Valuation Effect, Heterogeneous Investors and Home Bias

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Abstract

This paper examines the U.S. valuation effect (VE) on empirical and theoretical grounds. The empirical results show the importance of the VE for the U.S. during 1976-2015. In particular, the return differential between U.S. assets and liabilities averaged 3.5% and the portfolio investment (PI) was the main contributor to the return differential. Furthermore, the decomposition of the PI return differential into capital gains and exchange rate fluctuations provides evidence that most of the valuation changes came from asset price movements and that there was a U.S. dollar appreciation in periods of high asset price volatility. I use the portfolio balance approach in a general equilibrium framework to investigate the underlying factors of the VE channel. The microfoundations for the portfolio composition allow me to characterize the return differential as an equilibrium outcome and to derive the home bias restriction. This constraint not only restrains the solution space of the investors’ optimization problem but also increases the disparity of the attitude towards risk between domestic and foreign investors. For this reason, the numerical simulation shows that the standard assumptions of homogeneous investors and logarithmic utility function lead to optimal shares that are inconsistent with the data. Finally, the model is able to replicate some empirical facts of the U.S. VE, specifically the appreciation of the U.S. dollar in times of high volatility and the decrease of the return differential after the crisis in 2007. The latter could be explained by higher risk aversion and/or higher volatility of the foreign asset.

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1 Introduction

The debate about the sustainability of the persistent deficit in the U.S. current account (CA) and how to rebalance it is still unresolved. In 2015, the U.S. CA deficit was -$463 billion, the biggest in U.S. dollar terms in the world\(^1\) (or -2.57% of U.S. GDP). The traditional intertemporal models suggest that the evolution of a country’s Net International Investment Position (NIIP) is fully determined by the CA (Svensson and van Wijnbergen, 1989; Obstfeld and Rogoff, 1995). In reaching this conclusion, this strand of the literature has made two strong assumptions: assets issued by different countries are perfect substitutes and investors are risk neutral. The CA is mainly determined by the trade balance and a large CA deficit (and, its counterpart, a deteriorating NIIP) can be corrected by running a trade surplus – the so-called trade channel. Recently, the literature has considered that changes in exchange rates and asset prices can slow the deterioration of the negative U.S. NIIP (net debt) without requiring a trade surplus. This is known as the valuation effect channel. Gourinchas and Rey (2007) measure this channel in terms of the return differential between U.S. external assets and liabilities (henceforth, the return differential) and find that 27% of the cyclical international adjustment of the U.S. external imbalances has been done through this channel. Similarly, Obstfeld (2004), Tille (2003, 2008), Lane and Milesi-Ferretti (2007a, 2007b), Devereux and Sutherland (2010), and Curcuru, Dvorak and Warnock (2010, 2013) provide empirical evidence that the valuation effect for the U.S. is a considerable source of adjustment.

The aim of this paper is twofold. Firstly, following Gourinchas and Rey (2005, 2007), I calculate the real return differential - yield and capital gains adjusted by inflation rate - of U.S. NIIP from 1976 to 2015 by type of investment (direct investment, portfolio investment and other investment) and by-asset-class (short-term debt, long-term debt, equity, and derivatives). Secondly, I develop a simple model of endogenous international portfolio choice to study the underlying factors of this external adjustment channel. The model is built to link the role of risk aversion of investors, imperfect substitutability of assets and the variance-covariance matrix of returns on assets, to the valuation effect channel and its impact on the NIIP. I address these issues by extending the model of Blanchard, Giavazzi and Sá (2005) in two ways. First, I provide microfoundations for the portfolio composition under a general equilibrium approach in which risk averse investors optimize the desired holdings of domestic and foreign assets in a single global market. Second, I relax the assumptions of homogeneous investors and logarithmic utility function, two main drawbacks of portfolio balance models (Kouri, 1976; Kouri and Braga de Macedo, 1978; Alder and Dumas, 1983; Branson and Henderson, 1985), to study their implications on the solution and calibration of the model.

On empirical grounds, the paper’s contribution highlights not only the importance of the positive valuation effect for the U.S., but also the potential U.S. vulnerabilities due to a recent lower return differential, at least after the Great Recession. In other words, the U.S. has benefited from higher returns on its assets and lower cost of debt, averaging 3.5% between 1976 and 2015. However, from 2010 to 2015, the return differential is negative, averaging -0.13%. This positive but decreasing return differential in favor of U.S. investors is present in different types of investments (direct investment, portfolio investment and other investment) and within individual asset classes (equity, derivatives and bonds) during 1976-2015. In fact, portfolio investment is the major contributor to the U.S. valuation effect and its composition is changing over time towards risky assets (equity and derivatives) and safe liabilities (long-term bonds).

\(^1\)According to the IMF WEO data as of July, 2017, other countries with similar current account deficits are: the U.K. (-$123 billion, -4.28% of GDP), Australia (-$58 billion, -4.73% of GDP), Canada (-$52 billion, -3.40% of GDP), and New Zeland (-$6 billion, -3.36% of GDP).
To the best of my knowledge, this paper is the first to decompose the return on securities of portfolio investment into percentage changes in prices and exchange rate. Most of the valuation changes come from asset price movements and there is a U.S. dollar appreciation in periods of high asset price volatility.

The theoretical framework provides a reasonable qualitative and quantitative explanation of these empirical facts of the U.S. valuation effect. I characterize the excess return on U.S. assets as an equilibrium condition and the home bias as a restriction to the solution space of the optimal portfolio shares. Indeed, the solution of the model provides a quantitative account of the importance of each component - return differential, investors' risk aversion and variance-covariance matrix of returns - in the valuation effect and, in this respect, it has major implications.

The first implication is related to the risk aversion parameter. Risk neutral investors are a strong assumption which is not compatible with the data and the model has no solution. The other strong assumption, the logarithmic utility function, leads to negative optimal shares that are inconsistent with the data. The numerical simulation shows the different optimal demands for assets for each level of risk aversion between 2 and 10 under two different scenarios: with and without the home bias restriction.

In the first scenario, the discussion of the appropriate value of the risk aversion parameter goes beyond the portfolio balance models. Within DSGE framework\(^2\), despite the significant advances in modeling the valuation effect, the risk aversion parameter may not be specified correctly. For instance, Tille and van Wincoop (2010) and Evans and Hatzkovska (2012) calibrate their models using a value of 1 while Ghironi, Lee and Rebuoci (2015) do it with a value of 2. Under mean-variance approach, I show that the risk aversion parameter must be at least 6.5 in order to get allocations in line with empirical findings. Besides, after this threshold investors are more sensitive to changes in the variance-covariance matrix than changes in the return differential. A high rate of risk aversion is not unreasonable, and along this line, Devereux and Sutherland (2010) calibrate their DSGE portfolio choice model with a value of 5.

It is well known that investor’s preferences represented by a logarithmic function in wealth are lack of wealth effect, i.e., wealth and substitution effects exactly cancel out. But recent empirical literature has documented the importance of the wealth effect of the valuation channel. Even on theoretical grounds, as Pavlova and Rigobon (2015, p.11) state "(...) investors with logarithmic preferences do not wish to hedge against changes in their investment opportunity set (stock and bond price dynamics) - in that sense they behave myopically."

Contrary to the first scenario, the inclusion of the home bias restriction changes the value of the variance-covariance matrix as well as the value of the risk aversion parameters. In fact, the disparity of the attitude towards risk between domestic and foreign investors is significant. Consequently, domestic portfolios are more sensitive to variations in the risk premium, and foreign portfolios are more responsive to changes in the variance-covariance matrix.

A second implication of the optimal mean-variance portfolio is that it brings to the debate tentative explanatory factors of home bias; a robust portfolio fact. After I find the optimal portfolio shares, I illustrate that the home bias could be explained by risk aversion parameters, volatility of the depreciation rate and the correlation structure of depreciation rates and asset returns. In other words, international investors are exposed to exchange rate risk and, for instance, an increase in volatility of the depreciation rate tends to induce a home bias. This feature is in line with

\(^2\)There are other types of models that consider other factors such as the development of the financial market (Caballero et al, 2008) and equity holdings and portfolio choice under incomplete markets (Pavlova and Rigobon, 2015). Gourinchas and Rey (2014) survey the existing literature on valuation effect.
Coeurdacier and Rey (2013) who explore this hedging motive.

Another encouraging implication is that the model can be used to calculate the world return on assets. It went from 17.4% in 1976 to 5.6% by the end of 2015, being below its historical average (13.8%). Indeed, the recent pattern of a low world return on assets is similar to the path of the world interest rate documented by Gourinchas and Rey (2014).

The rest of the paper is organized as follows. In section 2, I present estimates of the valuation effect for the U.S. current account balance between 1976 and 2015. In particular, I decompose the return on securities of portfolio investment into percentage changes in prices and exchange rate. In section 3 I set up the model to explain the valuation effect channel and provide the short-run and long-run equilibrium conditions. Section 4 illustrates the main results in the short-run by means of numerical simulations. Finally, section 5 discusses the main findings and section 6 concludes my arguments.

2 The method and stylized facts

This section highlights the stylized facts of the U.S. valuation effect and shows the quantitative importance of this international adjustment channel. A major drawback of the official balance of payments statistics is the absence of the valuation component in the current account measures. For this reason, I begin the study by estimating the valuation effect following Gourinchas and Rey (2005, 2007).

Keeping with the National Accounts, let’s define the Net International Investment Position (NIIP) at the end of period $t$ as $B_t = A_t - L_t$, where $A_t$ are the gross assets and $L_t$ are the gross liabilities. The change in NIIP is given by $B_t = R_t B_{t-1} + NX_t$ where $NX_t = X_t - M_t$ denotes the balance on goods, services and net transfers during period $t$ and $R_t$ is the gross portfolio return on $B_{t-1}$. Since the current account is the sum of net balance of trade and net transfers ($NX_t$) and net income balance ($IB_t$), $CA_t = NX_t + IB_t$, I can add and subtract $B_{t-1}$ and $IB_t$ on both sides of the previous definition of the CA to get

$$B_t - B_{t-1} = CA_t + [(R_t - 1)B_{t-1} - IB_t] = CA_t + VE_t$$

According to Equation (1), the change in NIIP is equal to the current account ($CA_t$) plus the valuation effect ($VE_t$); the latter includes net capital gains.

The next step is to estimate the valuation change (or component) for gross assets ($A_t$) and gross liabilities ($L_t$). For each type of security ”i” (asset or liability), I consider the following law of motion

$$PX_{t+1}^i = PX_t^i + FX_{t+1}^i + VX_{t+1}^i + OX_{t+1}^i$$

where $PX_t^i$ is the position at the end of period $t$, $FX_{t+1}^i$ denotes the corresponding flow during period $t+1$ as recorded in the balance of payments, $VX_{t+1}^i$ is the valuation gain during period $t+1$ due to a change in exchange rate and/or asset price, and $OX_{t+1}^i$ is the statistical error. Note that $PX_t^i$ is a stock variable which represents foreign holdings of U.S. securities ($PX_t^i = L_t^i$) or U.S.

3 However, the Bureau of Economic Analysis (BEA) publishes the decomposition of IIP on an annual basis where flows, price change, exchange rate changes, and other changes are presented separately by type of investment for gross assets and gross liabilities since 2003.

4 Methodological details on the construction of the estimates are shown in the appendix of these documents.
holdings of foreign securities \( PX_i^t = A_i^t \) at the end of period \( t \). Regarding the flow of each class of security, let’s denote \( FX_i^t = FA_i^t \) for assets and \( FL_i^t = FL_i^t \) for liabilities.

Given (2), a positive valuation effects arises when the change in the market value of foreign assets held by domestic agents \( (V X_i^t = V A_i^t) \) is larger than the change in the market value of domestic assets held by foreign agents \( (V X_i^t = V L_i^t) \).

Data on the net and gross assets and liabilities of the U.S. is available from the U.S. Department of Commerce’s Bureau of Economic Analysis (BEA) and the Federal Reserve Flow of Funds Accounts (FFA).

From the constructed series \( V X_i^{t+1} \), I can compute the return on security "i" as

\[
(R_t^{i} - 1) \cdot PX_i^t = I_{i+1}^t + V X_i^{t+1}
\]

where \( I_{t+1}^t \) is the yield distributed at time \( t+1 \) as recorded in the balance of payments.

Summing across securities, we get \( A_t = \sum_i A_i^t, L_t = \sum_i L_i^t, FF_t = \sum_i FA_i^t - \sum_j FL_j^t \) and \( VE_t = \sum_i V A_i^t - \sum_j V L_j^t \), where \( FF_t \) is the financial account. Thus, we can use a simplified version of the balance of payments identity \( FF_t = CA_t + SD_t \) where \( SD_t \) is the statistical discrepancy.

### 2.1 The Valuation Effect Channel of the U.S.

Having a fuller picture of the empirical methodology, I present the main stylized facts of the U.S. valuation effect. The first fact is that the U.S. issues debt in its own currency while most of its assets are denominated in foreign currency. Thus, a dollar depreciation raises the value of foreign assets measured in dollars and consequently, there is a transfer of wealth from the rest of the world to the United States. This feature has been extensively studied by Lane and Milesi-Ferretti (2007a, 2007b), Gourinchas and Rey (2007), and Tille (2003).

The second stylized fact is related to the changing composition of the U.S. external balance sheet. I keep the BEA’s definition of direct investment (DI) and define portfolio investment (PI) as the sum of debt securities (short-term and long-term debt), equity and financial derivatives. All other types of investments are part of other investment (OI). Figure 1 presents the composition of assets and liabilities by type of investment. The composition of assets is shown on Panel A and something that draws attention is the pattern of PI as a share of Total Assets (TA). In 1976 it was 12% and remained at that level until the end of the 1980s. In the following decades and in line with the liberalization of international financial markets, this type of investment started to grow steadily until representing 51% of TA by the end of 2015. Making a more detailed evaluation of PI, the fixed-income securities (short-term and long-term debt) are on average 10% of TA over the entire period. But the more striking fact is related to variable-income securities (equity and derivatives) because they went from 3% in 1976 to 40% by the end of 2015.

The story is quite different on the liabilities side (Panel A of Figure 1). The PI was 52.6% of total debt in 1976, of which 16.3% was equity, 18.4% was short-term debt and 17.9% was long-term debt. During the 1980s and 1990s, the PI remained at 40% but since 2000, it began to grow again until it reached the value of 62.1% of total liabilities by the end of 2015. Over this period, the short-term debt reduced to 3.1% whereas the relevance of the long-term debt has increased significantly over time being 31% of total liabilities.

Due to the importance of variable-income securities (risky securities) on both sides of the U.S. external balance sheet, a positive valuation effect can occur with small changes in its market value.
For instance, supposing that everything else remains constant, an increase of 1% in the market value of variable-income securities causes a net increase of US$ 6,666 million in the U.S. external balance sheet.

Measuring assets and liabilities as a share of GDP, I find those time series share the same path (Panel B of Figure 1). As of December 2015, the U.S. net foreign asset position was -$7.3 trillion (or 40% of U.S. GDP), with assets representing $23.3 trillion (129% of U.S. GDP) and liabilities $30.6 trillion (169% of U.S. GDP). The United States went from being a net creditor in the 1980s to a net debtor in the mid-1990s, with a growing structural gap between the national spending and income causing an unsustainable debt path in recent years. Something that has to be mentioned is the role of long-term debt in the liabilities side. It was $9.5 trillion or 53% of GDP in 2015, hence more than half of the output could be used to pay long-term debt.

The third stylized fact is the U.S. net international borrowing needs. The large U.S. current account deficit raises a concern about the sustainability of this mounting debt and, at first glance, the U.S. would face problems to finance its expenditure. A look at the data suggests that the ratio of CA to GDP is growing: averaged -2.41% from 1976 until 2015, was -2.57% of the country’s GDP in 2015 but recorded its lowest level of -5.82% in 2006. Another natural way to analyze the U.S. international indebtedness is to observe the evolution of the NIIP. It went from US$ 80,539 million in 1976 to US$ -7,280,637 million in 2015; 1988 being its last year as a net creditor (US$ 21,479 million). Then, the U.S. external debt averaged US$ -2,154,571 million from 1989 until 2015, with an increasing trend.

But an analysis of the cumulative CA and cumulative valuation effect (VE) gives us a better idea of the U.S. international borrowing needs. A special comparison between NIIP reported by BEA and my estimates of NIIP is shown in Figure 2a. As the figure depicts, the resulting gap is relatively small. However, it appears that there is a big difference between the dynamics of NIIP using the cumulative CA as reported in the balance of payments and my estimates of NIIP. According to the standard intertemporal models of CA determination based on the trade channel, the CA deficit and the change in the NIIP have to move together in an amount equal to the CA deficit but this theoretical fact is not consistent with the data.

The same feature is highlighted in Figures 2b and 2c. NIIP/GDP and the cumulative CA/GDP have a similar pattern but the gap between them is increasing over time. In 2015, the NIIP was -40% whereas the cumulative CA was -94% of GDP. On the other hand, the VE as a percentage of GDP started to be more important since 1990, when portfolio investment began to grow considerably. In 1976, the gap between cumulative VE/GDP and cumulative CA/GDP was not big (VE = 1.55% and CA = -0.68%) but it became considerably larger after 1990. These two time series followed opposite trends but partially proportional, reaching the highest historical values in 2015 (cumulative VE/GDP = 40.38% and cumulative CA/GDP = -94.11%). These numbers indicate that almost 50% of the cumulative current account deficit was offset by the change in the value of U.S. external balance sheet.

Regardless the type of measure, in nominal terms or as share of GDP (Figure 3a and Figure 3b, respectively), the valuation component of the U.S. external balance sheet becomes more significant since 2000. The increase in the share of variable-income securities in total assets and fixed-income securities in total liabilities cause positive capital gains until 2007, but the year after the U.S experienced the biggest drop of this valuation component (-13.26% of GDP). In the following years it remains low and since 2013 the capital gains of the U.S. international investment position are negative.

To understand the fourth fact - a decreasing return differential - it is better to recall equation
(3) and let $r^a$, $r^l$ and $(r^a - r^l)$ be the return on assets, return on liabilities and return differential, respectively. Figure 3c documents three features: $r^a$ is higher and more volatile than $r^l$, $(r^a - r^l)$ is positive for almost all years, and $r^a$ and $r^l$ fall during the years following the international crises (1998 and 2007). During 2000-2002 and 2008-2009 both returns are negative, however, in the latter period, the return on assets is close to zero while the return on liabilities significantly negative (-7.77% in 2009). In this way, the U.S. benefits not only from a negative cost of debt but also less amount of debt in real terms.

For a better understanding of the decreasing return differential, let's break it up into different sub-samples and types of investments (Table 1). On average, the U.S. experiences a positive return differential of 3.49% on its gross investment position during 1976-2015 but it is getting smaller through different sub-samples. The sample time period is important to get some insights about the return differential because it is about to 4% until 2005, then it reduces to 1.56% during 2006-2015 and becomes negative from 2010 until 2015.

Table 2 presents earlier estimates of the literature measuring the return differential. Gourinchas and Rey (2005) find an excess return on assets over liabilities of 3.32% ($r^a = 6.82\% - r^l = 3.50\%$) during 1973-2004. This positive excess return on U.S. foreign assets has been documented by Lane and Milesi-Ferretti (2009), Obstfeld and Rogoff (2005) and Forbes (2010). The key lesson of Tables 1 and 2 is that the return differential is positive but decreasing.

Furthermore, it is notable that all types of investments exhibit a decreasing excess return on assets over liabilities (Table 1 and Figure 4). Due to the composition of PI, its return differential ($r^a - r^l$) has the higher risk-return trade-off compared to other types of investments (DI and OI). It turns out that $r^a$ and $r^l$ display on average a standard result in finance theory during the whole sample: higher return but also higher risk on the assets side, compared to the liabilities side. However, when we analyze the risk-return trade-off for different sub-samples, we see that the $Var(r^a)$ is not always greater than $Var(r^l)$. Note that after 2006 the volatility of $r^a$ of PI is higher than its historical average while the volatility of $r^l$ is lower than its historical average. This empirical pattern could imply a fundamental breakdown of the risk-return relationship as proposed by financial theory, and a time-varying risk-return relationship.

As it is stated above, PI as a share of total assets and total liabilities began to be larger since 2000. For this reason I restrain the sample to 2000-2015, compute the return on equity, short-term debt and long-term debt and then, weight these returns by their shares on portfolio investment (the weights are the same as those reported in Figure 1). As we can see in Figure 6, within this type of investment, the "risky asset" contributes significantly to the return on assets like the "safe asset" does to the return on liabilities. On average, the return on risky asset is 3.9% and the return on safe asset is 1.92%. Nevertheless, during 2003-2007 the return differential exceeds 10% which means that U.S. investors received a net positive return of more than 10%.

Given the fact that I focus on the return differential of the portfolio investment, it is better to decompose $r^i$ for $i = a, l$ into percentage changes in asset prices and exchange rate. Table 3 points out that most of the valuation changes comes from asset prices movements, however, the small average percentage change of the exchange rate indices does not imply small valuation component of it. In other words, large absolute changes can exist even if the average percentage change is small. During 1976-1985 and 1986-1995 the United States has benefited from changes in asset prices which implies that the change in the market value of its external balance sheet has played in favor of the U.S. NIIP.

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5 I construct asset- and liability weighted exchange rate indices. For further details, see appendix 1.
The pattern of the exchange rate shows an appreciation of the U.S. dollars for the whole period and among sub-samples, except during 1986-1995. As we can see in Figure 5 and Table 3, there is a U.S. dollar appreciation in periods of high volatility of return on securities.

Other signs of the importance of the valuation effect can be seen in the co-movement of different economic variables (GDP, CA, FA, TB, NIIP) with U.S. return on assets ($r^a$), return on liabilities ($r^l$), and return differential ($r^a - r^l$). As shown in Table 4, total investment, direct investment and portfolio investment ($r^a$, $r^l$ and $r^a - r^l$) are positively correlated with the NIIP and the growth rate of GDP, but low or negatively correlated with $\Delta NIIP$. It is important to note that portfolio investment ($r^a$, $r^l$ and $r^a - r^l$) exhibit the strongest positive correlation with the NIIP and the growth rate of GDP, even if those returns are adjusted by exchange rate fluctuations (last three rows of Table 4). What is interesting about Table 4 is that the trade balance (TB) and the return differential of total investment are negatively correlated. However, the correlation between TB and the return differential of PI is positive and high. Based on total investment, it could be seen ($r^a - r^l$) as a wealth transfer which affects the net exports but, based on portfolio investment, there is no wealth effect.

The correlation between the return differential and CA and FA is not clear because it changes by type of investment. However, the return differential of PI has the strongest correlation with CA and FA. This feature is quite relevant because during the whole sample the return differential has been decreasing while the net inflow of capital to the United States from the rest of the world has been increasing. Based on correlation coefficients, it seems that foreign investors finance a domestic economy which relies on foreign financing despite the growth of the economy.

Assuming that the standard deviation is the correct measure of risk, I want to highlight two features about the portfolio investment. First, the probability density function shows the gains and losses do not cancel out and therefore, the expected value of the spread is not zero (Figure 7). The fat tails reflect the fact that the return on foreign assets has a high probability of a capital gain (or higher likelihood of extreme price falls). This could be a potential cause of the risk-return anomaly.

We can draw some lessons from the U.S. valuation effect:

- Despite the increasing debt of U.S., there was a positive valuation effect which mitigated the impact of the persistent CA deficit on the NIIP and in this way, influence the U.S. solvency. But it is also important to note that the valuation effect could work in the opposite direction and weaken the U.S. NIIP like in the last years.

- The U.S. trade deficit is not the only factor explaining the change in the U.S. NIIP and, in this sense, capital gains and exchange rate variations can be seen as a "trade surplus". On average, the current account deficit is -2.4% of GDP but on the other hand, the valuation effect of gross assets and liabilities are 2.5% and 1.7% of GDP, respectively. Thus, valuation effects reduced the effect of CA deficits on NIIP by about one third ($|(2.5-1.7)/-2.4|$. It is noteworthy that between 2000 and 2006, these valuation components are quite large in terms of GDP, however, after the crisis they went back to their historical averages.

- The analysis of the real return on gross assets and gross liabilities evidences a return differential against foreign investors before 2010. This excess return on assets is present in gross investment, different types of investments (direct investment, portfolio investment and other investment) and within individual asset classes (equities, derivatives and bonds). This return differential is negative on average from 2010 until 2015.
• Portfolio investment is the main contributor to the U.S. valuation effect and its composition is changing over time. On the assets side, equity and derivatives are gaining weight and it seems that this pattern is going to continue for the next few years. On the liabilities side, long-term debt is the principal component and the returns on this type of investment are decreasing steadily. Even though the return differential decreases significantly after 1995, it is still positive.

If investors are rational, the positive excess return on U.S. foreign assets could be seen as an equilibrium outcome, thus, understanding the magnitude and sources of the return differential is essential since it has significant implications for trade policy, asset pricing and sustainability of U.S. debt. In my analysis below, I study the relationship between the excess of return on U.S. international financial assets and risk factors as the risk aversion of investors and the variance-covariance matrix of return on financial instruments. The empirical fact of home bias plays a role in determining the solution space of the optimal portfolio shares. Even if the model considers the broad definition of investment, I want to focus on the portfolio choice and explore the effect of risk aversion and higher moments of returns (variance and covariance) on the return differential over time. Direct investment is studied extensively in international trade literature and the other investment - which includes currency and deposits - is mainly explained by monetary theory.

3 The model

In this section, I set up a framework to illustrate the capacity of the interaction between optimal portfolio allocations and return differential in explaining the valuation effect and therefore, its implication on the U.S. external balance sheet. To attain that objective, I use a general equilibrium portfolio balance approach to specify the supply of and demand for assets and relax the assumption of perfect substitutability of assets. There is a single global capital market in which the mechanism that equilibrates demand and supply is the value of financial assets, and the final outcome is achieved by decentralized interactions of investors. In other words, the global capital market is competitive but the financial assets are not perfect substitutes.

The idea behind the portfolio balance approach is to give a more robust explanation of the observed link between asset prices, exchange rates, and current account movements. Rational investors are the only agents in this model and they have target stocks of wealth and its composition given the ex-ante expected return differential, variance-covariance matrix of returns and level of risk aversion. I simplify the world market into two countries: the domestic economy (U.S.) and the foreign economy (rest of the world). I also assume that the domestic economy only produces assets denominated in domestic currency \(D^S\) and the rest of the world only produces assets denominated in foreign currency \(F^S\). The stock of global wealth is composed by the market value of domestic assets \(P^D D^S\) and foreign assets \(P^F S F^S\) where \(P^D\) is the price of the domestic asset, \(P^F\) is the price of the foreign asset and \(S\) is the nominal exchange rate defined as the domestic price of foreign currency.

Contrary to previous portfolio balance models such as Frankel (1982), Alder and Dumas (1983) and Branson and Henderson (1985), the prices are determined endogenously (asset prices and exchange rate) in the system and they do not follow a geometric Brownian motion, which is a standard assumption in finance theory.

\(^6\)There are no transactions costs, taxes or any other rigidity in the market.
The specification of the short-run and long-run equilibrium depends on the role of the current account in the accumulation or decumulation of net foreign assets. In this regard, the short-run\(^7\) equilibrium is an end-of-period equilibrium in which the return differential does not change through current account imbalances. The basic predictions of the model are determined by comparative statics experiments. In the long-run equilibrium, the current account influences the asset accumulation and, consequently, the prices and optimal allocations in the economy. Finally, it is worth emphasizing that there is no central bank intervening in the forex market or asset markets.

### 3.1 Prices and Portfolio Allocation

It is well known that a security (as a share) pays out a return in two ways, by dividends and capital gains that investors get if the price of the security increases

\[
i_D^{t+1} = \frac{P_D^{t+1} + d_D^{t+1} - P_D^t}{P_D^t}
\]

\[
i_F^{t+1} = \frac{P_F^{t+1} + d_F^{t+1} - P_F^t}{P_F^t}
\]

where the superscript \(D\) denotes the domestic economy and \(F\) denotes the foreign economy; \(P_j^t\) is the price of financial asset \(j\) at time \(t\); \(d_i^{t+1}\) is the distributed yield or dividend of the financial asset \(j\) at time \(t+1\), for \(i = D, F\), which is uniformly distributed \(\in [0, 1]\). Equations (4) and (5) are the domestic currency return and the foreign currency return, respectively. This is the most general specification of returns on financial assets which includes bonds or equity.

First, I describe the portfolio decision on the part of the domestic investor. The portfolio decision for the foreign investor is completely symmetric, however, the parameters are different. For the domestic investor, equations (6) and (7) are the real returns on domestic and foreign assets in terms of domestic currency, respectively

\[
(1 + r_D^{t+1}) \equiv (1 + i_D^{t+1}) \frac{P_t}{P_{t+1}} \approx 1 + i_D^{t+1} - \pi_{t+1}
\]

\[
(1 + r_F^{t+1}) \equiv (1 + i_F^{t+1}) \frac{S_t^{t+1}}{S_t} \frac{P_t}{P_{t+1}} \approx 1 + i_F^{t+1} + \Delta s_{t+1} - \pi_{t+1}
\]

where \(P_t\) is the domestic price level at time \(t\), \(\pi_{t+1}\) the inflation rate at time \(t+1\), \(s_t\) is the log exchange rate at time \(t\) and \(\Delta s_{t+1}\) the depreciation rate at time \(t+1\).

Now, let denote the excess return on foreign asset as \(er_{t+1} \equiv i_F^{t+1} + \Delta s_{t+1} - i_D^{t+1}\). Note that it can be written as \(er_{t+1} = pr_t + \epsilon_{t+1}\) where \(pr_t = E_t(er_{t+1})\) is the predictable component at time \(t\) and \(\epsilon_{t+1}\) is the statistical forecast error. In this respect, the excess return ex-ante might be non-zero because the assets are not perfect substitutes and, hence, it could be explained by the sovereign risk premium and/or the exchange rate premium. Also, the excess return could be different from zero ex-post since the ex-post exchange rate could differ from the expected returns differential ex-ante\(^8\).

\(^7\)The short-run here is defined as a period of time short enough so that stocks of assets do not significantly change through fiscal deficits, capital investment, or current account imbalances.

\(^8\)The excess return on foreign asset could be constant. The investors are indifferent at the margin between uncovered holdings of domestic and foreign assets. The principle of risk aversion is that investors will take more risk only if there is a sufficient increase in expected real return to compensate, i.e., there is a risk premium. Then, the uncovered
The real return on the home portfolio is
\[ r^D_{p,t+1} = x^D_t r^F_{t+1} + (1 - x^D_t) r^D_{t+1} \] (8)

where \( x^D_t \) is the share of wealth held in the foreign asset and by construction, \( (1 - x^D_t) \) is the share of wealth held in home asset by domestic investors.

Period by period, the investor wants to maximize end-of-period wealth. Let \( W^D_t \) be the real wealth of domestic investor at the end of time \( t \), hence the next period real wealth is \( W^D_{t+1} = W^D_t(1 + r^D_{p,t+1}) \). What concerns investors for the international portfolio allocation decision are the first and second moments of asset returns. Since the two securities are issued in different countries, investors might believe that the return on the two securities are uncertain and that these returns are not perfectly correlated. Indeed, the investors choose \( x^D_t \) to maximize an objective function that is increasing in the conditional mean but decreasing in the conditional variance of end-of-period wealth
\[ V = V(E_t(W^D_{t+1}), Var_t(W^D_{t+1})) \] (9)

where \( \frac{\partial V}{\partial E_t(W^D_{t+1})} > 0 \) and \( \frac{\partial V}{\partial Var_t(W^D_{t+1})} < 0 \).

The domestic investor wants to optimize his/her portfolio in each period by maximizing a linear function of expected real return and variance of return. Under these assumptions, the domestic investor’s decision becomes a standard mean-variance optimization problem.
\[ E_t(U) = x^D_t E_t r^F_{t+1} + (1 - x^D_t) E_t r^D_{t+1} - \frac{1}{2} \gamma \left[ \frac{x^D_t}{1 - x^D_t} \right]' \sum \left[ \frac{x^D_t}{1 - x^D_t} \right] \] (10)

where \( \gamma \) is the risk aversion parameter and \( \sum \) is the variance-covariance matrix.

The FOC yields the optimal portfolio share for domestic investor
\[ x^D_t = \frac{E_t r^F_{t+1} - E_t r^D_{t+1} + \gamma [Var_t(r^D_{t+1}) - Cov_t(r^D_{t+1}, r^F_{t+1})]}{\gamma [Var_t(r^D_{t+1}) + Var_t(r^F_{t+1}) - 2Cov(r^D_{t+1}, r^F_{t+1})]} \] (11)

For the foreign investor, the real returns in terms of foreign currency are denoted with an asterisk
\[ (1 + r^*_{s,t+1}) \equiv (1 + i^*_t) \frac{S^*_t}{S^*_{t+1}} \frac{P^*_t}{P^*_{t+1}} \approx 1 + i^*_t - \Delta s_{t+1} - \pi^*_{t+1} \] (12)
\[ (1 + r^*_{s,t+1}) \equiv (1 + i^*_t) \frac{P^*_t}{P^*_{t+1}} \approx 1 + i^*_t - \pi^*_{t+1} \] (13)

where \( P^*_t \) is the price level of the foreign economy at time \( t \), \( \pi^*_{t+1} \) the foreign inflation rate at time \( t+1 \), \( s^*_t \) is the log exchange rate at time \( t \) and \( \Delta s_{t+1} \) the depreciation rate at time \( t+1 \).

interest parity condition will not hold due to the existence of the risk premium.

\(^9\)For the purpose of this paper, ex-ante and ex-post deviations from the purchasing power parity are allowed. Consider a U.S. investor holding a European security with a given nominal return. If this nominal return is measured in Euros, the investor will translate it into dollars and then deflate it using the U.S. CPI. Similarly, a European investor holding a U.S. security has to first convert it into Euros and second to deflate it by the European CPI. Assuming that the nominal returns of both securities were the same, if PPP held then the two price indices were exactly in line with the exchange rate and hence, the two investors would view the real returns identically.
In a seminal paper, Adler and Dumas (1983) show strong evidence from deviations of Purchasing Power Parity (PPP). Therefore, it is reasonable to suppose that domestic and foreign investors have different measures of real returns (e.g., price indices) and risk. Consequently, it is natural to expect that the composition of their portfolios also to differ.

Since the optimization problem is similar for the foreign investor, the optimal portfolio share is

$$x_t^F = \frac{E_t r^D_{s,t+1} - E_t r^F_{s,t+1} + \gamma^* \left[ Var_t(r^F_{s,t+1}) - Cov_t(r^D_{s,t+1}, r^F_{s,t+1}) \right]}{\gamma^* \left[ Var_t(r^D_{s,t+1}) + Var_t(r^F_{s,t+1}) - 2Cov_t(r^D_{s,t+1}, r^F_{s,t+1}) \right]} \quad (14)$$

As noted, equations (11) and (14) are the shares of the domestic holdings of foreign assets and the foreign holdings of domestic assets, respectively. These optimal demands exhibit a standard result in financial theory because they offer a hedge against different types of risks: return variances and covariances, exchange rate variations and inflation rate. Also, note that the domestic holdings of domestic assets (1 – xd) and the foreign holdings of domestic assets (xf) satisfy the stability conditions

$$\frac{\partial (1-x^D_t)}{\partial t^D_t} > 0, \quad \frac{\partial (1-x^F_t)}{\partial t^F_t} > 0, \quad \frac{\partial (1-x^D_t)}{\partial t^D_{s,t+1}} < 0, \quad \frac{\partial (1-x^F_t)}{\partial t^F_{s,t+1}} < 0$$

The signs of the derivatives with respect to the nominal rates of returns, expected depreciation of domestic currency and expected inflation reflect the fact that domestic and foreign assets are gross substitutes10.

The vector of optimal portfolio shares xd and xf can be interpreted as the sum of two portfolios: a speculative portfolio demand and the global minimum-variance portfolio demand (Kouri and Braga de Macedo, 1978; Frankel, 1982; Adler and Dumas, 1983; Branson and Henderson, 1985; Trevor, 1986).

$$x_t^D = \frac{E_t r^F_{s,t+1} - E_t r^F_{t+1}}{\gamma [Var_t(r^F_{t+1}) + Var_t(r^F_{s,t+1}) - 2Cov_t(r^F_{s,t+1}, r^D_{t+1})]} + \frac{[Var_t(r^D_{s,t+1}) - Cov_t(r^F_{s,t+1}, r^D_{t+1})]}{[Var_t(r^F_{s,t+1}) - Cov_t(r^F_{s,t+1}, r^D_{t+1})] \left[ Var_t(r^F_{s,t+1}) + Var_t(r^F_{s,t+1}) - 2Cov_t(r^F_{s,t+1}, r^F_{s,t+1}) \right]}$$

$$x_t^F = \gamma^* [Var_t(r^D_{s,t+1}) - Cov_t(r^F_{s,t+1}, r^D_{s,t+1})] + \frac{[Var_t(r^D_{s,t+1}) - Cov_t(r^F_{s,t+1}, r^D_{s,t+1})]}{[Var_t(r^F_{s,t+1}) + Var_t(r^F_{s,t+1}) - 2Cov_t(r^F_{s,t+1}, r^F_{s,t+1})] \left[ Var_t(r^F_{s,t+1}) + Var_t(r^F_{s,t+1}) - 2Cov_t(r^D_{s,t+1}, r^F_{s,t+1}) \right]}$$

The first terms of the right-hand-side of previous equations are the speculative portfolio demands which depend on the difference of the expected real return, risk, covariance and risk aversion parameter. The second terms of those equations are the global minimum-variance portfolio demands which hedge the world risks facing investors and do not depend on expected returns differential nor risk aversion of investors.

In the case that the expected returns on financial instruments are the same, the optimal allocation of wealth depends on the variance-covariance matrix. Even if the excess returns on foreign assets are different from zero, the vector of optimal portfolio shares would be mainly explained by the variance-covariance matrix.

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10The balance sheet constraint for investors (domestic and foreign) requires that the sum of their nominal demand for all securities must equal their nominal wealth. This constraint implies that x and (1 – x) must sum to one and the sum of the partial effects on the two asset demands of a change in either of the two returns must be zero.
3.2 Home Bias

The financial literature on home bias has considered it as an empirical phenomena but less attention has been paid to the drivers behind it. Based on the optimal portfolio allocation of domestic and foreign investors, I link the home bias and the excess return on foreign assets (from the point of view of domestic investors):

\[(1 - x_t^D) + (1 - x_t^F) > 1\]

Substituting equations (11) and (14) into the previous inequality, we get a mathematical expression to describe the return differential

\[E_{t+1}^F - E_{t+1}^D = pr_t > \gamma [\text{Var}_t(r_{t+1}^D) - \text{Cov}_t(r_{t+1}^F, r_{t+1}^D)] \frac{\gamma^* \Theta^*}{\gamma \Theta - \gamma^* \Theta^*} \quad (15)\]

where

\[\Theta^* \equiv \text{Var}_t(r_{t+1}^D) + \text{Var}_t(r_{t+1}^F) - 2\text{Cov}_t(r_{t+1}^D, r_{t+1}^F)\]

\[\Theta \equiv \text{Var}_t(r_{t+1}^D) + \text{Var}_t(r_{t+1}^F) - 2\text{Cov}_t(r_{t+1}^F, r_{t+1}^D)\]

In line with the empirical results in section 2, I assume \[E_{t+1}^F - E_{t+1}^D > 0\] which implies that the right-hand side of equation (15) is positive. In addition, the combination of \(\gamma, \gamma^*, \Theta, \Theta^*, \text{Var}_t(r_{t+1}^F)\) and \(\text{Cov}_t(r_{t+1}^F, r_{t+1}^D)\) cannot exceed \[E_{t+1}^F - E_{t+1}^D\]. Without loss of generality, I assume that \(d_t^D = 0, \pi_{t+1}^F = 0\) and drop the subscript of time. In fact, the assumption of zero inflation is not critical because the empirical literature has shown that the volatility of the prices in goods markets is low, the covariance and correlation with financial variables are also low and it is well known that inflation does not explain exchange rate movements, at least in the short and medium run.

Therefore, equation (15) can be rewritten as (see appendix A.2)

\[pr > \frac{1}{\left[\frac{1}{\gamma^*} - \frac{1}{\gamma}\right]} [\text{Cov}(\Delta s^D, i^D) - \text{Cov}(i^F, \Delta s^F) - \text{Var}(\Delta s^D)]\]

Given the fact that the risk aversion parameters and the variance of returns are positive, the right-hand side of equation (15) is bounded from above by \(pr\). This inequality shows the link between the variance and covariance of assets and the return differential. Based on the theoretical model and the empirical fact of home bias, this inequality must be satisfied.

3.3 Asset Market Equilibrium

As it is stated before, the domestic economy supplies securities denominated in domestic currency \(D_t^S\) and the foreign economy supplies securities denominated in foreign currency \(F_t^S\). Both supplies are exogenous and fixed; I keep the subscript "t" to be consistent with the notation. Given the optimal portfolio allocation for each period, then the market clearing conditions measured in domestic currency are

\[D_t^S = (1 - x_t^D)W_t^D + x_t^F S_t W_t^F \quad (16)\]

\[S_t F_t^S = x_t^D W_t^D + (1 - x_t^F) S_t W_t^F \quad (17)\]

\[11\text{ A good theoretical discussion is in Coeurdacier and Rey (2013).}\]
Since $W_i^t$ is the market value of wealth of country $i$, an increase of the wealth of the investor increases the demand for both assets. For instance, if there is an increase in the price of the domestic asset ($P_t^D$), the investor will convert some of this extra wealth into the foreign asset and keep the remainder in the form of the domestic asset. Similarly, an increase in the price of the foreign asset ($P_t^F$) or the exchange rate ($S_t$) would make the investors to balance their portfolios and hence, some share of their wealth is used to buy domestic assets.

The domestic and foreign returns are free to vary to ensure equilibrium in the asset markets. For simplicity, assume that the expected rate of depreciation is fixed. Equation (16) is the Domestic Portfolio Balance (DPB) or the equilibrium in the domestic asset market. Assume there is a depreciation of $S$, then there is an increase in the value of foreign assets measured in domestic currency and consequently, there is an increase in wealth. This increase in wealth leads to a subsequent increase in the demand for domestic assets which pushes up the price and decreases the expected return next period. Therefore, DBP is downward-sloping in $(S, i)$ space.

Similarly, equation (17) is the Foreign Portfolio Balance (FPB) or equilibrium in the foreign asset market. Assume there is an increase in $i$, investors adjust their portfolio by purchasing domestic assets and selling foreign securities which decreases $S$.

The relative size of these effects relies on the degree of substitutability which depends on the risk aversion parameters and the variance-covariance matrix. As you will see in section 4, risk aversion could alter this degree of substitutability such that investors are no longer indifferent in relation to what asset to acquire. Besides, if D and F are not close substitutes, then the wealth effect dominates the substitution effect leading to changes in $pr$ and consequently in $x^i_t$. Following this line of reasoning, demand shifts will alter the relative distribution of wealth between domestic and foreign residents due to home bias.

By Walras’ Law, only one equation is independent thus it is enough to model the equilibrium in the domestic asset market and by implication, we could understand the equilibrium in the foreign asset market.

### 3.4 Trade Balance and Current Account

To close the model, the external budget constraint of the domestic economy has to be specified; for the foreign economy this can be done in a similar way. In effect, the portfolio balance approach delivers the equilibrium condition that ensures the foreign exchange market clears by specifying the balance of payment. I start with the income balance assuming the domestic (foreign) economy issues debt only in its own currency.

Let us denote the following variables at time $t$

- $D_t$ stock of domestic assets held by foreign investors in domestic currency
- $F_t$ stock of foreign assets held by domestic investors in foreign currency
- $P_t^D$ price of the stock of domestic assets
- $P_t^F$ price of the stock of foreign assets
- $F_t \equiv P_t^F F_t$ the market value of the foreign asset in foreign currency
- $D_t \equiv P_t^D D_t$ the market value of the domestic asset in domestic currency
Given that $D_{t-1}$ corresponds to the stock of contracted debt at the end of period $t-1$, it is evaluated according to the price of that period thus $D_{t-1} = P_{t-1}^D \bar{D}_{t-1}$ and $F_{t-1} = P_{t-1}^F \bar{F}_{t-1}$. Now let us denote the Net International Investment Position (NIIP) as

$$B_t = S_{t-1}P_{t-1}^F \bar{F}_{t-1} - P_{t-1}^D \bar{D}_{t-1}$$

The NIIP can change for movements of asset prices, the exchange rate, or both. Also, note that the income from foreign assets (domestic assets) can be written in terms of the returns on financial assets or in terms of the income received

$$r_t^F S_{t-1}P_{t-1}^F \bar{F}_{t-1} = S_tP_t^F \bar{F}_{t-1} - S_{t-1}P_{t-1}^F \bar{F}_{t-1} \quad \text{(income from foreign assets - received)}$$

$$r_t^D P_{t-1}^D \bar{D}_{t-1} = P_t^D \bar{D}_{t-1} - P_{t-1}^D \bar{D}_{t-1} \quad \text{(income from domestic assets - sent)}$$

Therefore, the income balance (IB) is

$$IB_t = (S_tP_t^F \bar{F}_t - S_{t-1}P_{t-1}^F \bar{F}_{t-1}) - (P_t^D \bar{D}_t - P_{t-1}^D \bar{D}_{t-1})$$

(18)

The second equation, which explains the dynamics of the holding of international assets, is the trade balance (TB). I use the conventional definition and assume it is an increasing function of exchange rate depreciation. All other factors that increase the trade balance are captured by $z_t$.

$$TB_t(S_t, z_t) = 0$$

(19)

$$\frac{\partial TB_t(S_t, z_t)}{\partial S_t} > 0 \quad \text{and} \quad \frac{\partial TB_t(S_t, z_t)}{\partial z_t} > 0$$

Before the TB is included in the dynamics of NIIP, it is better to show the role of the valuation effect. By definition, the current account balance (CA) corresponds to a change in the net stock of assets measured in current prices

$$CA_t = (S_tP_t^F \bar{F}_t - P_t^D \bar{D}_t) - (S_tP_t^F \bar{F}_{t-1} - P_t^D \bar{D}_{t-1})$$

which can be written as

$$B_{t+1} - B_t = CA_t + (S_tP_t^F - S_{t-1}P_{t-1}^F) \bar{F}_{t-1} - (P_t^D - P_{t-1}^D) \bar{D}_{t-1}$$

(20)

Equation (20) shows that the NIIP variation is not equal to the CA due to a change in asset prices and exchange rate. In fact, the variation in the NIIP is equal to the CA plus the valuation effect.

An alternative definition of the CA can be done using the returns on assets

$$B_{t+1} - B_t = CA_t + r_t^F S_{t-1}P_{t-1}^F \bar{F}_{t-1} - r_t^D P_{t-1}^D \bar{D}_{t-1}$$

(21)

Hence, those returns include both dividends and capital gains terms, the latter is not usually counted as part of the measured CA.

Finally, the standard definition of CA is presented below

$$CA_t = (S_tP_t^F \bar{F}_t - P_t^D \bar{D}_t) - (S_tP_t^F \bar{F}_{t-1} - P_t^D \bar{D}_{t-1}) = IB_t + TB_t$$

$$= (S_tP_t^F \bar{F}_t - S_{t-1}P_{t-1}^F \bar{F}_{t-1}) - (P_t^D \bar{D}_t - P_{t-1}^D \bar{D}_{t-1}) + TB_t$$

$$x_t^D W_t^D - x_{t-1}^D W_{t-1}^D = r_t^F x_{t-1}^D W_{t-1}^D - r_t^D x_{t-1}^F S_{t-1} W_{t-1}^F + TB(S_t, z_t)$$

(22)
3.5 The Valuation Effect: international adjustment channel

Using the definition of IB in terms of real returns, I can rewrite the CA measured at current prices as follow

\[ B_{t+1} - B_t = r^F_t B_t + (r^F_t - r^D_t)D_{t-1} + TB(S_t, z_t) \]

Then, iterating it forward, imposing a no-Ponzi condition and taking conditional expectations\(^{12}\)

\[ B_t = -E_t \sum_{n=0}^{\infty} \left[ \prod_{n=0}^{\infty} \frac{1}{1 + r^F_{t+n}} TB(S_{t+n}, z_{t+n}) \right] - E \sum_{n=0}^{\infty} \left[ \prod_{n=0}^{\infty} \frac{1}{1 + r^F_{t+n}} (r^F_{t+n} - r^D_{t+n})D_{t+n-1} \right] \tag{23} \]

Equation (23) shows that the NIIP of a country has two components. The first term is the trade channel which is the negative of the expected present discounted value of future trade balances at the cumulated return on foreign assets. The second term is the opposite of the expected path of the return differential times the gross liabilities position. The difference in yield between domestic and foreign assets is in parentheses and it is the source of the predictable component of the return differential \((r^F_t - r^D_t)\). The valuation effect is the composition of the predictable excess return on foreign assets and the future path of returns on gross asset position. Another way to see equation (23) is assuming that the composition of assets is the same as liabilities and the domestic economy is gaining an excess return on assets over liabilities. Even in this scenario, the return differential is a factor which explain the dynamics of the NIIP.

Assume that the local investors expect tomorrow an increase of the return on their holdings of foreign assets. This change in the expectation would lead to an increase in the value of the gross asset position today and consequently, an increase in the NIIP. Similarly, a future decrease on the cost of debt would lead to an increase in the value of the gross debt today, causing a decrease in the current NIIP.

The trade channel works as follows: an increase in the expected future path of net exports leads to a decrease in the value of the current NIIP by changes in the exchange rate and asset prices. The latter affects the expectations on the returns on foreign assets.

The valuation effect arises when there are asset prices and exchange rate variations. Similar to Blanchard, Giavazzi and Sá (2005), an exchange rate depreciation increases the value of the NIIP and the trade balance, thus, both channels have a positive effect on the current account.

In a model where financial assets are perfect substitutes, there is only a riskless asset (government bond) and the interest rate is constant, then the equation (23) simplifies to

\[ B_t = -E_t \sum_{n=0}^{\infty} \left( \frac{1}{1+r} \right) TB(S_{t+n+1}, z_{t+n+1}) \]. In this scenario, any change in the dynamic future path of the trade balance or net exports affects the present value of the NIIP. This international adjustment channel relies on the determinants of the trade balance such as \(S_t\)\(^{13}\) and \(z_t\).

\(^{12}\)See appendix 3

\(^{13}\)It should be noted that as in Obstfeld and Rogoff (1995), \(S_t\) could be the real exchange rate which is a function of nominal exchange rate, terms of trade and/or prices of tradable and non-tradable goods; this is outside the scope of this paper. In addition, since there is no valuation effect, the change in the NIIP \((B_{t+1} - B_t)\) coincides with the current account \(CA_t\).
4 Short-Run Equilibrium

From the perspective of the general equilibrium, it is enough to model the domestic asset market (equation 16). The short-run equilibrium is consistent with the efficiency of the market under rational expectations in which prices reflect all information available to investors and they take the returns on securities, exchange rate depreciation and the variance-covariance matrix as given. The aims of this section are to gain insight into the optimal portfolio shares (equations 11 and 14) and to simulate the domestic asset market. For these purposes, I keep the assumptions of $d_t^i = 0, \pi_{t+1}^i = 0$ and fixed supplies of the securities.

4.1 Solving the model

For simplicity, I drop the subscript t (time) and study the effects of the expected returns on securities, variance-covariance matrix, and level of risk aversion on the optimal portfolio allocations. I want to highlight the fact that fluctuations of the expected returns on securities and the exchange rate are unrelated to the underlying current account drivers.

As shown in the preceding section, the home bias stylized fact restrains the solution space of the optimal portfolio allocations. The empirical evidence suggests that home bias is less prevalent than it was in the 1980s or two decades ago. Coeurdacier and Rey (2013) document that, by the end of the 1980s, the home bias in Japan, Australia, Canada and the United States was around 90% and in Europe was around 80%. In 2008, these numbers were smaller: the United States (77%), Japan (73.5%), Australia (76.1%), Canada (80.2%), the United Kingdom (54.5%) and the Euro Area (56.7%). In addition, as reported in Blanchard, Giavazzi and Sá (2005), 77% of U.S. wealth was invested in American assets and 71% of foreign wealth was allocated in foreign assets by the end of 2003. This evidence suggests that any set of parameters of the present model that give an optimal demand for local assets $x_i^D \in [0.55, 0.85]$ would be in line with empirical findings.

The next important step is to disentangle the return differential presented in Table 1, i.e., how much of those returns are due to changes in prices and exchange rates. To that end, I take the capital gains from Table 1.3. of the Bureau of Economic Analysis (BEA) because it shows the decomposition of the valuation effect of IIP on an annual basis since 2003. Following the same approach as in section 2, the total returns are comprised of yield and capital gains. The average percentage change of the Trade Weighted U.S. Dollar Index is a proxy variable of the expected rate of depreciation. Finally, I calculate the variance-covariance matrix of the returns on securities for this economy.

A solution to the model without the home bias restriction (equation 15) is obtained with the following moments and parameters:

- $E(i^F) = 0.108; E(\Delta s^e) = 0.0116; E(i^D) = 0.0566$
- $\gamma = 5.5; \gamma^* = 6.2$
- $Var(i^F) = 0.0185; Var(\Delta s^e) = 0.015; Var(i^D) = 0.0029$
- $Cov(i^F, \Delta s^e) = 0.00088; Cov(i^D, i^F) = 0.00566; Cov(i^D, \Delta s^e) = 0.0007$

The optimal allocations are $1 - x^D = 0.61$ and $x^F = 0.19$ (or $1 - x^F = 0.81$). Is this the only solution of the model? The answer is no. I study the range of possible values of each variable supporting demand for assets within the preset interval given the level of risk aversion of investors.
(γ = 5.5 and γ* = 6.2). As reported in Figure 8, the domestic demand for domestic assets \((1 - x^D)\) and the foreign demand for domestic assets \((x^F)\) are linear functions of the change in the return differential, i.e., the optimal shares are linear in the relative change in the excess return on assets \((i^F, Δs^e)\) or \(i^D\). However, these demands are nonlinear functions of nonlinear risk factors of the variance-covariance matrix and the allocations are very sensitive to changes in the covariances. These findings indicate that the risk factors in the variance-covariance matrix could have a better explanatory power than the changes in the return differential.

What is the role of γ in the optimal shares? To answer this question, I study two common assumptions found in the previous literature: risk neutral investors \((γ^i = 0)\) and homogeneous investors with preferences represented by a logarithmic function in wealth \((γ^i = 1)\). Risk neutral investors are a strong assumption not compatible with the data and the model has no solution. Also, it does not allow us to have a return differential due to perfect substitutability of assets and the study of the changes in the volatility and covariances between returns is meaningless. The other strong assumption, the logarithmic utility function (Adler and Dumas, 1983; Branson and Henderson, 1985; Tille and van Wincoop, 2010; and Evans and Hnatkovska, 2012), leads to optimal shares that are negative or inconsistent with the data\(^{14}\). There is no solution in which \(1 - x^i \in [0.55, 0.85]\).

Since values of risk aversion of 0 and 1 are not compatible with the empirical facts, I consider higher levels of risk aversion \(γ^i \in [2, 10]\), up to 10 since Mehra and Prescott (1985) suggest this number as a reasonable upper bound. It can be seen in Figure 9 that, keeping everything else constant, both demands for domestic assets are increasing on risk aversion parameter. To get optimal shares in line with the actual data, the risk aversion parameter must be at least 5 for domestic investors and 6.1 for foreign investors. Indeed, risk aversion values of \(γ \in [5.0, 9.5]\) and \(γ^* \in [6.1, 9.9]\) produce portfolios of \(1 - x^D \in [0.57, 0.83]\) and \(x^F \in [0.16, 0.35]\), respectively.

The return differential is one of the most studied variables in the previous literature, thereby I explore how the optimal shares change due to an increase in \(pr \in [0.04, 0.085]\) given different investors’ attitude towards risk. Figure 9 reports results for \(γ^i = \{7, 8, 9\}\) which are in line with the theoretical framework, the higher the risk aversion the less sensitive the demands are to changes in the return differential. Nevertheless, there are optimal shares \(1 - x^D\) and \(x^F\) within the established interval for values of risk aversion higher than 3 and lower than 7 \((γ^i = [3, 7])\).

Another question that needs to be studied is how investors rebalance their portfolios due to changes in the variance-covariance matrix given different levels of risk aversion (Figure 10). It follows from this analysis that demands for domestic assets shift to the right (almost parallel) for each increase in risk aversion. As in the previous case, there are optimal solutions for \(γ^i = [3, 7]\) but Figure 10 reports only the results for \(γ^i = \{7, 8, 9\}\).

How does this home bias fact change the previous results? I explore this question by adding the home bias restriction to the optimization problem. The following set of variables and parameters serve as the starting point for this analysis.

- \(pr = E(i^F) - E(Δs^e) - E(i^D) = 0.07\)
- \(γ = 3.2; γ^* = 6.6\)
- \(Var(i^F) = 0.025; Var(Δs^e) = 0.006; Var(i^D) = 0.0029\)
- \(Cov(i^F, Δs^e) = 0.01; Cov(i^D, i^F) = 0.00566; Cov(i^D, Δs^e) = 0.005\)

\(^{14}\)For example, the share of wealth on the domestic asset is negative for U.S. investors \((1 - x^D = -1.93)\) and positive for foreign investors \((1 - x^F = 3.09)\).
The optimal allocations are \(1 - x^D = 0.57\) and \(x^F = 0.42\) (or \(1 - x^F = 0.58\)). As in the previous exercise, I proceed to solve the model under different values of risk aversion \(\gamma^i \in [2, 10]\). One of the most significant differences between the solution with and without the home bias constraint is the disparity of the attitude towards risk between domestic and foreign investors. Figure 11 illustrates this finding by reporting the optimal allocations due to changes in the variance-covariance matrix under different levels of risk aversion. Note that the risk aversion for domestic investors is between 3.2 and 3.6, while for foreigners it is between 7.2 and 8.4. There are no domestic portfolio shares for values less than 3 and greater than 4, as well as there are no foreign portfolio shares for values less than 5 and greater than 9.4. Additionally, the model cannot be solved for similar risk aversion values \((\gamma = \gamma^*)\), regardless of the value of risk aversion associated with a logarithmic utility function.

Due to this discrepancy between \(\gamma\) and \(\gamma^*\), \(1 - x^D\) is more sensitive to changes of the \(pr\) than \(x^F\), and \(x^F\) is more sensitive to changes in the variance-covariance matrix than \(1 - x^D\). At a lower risk aversion level, the domestic investor is going to react to changes in the relative returns on assets while at a higher level of risk aversion, the foreign investor reacts more to changes in the variance-covariance matrix.

Another interesting finding is that domestic and foreign investors can allocate the same share of their wealth into local assets without the assumption of homogeneous preferences. For instance, when \(Cov(i^D, \Delta s^e) = 0.004\), \(\gamma = 3.2\) and \(\gamma^* = 8.6\), the portfolio composition is \(1 - x^i = 0.56\).

Finally, it is worth noting that for negative values of any of the covariances, the model gives counterintuitive results. For example, the domestic demand for domestic assets is increasing in \(pr\) for negative values of \(Cov(i^F, \Delta s^e)\).

### 4.2 The return on domestic assets and the exchange rate

Having characterized the underlying factors of the return differential in section 2, it is an important thing to be aware of how risk factors affect the return on assets and look at some of their implications. For this purpose, I calibrate the model to replicate the optimal portfolio shares reported by Blanchard, Giavazzi and Sá (2005): \(pr = 0.07\), \(\gamma = 3.2\) \(\gamma^* = 7.2\); \(Var(i^F) = 0.025\); \(Var(\Delta s^e) = 0.006\); \(Var(i^D) = 0.0029\); \(Cov(i^D, \Delta s^e) = 0.01\);

\[\text{and } Cov(i^F, \Delta s^e) = 0.005.\]

Due to lack of data availability, I use their estimates of financial wealth: U.S. Financial Wealth = $34.1 trillion (\(W^D\)) and Non-U.S. Financial Wealth = $36 trillion (\(SW^F\)) in 2003. Since I am interested in the return on assets and the main variable is the relative price of assets, I assume that \(P^D = P^F = 1\) and use equation (16) to solve for the implicit \(S\), which is equal to 0.88\(^{15}\).

With these numbers, I want to study the comparative-static effects of increases in variances of returns. An increase in one of the three variances induces, ceteris paribus, investors to adjust their portfolios and a new equilibrium is established at a new return differential. Keeping \(i^F\) and the expected prices and exchange rate constant, Figure 12 provides an overview of the path of the depreciation of the spot exchange rate and \(i^d\) for different levels of variances. With successive increases in variances, \(\Delta s\) and \(i^d\) move in the predicted direction. Consider an increase in \(Var(i^F)\) from 0.025 (\(\sigma_F = 15.81\%\)) to 0.029 (\(\sigma_F = 17.03\%\)). The effect of such increase in risk is to appreciate the U.S. dollar in 42.1% and to reduce the return on domestic asset in -20.25%. Similarly, an increase in \(Var(i^D)\) from 0.0029 (\(\sigma_D = 5.39\%\)) to 0.0069 (\(\sigma_F = 8.31\%\)) depreciates the U.S. dollar in 85%.

\(^{15}\)In 2003, U.S. holding of foreign assets, at market value, were equal to $8.62 trillion. Note that BEA uses Local Currency Units per unit of U.S. dollar as exchange rate which is the inverse of the definition used in the model. Given that the market for U.S. assets is in equilibrium, I calculate \(x^F SW^F\) which is equal to $7.62 trillion, and then, solve for \(S\) (the domestic price of foreign currency).
and increases $i^d$ in 56.62%.

The most striking result emerges from an increase in $Var(\Delta s^e)$ from 0.006 ($\sigma_{\Delta s^e} = 7.75\%$) to 0.01 ($\sigma_{\Delta s^e} = 10\%$). The net effect depends on the magnitude of the change in $1 - x^D$ and $x^F$ since both demands for local assets increase when $Var(\Delta s^e)$ raises. Let me recall the home bias equation $((1 - x^D) + (1 - x^F) - 1)$ which means that a transfer of one dollar of U.S. to foreign investors implies a decrease in the demand for U.S. assets. Given the change in $Var(\Delta s^e)$, $1 - x^D$ increases in 9.81% while $x^F$ decreases in 33.68%. Therefore, the price of domestic assets reduces causing an increase in $i^d$ by 6.67% and a depreciation of the exchange rate by 6.3%.

4.3 The world return on assets

Having discussed what is the purpose of using Blanchard, Giavazzi and Sá (2005)’s estimates and the appropriate set of parameters, I now move on to calculate the world return on assets. I assume that the ratios of countries’ financial wealth to world’s financial wealth do not change over time: $\theta = W^D/(W^D + SW^F) = 0.49$ and $1 - \theta = 0.51$.

The next step is to use equation (10) for each country to get the following world real return on financial assets ($r^W$)

$$r^W_{t+1} = \theta r^D_{p,t+1} + (1 - \theta) r^F_{p,t+1}$$

(24)

where $\theta$ is the share of domestic financial wealth in the world’s financial wealth.

Figure 13 reports the world real return on assets for the full sample. There is a significant decline in $r^W$, from 17.4% in 1976 to 5.6% by the end of 2015. At the beginning of the last decade and previous to the Great Recession (2001-2007), the world return was 7.7% on average. But during the peak of the Great Recession (2008-2010), there was a sudden drop in $r^W$, reaching a value of 4.8% on average. In turn, these capital gains and losses are bound to affect the world return on financial assets. One interpretation of current pattern of $r^W$ is that we have moved into an era in which the long-term real return to capital is near zero as a result of factors such as fewer investment opportunities and slower productivity growth (Bernanke, 2015)\(^{16}\). Also, Caballero, Farhi and Gourinchas (2008) capture the notion of a shortage of store of value or investment opportunities in a world economy model as one of the main causes of having a low $r^W$. Focusing on the short-term and long-term bond interest rates, Gourinchas and Rey (2014) document a similar pattern of the world real interest rates, being negative since 2007.

The recent pattern of a depressed world return on assets is not a short-term fact, but part of a long-term trend. It is below its historical average (13.8%) and is reflecting the weak prospective return on capital investments and/or financial markets. The bottom line is that the world economy is in a state where low returns on assets are expected to continue. At least in principle, if investment abroad is not as profitable as it was a few years ago, capital income will continue low causing a weak demand for assets. In this scenario, domestic and foreign investment opportunities are going to be limited in the near future.

5 Discussion

In this part I discuss the main findings of previous section. First, the expression for optimum portfolio choice derived in section 3 provides a reasonable explanation of how rational and risk

averse investors allocate their wealth among international assets. Contrary to the classical portfolio theory, the expected return is not the main driver of this allocation process since the investors may not react to changes in the expected return on assets for a higher level of risk aversion. In this sense, the risk premium (or return differential) has a limited impact on the rebalancing of the portfolios. Actually, the covariances of returns on assets become a more important determinant of the portfolio composition. The latter plays a vital role in understanding the mechanism since changes in the variance-covariance matrix cause a reoptimization of the portfolios which leads to variations in the return differential, i.e., variations in the valuation effect.

Second, the solution of the model without the home bias restriction allows us to analyze the case of similar investors’ attitudes towards risk. For $\gamma^D = \gamma^F = 6.5$ and given the initial values of the variables, the optimal demand for assets are $1 - x^D = 0.69$ and $1 - x^F = 0.80$. However, this analysis cannot be performed under the second scenario since the home bias restriction make impossible to find a solution to the model. This result has an important implication because the regular assumption of homogeneous investors of the portfolio balance models (Kouri, 1976; Adler and Dumas, 1983; Branson and Henderson, 1985) is not necessarily a good starting point to study international portfolio allocation.

The size of the risk aversion parameter is crucial to learn about the sensitivity of portfolio composition to changes in the variance-covariance matrix. Due to the disparity of the attitude towards risk between domestic and foreign investors, it seems that the foreign investors are more risk averse than domestic investors and consequently, the share invested in the home asset is higher for domestic investors than for foreign investors.

The other common assumption in the literature is that the investor’s utility function is logarithmic in wealth ($\gamma = 1$). No matter whether in portfolio balance models (Adler and Dumas, 1983; Branson and Henderson) or DSGE models (Tille and van Wincoop, 2010; Evans and Hnatkovska; 2012\textsuperscript{17}), this assumption requires further research and reflection. A reasonable alternative is to consider a higher level of risk aversion and the results presented in this document support this idea. A similar exercise is done by Devereux and Sutherland (2010) who investigate higher levels of risk aversion ($\gamma \in [1.5, 8]$) which are still within the range used in asset pricing studies. In the end, they calibrate their DSGE portfolio choice model with $\gamma = 5$ which is close to the value reported in this section.

Third, there is no one set of statistical moments and parameters to solve the model which means that more than one outcome is possible. More precisely, there is no universal risk-return trade-off that holds for all investors and even if a global optimal portfolio cannot be identified, many sub-optimal portfolios could be discarded due to the violation of home bias.

Fourth, the provision of microfoundations for the portfolio composition opens the door to understand the relationship between the portfolio shares and the variance-covariance matrix under different levels of risk aversion. Contrary to Blanchard, Giavazzi and Sá (2005), an increase in an exogenous variable, e.g., the volatility of return on foreign assets, has a different impact on the domestic and foreign investors. Furthermore, their model predicts a substantial future depreciation of the U.S. dollar since the exchange rate is the only equilibrating variable. In the present framework, fluctuations in the return differential could be done by changes in the return on foreign and/or domestic assets.

Fifth, I illustrate that an increase in volatility of the depreciation rate tends to induce a home

\textsuperscript{17}They compute the equilibrium using higher levels of risk aversion but it does not change the properties of the optimal holdings.
bias. Following Coeurdacier and Rey (2013) reasoning, whenever return on foreign asset outperforms return on domestic asset, domestic investors are going to buy more foreign assets. In this way, domestic investors are more exposed to exchange rate risk thus any increase in its volatility (even keeping the expected returns constant) induces a repatriation of their holdings of assets abroad. This is a mechanism for investors to hedge exchange rate risk.

Sixth, the world real return on assets has been steadily declining since 1976. It is currently below its historical average and is apparently going to remain low for the next few years. As mentioned above, this feature is a long-term trend and highlights the lack of investment possibilities.

Ultimately, the statistics taken from the data confirm both the return differential and the home bias, two stylized facts of the valuation effect of the U.S. After 2007, the excess return on assets declined and there are sufficient reasons to believe that a combination of three events were at play: an increase in the volatility in the foreign return, an increase in the risk aversion parameter and a decrease in the volatility of the return on the domestic asset.

6 Conclusions

The traditional statistics of balance of payments and NIIP cannot be used to study the valuation effect which is an important international adjustment channel for the U.S. The current account is one driver of the assets and liabilities of a country but the change in the NIIP is partially explained by valuation gains and losses coming from changes in asset prices and exchange rates. I show evidence that the U.S. has a positive valuation effect since the late 1980s which acts as a stabilizer of the NIIP. Nevertheless, this positive return differential is coming to an end. After 2006, it is not as economically significant as before and, in this regard, it threatens the sustainability of the U.S. current account balance.

The most natural interpretation of the numerical results is that this positive excess return on assets may be an equilibrium outcome and the theoretical framework developed in this paper provides a reasonable qualitative and quantitative explanation of the valuation effect. The microfoundations of the demand for assets present the underlying sources of this valuation effect and, as a result, the home bias restriction can be derived; absent in the previous literature. This constraint not only restrains the solution space of the investors' optimization problem but also increases the disparity of the attitude towards risk between domestic and foreign investors.

The parameter of risk aversion plays a fundamental role in the optimization of the portfolio shares and, according to the empirical findings, it could have changed over time. Risk aversion parameters supported by the data deliver values that are inconsistent with risk neutral investors, logarithmic utility function and homogeneous investors assumptions. From the theoretical model, an increase in the risk aversion of domestic and foreign investors increases the demand for domestic assets causing a decrease in the return as well as an appreciation.

References


### Table 1. The U.S. return differential estimates

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<th>Period</th>
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<td>$r_t$</td>
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<td>8.24</td>
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<td>9.39</td>
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### Table 2. Estimates of the Return Differential

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<tr>
<td>Gourinchas and Rey (2005)</td>
<td>1973 - 2004</td>
<td>3.32 3.79*</td>
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<tr>
<td>Lane and Milesi-Ferretti (2009)</td>
<td>1980 - 2004</td>
<td>3.9 2.5</td>
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*My estimates are for the sample period 1975-2004 whereas Gourinchas and Rey (2005) calculate for 1973-2004
Table 3. Valuation Changes of Portfolio Investment  
(percentage change)

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Table 4. Correlation

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Figure 1. External Balance Sheet of the U.S.

Panel A

Panel B
Figure 4. Returns and Volatility of Returns

Direct Investment

Real Return

Volatility of Real Return

Portfolio Investment

Real Return

Volatility of Real Return

Other Investment

Real Return

Volatility of Real Return
Figure 5. Decomposition of the return differential of Portfolio Investment
Return on Assets

Return on Liabilities

Figure 6. Return on Risky Asset and Cost of Debt

Figure 7. Density of Portfolio Investment by Gross Assets and Gross Liabilities
Figure 8. Range of returns, variances and covariances
(given $\gamma = 5.5$ and $\gamma^* = 6.2$)

Returns

Volatility

Covariances
Figure 9. Levels of Risk Aversion and Return Differential

Risk Aversions $\gamma$ and $\gamma^*$ given return differential

Optimal demands given $rp \in [0.04, 0.085]$, $\gamma = \{7, 8, 9\}$ and $\gamma^* = \{7, 8, 9\}$
Figure 10. Levels of Risk Aversion and Var-Cov Matrix
(Domestic Demand)
Figure 10. Levels of Risk Aversion and Var-Cov Matrix (Foreign Demand)
Figure 11. Home bias restriction\(^{18}\)

\[
\begin{align*}
\gamma &= 3.4 \text{ and } \gamma^* = 7.6 \\
\gamma &= 3.2 \text{ and } \gamma^* = 7.2
\end{align*}
\]

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\begin{align*}
\gamma &= 3.2 \text{ and } \gamma^* = 7.2 \\
\gamma &= 3.4 \text{ and } \gamma^* = 8.4
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\]

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\begin{align*}
\gamma &= 3.4 \text{ and } \gamma^* = 7.6 \\
\gamma &= 3.2 \text{ and } \gamma^* = 7.2
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\begin{align*}
\gamma &= 3.4 \text{ and } \gamma^* = 8.4 \\
\gamma &= 3.2 \text{ and } \gamma^* = 7.2
\end{align*}
\]

\(^{18}\)Other solutions:

\[
\begin{align*}
\text{Cov}(i^d, \Delta s^*) &= 0.004, \gamma = 3.2 \text{ and } \gamma^* = 8.6 \implies 1 - x^D = 0.56 \text{ and } x^F = 0.44 \\
\text{Cov}(i^d, i^F) &= [0.009, 0.016], \gamma = 3.4 \text{ and } \gamma^* = 7.4 \implies 1 - x^D = [0.63, 0.79] \text{ and } x^F = [0.45, 0.38] \\
\text{Cov}(i^d, \Delta s^*) &= 0.012, \gamma = 3.2 \text{ and } \gamma^* = 8 \implies 1 - x^D = 0.62 \text{ and } x^F = 0.43 \\
\text{Var}(i^d) &= [0.006, 0.007], \gamma = 3.6 \text{ and } \gamma^* = 8.4 \implies 1 - x^D = [0.59, 0.57] \text{ and } x^F = [0.44, 0.43] \\
\text{Var}(i^F) &= [0.021, 0.022], \gamma = 3.6 \text{ and } \gamma^* = 8.4 \implies 1 - x^D = [0.59, 0.60] \text{ and } x^F = [0.42, 0.44] \\
\text{Var}(\Delta s^*) &= [0.003, 0.004], \gamma = 3.4 \text{ and } \gamma^* = 6.2 \implies 1 - x^D = [0.57, 0.58] \text{ and } x^F = [0.44, 0.43]
\end{align*}
\]
Figure 12. Return on domestic asset and percentage change of spot.
Figure 13. World return on assets and world interest rates

*Current estimate of the model

**Gourinchas and Rey (2014), Figure 10.2 (p. 589)
A Appendix

A.1 Return differential of Portfolio Investment

In order to evaluate the extent and the nature of the return differential of portfolio investment, one needs to measure the valuation effect of assets and liabilities due to exchange rate fluctuations. Equity, short-term securities, and long-term securities positions are obtained from the Treasury International Capital (TIC) - U.S. Department of the Treasury. The official exchange rates (LCU per US$, period average) are obtained from FRED Economic Data - The Federal Reserve Bank of St. Louis. Then, I construct asset- and liability weighted exchange rate indices. These indices are reweighted annually on the basis of the share accounted for by each country.

Foreign holdings of U.S. securities at the end of year shown (as share of Total Securities)

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A.2 Home Bias

Deriving the relationship between the home bias and the expected return differential

\[(1 - x_t^F) + (1 - x_t^F) > 1 \]

\[1 > \frac{rp}{\Theta} + \frac{\gamma}{\Theta} \sum \frac{\text{Var}(i^D) - \text{Var}(i^F, i^D) - \text{Cov}(\Delta s^e, i^D)}{\Theta} \]

\[x_t^D + x_t^F = \frac{rp + \gamma}{\Theta} \sum \frac{\text{Var}(i^D) - \text{Var}(i^F, i^D) - \text{Cov}(\Delta s^e, i^D)}{\Theta} \]

Taking conditional expectation and imposing a no-Ponzi condition, we get

\[rp > \frac{1}{\frac{\gamma}{\Theta} - 1} \left[ \text{Cov}(\Delta s^e, i^D) - \text{Cov}(i^F, \Delta s^e) - \text{Var}(\Delta s^e) \right] \]

A.3 Current Account

Deriving the valuation effect channel

\[B_{t+1} - B_t = r_t^F S_t - P_{t-1}^F F_{t-1} - r_t^F P_{t-1}^D D_{t-1} + TB(S_t, z_t) \]

\[B_{t+1} - B_t = r_t^F S_t - P_{t-1}^F F_{t-1} - r_t^F P_{t-1}^D D_{t-1} + r_t^F P_{t-1}^F F_{t-1} - r_t^F P_{t-1}^D D_{t-1} + TB(S_t, z_t) \]

\[B_{t+1} - B_t = r_t^F B_t + (r_t^F - r_t^D) P_{t-1}^D D_{t-1} + TB(S_t, z_t) \]

\[B_{t+1} = (1 + r_t^F) B_t + (r_t^F - r_t^D) P_{t-1}^D D_{t-1} + TB(S_t, z_t) \]

\[B_t = \frac{1}{1 + r_t^F} \left[ B_{t+1} - (r_t^F - r_t^D) D_{t-1} - TB(S_t, z_t) \right] \]

Iterating forward

\[B_{t+1} = \frac{1}{1 + r_t^F} \left[ B_{t+2} - (r_t^F - r_t^D) D_t - TB(S_{t+1}, z_{t+1}) \right] \]

\[B_t = \frac{1}{1 + r_t^F} \sum_{n=0}^{\infty} \left[ \frac{1}{1 + r_{t+n}^F} \left[ \frac{1}{1 + r_{t+n}^D} - (r_t^F - r_t^D) D_{t+1+n} - TB(S_{t+n}, z_{t+n}) \right] \right] \]

\[B_t = \frac{1}{1 + r_t^F} \sum_{n=0}^{\infty} \left[ \frac{1}{1 + r_{t+n}^F} \left[ \frac{1}{1 + r_{t+n}^D} (r_{t+n}^F - r_{t+n}^D) D_{t+n} - TB(S_{t+n}, z_{t+n}) \right] \right] \]

\[- \frac{1}{1 + r_t^F} (r_t^F - r_t^D) D_{t-1} - \frac{1}{1 + r_t^F} TB(S_t, z_t) \]

Taking conditional expectation and imposing a no-Ponzi condition, we get

\[B_t = -E_t \sum_{n=0}^{\infty} \left[ \prod_{n=0}^{\infty} \left( \frac{1}{1 + r_{t+n}^F} (r_{t+n}^F - r_{t+n}^D) D_{t+n} \right) \right] - E_t \sum_{n=0}^{\infty} \left[ \prod_{n=0}^{\infty} \left( \frac{1}{1 + r_{t+n}^F} \right) TB(S_{t+n}, z_{t+n}) \right] \]