE WORLD? BASE PROJECTIONS AND IMPLIED INTERNATIONAL PORTFOLIO ADJUSTMENTS**

In this section, we examine the outlook for international debt and net income flows using historical rates of return and assumptions regarding portfolio allocations, in a manner consistent with relationships regarding the trajectory of rates of return and debt as described in Kitchen (2007).<sup>21</sup> The exercise does *not* produce a forecast per se, but rather a projection that is consistent with other projections and assumptions. In our base case, we rely upon the CBO's economic and debt projections over the next 10 years. We project foreign holdings and the U.S. international investment position for the period up to 2020, based on historical investment position data available through 2009 (Bureau of Economic Analysis(2010)).<sup>22</sup>

### **5.1. Interest rates and other assumptions in the base case outlook**

In constructing the base case (and to illustrate the implied role for foreign official holdings), the various components and assumptions were derived in a manner to be as consistent as possible with the CBO projections of the President's budget from March 2010. CBO's economic assumptions have the output-unemployment gaps closing to zero over several years and inflation settles at a targeted level (around 2 percent depending on the inflation measure used). In CBO budget projections, the structural budget deficit initially falls from recent highs but then begins to gradually rise relative to GDP through the end of the 10-year projection; by 2020 the structural budget deficit approaches 6 percent of GDP.<sup>23</sup> Those budget assumptions yield the outlook in the CBO projections for the debt held by the public, which under the estimates for the President's budget, rises to 90 percent of GDP. In the base case of this analysis, foreign official holdings of U.S. Treasury securities are determined – based on the empirical estimates above – so as to yield the CBO interest rate assumptions. CBO's projections of long-term Treasury yield projections are similar to those of the Administration and the Blue Chip consensus forecast, so our results are not being driven by any special characteristics of the CBO outlook.<sup>24</sup>

---

<sup>21</sup> Kitchen (2007) provides a description of the model used; it has been maintained and updated to incorporate new data and minor methodological changes. A separate appendix for the framework is available from the authors.

<sup>22</sup> Cline (2005, 2009) also addresses the implications of the U.S. fiscal outlook for the U.S. international debt position and international income flows, but without a full explicit accounting for the specific international and domestic sources for financing U.S. Treasury debt and the implications thereof.

<sup>23</sup> CBO (2010(d)) published the cyclically-adjusted deficit estimates for historical and initial projection years (through 2014); for subsequent years an estimated cyclical adjustment was determined from a regression for the historical values and the CBO estimated unemployment gap from NAIRU. Also, adjustments were made to the baseline projections to account for the effects of CBO estimates of the President's budget.

<sup>24</sup> Note that Cline (2009) observes that “the CBO long-term projection itself does not appear to increase the interest rate in response to the higher deficit ...” Here, the derivation allows foreign official flows to provide the financing that keeps rates at the levels of the CBO assumptions.

Table 2 shows the results for the projections for interest rates for the second half of the decade. Generally, similar results are observed for the Taylor rule-generated short-term rates compared to the public and private projections, with the Blue Chip, Administration, and base case estimates averaging at about 4.1.<sup>25</sup> CBO’s short-term rate is on the high side at 4.8 percent. Using the estimated relationships from the equation of line 3 in Table 1 and the base case budget assumptions for the structural budget deficit, the estimated term spread in the final line of Table 2 is produced by assuming the needed increase in foreign official holdings to approximately replicate the 10-year yield levels of the CBO and other projections.<sup>26</sup> The increase in foreign official holdings required to produce the base case interest rates (given the rising structural budget deficit) is addressed further in the following discussion.

## 5.2. Portfolio allocations – historical data and base projections

Table 3 shows the international portfolio allocations for U.S.-owned assets abroad and foreign-owned assets in the United States for selected years for a historical period and our assumptions for the base

**Table 2**  
**Projections for Key Treasury Security Interest Rates**

	<i>Percent, annual</i>					
	2015	2016	2017	2018	2019	2020
<b><u>CBO, Jan 2010</u></b>						
3-Month Treasury Bill	3.9	4.2	4.7	4.8	4.8	4.8
10-Year Treasury Yield	<u>5.2</u>	<u>5.4</u>	<u>5.6</u>	<u>5.6</u>	<u>5.6</u>	<u>5.6</u>
Spread	1.3	1.2	0.9	0.8	0.8	0.8
<b><u>Administration, Feb 2010</u></b>						
3-Month Treasury Bill	4.1	4.1	4.1	4.1	4.1	4.1
10-Year Treasury Yield	<u>5.3</u>	<u>5.3</u>	<u>5.3</u>	<u>5.3</u>	<u>5.3</u>	<u>5.3</u>
Spread	1.2	1.2	1.2	1.2	1.2	1.2
<b><u>Blue Chip, March 2010</u></b>						
	<u>2012-2016</u>			<u>2017-2021</u>		
3-Month Treasury Bill	3.9			4.2		
10-Year Treasury Yield	<u>5.4</u>			<u>5.5</u>		
Spread	1.5			1.3		
<b><u>Base Case Estimate/Fitted</u></b>						
3-Month Treasury Bill (Taylor)	3.7	3.9	4.1	4.1	4.1	4.1
10-Year Treasury Yield	<u>5.4</u>	<u>5.5</u>	<u>5.6</u>	<u>5.6</u>	<u>5.6</u>	<u>5.6</u>
Spread	1.6	1.6	1.5	1.5	1.5	1.5

<sup>25</sup> The Taylor rule specification employed is based on the form identified in Taylor (1993), with a coefficients on the unemployment gap of 1.0 (twice as large as the 0.5 for the output gap via Okun’s law) and a coefficient on the inflation gap of 0.5; we use an equilibrium short-term real rate of 2.1 percent and a target CPI inflation rate of 2 percent.

<sup>26</sup> The CBO’s assumed term spread appears abnormally low at less than one percentage point, yet the overall level of the CBO’s 10-year yield is similar to others’ because of the high short-term rate.

projection. The portfolio shares used in the projections should be viewed as being representative of the changes that would have to occur in order to conform to the changes in foreign official holdings assumed or required to occur by case. A fully-specified portfolio allocation model for international assets could potentially be a useful enrichment of the analysis provided here, but is beyond the scope of the present analysis and is an area for further research.<sup>27</sup> In particular, a better understanding of the potential relative asset effects for "crowding out" in the international portfolio could be gained.<sup>28</sup>

Of particular importance in the projections is the path of foreign holdings of U.S. Treasuries relative to GDP that is required to be consistent with the interest rate projections of the base case economics – and the resulting portfolio shares of U.S. treasuries for foreign holdings of U.S. assets. The derived large increase in the portfolio share for foreign official holdings of Treasuries – rising from 25 percent to 45 percent – reveals the extent to which the projections for long-term Treasury interest rates remaining at around 5½ percent (as in private and public projections) in the face of a rising Federal structural budget deficit depend on an increase in foreign holdings.<sup>29</sup>

The portfolio shares of the base projection also show the phenomenon of “crowding out” occurring in the portfolio allocations for international financial assets. Historically, the concept of crowding out associated with budget deficits referred to the prospect of domestic investment being crowded out because of higher interest rates. However, beginning with the large budget deficits of the mid-1980s, net exports were more likely to be crowded out. Hence, the United States was able to continue to maintain private domestic investment and even continued positive net international investment income flows, even as the U.S. net international debt increased. In the base case presented here, however, the implied portfolio shares reveal the pressures that will occur with the persistent need to fund U.S. budget deficits – increasing shares of assets held in U.S. Treasury securities, and decreasing shares held in direct foreign investment, corporate stocks and bonds, and in other assets. Reduced foreign flows and holdings in private assets reveal the potential manifestation of crowding out in the foreign asset portfolio.

---

<sup>27</sup> See, for example, Black and Litterman (1992) and He and Litterman (1999).

<sup>28</sup> Mann (2009, p. 48) discusses the challenges regarding understanding the determination of the portfolio allocations for foreign held assets: “All told, from the standpoint of sustainability research relevant for projections, this body of analysis points out the challenges of projecting both the level and any change in the desire of foreigners to continue to buy US assets and the type of assets.”

<sup>29</sup> Note that the required increase in foreign holdings of Treasuries is directly dependent on the magnitude of the coefficient on foreign holdings as estimated and reported in Table 1. If we were to use a larger estimated effect (such as observed by Chinn and Frankel (2007) or at the upper end of the Warnock and Warnock (2006), the required increase in foreign holdings for the base case would be accordingly smaller, and on a roughly proportional basis. For example, an estimated coefficient at around -0.55 instead of the constrained -0.271 we used would require an increase in foreign holdings only about half as large as we have in the base case.

**Table 3**  
**International Investment Asset Shares, Percent of Total**

	<i>Projections/Assumptions</i>						
	<b>2001</b>	<b>2005</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2016</b>	<b>2020</b>
<b>US Owned Assets Abroad:</b>							
Direct Investment	26.8	24.6	27.2	26.2	25.2	23.7	23.1
Foreign Securities	34.4	40.2	36.8	38.2	38.9	40.1	40.1
Bonds	8.8	9.4	10.0	10.4	10.2	10.3	10.3
Corporate Stocks	25.6	30.8	26.8	27.9	28.8	29.8	29.8
US claims, Nonbanks	13.3	9.5	5.3	5.6	5.8	6.5	6.7
US claims, Banks	22.0	23.3	27.3	27.2	27.1	26.9	26.9
Official	2.1	1.7	2.7	2.2	2.5	2.5	2.9
Other US Govt	1.4	0.7	0.6	0.5	0.4	0.4	0.4
<b>Foreign Owned Assets in the US:</b>							
Direct Investment	18.6	14.9	15.1	14.9	14.7	13.5	12.9
US Treasury Securities	4.6	5.0	4.7	4.8	5.0	5.2	5.2
US Securities other than Treas	34.5	34.1	29.8	29.5	29.2	20.6	17.8
Corporate and other bonds	16.4	17.6	16.0	15.9	15.7	11.4	10.0
Corporate stocks	18.1	16.5	13.8	13.6	13.5	9.2	7.8
US currency	2.8	2.2	1.8	1.8	1.7	1.6	1.4
US liabilities, nonbanks	9.8	5.2	3.8	3.8	3.7	3.3	3.1
US liabilities, banks	16.2	20.4	20.3	20.1	19.9	15.6	14.2
Official	13.6	18.1	24.7	25.2	25.9	40.2	45.4

Source: Historical data, Bureau of Economic Analysis; authors' projections

### **5.3. The international debt and income outlook under the base case – and other issues**

The overall U.S. net international debt position and the associated net international income flows derived under the base case are shown in Charts 6 and 7. Under the base case, U.S. net international debt as a share of GDP nearly doubles over the 10-year projection period, increasing from about 20 percent of GDP to 38 percent. Net international income flows turn negative and steadily decline, from roughly +1 percent of GDP in recent years to about -1.9 percent of GDP by the end of the ten-year projection. That negative net international income flow represents a wedge between GDP and national income. Note that, even with the assumption in the base case of a gradually improving U.S. net trade position over the projection, the current account deficit would gradually widen, reflecting the increasingly negative net international income flows.

The increased foreign holdings of Treasury securities under the base case result in a substantial increase in interest payments to foreigners on Treasury debt as part of the net international income flow (see Charts 8 and 9). Chart 9 shows that interest payments for Treasuries relative to GDP account for the bulk of the change in net international flows over the ten-year projection (shown in Chart 6), accounting for an increase of roughly 3 percent of GDP. Charts 8 and 9 also highlight the interesting result that, initially, the payments to foreign holders of Treasuries are relatively low for several years – despite rising foreign holdings – as interest rates on Treasuries are projected to be abnormally low during the recession and early recovery period. However, as interest rates rise to higher levels, interest payments to foreign holders of Treasuries rise sharply, in absolute terms, and relative to GDP.<sup>30</sup> Chart 8 also shows that the increase in foreign holdings of Treasuries under the base case over the 2010-2020 projection – that is, the increase required to keep Treasury bond yields from rising higher than shown in the base economic assumptions (given the structural budget deficit projection) – amounts to the bulk of the \$11 trillion increase in the base-case projection for publicly-held Treasury debt.<sup>31</sup>

---

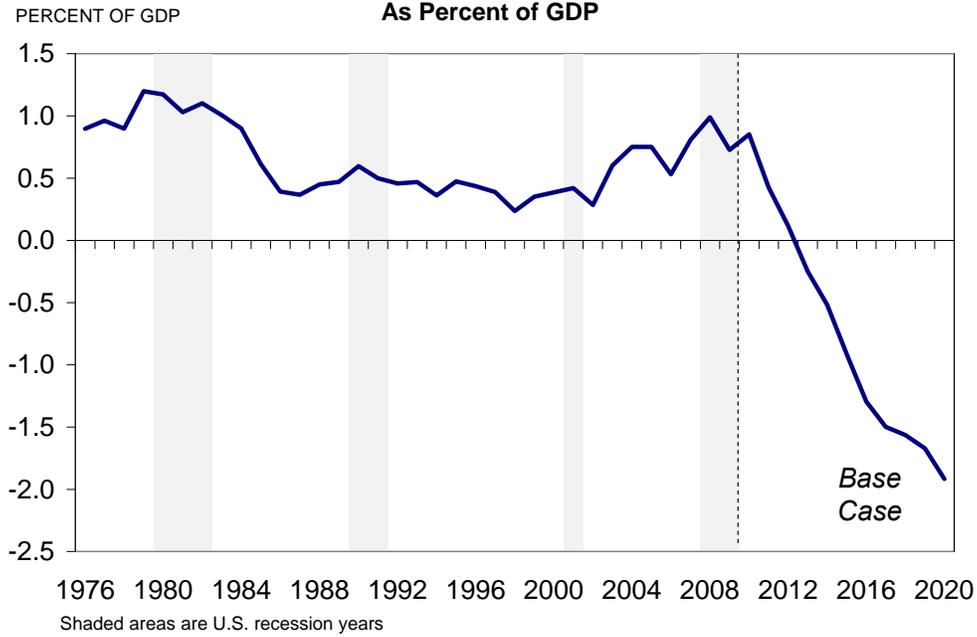
<sup>30</sup> These increases essentially show the combined effect from having the growing share of Treasuries in the foreign-held asset portfolio (the share rising from 25 percent to 45 percent) and the increasing effective rate of return on those assets from just over 2 percent to around 5 percent.

<sup>31</sup> This result reflects the estimated relationships for the term spread and the equality of the estimated coefficients for the budget deficit effect and the foreign official holdings effect reported in Table 1 and used in the analysis.

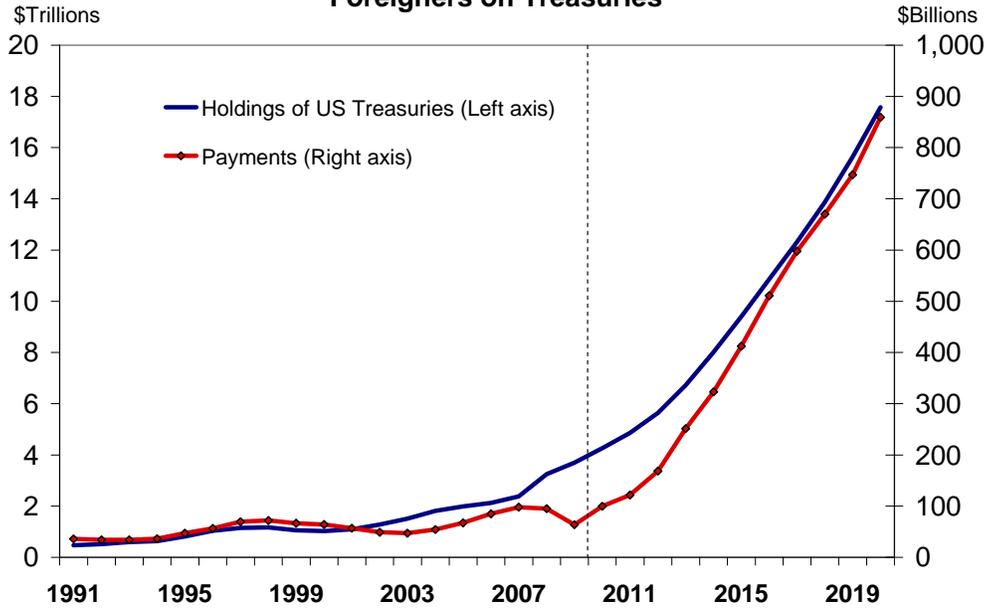
**Chart 6**  
**U.S. Net International Investment Position**  
**As Percent of GDP**



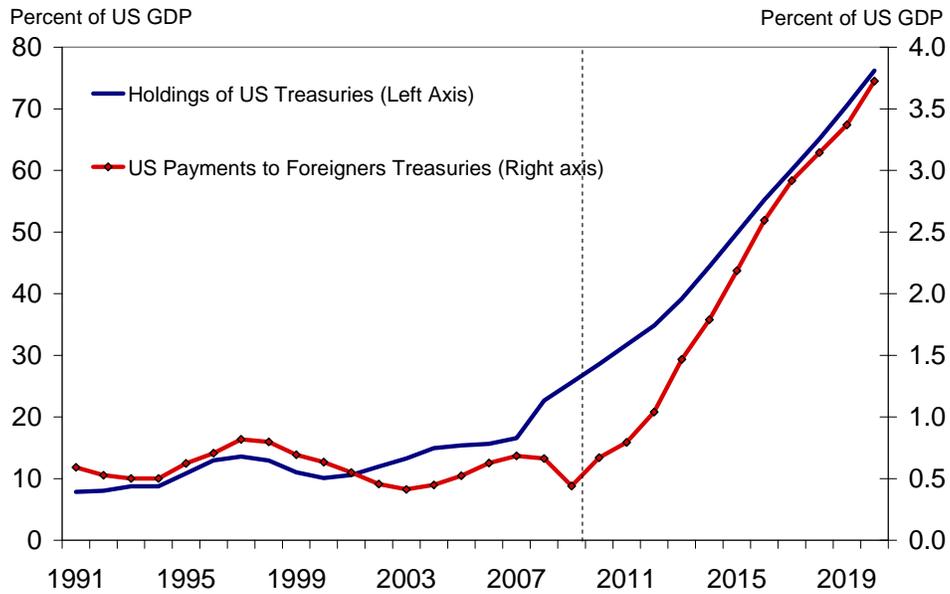
**Chart 7**  
**U.S. Net Factor Income (NIPAs)**  
**As Percent of GDP**



**Chart 8**  
**Foreign Holdings of US Treasuries and U.S. Payments to Foreigners on Treasuries**



**Chart 9**  
**Foreign Holdings of US Treasury Debt and US Government Payments to Foreigners for Treasuries (% of US GDP)**



#### **5.4. Further and fundamental challenges of the base case**

As discussed above, the base case projection generally follows private and public economic forecasts, and in particular regarding nominal GDP growth, interest rates and the U.S. net export outlook. As such, the projection includes: U.S. GDP growth rebounding out of the recession and then subsequently returning to potential; an improvement in the U.S. trade balance (with an associated gradual decline in the value of the dollar over time); and relatively benign longer-term interest rate levels.<sup>32</sup> Those results are assumed to occur with and despite rising structural budget deficits.<sup>33</sup>

**5.4.1. Foreign official holdings and currency values?** One challenge concerns the relationships involved with foreign official holdings, currency values, and the net export outlook. From the perspective of the balance of payments, and the recognition of the role of increasing foreign official assets in keeping exchange values of currencies low, a fundamental question emerges regarding whether such a large increase in foreign official assets – required to keep U.S. long-term interest rates relatively low – could also be associated with the improving net export deficit assumed by public and private forecasters and used in the base case. The projections of the base case were derived implicitly and explicitly accounting for the effects on international flows and stocks accompanying the assumptions. Hence, the required matching of trade and financial flows occurs. But this is fundamentally different from what has occurred historically, with foreign official holdings accommodating currency valuations – and also in a manner that mirrored the U.S. net export deficit (see Chart 10). Hence, the question exists whether the joint set of assumptions properly accounts for the trade-offs for foreign official holdings, managed currency valuations, and trade. High foreign official holdings of Treasuries could keep Treasury yields low, but also could tend to be associated with relatively higher demand for the dollar and keeping the exchange value of foreign currencies low relative to the dollar. That, in turn, could tend to promote continued U.S. trade imbalances – a result contrary to the underlying assumptions of the base case.

**5.4.2. Negative impacts on GDP from international portfolio crowding out?** A second challenge regards whether the real GDP growth assumptions fully account for the adverse impacts on investment associated with the distorted financial flows and portfolio allocations of the base case. With the extent of crowding out of private flows to private allocations in the international accounts in order to accommodate holdings of Treasury securities (see Table 3) – potential crowding out of investments in corporate equity

---

<sup>32</sup> That is, benign on a historical comparison basis for the economy in a sustained expansion with relatively low inflation.

<sup>33</sup> Note that CBO (2010(c)) – in its description of the potential economic effects from the President’s budget – considered some aspects of the open vs. closed economy relationships and the role of international flows. Much of that focus was on the behavior of private flows – a different perspective than the role of foreign official holdings.

and bonds, banking assets, and even foreign direct investment – does the real GDP growth and underlying investment assumed in the base case fully account for that?<sup>34</sup> One way to avoid such crowding out would be for an overall higher flow of international financing – for trade and current account deficits to widen (as in the first challenge above) – but such an outcome is inconsistent with the assumptions of the base case, and would further perpetuate international imbalances that most observers view as unsustainable.

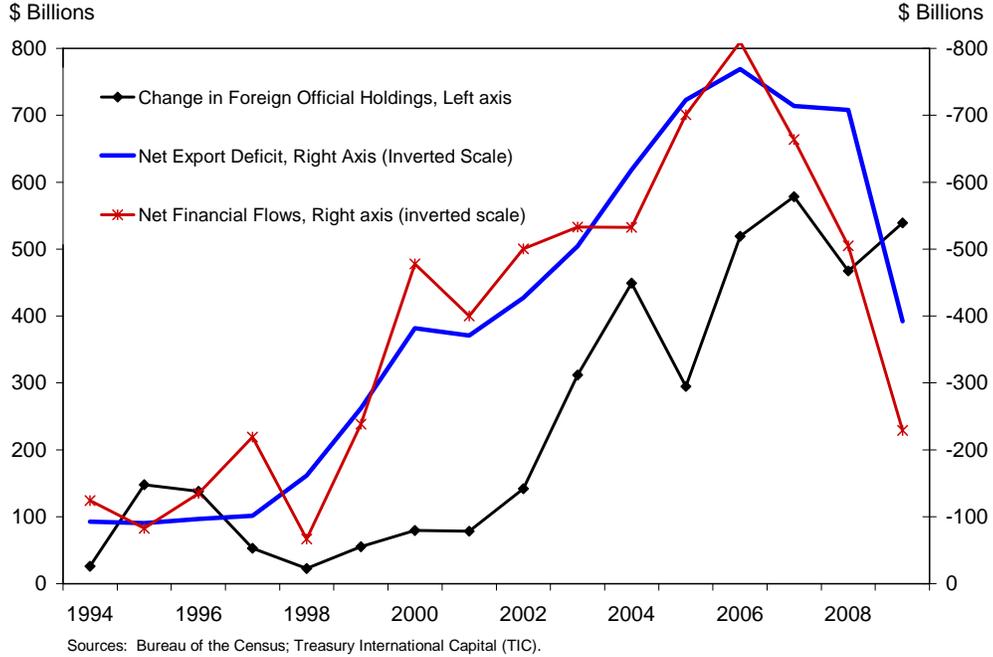
**5.4.3. Is there enough money in the world ... in the “global portfolio?”** A third challenge is whether the increase in foreign holdings of such magnitude as in the base case is plausible or even possible. That is, reflecting the Meltzer quote earlier in the paper: "Is there enough money in the world?" Chart 11 shows the implied effect from the base case on foreign official holdings of U.S. Treasury securities as a percent of world GDP (in U.S. dollars). The large increase in foreign official holdings implied by the base case would require those holdings to rise to about 19 percent of rest-of-world (ROW) GDP, up from less than 5 percent for most years of history. Bertaut, Kamin and Thomas (2009) and Mann (2009) examine the issue of the U.S. asset share of the total world asset portfolio and the extent to which foreign investment in U.S. assets can increase under continued U.S. current account deficits and growth in the U.S. net international debt. Mann observed a “financial leverage” for the “global investor portfolio” of 1.6 times (160 percent) ROW GDP. The implied change in foreign official holdings from about 7 percent of world GDP in 2009 to more than 18 percent of ROW GDP by 2020 could at first glance therefore represent a potentially manageable shift compared to the total (non-U.S.) world portfolio. Mann showed that the share of U.S. assets held by foreigners in the world portfolio was about 14 percent in 2006, and that even with a doubling or tripling of that share (associated with projected U.S. current account imbalances), “these percentages would appear to imply US assets in the global investor’s portfolio about equal to the market cap weights.” Although questions would remain about the implementation and allocations associated with increased foreign official holdings – including issues associated with private versus official portfolio allocations and competition for funds amongst various international borrowers in a time of higher debt – the relationships suggest at face value that “there would be enough money in the world” to meet the financing requirements for U.S. Treasuries over the intermediate horizon (through 2020) and under the assumptions considered in this analysis. Uncertainty remains, however, under such a projection whether world portfolio allocations would, in fact, adjust sufficiently to accommodate higher shares of U.S. assets. Further, such an expansion has limits that ultimately could not be sustained indefinitely over the long run and beyond the intermediate horizon considered here.<sup>35</sup>

---

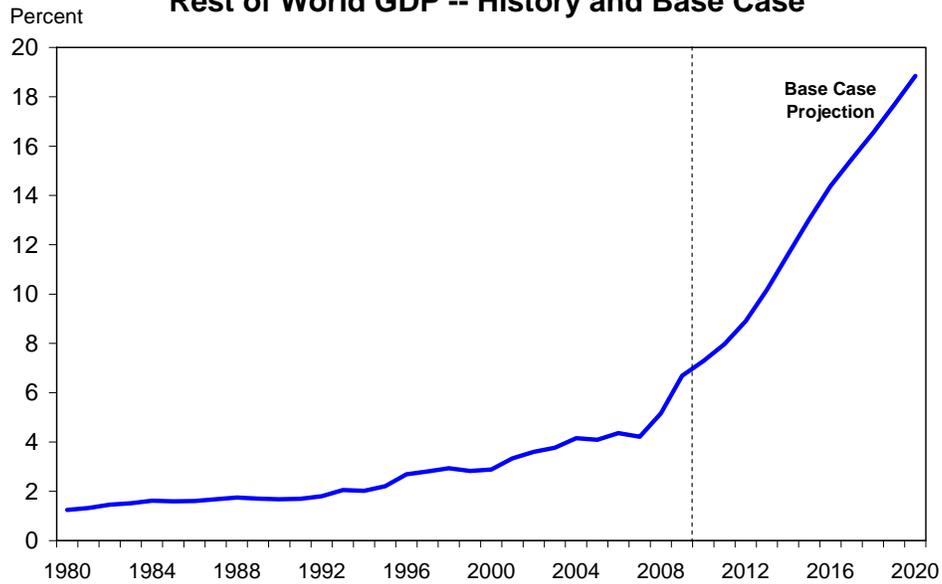
<sup>34</sup> Auerbach and Gale (2009) discuss concerns about negative effects on GDP growth and lower potential output.

<sup>35</sup> Similarly, Mann concluded that, in contrast to the implications from the average portfolio percentages, it “looks unreasonable” for the required marginal contributions per dollar of new investment that would have to occur for holdings of U.S. assets under those increased world portfolio shares.

**Chart 10**  
**US Net Export Deficit and Change in Foreign Official Holdings**



**Chart 11**  
**Foreign Official Holdings of Treasuries as Percent of Rest of World GDP -- History and Base Case**



## 6. ALTERNATIVE CASES

Although many different alternatives to the base case could be examined, two additional scenarios are presented to illustrate how the projections would be affected by alternative outlooks for (1) foreign official holdings and (2) sustained higher growth of Federal Reserve holdings (i.e., the domestic monetary base). Table 4 presents information on key assumptions and relationships in the scenarios.<sup>36</sup>

### 6.1. Alternative 1: Foreign official holdings at maintained percent of U.S. GDP – higher U.S. interest rates ...

If foreign official holdings were not to increase relative to the size of the U.S. economy over the projection period, and were only to grow with the growth in the U.S. economy, long-term Treasury security interest rates would be higher than under the base case. Under such a scenario, foreign official holdings, while fixed as a percent of U.S. GDP, would have a substantially lower portfolio share of total foreign assets – about 14 percent by 2020 compared to the base case of about 45 percent.

Using the estimated relationships from Section 4.1, point estimates show the 10-year Treasury yield would rise relative to the 5.2 percent to 5.6 percent of the base case for 2015-2020 to about 6.7 percent in 2015 and to 7.1 percent by 2020.<sup>37</sup> These estimates reflect the role of the rising structural budget deficit of the base case without the offset from foreign official flows – as well as the endogenous feedback to the structural deficit from higher debt service costs. Estimates of the resulting effect of the higher longer-term Treasury yields on the debt service costs for the budget indicate an increase by about \$75 billion in 2016 and about \$120 billion by 2020, with a cumulative effect on the debt of about \$670 billion – about 3 percent of GDP – by 2020.<sup>38</sup>

---

<sup>36</sup> The alternative cases considered here are not derived in fully-specified general equilibrium models that would account for all of the interactions and changes to the associated underlying economic variables. As such, the scenarios do not represent the complete spectrum of effects or the behavioral and second-order relationships that would occur. The scenarios are intended to be illustrative of the changes and pressures that would occur and not full model outcomes or forecasts.

<sup>37</sup> As this analysis was being completed, the IMF (2010) released a report examining special issues for the United States, with a section that addressed “The Financing of U.S. Federal Budget Deficits.” That analysis used rules of thumb reflecting the results of Laubach (2009) – and similar to those estimated here – to examine the potential effect from higher U.S. debt on borrowing costs, with results suggesting an increase of 50 to 150 basis points. That range encompasses the estimated effects presented in this paper. The analysis of this paper explicitly estimates and addresses the relationships and roles for alternative sources of financing – in particular foreign official vs. private – and how those relative allocations would affect long-term Treasury rates.

<sup>38</sup> These estimates were made in a small model for debt service budget effects from higher interest rates (a notable assumption used was that new debt issuance was assumed to keep the relative maturity structure stable). The model was tested to successfully replicate the CBO’s estimates presented in CBO (2010(a)) in Appendix Table C.1. Note that the estimates presented in the text are not for an equivalent shift of interest rates across the term structure (as in the CBO tabular estimates), but rather for an increase in intermediate- and longer-term rates relative to the short-term rate.

**Table 4**

Key Assumptions and Relationships for the Base and Alternative Cases								
	Economics		Budget		Foreign Official Holdings of Treasuries		Federal Reserve Holdings of Treasuries	
	General Assumption	10-Year Treasury Yield, 2020	General Assumption	Federal Budget Deficit, 2020, % of GDP	General Assumption	Foreign Official Portfolio %, 2020 (2009: 25%)	General Assumption	Average annual rate of growth, 2010-2020
<b>Base Case</b>	CBO economics	5.6%	CBO President's budget	90%	As required by long-term Treasury yield of economic assumptions	45%	Steady growth at rate of nominal GDP growth of base case	4%
<b>Alternative 1</b>	Base with higher LT Treasury yield	7.1%	Base plus higher interest/debt service costs	93%	Held fixed as percent of U.S. GDP	14%	Same as Base	4%
<b>Alternative 2</b>	Base with higher inflation, higher ST and LT nominal interest rates, declining exchange value of the \$	6.6%	Base plus higher interest costs and budget effects of higher inflation	84%	As required to maintain term spread for Treasury yield	45%	Grow 1 percent per year faster than in Base	5%

## **6.2. Alternative 2: Faster sustained growth of Federal Reserve holdings of U.S. Treasuries – higher inflation, interest rates, and lower exchange value of the dollar ...**

The final scenario presented here considers the general effects from sustained higher growth of Federal Reserve holdings of Treasuries – an illustration of a partial “monetization of the debt.”<sup>39</sup> The scenario is based on examining the general pressures that would arise from faster *sustained* growth of Federal holdings of U.S. Treasury securities, and the implications for inflation, interest rates, and the international position and flows as examined in the other scenarios of this analysis. It uses standard restrictive “monetarist” relationships that illustrate the long-run pressures that would be exerted on key variables. Under those assumptions, a sustained increase in the rate of growth of Federal Reserve holdings of Treasuries (increase in monetary base growth) by one percent per year relative to the base case passes through one-for-one to the money supply, and one-for-one to inflation being higher by one percent per year. In turn, the higher inflation rate passes through to nominal interest rates being higher by one percentage point, and the exchange value of the dollar declines by an additional one percent per year relative to the base case, maintaining relative parity relationships. For purposes of the monetary policy rule, the target inflation rate also increases by one percent. We assume no change to the projection for real GDP growth, and no change in net exports as the changes in prices and the exchange value of the dollar lead to no change in real prices for exports and imports. Reflecting the higher rate of inflation, nominal GDP growth is one percentage point higher per year. Although short-run dynamics and transitions could be very different from these assumptions, the restrictive assumptions meet the intent of the projections being to examine the general implications and pressures from indefinitely sustained higher growth of Fed Treasury holdings. Foreign official holdings of Treasuries are assumed to continue at the base scenario percentages of GDP – in order to maintain the same Treasury yield term spread of the base case; the only change to nominal interest rates is the one percentage point increase to the nominal yield at all terms associated with the increase in the inflation rate of one percentage point.

CBO (2010(a)) published the estimated effects on the budget from changes in economic assumptions; here the budget effects of a one percentage point increase in the inflation rate are used, a cumulative effect through 2020 of \$728 billion.<sup>40</sup> The budget effect from higher inflation is small relative to the increase in nominal GDP; the debt-to-GDP ratio is lower in 2020, at 84 percent of GDP under the alternative scenario, compared to 90 percent in the base case. The debt-to-GDP ratio is often viewed as

---

<sup>39</sup> Some analysts and researchers view monetization of the debt as an option for reducing the “burden” from high government debt levels. See, for example, Aizenman and Marion (2009); and Mankiw (2009), who stated: “A little more inflation might be preferable to rising unemployment or a series of fiscal measures that pile on debt bequeathed to future generations.”

<sup>40</sup> Higher inflation results in higher spending – for discretionary programs, indexed mandatory spending, and higher interest costs – with the spending increases only partly offset by rising nominal receipts.

the metric by which the debt burden is measured (see, for example, Aizenman and Marion (2009)), focusing on the value of the stock of debt relative to the production flow in the United States. With the large share of foreign holdings of U.S. Treasury debt, and with ongoing U.S. deficits and debt turnover to be financed, it is important to also recognize the role of payments to foreign holders of U.S. Treasuries and the impact on domestic national income relative to production. In the alternative scenario being addressed here of higher inflation and interest rates, the continued high foreign holdings of U.S. Treasury debt combined with higher nominal interest rates result in higher payments to foreign holders of U.S. Treasury debt than under the base case – and higher relative to GDP (4.2 percent of GDP in the alternative compared to 3.7 percent in the base case). Overall net international income flows are more negative – at -2.2 percent of GDP in the alternative scenario compared to the -1.9 percent of the base case – so the notion of “improvement” in the debt burden is slightly mitigated when accounting for the income flows. Note also, that because of the higher U.S. nominal GDP and the greater decline in the value of the dollar in this alternative scenario, the U.S. net international debt position relative to GDP is lower at about 31 percent of GDP in 2020 compared to the 38 percent of the base case. The results show that higher inflation would reduce the relative stocks of government debt and net international debt measured relative to GDP, but with the potential for higher net international income payments abroad and the resulting lower national income relative to GDP.

## **7. CLOSING DISCUSSION**

The analysis and results presented in this paper confirm the fundamental challenges associated with funding U.S. deficits and debt, with a specific recognition of the role of – and interactions with – international financial assets and flows. We reiterate that the results and scenarios presented in this paper are not “forecasts” per se, but rather projections that illustrate some fundamental relationships for the U.S. fiscal outlook in an international setting, and specifically the role of international financial flows and portfolio adjustments; also, the analysis focuses on the intermediate-horizon outlook and does not directly address issues or questions associated with varying views of short-run policy or cyclical behavior. The base case and alternative scenarios are descriptive of the relationships involved regarding alternative assumptions about foreign official holdings of U.S. Treasury securities for financing U.S. debt. New empirical evidence was presented that explicitly accounted for the roles of U.S. structural budget deficits and foreign official holdings of U.S. Treasuries in determining Treasury security interest rates, with the empirical results being used to examine the implications of changing relative magnitudes of foreign official holdings for Treasury interest rates. Two alternative scenarios considered (1) how the projected outlook would be affected if foreign official holdings of Treasuries did not increase substantially as assumed in the base case, and (2) the effects on the projections from assuming the Federal Reserve (Fed)

would increase the rate of growth for its holdings of U.S. Treasury securities, i.e., a partial monetization of the debt.

The results from the cases examined highlight several specific challenges and potential tradeoffs. The results indicate that current private and public economic forecasts (and as used in our base case) implicitly require that foreign official holdings continually increase – and by large amounts – to fund continued deficits and to keep interest rates as low as assumed in those forecasts. Yet, historically, large increases in foreign official holdings have tended to be associated with management of currency values and ongoing U.S. trade deficits. Those relationships pose a potential problem for assuming both relatively low interest rates and ongoing improvement in the U.S. trade deficit with, at the same time, continued budget deficits and growing debt. Further, if the share of foreign financial flows devoted to U.S. Treasuries increases, then the potential exists for “crowding out” of foreign flows that have historically been a key source for funding domestic investment. The question arises, then, as to how domestic investment and potential output growth would be affected. Finally, although the general interpretation presented here and by other researchers is that the world portfolio could potentially accommodate the “required” increase in foreign funding of U.S. Treasury securities, it remains an open question whether such an increase would be forthcoming. Ultimately, measures that reduce the deficit by changing the trajectory of tax revenues and spending, particularly in the latter years of the horizon we consider and beyond, would mitigate the concerns about the financing of the U.S. budget and current account deficits.

## REFERENCES

- AIZENMAN, JOSHUA AND NANCY MARION (2009), “Using Inflation to Erode the U.S. Public Debt,” National Bureau of Economic Research, Working Paper 15562, December.
- AUERBACH, ALAN AND WILLIAM GALE (2009), “The Economic and Fiscal Crises: 2009 and Beyond, An Update,” Brookings Institution, September.
- BERGSTEN, C. FREDERICK (2009), ed., *The Long-Term International Economic Position of the US*, Institute for International Economics, April.
- BERNANKE, B. (2005), “The Global Saving Glut and the U.S. Current Account Deficit.” The Homer Jones Lecture, St. Louis, Missouri, April 14.
- BERTAUT, CAROL C., STEVEN B. KAMIN, AND CHARLES P. THOMAS (2009), “How Long Can The Unsustainable U.S. Current Account Deficit Be Sustained?” *IMF Staff Papers*, 56.

- BLACK, FISHER AND ROBERT LITTERMAN (1992), "Global Portfolio Optimization," *Financial Analysts Journal*, September/October.
- BLANCHARD, OLIVIER, FRANCESCO GIAVAZZI AND FILIPA SA (2005), "The U.S. Current Account Deficit and the Dollar," National Bureau of Economic Research, Working Paper 11137, February.
- BLUE CHIP ECONOMIC INDICATORS* (2010), Aspen Publishers, March.
- BRANSON, WILLIAM H. AND DALE W. HENDERSON (1985), "The Specification and Influence of Asset Markets," in *Handbook of International Economics*, volume 2, edited by Ronald W. Jones and Peter B. Kenen, Elsevier Science Publishers.
- BUREAU OF ECONOMIC ANALYSIS (2010), "U.S. International Investment Position at Yearend 2009," June.
- CANZONERI, MATTHEW B., ROBERT E. CUMBY, AND BEHZAD T. DIBA (2002), "Should the European Central Bank and the Federal Reserve Be Concerned About Fiscal Policy?" *Rethinking Stabilization Policy*, Federal Reserve Bank of Kansas City.
- CHINN, MENZIE (2005), "Getting Serious about the Twin Deficits," Council on Foreign Relations, September.
- CHINN, MENZIE, AND JEFFREY FRANKEL (2007), "Debt and Interest Rates: The U.S. and the Euro Area," January.
- CLINE, WILLIAM R. (2005), *The United States as a Debtor Nation*, Institute for International Economics, September.
- CLINE, WILLIAM R. (2009), "Long-Term Fiscal Imbalances, US External Liabilities, and Future Living Standards," in C. Frederick Bergsten, ed., *The Long-Term International Economic Position of the US*, Institute for International Economics, April.
- CONGRESSIONAL BUDGET OFFICE (2010(a)), *The Budget and Economic Outlook: Fiscal Years 2010 to 2020*, January.
- CONGRESSIONAL BUDGET OFFICE (2010(b)), *CBO's Budgetary Treatment of Fannie Mae and Freddie Mac*, January.
- CONGRESSIONAL BUDGET OFFICE (2010(c)), *An Analysis of the President's Budgetary Proposals for Fiscal Year 2011*, March.
- CONGRESSIONAL BUDGET OFFICE (2010(d)), *The Effects of Automatic Stabilizers on the Federal Budget*, May.
- CONGRESSIONAL BUDGET OFFICE (2010(e)), *The Long Term Budget Outlook*, June.
- CONGRESSIONAL BUDGET OFFICE (2010(f)), *Federal Debt and the Risk of a Fiscal Crisis*, July 27.
- COUNCIL OF ECONOMIC ADVISERS (2010), *Economic Report of the President*, February.

- EICHENGREEN, BARRY (2006), "Global Imbalances: The New Economy, the Dark Matter, the Savvy Investor, and the Standard Analysis," *The Journal of Policy Modeling*, Volume 28, Issue 6, September.
- ENGEL, CHARLES AND ROGERS, JOHN H. (2006), "The US Current Account Deficit and the Expected Share of World Output," *Journal of Monetary Economics* 53.
- FEDERAL RESERVE BOARD OF GOVERNORS (2010), "Minutes of the Meeting of April 27-28, 2010."
- FELDSTEIN, MARTIN (1986), "The Budget Deficit and the Dollar," NBER Working Paper 1898, April.
- GAGNON, JOSEPH E., MATTHEW RASKIN, JULIE REMACHE, AND BRIAN P. SACK (2010), "Large-Scale Asset Purchases by the Federal Reserve: Did They Work?" FRB of New York Staff Report No. 441, March 1.
- GALE, WILLIAM G., AND PETER R. ORSZAG (2002), "The Economic Effects of Long-Term Fiscal Discipline," Urban-Brookings Tax Policy Center Discussion Paper, December.
- GALE, WILLIAM G., AND PETER R. ORSZAG (2005), "Budget Deficits, National Saving, and Interest Rates," *Brookings Papers on Economic Activity*.
- GREENSPAN, ALAN (2009), "The Fed Didn't Cause the Housing Bubble," *Wall Street Journal*, March 11.
- HE, GUANGLIANG AND ROBERT LITTERMAN (1999), "The Intuition Behind Black-Litterman Model Portfolios," Goldman Sachs, December.
- HIGGINS, MATTHEW, THOMAS KLITGAARD AND CEDRIC TILLE (2005), "The Income Implications of Rising U.S. International Liabilities," *Current Issues in Economics and Finance*, Federal Reserve Bank of New York, December.
- INTERNATIONAL MONETARY FUND (2010), *United States: Selected Issues Paper*, IMF Country Report No. 10/248, July.
- KITCHEN, JOHN (2003), "A Note on Interest Rates and Structural Federal Budget Deficits," Manuscript, October.
- KITCHEN, JOHN (2007), "Sharecroppers or Shrewd Capitalists? Projections of the U.S. Current Account, International Income Flows, and Net International Debt," *Review of International Economics*, Vol. 15, Issue 5, November.
- KOHN, DONALD L. (2009), "Monetary Policy Research and the Financial Crisis: Strengths and Shortcomings." Speech delivered at the Federal Reserve Conference on Key Developments in Monetary Policy, Washington D.C., October 9.
- KOURI, PENTTI (1976), "The Exchange Rate and the Balance of Payments in the Short Run and in the Long Run: A Monetary Approach," *Scandinavian Journal of Economics* 78(2).
- LAUBACH, THOMAS (2009), "New Evidence on the Interest Rate Effects of Budget Deficits and Debt," *Journal of the European Economic Association*, June.
- MANKIW, N. GREGORY (2009), "It May Be Time for the Fed to Go Negative," *New York Times*, April 18.

- MANN, CATHERINE (1999), *Is the U.S. Trade Deficit Sustainable?* Washington: DC: Institute for International Economics.
- MANN, CATHERINE (2009), "International Capital Flows and the Sustainability of the US Current Account Deficit," in C. Frederick Bergsten, ed., *The Long-Term International Economic Position of the US*, Institute for International Economics, April.
- MELTZER, ALAN (2009), Interview in *Financial Intelligence Report*, MoneyNews.com, Vol. 7, no. 12, December.
- OFFICE OF MANAGEMENT AND BUDGET (2010), *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2011*, February.
- PAKKO, MICHAEL (1999), "The U.S. Trade Deficit and the 'New Economy,'" *Federal Reserve Bank of St. Louis Review* 81(5).
- ROUBINI, NOURIEL AND BRAD SETSER (2004), "The US as a Net Debtor: The Sustainability of the US External Imbalances," manuscript, November.
- STOCK, JAMES H. AND MARK W. WATSON (2003), "Forecasting Output and Inflation: The Role of Asset Prices," *Journal of Economic Literature*, Vol. 41, No. 3, September.
- TAYLOR, JOHN B. (1993), "Discretion Versus Policy Rules in Practice," *Carnegie Rochester Series on Public Policy*, 39.
- WARNOCK, FRANCIS E. AND VERONICA CACDAC WARNOCK (2006), "International Capital Flows and U.S. Interest Rates," NBER Working Paper 12560, October.
- WRIGHT, JONATHAN H. (2006), "The Yield Curve and Predicting Recessions," Staff Working Paper, Federal Reserve Board of Governors, February.