



# IMF Working Paper

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## Globalization, Gluts, Innovation or Irrationality: What Explains the Easy Financing of the U.S. Current Account Deficit?

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Volodymyr Tulin*



## **IMF Working Paper**

Western Hemisphere Department

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**Prepared by Ravi Balakrishnan, Tamim Bayoumi, Volodymyr Tulin<sup>1</sup>**

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#### **Abstract**

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This paper examines the roles of U.S. financial innovation, financial globalization, and the savings glut hypothesis in explaining the rise in U.S. external debt, first in a portfolio balance model, and then empirically. Perhaps surprisingly, financial deepening and falling home bias in industrialized countries explain a large share of external financing. The savings glut hypothesis (including difficult-to-track petrodollar recycling) and U.S. financial innovation are also important, in part as a cause of declining home bias in industrialized countries. The latter underscores the importance of not looking at these factors in isolation, but rather as a constellation of forces that can be self-reinforcing.

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	Contents	Page
I.	Introduction.....	4
II.	Portfolio Balance .....	5
	A. The Basic Model.....	6
	B. Rising Financial Globalization and Declining Home Bias.....	7
	C. Global Savings Glut.....	8
	D. Financial Innovation .....	8
III.	Impact on Borrowing Costs .....	11
IV.	Impact on Asset Allocation: Considerations in Decomposing the Rise in U.S. External Debt.....	12
	A. Regional Picture.....	13
	B. Portfolio Balance Between U.S. and Industrialized Country Investors.....	14
V.	Empirical Decomposition of the Rise in U.S. External Debt .....	17
	A. Overview of the Main Factors in the Decomposition.....	17
	B. Further Data Considerations .....	18
	C. Results of the Decomposition .....	18
	D. Home Bias and Financial Deepening in Industrialized Countries .....	20
	E. Global Savings Glut: Emerging Market Country and Petrodollar Financing.....	21
	F. Financial Innovation .....	23
	G. Other Factors Explaining the Residual .....	24
VI.	Conclusions and Implications .....	25
	References.....	37
	Figures	
1.	Financing of the Current Account Deficit .....	4
2.	Selected Yields on Long-Term Government Securities .....	11
3.	Selected Nonfinancial Long-Term Corporate Credit Spreads.....	12
4.	Regional Composition of Net Bond Flows into the United States .....	14
5.	ICAPM-Implied and Actual Bond Holdings of United States vis-à-vis Industrial Countries.....	16
6.	Breakdown of the Net Increase in U.S. Bond Liabilities Against Industrial Countries.....	19
7.	Decomposition of the Net Increase in U.S. Bond Liabilities Against Industrial Countries.....	19
8.	Breakdown of Industrial Countries' Net Purchases of U.S. Bonds (average Weighting) .....	19
9.	Breakdown of U.S. Net Purchases of Industrial Countries Bonds .....	19
10.	Home Bias Trends in Industrial Countries.....	20
11.	Financial Deepening .....	21
12.	Private Debt Securities Outstanding.....	23
13.	Speculative Grade Share of First Time Corporate Issuers.....	24

14.	Issuance of Asset-Backed Securities in Europe and the United States.....	24
15.	Holding of U.S. Long Term Bonds by Emerging Asia Economies.....	27

#### Tables

1.	Impact of Different Explanations of Current Account Financing on Yields and Asset Allocation.....	10
2.	Global Current Account Balances .....	21

#### Appendices

I.	Tracing Out Some of the Effects In the Basic Portfolio Balance Model.....	28
II.	Data .....	31
III.	Derivation of Decomposition of Changes in the U.S. NFA Position .....	32
IV.	Portfolio Balance Between Private and Government Instruments .....	36

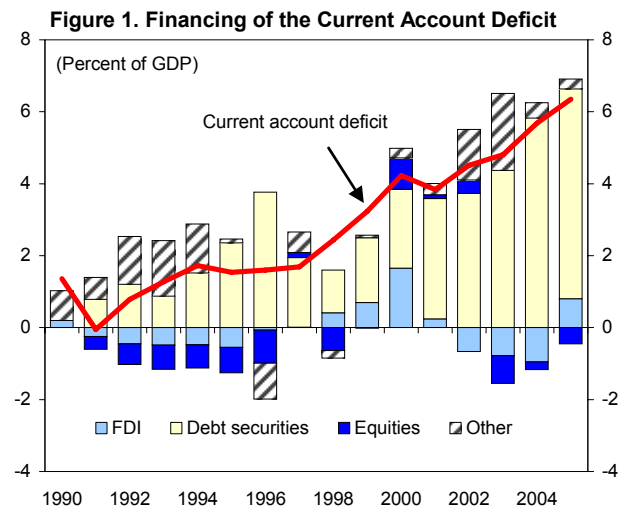
## I. INTRODUCTION

Increasing global imbalances are one of the most striking trends in the international economy. The substantial rise in the U.S. current account deficit as a ratio to GDP over the last decade, counterbalanced by surpluses in Asia and, more recently, oil exporters, has been the focus of significant concern and controversy. For example, global imbalances have been seen as a key risk in the International Monetary Fund's commentary on the global economy in its *World Economic Outlook* since at least the late 1990s.

On the one hand, many macroeconomic analysts have pointed out that an extremely large exchange rate adjustment would be needed to slow or stabilize U.S. international debt (Krugman 2006 and Obstfeld and Rogoff 2005). Markets could also rapidly reassess the need for a "risk premium" to compensate for this depreciation, which is currently absent, suggesting a risk of a rapid and disruptive correction in global financial markets and growth.

On the other hand, the seeming ease with which the current account deficit has been funded has led others to hypothesize that the deficit reflects the underlying strengths of the U.S. economy, in terms of productivity and financial market structure. In this view, financial instruments are correctly priced, and risks of a disorderly adjustment are limited.<sup>2</sup> Indeed, rising U.S. net borrowing has occurred despite market forecasts of dollar depreciation that imply a negative risk premium on the dollar (Balakrishnan and Tulin, 2006). Supporting this, Kamin, Reeve, and Sheets (2007) find that the results of large trade balance adjustments in the U.S. and other industrialized countries have generally been benign.

Some have suggested that the strength of the U.S. economy is a key factor. For example, a higher level of productivity growth may have made U.S. assets more attractive (Caballero, Farhi, and Gourinchas 2006).<sup>3</sup> However, the fact that the rise in U.S. indebtedness has been almost exclusively financed through fixed income instruments as opposed to equity, and that equity valuations (as measured by price-earnings ratios) are modest, suggests that other explanations are needed (Figure 1). In particular, bonds usually have a fixed



Sources: Haver Analytics; Flow of Funds Accounts; and Treasury International Capital System.

<sup>2</sup> See Xafa (2007) for a summary of the "new paradigm view".

<sup>3</sup> Some have also expressed these underlying strengths in terms of the existence of "dark matter" that supports the U.S. income position (Hausmann and Sturzenegger, 2006).

nominal interest rate, and so relative growth prospects should not affect their demand significantly.

Indeed, the real question is why greater net U.S. borrowing has not put upward pressure on U.S. bond rates and spreads. Various explanations have been offered. The first is that demand and supply conditions in global bond markets have lowered borrowing costs. For example, increased saving from rapidly growing emerging markets that has not been matched by additional creation of liquid financial instruments has created a “global savings glut”, possibly allied with a preference for Asian countries to maintain competitiveness in goods markets.<sup>4</sup> Alternatively, at a time of rapid financial globalization and declining home bias, the depth and innovativeness of U.S. financial markets has favored dollar instruments.<sup>5</sup>

This paper provides a framework for evaluating these explanations. First, it sketches a simple International Capital Asset Pricing model of portfolio balance (ICAPM) that illustrates the likely impact of these explanations on government bond yields/corporate spreads as well as the global allocation of U.S. and foreign bonds. Particular emphasis is put on the potential role of U.S. financial innovation—in the form of new instruments with different risk characteristics—in explaining the relative attractiveness of U.S. bonds for international investors. Second, the paper constructs a comprehensive global dataset on bond yields, capital flows, overall foreign asset and liability positions, and size of bond markets from a variety of sources. Using this dataset, the paper then studies a variety of bonds yields across industrialized countries to see if they are consistent with any of the channels traced out in the portfolio balance model. Finally, the paper looks at asset allocation, using an extension of the ICAPM model to decompose the deterioration in the U.S. net foreign asset (NFA) position.

## II. PORTFOLIO BALANCE

In this section, we sketch a highly stylized ICAPM model of portfolio balance which allows us to examine the impact of the global savings glut, declining home bias and financial innovation. As we shall see later in section IV, it’s very difficult to take such a model to the data. Indeed, we will have to extend the model to construct a decomposition that specifically allows us to quantify the impact of the aforementioned factors on the U.S. NFA position. That said, the purpose of the model is to illustrate the likely impact of the different explanations on government bond yields/corporate spreads and the allocation of U.S. and foreign bonds *in all regions*. Further details of the model are provided in Appendix I.

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<sup>4</sup> Bernanke (2005) discusses the global saving glut. Dooley, Folkerts-Landau, and Garber (2003) discuss the “new Bretton Woods” explanation of Asian inflows into U.S. bonds. Other factors may have included limited business investment and regulatory changes that have increased demand for fixed income instruments (IMF, 2006a and b).

<sup>5</sup> Evidence that U.S. markets are innovating faster than competitors is provided in IMF (2006c).

### A. The Basic Model

Consider a model in which bond yields are characterized by a market-determined promised return ( $r$ ) and risks factors ( $\varepsilon$ ) which (for simplicity) are assumed to be normally distributed and uncorrelated. More concretely, let us assume there are two types of bonds—a government security that has a “country specific” risk factor and a corporate bond that also includes a “corporate” risk factor—and two countries—labeled the U.S. and EA (for the euro area). Hence, there are four bonds: U.S. government, euro area government, U.S. corporate, and euro area corporate. In addition to “country specific” U.S. and euro area shocks, we assume a single corporate shock common to both areas. While this is clearly a simplification, and adding factors that represent U.S.- and euro area-specific corporate shocks might be more realistic, this adds complications without changing the underlying conclusions from the model.

The yields on the four instruments are thus:

$$\begin{aligned} r_G^{US} &= f(r, \varepsilon_{US}) \\ r_C^{US} &= f(r, \varepsilon_{US}, \varepsilon_C) \\ r_G^{EA} &= f(r, \varepsilon_{EA}) \\ r_C^{EA} &= f(r, \varepsilon_{EA}, \varepsilon_C) \end{aligned} \tag{1}$$

where  $r$  is the risk free real rate,  $r$  with superscripts/subscripts G, C, US, and EA refer to yields on government, corporate, United States, and euro area bonds, respectively, and  $\varepsilon_{US}$ ,  $\varepsilon_{EA}$ , and  $\varepsilon_C$  refer to the risk factors associated with U.S., EA, and corporate assets, respectively.

There are two identical investors—in the United States and the euro area—with unlimited access to capital at the risk free real rate (assumed to be zero) and identical mean-variance preferences:

$$U = \mu - \sigma^2/2. \tag{2}$$

Assuming outstanding balances for each instrument (using obvious notation) of  $2\alpha_G^{US}$ ,  $2\alpha_G^{EA}$ ,  $2\alpha_C^{EA}$  and  $2\alpha_C^{US}$ , and observing that because investors are identical they each hold half of the market, the investor’s problem is to maximize utility by selecting optimal amounts of each instrument:

$$\begin{aligned} \text{Max } & \alpha_G^{US} r_G^{US} + \alpha_G^{EA} r_G^{EA} + \alpha_C^{US} r_C^{US} + \alpha_C^{EA} r_C^{EA} \\ & - ((\alpha_G^{US} + \alpha_C^{US})^2 \sigma_{US}^2 - (\alpha_G^{EA} + \alpha_C^{EA})^2 \sigma_{EA}^2 - (\alpha_C^{US} + \alpha_C^{EA})^2 \sigma_C^2)/2 \end{aligned} \tag{3}$$



The resulting yields on government bonds and the spread on corporate loans from this maximization problem are:

$$\begin{aligned} r_G^{US} &= (\alpha_G^{US} + \alpha_C^{US}) \sigma_{US}^2 \\ r_G^{EA} &= (\alpha_G^{EA} + \alpha_C^{EA}) \sigma_{EA}^2 \\ r_C^{US} - r_G^{US} &= r_C^{EA} - r_G^{EA} = (\alpha_C^{US} + \alpha_C^{EA}) \sigma_C^2 \end{aligned} \quad (4)$$

Yields on government bonds depend on borrowing by that country in the market and the underlying uncertainty associated with that country, while the spread on corporate bonds depends on the size of overall corporate borrowing and associated risks.

As investors hold identical portfolios, U.S. net international debt is:

$$Net\ Debt = 2((\alpha_G^{US} + \alpha_C^{US}) - (\alpha_G^{EA} + \alpha_C^{EA})) \quad (5)$$

Additional international borrowing involves either more borrowing by the U.S. government or corporates. Such an increase in U.S. borrowing raises interest costs for U.S. and (possibly) foreign corporate borrowers. For example, if the U.S. government borrows an additional  $\delta_G^{US}$ , this will raise the required yield on U.S. government/corporate bonds by  $\delta_G^{US} \sigma_{US}^2$ . If the additional borrowing comes from the U.S. private sector, there is also a rise in spreads on both U.S. and EA corporate spreads of  $\delta_C^{US} \sigma_C^2$ . Hence, higher U.S. international debt comes at the price of higher borrowing costs.

To summarize, we have the following relationships for U.S. borrowing on spreads and net debt:

$$\begin{aligned} \Delta r_G^{US} &= (\delta_G^{US} + \delta_C^{US}) \sigma_{US}^2 \\ \Delta (r_C^{US} - r_G^{US}) &= \delta_C^{US} \sigma_C^2 \\ \Delta US\ net\ debt &= 2(\delta_G^{US} + \delta_C^{US}) \end{aligned} \quad (6)$$

## B. Rising Financial Globalization and Declining Home Bias

One type of explanation for why higher U.S. international debt has not led to higher borrowing costs is that it has been accompanied by a generalized erosion in home bias, which has naturally increased the indebtedness of countries that were initial debtors. In our framework, this can be modeled as a reduction in the disutility of foreign borrowing. This reduction in disutility lowers costs to borrowers while expanding the proportion of assets held by foreigners, thereby increasing net borrowing and net lending (see Appendix I for an illustration of this).

### C. Global Savings Glut

A global savings glut can be modeled in this framework by assuming that a new investor is added to the model but the supply of securities remains the same. Reverting to the baseline model, if the new “emerging Asia” (AS) investor is identical to the other two, then the portfolios of the other two investors each shrink by one-third to accommodate the new region. As a result, all interest rates and spreads are also lowered by one-third. Furthermore, net foreign borrowing by the U.S. rises by one-half as the AS investor now holds one-third of the global portfolio of securities.

The analysis can be made more interesting and realistic by assuming that the AS investor is more concerned about corporate risks (i.e. is more risk averse) and about euro area risks than his/her U.S. and EA counterparts—implying a preference for U.S. government instruments, possibly reflecting intervention to stabilize the dollar exchange rate. In this case, it is easy to show that—compared to the case of adding an identical investor—the addition of this AS reduces U.S. government bond yields by the same amount, but puts less downward pressure on yields on the other three bonds. Reflecting these investor preferences, there is a larger rise in U.S. net international debt than in EA net debt (see Appendix I for further details).

Some analysts have also posited that the downward pressure on yields has come less from a global saving glut than from a dearth of global investment opportunities. In this model, such a situation can be modeled as a reduction in issuance of debt by the U.S. and EA. For this to raise U.S. net international borrowing, the fall must be larger in the EA than in the U.S., implying greater downward pressure on EA than U.S. borrowing costs.

### D. Financial Innovation

#### Innovation Through New Products

Now consider a situation in which the U.S. private sector starts issuing a new bond which is linked to household risk (H) rather than its corporate counterpart (C), and these risks ( $\varepsilon_C$  and  $\varepsilon_H$ ) are assumed uncorrelated. The new bond has the following yield:

$$r_H^{US} = f(r, \varepsilon_{US}, \varepsilon_H)$$

The equations for the rates of return are now:

$$\begin{aligned} r_G^{US} &= (\alpha_G^{US} + \alpha_C^{US} + \alpha_H^{US}) \sigma_{US}^2 \\ r_G^{EA} &= (\alpha_G^{EA} + \alpha_C^{EA}) \sigma_{EA}^2 \\ r_C^{US} - r_G^{US} &= r_C^{EA} - r_G^{EA} = (\alpha_C^{US} + \alpha_C^{EA}) \sigma_C^2 \\ r_H^{US} - r_G^{US} &= \alpha_H^{US} \sigma_H^2 \end{aligned} \tag{7}$$

As investors continue to hold identical portfolios, higher U.S. borrowing will raise U.S. net debt. The difference in this case is that while this additional borrowing raises the return on government bonds as in the base case, diversification into new products unambiguously reduces upward pressures on private spreads, and can even lower the cost of private sector borrowing, particularly for the United States.

To see this, compare the impact of issuing an additional  $\delta_C^{US}$  of “traditional” corporate bonds discussed above with the impact of borrowing the same amount of “new” household bonds on spreads. If the money is borrowed using the “new” instruments, there is now no upward pressure on global corporate bond spreads. Indeed, as the household bond is scarce and hence in high demand its spread remains lower than that for corporates under the not very stringent condition that  $\alpha_H^{US}$  is less than  $(\alpha_C^{US} + \alpha_C^{EA}) \sigma_C^2 / \sigma_H^2$ . Hence, the average spread on U.S. private sector borrowing falls as long as the additional borrowing in household bonds is lower than the risk-adjusted aggregate size of the corporate bond market. Moreover, to the extent that additional issuance in the new H market partly substitutes for borrowing in the C market—and hence the aggregate amount of U.S. corporate borrowing ( $\alpha_C^{US}$ ) is reduced—these “new” instruments will lead to a fall in global corporate spreads.

In addition to the reduction in the level of spreads as a result of introducing the new bond, it can also be easily shown that additional borrowing now puts less upward pressure on spreads than in the case when there are only corporate bonds (this assumes that the additional borrowing comes in part from both types of bonds). While the formulas get increasingly cumbersome, it is clear that under some conditions this model of financial innovation implies a fall in the cost of borrowing in the U.S. and elsewhere even if the U.S. increases its overall issuance of bonds and hence incurs higher net debt. Many argue, however, that financial innovation, rather than leading to a new product that creates new risks, leads to a new product that splits existing risks. Appendix I shows that this doesn’t matter, as increased lending with limited impact on borrowing costs generalizes to the case of financial innovation splitting risk.

### **Autonomous Rise in Demand for U.S. Assets**

Financial innovation could also cause an autonomous rise in demand for U.S. assets. In our two country model, this shows up as a decline in home bias (see Appendix I). In a multi-country model, however, it could also show up as an autonomous rise in portfolio demand. In particular, foreign investors could divert more of the capital they allocate to investments abroad to the United States, without a decline in home bias.

In sum, even in the face of an increase in U.S. borrowing and some increase in rates on government bonds, U.S. financial innovation can lead to lower overall borrowing costs through lower spreads on private borrowing, particularly in the United States.

Table 1 summarizes the impact of different factors, using the portfolio balance model, on borrowing costs and the allocation of bonds.

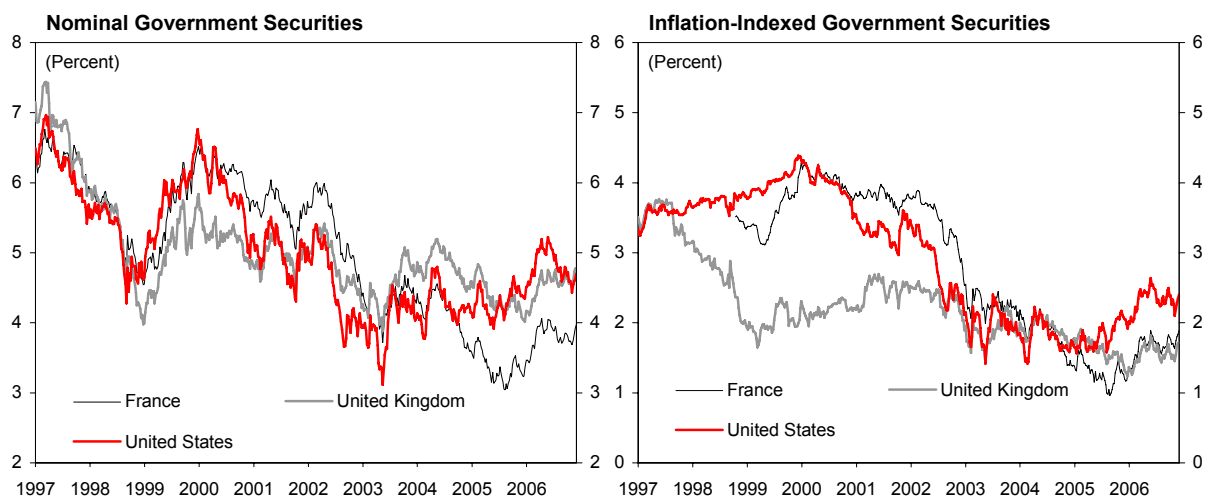
<b>Table 1. Impact of Different Explanations of Current Account Financing on Yields and Asset Allocation</b>		
<b>Change in Financial Structure</b>	<b>Impact on Borrowing Costs</b>	<b>Impact on Asset Allocation</b>
<b>None</b> U.S. issues more traditional government and private sector bonds.	Upward pressure on U.S. government bond yields and on private sector spreads	Rise in U.S. debt being held by other industrialized countries.
<b>Rising Globalization</b> Financial innovation lowers home bias across industrialized countries.	Some downward pressure on all borrowing costs and spreads, and less upward pressure from additional private sector borrowing.	Rise in proportion of industrialized country assets held by other industrialized countries.
<b>Autonomous Rise in Demand for U.S. assets</b> The rest of the world increases its demand for U.S. securities (could be caused by financial innovation).	U.S. yields fall while those on foreign securities do not, and less upward pressure on U.S. government yields from additional U.S. borrowing.	U.S. bonds become a larger part of foreign portfolios with no equivalent change in U.S. portfolios. Could result in a fall in home bias of foreign investors or simply a reallocation of their existing foreign asset portfolios.
<b>Savings glut</b> Financial innovation, rapid economic growth, and reserve build-ups widen the amount of industrialized country assets held by emerging markets.	Downward pressure on all borrowing yields and spreads, particularly U.S. government bonds, and less upward pressure from additional borrowing.	Expansion in proportion of U.S. and other industrialized country assets held by emerging markets.
<b>Financial innovation</b> U.S. issues a large amount of financial instruments that split/reconfigure risk.	Some upward pressure on U.S. government bond yields. A possible fall in private sector spreads, and less upward pressure from additional private sector borrowing.	Rise in U.S. bonds held by other industrialized countries, with much of the increase in new instruments, and potentially, a fall in industrialized country home bias.

### III. IMPACT ON BORROWING COSTS

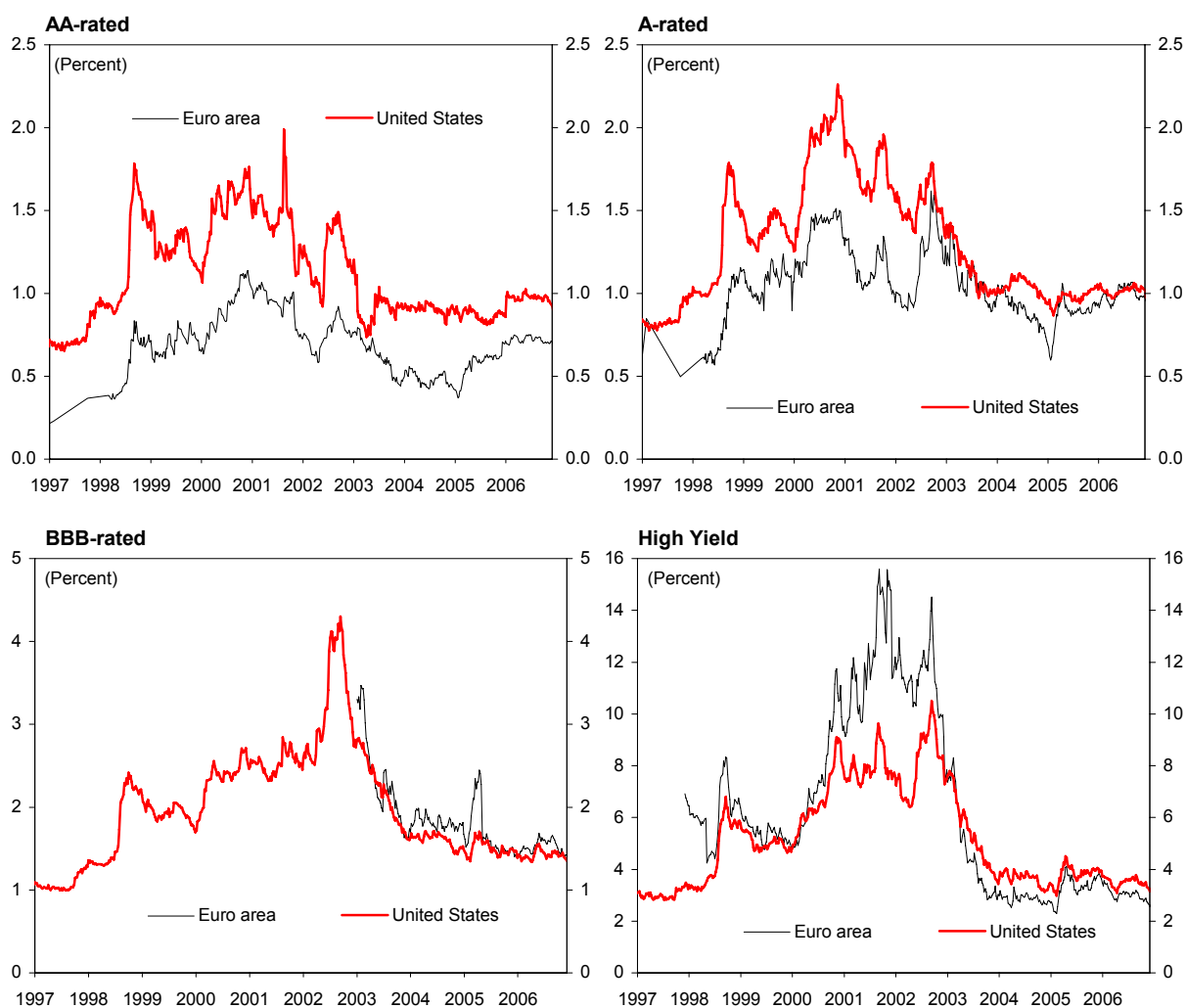
Analyzing yields across assets and countries to discriminate between the different explanations documented in Table 1 is a formidable task given the many factors that affect interest rates, and the difficulty of getting comparable yield data across countries—particularly with respect to corporate bonds. Nonetheless, Figures 2 and 3 make such an attempt, plotting yields/spreads for a variety of industrialized country government bonds, as well as investment grade and speculative grade corporate bonds for the United States and euro area.

In general, low long-term government bond yields have been common to many industrialized countries. Indeed, if anything, they have fallen by more in euro area countries than in the United States over the last few years. On the corporate side, spreads have fallen in both the United States and euro area. Investment grade corporate spreads have tightened a little more in the United States than in the euro area, but the levels of the spreads still remain marginally lower in the euro area. In contrast, speculative grade corporate spreads have tightened by more in the euro area. Overall, while such trends give a mixed picture—and could reflect other factors such as declining macroeconomic and financial volatility—the general decline in yields appears to be consistent with the savings glut and financial globalization hypotheses.

**Figure 2. Selected Yields on Long-Term Government Securities**



Source: Bloomberg L.P.

**Figure 3. Selected Nonfinancial Long-Term Corporate Credit Spreads**

Source: Bloomberg L.P.

#### **IV. IMPACT ON ASSET ALLOCATION: CONSIDERATIONS IN DECOMPOSING THE RISE IN U.S. EXTERNAL DEBT**

In this section, we set out a framework to analyze asset allocation and determine which explanations in Table 1 are consistent with recent trends. There are, of course, limits to what analysis can be done on asset allocation. As alluded to earlier, it is very difficult to take the ICAPM portfolio balance model sketched in section II to the data. That model suggests different global asset allocations for the savings glut, declining home bias in industrialized countries, and financial innovation. But existing datasets do not allow one to track the

proportion of industrialized country assets held by other industrialized countries or emerging markets for a reasonable time span.<sup>6</sup>

Detailed data on country-level U.S. assets and liabilities flows, however, are available from the Treasury International Capital (TIC) System, which records monthly transactions involving U.S. residents and foreigners, mainly reported by brokers and dealers. We use such data to decompose the deterioration of the U.S. NFA position by extending the ICAPM model sketched in section II. Given that most of the external financing has been through the bond market, as noted in section I, we concentrate on the NFA position of the United States with respect to bonds. We make one important correction to the gross bond flows into the United States for principal repayments on asset backed securities (ABSs). The monthly TIC system doesn't track such payments. Since 2002, however, the TIC website has started publishing data on repayment flows associated with foreign holdings of ABSs, which have grown substantially in recent years.<sup>7</sup>

We focus on flows between the United States and four major zones, industrialized countries, emerging market countries (including some large oil exporters), Middle Eastern oil exporting nations, and Caribbean offshore centers.<sup>8</sup> We group the countries as such because we want to discriminate between industrialized country financial globalization and the savings glut hypothesis—the latter which we view as manifested in flows of the “new players” or emerging market countries.<sup>9</sup> We consider Middle Eastern oil exporting nations separately as many analysts have argued that their capital flows are substantial but particularly difficult to track given the lack of information of some of the large sovereign wealth funds in this zone. Caribbean offshore centers are also considered separately, as it has been argued that they act as an important conduit for financing flows to and from the United States.

### **A. Regional Picture**

Figure 4 shows that while net flows from emerging markets to the United States have increased in the last 5 years (constituting around 30 percent of total net flows), the bulk of the

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<sup>6</sup> Coordinated Portfolio Investment Surveys conducted annually under the auspices of the IMF do have some bilateral data of industrialized country holdings in other industrialized countries. For many countries, however, the surveys are not particularly comprehensive, and generally only start in 2001.

<sup>7</sup> Principal repayments on asset-backed corporate and agency bonds are taken out in proportion to their regional holdings, with the latter taken from estimates published in the annual TIC surveys of U.S. liabilities.

<sup>8</sup> See Appendix II for the countries that make up the emerging market countries, Caribbean offshore centers, Middle Eastern oil exporting nations, and industrialized countries.

<sup>9</sup> As Bernanke notes, while population aging in other industrialized countries could also lead to a savings glut, the fact that their aggregate current account surplus has improved only marginally over the last decade suggests that other developments have been more important.

financing has come from the industrialized countries during the last decade (about two thirds). Middle Eastern oil exporter flows are surprisingly low and Caribbean offshore centers do not appear to be a major source of financing. We will analyze in more detail the reasons for such trends in section V.

### B. Portfolio Balance Between U.S. and Industrialized Country Investors

Given the evidence in Figure 4 that industrialized country flows are the biggest source of financing, we focus on decomposing these flows further. We build on the approach outlined in section II, emphasizing the international capital asset pricing model (ICAPM) aspect (also see Bertaut and Grier 2004). This implies that in equilibrium, each investor will hold exactly the same portfolio, which resembles the structure of the world market. Consequently, the allocation of the foreign assets should mirror the market structure of the rest of the world. In this subsection, we sketch a decomposition to demonstrate the main effects. For a full derivation, see Appendix III. Defining  $a$  as the size of U.S. bond markets,  $a^{ic}$  as the size of other industrialized country bond markets,  $a^{em}$  as the size of emerging market country bond markets,  $fa^{ic}$  as total foreign bond assets of other industrialized countries,  $fl^{ic}$  as total foreign bond liabilities of other industrialized countries, and  $fli$  as industrial country assets in the United States, if industrialized country investors place assets in the United States in accordance with the U.S. share in a “borderless” global bond portfolio:

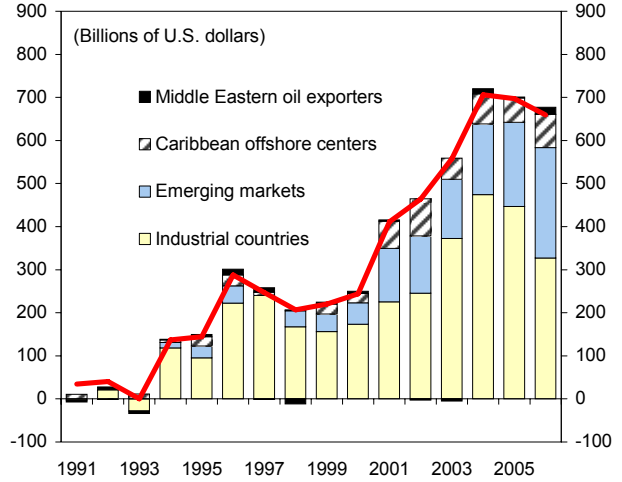
$$fli = \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \quad (8)$$

Totally differentiating equation (8):

$$\Delta fli = \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \left( \frac{\Delta a}{a} - \frac{\Delta(a + a^{ic} + a^{em})}{a + a^{ic} + a^{em}} \right) + \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \frac{\Delta fa^{ic}}{fa^{ic}} \quad (9)$$

We call the first term in equation 9 *the U.S. market effect*, as it shows that even with industrialized country foreign assets staying constant, if U.S financial markets are growing quicker than global markets, there should be a rebalancing within a representative

**Figure 4. Regional Composition of Net Bond Flows into the United States**



Source: Treasury International Capital System.



industrialized country investor's international portfolio, causing a flow into U.S. bonds.<sup>10</sup> The second term shows that if industrialized country foreign assets expand, then there should be a flow into U.S. bonds which is equal to the product of the share of U.S. bond markets in global markets and the increase in industrialized country foreign assets.

To get further insights, we decompose the second term of equation 9 using the concept of home bias. It is well documented that investors strongly favor their domestic markets, or, display home bias. To consider the impact of this, we follow Swiston (2005) and use a measure of home bias that accounts for the size of the domestic financial market relative to the rest of the world:<sup>11</sup>

$$Home\ Bias = \frac{A^*}{A} \bigg/ \frac{W - D}{W} \quad (10)$$

where  $A^*$  represents domestic holdings of foreign assets,  $A$  is domestic holdings of all assets,  $D$  is the size of the domestic market, and  $W$  is the size of the world financial market. The numerator measures the actual share of foreign assets in the portfolio, while the denominator measures what this ratio would be in a fully diversified world according to an ICAPM. A value of zero indicates no holdings of foreign assets, while a value of one indicates that the country's portfolio is perfectly diversified from a geographic perspective. This implies that U.S. investors would be expected to hold a lower share of foreign assets and a higher share of domestic assets, reflecting the country's greater weight in the global financial universe.

We can rewrite equation (10) to give:

$$A^* = \left( A \frac{W - D}{W} \right) HB \quad (11)$$

where  $HB$  is home bias.

Totally differentiating equation (11):

$$\Delta A^* = A^* \left( \frac{\Delta HB}{HB} + \frac{\Delta A}{A} + \frac{\Delta(W - D)}{W - D} - \frac{\Delta W}{W} \right) \quad (12)$$

---

<sup>10</sup> This can be further decomposed into a larger market effect for U.S. private and government bonds, and a compositional effect allowing for a switch between government and private bonds (see Appendix III for details).

<sup>11</sup> This is sometimes referred to as the foreign asset acceptance ratio (FAAR).

The first term of equation (12) represents the increase in foreign assets because of a decline in home bias ( $\Delta HB > 0$ ). The next three terms show notwithstanding constant home bias, because of increasing total assets—which we call *financial deepening*—or a decrease in the size of the domestic markets relative to world financial markets, a rebalancing of portfolios leads to higher demand for foreign assets.

If we insert equation 12 into equation 9, we have a predicted value for industrialized country gross flows, which is a function of three effects:

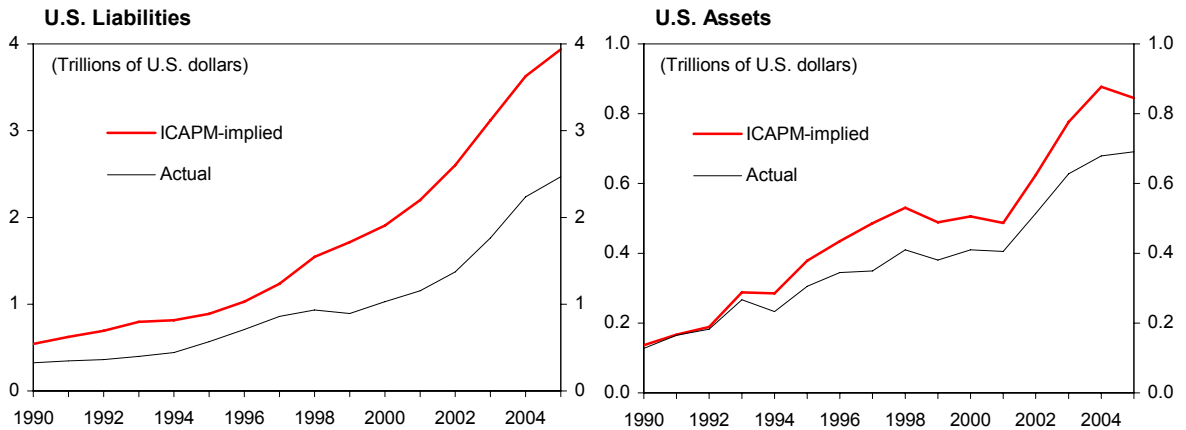
$$\Delta \hat{f}i = (\text{U.S. large market effect}) + (\text{declining home bias effect}) + (\text{financial deepening effect}) \quad (13)$$

As noted earlier, Appendix II has the full derivation of this decomposition and we will discuss in more detail each effect in section V. In this framework, interest rates will be endogenously determined given the shifts in bond market size, home bias, and financial deepening.

We make one final adjustment to equation 13 to take into account that actual stocks differ from the ICAPM benchmarks. In equation 13, the predicted value for inflows is essentially a function of changes in market size, home bias, and total assets; and a weighting factor—the ICAPM benchmarks. As Figure 5 shows, however, according to this criteria, foreign investors have been persistently underweight in U.S. assets (and U.S. investors have been persistently underweight in industrialized country assets). This suggests that we may be overestimating the impact of changes in market size, home bias and total assets on financing. To adjust for this, we add a term called the stock adjustment effect, which is:

$$stock_{adj} = (fli - \frac{a}{a + a^{ic} + a^{em}} fa^{ic}) \frac{\Delta fa^{ic}}{fa^{ic}} \quad (14)$$

**Figure 5. ICAPM-Implied and Actual Bond Holdings of United States vis-à-vis Industrial Countries**



Source: IMF staff estimates.

Thus, as industrialized country investors have been persistently underweight in U.S. assets, the sign of this adjustment is generally negative, reducing the magnitude of the flows predicted by the model:

$$\Delta \hat{f}i_{adj} = (\text{U.S. market effect}) + (\text{declining home bias effect}) + (\text{financial deepening effect}) + stock_{adj} \quad (15)$$

And:

$$\Delta fli = \Delta \hat{f}i_{adj} + \text{residual}_{us} \quad (16)$$

We derive a similar expression to equation 16 for U.S. gross capital flows to industrialized countries (see Appendix III):

$$\Delta fai = \Delta \hat{f}ai_{adj} + \text{residual}_{ic} \quad (17)$$

Where  $fai$  are U.S. assets in industrialized countries. Equations 16 and 17 are the decompositions we take to the data.

## V. EMPIRICAL DECOMPOSITION OF THE RISE IN U.S. EXTERNAL DEBT

### A. Overview of the Main Factors in the Decomposition

To summarize what we have learnt so far, Section IV shows that looking at raw TIC flows suggests that industrial country inflows have been the dominant source of financing of the U.S. current account deficit, although emerging market flows have increased in the last few years. Given this, we also derive a decomposition of the U.S. NFA position with respect to bonds against industrialized countries. This decomposition allows us to trace the impact of four key components on both inflows to and outflows from the United States:

- **Bond market size.** This effect captures a desired rebalancing within a representative industrialized country investor's international portfolio as the relative share of regional bond markets change. As equation 9 shows, for flows into the United States, this is made up of two components: (i) the growth rate of U.S. bond markets relative to that of the global bond markets; and (ii) a weighting factor, which is the share of the United States in the global bond market (also the expected level of bond holdings in the United States according to ICAPM). We have a similar equation for flows out of the United States to industrialized countries.
- **Declining home bias.** This leads to more capital being invested abroad. For industrialized countries, given the share of the United States in the global market,

such a decline leads to significant outflows to the United States. A similar effect applies for U.S. bond outflows to industrialized countries.

- ***Financial deepening.*** As equation 12 illustrates, if the total assets a country holds expands, this can lead to a further demand for foreign assets even if home bias has not changed. There are two components to increasing total assets or financial deepening: growing domestic bond markets and an improving NFA position.
- ***Residual.*** If the residual is positive, this would reflect a “pure” preference for U.S. assets. Part of it could be linked to “catching-up” to ICAPM predicted holdings given that we make an adjustment to the flows predicted by expanding bond markets, declining home bias, and financial deepening for the fact that foreign investors have been persistently underweight in U.S. assets (the stock effect). We will discuss further what else could explain a pure preference in subsection V.G.

Of course, apart from declining home bias and bond market size—which can be clearly linked to financial innovation—these four key components do not map one-to-one into the explanations highlighted in Table 1. Given this, we will discuss the mapping between the two of them in detail once we report the results. Indeed, we will show that financial innovation can be linked to more than just bond market size, and that the global savings glut could be a factor behind a decline in home bias of industrialized countries. Before getting to the results, however, we briefly discuss the dataset put together to estimate the decomposition.

## B. Further Data Considerations

Apart from the TIC data discussed at the beginning of section IV, we also need annual data on the size of bond markets for the United States, industrialized countries, and emerging markets, as well as gross foreign asset positions of the industrialized countries and the United States. For bond market size, we use BIS data, with changes in market size adjusted for valuation effects caused by exchange rate movements. For asset positions, we update the dataset used in Swiston (2005), which uses a combination of IIP data, estimates based on balance of payments, and various official sources (see Appendix II for more details).

## C. Results of the Decomposition

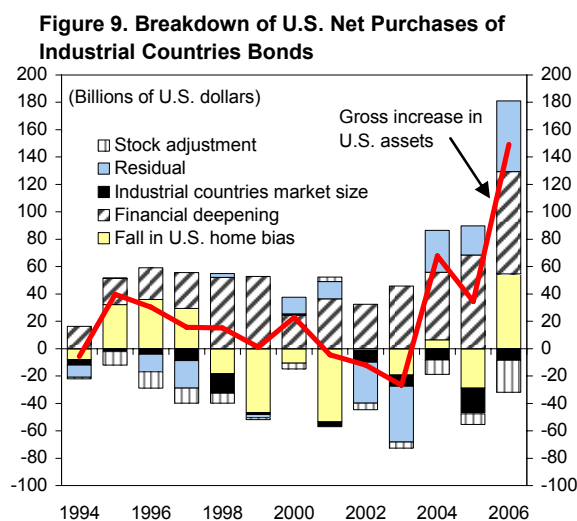
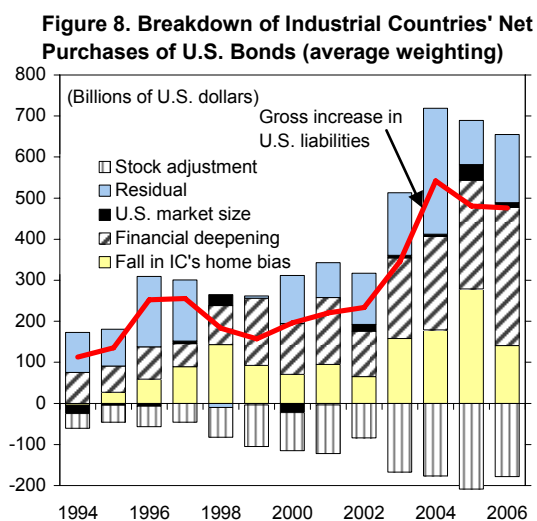
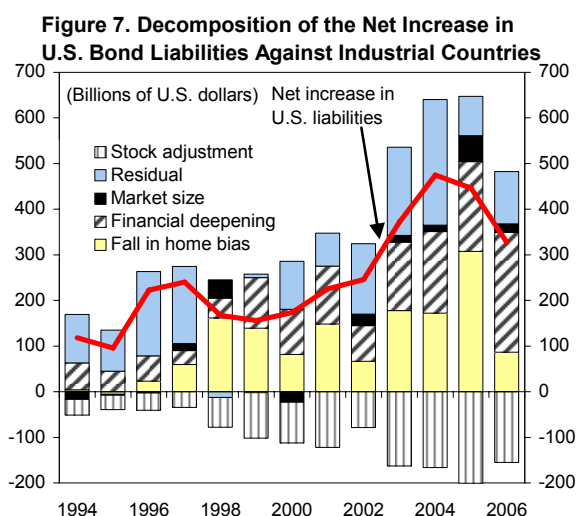
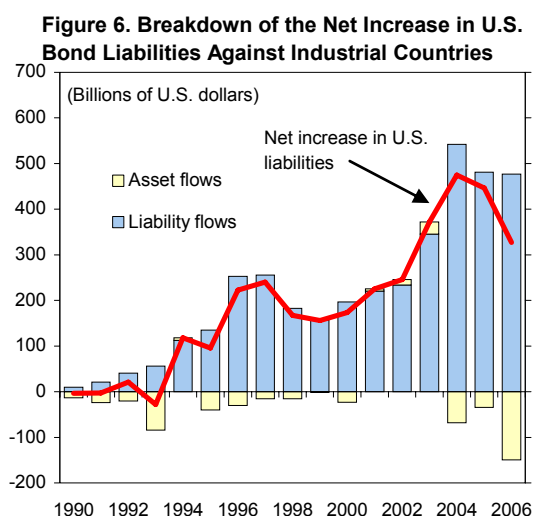
Figures 6-9 plot the results from estimating equation 16 and 17. Figure 6 shows that the trend of deterioration is dominated by liability flows, which for the period 1994-2006 have been over 10 times the size of asset flows. Decomposing overall net flows suggests that financial deepening and declines in home bias have been key drivers over the last decade (Figure 7). There is also, as expected, a negative effect from the stock adjustment; and, in general, a positive residual. As noted in subsection IV.B, these two effects are related. Indeed, in some years (e.g. 2005-6), the stock adjustment more than offsets the residual. This illustrates that if industrial country investors were using ICAPM to determine their purchases of U.S. assets at

the margin, in some years we could more than fully account for net industrial country flows to the United States.

On the liability side (Figure 8), the effect from the expansion of foreign assets of industrialized countries ( $fa^{ic}$ ) dominates, with a negligible U.S. market effect.

Figure 9 decomposes the increase in gross U.S. assets in industrialized countries, illustrating that U.S. home bias, if anything, has been increasing in recent years. Financial deepening in the United States, in contrast, is the main contributor to outflows over the whole period.

Next, we map these results into the explanations outlined in Table 1.

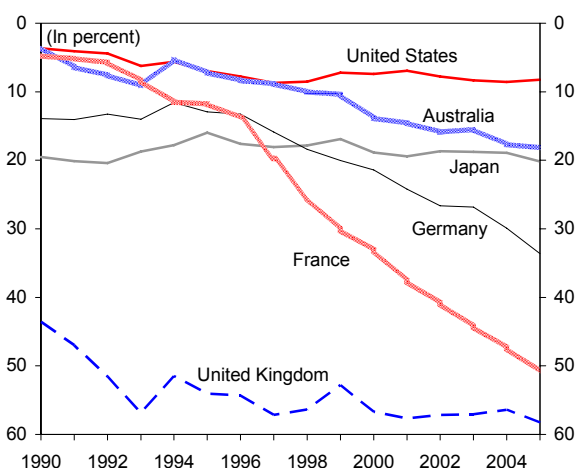


Sources: Treasury International Capital System; and IMF staff estimates.

### D. Home Bias and Financial Deepening in Industrialized Countries

As shown in Figure 10, according to our definition (with an inverted scale), home bias has been falling in industrialized countries in recent years. The level of gross foreign assets and liabilities at the country level has also expanded significantly, often referred to as financial globalization. Factors driving financial globalization and declining home bias include reductions in the costs of cross-border financial transactions, increasing investor sophistication, and financial deregulation (IMF 2005 a, b). For the euro area, the impact of the introduction of the euro cannot be ignored. In particular, it has allowed member countries to take on foreign assets without currency risk, and consequently led to a major reduction in home bias.

**Figure 10. Home Bias Trends in Industrial Countries<sup>1</sup>**

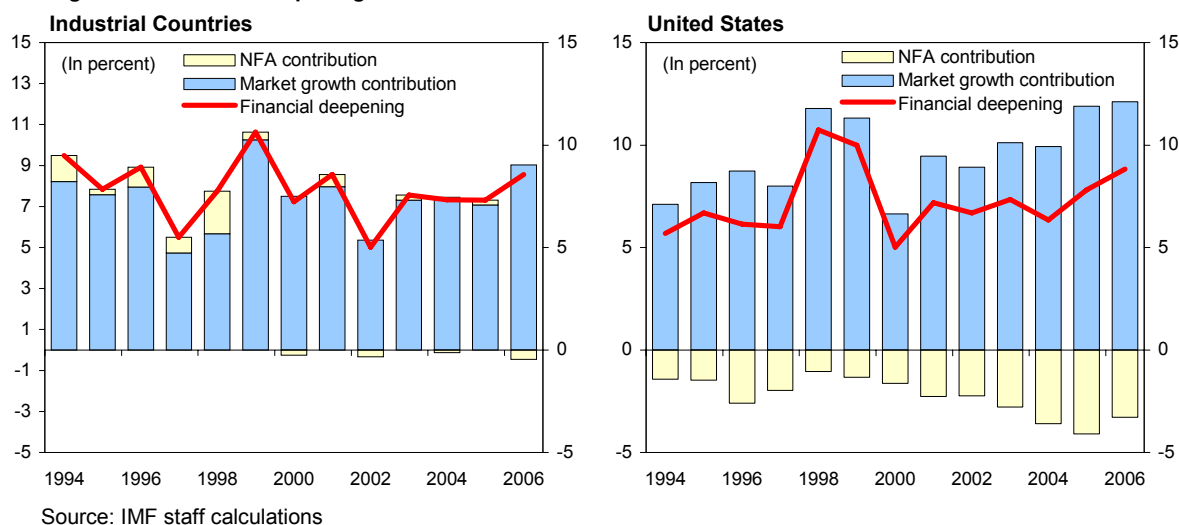


<sup>1</sup>Calculated according to equation 10, but shown on an inverted scale.

Source: IMF staff estimates.

In light of such trends, it is perhaps not surprising that declining home bias can explain a significant portion of expansion of industrialized country assets in the United States. Indeed, it is consistent with the views of former FOMC Chairman Greenspan, who believes that such trends have allowed individual countries to run large deficits for sustained periods (Greenspan 2005). On the U.S. asset side, home bias has remained high. Indeed, it has even increased in some years, and consequently made a negative contribution to U.S. outflows (as seen in Figure 9). This may be consistent with U.S. bond markets already being highly liquid, deep, and innovative, allowing U.S. investors to structure highly diversified portfolios with ease and likely reducing their interest in foreign fixed income securities.

Financial deepening has been the other key factor. For the other industrialized countries, this has mainly come about by a rapid increase in the size of domestic bond markets, rather than an increase in NFA, as their current account surpluses have not changed much over the last decade (Figure 11). As noted earlier, on the U.S. asset side, the biggest contribution to purchases of industrialized country assets comes from financial deepening. Again, this is fully explained by rapid growth of U.S. fixed income markets, as the U.S. NFA position has deteriorated.

**Figure 11. Financial Deepening**

### E. Global Savings Glut: Emerging Market Country and Petrodollar Financing

We noted in section IV.A that while net flows from emerging markets increased significantly in recent years, the bulk of the financing had come from the industrialized countries.

Moreover, despite elevated oil prices for the last few years, Middle Eastern oil exporter flows were surprisingly low. At first glance, this sits oddly with the fact that most of the deterioration in the U.S. current account position is mirrored by an improvement in the current account position of emerging market countries and Middle Eastern oil exporters (Table 2).

	1995	2000	2002	2006
United States	-114	-415	-472	-857
Euro area	56	-41	42	-28
Japan	111	120	113	170
Other industrial countries	-1	35	36	72
Emerging Asia ex. China	-34	58	83	108
China	2	21	35	239
Middle Eastern oil exporters	0	62	29	191
Other major emerging markets	-31	-22	4	72

<sup>1</sup>See Table A.1 for the list of countries included in the aggregated categories.  
Source: IMF World Economic Outlook.

As is well known, however, monthly TIC transactions have significant financial center bias.<sup>12</sup> Indeed, it could be that significant emerging market and petrodollar flows are showing up as industrialized country flows and, thus, explaining part of the residual. To test for the importance of such a bias, we performed some robustness checks using TIC flow data corrected using custodial data—which are considered more accurate and comprehensive—as

<sup>12</sup> For example, if the Bank of China instructed a private bank in London to buy U.S. Treasury bonds from a U.S. resident, this would show up in the TIC system as a treasury bond flow from the United States to the United Kingdom. For further details see Warnock and Cleaver (2002).

reported in infrequent benchmark surveys of U.S. assets and liabilities for the industrialized countries, emerging markets and offshore centers.<sup>13</sup>

While liability data from the benchmark surveys in theory still suffer from custodial bias, it doesn't appear to be strong for the big emerging market countries.<sup>14</sup> For example, the latest annual benchmark liability survey suggested that of the estimated \$1 trillion of reserves that China held at end-June 2006, around 70 percent were in U.S. dollars (assuming that virtually all holdings are official). Various commentators have suggested that this demonstrates that the annual surveys do not significantly undercount Chinese holdings of U.S. assets (Setser 2007), with an ICAPM suggesting that China should be holding around 40 percent of its foreign assets in U.S. securities. Overall, emerging market country flows don't change materially when using the corrected TIC data. Indeed, it appears that financial center bias largely affects country assignment *within* the industrialized countries; in particular, euro area flows are underestimated and U.K. flows are overestimated.

For the Middle Eastern oil exporters, financial center and custodial center biases could be more of a problem, likely explaining why their measured flows are so low. Indeed, as Setser (2007) argues, U.S. asset holdings of the Middle Eastern oil exporters recorded in the annual surveys are low relative to most estimates of total portfolios of the respective central banks and investment authorities. This may reflect the difficulty of tracking purchases of some of the major investment authorities in the Middle East, who rarely report their activities, in sharp contrast to the Norwegian Government Pension Fund. An example of a potentially significant channel for undercounting would be if large purchases are made through private fund managers in London. This would show up as a flow from the industrialized countries to the United States and, thus, explain part of the residual.

However, the trends in Table 2 could also be consistent with another theory—even if the emerging markets countries and Middle Eastern oil exporters haven't been providing direct financing of the US current account deficit, they have been providing *indirect financing* (Higgins, Klitgaard and Lerman, 2006). As a recent McKinsey Global Institute (2007) report notes, it doesn't matter whether such funds are invested in Europe or Asia rather than being invested directly in the United States; by increasing the capital available in the global financial system, they still contribute to the funding of the U.S. current account deficit.

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<sup>13</sup>We thank Frank Warnock for providing us with the benchmark consistent TIC data and readers interested in further details are referred to Thomas, Warnock, and Wongswan (2006) and Chinn, Rogers, and Warnock (2006).

<sup>14</sup> Warnock and Cleaver (2002) argue that while benchmark surveys of U.S. assets should not suffer from custodial bias, surveys of U.S. liabilities probably do. This is because the identifier on a U.S. security only provides information on the custodian, which is not necessarily in the country of the actual owner of the security. Nonetheless, the bias is significantly less than in the raw monthly TIC data.



For example, petrodollars may have been used to purchase assets in Japan. Since Japan is running a balance of payments surplus, this would lead to overfinancing, which, in turn, would lead to Japanese investments elsewhere. In other words, both the gross foreign assets and liabilities of the industrialized countries would expand equally. According to equation 16, this would show up as a decline in home bias of the industrialized countries as their total assets would remain unchanged. Under our decomposition, this would be part of the “declining home bias” component of the financing, but not financial deepening.

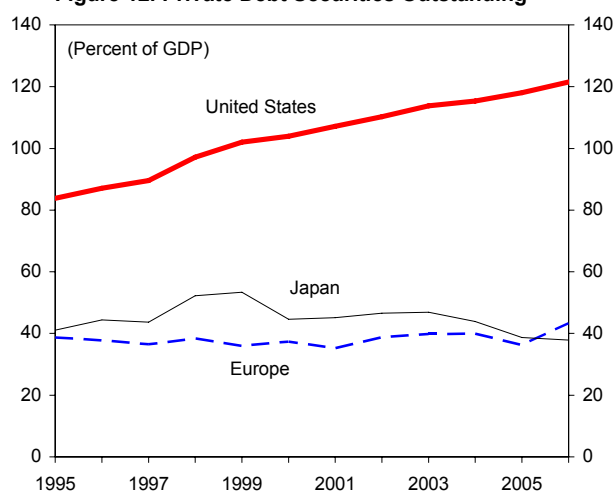
In sum, the global savings glut has likely played a bigger role in providing external financing than a first glance at Figure 4 would suggest. This is partly through misclassified emerging market/petrodollar purchases and its contribution to declining home bias of the industrialized countries, which our results suggest has been a key factor explaining current account financing.

## F. Financial Innovation

As noted in Section II, financial innovation can show up in various forms. It can be consistent with the U.S. market effect if innovation has led to the rapid expansion of U.S. private bond markets relative to other countries. Indeed, Appendix IV shows how the U.S. market effect can be split into a market effect for U.S. private and government bonds, and a compositional effect allowing for a switch between government and private bonds.

As Figure 8 shows, however, the U.S. market effect has not contributed much to inflows from industrialized countries to the United States. This may seem surprising given the global preeminence of U.S. private fixed income markets (Figure 12). But it reflects the fact that while U.S. fixed income markets have grown rapidly, so have such markets in the rest of the world. Thus, the dominance in terms of size of U.S. fixed income markets has not really changed in the last decade, and the U.S. market effect—which depends on changes—is small. It is worth underscoring, however, that although rapid expansion of bond markets both in the United States and abroad tend to offset each other in terms of the bond market size effect, they still lead to a substantial financial deepening effect on both flows into and out of the United States (subsection V.D).

**Figure 12. Private Debt Securities Outstanding**

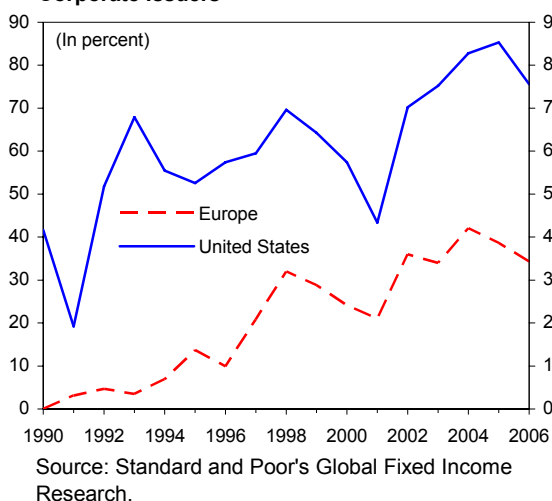


Sources: Haver Analytics; and Bank for International Settlements.

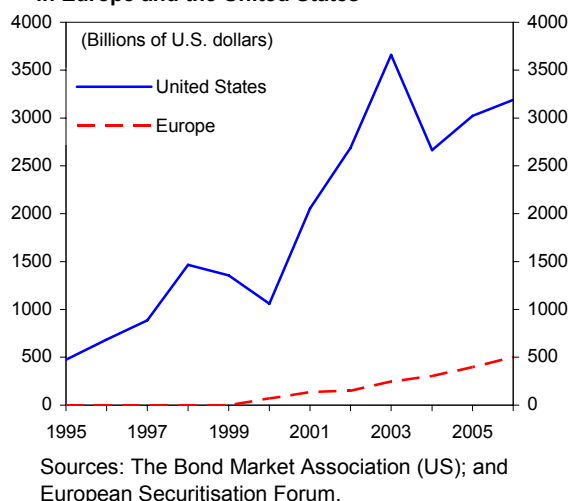
Financial innovation can also show up as a decline in home bias or as a portfolio rebalancing—with foreign investors diverting more of the capital they allocate to investments abroad to the United States—if it leads to an autonomous rise in demand for U.S. assets (subsection II.D). While declining home bias caused by financial innovation will be picked up by our decomposition, any resulting portfolio rebalancing would not be tracked and would show up in the residual.

There are good reasons why foreign investors may have autonomously raised their demand for U.S. fixed income instruments. Simply put, U.S. financial markets have produced assets which investors desire to create diversified portfolios. For example, U.S. corporates issue more speculative grade bonds than European corporates (Figure 13) and U.S. financial markets securitize vastly more assets than markets in other regions (Figure 14), both of which allow investors to purchase a wide array of assets with a variety of risks and embedded leverage. Thus, the *type* of bonds issued and not just the *size* of bond markets is important.

**Figure 13. Speculative Grade Share of First Time Corporate Issuers**



**Figure 14. Issuance of Asset-Backed Securities in Europe and the United States**



### G. Other Factors Explaining the Residual

The fact that the residual fell despite oil prices continuing to increase during 2005-2006 suggests that difficult-to-track petrodollar recycling is only part of the explanation. As noted earlier in this section, inflows associated with financial innovation could also be showing up in the residual. Other explanations for the positive, and often sizable, residual include the reserve currency role of the dollar and the level of investor protection that U.S. financial markets offer.

Does the stock adjustment also help explain the residual? As discussed earlier in this section, the stock adjustment effect is negative over the horizon considered, consistent with foreign investors being persistently underweight in U.S. assets. Clearly, an ICAPM is a

simplification as it implies that investors' relative holdings in equilibrium should depend only on the relative size of bond markets. The world economy, however, has faced many structural changes in recent years—including persistently elevated commodity prices, rapid financial development, and a secular decline in macroeconomic volatility. Given that the impact of such developments on desired portfolios may take time to process, investors may still be in a state of *transition* toward a new equilibrium, and different equilibriums given that they are unlikely to have identical preferences.

Mechanically, the negative stock adjustment reduces the size of the predicted flows from increasing bond market size, declining home bias, and financing deepening. This, in turn, increases the size of the residual. Does this imply that part of the residual could be “catch-up” associated with the stock adjustment effect? Possibly. Certainly, the decomposition does not capture flows associated with industrialized country investors attempting to “catch-up,” because they were initially underweight in US assets, as defined using an ICAPM approach. Although how large this affect could be is debatable as, if anything, the degree to which industrial country investors are underweight in U.S. assets has increased (Figure 5). The later, however, could reflect valuation effects.

## VI. CONCLUSIONS AND POLICY IMPLICATIONS

This paper develops a portfolio balance model to help evaluate to what extent the global savings glut hypothesis, financial globalization and declining home bias, and financial innovation can explain the easy financing of the U.S. current account deficit. One important explanation that we reject is that it reflects high expected U.S. productivity growth. This appears inconsistent with the fact that funding has occurred almost exclusively through fixed income markets and U.S. equity prices are moderate. Rather, globally low long-term interest rates on government debt and tightening spreads on a variety of corporate bonds suggest that the global savings glut and declining home bias in industrialized countries have been important drivers.

This is largely confirmed when looking at a detailed decomposition of the deterioration in the U.S. NFA position with respect to bonds. At a first pass, the decomposition suggests that the *majority* of financing can be explained by declining home bias and financial deepening in industrialized countries. The decomposition, however, also throws up a not insubstantial positive residual in the financing that industrialized country investors have provided to the United States for much of the last decade. This could be consistent with foreign investors having been persistently underweight in U.S. bonds according to an ICAPM model or having a preference for the wide array of bonds that deep and innovative U.S. financial markets issue, as well as difficult-to-track petrodollar recycling.

At a second pass, there are some important nuances to the decomposition. In particular, in many ways, the different factors are intertwined. For example, apart from showing up in the

residual, the global savings glut and financial innovation could also be factors behind the decline in home bias in other industrialized countries. This underscores the importance of not looking at these factors in isolation, but rather as a constellation of forces that can be self-reinforcing.

With most analysts forecasting continued large U.S. current account deficits over the medium term, what are the implications from the conclusions above for the financing of such deficits? To the extent that financial deepening and declining home bias continue in industrialized countries, it would appear that substantial financing will likely continue, consistent with the views expressed in McKinsey (2007).

Regarding financial deepening, one would certainly expect financial market capitalization to continue to grow rapidly in industrialized countries as they increasingly make use of risk transfer instruments—such as asset backed securities, collateralized debt obligations, and collateralized loan obligations—following the trend in the United States.

Regarding home bias, while we have argued that the global savings glut may have supported the trend fall in industrialized country home bias so far, there are other reasons why we may expect such a trend to continue. In particular, IMF 2005a suggests that out of the G-3, Japan still has much to gain from further international diversification. Cooper (2005) also argues that large current account surpluses are likely to persist in industrialized countries, such as Japan and Germany, that have aging populations. Moreover, industrialized country investors are still underweight in US assets using an ICAPM model. Combined with innovative U.S. fixed income markets providing many assets which are simply not available elsewhere, this suggests that, at least for the immediate future, a significant portion of industrialized countries funds to be invested globally will be directed toward U.S. fixed income instruments.

Some have argued that such trends are unlikely to be supported by the big emerging market countries and oil exporters, despite their increasingly important role in providing capital. In particular, as emerging market countries have accumulated significant reserve assets in recent years, it is argued that their sovereign wealth funds (often recently created) will start diversifying away from U.S. treasuries driving dollar depreciation as well as increases in relative interest rates in the United States. Moreover, as fixed income markets in emerging market countries continue the process of “catch up”, this will reduce the share of the United States in the global bond market, causing investors to rebalance their portfolios away from U.S. assets.

Against this, financial deregulation and increasing investor sophistication in these countries are likely to continue to reduce home bias. Combined with financial deepening, this will provide a large pool of funds to be invested globally. For the same reasons as outlined for industrialized countries, and given the reserve currency role of the dollar and the level of

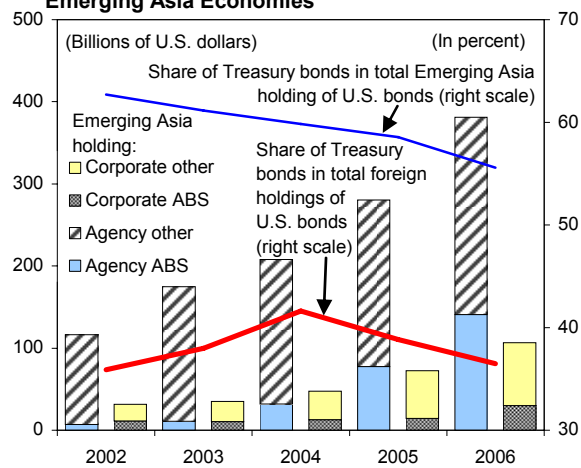
investor protection that U.S. financial markets offer, a substantial portion of such funds, while maybe not directed to U.S. treasuries, will likely be invested in U.S. assets. Indeed, emerging markets countries have already started diversifying away from treasuries—increasingly into asset backed securities (Figure 15)—and China’s sovereign wealth fund made one of its first investments in Blackstone, a U.S. private equity firm, in May 2007.

To be sure, risks to continued easy financing of large U.S. current account deficits remain. In particular, while we have argued that deep, liquid, and innovative U.S. fixed income markets should continue to attract foreign capital, they will have to carry on innovating more rapidly than other financial centers behind the U.S. frontier to retain a relative advantage.<sup>15</sup> Moreover, this relative advantage is one of the reasons why U.S. home bias with respect to bonds has remained so low. Already, U.S. home bias regarding equities has fallen considerably in recent years (IMF 2005b). If the edge that the United States has regarding financial markets is lost—through innovation elsewhere or a loss of attractiveness of securitized assets—it could lead not just to reduced inflows, but *rising outflows* as U.S. investors increasingly look abroad to structure their portfolios.

In this regard, U.S. Treasury Secretary Paulson has recently highlighted a concern regarding the competitiveness of U.S. financial markets (Paulson 2006). Although this is more likely a medium-term issue than a short-term concern, it highlights that the continued preeminence and attractiveness of U.S. financial markets cannot be taken for granted.

A second risk could arise from abruptly changing expectations of dollar depreciation. According to many analysts, further significant dollar depreciation is required to realign the exchange rate with medium-term fundamentals. However, markets are not factoring in this depreciation (e.g., relative long-term real interest rate differentials and consensus forecasts of dollar depreciation remain low). While the United States has gone through previous periods of strong capital inflows despite significant expectations of dollar depreciation (Balakrishnan and Tulin 2006), precisely because it would be unexpected, a sharp change of market sentiment toward the dollar could necessitate a ratcheting up of U.S. interest rates to sustain external financing and cause financial turbulence.

**Figure 15. Holding of U.S. Long Term Bonds by Emerging Asia Economies**



Source: Treasury International Capital benchmark surveys.

<sup>15</sup> The financial “product cycle” could reflect the gap between domestic innovation and foreign imitation—see Krugman (1979) for a model emphasizing a similar product-cycle in goods markets.

## Appendix I: Tracing Out Some of the Effects In the Basic Portfolio Balance Model

### *Rising financial globalization and declining home bias*

To illustrate the impact of declining home bias, consider a version of the model in which the U.S. investor's disutility from investing in U.S. bonds is lower than that from investing in euro area bonds, and vice versa. For example, exchange rate risk might increase the uncertainties involved in holding foreign bonds. More concretely, let us assume the U.S. investor's disutility from risk associated with U.S. bonds is  $\sigma_{US}^2$  and with EA bonds is  $(1+\theta_{EA})\sigma_{EA}^2$ , while the EA investor has disutilities of  $(1+\theta_{US})\sigma_{US}^2$  and  $\sigma_{EA}^2$  for the risks of investing in U.S. and euro area bonds respectively (i.e. their utility functions differ in terms of preferences over the variance of the various bonds). To further simplify the analysis, we will eliminate the corporate bonds (which complicate the mathematics with no additional insights). As each investor has a preference for "local" bonds, if we maintain the assumption that the two investors have unlimited access to capital, and that  $2\alpha_G^{US}$  and  $2\alpha_G^{EA}$  are issued of each bond, this implies interest rates on U.S. and EA government bonds are:

$$\begin{aligned} r_G^{US} &= \alpha_G^{US} (1 + \theta_{US}/(1 + \theta_{US}))\sigma_{US}^2 \\ r_G^{EA} &= \alpha_G^{EA} (1 + \theta_{EA}/(1 + \theta_{EA}))\sigma_{EA}^2 \end{aligned} \quad (A1)$$

As preferences are different across investors, it is necessary to separately identify the amount they each hold. Let  $\alpha_{GUS}^{US}$  be the amount of the U.S. government bond held by the U.S. investor, and  $\alpha_{GEA}^{US}$  be the amount held by the EA investor (with equivalent notation for EA government bonds), it follows that:

$$\begin{aligned} \alpha_{GUS}^{US} / \alpha_{GEA}^{US} &= 1 + \theta_{US} \\ \alpha_{GEA}^{EA} / \alpha_{GUS}^{EA} &= 1 + \theta_{EA} \end{aligned} \quad (A2)$$

Observing that  $\alpha_{GUS}^{US} + \alpha_{GEA}^{US} = 2\alpha_G^{US}$  (again with an equivalent expression for EA bonds), U.S. net international debt is:

$$\alpha_G^{US}/(2 + \theta_{US}) - \alpha_G^{EA}/(2 + \theta_{EA}) \quad (A3)$$

Two factors tend to lead to positive U.S. net debt—greater issuance of U.S. assets ( $\alpha_G^{US}$  being larger than  $\alpha_G^{EA}$ ) and a lower disutility of U.S. assets ( $\theta_{US}$  being smaller than  $\theta_{EA}$ ). This latter can be thought of as the U.S. exorbitant privilege due to a more liquid market and the use of the dollar as a reserve asset and unit of account.

Globalization can be modeled as a fall in the  $\theta$  coefficients that create home bias. This has two effects. First, by expanding the attractiveness of foreign bonds to borrowers it lowers yields. Second, a fall in the  $\theta$  coefficients reduces home bias. Assuming the fall in these

coefficients is equiproportional, this will automatically expand existing net debt/asset positions, hence allowing existing net borrowers to increase their indebtedness “automatically”, even as borrowing costs fall.

The more extreme case is where this is an autonomous rise in preferences for U.S. bonds. This can be modeled as a fall in  $\theta_{US}$ , possibly accompanied by a rise in  $\theta_{EA}$ . Clearly, in this case U.S. interest rates fall while U.S. indebtedness rises. There is, if anything, a rise in costs of borrowing elsewhere. This would also be consistent with financial innovation making U.S. assets more attractive to foreign investors with heterogeneous preferences.

### ***Global savings glut with emerging Asian investors preferring U.S. government bonds***

Formally, let us assume that the AS investor has the same access to capital as the other two investors, but has perceived disutilities of  $(1+\theta_C)\sigma_C^2$  and  $(1+\theta_{EA})\sigma_{EA}^2$  with respect to the variance of corporate and euro area government bonds respectively. In this case, for any given rate of return the new investor will have the same demand for U.S. government bonds as the other two investors.

For the EA government bonds, however, the demand from AS will be lower by a factor of  $1/(1+\theta_{EA})$ , for the U.S. corporate bond the demand will be lower by a factor of  $1/(1+\theta_C)$ , while for the euro area corporate bond, the demand will be lower by  $(\sigma_{EA}^2+\sigma_C^2)/(\sigma_{EA}^2(1+\theta_{EA})+\sigma_C^2(1+\theta_C))$ . In this case, it is easy to show that—compared to the case of adding an identical investor—the addition of this AS reduces U.S. government bond yields by the same amount, but puts less downward pressure on yields on the other three bonds. Reflecting these investor preferences, there is a larger rise in U.S. net international debt than in EA net debt.

### ***Innovation through splitting existing risk***

One objection to the analysis of financial innovation contained in the previous section is that the new bond is more likely to split up existing risk than to create a new variety of risk. For, example, suppose the initial “corporate” bond was floated by an investment bank, which has both corporate loans and household mortgages as assets. It then decided to issue securities backed by the payments on the mortgages. As these mortgages are effectively no longer on the investment bank’s books, the bond now has only commercial risk. Issuing the mortgage-backed security has thus separated the corporate and household risks initially bundled in the corporate bond, but has not lowered these risks.

This separation of risk can also lower borrowing costs, although demonstrating this requires adding some complications to the model. Assume as before that there is initially only a government and a corporate bond (C), but now the corporate bond has two sources of risk, associated with firms (F) and households (H):

$$r_C^{US} = f(r, \varepsilon_{US}, \varepsilon_C, \varepsilon_H) \quad (A4)$$

Assume that the two investors continue to have the same access to funds but different preferences for the two types of risk, possibly because of asymmetric information or different consumption bundles. More specifically, let us assume that for the U.S. investor the negative disutility for  $F$  and  $H$  risks are  $\sigma_F^2$  and  $(1+\theta)\sigma_H^2$ , respectively, while for the EA investor the disutilities are  $(1+\theta')\sigma_F^2$  and  $\sigma_H^2$  where  $\theta' = \theta\sigma_H^2/\sigma_F^2$ .

For the single corporate bond, C, both investors perceive the same risk  $(\sigma_F^2 + (1+\theta)\sigma_H^2)$ , so the amount of this bond being held by the U.S. investor (denoted by  $\alpha_C^{US}$ ) is equal to the amount being held by the EA investor ( $\alpha_C^{EA}$ ) and rates of return are:

$$\begin{aligned} r_G^{US} &= (\alpha_G^{US} + \alpha_C^{US}) \sigma_{US}^2 \\ r_G^{EA} &= (\alpha_G^{EA} + \alpha_C^{EA}) \sigma_{EA}^2 \\ r_C^{US} - r_G^{US} &= r_C^{EA} - r_G^{EA} = (\alpha_C^{US} + \alpha_C^{EA}) (\sigma_F^2 + (1+\theta)\sigma_H^2). \end{aligned} \quad (A5)$$

Suppose now, however, that instead of issuing a single bond in quantity  $2\alpha_C^{US}$ , the U.S. firm replaces it with half this amount ( $\alpha_C^{US}$ ) of a “firm” bond with only F risk and an equal amount  $\alpha_C^{US}$  of a bond with only household risk (denoted H). The yields on the two bonds are now:

$$\begin{aligned} r_F^{US} &= f(r, \varepsilon_{US}, \varepsilon_F) \\ r_H^{US} &= f(r, \varepsilon_{US}, \varepsilon_H) \end{aligned} \quad (A6)$$

The U.S. investor is now able to hold relatively more of the F bond, that (s)he prefers, and the EA investor relatively more of the H bond. Using obvious notation, it follows that  $\alpha_F^{US}/\alpha_F^{EA} = \theta$  and  $\alpha_H^{EA}/\alpha_H^{US} = \theta$ . Because investors are now holding more of the risk that they feel most comfortable with, it is easy to show that the aggregate spread on U.S. private bonds falls, as does the spread on foreign corporate borrowing (although to a lesser degree).

Additional borrowing from the U.S. which is equally split between the two “new” bonds will lead to the same rise in U.S. net debt as issuing the initial corporate debt, but there is a reduction in pressure on private sector spreads, and private sector borrowing costs can fall if the additional borrowing is associated with a conversion of some of the initial corporate debt into its component risks.



## Appendix II: Data

Table A.1 provides the list of countries included in industrialized countries, emerging markets, and Caribbean offshore centers.

*Debt securities outstanding.* From the Quarterly Review of the Bank for International Settlements, Tables 12A, 12B, 12C, 12D, 16A, and 16B. Bond market size corresponds to the stock of outstanding domestic and international debt securities, while market size change is the sum of net issues of international debt securities and changes in stocks of domestic debt securities adjusted for exchange rate valuations as calculated by BIS.

*Foreign assets position.* Data on international bond holdings and liabilities were kindly provided by Andrew Swiston (see Swiston, 2005), which we update for 2005 and 2006. These combine official data on international investment position with estimates based on balance of payments and various official sources. International bond flows data are from the IMF Balance of Payments Statistical Yearbook and other official sources.

Table A.1. List of Countries			
Industrial Countries	Emerging Markets	Offshore Centers	Middle Eastern Oil Exporters
Austria	Argentina	Bahamas	Bahrain
Australia	Brazil	Bermuda	Iran
Belgium	China,P.R.: Hong Kong	Cayman Islands	Iraq
Canada	China,P.R.: Mainland	Netherlands Antilles	Kuwait
Denmark	Chile		Oman
Finland	Colombia		Qatar
France	Czech Republic		Saudi Arabia
Germany	Hungary		United Arab Emirates
Greece	India		
Ireland	Indonesia		
Italy	Korea		
Japan	Malaysia		
Luxembourg	Mexico		
Norway	Peru		
Netherlands	Philippines		
Portugal	Poland		
Spain	Russia		
Sweden	Singapore		
Switzerland	Slovakia		
United Kingdom	South Africa		
	Taiwan Province of China		
	Thailand		
	Turkey		
	Venezuela		

### Appendix III: Derivation of Decomposition of Changes in the U.S. NFA Position

We focus on flows between the United States and four major zones, industrialized countries (ICs), emerging market countries (EMs), Middle Eastern oil exporting nations (PDs), and Caribbean offshore centers (OFCs)<sup>16</sup>. In other words, we look at:

$$\Delta(fl - fa) = \Delta(fle - fae) + \Delta(flo - fao) + \Delta(flp - fap) + \Delta(fli - fai) \quad (A7)$$

where:

$\Delta fl$  are gross purchases of U.S bonds by ICs, EMs, PDs, and OFCs;  
 $\Delta fa$  are gross U.S. purchases of foreign bonds in ICs, EMs, PDs, and OFCs;  
 $\Delta fle$  are gross purchases of U.S. bonds by EMs;  
 $\Delta fae$  are gross U.S. purchases of EM bonds;  
 $\Delta flo$  are gross purchases of U.S. bonds by OFCs;  
 $\Delta fao$  are gross U.S. purchases of OFC bonds;  
 $\Delta flp$  are gross purchases of U.S bonds by PDs;  
 $\Delta fap$  are gross U.S. purchases of PD bonds;  
 $\Delta fli$  are gross purchases of U.S. bonds by ICs;  
 $\Delta fai$  are gross U.S. purchases of IC bonds.

We further decompose flows between the United States and ICs. Defining  $a$  as the size of U.S. bond markets,  $a^{ic}$  as the size of IC bond markets,  $a^{em}$  as the size of EM bond markets,  $fa^{ic}$  as total foreign bond assets of ICs, and  $fl^{ic}$  as total foreign bond liabilities of ICs, if IC investors placed assets in the United States in accordance with the U.S. share in a “borderless” global bond portfolio:

$$fli = \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \quad (A8)$$

Totally differentiating equation (A8):

$$\Delta fli = \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \left( \frac{\Delta a}{a} - \frac{\Delta(a + a^{ic} + a^{em})}{a + a^{ic} + a^{em}} \right) + \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \frac{\Delta fa^{ic}}{fa^{ic}} \quad (A9)$$

We can derive an equation similar to equations (A8) and (A9) for U.S. investors’ bond purchases in IC countries:

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<sup>16</sup> See Appendix II for the list of countries that make up the EMs, OFCs, PDs, and ICs.

$$fai = \frac{a^{ic}}{a^{ic} + a^{em}} fa \quad (A10)$$

$$\Delta fai = \frac{a^{ic}}{a^{ic} + a^{em}} fa \left( \frac{\Delta a^{ic}}{a^{ic}} - \frac{\Delta(a^{ic} + a^{em})}{a^{ic} + a^{em}} \right) + \frac{a}{a^{ic} + a^{em}} fa \frac{\Delta fa}{fa} \quad (A11)$$

Home bias is measured as:

$$HomeBias = \frac{A^*}{A} \bigg/ \frac{W - D}{W} \quad (A12)$$

where  $A^*$  represents domestic holdings of foreign assets,  $A$  is domestic holdings of all assets,  $D$  is the size of the domestic market, and  $W$  is the size of the world financial market. For small countries, the denominator in the above equation is close to one, and the results of the formula are close to those obtained by taking foreign assets as a share of investors' portfolios. As a simplification, we consider this to be the case for individual industrialized countries. For the United States, however, the denominator is lower, and the difference between the simple share of foreign assets in investors' portfolios and the above formula is larger.

We can rewrite equation (A12) to give:

$$A^* = \left( A \frac{W - D}{W} \right) HB \quad (A13)$$

where  $HB$  is home bias.

Totally differentiating equation (A13):

$$\Delta A^* = A^* \left( \frac{\Delta HB}{HB} + \frac{\Delta A}{A} + \frac{\Delta(W - D)}{W - D} - \frac{\Delta W}{W} \right) \quad (A14)$$

It follows that:

$$\begin{aligned}
(W - D)^{us} &= a^{ic} + a^{em} \\
(W - D)^{ic} &= a + a^{ic} + a^{em} \\
W &= a + a^{ic} + a^{em} \\
A^{*us} &= fa \\
A^{us} &= fa + a - fl \\
A^{*ic} &= fa^{ic} \\
A^{ic} &= fa^{ic} + a^{ic} - fl^{ic}
\end{aligned} \tag{A15}$$

We can now decompose the increase in U.S. and IC foreign assets using equation (A14). For IC foreign assets we have:

$$\begin{aligned}
\frac{\Delta fa^{ic}}{fa^{ic}} &= \left( \frac{\Delta fa^{ic}}{fa^{ic}} - \frac{\Delta(fa^{ic} + a^{ic} - fl^{ic})}{fa^{ic} + a^{ic} - fl^{ic}} \right) && \text{falling home bias in ICs} \\
&+ \left( \frac{\Delta(fa^{ic} + a^{ic} - fl^{ic})}{fa^{ic} + a^{ic} - fl^{ic}} \right) && \text{increasing total assets of ICs}
\end{aligned} \tag{A16}$$

For US foreign assets we have (A17):

$$\begin{aligned}
\frac{\Delta fa}{fa} &= \left( \frac{\Delta fa}{fa} - \frac{\Delta(fa + a - fl)}{fa + a - fl} - \frac{\Delta(a^{ic} + a^{em})}{a^{ic} + a^{em}} + \frac{\Delta(a + a^{em} + a^{ic})}{a + a^{em} + a^{ic}} \right) && \text{falling home bias in US} \\
&+ \left( \frac{\Delta(fa + a - fl)}{fa + a - fl} \right) && \text{increasing total assets of US} \\
&+ \left( \frac{\Delta(a^{ic} + a^{em})}{a^{ic} + a^{em}} - \frac{\Delta(a + a^{em} + a^{ic})}{a + a^{em} + a^{ic}} \right) && \text{declining share of US markets}
\end{aligned}$$

It's important to notice that there is no market size effect in equation (A16) in contrast to equation (A17). This is because for individual ICs, we are assuming that  $W - D \approx W$ . This implies that the last two terms in equation (A14) drop out, reflecting that a change in the country's weight in the global financial universe does not have a significant impact on its asset flows. In contrast, for the United States, the last two terms of equation (A14) do not disappear from the U.S asset flow equation (A17). Substituting equation (A16) into equation (A9) and equation (A17) into equation (A11), we have predicted values for  $\Delta fli$  and  $\Delta fai$ :

$$\begin{aligned}
\Delta \hat{f}li &= \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \left( \frac{\Delta a}{a} - \frac{\Delta(a + a^{ic} + a^{em})}{a + a^{ic} + a^{em}} \right) \\
&+ \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \left( \left( \frac{\Delta fa^{ic}}{fa^{ic}} - \frac{\Delta(fa^{ic} + a^{ic} - fl^{ic})}{fa^{ic} + a^{ic} - fl^{ic}} \right) \right) \\
&+ \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \left( \frac{\Delta(fa^{ic} + a^{ic} - fl^{ic})}{fa^{ic} + a^{ic} - fl^{ic}} \right)
\end{aligned} \tag{A18}$$

$$\begin{aligned}
\Delta \hat{f}ai &= \frac{a^{ic}}{a^{ic} + a^{em}} fa \left( \frac{\Delta a^{ic}}{a^{ic}} - \frac{\Delta(a^{ic} + a^{em})}{a^{ic} + a^{em}} \right) \\
&+ \frac{a}{a^{ic} + a^{em}} fa \left( \frac{\Delta fa}{fa} - \frac{\Delta(fa + a - fl)}{fa + a - fl} - \frac{\Delta(a^{ic} + a^{em})}{a^{ic} + a^{em}} + \frac{\Delta(a + a^{em} + a^{ic})}{a + a^{em} + a^{ic}} \right) \\
&+ \frac{a}{a^{ic} + a^{em}} fa \left( \frac{\Delta(fa + a - fl)}{fa + a - fl} \right) \\
&+ \frac{a}{a^{ic} + a^{em}} fa \left( \frac{\Delta(a^{ic} + a^{em})}{a^{ic} + a^{em}} - \frac{\Delta(a + a^{em} + a^{ic})}{a + a^{em} + a^{ic}} \right)
\end{aligned} \tag{A19}$$

Substituting equations (A18) and (A19) into (A7), we have:

$$\Delta(fli - fai) = \Delta \hat{f}li + resid_{us} - \Delta \hat{f}ai - resid_{ic} \tag{A20}$$

We make one final adjustment to  $\Delta \hat{f}li$  and  $\Delta \hat{f}ai$  for the fact that actual assets of industrialized countries in the United States (and vice versa) are significantly below the stocks suggested by ICAPM. In particular:

$$\Delta \hat{f}li_{adj} = \Delta \hat{f}li + \left( fli - \frac{a}{a + a^{ic} + a^{em}} \right) fa^{ic} \frac{\Delta fa^{ic}}{fa^{ic}} \tag{A21}$$

$$\Delta \hat{f}ai_{adj} = \Delta \hat{f}ai + \left( fai - \frac{a}{a^{ic} + a^{em}} \right) fa \frac{\Delta fa}{fa} \tag{A22}$$

#### Appendix IV: Portfolio Balance Between Private and Government Instruments

The effect of a larger U.S. market on IC's flows to U.S. can be further decomposed into private and government bond market components.

Defining subscripts P and G in market size variables to represent private and government (issuers) components of bond markets, portfolio balance of IC investors can be presented as:

$$\frac{a}{a + a^{ic} + a^{em}} fa^{ic} = \frac{a_P}{a_P + a_P^{ic} + a_P^{em}} \frac{a_P + a_P^{ic} + a_P^{em}}{a + a^{ic} + a^{em}} fa^{ic} + \frac{a_G}{a_G + a_G^{ic} + a_G^{em}} \frac{a_G + a_G^{ic} + a_G^{em}}{a + a^{ic} + a^{em}} fa^{ic} \quad (A23)$$

Using the fact that  $\Delta \left( \frac{a_P + a_P^{ic} + a_P^{em}}{a + a^{ic} + a^{em}} \right) = -\Delta \left( \frac{a_G + a_G^{ic} + a_G^{em}}{a + a^{ic} + a^{em}} \right)$ , the change in the above expression may be expressed as:

$$\begin{aligned} & \frac{a_P + a_P^{ic} + a_P^{em}}{a + a^{ic} + a^{em}} fa^{ic} \Delta \left( \frac{a_P}{a_P + a_P^{ic} + a_P^{em}} \right) + \frac{a_G + a_G^{ic} + a_G^{em}}{a + a^{ic} + a^{em}} fa^{ic} \Delta \left( \frac{a_G}{a_G + a_G^{ic} + a_G^{em}} \right) + \\ & + \left( \frac{a_P}{a_P + a_P^{ic} + a_P^{em}} - \frac{a_G}{a_G + a_G^{ic} + a_G^{em}} \right) fa^{ic} \Delta \left( \frac{a_P + a_P^{ic} + a_P^{em}}{a + a^{ic} + a^{em}} \right) + \frac{a}{a + a^{ic} + a^{em}} \Delta fa^{ic} \end{aligned} \quad (A24)$$

The first two terms imply expansion in IC's holding of U.S. assets as the U.S. increases its share in world private and government bond markets. The third term can be interpreted as a switch in portfolio composition towards private instruments, implying an expansion in the ICs' holdings of U.S. assets given that the U.S. has a larger share in world private bond markets than it does in government bond markets. Finally, the above expression can be written in terms of growth rate differentials (equation A25):

$$\begin{aligned} & \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \left( \left( \frac{\Delta a_P}{a_P} - \frac{\Delta(a_P + a_P^{ic} + a_P^{em})}{a_P + a_P^{ic} + a_P^{em}} \right) \frac{a_P}{a} + \left( \frac{\Delta a_G}{a_G} - \frac{\Delta(a_G + a_G^{ic} + a_G^{em})}{a_G + a_G^{ic} + a_G^{em}} \right) \frac{a_G}{a} \right) + \\ & + \frac{a_P + a_P^{ic} + a_P^{em}}{a + a^{ic} + a^{em}} fa^{ic} \left( \frac{a_P}{a_P + a_P^{ic} + a_P^{em}} - \frac{a_G}{a_G + a_G^{ic} + a_G^{em}} \right) \left( \frac{\Delta(a_P + a_P^{ic} + a_P^{em})}{a_P + a_P^{ic} + a_P^{em}} - \frac{\Delta(a + a^{ic} + a^{em})}{a + a^{ic} + a^{em}} \right) + \\ & + \frac{a}{a + a^{ic} + a^{em}} fa^{ic} \frac{\Delta fa^{ic}}{fa^{ic}} \end{aligned}$$

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