Valuation Effect, Heterogeneous Investors and Home Bias*

Walter Bazán-Palomino
Department of Economics, Fordham University
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Abstract

This paper examines both empirically and theoretically the impact of the valuation effect channel (the changes in the market value of a country’s external assets and liabilities) on the net international investment position (NIIP) for the United States. After constructing estimates of the U.S. external assets and liabilities for the period 1976-2015, I find that a positive valuation effect mitigated the impact of the persistent current account deficit on the NIIP until 2007. Surprisingly, from 2008 to 2015, this effect worked in the opposite direction, contributing to the deterioration of the U.S. NIIP despite the current account improvement. The reason for this, as I demonstrate, is that the U.S. NIIP tends to decrease if the return on its external assets is less than the return on its external liabilities. This return differential is absent in official statistics, but I show that it was, on average, positive until 2007 and negative thereafter. To explain these empirical findings, I build a two-country, two-asset model of portfolio balancing where the interaction between investors’ risk-return preferences, optimal demands for assets, and home bias (the tendency for investors to over-invest in home assets) can account for the post-2007 drop in the U.S. return differential. The model illustrates that a decrease in the return differential is explained by an increase in foreign asset risk, a decrease in domestic asset risk, an increase in the risk aversion for both domestic and foreign investors, or any combination of these factors.

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1 Introduction

The U.S. net international investment position (NIIP) has deteriorated rapidly since the beginning of the global financial crisis in 2007 and the debate about its sustainability is still unresolved. In 2015, the U.S. NIIP was US$ -7.3 trillion (or -40.4% of U.S. GDP), the biggest in the world in U.S. dollar terms. The traditional intertemporal models suggest that the evolution of a country’s NIIP is fully determined by the current account (CA) balance (Svensson and van Wijnbergen, 1989; Obstfeld and Rogoff, 1995). 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 the value of the U.S. external assets and liabilities due to variations in asset prices and exchange rates 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, 2009), Devereux and Sutherland (2010), Curcuru, Dvorak and Warnock (2010, 2013), and Gourinchas, Rey and Govillot (2017) provide empirical evidence that the valuation effect for the U.S. is a considerable source of adjustment.

The aim of this paper is twofold. First, in order to ascertain the source of the valuation effect, I follow Gourinchas and Rey (2005, 2007) to calculate the valuation changes and the return differential - yield and capital gains adjusted by inflation rate - of the U.S. NIIP from 1976 to 2015 by types of investments (direct investment, portfolio investment and other investment) and by asset-class (short-term debt, long-term debt, equity, and derivatives). Second, I develop a model of endogenous international portfolio choice where the interaction between investors’ risk-return preferences, optimal demands for assets, and home bias explains the return differential and its implication on the U.S. external balance sheet. 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 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 investors’ risk-return preferences represented by a logarithmic utility function, two main drawbacks of portfolio balance models, to study their implications on the calibration and simulation of the model.

The paper has four main contributions: two empirical and two theoretical. On empirical grounds, I find that the deterioration of the U.S NIIP from 2008 to 2015 is mainly explained by the drop in the return differential since 2008. This new empirical fact – and a relevant contribution of the paper – is important because the post-2007 drop in the return differential jeopardizes the sustainability of the U.S. net external debt. The reason for this, as I demonstrate, is that the U.S. NIIP tends to decrease if the return on its external assets is less than the return on its external liabilities. This return differential is absent in official statistics, but I show that the U.S. benefited from higher excess returns on foreign assets during 1976-2007, averaging 4.44%. The average excess return on net foreign assets mitigated the impact of the persistent CA deficit on the NIIP. Consequently, the U.S. net external debt is much better than one would expect based on cumulated current account

1 Home bias is the tendency for investors to over-invest in home assets.

deficits. However, from 2008 to 2015, the return differential was negative, averaging -0.17%. Over this period, the CA deficit has actually improved while the negative NIIP has dropped rapidly. This means that the return differential was a factor which contributed to the deterioration of the U.S. net external debt.

This decrease in the return differential after 2007 is present in different types of investments (direct investment, portfolio investment and other investment) and within individual asset classes (equity, derivatives and bonds). One of the findings that emerges from this analysis is that portfolio investment (PI) - the sum of equity, derivatives and debt securities - exhibits the highest return differential among types of investment before (1976-2007) and after (2008-2015) the beginning of the crisis, averaging 13.1% and 1.4%, respectively. Therefore, it is the major contributor to the U.S. valuation effect. This is in part because the composition of investment has changed in favor of high-yielding and riskier assets (equity and derivatives), and low-yielding and safer liabilities (short-term and long-term debt).

The second empirical contribution of the paper is the decomposition of the PI returns into capital gains and exchange rate fluctuations. To the best of my knowledge, this paper is the first to do so, and it reveals that (1) most of the valuation changes came from asset price movements and (2) there was a U.S. dollar appreciation in periods of high asset price volatility. Specifically, during 2008-2009 there was a significant increase in the risk of U.S. external assets as well as a higher currency risk.

On theoretical grounds, I contribute to the literature on valuation effect and return differential in two ways. First, I provide a two-country, two-asset model of portfolio balancing where the interaction between investors’ risk-return preferences, optimal demands for assets, and home bias can account for the post-2007 drop in the U.S. return differential. In the model, the domestic assets (U.S. assets) are less risky than the foreign assets (rest of the world), and the domestic investor (U.S. investor) is less risk averse than the foreign investor. The difference in risk aversion between domestic and foreign investors is absent in Blanchard, Giavazzi and Sá (2005)’s paper, and this omission is quite important to explain the return differential in the short-run. The mechanics of the model provide a reasonable qualitative and quantitative explanation of the pattern of the return differential in the short-run. In particular, the model is able to replicate the decrease in the return differential since 2008, which can be explained by an increase in foreign asset risk, a decrease in domestic asset risk, an increase in the risk aversion for both domestic and foreign investors, or any combination of these factors. Furthermore, the model reproduces the appreciation of the U.S. dollar during times of high foreign asset risk. Due to an increase in foreign asset risk, domestic and foreign investors buy more domestic assets (U.S. assets) causing an appreciation of the domestic currency (U.S. dollar).

The second theoretical contribution of the paper is to shed new light on the link between the home bias and the level of risk aversion (for both domestic and foreign investors) supported by the data. In this regard, the optimal demands for assets allow me to rewrite the home bias as a restriction which, in turn, provides guidance on the reasonable region of parameters of the model. In the numerical calibration of the model, I study the appropriate value of the risk aversion parameter both without and with the home bias restriction. In the first scenario, the values supported by the data deliver levels that are inconsistent with the assumptions of risk neutral investors, a logarithmic utility function, and homogeneous investors. Contrary to the first scenario, the inclusion of the home bias constraint not only restrains the region of the parameters of the model but also increases the risk aversion differential – i.e. increases the disparity of the attitude towards risk between domestic and foreign investors. As a result, domestic portfolios are more sensitive to variations in the return
On the question of the appropriate value of the risk aversion parameter, Gourinchas, Rey and Govillot (2017) highlight how the differences in risk aversion affect the equilibrium portfolio allocations. However, they do not use the empirical fact of home bias to restrain the region of parameters. By the same token, within DSGE frameworks\(^3\), Devereux and Sutherland (2010), Evans and Hnatkovska (2012), and Ghironi, Lee and Rebucci (2015) suggest calibrating models using values of risk aversion larger than the unity. Nevertheless, they do not assume a difference in risk tolerance or use the stylized fact of home bias in the calibration process.

While I do not address the issue of home bias, my model is related to it. Along these lines, home bias could be explained by risk aversion parameters, volatility of the depreciation rate and the correlation structure of the depreciation rate and asset returns. For instance, an increase in the exchange rate volatility induces a bias towards local assets. This feature is in line with the mechanism described by Coeurdacier and Rey (2013) who explore the role of exchange rates in the asset market’s home bias.

The rest of the paper is organized as follows. In section 2, I present estimates of the valuation effect channel for the U.S. between 1976 and 2015. Also, I calculate the U.S. return differential, and 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 U.S. return differential 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

To study the valuation effect channel of the United States, time series of the balance of payments, gross international asset position, and gross international liability position are required. A major drawback of the official balance of payments statistics is the absence of the valuation component in the current account measures\(^4\). For this reason, using annual data from the Bureau of Economic Analysis (BEA) and the Federal Reserve Flow of Funds Accounts (FFA), I construct the valuation effect component and the return on securities (assets and liabilities) of the U.S. following Gourinchas and Rey (2005, 2007)\(^5\).

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 asset position and \(L_t\) are the gross liability position. 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

\[^3\]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.

\[^4\]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.

\[^5\]Methodological details on the construction of the estimates are shown in the appendix.
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 effect component for gross asset position \((A_t)\) and gross liability position \((L_t)\). For each type of security "i" (asset or liability), I consider the following mathematical expression

\[
P_{i,t+1} = P_{i,t} + F_{i,t+1} + V_{i,t+1} + O_{i,t+1}
\]

where \(P_{i,t}\) is the position at the end of period \(t\), \(F_{i,t+1}\) denotes the corresponding flow during period \(t+1\) as recorded in the balance of payments, \(V_{i,t+1}\) is the valuation gain during period \(t+1\) due to a change in exchange rate and/or asset price, and \(O_{i,t+1}\) is the statistical error. Note that \(P_{i,t}\) is a stock variable which represents foreign holdings of U.S. securities \((P_{i,t} = A_{i,t})\) or U.S. holdings of foreign securities \((P_{i,t} = L_{i,t})\) at the end of period \(t\). Regarding the flow of each class of security, let’s denote \(F_{i,t} = FA_{i,t}\) for assets and \(F_{i,t} = FL_{i,t}\) for liabilities. Given (2), a positive valuation effects arises when the change in the market value of foreign assets held by domestic agents \((V_{i,t} = VA_{i,t})\) is larger than the change in the market value of domestic assets held by foreign agents \((V_{i,t} = VL_{i,t})\).

Once the time series \(V_{i,t+1}\) were constructed, the return on security "i" can be computed as

\[
(R_{i,t+1} - 1) \cdot P_{i,t} = I_{i,t+1} + V_{i,t+1}
\]

where \(I_{i,t+1}\) is the yield distributed at time \(t+1\) as recorded in the balance of payments. Summing across securities, we get \(A_t = \sum_i A_{i,t}\), \(L_t = \sum_i L_{i,t}\), \(FF_t = \sum_i FA_{i,t} - \sum_j FL_{i,t}\) and \(VE_t = \sum_i VA_{i,t} - \sum_j VL_{i,t}\), 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, this section presents the main stylized facts of the U.S. valuation effect channel. The first fact is the currency denomination of the U.S. international financial positions. In particular, most of its assets are denominated in foreign currency while most of its debt is in U.S. dollar. Thus, a dollar depreciation raises the value of foreign assets measured in dollars and consequently, lead to a positive valuation effect. Lane and Milesi-Ferretti (2007a, 2007b), Gourinchas and Rey (2007), and Tille (2003)\(^6\) affirm that the valuation gains from the depreciation of the dollar are a significant transfer of wealth from the rest of the world to the United States, which allows it to continue financing its debt.

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\(^7\) (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

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\(^6\)Due to asymmetric currency composition between assets (mostly in foreign currency) and liabilities (in dollars), they show the stabilizing role of a dollar depreciation on the U.S. external balance sheet.

\(^7\)According to the BEA, ownership of 10 percent or more constitutes a direct investment.
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 11.9% 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 51.4% of TA by the end of 2015. Making a more detailed evaluation of PI, the fixed-income securities (short-term and long-term debt) were 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 2.5% in 1976 to 39.5% by the end of 2015.

The story is quite different on the liabilities side (Panel B of Figure 1). The PI was 52.6% of Total Liabilities (TL) 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 as a share of TL remained at 40% but since 2000, it began to grow again until it reached the value of 62.1% 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 in 2015.

Due to the importance of variable-income securities (risky securities) on both sides of the U.S. external balance sheet in recent years, a positive valuation effect can occur with small changes in its market value. For instance, supposing that everything else remains constant in 2015, an increase of 1% in the market value of domestic and foreign variable-income securities causes a net increase of US$ 6,666 million in the U.S. external balance sheet.

The third stylized fact is the economic importance of the valuation effect for the U.S. I would like to organize the third stylized fact around the relevance of the international investment position and the significance of my estimates (constructed data) of NIIP. To begin with, the visual inspection reveals that assets and liabilities as a share of U.S. GDP have increased considerably since 2000 which suggest that cross-border investments have become more significant (Panel B of Figure 1). The ratio TA/GDP went from 74.3% in 2000 to 129.4% in 2015 while the total liabilities increased from 89.2% of GDP in 2000 to 169.8% of GDP in 2015.

Turning now to the dynamics of the NIIP, 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 until 1999 but then it gets bigger. Moreover, an analysis of the cumulative CA and cumulative VE gives us a better idea of the U.S. international borrowing needs. What stands out in Figure 2a is that the cumulative CA (without including the valuation effect) could give us a potential misleading reflection of the NIIP. The same feature is highlighted in Figures 2b since NIIP/GDP was -40% whereas the cumulative CA/GDP was -94% in 2015.

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. For instance, the last year that the United States had run a current account surplus was 1981. Then, the cumulative CA from 1982 to 2015 was US$ -10,344 billion. In contrast, the U.S. NIIP has deteriorated during this period to US$ -72,807 billion. This gap is explained by the valuation effect channel.

The growing significance of the valuation effect is also reflected in Figure 2c. In 1976, the gap between the cumulative VE/GDP and cumulative CA/GDP was not big (VE = 1.55% and CA

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8 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.

9 The United States had a negligible current account surplus in 1991.
= -0.68%) but it became considerably larger after 1990, when portfolio investment began to grow considerably. The 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 a share of GDP (Figure 3a and Figure 3b, respectively), the valuation effect component of the U.S. external balance sheet became more sizeable since 1999. The increase in the share of variable-income securities in total assets and fixed-income securities in total liabilities caused positive capital gains until 2007, but the year after the U.S experienced the biggest drop of these valuation gains (-13.26% of GDP). In the following years it remained low and since 2013 the valuation losses were significant.

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: $r^a$ was higher and more volatile than $r^l$, $(r^a - r^l)$ was therefore positive for almost all years, and $r^a$ and $r^l$ fell during the years following the international crises (1998 and 2007). During 2000-2002 and 2008-2009 both returns were negative, however, in the latter period, the return on assets was close to zero while the return on liabilities was significantly negative (-7.77% in 2009). In this way, the U.S. has not only benefited from a negative cost of debt but also from lower 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). In terms of the U.S. gross external claims and liabilities positions, the average return differential was 3.49% during 1976-2015. But a closer inspection of the third column of Table 1 shows that this return differential is getting smaller through different sub-samples. Indeed, it was about to 4% until 2005, then it reduced to 1.56% during 2006-2015 and turned into negative from 2008 to 2015.

In accordance with the present results, previous studies have also shown that the U.S. has experienced a positive return differential in the last decades (Table 2). For instance, 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; Obstfeld and Rogooff (2005) obtain a value of 3.1% from 1983 to 2003; and Forbes (2010) get a value of 3.9% during 1980-2004. The key lessons of Tables 1 and 2 are that the return differential is positive but decreasing and that the sample time period is important to assess the valuation effect channel.

The decomposition of the return differential by different sub-samples and types of investments detects another interesting finding. According to columns 6, 9 and 12 of Table 1, and Figure 4, the decreasing excess return on assets over liabilities is present in all types of investments. Due to the composition of PI, its return differential $(r^a - r^l)$ has the highest 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. On the contrary, DI exhibits a breakdown of the risk-return relationship because $r^a < r^l$ and $\text{Var}(r^l) > \text{Var}(r^a)$ during 1976-1985 and 1996-2005.

Given that the PI plays a major role in the valuation effect, it is crucial to assess the asset valuation. As a first exercise, the sample period is restrained to 1999-2015 because since 1999 PI as a share of total assets and total liabilities began to be larger, and the swings in exchange rates, bond prices, and equity prices started to be more relevant. Prior to undertaking the measuring, let’s keep the definition of Equity and group short-term debt and long-term debt into a Bond. After defining terms, I compute the return on equity, short-term 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).

From Figure 6, it is apparent that the weighted return on the net equity position\textsuperscript{10} was positive for most years between 1999 and 2015. During 2000-2002 the weighted return on equity on the asset side (solid line) and liability side (dash line) fell together and consequently, the net return was -5.5\%, -9.9\%, and -3.7\%, respectively. On average, the return on external claims was 15.3\% and the return on external liabilities was 4.7\% during 2003-2007. Conversely, the weighted return on the net bond position\textsuperscript{11} was negative for most years of this sub-sample (Figure 7). In the crisis year 2008, the weighted return on the net equity position was -41.4\% while the weighted return on the net bond position was -4.2\%. This result reflects that asset price changes were accentuated during the crisis but the price of the U.S. "Bond" (a pool of securities) was stable between 2005 and 2012. We know very little about the structural economic mechanism behind this feature but Figures 6 and 7 provide an overview of the importance of Equity and Bond in the PI's return differential.

For a clear assessment of 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 for the full sample\textsuperscript{12}. 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 a small asset valuation due to exchange rate movements. In other words, large absolute changes can exist even if the average percentage change is small.

On the question of the asset price's role in the valuation effect channel, it is interesting to note that percentage changes in price on the asset side outperforms the liability side. From 1976 to 2015, the United States has benefited from net positive changes in asset prices averaging 8.88\% (column 1 - 3 of Table 3). The latter reveals that the change in the market value of its external balance sheet has played in favor of the U.S. NIIP. It is somewhat not surprising that the net positive return on assets is decreasing over time and has dropped after the beginning crisis in 2007. On average, it went from 11.57\% during 1976-2007 to 0.06\% during 2008-2015.

Also relevant are the patterns of the asset-weighted and the debt-weighted exchange rate indices (Table 3 and Figure 5). Their effects are usually going in the opposite direction, looking at both simultaneously, and they are crucial for assessing the sensitivity of the U.S. external balance sheet to exchange rate movements. The asset-weighted exchange rate index reveals a small average appreciation of the U.S. dollar while the debt-weighted exchange rate index documents a modest average depreciation for the whole period. Nonetheless, both indices report a U.S. dollar appreciation in periods of high asset price volatility measured by the standard deviation of the return on assets: 1998-1999, 2001-2002, and 2008-2009 (Figure 5).

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 Devereux and Sutherland (2010) state, a result of general equilibrium models is that the trade balance and the excess return on foreign asset of a country are negatively correlated. In simple frameworks, we would also expect a negative correlation between the return differential and the current account, and some kind of correlation with the GDP growth and the NIIP.

\textsuperscript{10}For equity, it is the weighted return on external claims (asset side) minus weighted return on external liabilities (liability side).

\textsuperscript{11}For bond, it is the weighted return on external claims (asset side) minus weighted return on external liabilities (liability side).

\textsuperscript{12}I construct asset and liability weighted exchange rate indices. For further details, see appendix A.1.
Table 4 reports that $r^a - r^l$ of gross IIP and the trade balance are low and negatively correlated while the correlation of $r^a - r^l$ of PI and the trade balance is positive and significant. Similarly, the $\text{cor}(r^a - r^l, CA)$ is negative for gross IIP but positive for PI. What is interesting about the correlation analysis is that the valuation component measured in terms of return differential is not independent of the GDP and NIIP. In this regard, total investment, direct investment and portfolio investment ($r^a$, $r^l$ and $r^a - r^l$) are positively correlated with the growth rate of GDP and the NIIP, 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 growth rate of GDP and the NIIP, even if those returns are adjusted by exchange rate fluctuations (last three rows of Table 4).

Something that is not entirely clear is the correlation between the return differential and FA because it changes by type of investment. It is negative for DI and OI but positive for PI. In fact, the correlation between the return differential of PI and FA is the highest among types. 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.

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, enhanced the U.S. solvency until 2007. But it is also important to note that the valuation effect could work in the opposite direction, weakening the U.S. NIIP like in the last years (2008-2015).

- 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 acted as a stabilizer of its net international debt until 2007. On average, from 1976 to 2015 the current account deficit was -2.4% of GDP while the valuation effect of gross assets and liabilities was 2.5% and 1.7% of GDP, respectively. Relative to GDP, valuation effects reduced the impact of CA deficits on NIIP by about one third ($|(2.5-1.7)/-2.4|). It is noteworthy to mention that between 2000 and 2007, these valuation gains and losses were quite large in terms of GDP, however, after the crisis they went back to their historical averages.

- The analysis of the real returns on gross assets and gross liabilities demonstrates a return differential against foreign investors until 2007. This excess return on foreign 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). However, the return differential was negative, on average, from 2008 to 2015.

- Portfolio investment was the main contributor to the U.S. valuation effect and one reason for that is the composition of investment has changed in favor of high-yielding and riskier assets (equity and derivatives), and low-yielding and safer liabilities (short-term and long-term debt). The break up of the return differential of PI into the asset price component and the exchange rate component indicates that most of the valuation effects came from asset prices movements. Moreover, on average, the net positive return on assets went from 11.57% during 1976-2007 to 0.06% during 2008-2015.
• The decreasing return differential of the gross IIP is driven by the composition of the portfolio investment and the diminishing net positive return on assets (Equity and Bond).

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. net international debt. In my analysis below, I study the relationship between the excess of return on foreign 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 a reasonable region of parameters of the model. Even if the model considers the broad definition of investment, I want to examine a country’s NIIP from a financial perspective. It is important to highlight that 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 how the interaction between investors’ risk-return preferences, optimal demand for assets and home bias explains the return differential and its implication on a country’s external balance sheet. To attain that objective, I study a version of Blanchard, Giavazzi and Sá (2005) portfolio balance model where heterogeneous investors conduct a mean-variance approach to optimize their demand for assets, and investors’ preferences are not represented by a logarithmic function in wealth. The microfoundations for the portfolio composition allow me to characterize the return differential as an equilibrium outcome, and to rewrite the home bias as a restriction which, in turn, provides guidance on the reasonable region of parameters of the model.

There are two countries in this economy, that is, the domestic country (the U.S.) and the foreign country (the rest of the world). Also, there is a risk averse investor in each of the countries but they differ in the risk tolerance or risk aversion. Moreover, there is a single competitive global capital market but the financial assets are not perfect substitutes. I assume that the supplies of domestic and foreign assets are fixed and exogenous, and the stock of global wealth is the sum of the market value of the stock of domestic and foreign assets. Contrary to previous portfolio balance models (Frankel, 1982; Alder and Dumas, 1983; Branson and Henderson, 1985; Sarno and Taylor, 2002), the prices in this economy (asset prices and exchange rate) are determined endogenously and they do not follow a geometric Brownian motion, which is a standard assumption in finance theory.

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 equilibrium is an end-of-period equilibrium in which the return differential does not change through current account imbalances. Indeed, the basic predictions of the model in the short-run 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.

\[13\] There are no transactions costs, taxes or any other rigidity in the market.

\[14\] 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.
3.1 Return, Risk 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 \( t \); \( d_{j,t+1} \) is the distributed yield or dividend of the financial asset \( j \) at time \( t+1 \), for \( j = D, F \), which is uniformly distributed \( \in [0, 1] \). Equations (4) and (5) are the domestic currency return and the foreign currency return, respectively.

From the perspective of the domestic investor, equations (6) and (7) are the real returns on domestic and foreign assets in terms of domestic currency, respectively

\[ (1 + r_{D,t+1}) \equiv (1 + i_{D,t+1}) \frac{P_{t}}{P_{t}} \approx 1 + i_{D,t+1} - \pi_{t+1} \]

\[ (1 + r_{F,t+1}) \equiv (1 + i_{F,t+1}) \frac{S_{t+1}}{S_{t}} \frac{P_{t}}{P_{t+1}} \approx 1 + i_{F,t+1} + \Delta s_{t+1} - \pi_{t+1} \]

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 level of the exchange rate at time \( t \) which is defined as the domestic price of foreign asset, \( s_{t} \) is the log exchange rate at time \( t \) and \( \Delta s_{t+1} \) the depreciation rate at time \( t+1 \).

The real return on the domestic portfolio is

\[ r_{p,t+1}^{D} = x_{t}^{D} r_{t+1}^{F} + (1 - x_{t}^{D}) i_{t+1}^{D} \]

where \( x_{t}^{D} \) is the share of wealth held in the foreign asset and by construction, \( (1 - x_{t}^{D}) \) is the share of wealth held in home asset by domestic investors.

Before the formulation of an optimal portfolio of assets, I start the formal analysis of investment centering on risk. To understand the importance of a diversified portfolio and why domestic and foreign assets are not perfect substitutes, I have to define the risk of an individual asset and the risk of the portfolio. The risk of an asset is defined as the variance of the return on asset (capital gains or losses). A less risky asset has a small variance, i.e., there is a very small probability that the ex-post realized return differs from the ex-ante expected return. I assume that the foreign asset is relatively risky compared to the domestic asset (\( Var(r_{D,t+1}^{F}) < Var(r_{D,t+1}^{F}) \)). There are differences in risk caused by differences in liquidity, tax treatment, default risk, political risk, inflation risk, exchange control risk and exchange rate risk. Hence, any of these types of risk will be reflected in the variances of the returns on assets which are exogenous.

Investors are risk averse, that is, investors accept risk if they expect a higher return on their investment. If the expected return on foreign asset is higher than the expected return on domestic asset, then foreign asset is more risky than domestic asset and, therefore, there is a positive risk premium.

Let denote the excess return on foreign asset or return differential as \( er_{t+1} \equiv i_{t+1}^{F} + \Delta s_{t+1} - i_{t+1}^{D} \), its predictable component at time \( t \) as \( pr_{t} = E_{t}(er_{t+1}) \) and the statistical forecast error as \( \epsilon_{t+1} \).
Hence, the return differential can be written as the sum of these two terms: \( er_{t+1} = pr_t + \epsilon_{t+1} \). Since this paper focuses on the predictable component of the return differential, it is necessary to mention that the ex-ante expected return differential might be non-zero due to the existence of a risk premium\(^{15}\).

After defining the risk of an asset, the next step is to define the risk of the entire portfolio. While it may seem counterintuitive, the risk of the portfolio is mainly measured by the covariance of asset returns, i.e., how much the returns on two risky assets move in tandem.

\[
\text{Var}(r_{D,t+1}^P) = (x_{D,t}^D)^2 \text{Var}(r_{F,t+1}^F) + (1 - x_{D,t}^D)^2 \text{Var}(r_{D,t+1}^D) + 2x_{D,t}^D(1 - x_{D,t}^D) \text{Cov}(r_{F,t+1}^F, r_{D,t+1}^D) \tag{9}
\]

According to equation (9), the riskiness of the portfolio is dependent on the riskiness of the two types of assets and the covariance between the foreign and domestic returns on assets; they are not perfectly correlated. Indeed, this covariance explains portfolio diversification which is a rational response to risk for a risk-averse investor.

Turning now to the optimal portfolio choice, I describe the optimization problem of the domestic investor. The portfolio decision for the foreign investor is completely symmetric, however, the parameters are different. 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 \( W_{t+1} = W_t(1 + r_{p,t+1}) \). Following a standard mean-variance approach, the investors choose \( x_{D,t}^D \) to maximize an objective function that is increasing in the conditional mean but decreasing in the conditional variance of end-of-period wealth

\[
V = V(E_t(W_{D,t+1}^D), \text{Var}_t(W_{D,t+1}^D)) \tag{10}
\]

where \( \frac{\partial V}{\partial E_t(W_{D,t+1}^D)} > 0 \) and \( \frac{\partial V}{\partial \text{Var}_t(W_{D,t+1}^D)} < 0 \).

The domestic investor wants to optimize her portfolio in each period by maximizing a linear function of expected real return and variance of return

\[
E_t(U) = x_{D,t}^D E_t(r_{F,t+1}^F) + (1 - x_{D,t}^D) E_t(r_{D,t+1}^D) - \frac{1}{2} \gamma \left[ x_{D,t}^D \right] ' \left[ \begin{array}{c} x_{D,t}^D \\ 1 - x_{D,t}^D \end{array} \right] \tag{11}
\]

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

The FOC yields the optimal portfolio share for domestic investor:

\[
x_{D,t}^D = \frac{E_t(r_{F,t+1}^F) - E_t(r_{D,t+1}^D) + \gamma \left[ \text{Var}(r_{D,t+1}^D) - \text{Cov}(r_{F,t+1}^F, r_{D,t+1}^D) \right]}{\gamma \left[ \text{Var}(r_{D,t+1}^D) + \text{Var}(r_{F,t+1}^F) - 2\text{Cov}(r_{F,t+1}^F, r_{D,t+1}^D) \right]} \tag{12}
\]

Likewise, from the perspective of the foreign investor, the real returns in terms of foreign currency are denoted with an asterisk

\[
(1 + r_{s,t+1}^D) \equiv (1 + i_t^D) \frac{S_t}{S_{t+1}} \frac{P_t^*}{P_{t+1}^*} \approx 1 + i_t^D - \Delta s_{t+1} - \pi_{t+1}^* \tag{13}
\]

\(^{15}\)Note that the expected return differential could be constant. Regardless its variability, the expected return differential is an ex-ante non-profit condition which must hold because investors are indifferent at the margin between uncovered holdings of domestic and foreign assets.
\[ (1 + r^{F}_{s,t+1}) \equiv (1 + i^{F}_{t}) \frac{P^{*}_{t}}{P^{*}_{t+1}} \approx 1 + i^{F}_{t} - \pi^{*}_{t+1} \] (14)

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 \( t+1 \). Rogoff (1996) has shown strong evidence of deviations from the Purchasing Power Parity (PPP) condition. 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

\[
x^{F}_{t} = \frac{E_{t}r^{D}_{s,t+1} - E_{t}r^{F}_{s,t+1} + \gamma^{*} [\text{Var}(r^{F}_{s,t+1}) - \text{Cov}(r^{D}_{s,t+1}, r^{F}_{s,t+1})]}{\gamma^{*} [\text{Var}(r^{D}_{s,t+1}) + \text{Var}(r^{F}_{s,t+1}) - 2\text{Cov}(r^{D}_{s,t+1}, r^{F}_{s,t+1})]} \tag{15}
\]

where \( \gamma^{*} \) is the risk aversion parameter of the foreign investor and \( x^{F}_{t} \) is the foreign demand for domestic assets.

As noted, equations (12) and (15) 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: assets returns variances and covariances, exchange rate variations and inflation rate fluctuations. Also, it is noteworthy to indicate that the domestic demand for domestic assets (\( 1 - x^{D}_{t} \)) and the foreign demand for domestic assets (\( x^{F}_{t} \)) satisfy the stability conditions

\[
\frac{\partial(1-x^{D}_{t})}{\partial x^{D}_{t}} > 0, \quad \frac{\partial(1-x^{D}_{t})}{\partial \Delta s_{t+1}} < 0, \quad \frac{\partial(1-x^{D}_{t})}{\partial \pi^{*}_{t+1}} < 0, \quad \frac{\partial(1-x^{D}_{t})}{\partial E_{t}\pi^{*}_{t+1}} < 0, \quad \frac{\partial x^{F}_{t}}{\partial E_{t}^{F}r^{D}_{s,t+1}} > 0.
\]

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 substitutes.

The vector of optimal portfolio shares \( x^{D}_{t} \) and \( x^{F}_{t} \) can be interpreted as the sum of a speculative portfolio demand and a global minimum-variance portfolio demand (Kouri and Braga de Macedo, 1978; Frankel, 1982; Adler and Dumas, 1983; Branson and Henderson, 1985):

\[
x^{D}_{t} = \frac{E_{t}r^{D}_{s,t+1} - E_{t}r^{F}_{s,t+1}}{E_{t}r^{D}_{s,t+1} - E_{t}r^{F}_{s,t+1}} + \frac{[\text{Var}(r^{D}_{s,t+1}) - \text{Cov}(r^{D}_{s,t+1}, r^{F}_{s,t+1})]}{[\text{Var}(r^{D}_{s,t+1}) + \text{Var}(r^{F}_{s,t+1}) - 2\text{Cov}(r^{D}_{s,t+1}, r^{F}_{s,t+1})]},
\]

\[
x^{F}_{t} = \frac{\gamma^{*}[\text{Var}(r^{D}_{s,t+1}) + \text{Var}(r^{F}_{s,t+1}) - 2\text{Cov}(r^{D}_{s,t+1}, r^{F}_{s,t+1})]}{[\text{Var}(r^{D}_{s,t+1}) + \text{Var}(r^{F}_{s,t+1}) - 2\text{Cov}(r^{D}_{s,t+1}, r^{F}_{s,t+1})]},
\]

\[1^6\] 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.

\[1^7\] The 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.
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 return differential is different from zero, the vector of optimal portfolio shares would be mainly explained by the variance-covariance matrix.

In summary, I assume that the foreign investor is more risk averse than the domestic investor \( (\gamma^* > \gamma) \). In terms of risk, I suppose that \( \text{Var}(r_{t+1}^F) > \text{Var}(r_{t+1}^D) \) which implies \( E_t r_{t+1}^F > E_t r_{t+1}^D \), but what matters for the portfolio risk is the covariance between asset returns. It is a single-period optimization problem in which investors choose portfolio weights that provide the optimal trade-off between the mean and the variance of the portfolio return for the next period.

### 3.2 Home Bias

Home bias means that investors tend to hold a disproportionate share of their wealth in local assets. The financial literature has considered it as a strong and empirical phenomenon but less attention has been paid to the drivers behind it\(^{18}\). By definition, the sum of home demands for home assets has to satisfy the following inequality
\[
(1 - x_t^D) + (1 - x_t^F) > 1
\]
where \( x_t^i < \frac{1}{2} \) for \( i = D, F \).

I link the home bias and the excess return on foreign asset (from the point of view of the domestic investor) by substituting equations (12) and (15) into the previous inequality. The mathematical expression is below
\[
E_t r_{t+1}^F - E_t r_{t+1}^D = pr_t > \gamma \left[ \text{Var}(r_{t+1}^D) - \text{Cov}(r_{t+1}^F, r_{t+1}^D) \right] \frac{\gamma^* \Theta^*}{\gamma \Theta - \gamma^* \Theta^*}
\]
(16)

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

In order to get a clear picture, I consider a limiting case when \( (1 - x_t^D) + (1 - x_t^F) \to 1 \) which gives \( pr_t \to \gamma \left[ \text{Var}(r_{t+1}^D) - \text{Cov}(r_{t+1}^F, r_{t+1}^D) \right] \frac{\gamma^* \Theta^*}{\gamma \Theta - \gamma^* \Theta^*} \). An advantage of focusing on the limiting case is that there is a positive lower bound for the right-hand side of equation (16). In line with the empirical results in section 2 and the previous assumption of \( E_t r_{t+1}^F - E_t r_{t+1}^D > 0 \), the right-hand side of equation (16) cannot exceed \( E_t r_{t+1}^F - E_t r_{t+1}^D \) and, under the limiting case, it is positive.

Without loss of generality, I assume that \( d_t^i = 0, \pi_{t+1}^i = 0 \) 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 (Engel, 2014). Therefore, equation (16) can be rewritten as (see appendix A.2)

\(^{18}\)A good theoretical discussion is in Coeurdacier and Rey (2013).
Given the level of risk aversion of domestic and foreign investors, there is a link between the variance and covariance of assets returns 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 \( (D_S) \) and the foreign economy supplies securities denominated in foreign currency \( (F_S) \). In line with the literature of portfolio balance models, both supplies are fixed in the short-run. Given the optimal portfolio allocation for each period, then the market clearing conditions measured in domestic currency are

\[
D_S^t = (1 - x^D_t)W^D_t + x^F_tS_tW^F_t
\]

\[
S_tF^S_t = x^D_tW^D_t + (1 - x^F_t)S_tF^F_t
\]

With the return on foreign and domestic assets given, I can express the definition of financial wealth and the demands for assets for each investor as follows:

- **Domestic investor**
  - \( W^D_t \equiv D^D_t + S_tF^D_t \) (financial wealth)
  - \( D^D_t = (1 - x^D_t)W^D_t \) (demand for domestic assets)
  - \( S_tF^D_t = x^D_tW^D_t \) (demand for foreign assets)

- **Foreign investor**
  - \( S_tF^F_t \equiv D^F_t + S_tF^F_t \) (financial wealth)
  - \( D^F_t = x^F_tS_tW^F_t \) (demand for domestic assets)
  - \( S_tF^F_t = (1 - x^F_t)SW^F_t \) (demand for foreign assets)

Since \( W^D_t \) is the market value of wealth of country i, an increase in the wealth of investors increases the demand for both assets. For instance, if there is an increase in the price of the domestic asset \( (P^D_t) \), the investor will convert some of this extra wealth into the foreign asset and keep the remainder in the form of the local asset. Similarly, an increase in the price of the foreign asset \( (P^F_t) \) 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 local assets.

The domestic and foreign returns as well as the exchange rate vary to ensure equilibrium in the asset markets within the limits imposed by the home bias. For simplicity, assume that the expected rate of depreciation is fixed. Equation (17) is the **Domestic Portfolio Balance (DPB)** or domestic asset market equilibrium schedules in the \((S, i)\) plane. Assume there is a depreciation of \( S_t \), 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 (18) is the Foreign Portfolio Balance (FPB) or foreign asset market equilibrium schedules in the \((S, i)\) plane. 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 \(x_i\). 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
- \(P_D^t\): price of the stock of domestic assets
- \(P_F^t\): price of the stock of foreign assets
- \(F_t \equiv P_F^t F_t\): the market value of the foreign asset in foreign currency
- \(D_t \equiv P_D^t D_t\): 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 \(D_{t-1} \equiv P_{t-1}^D D_{t-1}\) and \(F_{t-1} \equiv P_{t-1}^F F_{t-1}\). Now let us denote the Net International Investment Position (NIIP) as

\[
B_t = S_{t-1} P_{t-1}^F F_{t-1} - P_{t-1}^D D_{t-1}
\]

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

\[
\begin{align*}
    r_F^t S_{t-1} P_{t-1}^F F_{t-1} & = S_t P_{t}^F F_{t-1} - S_{t-1} P_{t-1}^F F_{t-1} \quad \text{(income from foreign assets - received)} \\
    r_D^t P_{t-1}^D D_{t-1} & = P_{t}^D D_{t-1} - P_{t-1}^D D_{t-1} \quad \text{(income from domestic assets - sent)}
\end{align*}
\]
Therefore, the income balance (IB) is

$$IB_t = (S_t P^F_t F_{t-1} - S_{t-1} P^F_{t-1} F_{t-1}) - (P^D_t D_{t-1} - P^D_{t-1} D_{t-1})$$ \hspace{1cm} (19)

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 the real exchange rate ($S_t$)\textsuperscript{19}. All other factors that increase the trade balance are captured by $z_t$.

$$TB_t(S_t, z_t) = 0$$ \hspace{1cm} (20)

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

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

$$CA_t = (S_t P^F_t F_{t-1} - P^D_t D_{t-1}) - (S_{t-1} P^F_{t-1} F_{t-1} - P^D_{t-1} D_{t-1})$$

which can be written as

$$B_{t+1} - B_t = CA_t + (S_t P^F_t - S_{t-1} P^F_{t-1}) F_{t-1} - (P^D_t - P^D_{t-1}) D_{t-1}$$ \hspace{1cm} (21)

Equation (21) shows that the NIIP variation is not equal to the CA due to changes in asset prices and exchange rate. In fact, the variation in the NIIP is equal to the CA plus the valuation effect.

Finally, the standard definition of CA is presented below

$$CA_t = (S_t P^F_t F_{t-1} - P^D_t D_{t-1}) - (S_{t-1} P^F_{t-1} F_{t-1} - P^D_{t-1} D_{t-1}) = IB_t + TB_t$$

$$= (S_t P^F_t F_{t-1} - S_{t-1} P^F_{t-1} F_{t-1}) - (P^D_t D_{t-1} - P^D_{t-1} D_{t-1}) + TB_t$$

$$= x^D_t W^D_t - x^D_{t-1} W^D_{t-1} = r^F_t x^D_{t-1} W^D_{t-1} - r^D_t x^F_{t-1} S_{t-1} W^F_{t-1} + TB(S_t, z_t)$$ \hspace{1cm} (22)

### 3.5 The Valuation Effect: international adjustment channel

In order to highlight the impact of the return differential on the current account, I omit dividends and use an alternative definition of the CA based on the returns on assets

$$B_{t+1} - B_t = CA_t + r^F_t S_{t-1} P^F_{t-1} F_{t-1} - r^D_t P^D_{t-1} D_{t-1}$$ \hspace{1cm} (23)

Using equation (23), I can rewrite the CA measured at current prices as follow

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

\textsuperscript{19}To simplify the analysis and focus on the change in asset prices, I assume $P_t = P^*_t = 1$. Sarno and Taylor (2002) mention that good prices are indeterminate in this kind of models.
Then, iterating it forward, imposing a no-Ponzi condition and taking conditional expectations\(^{20}\)

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

Equation (24) 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 foreign and domestic assets is in parentheses and it is the source of the predictable component of the return differential \((e_{t+n} = r_{t+n}^F - r_{t+n}^D)\). The valuation effect is the composition of the predictable excess return on foreign assets and the future path of returns on gross foreign assets position. Another way to see equation (24) 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 in 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 in 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 (24) simplifies to

\[
B_t = -E_t \sum_{n=0}^{\infty} \frac{1}{1 + r} TB(S_{t+n+1}, z_{t+n+1}).
\]

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 \(S_t\)\(^{21}\) and \(z_t\).

4 Short-Run Equilibrium

From the perspective of the general equilibrium, it is enough to model the domestic asset market (equation 17). 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

\(^{20}\)See appendix A.3.

\(^{21}\)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 \(CA_t\).
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 12 and 15) and to simulate the domestic asset market. 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. For these purposes, I drop the subscript \( t \) (time). I keep the assumptions of \( d^i = 0 \), \( \pi^i = 0 \), and in line with portfolio balance models, I assume that the supplies of foreign and domestic assets are fixed in the short-run.

4.1 Calibrating the model

To begin this process, I have to know the level of home bias for the domestic and foreign economies, to calculate the expected returns on assets and the variance-covariance matrix, and to find numerical values for the risk aversion parameters of domestic and foreign investors.

One of the aims of this section is to show that the home bias stylized fact restrains the reasonable region of parameters of the model and, consequently, 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 while 71% of foreign wealth was allocated in foreign assets by the end of 2003. This evidence suggests that any set of parameters of the model that gives an optimal demand for local assets \( 1 - x^i \in [0.55, 0.85] \) would be in line with empirical findings.

The next important step is to compute the expected return on assets, i.e., to decompose the return differential presented in Table 1 into capital gains and exchange rate fluctuations. 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 in the Trade Weighted U.S. Dollar Index is a proxy variable of the expected rate of depreciation\(^{22}\). After obtaining the returns on assets, I calculate the variance-covariance matrix.

Calibration certainly encompasses the idea of extracting the right value of the risk aversion parameters. Indeed, I would like to know the values of the risk aversion parameters of both domestic and foreign investors but portfolio balance models have not calculated them. Thus, I proceed as follow. Given the expected returns on assets and variance-covariance matrix, the first thing I do is to look for risk aversion values for both domestic and foreign investors that give me local demands for local assets within the established range. That is, I increase the risk aversion parameter from 0 to 10\(^{23}\) and see which of these values give me optimal portfolios between 0.55 and 0.85. From Figure 8, it can be seen that the domestic risk aversion parameter takes values from 5 to 9.5 while the foreign risk aversion parameter lies between 6.1 and 9.9. The natural reference point here is the values obtain in DSGE models. In particular, the values used by Devereux and Sutherland (2010) which go from 1.5 to 8. In the end, they calibrate their model with a value of 5. This is the reason why I start this analysis with values close to 5.

\(^{22}\)I compute the percentage change in the U.S. dollar against major currencies based on the constructed asset (liability) weighted exchange rate index (see appendix A.1). The results are similar and available upon request.

\(^{23}\)According to Mehra and Prescott (1985), 10 is a reasonable upper bound.
A solution to the model without the home bias restriction (equation 16) is obtained with the following statistical moments and parameters:

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

- **Parameters**
  - $\gamma = 5.5$; $\gamma^* = 6.2$

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. Once I know the minimum values of risk aversion for each of the investors ($\gamma = 5.5$ and $\gamma^* = 6.2$), I begin to change the value of each one of the variables that explain the optimal portfolio, keeping the objective solutions between 0.55 and 0.85. It is important to bear in mind that I report the results in terms of the demands for domestic assets ($1 - x^D$ and $x^F$), however, I carry out the study based on the responses of the local demands for local assets ($1 - i^i$).

Figure 9 provides the values of the returns on assets and the variance-covariance matrix supporting local demands for local assets within the preset interval. What stands out in this figure is that $(1 - x^D)$ and $(x^F)$ are linear functions of changes in the return differential, i.e., the optimal shares are linear in relative changes in the excess return on foreign asset ($i^F$, $\Delta s^e$ or $i^D$). But, 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 excess return on foreign asset.

The return differential is one of the most studied variables in the previous literature, thereby I explore the impact of an increase in $pr \in [0.04, 0.085]$ on the optimal shares given different investors’ attitude towards risk. By way of explanation, I combine a change in the return differential with an increase in the risk aversion parameters from 0 to 1. Figure 10 reports results for $\gamma^i = \{7, 8, 9\}$ 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 ($\gamma^i \in [3, 7]$).

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 11). 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 $\gamma^i \in [3, 7]$ but Figure 11 reports only the results for $\gamma^i = \{7, 8, 9\}$.

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

- **Statistical moments**
  - $pr = E(i^F) - E(\Delta s^e) - E(i^D) = 0.07$
\[ \text{Var}(i^F) = 0.025; \text{Var}(\Delta s^e) = 0.006; \text{Var}(i^D) = 0.0029 \]
\[ \text{Cov}(i^F, \Delta s^e) = 0.01; \text{Cov}(i^D, i^F) = 0.00566; \text{Cov}(i^D, \Delta s^e) = 0.005 \]

- Parameters
  \[ \gamma = 3.2; \gamma^* = 6.6 \]

The optimal allocations are \( 1 - x^D = 0.57 \) and \( x^F = 0.42 \) (or \( 1 - x^F = 0.58 \)). 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.

After I know the minimum values of risk aversion parameters including the HB restriction, the final step of the calibration procedure is the combination of changes in the variance-covariance matrix with different combinations of risk aversion parameters. The most surprising aspect of Figure 12 is the difference in the investors’ attitudes towards risk or the risk aversion differential. Notably, 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 in \( pr \) than \( x^F \), and \( x^F \) is more sensitive to changes in \( \Sigma \) 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 \( \text{Cov}(i^D, \Delta s^e) = 0.004; \gamma = 3.2 \) 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 \( \text{Cov}(i^F, \Delta s^e) \).

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

I can now conduct a computational experiment to assess the ability of the model to mimic features of the valuation effect. With this in mind, I want to examine the impact of risk factors on the return differential. For this purpose, I calibrate the model to replicate the optimal portfolio shares reported by Blanchard, Giavazzi and Sá (2005): \( pr = 0.07, \gamma = 3.2, \gamma^* = 7.2 \); \( \text{Var}(i^F) = 0.025; \text{Var}(\Delta s^e) = 0.006; \text{Var}(i^D) = 0.0029; \text{Cov}(i^F, \Delta s^e) = 0.01; \text{Cov}(i^D, i^F) = 0.018; \text{and Cov}(i^D, \Delta s^e) = 0.005 \).

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 (17) to solve for the implicit \( S \), which is equal to 0.9824.

With these numbers, I carry out comparative statics experiments of increases in the risk of assets. 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 13 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 \( i^F \) move in the predicted direction. Consider an increase in \( \text{Var}(i^F) \) 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 assets in -20.25\%. Similarly, an increase in \( \text{Var}(i^D) \) from 0.0029 (\( \sigma_D = 5.39\% \)) to 0.0069 (\( \sigma_F = 8.31\% \)) depreciates the U.S. dollar in 85\% and increases \( i^D \) in 56.62\%.

The most striking result emerges from an increase in \( \text{Var}(s^e) \) from 0.006 (\( \sigma_{s^e} = 7.75\% \)) to 0.01(\( \sigma_{s^e} = 10\% \)). 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 \( \text{Var}(s^e) \) raises. Let me recall the home bias equation \((1 - x^D) + (1 - x^F) - 1\) which means that a transfer of one dollar from U.S. to foreign investors implies a decrease in the demand for U.S. assets. Given the change in \( \text{Var}(s^e) \), \( 1 - x^D \) 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\%.

5 Discussion

In this part I discuss the main findings of previous section. First, the expected return on assets is not the main driver behind optimal demands for assets because investors may not react to changes in the expected return on assets above a certain level of risk aversion. Surprisingly, 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. Changes in the variance-covariance matrix cause a reoptimization of investors’ portfolios which leads to variations in the return differential, i.e., variations in the valuation effect. The latter plays a vital role in understanding the mechanics of the post-2007 drop in the U.S. return differential.

Second, I study two common assumptions found in the previous literature. To begin with, the assumption of risk neutral investors (\( \gamma^i = 0 \)) does not allow us to solve the model. The other strong assumption, homogeneous investors with preferences represented by a logarithmic utility function (\( \gamma^i = 1 \)), leads to optimal shares that are negative or inconsistent with the data.\(^{25}\) There is no solution in which \( 1 - x^i \in [0.55, 0.85] \). No matter whether in portfolio balance models (Kouri, 1976; Adler and Dumas, 1983; Branson and Henderson, 1985) or DSGE models (Tille and van Wincoop, 2010; Evans and Hnatkovska; 2012\(^{26}\)), 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.

Third, the solution of the model without the home bias restriction allows us to analyze the case of similar investors’ attitudes towards risk, i.e., homogeneous investors. For \( \gamma^D = \gamma^F = 6.5 \) and given the initial values of the variables, the optimal demands for assets are \( 1 - x^D = 0.69 \) and \( 1 - x^F = 0.80 \). However, this analysis cannot be performed under the second scenario because

\(^{25}\) 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 (\( 1 - x^F = 3.09 \)).

\(^{26}\) They compute the equilibrium using higher levels of risk aversion but it does not change the properties of the optimal holdings.
the home bias restriction rules out a single representative-agent model. Within portfolio balance models, this result raises the possibility that the regular assumption of homogeneous investors is not necessarily a good starting point to study international portfolio allocation.

Furthermore, the size of the risk aversion parameter is crucial to learn about the sensitivity of demands for assets to changes in the return differential and variance-covariance matrix. One of the most striking results is that foreign investors are more risk averse than domestic investors and, as a result, domestic portfolios are more sensitive to variations in the return differential while foreign portfolios are more responsive to changes in the variance-covariance matrix.

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., an increase in foreign asset risk, has a different impact on domestic and foreign portfolios. 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, an increase in $\text{Var}(i_F)$ generates an adjustment in both the return on domestic assets and depreciation rate to ensure a new asset’s market equilibrium in the short-run. Likewise, an increase in $\text{Var}(\Delta s^e)$ causes a decrease in the return differential thru variations in $i^D$ and $\Delta s^e$.

Fifth, I illustrate that an increase in the volatility of the depreciation rate tends to induce a home bias. Following Coeurdacier and Rey (2013) reasoning, whenever the return on foreign assets outperforms the return on domestic assets, 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 currency risk.

Last but not least, the model is able to replicate two empirical facts of the U.S. valuation effect. The first is the decline in the return differential since 2008 which can be explained by an increase in the risk of foreign assets, a decrease in the risk of domestic assets, an increase in the risk aversion for both domestic and foreign investors, or any combination of these factors. The second is the appreciation of the U.S. dollar in periods of high asset price volatility. Due to an increase in the variance of the return on foreign assets, domestic and foreign investors buy more domestic assets (U.S. assets) causing an appreciation of the domestic currency (U.S. dollar).

6 Conclusions

I have shown that the traditional balance of payments and NIIP statistics cannot be used to study the U.S. valuation effect, the relevance of which has recently been emphasized by many scholars. Along these lines, the U.S. current account could not explain the recent deterioration of its NIIP after 2007. Therefore, valuation losses coming from changes in asset prices and exchange rates were another factor affecting the U.S. NIIP.

Related to the valuation effect channel is the role of the difference between the returns on external assets and liabilities, i.e., the return differential. This study has found that periods of a positive valuation effect coincide with a positive return differential. On average, the return differential was positive until 2007 and negative thereafter. The post-2007 drop in the return differential contributed to the deterioration of the U.S. NIIP from 2008 to 2015. We need to understand what drives the decrease in the return differential to gauge the sustainability of the U.S. international debt.

As a way of addressing the empirical findings, I have studied a portfolio balance model where risk
averse and heterogeneous investors conduct a mean-variance approach to optimize their demands for assets, and investors’ preferences are not represented by a logarithmic utility function. The mechanics of the model provide a reasonable qualitative and quantitative explanation of the pattern of the return differential in the short-run. In particular, the model is able to replicate the decrease in the return differential since 2008, which can be explained by an increase in foreign asset risk, a decrease in domestic asset risk, an increase in the risk aversion for both domestic and foreign investors, or any combination of these factors.

The explicit interaction between investors’ risk-return preferences, optimal demands for assets and home bias is, I believe, novel. Furthermore, the optimal demands for assets allow me to rewrite the home bias as a restriction which, in turn, provides guidance on the reasonable region of parameters of the model. One of the most relevant findings that emerges from this analysis is the risk aversion differential, i.e., domestic investors are less risk averse than foreign investors. On the question of the level of risk aversion, the values supported by the data deliver levels that are inconsistent with risk neutral investors, a logarithmic utility function, and homogeneous investors assumptions. Taken together, the findings of this investigation complement those of earlier studies in portfolio balance models.

Researchers and policymakers should be cautious because the risk appetite is not independent of home bias or the statistical moments of the variables. A more current assessment of the world’s financial wealth as well as the home bias could slightly change the region of parameters of the model. However, the home bias did not change dramatically from 1980 to 2008, and the composition of the U.S. foreign assets and liabilities by country remained stable during 1980-2015. Notwithstanding the relatively limited data availability, this work offers valuable insights into the valuation effect for the United States and tentative levels of risk aversion for future research in asset pricing.

References


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

<table>
<thead>
<tr>
<th>Period</th>
<th>Total</th>
<th>Direct Investment</th>
<th>Portfolio Investment</th>
<th>Others</th>
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<tr>
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<td>$r^d$</td>
<td>$r^d$</td>
<td>$r^d - r^f$</td>
<td>$r^d$</td>
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<tr>
<td>1976-2015</td>
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<td>8.51</td>
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<tr>
<td>1976-1985</td>
<td>8.49</td>
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<td>St. Dev. (%)</td>
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<tr>
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<td>4.06</td>
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<td>6.07</td>
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<tr>
<td>St. Dev. (%)</td>
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<tr>
<td>1996-2005</td>
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<td>3.74</td>
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<td>St. Dev. (%)</td>
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<td>St. Dev. (%)</td>
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<tr>
<td>St. Dev. (%)</td>
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<tr>
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<tr>
<td>St. Dev. (%)</td>
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### Table 2. Estimates of the Return Differential

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<th>Estimates</th>
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<td>Gourinchas and Rey (2005)</td>
<td>1973 - 2004</td>
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<td>Lane and Milesi-Ferretti (2009)</td>
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Table 3. Valuation Changes of Portfolio Investment
(percentage change)

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<th>Liabilities</th>
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<td>Prices (A)</td>
<td>Ex. Rate</td>
<td>Prices (L)</td>
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<td>1976-2015</td>
<td>19.78 0.43</td>
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<td>10.91 -1.39</td>
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<td></td>
<td>19.51 10.06</td>
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<td>11.53 8.64</td>
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<td>21.29 10.59</td>
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<td>16.23 14.80</td>
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<td>1996-2005</td>
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<td>2.86 3.83</td>
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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 2a. Official NIIP vs estimated NIIP

Figure 3a. Valuation Component (Nominal)

Figure 2b. NIIP/GDP and Cumulative CA/GDP

Figure 3b. Valuation Component (%GDP)

Figure 2c. Cumulative CA/GDP and VE/GDP

Figure 3c. Annual Real Return
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

![Graph showing decomposition of return on assets and liabilities over time.]

Figure 6. Weighted Return on Equity 1999-2015

![Graph showing weighted return on equity over time.]

Figure 7. Weighted Return on Bond 1999-2015

![Graph showing weighted return on bond over time.]

32
Figure 8. Risk aversion parameters

Figure 9. Range of returns on assets, variances and covariances
(given $\gamma = 5.5$ and $\gamma^* = 6.2$)

Returns

Volatility

Covariances
Figure 10. Levels of Risk Aversion and Return Differential
Optimal demands given $r p \in [0.04, 0.085]$, $\gamma = \{7, 8, 9\}$ and $\gamma^* = \{7, 8, 9\}$
Figure 11. Levels of Risk Aversion and Var-Cov Matrix
(domestic demand for domestic assets)
Figure 11. Levels of Risk Aversion and Var-Cov Matrix
(foreign demand for domestic assets)
Other solutions:

\[ \text{Cov}(i_d, \Delta^s) = 0.004, \quad \gamma = 3.2 \text{ and } \gamma^* = 7.6 \implies 1 - x^D = 0.56 \text{ and } x^F = 0.44 \]
\[ \text{Cov}(i_d, i_F) = [0.009, 0.016], \quad \gamma = 3.4 \text{ and } \gamma^* = 7.4 \implies 1 - x^D = [0.63, 0.79] \text{ and } x^F = [0.45, 0.38] \]
\[ \text{Cov}(i_F, \Delta^s) = 0.012, \quad \gamma = 3.2 \text{ and } \gamma^* = 8 \implies 1 - x^D = 0.62 \text{ and } x^F = 0.43 \]
\[ \text{Var}(i_d^D) = [0.006, 0.007], \quad \gamma = 3.6 \text{ and } \gamma^* = 8.4 \implies 1 - x^D = [0.59, 0.57] \text{ and } x^F = [0.44, 0.43] \]
\[ \text{Var}(i_d^F) = [0.021, 0.022], \quad \gamma = 3.6 \text{ and } \gamma^* = 8.4 \implies 1 - x^D = [0.59, 0.60] \text{ and } x^F = [0.42, 0.44] \]
\[ \text{Var}(\Delta^s) = [0.003, 0.004], \quad \gamma = 3.4 \text{ and } \gamma^* = 6.2 \implies 1 - x^D = [0.57, 0.58] \text{ and } x^F = [0.44, 0.43] \]
Figure 13. Return on domestic asset and percentage change of spot.
Appendix

A.1 Return differential of Portfolio Investment

In order to assess the extent and 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.

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A.2 Home Bias

Deriving the relationship between the home bias and the expected return differential
\((1 - x_t^D) + (1 - x_t^F) > 1\)

\[x_t^D + x_t^F = \frac{rp + \gamma [Var(i^D) - Cov(i^F, i^D) - Cov(\Delta s^e, i^D)]}{\gamma [Var(i^D) + Var(i^F) + Var(\Delta s^e) + 2Cov(i^F, \Delta s^e) - 2Cov(i^F, i^D) - 2Cov(\Delta s^e, i^D)]}
\]

\[= \frac{rp + \gamma^* [Var(i^F) - Cov(\Delta s^e, i^F)]}{\gamma [Var(i^D) + Var(i^F) + Var(\Delta s^e) + 2Cov(i^F, \Delta s^e) - 2Cov(i^F, i^D) - 2Cov(\Delta s^e, i^D)]}
\]

\[= \frac{\gamma^* [Var(i^F) - Cov(\Delta s^e, i^F)]}{\gamma [Var(i^D) + Var(i^F) + Var(\Delta s^e) + 2Cov(i^F, \Delta s^e) - 2Cov(i^F, i^D) - 2Cov(\Delta s^e, i^D)]} + \frac{rp + \gamma [Var(i^D) - Cov(i^F, i^D) - Cov(\Delta s^e, i^D)]}{\gamma [Var(i^D) + Var(i^F) + Var(\Delta s^e) + 2Cov(i^F, \Delta s^e) - 2Cov(i^F, i^D) - 2Cov(\Delta s^e, i^D)]}
\]

\[= \frac{\gamma^* [Var(i^F) - Cov(\Delta s^e, i^F)]}{\gamma [Var(i^D) + Var(i^F) + Var(\Delta s^e) + 2Cov(i^F, \Delta s^e) - 2Cov(i^F, i^D) - 2Cov(\Delta s^e, i^D)]} + \frac{rp + \gamma [Var(i^D) - Cov(i^F, i^D) - Cov(\Delta s^e, i^D)]}{\gamma [Var(i^D) + Var(i^F) + Var(\Delta s^e) + 2Cov(i^F, \Delta s^e) - 2Cov(i^F, i^D) - 2Cov(\Delta s^e, i^D)]}
\]

\[\Delta B = B_{t+1} - B_t = r_t^F S_{t-1} P_{t-1}^F \overline{F}_{t-1} - r_t^F P_{t-1}^D \overline{D}_{t-1} + TB(S_t, z_t)
\]

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

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

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

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

\[B_{t+2} = \frac{1}{1 + r_{t+2}^F} \left[ B_{t+3} - (r_{t+2}^F - r_{t+2}^D) D_{t-1} - TB(S_{t+2}, z_{t+2}) \right] - \frac{1}{1 + r_{t+1}^F} \left[ (r_{t+1}^F - r_{t+1}^D) D_{t-1} - \frac{1}{1 + r_{t+1}^F} \right] TB(S_{t+1}, z_{t+1})
\]

Taking conditional expectation and imposing a no-Ponzi condition, we get
\[B_t = -E_t \sum_{n=0}^{\infty} \left( \prod_{n=0}^{\infty} \frac{1}{1 + r_{t+n}^F} \right) (r_{t+n}^F - r_{t+n}^D) D_{t+n-1} - E_t \sum_{n=0}^{\infty} \left( \prod_{n=0}^{\infty} \frac{1}{1 + r_{t+n}^D} \right) TB(S_{t+n}, z_{t+n})\]