

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

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ABSTRACT:

With a baseline outlook for continued U.S. budget deficits and growing debt, this paper examines the role of foreign official holdings of U.S. Treasury securities in determining Treasury security interest rates, and the resulting implications for international portfolio allocations, net international income flows, and the U.S. net international debt position. The analysis presents and employs updated estimates of the impact on Treasury interest rates of U.S. structural budget deficits, and of foreign official and Federal Reserve holdings of U.S. Treasury securities. Although relationships suggest that the world portfolio could potentially accommodate financing requirements over the intermediate horizon, substantial uncertainty remains regarding such accommodation and the associated effects on interest rates and adjustments in international portfolios.

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

1. INTRODUCTION

The United States and 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 fully comparable in nature to those facing the United States, have heightened the attention devoted to public finances in the U.S. In this regard, the willingness of foreign official actors to continue to purchase U.S. government debt is one of the central questions facing policymakers and market participants. In this paper, we examine the extent to which current debt and interest rate projections rely upon foreign official sector financing and what would happen if that quantity of financing failed to materialize.

In order to answer these questions, we extend the international accounts framework used by Kitchen (2007).¹ First, we estimate the impact of U.S. structural budget deficits and foreign official holdings of U.S. Treasuries on Treasury security interest rates. Using that information and taking as given economic and budget projections from the Congressional Budget Office, we calculate the implied necessary behavior of foreign official holdings, with specific focus on implied international portfolio adjustments for foreign holdings of U.S. international debt and other assets and the associated effects on projected the U.S. international net debt position and net income flows. Potential feedback effects to and from interest rates to the U.S. budget deficit are included. We also consider a scenario with assumed 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. The high level of foreign official holdings implied by most current public and private economic forecasts for Treasury interest rates thus highlights the importance of considering the Meltzer (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 of foreign official holdings of Treasury securities, the net international investment position, and other variables, for given projections of economic growth, budget deficits and interest rates. In this sense, the study abstracts from possible alternative short-run policy and cyclical factors.

¹ Kitchen (2007) found that the U.S. international debt position was more sustainable than commonly believed. The deterioration in public finances associated with the financial crisis and ensuing recession calls for a re-assessment.

We find that each one percentage point increase in the structural budget balance decreases the ten year-to-three month rate spread by 0.33 percentage points; further, we cannot reject the hypothesis that the impact from foreign official purchases of Treasuries and the Federal Reserve's balance sheet expansion under its large scale asset purchases (LSAP) have that same quantitative impact. Given these results, and consensus projections for growth, budget deficits and interest rates, we conclude that it is technically possible for increases in the Federal debt to be financed by the foreign official sector. However, the implied amounts of foreign-held Treasury debt would greatly exceed the bounds set by historical experience. Moreover, the explicit linkages we examine highlight the tension between an improving trade deficit, low interest rates and increasing foreign official funding of U.S. debt.

We consider the sensitivity of our conclusions to alternative scenarios. The first alternative considers the implications if foreign funding were not readily forthcoming. To illustrate that scenario, foreign holdings of U.S. Treasuries are maintained at a constant proportion of U.S. GDP; in that case, we find resulting long-term Treasury yields would be substantially higher. The second alternative considers what happens if the Fed maintains a sustained higher balance sheet, effectively raising the target inflation rate by one percentage point. In that case, the Federal debt and net international indebtedness would be slightly lower relative to GDP compared to the base case, while net income payments to the rest-of-the world would be higher. In general, the results and scenarios illustrate the importance of accounting for budget deficits, the Fed's balance sheet, and foreign official holdings in making projections of U.S. Treasury interest rates and international debt and financial portfolios.

Section 2 provides a brief review of relevant literature and Section 3 presents data and information on U.S. government debt and the baseline outlook consistent with projections by the Congressional Budget Office (CBO). Section 4 examines the empirical relationship for U.S. Treasury interest rates, and budget deficits, Federal Reserve (Fed) purchases, and foreign official holdings of Treasuries. Section 5 presents the base case projections, including an explicit accounting for the implied large change in foreign official holdings of U.S. Treasury securities (and other foreign portfolio allocations) required to meet the base case economic assumptions for interest rates. Section 6 examines two alternative scenarios: (1) foreign official holdings of Treasuries fixed as a percent of U.S. GDP (a declining share of total Treasury securities outstanding); (2) the Federal Reserve implements a sustained increase in the rate of growth for its holdings of U.S. Treasury securities. 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.² 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. 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)).³

This approach fell out of favor during the 1990s as public finances improved throughout the decade yet the current account deteriorated, an outcome consistent with multiple shocks. Various explanations were forwarded, including one attributing the deficits to enhanced growth prospects associated with the “New Economy” (e.g., Pakko (1999)). Engel and Rogers (2009) showed 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 this context, the “sustainability” of the U.S. current account deficit and the U.S. international debt position has reappeared as a policy concern.⁴ 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),

² 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 example, Blanchard, Giavazzi and Sa (2005).

³ The “twin deficits” view is a straightforward application of the Mundell-Fleming model of the open economy.

⁴ Mann (1999), Roubini and Setser (2004), Cline (2005), Higgins, Klitgaard, and Tille (2005), Eichengreen (2006), and Kitchen (2007).

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.⁵

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

3.1. Treasury debt and foreign official holdings

U.S. Treasury public debt 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 is private (P) or official (O).⁶

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 over \$3.2 trillion (35 percent of total outstanding) by the end of 2010. 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 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

⁵ 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.

⁶ 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.

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.⁷ 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.⁸

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.⁹ In November 2010, the FOMC announced plans “to purchase a further \$600 billion of longer-term Treasury securities by the end of the second quarter of 2011.”

⁷ Beyond Fannie Mae and Freddie Mac, the total amounts in Chart 2 include the Federal Home Loan Banks and other agencies.

⁸ 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)

⁹ At the end of 2010, agency and GSE-backed securities accounted for nearly 50 percent of the total assets on the Federal Reserve balance sheet, and Treasury securities accounted for about 40 percent, up from about 30 percent at the end of 2009. (See the H.4.1 release of the Federal Reserve Board of Governors.)

Chart 1
Outstanding Treasury Securities by Holder

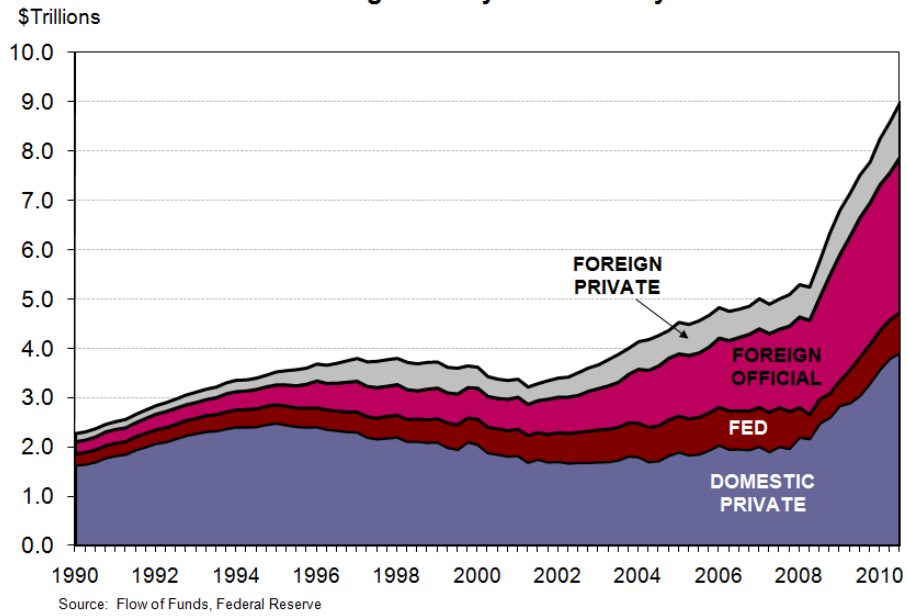
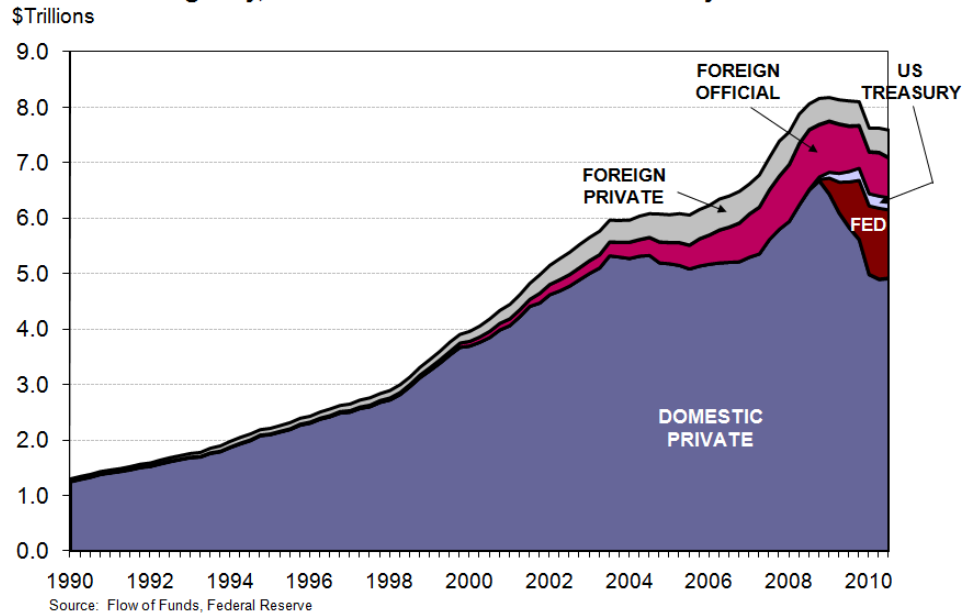


Chart 2
Agency, GSE and GSE-Backed Securities by Holder



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 share of the total agency and GSE debt (Chart 2). Also, the portfolio changes have been effectively, on net, primarily 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.

For the analysis of this paper, specific assumptions are made for the projections (described further below) regarding Federal Reserve holdings of longer-term Treasuries and GSE securities and Federal budget exposure – that the expansion will be gradually unwound in an orderly and benign fashion over a five year period (i.e., similar to Chung et al (2011) and as described by Yellen (2011)). Implicitly, we assume the Fed will gradually and successfully unwind its expanded portfolio holdings of GSE securities and longer-term Treasuries 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. An analogous assumption pertains to foreign portfolio holdings of GSE and agency securities.¹⁰

Regarding the Federal budget exposure, the CBO’s previous 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))). CBO estimates in 2009 included the implicit subsidy cost of the existing business as well as new business. The analysis presented here proceeds using the CBO projections, albeit a fuller accounting of the implied exposure to Fannie and Freddie could potentially suggest an expected debt effect of perhaps an additional couple hundred billion dollars.

3.3. The base case and CBO projections

The base case of this paper is based on CBO’s baseline economic assumptions (CBO 2011(a)). The CBO economic projections assume the U.S. economy continues to rebound from the recession and returns 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

¹⁰ Hence, we do not examine alternative speculative scenarios, although this analysis provides a framework from which to do so. The approach used is consistent with CBO baseline assumptions (CBO 2011) and the information presented in various statements and minutes of the meetings of the Federal Open Market Committee (Federal Reserve Board of Governors (2010)).

sustained real growth at potential with low inflation. The budget projections used in the analysis reflect CBO's baseline budget outlook adjusted to an alternative scenario that includes policies that would likely be adopted absent fundamental policy change. Although various alternative policy and budget outlooks are possible, the use of the CBO's projections under the alternative scenario 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.¹¹

Regarding the international economic outlook, both the Administration and the CBO – based on language in recent outlook discussions – implicitly have an improving net export outlook in their economic assumptions (Council of Economic Advisers, 2010, p. 132-33). The CBO (2011(a), p.41) also projects a trend decline in the value of the dollar as part of that adjustment process. Private forecasts are in accord with these projections. The average for the private Blue Chip forecasters' projections (Blue Chip Economic Indicators (2011)) of real net exports shows a slight downward trend over the 2012-2016 period with further small decline into the 2017-2021 period. 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

This section presents an empirical specification and results for estimating the role of budget deficits and changes in foreign official holdings of Treasury securities, as well as changes in the Fed balance sheet, 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.

¹¹ In a 2010 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 (2010(f)) also provided discussion of the risk of fiscal crisis from higher Federal debt.

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 by policy rule as a function of the output and inflation gaps, as described by Taylor (1993).

4.1. Empirical specification for U.S. Treasury rates

A large and growing literature exists relating interest rates to Federal debt and deficits, including Gale and Orszag (2002, 2005), Canzoneri, Cumby, and Diba (2002), Kitchen (2003), Laubach (2003, 2009), and Engen and Hubbard (2005). 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.

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 , π_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 σ_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 and Federal Reserve balances of longer-term securities, are 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.¹² The role of increased Fed holdings of longer-term Treasuries and mortgage backed securities as part of the large scale asset purchases (LSAP) program and the subsequent additional purchases of Treasuries (QE1 and QEII colloquially) is also included in the estimation.¹³

The empirical specifications used in regression analysis are based on:

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

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 rate from the natural rate (as estimated by the CBO)¹⁴; 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)¹⁵; 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, U.S. government agency, and mortgage-backed securities 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).¹⁶

¹² 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 here therefore provide information for why the term spread isn't always a clear predictor for subsequent economic activity.

¹³ Gagnon, Raskin, Remache and Sack (2010) found the LSAP reduced U.S. long yields during implementation.

¹⁴ 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.

¹⁵ 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.

¹⁶ 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

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

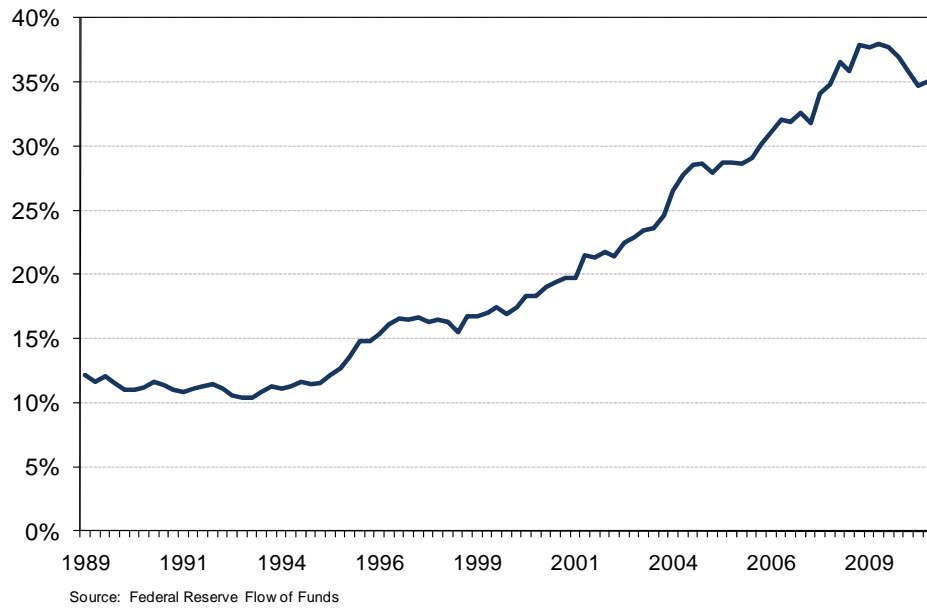
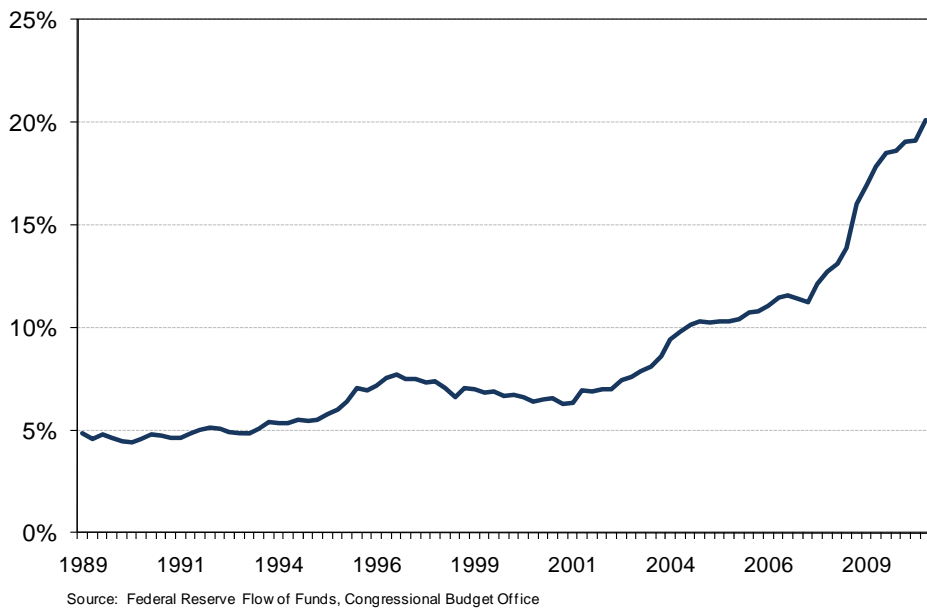


Chart 4
Foreign Official Treasury Holdings as Percent of Potential GDP



taken from the Federal Reserve's Flow of Funds accounts; the data for the historical structural budget deficit is from CBO. Warnock and Warnock (2006) used a specially constructed variable for foreign official flows.

The coefficient on the UNGAP variable, β_1 , is expected to be positive, and the coefficient on the INFLDEV variable, β_2 , is expected to be negative, reflecting their roles in the monetary policy rule and the resulting relationship to short-term rates.¹⁷ That is, consistent with the Taylor rule and 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 (*ceteris paribus*) 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, β_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 coefficients on the change in foreign official holdings of U.S. Treasuries, and for Federal Reserve holdings of long-term Treasuries, MBS and U.S. agency assets, are also posited to be negative; an increase in official holdings (foreign or domestic) is effectively an exogenous demand shift (at that point in time) that would lower longer-term yields.

4.2. Estimation results

Estimation of specifications from equation (3) above were conducted using annualized data, reflecting the fact that key variables for the broader analysis of the paper – budget projections and the international asset position – are only available at that frequency. The sample period covers 1979-2010 -- beginning when the Federal Reserve changed its operating procedures and continuing through the most recent data available. The regression results are reported in Table 1, building to the full specification and confirming the hypothesized relationships included in equations (2) and (3) above. 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). 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 examining an expanded version of the basic domestic specification.

¹⁷ 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.

Table 1
Regression Results for the Treasury Interest Rate Term Spread, 10-Year - 3 Month
 Ordinary Least Squares, Sample 1979-2010

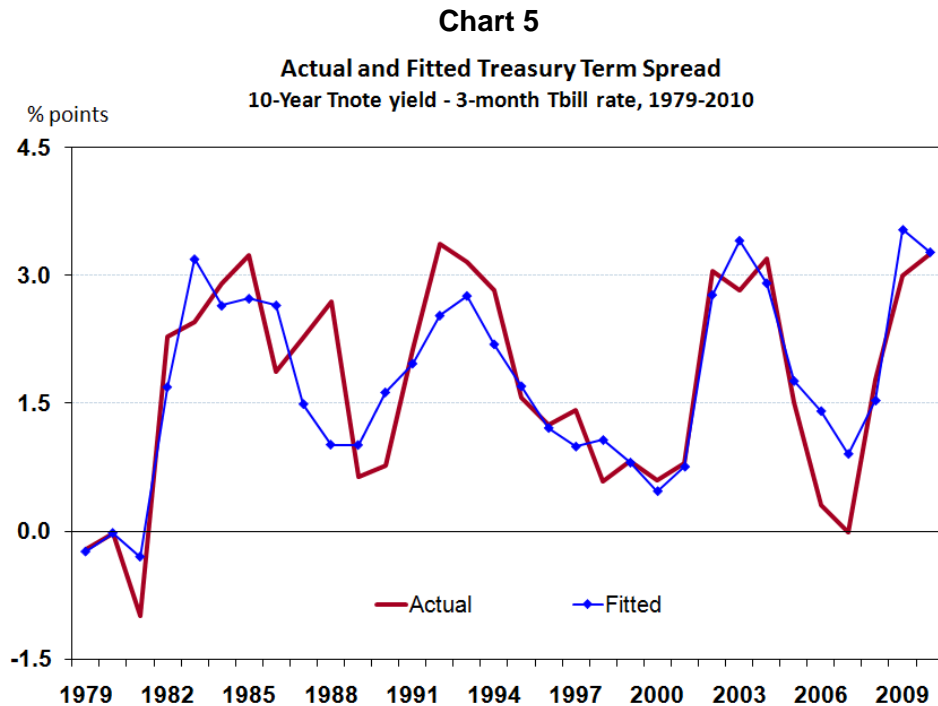
	C	UNGAP	INFL	STRSURP	FOROFFICIAL	FEDLT	DISCMPOL	Adj. R ²	DW	SE	AIC	F
1	1.373** (0.278)	0.416** (0.143)	-0.276** (0.072)	-0.190* (0.106)				0.553	1.29	0.823	2.56	
2	1.435** (0.269)	0.481** (0.142)	-0.383** (0.090)	-0.291** (0.116)	-0.445* (0.243)			0.588	1.66	0.790	2.51	
3	1.358** (0.238)	0.648** (0.137)	-0.407** (0.080)	-0.293** (0.102)	-0.147 (0.237)	-0.561** (0.189)		0.680	1.89	0.680	2.28	0.80
4	1.331** (0.191)	0.565** (0.091)	-0.420** (0.070)		-0.349** (0.086)			0.685	1.91	0.691	2.22	
5	1.265** (0.238)	0.608** (0.135)	-0.385** (0.079)	-0.306** (0.099)	-0.254 (0.239)	-0.442** (0.198)	0.748 (0.461)	0.699	1.94	0.675	2.24	0.18
6	1.223** (0.188)	0.557** (0.086)	-0.382** (0.069)		-0.335** (0.082)		0.847** (0.413)	0.717	1.96	0.655	2.13	

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, FOROFFICIAL and FEDLT.



Line 2 includes the variable for the change in foreign official holdings of Treasuries as a percent of potential GDP (FOROFFICIAL), and line 3 includes changes in Federal Reserve holdings of long-term government assets (FEDLT). 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 and domestic 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 and agency securities as part of the LSAP program lowered long-term yields and relative to short-term rates. 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 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, FOROFFICIAL, and FEDLT. 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 estimates of the resulting specification are reported in line 4 of Table 1.

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 35 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 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).¹⁸ Most recently, Gruber and Kamin (2010) obtain a coefficient of approximately 15 basis points impact on the ten year yield. For the FEDLT variable – the change in Fed holdings of Treasury, MBS and U.S. government agency securities with more than 5 years to maturity as a percent of potential GDP – the constrained coefficient estimate is also roughly consistent (albeit

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

somewhat higher) with other estimates from the literature for the effects of the Fed's purchases of longer-term assets. The FEDLT variable in our estimation had a value of about 2.8 percentage points of GDP for 2009, so the coefficient value of -0.35 indicates an estimated impact on the term premium of just under 100 basis points for that year. This estimate is somewhat larger than that obtained by Gagnon, et al. (2009), who estimated that the effect of the first-round LSAP was in the range of 38 to 82 basis points (although standard errors of the coefficient estimates indicate a degree of imprecision that allows for overlapping confidence intervals at typical levels).¹⁹

The summary regression statistics for the line 4 equation are also generally good, with an adjusted R-squared of 0.685, a Durbin-Watson of 1.91, and a standard error of the regression of just under 0.7 percentage point. Throughout the Table 1 results, the declining Akaike information criterion (AIC) 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. To examine an additional issue and relationship of recent years, lines 5 and 6 of Table 1 add a variable to examine Taylor's (2009) observation that the Fed's policy for interest rates during early years of the 2000s resulted in interest rates well below the levels indicated by the Taylor rule. Given that the specification employed is based on the assumption of short-term rates being determined by a Taylor rule, the DISCMPOL variable (for "discretionary monetary policy" and taking on a value of 1 for 2002-2004 and zero otherwise) was used to capture the effects in the estimation that result from the deviation from Fed policy from the Taylor rule over that time. The results in lines 5 and 6 show a significant positive coefficient for the DISCMPOL variable, conforming to the view that discretionary monetary policy kept short-term yields abnormally low for the given relative gap and inflation relationships of that period. The estimated coefficient shows the term spread was higher by nearly 1 percentage point, suggesting an equivalent negative effect on the short-term rate, a result that matches up with Taylor's (2009) observation about the Federal Reserve's use of discretionary policy during that time period. The other coefficient estimates of the equation are robust and change little, and the AIC statistics for equations 5 and 6 are lower than for equations 3 and 4, indicating significant added explanatory information from including the discretionary monetary policy term. Chart 5 shows the actual 10-year to 3-month Treasury spread compared to the fitted values from the full specification of line 6.²⁰

¹⁹ See, also, Hamilton and Wu (2010) for more discussion and comparisons of estimated effects of the LSAP.

²⁰ Estimation results for several alternative specifications and variable definitions are presented in the Appendix. Notably, the specification of equation (3) using the long-to-short term rate spread as the dependent variable effectively imposes the restriction that the short-term rate would have a coefficient of 1.0 if it were an explanatory variable in a regression with the long-term yield as the dependent variable; Appendix results show that restriction cannot be rejected at usual levels of significance. Also, the estimations in Table 1 use the structural budget surplus/deficit as the explanatory variable for the budget position; very similar results are observed using the

The results presented here confirm an analytical approach in which short-term rates are generally determined according to a Taylor rule, with budget deficits, foreign official holdings of Treasury securities, and Federal Reserve purchases of longer-term assets affecting long-term yields relative to short-term rates. The evidence also provides information for the debate of Taylor (2009) and Greenspan (2009, 2010) regarding the roles of domestic policy and international financial flows in contributing to the economic environment associated with and leading to the financial crisis. The results are consistent with specific aspects of the views of both Taylor – that U.S. short-term rates were kept abnormally low for several years – and Greenspan – that international flows from abroad kept long-term rates low. The results therefore also point to an interpretation that policy errors – both domestic and international – contributed to the financial imbalances of recent years. Notably, 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.²¹

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

Following Kitchen (2007), we conduct an exercise that does *not* produce a forecast per se, but rather a projection (with specific details) consistent with economic and budget projections reported by the CBO over a ten year horizon.²² Foreign holdings and the U.S. international investment position through 2020 are calculated using historical investment position data through 2009 (BEA (2010)).²³

average 5-year ahead projected surpluses/deficits (using historical CBO projections) and the correlation for the two series is 0.82. In effect, the contemporaneous structural budget deficit has been a reliable source of information for the multi-year projected budget outlook through time. This is not an unusual observation for many financial variables, with the observed regularity for forward and futures prices and values (and expectations, more generally) to move with current or spot values. The use of the structural budget surplus/deficit also allows more readily for making projections in our framework without having to make assumptions about forward budget projections in future years. The Appendix also presents some discussion and estimation results for the use of the level of the debt (stock) rather than the deficit (flow).

²¹ 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-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."

²² Kitchen (2007) provides a description of the model used; the model has been maintained and updated to incorporate new data and minor methodological changes.

²³ 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.

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 consistent with the CBO projections. 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). Budget projections consistent with an "alternative" budget outlook have the structural budget deficit initially falling from recent highs but then gradually rising relative to GDP through the end of the 10-year projection; by 2020 the structural budget deficit of the CBO alternative is over 6 percent of GDP. Those budget assumptions yield the outlook in the CBO projections for the debt held by the public, which under the alternative scenario including likely policies, rises to over 90 percent of GDP by 2020. Foreign official holdings are determined by the CBO-projected long-term Treasury yields, and the estimates reported in Section 4; those projections are similar to those of the Administration and the Blue Chip consensus forecast, so the results are not being driven by special characteristics of the CBO outlook.²⁴

Table 2 shows the results for the projections for interest rates for the years 2013-2020. The results do not change substantially if Taylor rule-generated short-term rates are substituted for these projections, with the estimates in the 3.9 to 4.4 percent range for 2017-2020, for example.²⁵ 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 (and also for the given assumed unwinding of the Fed's portfolio) to approximately replicate the 10-year yield levels of the CBO and other projections.

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 projection. These shares 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 in each

²⁴ Note Cline (2009) observes that "the CBO long-term projection itself does not appear to increase the interest rate in response to the higher deficit." CBO(2010(e)) accounts for that effect in separate discussion. Here, the derivation allows foreign official flows to provide the financing that keeps rates at the levels of the CBO assumptions.

²⁵ The Taylor rule specification employed is based on the form identified in Taylor (1993), with a coefficient on the unemployment gap of 1.0 (two times 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.

Table 2
Projections for Key Treasury Security Interest Rates
Percent, annual

	2013	2014	2015	2016	2017	2018	2019	2020
<u>CBO, Jan 2011</u>								
3-Month Treasury Bill	2.5	3.5	4.0	4.3	4.4	4.4	4.4	4.4
10-Year Treasury Yield	<u>4.2</u>	<u>4.6</u>	<u>5.0</u>	<u>5.3</u>	<u>5.4</u>	<u>5.4</u>	<u>5.4</u>	<u>5.4</u>
Spread	1.7	1.1	1.0	1.0	1.0	1.0	1.0	1.0
<u>Administration, Feb 2011</u>								
3-Month Treasury Bill	2.6	3.7	4.0	4.1	4.1	4.1	4.1	4.1
10-Year Treasury Yield	<u>4.2</u>	<u>4.6</u>	<u>5.0</u>	<u>5.2</u>	<u>5.3</u>	<u>5.3</u>	<u>5.3</u>	<u>5.3</u>
Spread	1.6	0.9	1.0	1.1	1.2	1.2	1.2	1.2
<u>Blue Chip, September 2010</u>						<u>2017-2021</u>		
3-Month Treasury Bill	3.2	3.6	3.7	3.8		3.9		
10-Year Treasury Yield	<u>4.7</u>	<u>4.9</u>	<u>5.0</u>	<u>5.1</u>		<u>5.2</u>		
Spread	1.5	1.3	1.3	1.3		1.3		
<u>Base Case Estimate/Fitted</u>								
3-Month Treasury Bill (Taylor)	1.2	2.3	3.2	4.1	4.2	4.3	4.3	4.3
10-Year Treasury Yield	<u>4.1</u>	<u>4.5</u>	<u>4.9</u>	<u>5.3</u>	<u>5.4</u>	<u>5.4</u>	<u>5.4</u>	<u>5.4</u>
Spread	2.9	2.2	1.7	1.2	1.2	1.1	1.1	1.1

case, rather than the outcome of a portfolio allocation model.²⁶ This means that our framework is not well-equipped to assess the specific aspects of the potential for “crowding out” within the portfolio.²⁷

Of particular interest is the large implied increase in the portfolio share for foreign official holdings of Treasuries (last line of Table 3) – rising from 24 percent of the total portfolio to nearly 49 percent. This reveals the extent to which the projections for long-term Treasury interest rates remaining below 5½ percent, in the face of a rising Federal structural budget deficit, depend on a continued large increase in foreign holdings of Treasuries.²⁸

²⁶ Implement the analysis in the framework of a portfolio balance model is beyond the scope of this paper. See, for example, Black and Litterman (1992) and He and Litterman (1999).

²⁷ 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.”

²⁸ 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 -0.34 we used would require an increase in foreign holdings only about three-fifths as large as we have in the base case; yet the general result would still hold.

Table 3
International Investment Asset Shares, Percent of Total

				<i>Projections/Assumptions</i>			
	2001	2005	2009	2010	2011	2016	2020
US Owned Assets Abroad:							
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
Foreign Owned Assets in the US:							
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	30.1	26.4	18.3	15.5
Corporate and other bonds	16.4	17.6	16.0	16.1	14.3	10.3	8.8
Corporate stocks	18.1	16.5	13.8	13.9	12.1	8.0	6.6
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	3.5	3.3
US liabilities, banks	16.2	20.4	20.3	20.4	18.6	14.5	13.1
Official	13.6	18.1	24.7	24.3	30.0	43.4	48.6

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

The portfolio shares of the base projection also show the potential “crowding out” that would occur in the portfolio allocations for international financial assets. In the base case presented here, 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.

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 roughly doubles over the 10-year projection period, increasing from about 20 percent of GDP to 44 percent. Net international income flows turn negative and steadily decline, from roughly +1

percent of GDP in recent years to about $-2\frac{1}{2}$ percent of GDP by the end of the ten-year projection. That negative net international income flow represents a growing 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 7), accounting for an increase of over 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 were and 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.²⁹ 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 \$13 trillion increase in the base-case projection for publicly-held Treasury debt.

5.4. Further and fundamental challenges of the base case

The base case economic projection above is generally consistent with private and public economic forecasts, and in particular regarding U.S. nominal GDP growth, interest rates and net export outlook. As such, the projection includes: GDP rebounding out of the recession and gradually returning to potential; an improving trade balance (with associated gradual decline in the dollar over time); and relatively benign longer-term interest rate levels. Those results are assumed to occur with -- and despite -- rising structural budget deficits.³⁰ In the following, we consider potential challenges from some alternative relationships.

²⁹ These increases essentially show the combined effect from having the growing share of Treasuries in the foreign-held asset portfolio (the share rising from 24 percent to nearly 49 percent) and the increasing effective rate of return on those assets from just over 2 percent to around 5 percent.

³⁰ 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.

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

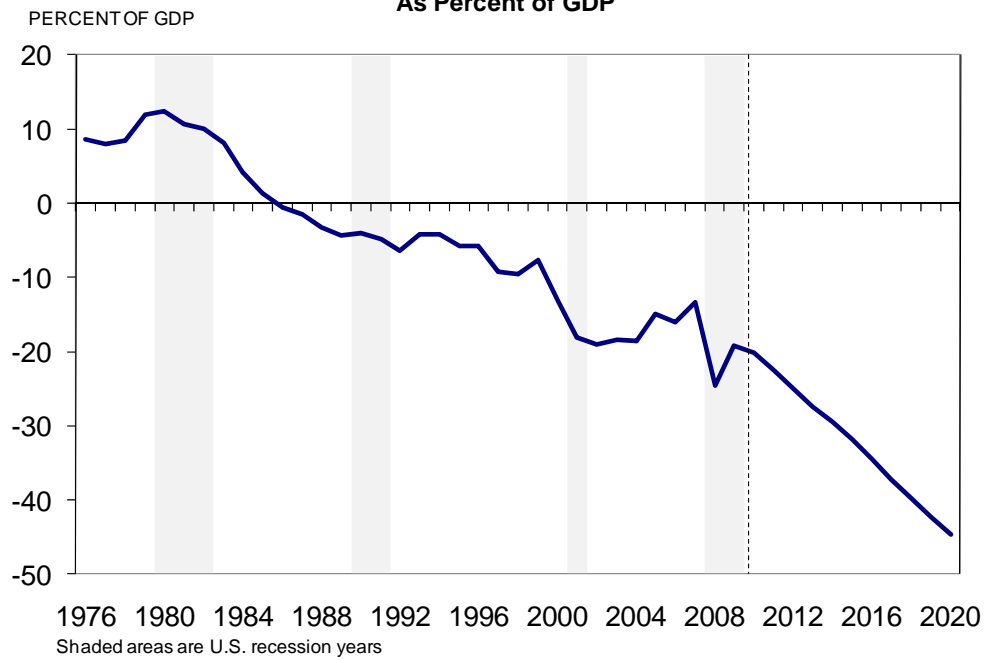


Chart 7
U.S. Net Factor Income (NIPAs)
As Percent of GDP

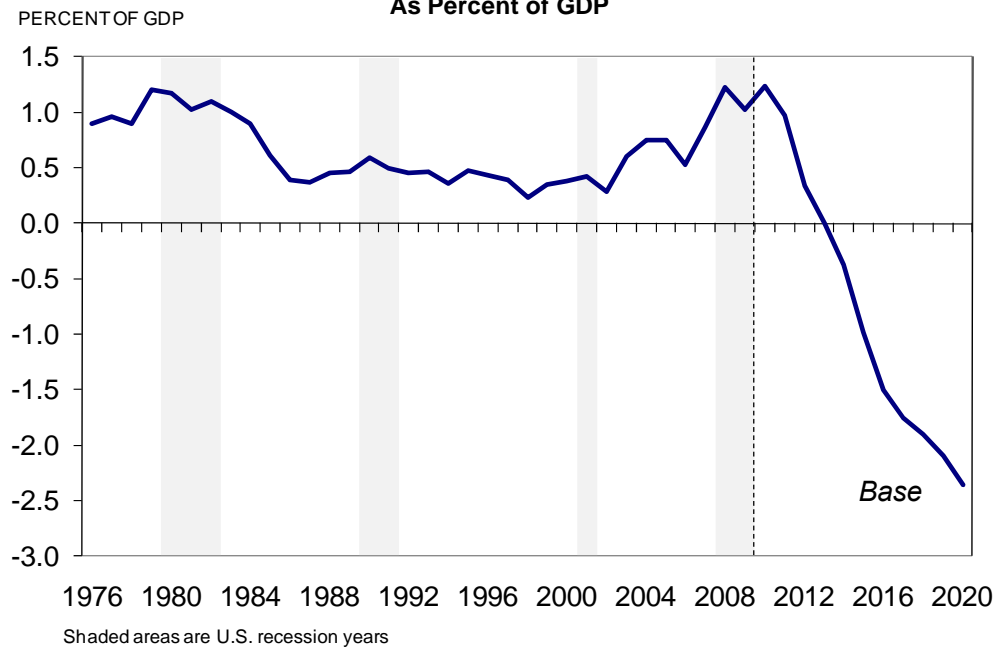


Chart 8
Foreign Holdings of US Treasuries and U.S. Payments to Foreigners on Treasuries

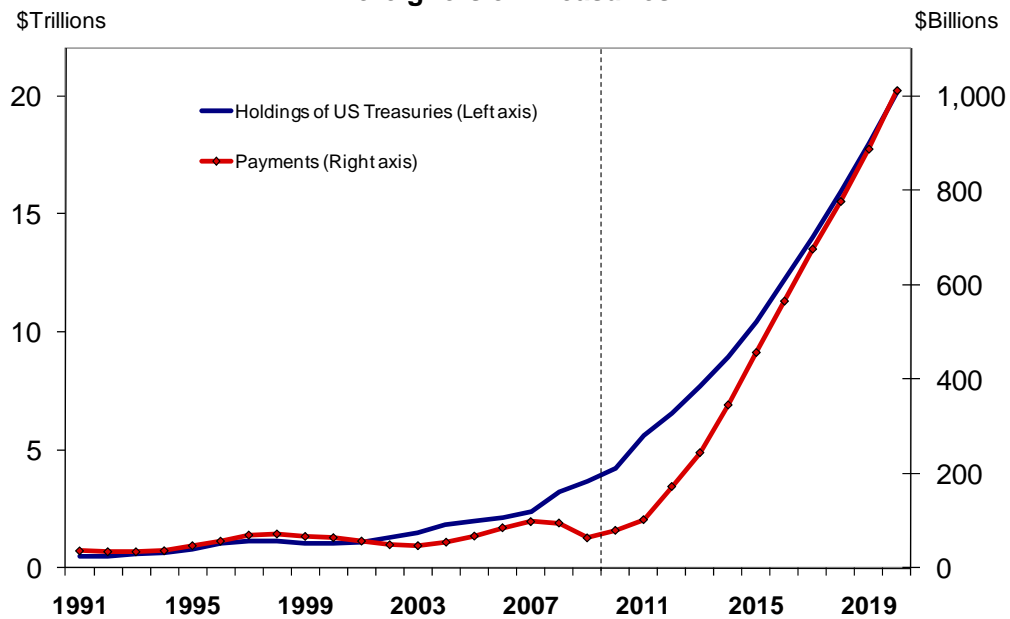
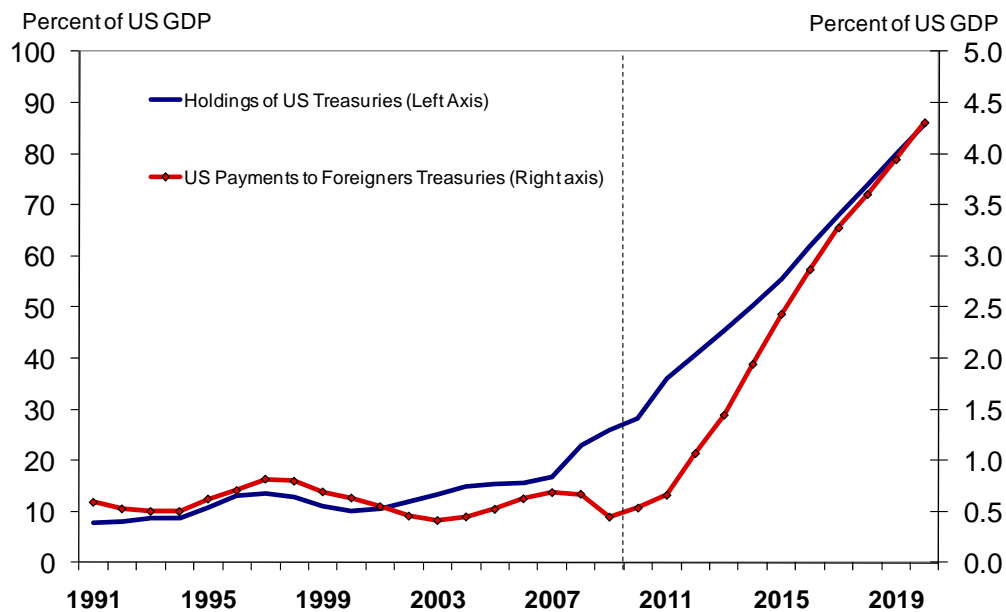


Chart 9
Foreign Holdings of US Treasury Debt and US Government Payments to Foreigners for Treasuries (% of US GDP)



5.4.1. 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 the combined set of assumptions is fundamentally different from what has occurred historically, with foreign official holdings accommodating currency valuations – and in a manner that roughly mirrored the U.S. net export deficit (see Chart 10). The question then 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 would 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. Even so, one can envision an intermediate case in which continued growth of foreign official holdings reduces, but does not eliminate, the downward trend in the value of the dollar and the needed improvement in net exports.

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 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?³¹ 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.

³¹ Auerbach and Gale (2009) and CBO (2010(c)) address concerns about negative effects on GDP growth and lower potential output.

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 over 20 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 increase in foreign official holdings to 20 percent of ROW GDP by 2020 could at first glance therefore seem to 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.³²

³² 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

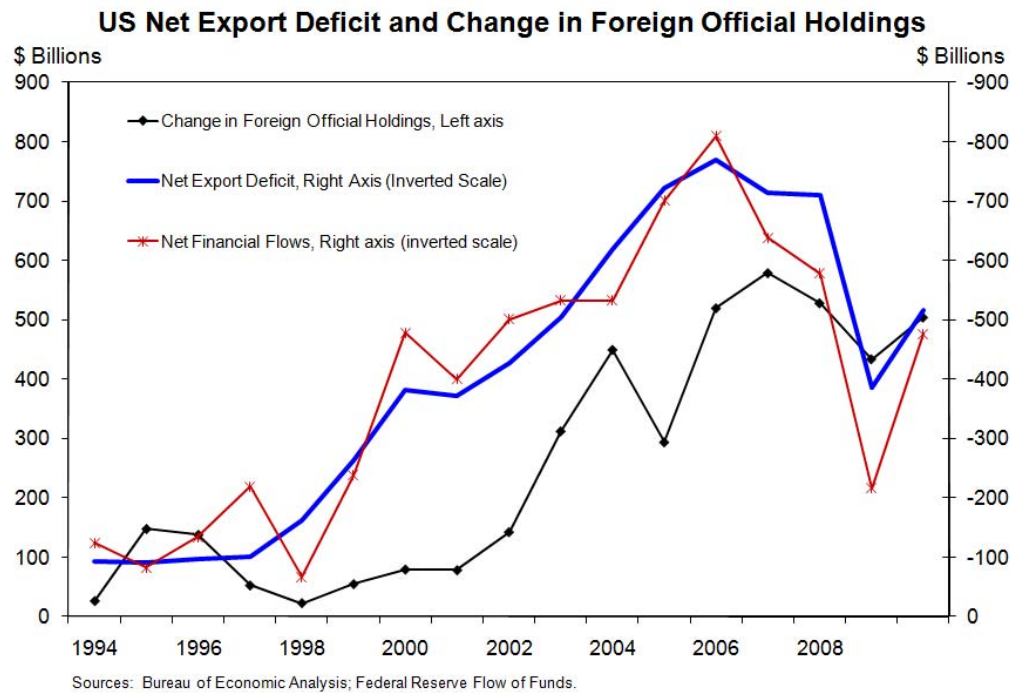
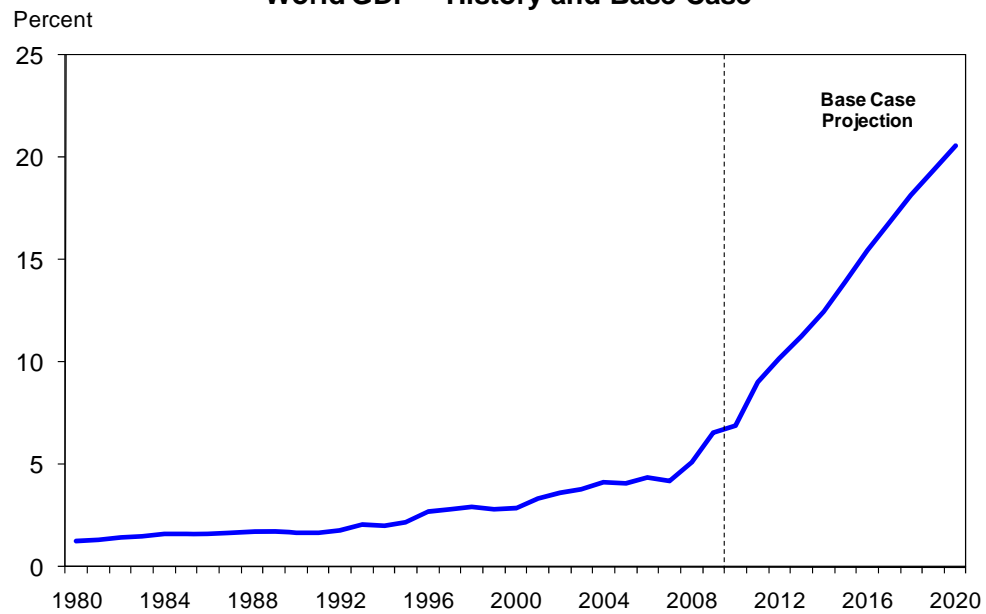


Chart 11
Foreign Official Holdings of Treasuries as Percent of Rest of World GDP -- History and Base Case



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 Federal Reserve holdings (i.e., the domestic monetary base). In effect, we vary the treatment regarding endogeneity or predetermination for interest rates and foreign official holdings. In the base case we assume a predetermined path for interest rates (and the Fed balance sheet) and allow for endogenous determination of foreign official holdings. In the first alternative, we assume a predetermined path for foreign official holdings (and the Fed balance sheet) and allow for endogenous determination of the long-term interest rate. In the second alternative, we assume an altered (predetermined) path for the Fed balance sheet, and maintain the predetermined path for the term spread for interest rates, with the required endogenous determination of foreign official holdings to attain that result. Table 4 presents information on key assumptions and relationships in the scenarios.

6.1. Alternative 1: Foreign official holdings kept 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 17 percent by 2020 compared to the base case of about 49 percent.

Using the estimated relationships from Section 4.1, point estimates show the 10-year Treasury yield would rise relative to the 5½ percent of the base case for 2015-2020 to about 7.1 percent in 2015 and to 7.9 percent by 2020.³³ These estimates reflect the role of the rising structural budget deficit of the base case (without the offsetting effect on interest rates 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

³³ IMF (2010) examined 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. 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.

increase by about \$100 billion in 2016 and about \$220 billion by 2020, with a cumulative effect on the debt of over \$1.1 trillion – an additional 5 percent of GDP – by 2020.³⁴

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.”³⁵ The scenario is based on examining the general pressures that would arise from *sustained* higher growth of Federal holdings of U.S. Treasury securities over time, 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: First, a sustained increase in the rate of growth of the Federal Reserve balance sheet (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. Second, the higher inflation rate passes through to nominal interest rates one-for-one, 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. Reflecting the higher rate of inflation, *nominal* GDP growth is one percentage point higher per year (while real magnitudes remain unchanged). 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 grow at the rate necessary to maintain the same Treasury yield term spread of the base case (and offsetting effects from the inflation-induced changes to the structural budget deficit as a percent of GDP); nominal interest rates change by the one percentage point increase associated with the increase in the inflation rate.

³⁴ 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 (2011). 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.

³⁵ 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.”

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 Public Debt, 2020, % of GDP	General Assumption	Foreign Official Portfolio %, 2020 (2009: 25%)	General Assumption	Average annual rate of growth, 2008-2020
Base Case	CBO economics	5.4%	CBO Alternative with Extended Policies	94%	As required by long-term Treasury yield of economic assumptions	49%	Unwind high balance sheet and return to pre crisis relationship relative to GDP over 5 years	4%
Alternative 1	Base with higher LT Treasury yield	7.9%	Base plus higher interest/debt service costs	99%	Held fixed as percent of U.S. GDP	17%	Same as Base	4%
Alternative 2	Base with higher inflation, higher ST and LT nominal interest rates, declining exchange value of the \$	6.4%	Base plus higher interest costs and budget and nominal GDP effects of higher inflation	88%	As required to maintain term spread for Treasury yield	43%	Grow 1 percent per year faster than in Base	5%

CBO (2011) 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 \$780 billion.³⁶ The budget effects from higher inflation are small relative to the increase in nominal GDP; the debt-to-GDP ratio is lower in 2020, at 88 percent of GDP under the alternative scenario, compared to 94 percent in the base case. The debt-to-GDP ratio is often viewed as 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 (4.5 percent of GDP in the alternative compared to 4.3 percent in the base case). Overall net international income flows are more negative – at -2.8 percent of GDP in the alternative scenario compared to the -2.4 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 41 percent of GDP in 2020 compared to the 44 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.³⁷

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. New empirical evidence is presented that explicitly accounts for the roles of U.S. structural budget deficits, expanded holdings of long-term securities by the Federal Reserve, and foreign official holdings of U.S. Treasuries in determining Treasury security interest rates; the empirical results being used to examine, in particular, the implications for Treasury interest rates

³⁶ 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.

³⁷ An anonymous referee noted that the analysis uses the par value of the debt and not the market value; if inflation and interest rates rise significantly, capital losses from changes in market value could be quite large. See, e.g., Bohn (1992), Hall and Sargent (2010), and the Dallas Fed website <http://www.dallasfed.org/data/data/natdebt.htm>.

from changing relative magnitudes of foreign official holdings. Two alternative scenarios consider (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 over time, 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 longer-term 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. Nonetheless, given the historical record in which the United States was able to finance debt in excess of 100 percent of GDP following World War II, broader issues and substantial uncertainties remain regarding the ability of the U.S. government to borrow and finance the debt even at large levels of debt relative to GDP. 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 help to mitigate concerns about the financing of the U.S. budget and current account deficits.

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APPENDIX -- EXAMINING ALTERNATIVE SPECIFICATIONS

Researchers have used alternative specifications for examining the effects of U.S. fiscal imbalances on interest rates (see, e.g., Gale and Orszag (2002), Engen and Hubbard (2005), Laubach (2009)). Engen and Hubbard (2005), notably, argue for the use of measures of the expected *stock* of debt, while numerous researchers have employed the *flow* variable of the budget deficit. Further, alternative specifications have been employed regarding the dependent variable; many have used the level of the long-term Treasury rate (with the short-term rate as an explanatory variable) and others have used the long- to short-term interest rate spread. In this paper, we use the flow variable of the Federal structural budget deficit, and the long-short rate spread. This Appendix shows estimation results for alternative specifications, with the general result that the interpretations and analysis of the paper should be expected to continue to hold under a variety of specifications based on using the flow approach; specifications using the stock of debt are not as reliable or (from our perspective) desirable.

Line 1 of Appendix Table 1 reproduces the final equation presented in the text discussion for ease of comparison.

Line 2 shows estimation results for relaxing the constraint of using the rate spread as the dependent variable, using the 10-year Treasury note rate on the left hand side and the 3-month Treasury bill rate on the right hand side. The coefficient on the 3-month rate is 0.925 and the F test statistic for testing the hypothesis that the coefficient equals 1.0 shows the hypothesis cannot be rejected. Other estimation relationships in the equation show little difference from the equation of the text.

Lines 3, 4 and 5 show specifications that use the CBO's budget surplus/deficit projections (the annual average for the 5-year ahead projected surplus/deficit as a percent of GDP). Line 3 shows the same specification as line 2, but uses the CBO projected surplus/deficit and relaxes the constraint of the equality of the coefficients across the budget surplus, foreign official holdings, and the Fed LSAP; the F test for that constraint shows it cannot be rejected. Line 4 includes that constraint, and presents the F test statistic for testing the constraint that the coefficient on the short-term rate is equal to 1.0; the test statistic is in a marginal area relative to usual levels of significance, being significant at about the 7 percent level. Line 5 presents the results equivalent to the equation of line 1 and the text, but using the CBO projected surplus/deficit; the results are again largely consistent with those of the text (albeit the constrained coefficient for the deficit/foreign official/Fed LSAP is slightly smaller at 0.262 compared to the 0.335 for the text equation). In general, the similarity of the results should not be surprising given the correlation of 0.82 for the structural surplus/deficit and the CBO projected surplus/deficit.

To examine whether short-term rates are related to budget deficits, the remaining lines of the table present regressions of the 3-month Treasury bill in various specifications with deficit variables as explanatory variables. Lines 6 and 7 show that neither the structural budget surplus/deficit nor the projected CBO surplus/deficit have a significant effect on the short-term rate in a simple regression. Lines 8 and 9 show that the result holds in broader specifications as well.

Appendix Table 2 presents estimation results using the CBO's projected level of the debt -- and for using the levels for the foreign official holdings and Federal Reserve balance sheet holdings of longer-term assets. Two alternative debt level variables are used: the DEBTAVG variable is the annual average for the 5-year ahead debt projections as a share of GDP; the DEBT5 variable is the 5-year-ahead projection for the level of the debt as a percent of GDP. The results in lines 1 through 4 show significant effects for the projected debt level using either the rate spread or the 10-year rate as the dependent variable, with the 5-year ahead level showing slightly stronger results. As observed in other studies, the magnitude of the coefficient on the debt level is much smaller than the coefficient on the surplus/deficit; the coefficient is about one-fifth the size of the coefficient estimate for the surplus/deficit estimation. These results reflect

the close relationship between movement in the debt projection and the underlying deficit outlook; the correlation coefficient between the debt projection and the deficit projection is 0.87. Further, the slope coefficient for a simple regression of the debt projection on the deficit projection yields an estimate of just less than 5 -- just as the relative size of the coefficient estimates would suggest.

Line 5 shows that coefficient on the level of foreign official holdings is of the anticipated negative sign and is significant, but the coefficient on the Fed long-term asset variable has the wrong sign and is not significant. The low Durbin-Watson statistics for the equations of lines 1 through 5 of Table 2 suggest misspecification; lines 6 and 7 show the results using first differences for the variables on both sides of the equation. The coefficient for the projected debt effect is fairly robust to that specification change, and the coefficients on the change in foreign official holdings and the Fed assets are of correct sign but are not significant.

These results generally reinforce our use of the specification in the analysis, including the choice of using the flow relationship of the surplus/deficit rather than the stock of the debt. Regarding the question of stock versus flow variables in the determination of interest rates, Friedman (1977) observed that "Financial market participants, keenly sensitive to the fact that the immediate determination of bond yields takes place in a market in which securities are bought and sold, typically believe that the interplay between borrowers' issues of new bonds and investors' newly available cash flows represents an important determinant of long-term yields. In contrast, most economists ...have argued that, if quantity variables are relevant at all, it is not flows but stocks which matter." He found results supporting an "optimal marginal adjustment" model of portfolio behavior in which "flow variables are a significant determinant of investors' short-run asset demands and hence of asset yields." A similar interpretation is applicable here.

Appendix Table 1: Regression Results for Alternative Specifications and Testing Constraints

Ordinary Least Squares, Sample 1979-2010

	Dependent Variable	C	3-Month Rate	UNGAP	INFL	STRSURP	FOROFFICIAL	FEDLT	5-Year Deficit Projection	DISCMPOL	Adj. R ²	DW	SE	AIC	F (Surp,For,Fed)	F (3-Mo = 1.0)
1	Spread	1.223** (0.188)		0.557** (0.086)	-0.382** (0.069)			-0.335** (0.082)		0.847** (0.413)	0.717	1.96	0.655	2.13		
2	10-Year Rate	1.511** (0.378)	0.925** (0.087)	0.517** (0.096)	-0.285** (0.136)			-0.348** (0.084)		0.675 (0.453)	0.950	1.89	0.656	2.16		0.75
3	10-Year Rate	1.978** (0.499)	0.853** (0.101)	0.340* (0.177)	-0.207 (0.137)			-0.278 (0.193)	-0.241 (0.197)	-0.336** (0.102)	0.759 (0.509)	0.952	1.52	0.646	2.18	0.19
4	10-Year Rate	2.127** (0.365)	0.832** (0.087)	0.407** (0.096)	-0.190 (0.127)			-0.301** (0.065)		0.655 (0.431)	0.955	1.55	0.624	2.06		3.70*
5	Spread	1.496** (0.167)		0.497** (0.088)	-0.398** (0.071)			-0.262** (0.064)		1.003** (0.412)	0.717	1.59	0.655	2.13		
SHORT-TERM RATE REGRESSIONS:																
6	3-Month Rate	6.127** (1.029)				0.245 (0.328)					-0.014	0.21	3.390	5.34		
7	3-Month Rate	5.068** (0.890)							-0.194 (0.294)		-0.019	0.28	3.397	5.34		
8	3-Month Rate	3.854** (0.361)		-0.471** (0.187)	1.382** (0.129)					-2.075** (0.897)	0.820	0.69	1.427	3.67		
9	3-Month Rate	4.586** (0.444)		0.061 (0.253)	1.164** (0.145)	0.152 (0.186)	-0.602 (0.366)	-0.397 (0.342)		-2.264** (0.845)	0.859	1.29	1.262	3.49		

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 (Surp,For,Fed) is the test value for the Wald test for the null hypothesis of equality of the coefficients on STRSURP, FOROFFICIAL and FEDLT.

F (3-Mo = 1.0) is the test value for the Wald test for the null hypothesis of the coefficients on the 3 Month Rate = 1.0.

Variables are as defined in the text of the paper; 5-Year Deficit Projection is the average annual value for the current and 5-year ahead CBO budget surplus/deficit.

Appendix Table 2: Regression Results for Specifications Using Debt Level

Ordinary Least Squares, Sample 1979-2010

	Dependent Variable	C	3-Month Rate	DEBTAVG	DEBT+5	FOROFFICIAL LEVEL	FEDLT LEVEL	Adj. R ²	DW	SE	AIC
1	Spread	-1.269* (0.738)		0.073** (0.017)				0.347	0.98	0.994	2.89
2	Spread	-0.804 (0.591)			0.063** (0.014)			0.381	0.94	0.968	2.83
3	10-Year Rate	-0.026 (0.944)	0.890** (0.056)	0.057** (0.018)				0.896	0.93	0.949	2.82
4	10-Year Rate	0.310 (0.684)	0.870** (0.049)		0.053** (0.013)			0.910	0.93	0.883	2.68
5	10-Year Rate	2.736** (0.922)	0.716** (0.061)		0.047** (0.012)	-0.240** (0.072)	0.243 (0.014)	0.933	1.18	0.761	2.43
FIRST DIFFERENCE SPECIFICATION											
6	10-Year Rate	-0.056 (0.141)	0.616** (0.101)		0.044* (0.022)			0.555	2.44	0.768	2.40
7	10-Year Rate	-0.010 (0.160)	0.627** (0.105)		0.057** (0.027)	-0.168 (0.199)	-0.005 (0.163)	0.536	2.53	0.783	2.50

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

DEBT is the annual average for the projection of the 5 year ahead debt levels (as % of GDP or GNP); DEBT5 is the projected debt level in the fifth year ahead.