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Financing US Debt: Is There Enough Money in the World – and at What Cost?*

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Abstract

With the outlook for continued US budget deficits and growing debt – and the uncertainties regarding their financing – we examine the role of foreign official holdings of US Treasury securities in determining Treasury security interest rates, and the resulting implications for international portfolio allocations, net international income flows and the US net international debt position. We update estimates of the relationship between Treasury interest rates and US structural budget deficits, and extend that empirical analysis to include foreign official and Federal Reserve holdings of US Treasury securities. Although relationships suggest that the world portfolio could potentially accommodate financing requirements over the intermediate horizon, substantial uncertainty surrounds the likelihood of that accommodation and the associated effects on interest rates and adjustments in international portfolios. Notably, unprecedented levels and growth of foreign official

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holdings of US Treasuries will be required to keep longer term Treasury security interest rates from rising substantially above current consensus projections.

I. 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 United States. In this regard, the willingness of foreign official actors to continue to purchase US government debt is one of the central questions facing policy makers 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 US structural budget deficits and foreign official holdings of US Treasuries on Treasury security interest rates. Using that information and taking as given economic and budget projections from the Congressional Budget Office (CBO), we calculate the implied necessary behaviour of foreign official holdings, with specific focus on implied international portfolio adjustments for foreign holdings of US international debt and other assets and the associated effects on the projected US international net debt position and net income flows. Potential feedback effects to and from interest rates to the US 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

[1] Kitchen (2007) found that the US 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.

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.

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 US 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 US Treasuries are maintained at a constant proportion of US 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 (ROW) 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 US Treasury interest rates and international debt and financial portfolios.

Section II provides a brief review of relevant literature and Section III presents data and information on US government debt and the baseline outlook consistent with projections by the CBO. Section IV examines the empirical relationship for US Treasury interest rates, and budget deficits, Federal Reserve (Fed) purchases and foreign official holdings of Treasuries. Section V presents the base-case projections, including an explicit accounting for the implied large change in foreign official holdings of US Treasury securities (and other foreign portfolio allocations) required to meet the base-case economic assumptions for interest rates. Section VI examines two alternative scenarios: (1) foreign official holdings of Treasuries fixed as a percent of US 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 US Treasury securities. Section VII provides closing discussion.

II. Some Background and Selected Literature

Questions about the sustainability of the US current account and the outlook for US international debt have received growing interest in recent years; the recent experience with and outlook for higher US 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 US 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 favour 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 (2006) showed that the US 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 US current account deficit and the US 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 US budget deficits (given the outlook for the US fiscal imbalance and growing debt), and against the backdrop of the

[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 et al. (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 et al. (2005), Eichengreen (2006) and Kitchen (2007).

outlook for continued US 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 US 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 et al. (2009) examine the world financial asset portfolio and the question of available international funding to meet prospective US international imbalances; we discuss their findings in more detail further below.[5]

III. US Government Debt: Historical Data, Trends and the Base Outlook

A. Treasury Debt and Foreign Official Holdings

US Treasury public debt is held by domestic and foreign holders, and private and official holders.

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

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 US Treasury debt held by the public (T_{TOT}) and growing foreign official ($T_{\mathrm{F,O}}$) holdings and shares for US 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 US$600 billion (17% of total Treasury debt securities outstanding) at the end of 1999 to over US$3.2 trillion (35% of total outstanding) by the end of 2010. Domestic official ($T_{\mathrm{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 10–15% of total outstanding Treasuries (and also generally in the range of about 4–6% of GDP). During the financial crisis, however, the Federal Reserve share fell

[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 US government across accounts (e.g. social security and other trust fund accounts) that are included in measures of the 'gross' debt.

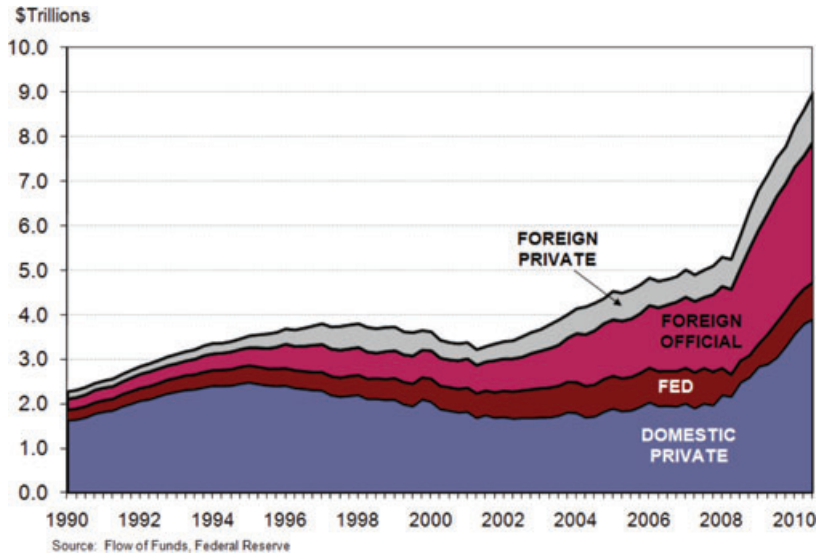

Chart 1: Outstanding Treasury Securities by Holder

sharply (to as low as 7% 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% of the total outstanding.

B. 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 US 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 US government undertook direct actions to provide backing

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

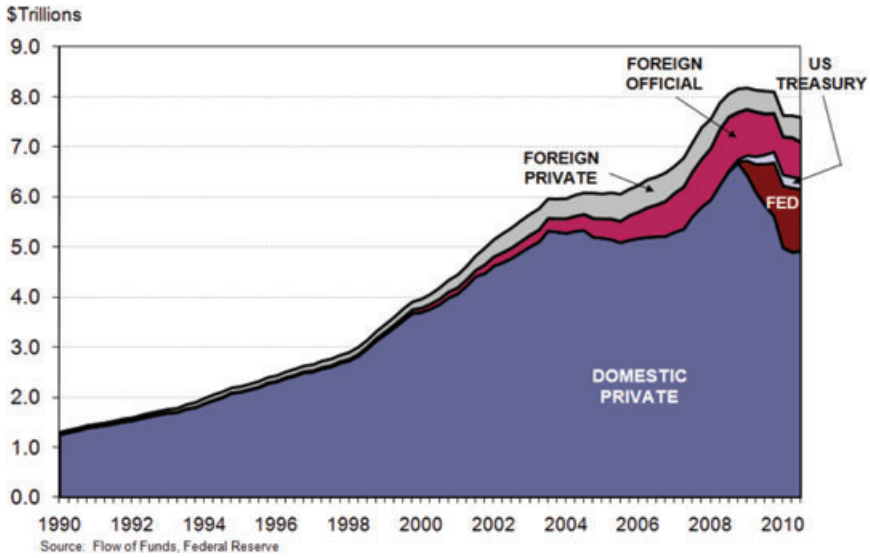

Chart 2: Agency, GSE and GSE-Backed Securities by Holder

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 (MBS) – 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 LSAP program. The Fed increased purchases of GSE and agency debt, MBS and longer term US Treasury securities. Federal Open Market Committee (FOMC) statements announced that the program would include purchases of up to US$200 billion of agency debt, up to US$300 billion

[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 US$226 billion in MBS from September 2008 to 31 December 2009, when the statutory authority for this program expired. In addition, the Federal Reserve engaged in GSE MBS purchases over this period totalling US$1 trillion through the end of 2009 (OMB 2010, p. 350).

in longer term US Treasury securities and up to US$1.25 trillion in agency MBS.[9] In November 2010, the FOMC announced plans 'to purchase a further US$600 billion of longer-term Treasury securities by the end of the second quarter of 2011'.

The data show the US 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 (that is, 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 2010b). 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.

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

[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).

C. The Base Case and CBO Projections

The base case of this paper is based on the CBO's baseline economic assumptions (CBO 2011). The CBO economic projections assume the US 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 sustained real growth at potential with low inflation. The budget projections used in the analysis reflect the 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, pp. 132–33). The CBO (2010a, 2011) 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 2012–16 period with further small decline into the 2017–21 period. Hence, to reflect the general 'consensus' among public and private forecasters, the base-case projection includes a gradual trend improvement in US net exports.

The outlooks for US 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 US Treasury securities, US 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.

[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 2010e, p. xi). CBO (2010f) also provided discussion of the risk of fiscal crisis from higher Federal debt.

IV. US 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 US Treasury interest rates. The estimated relationships are then used to analyse what the base-case projections implicitly require for foreign official holdings of US 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 behaviour of *official* domestic and foreign holdings of US 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).

A. *Empirical Specification for US Treasury Rates*

A large and growing literature exists relating interest rates to Federal debt and deficits, including Gale and Orszag (2002, 2005), Canzoneri et al. (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 US 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:

$$i_{t,k} - i_{t,j} = -\gamma(\pi_t - \overline{\pi}) - \phi(y_t - \overline{y_t}) + \sigma_t + \varepsilon_t \qquad (2)$$

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 ten-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 MBS as part of the LSAP program and the subsequent additional purchases of Treasuries (QEI and QEII colloquially) is also included in the estimation.[13]

The empirical specifications used in regression analysis are based on

$$\begin{aligned}\text{SPREAD}_t = \beta_0 + \beta_1 \text{UNGAP}_t + \beta_2 \text{INFL}_t + \beta_3 \text{STRSURP}_t \\ + \beta_4 \text{FOROFFICIAL}_t + \beta_5 \text{FEDLT}_t + e_t, \end{aligned} \tag{3}$$

where SPREAD is the term spread for longer term Treasury yields relative to short-term Treasury rates (the ten-year yield minus the three-month Treasury bill rate); UNGAP is the deviation of the unemployment rate from the natural rate (as estimated by the CBO); INFL is the difference between the inflation rate (the percentage change in the personal consumption expenditure (PCE) price index of the NIPAs) and targeted inflation (here assumed at 1.8%); 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 US Treasury securities as a percent of potential GDP and FEDLT is

[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 is not always a clear predictor for subsequent economic activity.

[13] Gagnon et al. (2010) found the LSAP reduced US long yields during implementation.

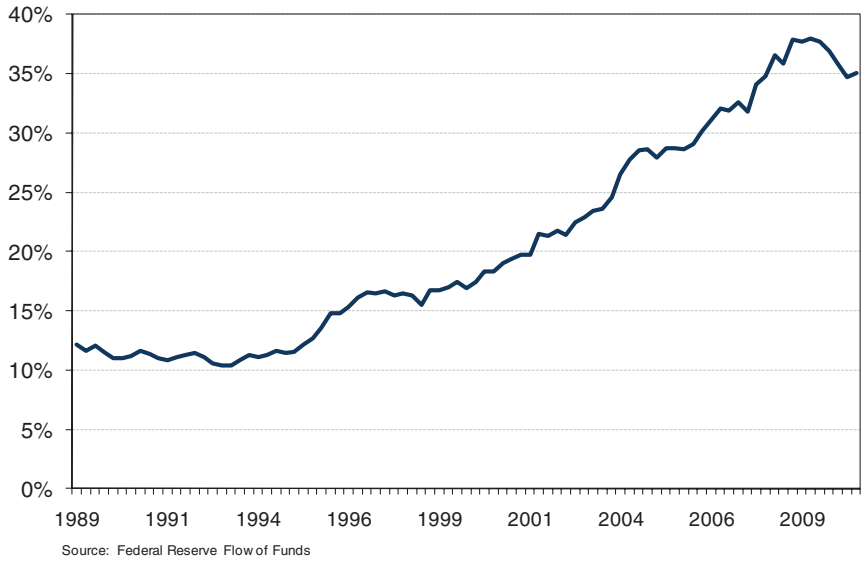

Chart 3: Foreign Official Treasury Holdings as Share of Total Outstanding Treasuries.

the change in Fed holdings of long-term (more than five years) Treasuries, US government agency and MBS as a percent of potential GDP.[14,15]

Chart 3 shows foreign official holdings of US Treasury securities as a share of total outstanding Treasury securities; Chart 4 shows foreign official holdings of US Treasury securities as a percent of US 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]

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

[14]The unemployment gap and the output gap are roughly interchangeable measures (a là 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 consumer price index (CPI) inflation rate; the 1.8% target rate use here is hence roughly equivalent to a CPI inflation rate of around 2% 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 are taken from the Federal Reserve's Flow of Funds accounts; the data for the historical structural budget deficit are from CBO. Warnock and Warnock (2006) used a specially constructed variable for foreign official flows.

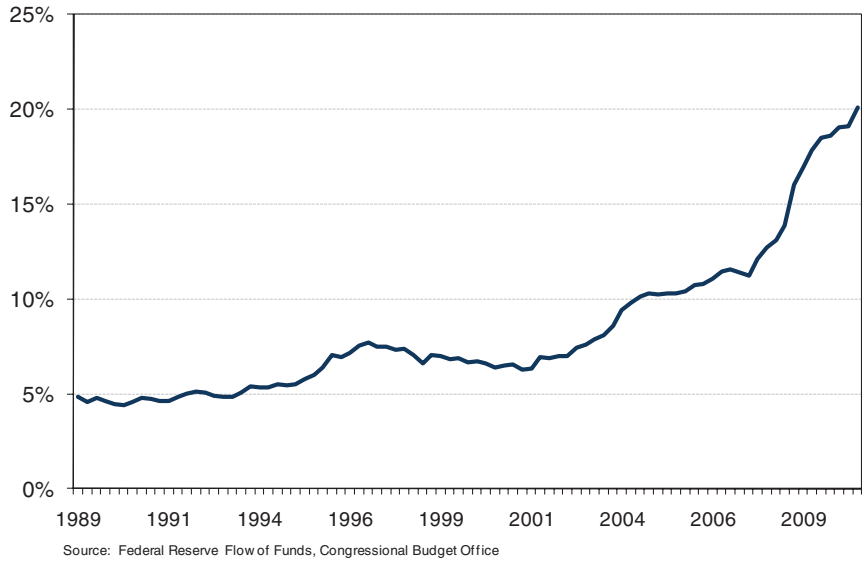

Chart 4: Foreign Official Treasury Holdings as Percent of Potential GDP

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 US Treasuries, and for Federal Reserve holdings of long-term Treasuries, MBS and US 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.

[17] Note that the specification does not '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.

B. 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. 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.

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 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 0.54–0.75 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 ten-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,

Table 1: Regression Results for the Treasury Interest Rate Term Spread, Ten-Years and Three Months

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

Note: Ordinary least squares, sample 1979–2010.
Standard errors are in parentheses; **significant at the 0.05 level; *significant at the 0.10 level.
DW, Durbin–Watson statistic; SE, standard error of the regression; AIC, 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.

2005) at 25–35 basis points and Laubach (2009) at 20–30 basis points. Also, as observed in Warnock and Warnock (2006) and 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 19–31 basis points and for foreign official flows (measured relative to GDP) of 24–61 basis points; Chinn and Frankel (2007) observe estimates in the range of 52–71 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 US government agency securities with more than five years to maturity as a percent of potential GDP – the constrained coefficient estimate is also roughly consistent (albeit 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. (2010), who estimated that the effect of the first-round LSAP was in the range of 38–82 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^2 of 0.685, a Durbin–Watson of 1.91 and a standard error of the regression of just under 0.7 percentage point. Throughout 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

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

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

1 for 2002–04 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 one 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 lines 5 and 6 are lower than for lines 3 and 4, indicating significant added explanatory information from including the discretionary monetary policy term. Chart 5 shows the actual ten-year to three-month Treasury spread compared to the fitted values from the full specification of line 6.[20]

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 US 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

[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 average five-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).

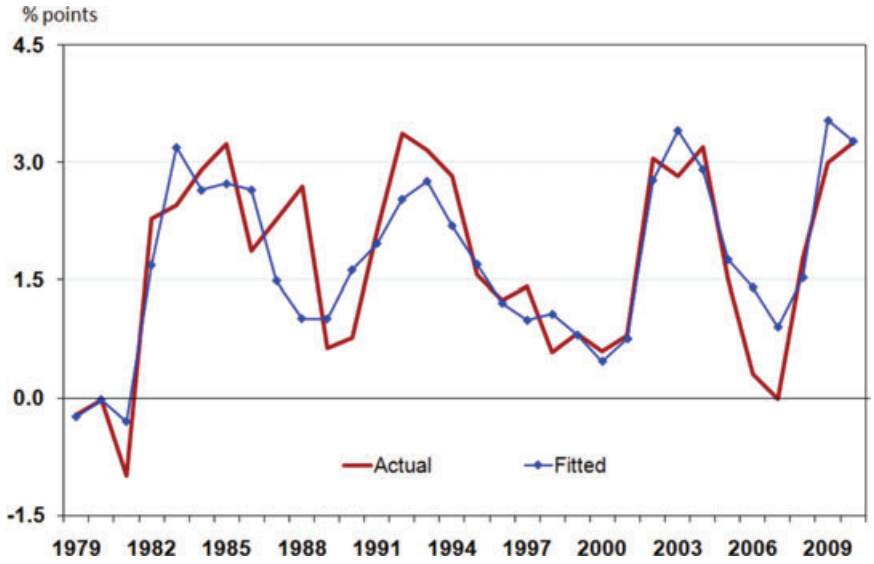

Chart 5: Actual and Fitted Treasury Term Spread 10-Year Tnote yield -3-month Tbill rate, 1979–2010

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]

V. 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 US international investment position through 2020 are

[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 ROW 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.

calculated using historical investment position data through 2009 (Bureau of Economic Analysis 2010).[23]

A. 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% 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 ten-year projection (CBO 2010d); by 2020, the structural budget deficit of the CBO alternative is over 6% 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% of GDP by 2020. Foreign official holdings are determined by the CBO-projected long-term Treasury yields, and the estimates are reported in Section IV; the 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 2013–20. The results do not change substantially if Taylor-rule-generated short-term rates are substituted for these projections, with the estimates in the 3.9–4.4% range for 2017–20, 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

[23] Cline (2005, 2009) also addresses the implications of the US fiscal outlook for the US international debt position and international income flows, but without a full explicit accounting for the specific international and domestic sources for financing US Treasury debt and the implications thereof.

[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 (2010e) 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 minus 1.0 (minus 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% and a target CPI inflation rate of 2%.

Table 2: Projections for Key Treasury Security Interest Rates (Percent, Annual)

	2013	2014	2015	2016	2017	2018	2019	2020
CBO, January 2011								
Three-month Treasury bill	2.5	3.5	4.0	4.3	4.4	4.4	4.4	4.4
Ten-year Treasury yield	4.2	4.6	5.0	5.3	5.4	5.4	5.4	5.4
Spread	1.7	1.1	1.0	1.0	1.0	1.0	1.0	1.0
Administration, February 2011								
Three-month Treasury bill	2.6	3.7	4.0	4.1	4.1	4.1	4.1	4.1
Ten-year Treasury yield	4.2	4.6	5.0	5.2	5.3	5.3	5.3	5.3
Spread	1.6	0.9	1.0	1.1	1.2	1.2	1.2	1.2
Blue Chip, September 2010						2017–21		
Three-month Treasury bill	3.2	3.6	3.7	3.8		3.9		
Ten-year Treasury yield	4.7	4.9	5.0	5.1		5.2		
Spread	1.5	1.3	1.3	1.3		1.3		
Base-case estimate/fitted								
Three-month Treasury bill (Taylor)	1.2	2.3	3.2	4.1	4.2	4.3	4.3	4.3
Ten-year Treasury yield	4.2	4.5	4.9	5.3	5.4	5.4	5.4	5.4
Spread	2.9	2.3	1.8	1.2	1.2	1.1	1.1	1.1

Note: CBO, Congressional Budget Office.

also for the given assumed unwinding of the Fed's portfolio) to approximately replicate the ten-year yield levels of the CBO and other projections.

B. Portfolio Allocations – Historical Data and Base Projections

Table 3 shows the international portfolio allocations for US-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 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]

[26] Implementing 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'.

Table 3: International Investment Asset Shares, Percent of Total

				Projections/assumptions			
	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, non-banks	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 Government	1.4	0.7	0.6	0.5	0.4	0.4	0.4
Foreign-owned assets in the United States							
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 Treasury	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, non-banks	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.

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% of the total portfolio to nearly 49%. This reveals the extent to which the projections for long-term Treasury interest rates remaining below 5½%, in the face of a rising Federal structural budget deficit, depend on a continued large increase in foreign holdings of Treasuries.[28]

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 US budget

[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.

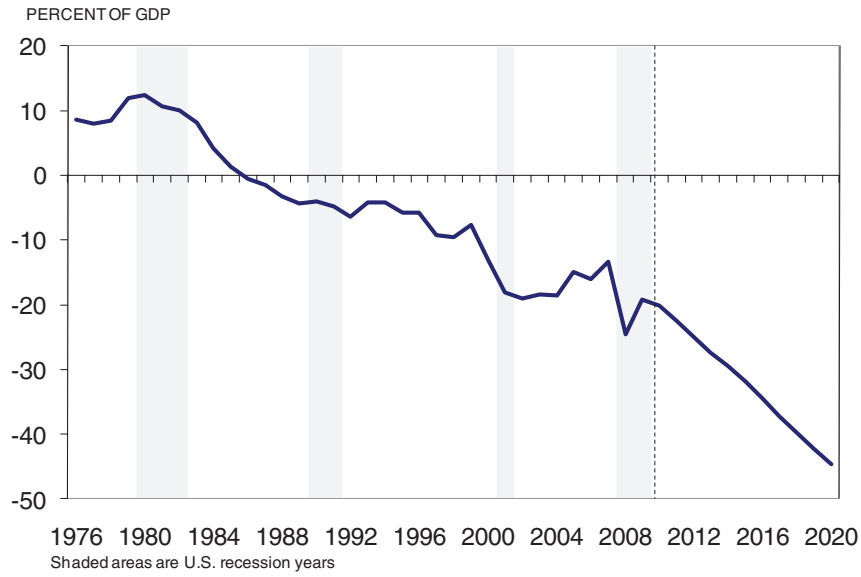

Chart 6: U.S. Net International Investment Position As Percent of GDP

deficits – increasing shares of assets held in US 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.

C. The International Debt and Income Outlook under the Base Case – And Other Issues

The overall US 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, US net international debt as a share of GDP roughly doubles over the ten-year projection period, increasing from about 20% of GDP to 44%. Net international income flows turn negative and steadily decline, from roughly +1% of GDP in recent years to about $-2\frac{1}{2}$% 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 US 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

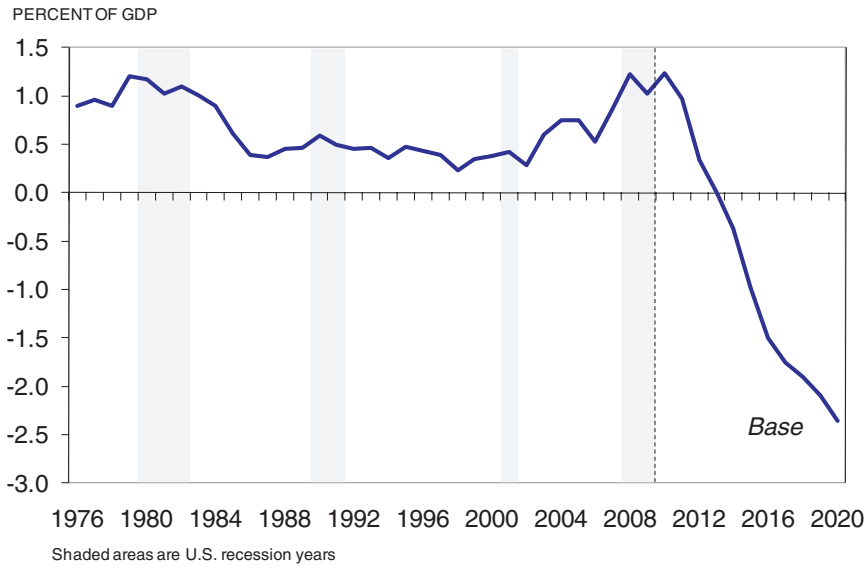

Chart 7: U.S. Net Factor Income (NIPAs) As Percent of GDP

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% 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 2010–20 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 US$13 trillion increase in the base-case projection for publicly held Treasury debt.

[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% to nearly 49%) and the increasing effective rate of return on those assets from just over 2% to around 5%.

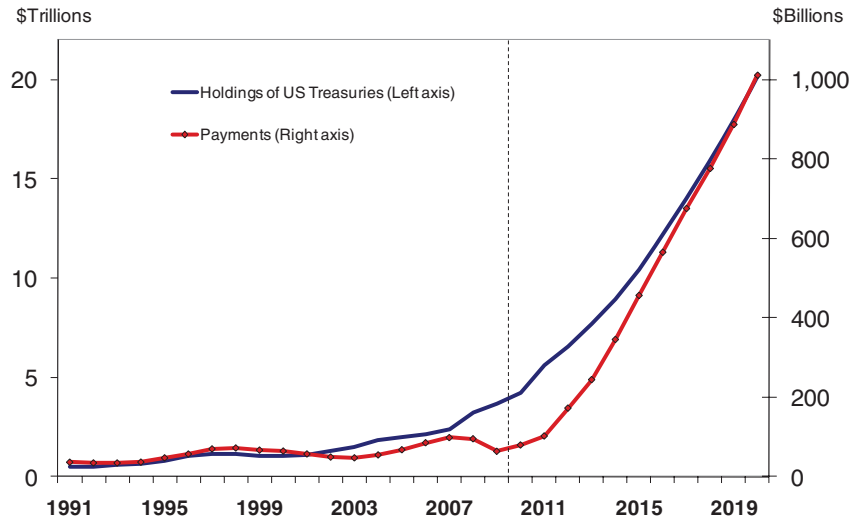

Chart 8: Foreign Holdings of US Treasuries and U.S. Payments to Foreigners on Treasuries

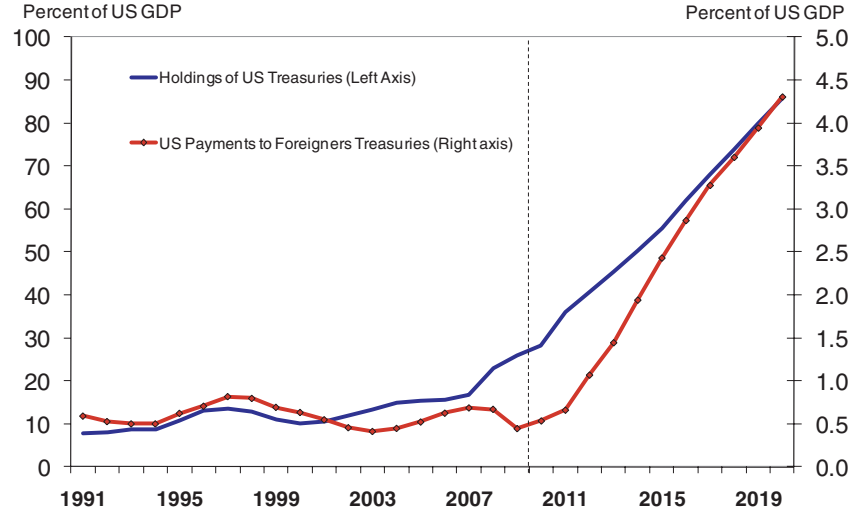

Chart 9: Foreign Holdings of US Treasury Debt and US Government Payments to Foreigners for Treasuries (% of US GDP)

D. 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 US 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.

D.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 US 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 US 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 US 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.

D.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

[30] Note that CBO (2010c) – in its description of the potential economic effects from the President's budget – considered some aspects of the open versus closed economy relationships and the role of international flows. Much of that focus was on the behaviour of private flows – a different perspective than the role of foreign official holdings.

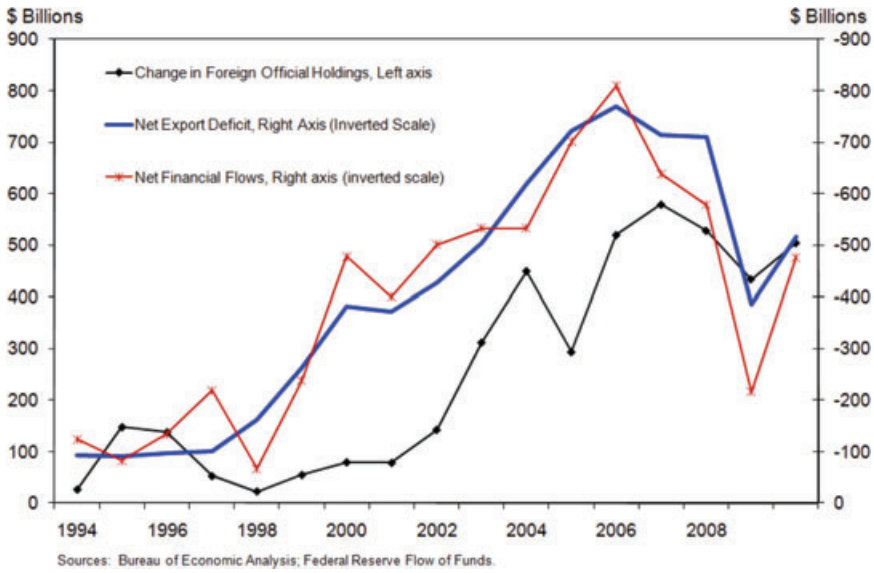

Chart 10: US Net Export Deficit and Change in Foreign Official Holdings

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.

D.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 US Treasury securities as a percent of world GDP (in US dollars). The large increase in foreign official holdings implied by the base case would require those holdings to rise

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

to over 20% of ROW GDP, up from less than 5% for most years of history. Bertaut et al. (2009) and Mann (2009) examine the issue of the US asset share of the total world asset portfolio and the extent to which foreign investment in US assets can increase under continued US current account deficits and growth in the US net international debt. Mann observed a 'financial leverage' for the 'global investor portfolio' of 1.6 times (160%) ROW GDP. The implied increase in foreign official holdings to 20% of ROW GDP by 2020 could at first glance therefore seem to represent a potentially manageable shift compared to the total (non-US) world portfolio. Mann showed that the share of US assets held by foreigners in the world portfolio was about 14% in 2006, and that even with a doubling or tripling of that share (associated with projected US 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 among 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 US 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 US 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]

VI. 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 (that is, 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

[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 US assets under those increased world portfolio shares.

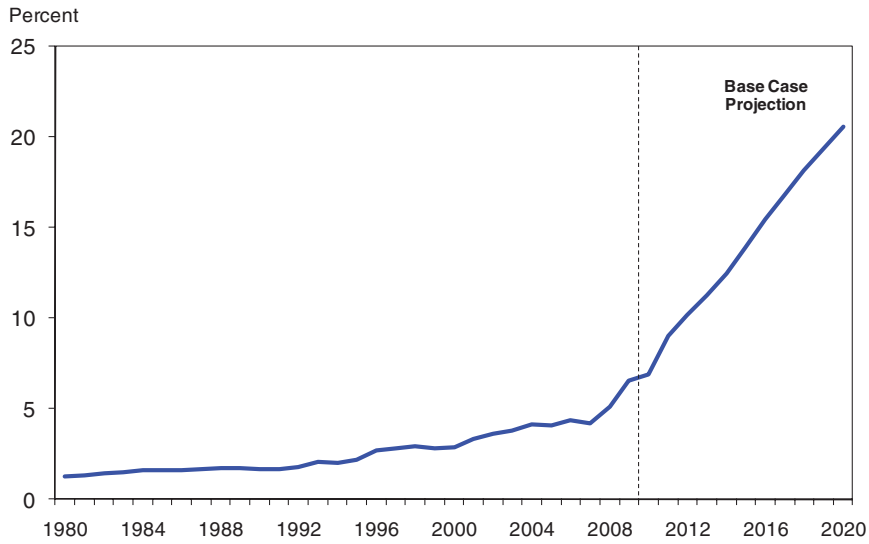

Chart 11: Foreign Official Holdings of Treasuries as Percent of Rest of World GDP – History and Base Case

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.

A. Alternative 1: Foreign Official Holdings Kept at Maintained Percent of US GDP – Higher US Interest rates . . .

If foreign official holdings were not to increase relative to the size of the US economy over the projection period, and were only to grow with the growth in the US 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 US GDP, would have a substantially lower portfolio share of total foreign assets – about 17% by 2020 compared to the base case of about 49%.

Using the estimated relationships from Section IV.A, point estimates show the ten-year Treasury yield would rise relative to the $5\frac{1}{2}$% of the base case for

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	Ten-year Treasury yield, 2020 (%)	General assumption	Federal public debt, 2020, GDP (%)	General assumption	Foreign official portfolio (%), 2020 (2009: 25%)	General assumption	Average annual rate of growth, 2008–20 (%)
Base Case	CBO economics		CBO Alternative 5.4with 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 five 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 US GDP	17	Same as Base	4
Alternative 2	Base with higher inflation, higher ST and LT nominal interest rates, declining exchange value of the US$	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% per year faster than in Base	5

Note: CBO, Congressional Budget Office.

2015–20 to about 7.1% in 2015 and to 7.9% 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 increase by about US$100 billion in 2016 and about US$220 billion by 2020, with a cumulative effect on the debt of over US$1.1 trillion – an additional 5% of GDP – by 2020.[34]

B. *Alternative 2: Faster Sustained Growth of Federal Reserve Holdings of US 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 US 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 1% 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 1% per year. Second, the higher inflation rate passes through to

[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 US debt on borrowing costs, with results suggesting an increase of 50–150 basis points. The analysis of this paper explicitly estimates and addresses the relationships and roles for alternative sources of financing – in particular foreign official versus private – and how those relative allocations would affect long-term Treasury rates.

[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'.

nominal interest rates one-for-one, and the exchange value of the dollar declines by an additional 1% 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 1%. 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.

The 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 US$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% of GDP under the alternative scenario, compared to 94% in the base case. The debt-to-GDP ratio is often viewed as the metric by which the debt burden is measured (see e.g. 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 US Treasury debt, and with ongoing US deficits and debt turnover to be financed, it is important to also recognize the role of payments to foreign holders of US 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 US Treasury debt combined with higher nominal interest rates result in higher payments to foreign holders of US Treasury debt than under the base case – and higher relative to GDP (4.5% of GDP in the alternative compared to 4.3% in the base case). Overall net international income flows are more negative – at −2.8% of GDP in the alternative scenario compared to the −2.4% 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 US nominal GDP and the greater decline in the value of the dollar in this alternative scenario, the US net international debt position relative to GDP is lower at about 41% of GDP in 2020

[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.

compared to the 44% 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. The higher inflation and interest rates of this scenario would lead to higher interest payments on newly issued debt, but existing bondholders would realize lower real value of interest payments, and capital losses on the value of their bond holdings.[37]

VII. Closing Discussion

The analysis and results presented in this paper confirm the fundamental challenges associated with funding US 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 US structural budget deficits, expanded holdings of long-term securities by the Federal Reserve, and foreign official holdings of US Treasuries in determining Treasury security interest rates; the empirical results being used to examine, in particular, the implications for Treasury interest rates 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 would increase the rate of growth for its holdings of US Treasury securities over time, that is, a partial monetization of the debt.

The results from the cases examined highlight several specific challenges and potential trade-offs. 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 perhaps implausibly large amounts – to simultaneously 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 US trade deficits. Those relationships pose a potential problem for assuming both relatively low interest rates and ongoing improvement in the US trade deficit with, at the same time, continued budget deficits and growing debt. Further, if the share of foreign financial flows devoted to US Treasuries increases,

[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, for example Bohn (1992), Hall and Sargent (2010) and the Dallas Fed website http://www.dallasfed.org/data/data/natdebt.htm.

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 US 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 concerns about the financing of the US budget and current account deficits. In the absence of such actions, it is unlikely that the ROW would finance our needs at the terms that are currently being projected, and American policy makers will become less and less the masters of our own economic fortunes.

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Appendix: Examining Alternative Specifications

Researchers have used alternative specifications for examining the effects of US 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 Table A1 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 ten-year Treasury note rate on the left-hand side and the three-month Treasury bill rate on the right-hand side. The coefficient on the three-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 3–5 show specifications that use the CBO's budget surplus/deficit projections (the annual average for the five-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% 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.

Table A1: Regression Results for Alternative Specifications and Testing Constraints

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

Note: Ordinary least squares, sample 1979–2010.
Standard errors are in parentheses;
**significant at the 0.05 level; *significant at the 0.10 level.
DW, Durbin–Watson statistic; SE, standard error of the regression; AIC, 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 month = 1.0) is the test value for the Wald test for the null hypothesis of the coefficients on the three-month rate = 1.0.
Variables are as defined in the text of the paper; five-year deficit projection is the average annual value for the current and five-year-ahead CBO budget surplus/deficit.

To examine whether short-term rates are related to budget deficits, the remaining lines of the table present regressions of the three-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 has 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.

Table A2 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 five-year-ahead debt projections as a share of GDP; the DEBT5 variable is the five-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 ten-year rate as the dependent variable, with the five-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

Table A2: Regression Results for Specifications Using Debt Level

	Dependent variable	*C*	Three-month rate	DEBTAVG	DEBT5	FOROFFICIAL LEVEL	FEDLT LEVEL	Adj. R^2	DW	SE	AIC
1	Spread	−1.269*		0.073**				0.347	0.98	0.994	2.89
		(0.738)		(0.017)							
2	Spread	−0.804			0.063**			0.381	0.94	0.968	2.83
		(0.591)			(0.014)						
3	Ten-year rate	−0.026	0.890**	0.057**				0.896	0.93	0.949	2.82
		(0.944)	(0.056)	(0.018)							
4	Ten-year rate	0.310	0.870**		0.053**			0.910	0.93	0.883	2.68
		(0.684)	(0.049)		(0.013)						
5	Ten-year rate	2.736**	0.716**		0.047**	−0.240**	0.243	0.933	1.18	0.761	2.43
		(0.922)	(0.061)		(0.012)	(0.072)	(0.014)				
First difference specification											
6	Ten-year rate	−0.056	0.616**		0.044*			0.555	2.44	0.768	2.40
		(0.141)	(0.101)		(0.022)						
7	Ten-year rate	−0.010	0.627**		0.057**	−0.168	−0.005	0.536	2.53	0.783	2.50
		(0.160)	(0.105)		(0.027)	(0.199)	(0.163)				

Note: Ordinary least squares, sample 1979–2010.
Standard errors are in parentheses;
**significant at the 0.05 level; *significant at the 0.10 level.
DW, Durbin–Watson statistic; SE, standard error of the regression; AIC, Akaike information criterion.
DEBT is the annual average for the projection of the five-year-ahead debt levels (as percentage of GDP or GNP); DEBT5 is the projected debt level in the fifth year ahead.

variables are relevant at all, it is not flows but stocks which matter'. He found results supporting an 'optimal marginal adjustment' model of portfolio behaviour 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.