Foreign Ownership of US Safe Assets: Good or Bad?

Jack Favilukis, Sydney C. Ludvigson, and Stijn Van Nieuwerburgh

London School of Economics, New York University, and NYU Stern
Global Imbalances

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- Last 20 years: sharp rise in international demand for U.S. reserve assets, **safe stores-of-value** (Treasuries, Agencies).

- Led to unprecedented degree of **foreign ownership** of U.S. government (-backed) debt, mostly held by Foreign Official Institutions (e.g., **central banks**).
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- Are such trends in international capital flows **good or bad for U.S. welfare**?
Some say trend in foreign ownership of U.S. assets is optimal/benign (e.g., Dooley et. al ’05, Garber ’05, Cooper ’07, Mendoza et. al. ’07 Caballero et. al. 08a’).
Academic Debate

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- **Missing from this debate**: general equilibrium models of aggregate and **idiosyncratic risk**, plausible **financial markets**, and lifecycle **heterogeneity** with which to study the welfare consequences of global capital flows.
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Here: such capital inflows boon for some (by a lot) 😊😊, bane for others (by less) 😐.
What are the consequences for U.S. of foreign capital inflows to U.S. safe assets?
Introduction

Questions

- What are the **consequences** for U.S. of **foreign capital inflows** to U.S. safe assets?

- For **macroeconomic aggregates**: $Y, C, I$  ⇒

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- For **asset prices**: interest rates, house prices, stock prices $\implies$
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For asset prices: interest rates, house prices, stock prices \implies

For household portfolios \implies

For welfare: who stands to gain or lose and how much?
  - Inter-generational tradeoff: young vs. middle-aged vs. old
  - Poor vs. rich
  - Stock- vs. bond- vs. home-owners
Our Goal: A Sufficiently General Model

- **Two-sector** general equilibrium model
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- Large number of overlapping generations
- Aggregate and idiosyncratic (income) risk

3 Asset Markets: Bond (one period risk-free), equity and housing

House is residential durable asset, utility to households illiquid (expensive to trade)–transactions costs used as collateral–collateralized borrowing constraints

Two sources agg. risk: productivity, shock to foreign holdings.
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- Two sources agg. risk: productivity, **shock to foreign holdings**
Definition

Foreign holdings of U.S. assets minus U.S. holdings of foreign assets is net foreign holdings of U.S. assets, or U.S. net liability position.

- Because model is silent on (net) FDI, we focus on the position in securities rather than assets; stylized facts for assets are similar.
Foreign Holdings of U.S. Treasuries and Agencies

- Treasury holdings increased from $1.1trn in 1994 to $4.1trn in 2010

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- As a share of marketable LT Treasuries, foreign holdings increase from **15% in 1974** to **38% in 1997** to **61% in 2008** to **53% in 2010**
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Foreign Holdings Relative to Trend U.S. GDP

- Increase from 16% of U.S. Trend GDP in 2002 to 35% in 2010

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Foreign Ownership of US Safe Assets
Trends Driven By Net Flows into U.S. Safe Assets

- We study changes in net foreign holdings of “safe” assets.
Trends Driven By Net Flows into U.S. Safe Assets

- Net foreign holdings of other securities as fraction of U.S. trend GDP have hovered close to zero since 1994.

![Graph showing trends in net foreign holdings]

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Foreign Ownership of US Safe Assets
Trends Driven By Net Flows into U.S. Safe Assets

- All of trend in U.S. NFL is result of upward trend in net foreign holdings of safe assets.

![Graph showing trends in net foreign holdings to U.S. trend GDP](image-url)
Foreign Official Holdings

- Model foreign asset holdings as owned by governmental holders
  - June 2010: 75% of foreign Treasury holdings are by Foreign Official Institutions (FOI) according to TIC
  - 75% is an underestimate (Warnock and Warnock ’09)
  - FOI holdings account for 81% of increase in foreign holdings of U.S. Treasuries from March 2000-June 2010.
Stylized Facts

Foreign Official Holdings

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- FOI have inelastic demand for U.S. safe securities
  - Krishnamurty and Vissing-Jorgensen ’10: demand for U.S. safe assets by FOI displays zero price elasticity.
  - Large effects on real interest rates (Warnock and Warnock ’09, Bernanke ’11)
Foreign Official Holdings

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- FOI have inelastic demand for U.S. safe securities

- FOI have objective function not well described by behavior of optimizing private investors
  - Regulatory/reserve currency motives (Kohn ’02)
  - Cross-country evidence in Alfaro et al. ’11: argue that “official flows main driver of uphill capital flows;” not well described by neoclassical model; (private flows are, but they go downhill)
Related Literature

- Our study motivated by reserve-driven upward trend in the U.S. net foreign debtor position over time ⇒
  - We study how changes in net foreign holdings of U.S. *safe* assets affect macroeconomy, welfare.
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This paper: silent on consequences of *gross* flows and cyclical fluctuations in foreign holdings of *risky* securities.
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- **Gourinchas and Rey (2007) and Maggiori (2011)** study how U.S. NFA position invested in risky securities varies cyclically across normal and “crisis” times $\Rightarrow$
  - Importance of gross flows.
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These papers are silent on reasons for large and growing **U.S. net foreign debtor position in good times**, and on its **upward trend over time**.
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We view these studies as complementary to ours.
Foreign Bond Purchases in Model

- Time is discrete, a period equals one year
- **Foreign bond holdings** $B_{F,t}$ owned by governmental holders who inelastically place all funds in riskless bond.
- Take observed changes in net capital flows as equilibrium outcomes, calibrate a process to match U.S. data.
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- $b_{F,t} \equiv B_{F,t} / \bar{Y}_t$ evolves according to:
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  b_{F,t+1} = (1 - \rho_b) \bar{b} + \rho_b b_{F,t} + \sigma_b \eta_{t+1}.
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- **Foreign bond holdings** $B_{F,t}$ enter market clearing condition alongside domestic household demand; equilibrium interest rate clears bond market.
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- $b_{F,t}$ reverts to a mean, $\bar{b} =>$ while some amt of debt is expected to be refinanced in perpetuity, amounts above mean cannot.
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  As long as specification of capital flows is good description of data, equilibrium allocations are identical to those from model where the same flows arose endogenously from primitive shocks governing mechanics of trade adjustment.
Independence of Shocks to Foreign Holdings

- Model assumes that innovations to foreign holdings of U.S. safe assets are independent of other shocks in economy (e.g., aggregate productivity shocks)
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- Data suggest this is reasonable approximation
  
  - Estimate Granger Causality regressions of log changes in foreign holdings on lagged log changes and lagged log changes in log changes in GDP or TFP (Fernald ’11)
  
  - Very little explanatory power of lagged GDP or lagged TFP for foreign capital flows (low $R^2$)
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  - Very little explanatory power of lagged GDP or lagged TFP for foreign capital flows (low $R^2$)

- Despite independence of shocks, model endogenously generates mild positive contemporaneous correlation between capital inflows and GDP, commensurate with the data
Equilibrium

- Recursive competitive, bounded rationality equilibrium.
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- Resource constraint: non-housing output = non-housing consumption (inclusive of $F_t$) + $G_t$ + Inv. (gross of adj. costs) less change in value of net foreign holdings:

\[ Y_{C,t} = C_t + F_t + G_t + I_{C,t} + \phi_C \left( \frac{I_{C,t}}{K_{C,t}} \right) K_{C,t} + I_{H,t} + \phi_H \left( \frac{I_{H,t}}{K_{H,t}} \right) K_{H,t} \]

\[ -\left( B_{F,t+1} q(\mu_t, Z_t) - B_{F,t} \right) \]

*Trade Balance*
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\]

- **Trade balance** $\equiv$ current account + net financial income from abroad $\Leftrightarrow$

- Current account $\equiv$ $-\text{change in value of net foreign holdings} = -(B_{F,t+1} - B_{F,t})q_t$, $q_t =$ bond price.
Effect of Capital Flows on Quantities

- Capital inflow finances domestic spending, acts like a positive economic shock.

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Detrended levels of aggregate quantities, high and low inflow states.
## Effect of Capital Flows on Quantities

- Capital **inflow** stimulates *housing consumption*

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</tr>
<tr>
<td><strong>Total Cons.</strong></td>
<td>C</td>
<td>1.11</td>
<td>1.12</td>
</tr>
<tr>
<td><strong>Non-housing Cons.</strong></td>
<td>( C_H )</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td><strong>Housing Cons.</strong></td>
<td>( I_T )</td>
<td>0.64</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>Total Inv.</strong></td>
<td>( I )</td>
<td>0.55</td>
<td><strong>0.58</strong></td>
</tr>
<tr>
<td><strong>Business Inv.</strong></td>
<td>( p^H Y_H )</td>
<td>0.09</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Detrended levels of aggregate quantities, high and low inflow states.
Effect of Capital Flows on Quantities

- Capital inflow stimulates *residential investment*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Δb_F - High Inflows</th>
<th>Δb_F - Low Inflows</th>
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<tr>
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<td>Y 2.23</td>
<td>2.24</td>
<td>2.22</td>
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<td>Total Cons.</td>
<td>C_T 1.59</td>
<td>1.60</td>
<td>1.57</td>
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<tr>
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<td>1.10</td>
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<td>0.68</td>
<td>0.60</td>
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<td>I 0.55</td>
<td>0.58</td>
<td>0.52</td>
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<td>Residential Inv.</td>
<td>p^H Y_H 0.09</td>
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<td><strong>0.08</strong></td>
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Detrended levels of aggregate quantities, high and low inflow states.
## Effect of Capital Flows on Quantities

- Capital inflow stimulates wage growth

### Table: Mean Detrended Levels of Aggregate Quantities, High and Low Inflow States

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<tr>
<td>Output</td>
<td>$Y$</td>
<td>2.23</td>
<td>2.24</td>
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<td>1.60</td>
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Detrended levels of aggregate quantities, high and low inflow states.
Effect of Capital Flows on Quantities

- **Procyclicality** consistent with U.S. data: correlation between 4-qtr change log GDP and 4-qtr change in foreign stock safe assets (1984:Q4-2010:Q2) is 27%

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Detrended levels of aggregate quantities, high and low inflow states.
Effect of Capital Flows on Asset Prices

- **Inflows** have large effects on asset prices.

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<tr>
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<th>(\Delta b_F) - High Inflows</th>
<th>(\Delta b_F) - Low Inflows</th>
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<tbody>
<tr>
<td>(E[R_f])</td>
<td>1.86</td>
<td>2.29</td>
<td>0.55</td>
<td>-3.43</td>
<td>4.60</td>
</tr>
<tr>
<td>(Std[R_f])</td>
<td>2.06</td>
<td>2.28</td>
<td>5.19</td>
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<td>6.05</td>
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<td>(Std[R_S])</td>
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<td>5.50</td>
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<td>(SR[R_S])</td>
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<td>0.41</td>
<td>0.62</td>
<td>0.78</td>
<td>0.46</td>
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<tr>
<td>(E[R_H])</td>
<td>11.20</td>
<td>9.83</td>
<td>12.88</td>
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<tr>
<td>(\Delta (p^S/D))</td>
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Notes: \(R_H\) is housing return, \(R_S\) is stock return, \(R_f\) is risk-free rate, \(p^H/R\) is house price-rent ratio, \(p^S/D\) is stock market price-dividend ratio.
Effect of Capital Flows on Asset Prices

- **Inflow** ⇒ large decline in real interest rate and in expected return on equity, housing

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Effect of Capital Flows on Asset Prices

- Equity premium rises; SR in high $\Delta b_F$ is 70% higher than low $\Delta b_F$.

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Effect of Capital Flows on Asset Prices

- Despite rise in risk, **valuations are higher** because inflow is met with *lower discount rates* and *higher expected dividend growth*.

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Effect of Capital Flows on Asset Prices

- Despite rise in risk, **valuations are higher** because inflow is met with **lower discount rates and higher expected dividend growth.**
  - $p^S/D$ in high $\Delta b_F$ is 48% higher than average

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Effect of Capital Flows on Asset Prices

- **Housing risk premium rises**: SR on housing in high $\Delta b_F$ is 6% higher than low $\Delta b_F$.

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$\Delta (p^H/R)$: 
- $\Delta (p^H/R) = 2.60$ for high $\Delta b_F$.
- $\Delta (p^H/R) = -2.64$ for low $\Delta b_F$.

$\Delta (p^S/D)$:
- $\Delta (p^S/D) = 47.76$ for high $\Delta b_F$.
- $\Delta (p^S/D) = -48.42$ for low $\Delta b_F$.

Notes: $R_H$ is housing return, $R_S$ is stock return, $R_f$ is risk-free rate, $p^H/R$ is house price-rent ratio, $p^S/D$ is stock market price-dividend ratio.
Effect of Capital Flows on Asset Prices

- Lower discount rates ⇒↑ in $p^H / R$, but **effect is small** (2.60% higher than average)

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Effect of Capital Flows on Asset Prices

- Lower discount rates $\Rightarrow \uparrow$ in $p^H / R$, but effect is small (2.60% higher than average)
- Expected rental growth falls: $\uparrow$ res. inv. $\Rightarrow$ expectation of higher future housing stock.

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Effect of Capital Flows on Asset Prices

- Lower discount rates \(\Rightarrow\) ↑ in \(p^H / R\), but effect is small (2.60% higher than average)
- Risk premia rise

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Effect of Capital Flows on Asset Prices

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  - Both of these offset effect of lower interest rates from inflow.

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Endogenous Response of Risk Premia

- Response of risk premia to capital inflow worthy of emphasis.

Higher capital inflows raise risk premia, rather than lower them. This runs contrary to arguments of some (e.g., Geithner, Jan. 11, 2007) that free flow of capital across borders lowers risk premia. Here foreign purchases of safe asset make equity and housing more risky:

- Domestic savers crowded out of safe bond market by governmental holders → Reduces effective supply of safe assets available to domestic investors.
- Domestic investors more exposed to systematic risk in equity and housing markets.
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  - Domestic savers *crowded out* of safe bond market by governmental holders →
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  - Domestic investors *more exposed* to systematic risk in equity and housing markets.
Welfare Calculations

- EV welfare measure:
Welfare Calculations

- **EV welfare measure:**
  - Computes *increment to lifetime utility* (in consumption units) of being in high versus low $b_{F,t+1}$.
Welfare Calculations

- **EV welfare measure:**
  - Computes **increment to lifetime utility** (in consumption units) of being in high versus low $b_{F,t+1}$.
  - Tells how much lifetime composite consumption must be increased so that value from remaining in $b_{F,t}$ equals that from transitioning to $b_{F,t} + \Delta$.

Multiply by 100 to express as %. Positive numbers → welfare gain from transitioning, negative numbers imply welfare loss.
Welfare Calculations

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  - Calibrate $\Delta$ to equal a **one st.dev. innovation** in $b_{F,t+1}(\eta_{t+1})$. 
Welfare Calculations

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- Calibrate $\Delta$ to equal a **one st.dev. innovation** in $b_{F,t+1}$ ($\eta_{t+1}$).

- Calculation for newborns: measure **under veil of ignorance**.
Welfare by Age

- Positive numbers ⇒ welfare gain

Welfare change by age and by quintile of external leverage.

Favilukis, Ludvigson, Van Nieuwerburgh

Foreign Ownership of US Safe Assets
Welfare by Age

- **Young benefit from inflow** (1% EV) and are **hurt by outflow** (-2%).

![Graph showing welfare change by age and by quintile of external leverage.](image)

Welfare change by age and by quintile of external leverage.
Welfare by Age

- **Young benefit** from inflow (1% EV) and are **hurt** by outflow (-2%).
- Inflow raises collateral values, relaxes borrowing constraints, expands risk-sharing/insurance opportunities for young.

![Graph showing welfare change by age and by quintile of external leverage.](image)

Welfare change by age and by quintile of external leverage.
Welfare by Age

- **Young** benefit from **inflow** (1% EV) and are **hurt** by **outflow** (-2%).

- **Inflow** raises wages, lowers borrowing costs

---

**Favilukis, Ludvigson, Van Nieuwerburgh**

**Foreign Ownership of US Safe Assets**
Welfare by Age

- **Middle-aged are hurt** by inflow though effect is smaller

![Graph showing welfare change by age and quintile of external leverage]

Welfare change by age and by quintile of external leverage.
Welfare by Age

- **Middle-aged are hurt** by inflow though effect is smaller
  - Benefit from *higher wages* and asset *valuations*

Welfare change by age and by quintile of external leverage.
Welfare by Age

- **Middle-aged are hurt** by inflow though effect is smaller
- **Hurt** because saving for retirement, they earn *lower expected returns* on assets
Welfare by Age

- **Middle-aged are hurt** by inflow though effect is smaller
  - As savers, *exposed to more systematic risk*, hence higher risk premia

Welfare change by age and by quintile of external leverage.
Welfare by Age

- **Old benefit** from an inflow (1% EV) and would forego up to 2.8% of lifetime consumption to avoid outflow.

Welfare change by age and by quintile of external leverage.
Welfare by Age

- **Old benefit** from an inflow (1% EV) and would forego up to 2.8% of lifetime consumption to avoid outflow.
- Their *horizon is short* so they are unaffected by lower exp asset returns.
Welfare by Age

- **Old benefit** from an inflow (1% EV) and would forego up to 2.8% of lifetime consumption to avoid outflow.

- **Higher asset values** allow to increase consumption today.

Welfare change by age and by quintile of external leverage.
Welfare by Age

- **Old benefit** from an inflow (1% EV) and would forego up to 2.8% of lifetime consumption to avoid outflow.
  - *Less concerned with* higher systematic *risk* because they earn pensions

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Favilukis, Ludvigson, Van Nieuwerburgh

Foreign Ownership of US Safe Assets
Welfare Magnitudes are Potentially Large

- **Youngest** require 1 percent more *lifetime consumption* to make them as well off as they would be transitioning to state where external leverage is higher for *one year* by the *typical annual increment* in Foreign holdings.
Welfare Magnitudes are Potentially Large

- **Youngest** require 1 percent more *lifetime consumption* to make them as well off as they would be transitioning to state where external leverage is higher for *one year* by the *typical annual increment* in Foreign holdings.

- Youngest would be willing to **forgo 2%** lifetime consumption to avoid *just one year* of *typical annual decline* in foreign holdings of safe asset.
Welfare Magnitudes are Potentially Large

- **Youngest** require 1 percent more *lifetime consumption* to make them as well off as they would be transitioning to a state where external leverage is higher for **one year** by the *typical annual increment* in Foreign holdings.

- Youngest would be willing to **forgo 2%** lifetime consumption to avoid **just one year** of *typical annual decline* in foreign holdings of safe asset.

- Effect could be several times larger for **greater-than-typical** decline or for **series** of annual **declines**.
Welfare Magnitudes are Potentially Large

- **Youngest** require 1 percent more *lifetime consumption* to make them as well off as they would be transitioning to state where external leverage is higher for *one year* by the *typical annual increment* in Foreign holdings.

- Youngest would be willing to **forgo 2%** lifetime consumption to avoid *just one year* of *typical annual decline* in foreign holdings of safe asset.

- Effect could be several times larger for *greater-than-typical* decline or for *series* of annual *declines*.

- **Middle-aged**: Gain from *outflow* but abs. value of EV measure for sixty year-olds is 10 times smaller.
Welfare Effects of Outflow by Wealth and Income

- The **wealthy young** are able to self insure without benefit of easier borrowing terms ⇒ they **suffer least**

Welfare change by age and by income (left) or net worth (right).

Favilukis, Ludvigson, Van Nieuwerburgh

Foreign Ownership of US Safe Assets
Welfare Effects of *Outflow* by Wealth and Income

- The **wealthy old** suffer most b/c asset values drop; they have more to lose than least wealthy.

Welfare change by age and by income (left) or net worth (right).
Welfare Under Veil of Ignorance (Newborns)

- Provides one way of summarizing the expected welfare effects over the life cycle

![Graph showing the cost of being born in the 1st quintile (b_{F,t+1}^{(1)}) relative to the 5th quintile (b_{F,t+1}^{(5)}) over different quintiles of b_{F,t+1}.]
Welfare Under Veil of Ignorance (Newborns)

- Computed using value function at **start of life**

The graph shows the expected value (EV) compared to being in the fifth quintile for different quintiles of $b_{F,t+1}$. The cost of being born in the 1st quintile ($b_{F,t+1}^{(1)}$) relative to the 5th quintile ($b_{F,t+1}^{(5)}$) is illustrated.
Welfare Under Veil of Ignorance (Newborns)

- Incorporates agent’s expectation of lifetime utility over all possible aggregate, idiosyncratic shocks.
Welfare Under Veil of Ignorance (Newborns)

- Individual born into 5th quintile of $b_{F,t+1}$ (but with same $b_{F,t}$) would be willing to forego 18% lifetime consumption to avoid being born into 1st quintile $b_{F,t+1}$. 

![Graph showing EV compared to being in fifth quintile](chart.png)
Conclusion

- Foreign Official purchases of U.S. safe assets have surged in past 20 years.

- Foreign inflows are **stimulative**: raise output, consumption, investment, wages, and valuations. They **lower interest rates** and expected asset returns but **raise risk premia**.

- Low real interest rates are a **boon to young households** who can purchase a (larger) home earlier, and to **older households** who enjoy capital gains

- **Reduction in foreign holdings** from a high level would hurt average household but especially the young and old; **middle-aged savers might benefit**

- **Under veil of ignorance**: Better to be born into world where **foreigners buy lots of domestic debt**
Government

- Inelastically supplies bonds in quantity $B^G_t = b^G Y^{TR}_t$

- Government debt to trend GDP, $b^G$, assumed fixed at observed 0.30 value (1984-2008)
In inelastically supplies bonds in quantity $B_t^G = b^G \gamma_t^{TR}$

Government debt to trend GDP, $b^G$, assumed fixed at observed 0.30 value (1984-2008)

Government uses taxes/transfers to keep debt-trend GDP constant:

$$p_t^L \mathcal{L}_t = T_t + \gamma_t^{TR} b^G (q_t e^g - 1)$$

If land revenues are insufficient to pay interest on the debt, the government taxes households (lump-sum): $T_t < 0$. 

Favilukis, Ludvigson, Van Nieuwerburgh
Government

- Inelastically supplies bonds in quantity $B_t^G = b^G Y_t^{TR}$
- Government debt to trend GDP, $b^G$, assumed fixed at observed 0.30 value (1984-2008)
- Government uses taxes/transfers to keep debt-trend GDP constant:
  \[ p_t^L \mathcal{L}_t = T_t + Y_t^{TR} b^G (q_t e^g - 1) \]
- If land revenues are insufficient to pay interest on the debt, the government taxes households (lump-sum): $T_t < 0$. 

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Foreign Ownership of US Safe Assets
All of upward trend in U.S. net debtor position due to the upward trend in foreign purchases of U.S. safe assets.

U.S. Capital Flows

**Comments**

- **Current Account deficit**
- **∆ net foreign holdings all assets**
- **∆ net foreign holdings all securities**
- **∆ net foreign holdings safe securities**

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**Foreign Ownership of US Safe Assets**
Comments

Beginning of 2000

Beginning of 2006

End of 2010

Beginning of 2000

Appendix

U.S. Capital Flows

- ∆ net foreign holdings all assets
- ∆ net foreign holdings all securities
- ∆ net foreign holdings safe securities
- Current Account deficit

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Foreign Ownership of US Safe Assets
U.S. Capital Flows

Comments

- Beginning of 2000
- Beginning of 2006
- End of 2010

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Foreign Ownership of US Safe Assets
U.S. Capital Flows

Comments

- Beginning of 2000
- Beginning of 2006
- End of 2010

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Foreign Ownership of US Safe Assets
Measures of U.S. Capital Flows

Appendix

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Foreign Ownership of US Safe Assets
Appendix

Measures of U.S. Capital Flows

<table>
<thead>
<tr>
<th>Year</th>
<th>∆ net foreign holdings</th>
<th>∆ net foreign securities</th>
<th>∆ net foreign safe securities</th>
<th>Current Account deficit</th>
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<td>2010</td>
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</tbody>
</table>

End of 2005 →

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Foreign Ownership of US Safe Assets
Related Literature

- Incomplete markets and equity pricing
  - Aiyagari and Gertler ’91; Telmer ’93; Lucas ’94, Heaton and Lucas ’96; Basak and Cocco ’98; Luttmer ’99; Lustig and Van Nieuwerburgh ’05; Storesletten et. al ’07; Gomes and Michaelides ’08; Favilukis ’08, Krueger and Lustig ’09, Chien, Cole, and Lustig ’10.

- Incomplete markets and housing
  - Fernandez-Villaverde and Krueger ’05; Rios-Rull and Marcos ’06; Peterson ’06; Ortalo-Magne and Rady ’06; Lustig and Van Nieuwerburgh ’07 ’08; Piazzesi and Schneider ’08; Kiyotaki et. al., ’08; Corbae and Quintin ’09, Favilukis, Ludvigson, and Van Nieuwerburgh ’10.

- Global imbalances and sudden stops
  - Mendoza, Quadrini, and Rios-Rull ’07, Caballero, Farhi, and Gourichas ’08 (a,b), Obstfeld and Rogoff ’09, Caballero ’11, Farhi, Gourinchas, and Rey ’11
  - Calvo ’98; Caballero and Krishnamurty ’01; Martin and Rey ’06; Gertler, Gilchrist, Natalucci ’07; Mendoza ’10.

- Foreign Ownership of US Safe Assets
  - Favilukis, Ludvigson, Van Nieuwerburgh

- Obstfeld and Rogoff ’09
Related Literature

- Incomplete markets and equity pricing
  - Aiyagari and Gertler ’91; Telmer ’93; Lucas ’94, Heaton and Lucas ’96; Basak and Cocco ’98; Luttmer ’99; Lustig and Van Nieuwerburgh ’05; Storesletten et. al ’07; Gomes and Michaelides ’08; Favilukis ’08, Krueger and Lustig ’09, Chien, Cole, and Lustig ’10.

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  - Calvo '98; Caballero and Krishnamurty '01; Martin and Rey '06; Gertler, Gilchrist, Natalucci '07; Mendoza '10.
Cumulative Loan-Value Ratios, LA County

- CLTV ratio at time of home purchase; percentage all home purchases.

Properties with CLTV greater or equal to 1

Fraction

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

0.1
0.2
0.3
0.4
0.5
0.6

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