# Asset Price Changes, External Wealth and Global Welfare *

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**Abstract**

U.S. equity outperformance and sustained dollar appreciation have led to large valuation gains for the rest of the world on the U.S. external position. I construct their global distribution, carefully accounting for the role of tax havens. Valuation gains are concentrated and large in developed countries, while developing countries have been mostly bypassed. To assess the welfare implications of these capital gains, I adopt a sufficient statistics approach. In contrast to the large wealth changes, most countries so far did not benefit much in welfare terms. This is because they did not rebalance their portfolios and realize their gains. In contrast, direct welfare effects from the dollar appreciation on import and export prices are an order of magnitude larger.

**JEL classification**: F21, F32, F40, G15
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# 1 Introduction

U.S. equity markets and the dollar have performed exceptionally well since 2010. The S&P 500 more than tripled up to 2021, outperforming world markets by far and the dollar appreciated by around 20% against other currencies at the same time.[1] The implications of this asset price boom are felt not only in the U.S. but also globally. Foreigners are major investors in the world's largest asset market, holding more than 20 % of U.S. equity and bonds (corporate and treasuries).[2] Therefore, this has resulted in large capital gains of around 4% of U.S. GDP annually on the U.S. foreign asset position for the rest of the world. This stands in contrast to the structurally high valuation gains the U.S. was earning pre-crisis, often referred to as the *exorbitant privilege*. Hence, recent valuation losses have been referred to as the *end of privilege* (Atkeson et al., 2024).

This paper studies the global implications of this process. First, I ask a very simple question: Who is earning these capital gains? Next, it is natural to ask whether the reversal of valuation gains and the associated 'end of privilege' go hand-in-hand with a reversal of welfare gains towards foreigners. To accomplish this, I develop a sufficient statistic to assess the welfare impacts of these asset price movements.

To answer the first question and find out where the valuation gains are, I need go beyond standard macroeconomic data, which records the U.S. external position relative to the rest of the world. Hence, my first contribution is to break down the U.S. international economic accounts to the bilateral level by combining multiple data sets, which are themselves inputs to the U.S. aggregate accounts. The constructed bilateral data is consistent with the aggregates recorded in the U.S. external balance sheet and records all asset categories with major asset price movements at market value.[3]

The widespread use of tax havens obfuscates the true geography of global capital and in the raw data, around 30% of foreign holdings of U.S. assets are recorded in tax havens. I address this

[1] For the dollar appreciation consider e.g. Jiang et al. (2024b).

[2] The number on foreigners' equity holdings is taken from Atkeson et al. (2024), foreign holdings of U.S. treasury and corporate bonds are studied in treasury's annual reports on foreign holdings of U.S. securities.

[3] There are small differences in coverage and concepts, in practice these are minor for the period considered, see the discussion in appendix A.2.

by carefully restating the bilateral data to a *nationality basis*, so that valuation gains are attributed to their ultimate owners. To accomplish this, I use data on parent companies of tax haven investors for foreign direct investment. For traded securities, I leverage insights from the tax evasion literature (Alstadsæter et al., 2018) and use the Bank of International Settlements (BIS) locational bankings statistics on the nationality of depositors in tax havens, together with the restatement matrices of Coppola et al. (2021). In total, the constructed data set is a bilateral panel of gross positions, flows and valuation gains between the U.S. and over 80 other countries, broken down by asset category. In this sense, the paper constitutes a first step towards a set of *bilateral economic accounts*.[4]

With this at hand, I am able to trace asset price gains to their ultimate earners and provide evidence on their distribution. The global map of valuation gains skews heavily towards high income countries in Europe and the rest of world. For these countries, valuation gains can be strikingly large. For the biggest gainers relative to country GDP, Norway and Canada, they amount to around 8% of GDP every year on average between 2010 and 2021. But also for most other high-income countries they are substantial, usually exceeding 1% of GDP annually from 2010 to 2021. Low and middle income countries have been mostly bypassed by the U.S. asset boom. The true geography of valuation gains becomes very apparent only after accounting for tax evasion and related activities, which otherwise distort the global map of capital. Importantly, I document that during this time period, net transactions have been an order of magnitude smaller than capital gains. Most countries held their positions, with some central European countries being important buyers of U.S. assets. These findings are robust to a variety of measurement approaches and tax haven restatements, for example measurement from the asset side through the IMF's coordinated portfolio survey or alternative restatements of tax haven holdings as in Gourinchas et al. (2012). Using these approaches, I provide bounds on the estimated valuation gains.

To understand the heterogeneity across countries I decompose valuation gains into three components: capital gain differentials, portfolio composition, and timing of investors (Gourinchas and Rey, 2007a; Curcuru et al., 2010). The decomposition clarifies that the main driver of hetero-

[4] In section 2, I discuss the advantages my data has relative to existing data sets. Most importantly, my data restates tax havens and is consistent with U.S. national accounts.

geneity is the capital gain differential, i.e., the performance of U.S. assets relative to those in the counterpart. The emerging market portfolio tilt towards safe assets further means that they have not been in position to see large gains from increasing equity prices. By contrast, timing effects are small which means that investors reacted very little to the large asset price changes.

Given large valuation gains for the rest of the world, it is natural to ask what their welfare implications are. The traditional view on this question is shaped by the high valuation gains the U.S. earned on its external position up to the financial crisis. Many authors argue that these gains put the U.S. in a unique position that enabled its persistent current account deficit – hence the name *'exorbitant privilege'*. For example, Gourinchas and Rey (2022) argue that *'One direct consequence of the exorbitant privilege is to relax the external constraint of the U.S., allowing it to run larger trade and current account deficits without worsening its external position commensurately'*.

To determine whether similar benefits accrued to the rest of the world in the past decade, I build a simple open economy framework in which countries trade assets with the U.S.. Within this framework, I develop a sufficient statistic, extending the tools of Fagereng et al. (2024) to the open economy. Intuitively, the sufficient statistic quantifies how asset price movements affect the external constraint of foreign economies. To first order, valuation gains loosen the external budget constraint when they are realized. Countries who never 'cash in' on their gains stand to gain nothing from booming asset prices. What is more, countries seeking to accumulate external savings are even hurt by asset price gains because they are buying assets at a premium. In the open economy, the source of asset price changes also matters. Valuation changes from a dollar appreciation do not only matter via financial channels, but have real consequences through the price of exports and imports denominated in dollars.

Implementing the sufficient statistic to quantify these channels reveals that, up to now, welfare gains from rising valuations are small (on the order of 0.1% of GDP annually) and even negative for many countries. This stands in stark contrast to the large wealth gains. The reason is simple: foreigners did mostly not react to their gains and at times kept buying U.S. assets at a

premium.[5] The lack of capital gain realization and portfolio adjustment means that welfare gains from asset price movements are limited for most countries. On the other hand, the direct effects of dollar movements on import and export prices have far larger welfare implications. In most countries in my sample, asset price movements generate positive welfare gains because these countries invoice more exports than imports in dollars. The welfare effects on the real side from increased prices far outweigh the effects from asset revaluations in terms of size.

I show how to extend the sufficient statistic to account for additional features. In particular, I show how to incorporate varying degrees of stickiness in invoicing currency, assets that are continuously rolled over and future valuation gains. These extensions affect my results quantitatively, but not qualitatively: Welfare gains from pure asset revaluations remain small.[6] My sufficient statistic highlights the welfare consequences of the future adjustment path of the U.S. net foreign asset position, which has become very negative after more than a decade of current account deficits and valuation losses. If adjustment happens largely through the current account, foreigners will benefit in welfare terms by realizing the future consumption opportunities afforded to them by their valuation gains. If on the other hand valuations adjust, foreigners will see their asset price gains melt away without realizing them. Most forecasts indicate that a bulk of the adjustment will come through a valuation channel (Gourinchas and Rey, 2007b), in which case welfare gains will remain limited. Large welfare gains for foreigners are only generated through sharp adjustments in the U.S. current account.

In conclusion, for the rest of the world, the change in the capital gains on the U.S. foreign asset position has so far materialized mostly in wealth terms, but not in welfare terms.

**Literature.** This article contributes to three strands of the literature. First, I relate to work on the exorbitant privilege and the importance of capital gains on the net foreign asset position (Gourinchas and Rey, 2007a; Curcuru et al., 2008; Gourinchas et al., 2019; Jiang et al., 2024a; Sauzet,

[5] Bergant and Schmitz (2018) also note a lack of re-balancing in security-level data on Euro-area investors. Tabova and Warnock (2023) also find that foreigners time their purchases of treasuries poorly, such that their internal rates of return are lower than buy-and-hold returns.

[6] Applying my sufficient statistic to the U.S. for the period of the exorbitant privilege 1973–2004 yields sizable welfare gains, because the U.S. ran large current account deficits, so that asset price gains loosened its external constraint.

2023; Bertaut et al., 2023). The reversal of valuation gains since 2010 is studied in Atkeson et al. (2024) from a U.S. perspective. Relative to these papers focusing on the U.S., I provide the counterpart, tracing the valuation gains to the foreigners earning them. In pioneering work, Gourinchas et al. (2012) construct a similar set of bilateral valuation effects from 2007Q4-2008Q4, using the assumption that bilateral asset flows are proportional to asset holdings. Given recent advances in the literature and increased data availability, my estimates significantly relax their assumptions on the construction of valuation changes and tax havens while also covering a longer time period. Milesi-Ferretti (2022) studies valuation changes on foreign asset positions at the aggregate (and not the bilateral) level, highlighting an important discrepancy: In U.S. national accounts, foreign holdings and capital gains are much larger than when aggregating national accounts in the rest of the world. He attributes this to measurement issues related to tax havens, which lead to an understatement of U.S. holdings by foreigners. My estimates are constructed from the U.S. balance sheet and account for holdings through tax havens and financial centers. These would otherwise go unrecorded (Zucman, 2013), considerably understating valuation gains for the rest of the world.

Second, an important literature studies the origins and distributional effects of asset price booms in the closed economy (Greenwald et al., 2019; Kuhn et al., 2020; Martínez-Toledano, 2020; Kuvshinov and Zimmermann, 2022; Del Canto et al., 2023). With open financial markets, asset price booms also spill across borders. For the case of the U.S. equity boom, I show that this means large wealth gains for high-income countries. This provides an international analogue for the finding of Kuhn et al. (2020), who show that within the U.S., it is the rich who gain from rising equity valuations. The sufficient statistic approach I use to evaluate welfare gains builds on Fagereng et al. (2024), who study welfare effects from asset price booms with heterogeneous households. Auclert (2019) and Zhou (2022) provide analogues for monetary policy and exchange rate transmission respectively.

Finally, the article contributes to work on global capital allocation. Tax havens are known to distort global capital allocation and capital flows, prompting research focused on uncovering the true economic activity underlying the data (Zucman, 2013; Alstadsæter et al., 2018; Damgaard et

al., 2019; Coppola et al., 2021; Beck et al., 2024). I rely on and contribute to this effort by restating the U.S. external position to a nationality basis in terms of holdings, flows and valuation changes.

The article proceeds as follows: Section 2 introduces data and methods to decompose the U.S. external balance sheet across countries. I then present results on the global distribution of valuation gains and its drivers in section 3. Finally, in section 4, I develop a sufficient statistic to study welfare, which I implement in section 5.

# 2 Data and Methodology

In this section I introduce the data and explain the construction of the bilateral valuation effects. The goal of this section is to construct, for every country and asset class, holdings, transactions and valuations changes on the U.S. external position. First, I review basic concepts of national accounting in section 2.1. Second, in section 2.2, I describe the main data inputs to my analysis. Finally, sections 2.3 and 2.4 explain how I restate positions in financial centers and tax havens. All data sources and restatements are summarized in Table A.1.

## 2.1 Concepts in the International Economic Accounts

First I review basic concepts of national accounting that will be used throughout. The net foreign asset position (NFA) of a country is defined as the difference between the foreign assets and liabilities, that is the assets owned abroad by the country less the assets of the country owned by foreigners. Assets and liabilities are split into three main asset categories, which I briefly summarize. Table 1 gives an overview of the structure of the U.S. net foreign asset position.

- **Foreign direct investment** captures cross-border investment associated with "significant degree of influence on the management of an enterprise", that is with an ownership stake of greater than 10%.

- **Portfolio investment** includes cross border positions in debt or equity which are not included

Table 1: Structure of the U.S. NFA

| **Assets** | **Liabilities** |
|---|---|
| Outward Foreign Dir. Inv. | Inward Foreign Dir. Inv. |
| Equity Holdings abroad | Foreign Equity Holdings in U.S. |
| Bond Holdings abroad | Foreign Bond Holdings in U.S. |
| Other Assets | Other Liabilities |
| *Net Foreign Asset Position (NFA) = Assets - Liabilities* | |

Notes: This table illustrates the U.S. net foreign asset position.

in direct investment. It is split into its debt and equity components and captures the majority of cross-border financial investments.

- **Other Assets** includes loans, deposits, trade credit, derivatives and currencies. For the U.S., this category mostly consists of cross-border loans and deposit holdings.

The NFA and its subcomponents record the stock of assets, while the balance of payments records flows (transactions) within asset categories. Importantly, revaluations are not included in the flows. The asset side of the U.S. external balance sheet represents foreign assets held by U.S. citizens, while the liabilities side consists of claims of the rest of the world on the U.S.. Hence, increases in the price of U.S. assets relative to foreign assets result in a valuation loss on the U.S. net foreign asset position.[7] On both sides of the balance sheet, the BEA records annual positions, flows and valuation changes.

The development of the NFA can be expressed in the law of motion

$$\text{NFA}_{t+1} = \text{NFA}_t + CA_{t+1} + VA_{t+1} + OVC_{t+1},$$

which indicates that changes in the aggregate U.S. net foreign asset position can be split into flows (the current account $CA_t$), valuation changes $VA_t$ and other valuation changes. Other volume changes $OVC_{t+1}$ result from changes in concepts, statistical discrepancies or mismeasurement.

[7] Note that this does *not* mean that the U.S. gets poorer in total as total U.S. wealth is the sum of net foreign assets (which go down) and domestic assets, which go up and are larger than the foreign asset position.

For the period I consider, other changes are very small as I show in appendix A.1. [8]

Each component of the accumulation equation is the sum of the underlying asset categories, such as portfolio investment or FDI across both sides of the external balance sheet, i.e. foreign holdings in the U.S. and U.S. holdings abroad. The key limitation of the NFA is that it refers to the aggregate position of the U.S. vis-a-vis the rest of the world. For my study, I need to go beyond the aggregate position and construct bilateral linkages.

To understand what I do, let $A_{i,t}$ be the year-end holdings bilateral holdings with the U.S. of country $i$ at $t$ (for example U.S. portfolio equity held by France, or U.S. FDI in France). The change in asset holdings can be decomposed into flows, price changes and other volume changes using the accounting identity

$$A_{i,t+1} - A_{i,t} = CA_{i,t+1,A} + VA_{i,t+1,A} + OVC_{i,t+1,A}. \tag{1}$$

Here, $CA_{i,t+1,A}$ is the balance on the bilateral current account for the asset $A$ (which is equal to the net financial transactions), and $VA_{i,t+1,A}$ are bilateral valuation changes of the asset. I follow the recommendations of Lane and Milesi-Ferretti (2009) and allocate other changes to valuation changes for direct investment and to flows for all components of portfolio investment. This does not affect the valuation gains materially as residual changes are small during the recent period, as I show in appendix A.1. The first goal of the paper is to construct the components of equation 1 for as many countries and asset categories as possible using inputs to the U.S. national accounts, while maintaining consistency with the aggregate data.

Valuation changes include changes in the exchange rate. This matters, as the asset and liability side of the U.S. balance sheet are mismatched in terms of currency – many U.S. assets held abroad are denominated in foreign currency, while foreign investment in the U.S. is generally denominated in dollars. Hence, a dollar appreciation also leads to valuation gains for the rest of

[8] In this paper, I follow the terminology Gourinchas and Rey (2014) and use the the terms capital gains and valuation changes interchangeably. This stands in contrast to parts of the finance literature, which uses the term valuation changes to refer to changes in the price dividend ratio. This is the measure I will use to implement my sufficient statistic in section 5.

the world on net. Valuation changes are central to my study, so I will discuss measurement and robustness in detail when describing the data.

A large problem with international financial statistics is their reliance on the *residence principle*, which means that securities are allocated to the location in which the issuer or holder of that security resides. As the importance of tax havens grows, this problem becomes more acute. Therefore, I construct estimates of foreign positions on the basis of *nationality*, meaning they are allocated to the ultimate holder of the security. The procedure is discussed in detail in section 2.3.

## 2.2 Data and Construction of Bilateral Positions

This section describes how I break down the aggregate international position of the U.S. into bilateral components as illustrated in equation 1 using inputs to the U.S. national accounts.[9] For now, all the data will be on a residence basis, the next section will focus on nationality-basis restatement. I use different sources for portfolio and direct investment, which I describe in turn.

**Portfolio Investment.** Portfolio investment is well captured through the Treasury International Capital (TIC) reporting system, which is the input to the international economic accounts produced by the BEA. It relies on direct reporting from financial corporations, so the data quality is very high. In principle, data on both positions and transactions are collected monthly by country. Due to the so-called 'transaction bias' (Bertaut et al., 2006), I do not use the transaction data, but instead use the Bertaut and Judson (2022, 2014) data, which uses the monthly positions data together with country and asset specific price indices to estimate valuation changes. Concretely, this means that monthly holdings data are observed, but that valuation changes are estimated using asset prices and then flows are calculated as the residual of the accumulation equation 1. I discuss the validity

[9] Valuation gains could also be constructed from the balance sheet of other countries, e.g. with the IMF's CPIS. There are four reasons why I choose to construct them from the U.S. balance sheet: (i) Total foreign assets of all countries are an order of magnitude *smaller* than total foreign liabilities (Milesi-Ferretti, 2022), so estimates from the asset side will understate the valuation gains of the rest of the world (ii) Investment inward is likely better captured in national accounts than investment outward, so the U.S. balance sheet is best used for assessing foreign exposure to the U.S. equity boom (iii) Bilateral U.S. statistics are available for a long time horizon with a consistent methodology, whereas many nations that are important for capital flows (specifically tax havens) report limited data on their external assets (iv) U.S. data breaks out equity holdings separately, whereas CPIS generally refers to 'Equity and Investment Funds', some of which may consist of bonds. I show valuation gains constructed from the CPIS in the next section.

of these assumptions in detail below. The asset categories covered are granular and consist of equities; corporate, agency and treasury bonds, and are all are priced at market value.

The stock data displays so-called 'custodial bias', which means that assets are at the recorded at the residence of the custodian. If a German citizen decides to hold U.S. assets through a Swiss bank, this will be recorded as a liability towards Switzerland, distorting the geography of capital flows. I sidestep this issue for now and discuss it separately in section 2.4.

**Foreign Direct Investment.** Foreign direct investment is collected by the BEA through surveys, which all investors undertaking FDI are required to file and report their nationality.[10] FDI is harder to capture at markets prices, and both assets and liabilities are collected at book value. The BEA then uses the stock price indices to revalue the equity position of direct investment to market value for the headline measure. Similarly, I revalue the bilateral data from book to market values and match the BEA's headline numbers.[11] Data is collected annually for both the stock and flow of bilateral direct investment for a large set of economies. Using the accumulation equation (1), I then compute valuation effects using information on the annual positions and flows. Concretely, this means that while annual positions and flows of foreign direct investment are observed on a bilateral basis, valuations gains are constructed as a residual using 1.

The countries covered in the TIC data (covering portfolio investment) and the direct investment data largely coincide. This allows me to construct a large panel of more than 80 countries available in both data sets. The country coverage increases over time, allowing me to track more capital flows and valuation gains in recent years. Importantly, claims and liabilities towards well known tax havens are included in the data. The countries in my sample make up over 95% of the total external balance sheet of the U.S in recent years, as I show in figure A.3 in the appendix.

[10] All files are available at https://www.bea.gov/international/direct-investment-and-multinational-enterprises-comprehensive-data.

[11] Two measures of the FDI are available at the aggregate, relating to the treatment of multinationals (see the BEA's IIP table 2.1): The first (asset/liability basis) also includes assets owned by U.S. resident corporations that are foreign owned. The second, 'directional' measure consolidates the positions in debt instruments for multinationals. These transactions only affect the gross positions of the debt component of foreign direct investment, the net position and gross equity components is unchanged. As the data on bilateral positions is only available on a directional basis. (details in U.S. Bureau of Economic Analysis (2022) table 32.a.) I use this as my measure. In practice, gross positions using either treatment of FDI co-move closely in the aggregate.

Appendix table A.2 gives details on the sample and harmonization of countries over time.

**Discussion.** The bilateral data I construct covers a large subset of the U.S. external balance sheet, and more importantly covers the asset classes in which valuation gains have been concentrated. More than 70% of the U.S. external balance sheet consists of portfolio and direct investment in recent years. As Atkeson et al. (2024) show, these are the asset classes where the vast amount of asset price changes have been occurring. Cross-border loans or deposits, which make up most of the remaining assets and are not covered, experienced almost no valuation changes, this is shown explicitly in figure A.2. I also show in Appendix A.2 that the constructed bilateral valuation gains are consistent with the aggregate.

A downside of my approach is that I have to estimate valuation changes in portfolio investment using benchmark asset price indices. This introduces the implicit assumption that every investor country earns the same capital gains within an asset class (as in Jiang et al. (2024a); Meng and van Wincoop (2020)). I directly test this assumption in appendix A.5, using mutual fund data from Maggiori et al. (2020) as well as the portfolio of the Norwegian Sovereign fund and the Japanese Government Pension fund. The evidence indicates that these investors track benchmark indices closely, with deviations on the order of a few basis points. This is consistent with other evidence that international investors track indices closely (often this is their institutional mandate). Using security-level data on mutual funds, Alok et al. (2022) document that flows backed out using price indices closely match flows obtained from the true asset allocation of funds. Bertaut et al. (2023) use the security-level data underlying the TIC to study cross-border returns, finding that returns line up closely with indices.

The structure of corporate payouts may further be relevant for the decomposition into valuation gains and flows. In recent years, U.S. corporations have increasingly shifted the structure of corporate payouts from dividends towards share repurchases (see Zeng and Luk (2020) for an overview). If a company shifts from paying dividends to repurchasing its own stock, shareholders can replicate the foregone dividend by selling the commensurate amounts of assets. Therefore, share repurchases may not be considered a pure valuation gain in that sense. In my baseline esti-

mates, I follow the U.S. international economic accounts (Bureau of Economic Analysis, 2023) and do not make an adjustment for this. In appendix A.3, I construct share repurchases following Chen et al. (2017) and compute the implied capital gains when netting out repurchases. Repurchases lower capital gains only mildly, because aggregate share repurchases have been small relative to capital gains.

Milesi-Ferretti (2022) raises concerns about the valuation of FDI in the U.S. national accounts, arguing that using U.S. equity markets to value subsidiaries of multinationals in the U.S. is unsatisfactory. My baseline numbers follow U.S. national accounts, however I offer a breakdown into portfolio investment and FDI. For the most part, the geographic distribution of valuation gains in FDI and portfolio investment is similar, with each accounting for around 50 % of valuation gains. This means that directionally, the results of this paper are not affected by the valuation of FDI, in magnitude however the valuation gains are lowered when disregarding FDI.

## 2.3 Dealing with Tax Havens

A well known problem with international financial data is the widespread use of tax havens. The *residence principle* means that assets are attributed to the counterpart's residence, so tax havens are over represented in my data. As I show in appendix figure A.6, in recent years around 30% of foreign holdings are attributed to tax havens.[12] Fortunately, academic researchers and statistical agencies have recognized the necessity of understanding the true nature of international financial linkages, and have begun unveiling the global map of capital.

In this section, I outline how I restate the U.S. external position from a *residency* to a *nationality* basis. My estimates account for three important types of tax evasion, which I outline only briefly here for conciseness. The details of each are in appendix A.4, which also discusses the robustness of my approach. In general, my approach can be summarized in terms of reallocation matrices, which transform the data from a nationality to a residency basis. Concretely, let $x_i^R$ be the position of a country $i$ on a residence basis and $x_{i,k}^{R \to N}$ the position that is reallocated from $i$

[12] Here, and in general I follow the tax haven classification of Coppola et al. (2021) with the addition of Switzerland.

to country $k$ under a restatement from residence to nationality basis. Then I employ a reallocation matrix $\Omega$ which has entries $\omega_{i,k} = x_{i,k}^{R \to N} / x_i^R$, such that $\Omega = (\omega_{i,k})_{i,k}$. Using this matrix, the holdings on a nationality basis are given by

$$x^N = \Omega x^R, \tag{2}$$

with vectors $x^N$ and $x^R$ of holdings on a nationality and residence basis. In this paper, the restatement matrix $\Omega$ varies by year, asset class and the direction of investment (foreign in U.S. or U.S. in foreign). Reallocation matrices are applied to all components (holdings, valuation gains and transactions) of the accumulation equation 1 to obtain consistent restatements for each. I now outline the construction of these restatement matrices.

First, to correct for the fact that firms issue securities in tax havens, I use the matrices of Coppola et al. (2021) to restate U.S. holdings of securities issued in tax havens. These matrices are applied to U.S. portfolio holdings abroad, using their baseline 'fund holdings' methodology.

Second, on the liability side of the U.S. external portfolio, I restate foreigners' portfolio holdings in the U.S. through tax havens. To do so, I follow Alstadsæter et al. (2018) and use the BIS locational banking statistics recording foreign claims in tax haven banks.[13] These statistics offer information on the nationality of the owners of tax haven deposits, so that I use them to fill the rows in the matrix $\Omega$ pertaining to tax havens. The drawback of this approach is that this data only refers to bank deposits, which are only an imperfect proxy for portfolio holdings. Hence, I validate this approach through a range of robustness checks explained below. For two central financial centers in Europe, Ireland and Luxembourg, Beck et al. (2024) provide data on the ownership of the mutual fund sector, which accounts for a bulk of foreign investment in these countries. I use this data to construct the rows of $\Omega$ corresponding to these countries.[14]

Third, I correct FDI that is carried out indirectly through shell companies. Here, I use data on

[13]The locational banking statistics are widely used in the tax evasion literature (Alstadsæter et al., 2018; Menkhoff and Miethe, 2019; Andersen et al., 2022) to understand the ownership of tax haven assets.

[14]Data is available from 2014 on for Ireland and 2016 on for Luxembourg. Before, I hold the ownership structure, which does not vary much over time, fixed.

the ultimate beneficial owners of FDI, that is the ultimate company owning the tax haven affiliate. The BEA collects this data directly in the surveys used to construct FDI.[15] For the outflow of FDI from the U.S. I rely on data collected by Damgaard et al. (2019). They collect data on 'true' nature of FDI using reports from tax haven statistical agencies, augmented with Orbis firm data. For both outward and inward holdings, I observe vectors $x^R$ and $x^N$, but not the full restatement matrices. I distribute the valuation gains in tax havens proportionally to the share of holdings that is restated towards a country, i.e. proportional to the 'hidden' FDI $x_i^N - x_i^R$ of a country. This ensures that the aggregate valuation gains are unchanged and corresponds to a reallocation matrix with off-diagonal terms that add tax haven holdings to non-havens. This assumes that valuation gains in tax havens are similar to those in non-havens, figure A.7 in the appendix provides evidence on this.

A related form of tax evasion is profit shifting by multinational corporations. Adjusting for this affects the income earned on foreign investment, and therefore the income component of FDI returns. However, this will not change the valuation effects or the current account– it means U.S. net exports are 'too small', while U.S. income earned abroad is 'too large'. These changes net out when constructing the current account (and therefore also valuation gains), as also argued in Guvenen et al. (2022).

**Robustness.** Offshore wealth is not meant to be found easily, so retracing it to its owners inevitably involves assumptions, in particular on the foreign owners of portfolio investment in the U.S.. To validate my approach, I construct three additional estimates. I first consider the approach employed in Gourinchas et al. (2012). They assume that positions through tax havens are partly positions of the country into itself, following the degree of portfolio home bias, and the rest of the investment is distributed following all other (non tax-haven) investment. In addition, I construct estimates from the IMF's CPIS, in which foreign countries report their annual asset allocation. Finally, I make no adjustment and show the estimates obtained directly from the raw data. In the end, all these different ways of deconstructing the U.S. external balance sheet arrive at similar conclusions about the geography of the valuation gains on the U.S. NFA. Details on these approaches

[15] Companies are required to trace their ownership structure through their parents (or majority owner if they have more than one parent). For details see the definition of the BEA.

are in Appendix A.4.

A particular source of uncertainty are large holdings of U.S. assets recorded in the Caribbean (specifically in the Cayman Islands). In 2021, the Cayman Islands, an important hedge fund residence, accounted for more than 2 trillion dollars of U.S. securities in TIC data. My baseline restatement using the locational banking statistics attributes 70% of these assets back to the U.S. as an ultimate owner. The fact that most of these assets are attributed back to the U.S., is plausible given the gravity structure of foreign investment (Portes and Rey, 2005) as well as reports by the Cayman Island Monetary Authority (Cayman Islands Monetary Authority, 2019). In appendix figure B.4, I show the implied restatement for the Caymans Islands and explore the robustness of my results to other alternatives. In particular, I produce results which assign all these assets back to the U.S., among other potential assumptions. This only slightly lowers capital gains for foreigners, because my baseline method already attributes most Cayman holdings to U.S. citizens.

## 2.4 Custodial Bias

An issue of the TIC data on portfolio investment is the so-called custodial bias (Bertaut et al., 2006). This ocurrs when a foreign resident holds a U.S. security through a third country financial institution. The TIC data will then record this as a liability to the third country. In this section, I discuss the potential bias induced by this.

To gauge the bias, I compare the TIC data with portfolio holdings data from the Coordinated Portfolio Investment Survey (CPIS). As valuation gains mostly occurred in equity holdings, I compare the equity positions of the largest U.S. equity holders in the CPIS, raw TIC data and my preferred estimate (which restates tax haven wealth) in figure A.10 in the appendix.[16] There is a strong tilt towards tax havens in both the unadjusted TIC and the CPIS data, suggesting that issues relating to the custodial bias are present in both data sets and need to be adjusted.

There are numerous reasons why the TIC and the CPIS may conflict beyond custodial bias.

[16]Comparisons of the debt components of portfolio investment are hard because the CPIS does not include reserve holdings, but TIC does.

An obvious candidate is differences in reporting: In the CPIS, total foreign equity holdings in the U.S. are around 30% lower than in the TIC data. Custodial bias should not influence this aggregate, unless the custodian is in fact helping households evade taxes (Zucman, 2013). Beyond tax evasion, it is likely that not all foreign asset holdings are covered in many countries. The CPIS manual mentions that many countries find it hard to sample all foreign assets held by their residents. Large breaks in the time series of asset holdings in the CPIS for many countries point to the same fact. The TIC data on the other hand is based directly on the reports of intermediaries, ensuring that the aggregate coverage should be better and consistent over time.

I also construct estimates of valuation gains using the CPIS, which are similar to my baseline estimates. Although custodial bias remains an issue, this indicates that the broad trends are the same across measurement approaches.

# 3 Results

With the data at hand, I now describe the global distribution of the valuation effects on the U.S. net foreign asset position. My baseline estimates are constructed as described in the last section.

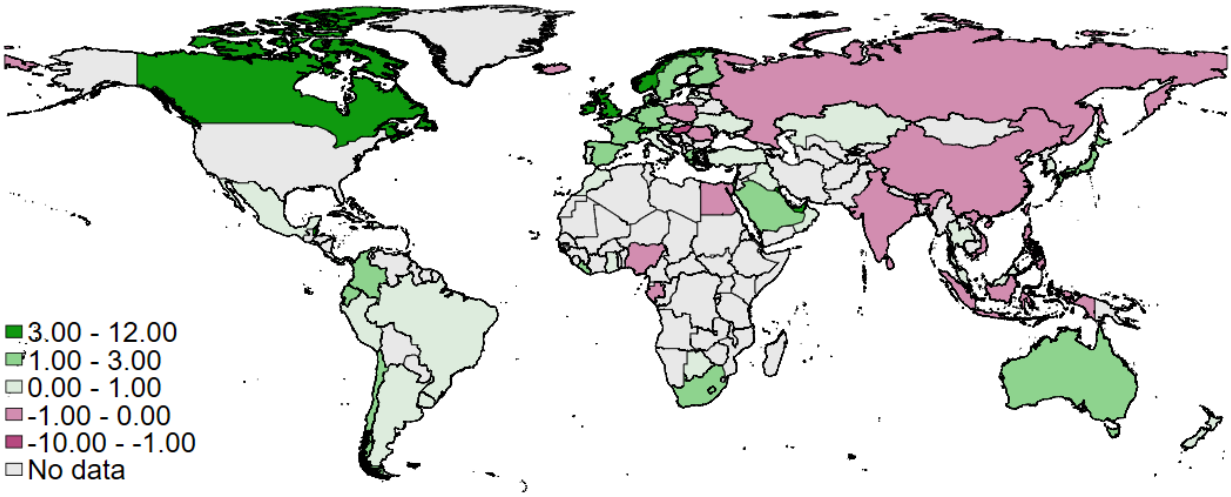
## 3.1 The Geography of Valuation Effects

Figure 1 illustrates the global distribution of valuation gains on the U.S. NFA. In particular, it shows the average annual valuation gains vis-a-vis the U.S. for the 'end of privilege' period 2010-2021 (Atkeson et al., 2024) as a percent of GDP for the countries in my sample, that is the valuation gains a country $i$ made on the liability side of the U.S. external balance (foreign holdings in the U.S.), less the valuation gains the U.S. made abroad, $\frac{1}{12}\sum_{t=2010}^{2021}\frac{VA_{i,t}}{GDP_{i,t}}$. The sign of the valuation gain in the figure is positive if a country made net valuation gains vis-a-vis the U.S..[17]

Valuation gains are large in developed countries around the world, sometimes even exceeding 3% of GDP annually, especially in Northern Europe. Cumulated over the 11-year horizon, this

[17]GDP is taken from the 2022 vintage of the Lane-Millesi-Ferretti database (Lane and Milesi-Ferretti, 2018). In this and all other maps I truncate values outside of the bins, in practice this affects tax havens.

Figure 1: World Map of Valuation Gains and Losses




Notes: This figure shows the average annual net valuation effects from 2010-2021 as a percentage of GDP for each country. Data construction and tax haven restatement is as in section 2. All numbers underlying the figure are in table B.1.

implies large gains on the net foreign asset position vis-a-vis the U.S.. Developing giants such as India or China, often seen as the source of the global savings glut (Caballero et al., 2008), see much lower gains. Some emerging countries even experience small valuation losses.

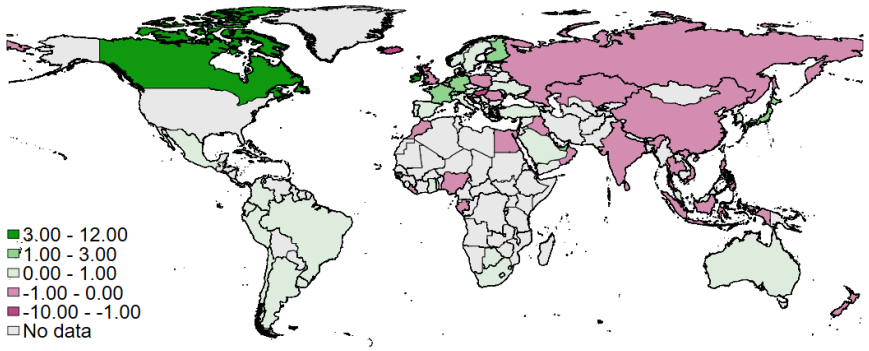
To illustrate the size of these gains, I compare them to total wealth growth,[18] which is the sum of domestic wealth and the foreign asset position in appendix table B.1. Valuation gains are computed using the different scenarios for the treatment of tax havens and custodial bias. Valuation gains on the U.S. NFA are sizable, even compared to total wealth growth. In some countries, such as Germany, Norway or France, their size is even around 20% of total wealth growth.

**Foreign Direct and Portfolio Investment.** Figure 2 decomposes the net valuation gains from figure 1 into FDI and portfolio investment. In general, gains in these two assets are highly correlated. Valuation gains in FDI are found mostly in Canada and central Europe, countries with many foreign corporate holdings abroad. Again, emerging economies see negative valuation gains. For portfolio investment, northern European countries, Canada and large oil exporters see the largest gains. I further decompose valuation gains in portfolio investment into its bond and equity subcomponents in figure B.2 in the appendix. The bulk of valuation gains are in portfolio equity, as

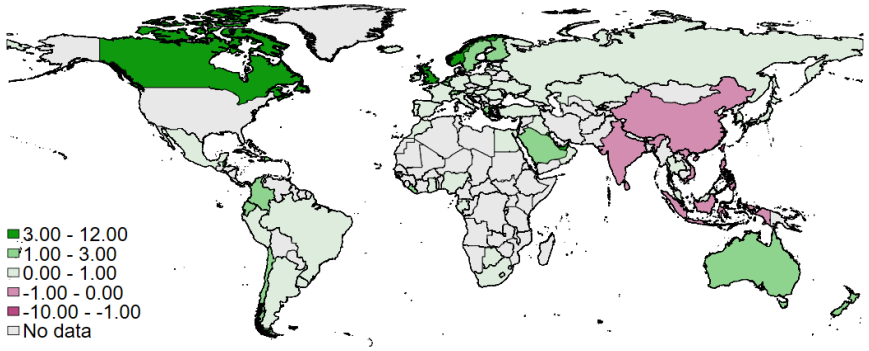
[18] Data on total wealth comes from the World Inequality Database.

stock market movements have been much larger than those in bond prices.

Figure 2: Valuation Gains in Portfolio Investment and Foreign Direct Investment




(a) Foreign Direct Investment




(b) Portfolio Investment

Notes: This figure shows the annual net valuation effects from 2010-2021 as a percent of GDP for each country. Panel a) shows net valuation gains in FDI, while panel b) considers portfolio investment (equities + bonds). Data construction and tax haven restatement is as in section 2. All numbers underlying the figure are in table B.1.

The valuation gains I show are *net* valuation gains. On each side of the U.S. external balance sheet there are large gross valuation gains for foreigners investing in the U.S. or U.S. Americans investing abroad. This will mean that countries who had larger equity booms themselves will tend to see lower valuation gains on their position vis-a-vis the U.S.. I study net valuation gains, as these aggregate up to the valuation gains on the U.S. net foreign asset position. Additionally, for the framework developed to analyze welfare later, valuation gains on both side of the U.S. external balance sheet will matter.[19] For reference, valuation gains on the asset and liability side are shown

[19]There is a further technical reason to prefer net capital gains. Gross capital gains depend on the currency choice in which to record capital gains in the data. Net capital gains are invariant to the currency choice – a dollar appreciation corresponds to a depreciation of the foreign currency.

and discussed in appendix figure B.3.

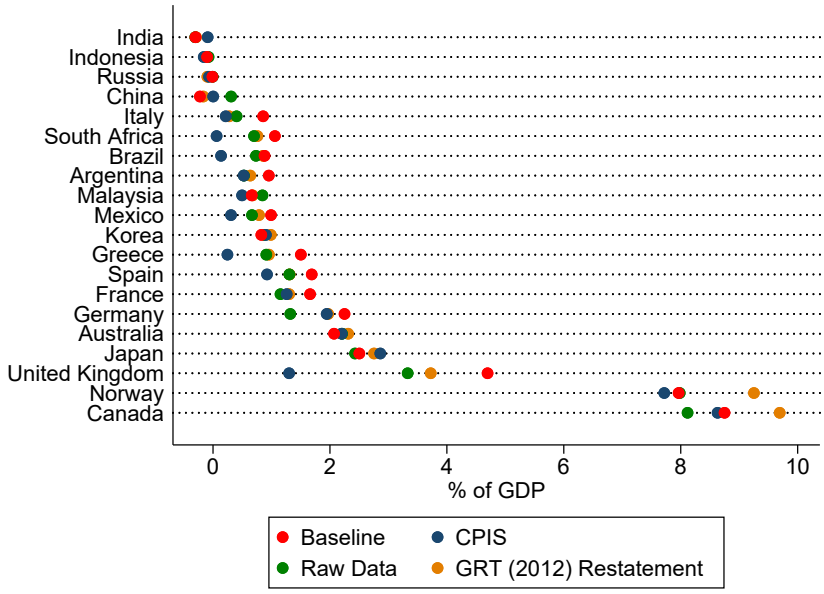
**Flows.** The period I study is dominated by large valuation swings on the U.S. NFA. By contrast, the current account deficit of the U.S moderated and averaged around $-2\%$ of U.S. GDP over this time period (see figure A.1). In figure B.5 in the appendix, I show the geography of these financial flows in my data to study who is funding the U.S. current deficit. In most countries, there are only moderate financial transactions observed during the period. The U.S. current account deficit is financed mostly by advanced economies in Europe and Asia. However, even for these countries, the flows are small compared to the the size of their capital gains.

**Robustness.** The allocation of tax haven wealth and the associated valuation gains involves assumptions, although with advances in this area these are less restrictive than in the previous literature. To quantify the uncertainty and assess the robustness of my findings, I provide three alternative estimates. First, I make no corrections and show the raw data. Second, I reassign portfolio holdings in tax haven wealth using the assumption of Gourinchas et al. (2012), that is using the 'leave-out'-distribution of U.S. asset holdings when excluding tax havens. Finally, to address concerns about custodial bias in the TIC, I measure portfolio investment from the asset side using the CPIS. Figure 3 shows the difference in capital gain estimates for a number of large countries. Alternative maps are in figure B.1 in the appendix, along with the precise numbers in table B.1.

The main conclusion is very robust: Gains on the U.S. assets were mainly earned by developed economies. The developing world was largely left out, Latin America being somewhat of an exception. The differences between estimates are usually in the range range of 1-2 percentage points of GDP. Accounting for the presence of tax havens is important to assess the distribution of valuation gains within those groups however. Large parts of the European periphery see their valuation gains rise, as do many Latin American economies.

The largest difference arises for United Kingdom, whose holdings of U.S. assets in the TIC data are around twice as large as in the CPIS. A similar gap is found in Beck et al. (2024) for U.K investments in the Euro Area. They attribute this to incomplete coverage of foreign holdings in the U.K. national accounts and custodial bias. U.K. national accounts miss investment fund holdings

Figure 3: Capital Gains under Alternative Restatments




Notes: This figure shows the average annual capital gains under different restatements. Capital gains are measured as a percentage of GDP, as in figure 1. The red dots are the baseline estimates. Alternative estimates are constructed using holdings from the CPIS (blue), raw data without adjustments for tax havens (green) and the restatement of Gourinchas et al. (2012) (yellow). World maps using those restatements are in figure B.1, the precise numbers are in table B.1.

of households and nonprofits, which are important components of foreign investment in many countries, so that the CPIS likely underestimates the U.K.'s foreign exposure. However, it stands to reason that the U.K. is also intermediating assets for other foreigners. Unveiling the countries underlying the U.K. custodians is an open question. The U.K. discrepancy is not large enough to change the conclusions about the foreign earners of capital gains on the U.S. NFA.

**Currency Movements.** From 2010-2021, the U.S. Dollar has appreciated more than 20% against other major currencies (Jiang et al., 2024b).[20] This creates valuation gains on the net foreign asset position through the currency mismatch on the U.S. external balance sheet: Nearly all claims foreigners have on the U.S. are dollar denominated, while U.S. citizens often hold foreign currency assets abroad (though there is a significant home-currency bias (Maggiori et al., 2020)). In Appendix B.3, I separate valuation gains into those stemming from exchange rate movements and

[20] Jiang et al. (2024b) link this to an increase in savings from foreign investors, relatively tight U.S. monetary policy and investor demand shifts towards U.S. financial assets

pure price effects. As I outline there, I create bilateral currency exposure shares for the U.S. net external position, extending the work of Lane and Shambaugh (2010) and Bénétrix et al. (2015) to the bilateral level. Figure B.6 shows the map of valuation gains through exchange rate movements for the period 2010-2021, again normalized by GDP. These gains are positive for most countries, but smaller than the total valuation gains (pure asset prices plus exchange rate movements). They are relatively large for South American countries, South Africa, and the U.K., which have experienced large depreciations over this time period. This leads many Latin American economies to experience larger valuation gains than other emerging markets over this time period.[21]

## 3.2 Decomposing Valuations Effects

Why did some countries experience very large valuation gains while others lost out? To answer this, I decompose gains into three components: Return differences within an asset class, allocation between asset classes and timing effects.

The decomposition follows Curcuru et al. (2010) and Gourinchas and Rey (2007a).[22] In an accounting sense, the average net valuation gain $\bar{v}_i^{\text{net}}$ for a country $i$ from figure 1 is

$$\bar{v}_i^{\text{net}} = \frac{1}{T}\sum_{t=1}^{T}\sum_{k=1}^{K} w_{i,k,t-1}^{\text{A}} r_{i,k,t}^{\text{A}} - \frac{1}{T}\sum_{t=1}^{T}\sum_{k=1}^{K} w_{i,k,t-1}^{\text{L}} r_{i,k,t}^{\text{L}},$$

where $k = 1 \dots K$ are different asset categories (FDI, Portfolio equity $\dots$) and $t = 1 \dots T$ is the time covered. Moreover, $r_{i,k,t}^{A}$ is the capital gain on the asset side of the U.S. balance sheet, and $w_{i,k,t}^{A}$ are total holdings to GDP of the asset (resp. $r_{i,k,t}^{L}$ and $w_{i,k,t}^{L}$ for the liabilities and capital gains earned on them). Each component varies by country, except for the capital gains on portfolio holdings in the U.S., which are constant within an asset class and period as explained in section

[21] See De Gregorio and Peña (2023) for further evidence on dollar appreciation and valuation effects in emerging markets.

[22] The subtle differences are the following: While Curcuru et al. (2010) and Gourinchas et al. (2012) consider the net return differential, I study the net valuation gains, which can be seen as the capital gain component of returns times the amount of assets allocated. Hence in their framework $w_{k,t-1}$ is a portfolio share, while I use absolute amount allocated towards an asset class. Moreover, they also include the dividend component of returns, while I focus on the capital gain component.

2. This can be rearranged to the following identity, in which each line is one component of the decomposition:

$$
\begin{aligned}
\bar{va}_i^{\text{net}} = & \sum_{k=1}^{K} \left( \frac{\bar{w}_{i,k}^{\text{A}} + \bar{w}_{i,k}^{\text{L}}}{2} \right) (\bar{r}_{i,k}^{\text{A}} - \bar{r}_{i,k}^{\text{L}}) \\
& + \sum_{k=1}^{K} \left( \frac{\bar{r}_{i,k}^{\text{A}} + \bar{r}_{i,k}^{\text{L}}}{2} \right) (\bar{w}_{i,k}^{\text{A}} - \bar{w}_{i,k}^{\text{L}}) \\
& + \frac{1}{T} \sum_{t=1}^{T} \sum_{k=1}^{K} (w_{i,k,t-1}^{A} - \bar{w}_{i,k}^{\text{A}}) r_{i,k,t}^{\text{A}} \\
& - \frac{1}{T} \sum_{t=1}^{T} \sum_{k=1}^{K} (w_{i,k,t-1}^{\text{L}} - \bar{w}_{i,k}^{\text{L}}) r_{i,k,t}^{\text{L}}.
\end{aligned}
\tag{3}
$$

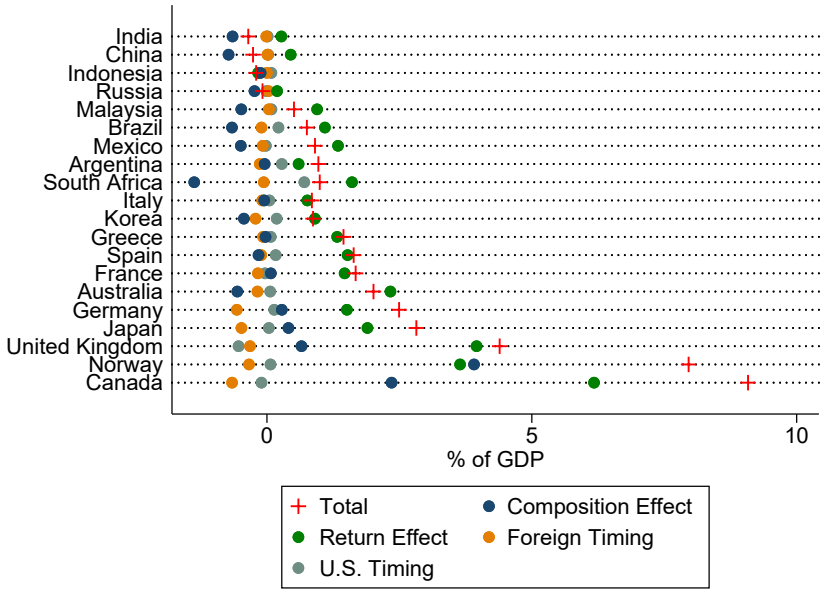
Here the bars indicate averages (e.g. $\bar{w}_{i,k}^{A}$ the average holding as a fraction of GDP).

Every line of equation 3 carries a straightforward interpretation. The first line shows the differential valuation induced by return differences between the U.S. and the foreign country with asset classes (*Return Effect*). The next line captures the opposite, the differential arising through the difference in portfolios, given average returns over an asset class (*Composition effect*). The last two lines capture what Curcuru et al. (2010) call the *timing effect*, the differential introduced by the covariance of returns and portfolio adjustment. The third line is the U.S. timing, which is positive when U.S. investors increase their holdings in a country and asset class as returns are high. The last line is foreign timing, the covariance of foreign investment flows and U.S. returns.[23]

I compute each component of equation 3 using my baseline estimates of valuation gains and portfolio allocations for a number of large countries. In computing the decomposition, I distinguish three asset classes: FDI, portfolio investment in equity and portfolio investment in debt securities. Figure 4 presents the decomposition for a number of developing and developed countries. The crosses indicate the net valuation gain in terms of the country's GDP, the dots represent the other components from equation 3. As in the map, a positive total indicates that the country has been gaining in terms of valuations vis-a-vis the U.S..

[23]The FDI data is annual, but the TIC data is monthly. This means that the timing effects in lines 3 and 4 of equation 3 refer to monthly timing for portfolio investment but annual timing for foreign direct investment.

Figure 4: Return Decomposition for Select Countries (2010-2021)




Notes: This figure shows the result of the decomposition in equation 3 for a panel of countries. 'Total' refers to the sum, i.e. the valuation gain. Numbers are shown as a percentage of GDP and over the period 2010-2021.

It is clear from this chart what drives differences across countries: The return effect accounts for most of the dispersion across countries. This means that valuation gains differ primarily because of country heterogeneity in asset performance.[24] The return effect is high for many high-income countries whose equity markets have performed poorly relative to the U.S.. For low income countries the return effect is still positive, but lower in general. The composition effect is generally negative for many emerging economies, which reflects their portfolio tilt towards safer assets. Timing effects are usually small. The timing of U.S. investors is close to zero throughout the sample, while there is some evidence that foreign investors in the U.S. exhibit bad timing. I show that these findings are not specific to the countries shown in table B.2 in the appendix, where I show the decomposition separately for advanced and emerging economies.

Concretely, this means that foreign investments can be characterized largely as buy-and-hold investors. Simply using average portfolio weights and returns (the return and composition effects),

[24]Note however that these asset price differentials are weighted by the portfolio shares as can be seen in the first line in equation 3, so holding more assets in a portfolio category with a large differential increases the return effect.

can explain most differences in valuation gains across countries. By contrast, timing effects which would result from large portfolio re-balancing, are small. Through the lens of the sufficient statistic in section 5 this means that welfare gains at the country level are small.

These findings are interesting in light of the pre-crisis literature on exorbitant privilege. Gourinchas and Rey (2007a) and Curcuru et al. (2010) estimate similar decompositions on data up to 2004 and 2007 respectively. Gourinchas and Rey (2007a) find a return effect that favors the U.S., opposite from my computation for the period 2010-2021. Consistent with Curcuru et al. (2008), foreigners exhibit bad timing. It will be interesting to see how return effects will evolve going forward, given the finding of Curcuru et al. (2010) that these effects fluctuate a lot depending on the sample.

# 4 Wealth Changes and Welfare Changes

The striking size of the spillovers from the U.S. asset price boom beg the question: Are these price changes meaningful or just paper gains? To answer this, I develop a sufficient statistic for welfare.

## 4.1 Framework

The baseline setting is a simple framework in which countries trade assets with the U.S., and trade in international goods markets. This results in a key role for the exchange rate, which induces changes in asset prices, but also affects the cost of imports.

**Financial markets.** Consider an economy which trades with the U.S. in international financial markets. There is no risk and time runs forever. There are domestic currency one-period bonds $B_t$ available, which pay out 1 in the next period and trade at price $Q_t$. Moreover, countries can buy or sell shares $N_{t,k}$ in $k = 1 \dots K$ U.S. assets at price $P_{t,k}$ (in dollars) on the global financial market. Let $s_t$ be the nominal exchange rate, defined as the price of foreign currency in home currency units, so that an increase in $s_t$ is a depreciation of home currency. Hence, purchasing $N_{t,k}$ shares of a U.S. security costs $P_{t,k}s_t$ units of home currency. Assets pay dividends $D_{t,k}$ in

the currency of denomination, so that the gross return from the perspective of the open economy is $R_{t,k+1} = (D_{t,k+1} + P_{t,k+1}s_{t+1})/P_{t,k}s_t$ in domestic currency.[25] Similarly, there exist $l = 1 \dots L$ domestic assets, with the holdings denoted $N_{t,l}$, which pay out dividends in domestic currency. Of each asset, there is a total supply of $\overline{N}_k$ and $\overline{N}_l$.[26]

The gross return of the bond is $R_{t+1} = 1/Q_t$. Denote by $R_{0\to t} = R_1 \cdots R_t$ the total gross return on the bond from time 0 to $t$. Finally, in order to make portfolios determinate, there is an infinitesimal adjustment cost $\chi_k(\Delta N_{t,k})$ for U.S. and a similar adjustment cost $\chi_l$ for domestic assets. As there is no uncertainty, without adjustment costs there would be no difference between assets. For the welfare gains to first order, adjustment costs and their functional form do not matter.

**Households.** A representative household consumes and trades goods, some of which are invoiced in dollars. There are two types of goods, home goods $H$ and foreign goods $F$ that are invoiced in dollars, with prices $P_{H,t}$ and $P_{F\$,t}$ respectively. The welfare gains will work through the price of goods invoiced in dollars, therefore I only consider trade invoiced in dollars.[27] In addition to their dividend income from asset ownership as introduced above, households have an endowment $Y_{H,t}$ of the home good.

Households have a utility function $U$ over a consumption aggregate $C_t^{\text{agg}}$ that is implicitly defined over home and foreign goods,

$$\mathcal{C}(C_{H,t}, C_{F\$,t}, C_t^{\text{agg}}) = 1$$

with $\mathcal{C}$ increasing over $C_{H,t}$ and $C_{F\$,t}$ and decreasing in $C_t^{\text{agg}}$. The corresponding ideal price index $P_t^{\text{agg}}$ is defined as $P_t^{\text{agg}} := E(P_{H,t}, P_{F\$,t}s_t, C_t^{\text{agg}})/C_t^{\text{agg}}$ given the countries implied expenditure function $E$. Therefore, given choices of $C_{H,t}$ and $C_{F\$,t}$, the cost of purchasing these goods is $C_{H,t}P_{H,t} + C_{F\$,t}P_{F\$,t}s_t$.

[25] Foreign one-period bonds are nested here as assets with dividend 1 and maturing at $t + 1$.

[26] This supply is assumed to be in excess of the domestic asset demand and only matters for defining the net foreign asset position lateron.

[27] I do not attempt to model the effects of exchange rate movements on trade that is not invoiced in dollars. This is because these effects are a lot more uncertain, whereas the fact that prices of goods at the border move in line with the currency they are invoiced is well established in the literature (Gopinath and Itskhoki, 2022; Auer et al., 2021). Appendix D.2 considers an extension with imperfect pass-through.

In addition, foreigners demand home goods, which are exported and can be invoiced in dollars. Foreigners have a demand function $C^*_{H\$,t} = \mathcal{D}^*(P_{H,t}s_t)$ for the exports invoiced in dollars, so that export revenues in local currency are $C^*_{H\$,t}P_{H,t}s_t$.[28] Household income from sales of domestic and foreign goods is therefore $Y_t = C_{H,t}P_{H,t} + C^*_{H\$,t}P_{H,t}s_t$.

Prices are taken as given, so that the household problem becomes

$$V = \max_{C_t, B_t, N_{t,k}, N_{t,l}} \sum_{t=0}^{\infty} \beta^t U(C_t^{\text{agg}})$$

subject to the initial holdings $B_{-1}$, $N_{k,-1}$, $N_{l,-1}$ and the budget constraint

$$\begin{aligned}\sum_{k=1}^{K} \Delta N_{t,k}P_{t,k}s_t + \sum_{l=1}^{L} \Delta N_{t,l}P_{t,l} + Q_tB_t + C_{H,t}P_{H,t} + C_{F\$,t}P_{F\$,t}s_t + \mathcal{X}_t \\ = C_{H,t}P_{H,t} + C^*_{H\$,t}P_{H,t}s_t + \sum_{k=1}^{K} D_{t,k}N_{t-1,k}s_t + \sum_{l=1}^{L} D_{t,l}N_{t-1,l} + B_{t-1}\end{aligned}$$

such that all income is used to trade financial assets or consume at each time $t$. Here $\mathcal{X}_t$ are the aggregate trade costs for all assets. The associated no ponzi conditions for the bond, domestic and foreign assets are

$$\lim_{t\to\infty} R^{-1}_{0\to t}B_tQ_t = 0, \quad \lim_{t\to\infty} R^{-1}_{0\to t}N_{t,k}s_tP_{t,k} = 0 \;\forall k, \quad \lim_{t\to\infty} R^{-1}_{0\to t}N_{t,l}s_tP_{t,l} = 0 \;\forall l. \tag{4}$$

**Relationship to the Balance of Payments.** The setup above relates naturally to the accumulation equation for the net foreign asset position, $\text{NFA}_{t+1} = \text{NFA}_t + \text{CA}_{t+1} + \text{VA}_{t+1}$, as outlined in section 2. In this setup, only positions and transactions with the U.S. are considered, so these objects are bilateral foreign positions. For each country, its bilateral foreign asset position (in local currency) is given by

$$\text{NFA}^{\text{bilat}}_t = \sum_{k=1}^{K} N_{t,k}P_{t,k}s_t - \sum_{l=1}^{L} \underbrace{(\overline{N}_l - N_{t,l})}_{\text{Domestic assets held by U.S.}} P_{t,l}$$

[28] What will matter for computing the sufficient statistic is the total value of imports and exports in dollars by country (i.e $C_{F\$,t}P_{F\$,t}s_t$ resp $C^*_{H\$,t}P_{H,t}s_t$), which is readily computed in the data. Thus I do not have to take a stance on the precise price indices in the implementation.

The framework only considers asset trading with the U.S., so assets are held by the U.S. or the foreign country. Taking the sum over all countries yields the aggregate U.S. net foreign asset position. The net international transactions (or equivalently, current account) are

$$\text{CA}_{t+1}^{\text{bilat}} = \sum_{k=1}^{K}(N_{t+1,k} - N_{t,k})P_{t+1,k}s_{t+1} - \sum_{l=1}^{L}(N_{t,l} - N_{t+1,l})P_{t+1,l}.$$

Finally, the valuation changes are

$$\text{VA}_{t+1}^{\text{bilat}} = \sum_{k=1}^{K} N_{t,k}(P_{t,k+1}s_{t+1} - P_{t,k}s_t) - \sum_{l=1}^{L}(\overline{N}_l - N_{t,l})(P_{t+1,l} - P_{t,l}).$$

## 4.2 Sufficient Statistic

I consider the impact of a price deviation $(\mathrm{d}s_t, \{\mathrm{d}P_{t,k}\}, \{\mathrm{d}P_{t,l}\})_{t=0}^{\infty}$, i.e changing asset prices and exchange rates. In this setting, I define the *welfare gain* as the effect of these price movements on total welfare $V$ scaled by the marginal utility of consumption at time $0$,

$$\text{Welfare gain} = \mathrm{d}V/U'(C_0^{\text{agg}}).$$

The *welfare gain* defined in this sense can be interpreted as the willingness to pay for a given path of prices (equivalent variation). It captures what foreign countries would be willing to pay for the observed path of price of U.S. assets, domestic assets and exchange rates. Proposition 1 decomposes the welfare gains from these price movements, extending the results from Fagereng et al. (2024). Welfare gains from revaluation of foreign assets through the exchange rate and price changes depend on the net purchase or sale of the assets, not the holdings or valuation gains. In language of the balance of payments, what matters for welfare is the current account. Further, exchange rate movements not only have effects on the valuation of foreign assets, but also on the price of imports, exports and the value of dividends.

**Proposition 1 (Welfare Gain in Open Economy)** *The welfare gain coming from a price devia-*

*tion* $\{ds_t, \{dP_{t,k}\}_k, \{dP_{t,l}\}_l\}_{t=0}^{\infty}$ *is*

$$\text{Welfare gain} = \sum_{t=0}^{\infty} R_{0\to t}^{-1} \Bigg( \underbrace{\sum_{k=1}^{K} (N_{t-1,k} - N_{t,k})(s_t \mathrm{d}P_{t,k} + P_{t,k}\mathrm{d}s_t)}_{\text{Asset Revaluation (Foreign in U.S.)}} + \underbrace{D_{t,k}N_{t-1,k}\mathrm{d}s_t}_{\text{Dividend Revaluation}} + \underbrace{\sum_{l=1}^{L} (N_{t-1,l} - N_{t,l})\mathrm{d}P_{t,l}}_{\text{Asset Revaluation (U.S in Foreign)}} + \underbrace{(C^*_{H\$,t}P_{H,t} - C_{F\$,t}P_{F\$,t})\mathrm{d}s_t}_{\text{Goods Price Change}} \Bigg)$$

The proof is given in Appendix D. From this expression it becomes clear that valuation gains are welfare improving in so far as they relax the external budget constraint. Whether they do so depends on financial transactions: Buyers of expensive assets are hurt while the sellers benefit. Holdings that are never touched do not affect the budget constraint to first order so that they have no welfare effects. Relative to the closed economy there are new channels, driven by the exchange rates. The exchange rate revalues foreign assets and dividends, but also has direct effects on the price of traded goods. The first three components capture the welfare effects induced through *financial* channels, i.e. the revaluations of assets and dividends. The final component allows for a comparison of these financial effects to the *real* effects of exchange rate movements on the price of imports and exports. To first order, dollar exchange rate movements have a direct impact on goods invoiced in dollars: They make exports invoiced in dollars more expensive, generating a welfare gain for dollar exporters, but also increase the price of imports invoiced in dollars. The net welfare effect depends on the amount of exports and imports invoiced in dollars. A further discussion of the interpretation and extensions to the sufficient statistic is provided in section 5.

In the world economy, an aggregation result holds for the welfare gains from revaluations: For every buyer there is a seller, so the worldwide welfare gains coming from these terms are zero. Corollary 2 formalizes this.

**Corollary 2 (Aggregation in the World Economy)** *Suppose that all prices holding initially clear markets. Then the aggregate welfare gains from asset revaluation are 0.*

The corollary follows directly by noting that when taking the sum over all countries $c = 1 \dots C$

including the U.S., asset trades sum to 0, i.e $\sum_{c=1}^{C}(N_{t,ck} - N_{t-1,ck}) = 0$ for any asset $k$ (for every buyer, there is a seller).

## 4.3 Implementation of the Sufficient Statistic

I now describe how I measure the sufficient statistic from proposition 1 in the data. Asset transactions are constructed directly together with valuation gains using the accumulation equation 1. In addition, I use data on price deviations as well as trade invoicing.

**First-order Approximation.** Conceptually, the sufficient statistic from equation 1 applies to infinitesimal deviations of prices and exchange rate. To operationalize this, I use a first order-approximation $\{\Delta s_t, \{\Delta P_{t,k}\}_k, \{\Delta P_{t,l}\}_l\}_{t=0}^{\infty}$,

$$\text{Welfare gain} = \sum_{t=0}^{\infty} R_{0\to t}^{-1}\Bigg( \sum_{k=1}^{K}(N_{t-1,k} - N_{t,k})(s_t\Delta P_{t,k} + P_{t,k}\Delta s_t) + D_{t,k}N_{t-1,k}\Delta s_t \\ + \sum_{l=1}^{L}(N_{t-1,l} - N_{t,l})\Delta P_{t,l} + (C^*_{H\$,t}P_{H,t} - C_{F\$,t}P_{F\$,t})\Delta s_t\Bigg)$$

Note that the sufficient statistic is then a function of observed quantities, for example

$$(N_{t-1,k} - N_{t,k})s_t\Delta P_{t,k} = \underbrace{((N_{t-1,k} - N_{t,k})P_{t,k}s_t)}_{\text{Measured Transactions}} \underbrace{\frac{\Delta P_{t,k}}{P_{t,k}}}_{\text{Price Deviation}} .$$

**Price Deviations and Exchange Rate Deviations.** The sufficient statistic considers changes in prices relative to a baseline scenario holding dividends constant. To approximate this concept, I define price deviations from a path with a constant price dividend ratio, following Fagereng et al. (2024). Therefore, I consider welfare gains relative to a world in which the ratio of prices to payouts remained constant. Importantly, the U.S. equity market has seen a large increase in prices relative to fundamentals, as I show below (see also Greenwald et al. (2019)). Alternatively, the baseline scenario could be defined as one in which prices are constant, ignoring the issue of corporate valuations. I show that this yields similar conclusion in appendix D.1.

In practice there is also a complication with using the price dividend ratio as a measure of valuation, which arises from retained corporate earnings (Bauluz et al., 2022; Fagereng et al., 2024). A firm can decide to pay out its profits in terms of dividends or to keep them, which will then be accounted as retained earnings. To abstract from this, I use the *price to earnings ratio* as my measure of valuation, which is invariant to the corporate dividend policy.[29] I use the cyclically adjusted price earnings ratio (CAPE) from Robert Shiller's data as a measure of the price to earnings ratio, which has the advantage of averaging over past earnings so that it is robust to large earnings swings or negative earnings.[30]

I consider price deviations starting from January 2010, the start of the 'end of privilege' period. The implementation considers price deviations relative to a fixed price-earnings ratio. Given the baseline value $\overline{PE}$ of the price earnings ratio in 2010, the price deviation is equal to

$$\Delta P_{t,k} = P_{t,k} - \overline{PE} \times E_{t,k}. \tag{5}$$

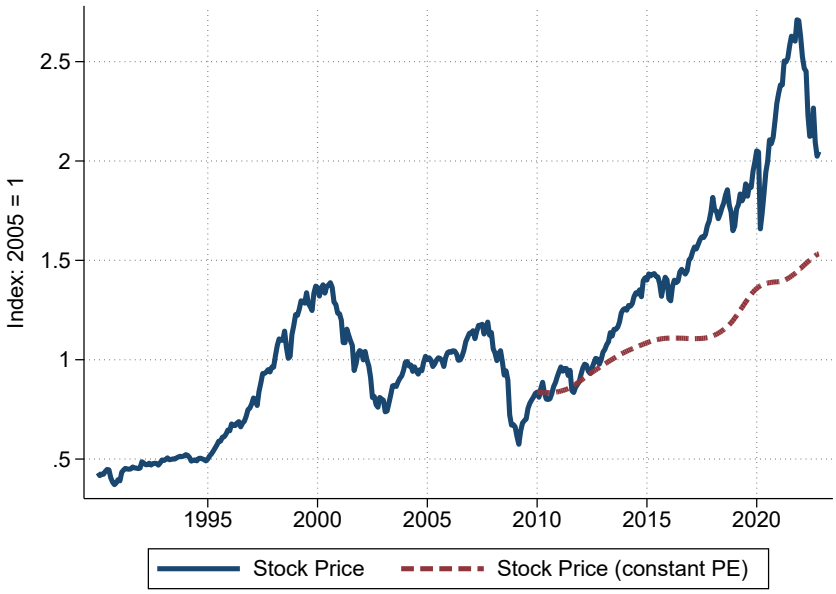
The U.S. equity boom between 2010 and 2021 was characterized by a strong increase of prices relative to earnings. I illustrate this in figure 5, which shows the S&P 500 together with a counterfactual stock index where earnings move but the price to earnings ratio its fixed to its value in January 2010. The difference between the lines is the price deviation as defined in equation 5. I construct similar measures for foreign equity price indices from Global Financial Data, which are shown in figure C.3. For bonds and exchange rates, I consider price deviations as differences to January 2010 bond price indices, i.e. $\Delta P_{t,k} = P_{t,k} - \overline{P_{2010,k}}$. Further details and illustrations of the asset prices employed are given in appendix C.2. I show welfare gains using the pure equity price deviations (not the deviation from a constant PE ratio) in appendix D.1, they are similarly small.

In my baseline results I exclude FDI in the calculations, as portfolio choice consideration in FDI are likely driven by very different factors (cross-border mergers, acquisitions etc.), than the ones considered in my setup and there exist large measurement issues with the dividend payments

[29] Fagereng et al. (2024) employ a similar measure for Norway, which they note is close to the P/E ratio.
[30] For foreign countries, I use a similar measure from Global Financial Data, see appendix C.2.

from FDI related to profit shifting (Guvenen et al., 2022). Welfare gains including FDI are in appendix figure D.2, they are more negative as many countries have been large buyers of U.S. FDI.

Figure 5: Illustration of the Price Deviation for U.S. equity




Notes: This figure illustrates the price deviation as defined in equation 5. Stock prices refer to the S&P 500 indexed so that January 2005 is set to 1. The stock price under a constant PE ratio shows a counterfactual stock index in which the price to earnings ratio is fixed to its value in January 2010 and earnings (computed as in Robert Shiller's CAPE) grow as in the data. The difference between the lines is the price deviation from equation 5.

**Goods Prices and Dividends.** The sufficient statistic also considers exports, imports and dividends. For dividends, I consider dividends on portfolio equity and interest on portfolio debt paid to foreigners as recorded in the BEA's current account. I then distribute these to equity and bond holders according to their portfolio shares in these asset categories. The value of imports and exports over GDP in each country is taken from the World Bank. I then compute the value of total imports and exports invoiced in dollars using data from Boz et al. (2022).[31] I show summary statistics on all inputs to the sufficient statistic for each country in table D.1 in the appendix.

**Infinite and Finite Horizons.** The sufficient statistic from proposition 1 refers to an infinite horizon economy. In practice, horizons are finite, so I truncate the sum after 2021. The sufficient

[31] I extend invoicing shares forward and backward in time where necessary, assuming that they remain constant. For Canada, I follow Boz et al. (2022) and use Devereux et al. (2015), Table 2 for the invoicing currency in imports.

statistics can still be interpreted as the welfare gains up to 2021, or as the welfare gains if price deviations revert to 0 after 2021. A natural limitation of this approach is that future asset sales are not considered. However, given the fall in equity prices after 2021, price deviations for equity are currently dropping towards their 2010 values, as shown in figures 5 and C.3. I discuss how to account for future asset price movements using forecasts in section 5.2.

# 5 Welfare Gains

The sufficient statistic from proposition 1 can now be used directly to quantify welfare gains. I do this for all countries without missing data and that have holdings of all asset categories.

## 5.1 Sufficient Statistic Results

The sufficient statistic is

$$\text{Welfare gain} = \sum_{t=0}^{T} R_{0\to t}^{-1}\Bigg( \underbrace{\sum_{k=1}^{K}(N_{t-1,k}-N_{t,k})(s_t\Delta P_{t,k}+P_{t,k}\Delta s_t)}_{\text{Asset Revaluation (Foreign in U.S. )}} + \underbrace{D_{t,k}N_{t-1,k}\Delta s_t}_{\text{Dividend Revaluation}} + \underbrace{\sum_{l=1}^{L}(N_{t-1,l}-N_{t,l})\Delta P_{t,l}}_{\text{Asset Revaluation (U.S. in Foreign)}} - \underbrace{(C^*_{H\$,t}P_{H,t}-C_{F\$,t}P_{F\$,t})\Delta s_t}_{\text{Goods Prices}}\Bigg).$$

The discounting is calibrated such that $R_{0\to t}^{-1} = \beta^t$ with an annual value of $\beta = 0.96$. I divide the total welfare gain each year by GDP and average across years, consistent with my treatment of valuation gains. Figure 6 presents real average annual welfare gains together with each component for a number of countries.

In panel (a), I show only the welfare effects through financial channels, as captured in the first three components of the sufficient statistic. Welfare gains through financial channels are small, on the order of 0.1% of GDP annually and an order of magnitude lower than wealth gains, which are often larger than 1% of GDP. The reason is simple: Most countries did not re-balance their

positions during this period and financial transactions were much smaller than capital gains. The return decomposition from section 3.2 similarly indicates that portfolio re-balancing by different countries is small.

In fact many countries, such as Germany or Korea, even kept buying U.S. assets at a premium so that price increases of U.S. assets effectively tightened their budget constraint. In the chart, this can be seen through the negative blue dots for these countries. Therefore, for many countries, aggregate welfare gains through financial channels are negative. Countries which re-balanced away from U.S. assets, such as Mexico or Russia, benefited. Welfare effects through dividends are generally positive, as the dollar appreciation increased the value of the dividends on U.S. holdings in real terms. However, even for the largest gainers in terms of wealth, Canada and Norway, total welfare gains from these financial channels are a small fraction of GDP compared to capital gains exceeding 8% of GDP annually.

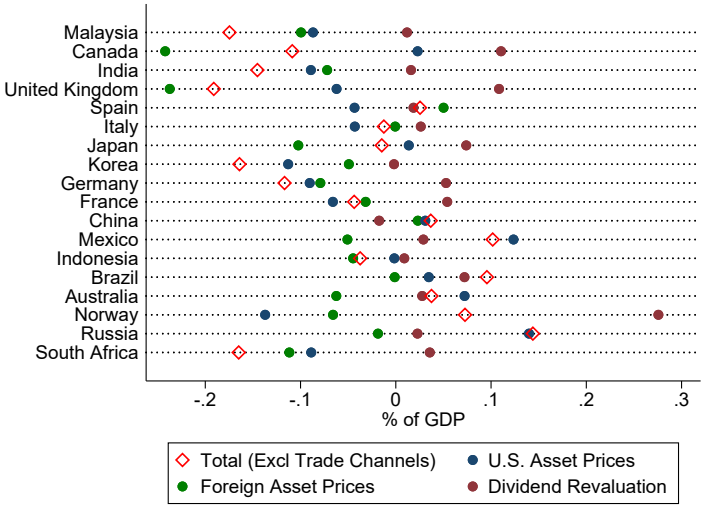
Panel (b) adds to this the real effects of the dollar appreciation on prices of traded goods, the fourth component of the sufficient statistic.[32] These welfare gains work through changes in the price of exports (generally positive) and imports (generally negative) invoiced in dollars. The welfare gains through these channels are an order of magnitude larger than those working through asset valuations, which may seem surprising in light of the large valuation gains for many countries documented in section 3. This is because most valuation gains are not realized, so they do not affect the budget constraint to first order. On the trade side, the fact that many countries have large portions of trade that is invoiced in dollars means that a dollar appreciation translates directly into higher prices for a large fraction of the goods transactions in these countries.[33]

On net, the welfare gains through these channels depend on a country's hedge against dollar fluctuations in terms of invoicing currency. For most economies, the invoicing currency of imports and exports is matched relatively well, so that the net effect is close to zero. However, because

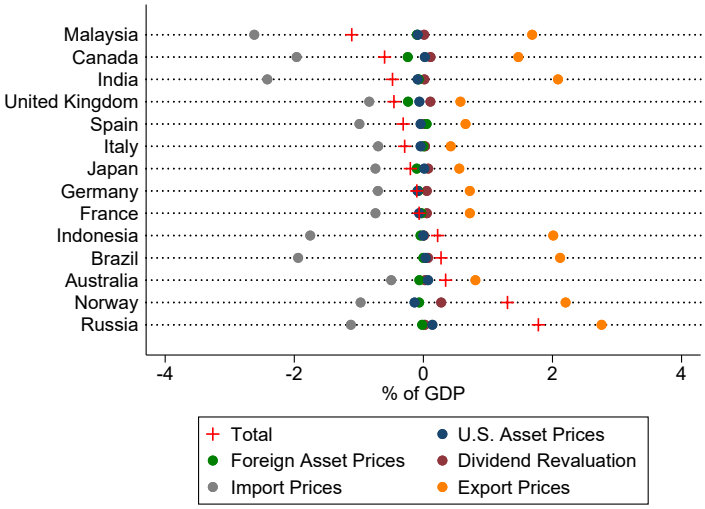
[32]Note that the sample of countries is reduced slightly as invoicing data is available for a set of economies.

[33]Note that my analysis does not depend on the pass-through of border prices into store prices. As I do not account for household heterogeneity, this distinction is not important, as all imports of the country need to be purchased at the border. Within a heterogeneous agent framework the pass-through into store prices matters, as consumers purchase goods at the store while importers pay for these goods at the border.

Figure 6: Welfare Gains from Price Changes




(a) Welfare Gains excluding Goods Prices




(b) Welfare Gains including Goods Prices

Notes: This figure presents welfare gains computed through the sufficient statistic from proposition 1. The red crosses represent the aggregate welfare gain, while the dots represent the components of the welfare gain as shown in proposition 1. Panel (a) presents the welfare gains from the first three components, while panel (b) adds the fourth component, the effect on goods prices. For a few countries, data on the currency of invoicing in both imports and exports is not available, these are dropped in panel (b). All underlying numbers are in table D.1.

these welfare channels are much larger in gross terms, even small deviations from a perfect hedge can lead to relatively large welfare gains or losses. Some economies that have many dollar exports, such as Russia or Norway see welfare gains, whereas economies with many dollar imports (such

as Mexico) see welfare losses.

Results for the other countries are shown in Appendix D.1, where I also show welfare gains including FDI and when using a different measure of price changes in figure D.2. In both versions, the direct welfare gains from increasing asset prices are much smaller than the valuation gains.

**Discussion.** Price deviations in the sufficient statistic correspond to changes in prices holding earnings fixed.[34] Starting with Campbell and Shiller (1988), the majority of the asset pricing literature has attributed fluctuations in U.S. equity prices to such shifts in valuations. On the other hand, Atkeson et al. (2024) attribute the U.S. equity boom to a rise in free cash flows accruing to firm owners. The sufficient statistic only uses the variation in prices captured by a deviation from a constant price-earnings ratio in the baseline period. Figure C.2 in the appendix decomposes the increase in U.S. equity prices into changes into earnings growth and growth in the price-earnings ratio in an accounting sense. Over my sample, both contribute roughly in equal proportions to the boom in stock prices, with rising price-earnings ratios contributing somewhat more at the end.

In general equilibrium, changes in asset prices are the result of shifts in the economy, while in the sufficient statistic price movements are exogenous. Importantly, the sufficient statistic holds irrespective of the ultimate causes of the high valuation gains. Of course, the sources of these price movements may carry further welfare implications themselves. Fagereng et al. (2024) show that modeling the source of asset price fluctuations would result in direct effects that are added as additional terms to the sufficient statistic in proposition 1. In this case the sufficient statistic does not capture the full welfare consequences but rather the part pertaining to the effects on asset prices. My approach is agnostic and I do not take a stance on the underlying cause of price movements.[35]

My approach is only accurate up to first order and may thereby miss important second order effects. An example of such a second order effect is if a country, backed by its valuation gains on U.S. holdings, sees its borrowing constraints relaxed and borrows abroad. A similar concern is that countries might already be consuming against valuation gains in anticipation of future asset sales.

[34] This corresponds to changes in discount rates in the language of the asset pricing literature.

[35] Additionally, Del Canto et al. (2023) show how to derive a similar sufficient statistic in the closed economy in an environment with risk, this could also be extended to my setting.

In either case, the current account should be decreasing in economies with high capital gains. In Appendix D.7, I show that if anything, countries with more valuation gains *saved more* externally over this time horizon. Concretely, I show that across the current account balance increases in response to valuation gains on the U.S. net foreign asset position.

A further concern might be that my sufficient statistic mechanically leads to small welfare effects from valuation gains. I show that this is not the case in Appendix D.6, in which I calculate the implied welfare gains for the U.S. from 1973-2004. During this period, the U.S. was earning structurally high valuation gains on their NFA while also running a substantial current account deficit (in this sense realizing their valuation gains). The sufficient statistic implies that the average annual welfare gains are on the same order of magnitude as the average annual wealth gains.

## 5.2 Extensions to the Sufficient Statistic

The sufficient statistic can be extended in a number of ways to take further aspects into account. In this section, I present three extensions. These alter the results of the main text somewhat quantitatively, but not qualitatively. Welfare gains from asset revaluations remain small compared to welfare gains through more direct trade channels.

**Welfare Effects from Future Sales.** The sufficient statistic only covers asset price movements up to 2021. A natural question is what will happen to welfare going forward. I tackle this question in two ways: First, I consider a theoretically-founded forecast for the aggregate U.S. external position based on Gourinchas and Rey (2007b). Second, I consider a scenario analysis at the bilateral level to understand which scenarios generate high welfare gains in the future.

In the long run, terminal conditions embedded in most economic models suggest that the consistently negative valuation gains and current account deficit that shaped the U.S. external position in the past decade cannot continue forever. The needed adjustment may happen either through positive valuation gains for the U.S. or through a U.S. current account surplus. Gourinchas and Rey (2007b) develop a forecasting method based on the so-called cyclical external imbalance to quantify the size of these channels. My sufficient statistic clarifies that the nature of the adjustment

process carries important welfare implications: Adjustment through the current account (trade channel) means that foreigners will eventually realize their capital gains. Adjustment through valuation gains (financial channel) means that foreigners will see their asset price gains melt away over the next few years without gaining in welfare terms.

I extend their methodology to the present and use it to forecast the development of the U.S. external position; for details and a comparison of findings see appendix D.3. In line with Gourinchas and Rey (2007b), the forecast predicts that a large fraction of the adjustment will work through the financial channel, i.e. world markets are predicted to outperform U.S. markets, with only a mild adjustment in the U.S. current account deficit. I then apply the sufficient statistic to compute the implied welfare gains for the rest of the world in appendix table D.3. As the forecast does not predict returns and adjustment within specific asset classes or countries, I can only compute welfare at the aggregate level, not the bilateral level. Because the forecast predicts large adjustment through the valuation channel and not the trade channel, future transactions and welfare gains remain small.

This methodology can not be used for bilateral adjustment. However, I consider two simple scenarios to assess the welfare consequences of the future adjustment of the U.S. external position at the bilateral level in appendix D.4, where the details and corresponding figures can be found. In the first scenario, I model bilateral adjustment through the valuation channel. Concretely, I let price deviations decay back to their initial value, and set transactions equal to their sample average for each country and asset class. This results in small future welfare gains, as foreigners keep holding on to or even buying expensive U.S. assets. Welfare gains including the forecast are close to my baseline welfare gains up to 2021.

In the second scenario, I model bilateral adjustment through the trade channel. I hold asset valuations fixed after 2021 and consider a path in which every country has asset transactions that exactly offset the valuation gains it has earned from 2010 to 2021. This results in large welfare gains for foreigners going forward, in particular for the countries with high valuation gains, who become important sellers of U.S. assets. However, this scenario implies large adjustments in the

U.S. current account and generates a large U.S. current account surplus.

In conclusion, through the lens of the sufficient statistic, a large adjustment in the current account is required to generate broad-based welfare gains for foreigners. The aggregate forecasts suggest that this is unlikely in the next years.

**Changes in Short-Term Interest Rates.** The changes in asset valuations I consider concern changes in the valuation of long-lived assets, such as equities and long term bonds, in which the largest revaluations over the past years have occurred. In contrast to these long-lived assets, short term assets (such as the one-period bond in my framework or short-term treasuries) must be continuously rolled over, so for these assets holdings and transactions coincide. I extend the sufficient statistic to include such assets in appendix D.2. Measuring the size of the asset stock that is continuously rolled over is difficult without security-level data, so I consider short-term holdings, i.e. holdings maturing in less than one year, as a proxy. Throughout my sample, most foreigners are tilted towards longer-term assets and these assets only make up less than 20% of their total portfolio of debt securities in the U.S.. The strong dollar and rise in the price of U.S. short term debt has meant that the cost of rolling over short-term debt has increased and foreigners lose slightly more in terms of welfare through this channel. Quantitatively, however these effects are relatively small. This is a combination of the fact that most foreign investors are long-term investors and the fact that price deviations in interest rates are small relative to equity.[36]

**Stickiness of Prices.** The sufficient statistic assumes that imports invoiced in dollars exhibit price stickiness in this currency. This aligns with extensive literature on invoicing currencies and trade prices, which demonstrates that border prices closely co-move with exchange rates (Burstein and Gopinath, 2014; Gopinath et al., 2020; Auer et al., 2021; Gopinath and Itskhoki, 2022). For example, Gopinath et al. (2020) report a pass-through of approximately 80%, whereas Auer et al. (2021) find up to 95% using granular data from Switzerland. In appendix D.2, I extend the sufficient statistic to incorporate an arbitrary degree of stickiness. When prices move less closely with

[36]Changes in short-term interest rates may also be interpreted as changes in the discount factor at which valuation gains are discounted in the sufficient statistic. Changing the discount factor mechanically scales all components of the sufficient statistic.

exchange rates, this mutes the effects coming from the final term in the sufficient statistic. However, these effects remain much larger than the financial channels from pure asset revaluations for realistic calibrations. I also abstract from indirect effects on output from exchange rate movements, for example through the price of imported intermediates or real income channels. Given the lack of consensus about the macroeconomic consequences of depreciations (Auclert et al., 2021; Fukui et al., 2023), I do not attempt to include these.

# 6 Conclusion

In a financially integrated world, asset price changes redistribute wealth at a global scale. The global footprints of the U.S. asset price boom can be traced primarily to wealthy countries where the exposure to equity markets is largest. My analysis however also suggests that so far, the welfare impacts of these asset price changes have been small or even negative as countries failed to capitalize on their valuation gains. Most economies realized little of their valuation gains or did not run large current account deficits like the U.S. during the pre-crisis years.

In future work, it is important to understand how the valuation gains are distributed within countries. Some countries produce statistics on foreign asset holdings by sector, which could be used as a first benchmark. This could as provide some insights as to why foreigners seem to not have reacted much to the large valuation gains they have earned. Finally, the methods in this paper could be extended to understand other important phenomena in international economics, such as the welfare effects of U.S. monetary policy shocks in the rest of the world or the welfare effects of large swings in capital flows around sudden stops.

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# A Appendix: Data and Methodology

This appendix gives details on the data and the methodology. The construction of valuation gains and associated restatements of tax haven holdings requires many steps, I summarize the data sources and procedures in table A.1 below. Details on the restatements are in the next sections.

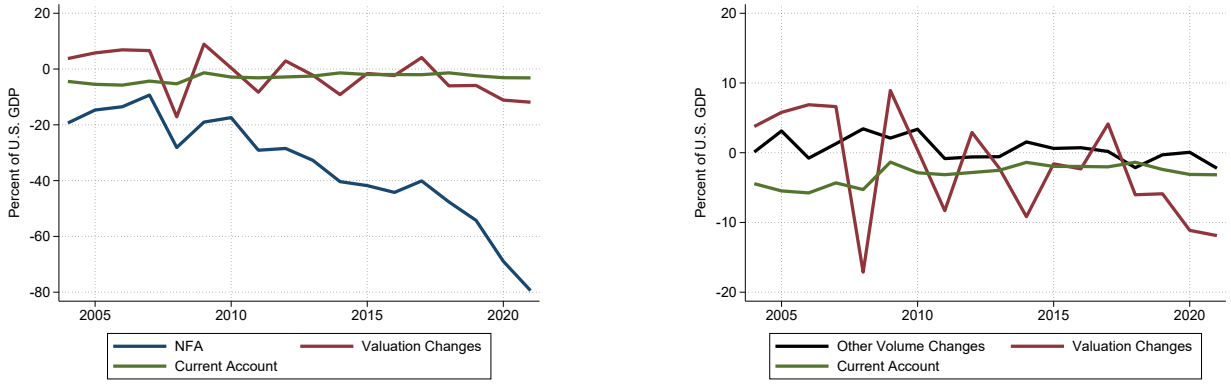
Table A.1: Overview of Data Sources

| **Assets** | **Liabilities** |
|---|---|
| *FDI* | *FDI* |
| • Data source: BEA Bilateral Direct Investment (Bureau of Economic Analysis, n.d.)<br>• Valuation Changes: Computed as residual from holdings and flows<br>• Tax Haven Adjustment: Restatement matrices computed from Damgaard et al. (2019) | • Data source: BEA Bilateral Direct Investment (Bureau of Economic Analysis, n.d.)<br>• Valuation Changes: Computed as residual from holdings and flows<br>• Tax Haven Adjustment: BEA Data on ultimate owners of FDI |
| *Portfolio Investment* | *Portfolio Investment* |
| • Data source: TIC Data<br>• Valuation Changes: Computed using asset price indices from Bertaut and Judson (2022). 2 Asset Classes: Equity, Bonds<br>• Tax Haven Adjustment: Restatement matrices from Coppola et al. (2021) | • Data source: TIC Data<br>• Valuation Changes: Computed using asset price indices from Bertaut and Judson (2022). 4 Asset Classes: Equity, agency bonds, corporate bonds, sovereign bonds<br>• Tax Haven Adjustment: Restatement matrices computed from Alstadsæter et al. (2018) and Beck et al. (2024) for Ireland and Luxembourg |

## A.1 Macro-Environment

In the aggregate data, the valuation losses on the U.S. NFA are clearly visible. Figure A.1 presents the U.S. NFA, together with the current account and the valuation changes. Data is taken from the BEA's IIP table 1.3, so the valuation changes exclude the so-called 'Other Changes in volume'. Panel (b) of the figure shows the other changes, together with the valuation changes and the current account. Other changes are small in the period after 2010, so that the decision whether to allocate them to flows or capital gains has little influence on the results.

Figure A.1: Macroeconomic Context




(a) Evolution of the U.S. NFA

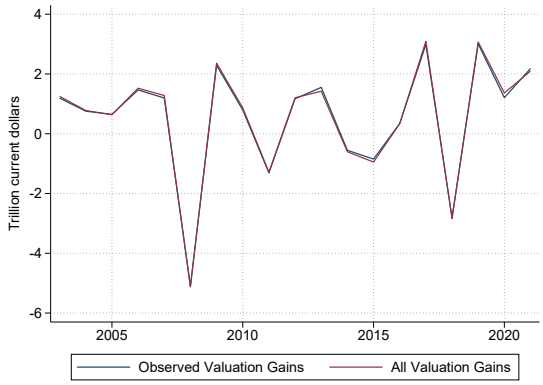
(b) Evolution of other changes

Notes: Panel (a) displays the U.S. NFA, current account, and valuation changes as a percentage of GDP (excluding other changes in volume). Panel (b) shows other changes alongside valuation changes and the current account.

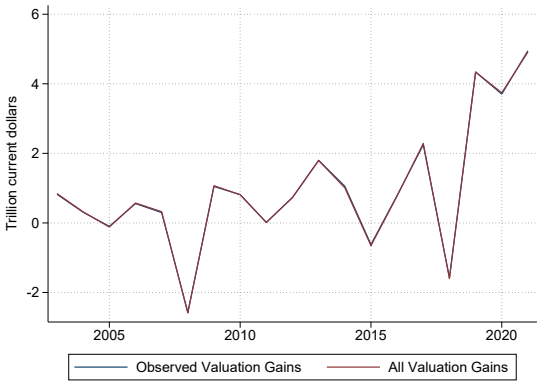
## A.2 Details on the Data Sources

**Valuation effects by asset class.** The bilateral data I construct only contains portfolio and direct investment. The other parts of the U.S. external balance sheet (mostly bank loans) do not experience large valuation effects in general. Figure A.2 shows this explicitly by comparing the valuation gains on portfolio and direct investment (observed) to all valuation gains (including other asset classes without bilateral data). The difference between the lines is negligible, which shows that valuation gains on assets that are not covered are small.

Figure A.2: Valuation Gains on observed asset categories and on all asset categories




(a) Valuation gains on observed assets and on all assets




(b) Valuation gains on observed liabilities and on all liabilites

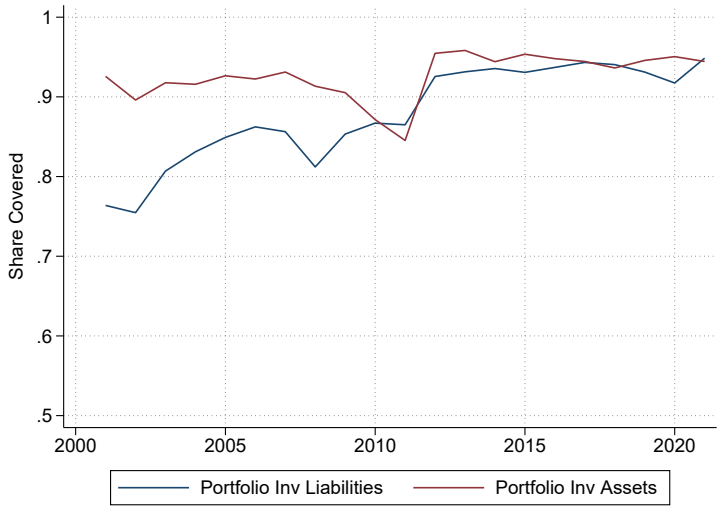
Notes: This figure shows the valuation gains on the asset categories covered in my bilateral data and on all asset categories. Data is shown separately for assets (U.S. holdings abroad) and liabilities (foreign holdings in the U.S.). The main asset category not covered in the bilateral data is 'other investment', mostly comprised of bank loans.

**Country Coverage.** I cover all countries which are included in both the bilateral FDI and the TIC data. In total, there are 82 countries which I am able to cover, these are listed in table A.2. As the country coverage varies over time, I aggregate British and Dutch tax havens in the Caribbean to achieve consistency. These countries include all major economies and tax havens. Taken together, they also make up the vast majority of the U.S. external balance sheet. I compare the bilateral data to the aggregate position in portfolio investment in figure A.3. For portfolio investment, I am also able to cover more than 90 % in the years after 2010, the period most critical for my study. Holdings in small countries are not covered in the TIC and therefore missing.

In figure A.4 I further show that the capital gains on the U.S. net foreign asset position and the (aggregated) bilateral capital gains are consistent. There are small discrepancies, mostly related to the coverage across countries, which make my (aggregated bilateral) capital gains a bit smaller. Bertaut et al. (2023) estimate returns in portfolio assets from the security level data underlying the TIC, without relying on asset price indices. In general, they find that returns obtained from the security-level data and aggregates are quite similar. Aggregate valuation gains are also very close across methods, although they are a bit less negative in the security-level data. Concretely,

cumulative aggregate valuation gains in portfolio investment decline by 18 p.p. from around 8% of U.S. GDP in 2007 to -10% of GDP in 2020 in the security-level data but by 22 p.p. from 12% to -10% in the aggregate data.[37] Adjusting for this would likely decrease the capital gains made in the rest of the world in portfolio investment, but still leave sizable capital gains remaining.

Figure A.3: Share of the Net Foreign Asset Position Covered in Bilateral data




Notes: This figure shows the share of the aggregate IIP that is covered in the bilateral data. This is constructed by aggregating all covered countries and dividing by the headline position in the asset category as reported in the U.S. international investment position.

[37] These numbers are taken from figure 5 in their 2023 working paper.

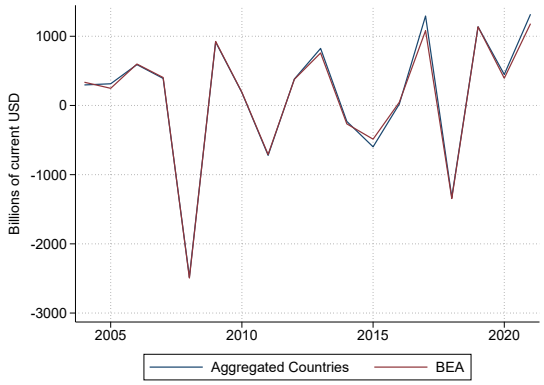
Table A.2: Country Coverage in FDI and TIC Data

| Country | TIC Coverage | FDI Coverage | Country | TIC Coverage | FDI Coverage |
|---|---|---|---|---|---|
| Argentina | 2001–2021 | 2001–2021 | Kuwait | 2012–2021 | 2012–2021 |
| Australia | 2001–2021 | 2001–2021 | Latvia | 2012–2021 | 2012–2021 |
| Austria | 2001–2021 | 2001–2021 | Lebanon | 2001–2021 | 2001–2021 |
| Bahamas | 2001–2021 | 2001–2021 | Liberia | 2001–2021 | 2001–2021 |
| Bahrain | 2012–2021 | 2012–2021 | Luxembourg | 2001–2021 | 2001–2021 |
| Barbados | 2012–2021 | 2012–2021 | Malaysia | 2001–2021 | 2001–2021 |
| Belgium | 2001–2021 | 2001–2021 | Malta | 2012–2021 | 2012–2021 |
| Belize | 2012–2021 | 2012–2021 | Marshall Islands | 2012–2021 | 2012–2021 |
| Bermuda | 2001–2021 | 2001–2021 | Mauritius | 2012–2021 | 2012–2021 |
| Botswana | 2012–2021 | 2012–2021 | Mexico | 2001–2021 | 2001–2021 |
| Brazil | 2001–2021 | 2001–2021 | Morocco | 2001–2021 | 2001–2021 |
| British Caribbean [a] | 2001–2021 | 2001–2021 | Netherlands | 2001–2021 | 2001–2021 |
| Canada | 2001–2021 | 2001–2021 | New Zealand | 2001–2021 | 2001–2021 |
| Channel Islands and Isle of Man | 2001–2021 | 2001–2021 | Nigeria | 2012–2021 | 2012–2021 |
| Chile | 2001–2021 | 2001–2021 | Norway | 2001–2021 | 2001–2021 |
| China | 2001–2021 | 2001–2021 | Oman | 2012–2021 | 2012–2021 |
| Colombia | 2001–2021 | 2001–2021 | Panama | 2001–2021 | 2001–2021 |
| Croatia | 2012–2021 | 2012–2021 | Peru | 2001–2021 | 2001–2021 |
| Cyprus | 2012–2021 | 2012–2021 | Philippines | 2001–2021 | 2001–2021 |
| Denmark | 2001–2021 | 2001–2021 | Poland | 2001–2021 | 2001–2021 |
| Dominican Republic | 2012–2021 | 2012–2021 | Portugal | 2001–2021 | 2001–2021 |
| Dutch Caribbean [b] | 2001–2021 | 2001–2021 | Qatar | 2012–2021 | 2012–2021 |
| Ecuador | 2001–2021 | 2001–2021 | Romania | 2001–2021 | 2001–2021 |
| Egypt | 2001–2021 | 2001–2021 | Russia | 2001–2021 | 2001–2021 |
| El Salvador | 2012–2021 | 2012–2021 | Saudi Arabia | 2012–2021 | 2012–2021 |
| Finland | 2001–2021 | 2001–2021 | Serbia and Montenegro | 2001–2021 | 2001–2021 |
| France | 2001–2021 | 2001–2021 | Singapore | 2001–2021 | 2001–2021 |
| Gabon | 2012–2021 | 2012–2021 | South Africa | 2001–2021 | 2001–2021 |
| Germany | 2001–2021 | 2001–2021 | Spain | 2001–2021 | 2001–2021 |
| Ghana | 2001–2021 | 2001–2021 | Sri Lanka | 2012–2021 | 2012–2021 |
| Greece | 2001–2021 | 2001–2021 | Sweden | 2001–2021 | 2001–2021 |
| Hong Kong | 2001–2021 | 2001–2021 | Switzerland | 2001–2021 | 2001–2021 |
| Hungary | 2001–2021 | 2001–2021 | Taiwan | 2001–2021 | 2001–2021 |
| Iceland | 2012–2021 | 2012–2021 | Thailand | 2001–2021 | 2001–2021 |
| India | 2001–2021 | 2001–2021 | Trinidad and Tobago | 2001–2021 | 2001–2021 |
| Indonesia | 2001–2021 | 2001–2021 | Turkey | 2001–2021 | 2001–2021 |
| Iraq | 2012–2021 | 2012–2021 | Ukraine | 2012–2021 | 2012–2021 |
| Ireland | 2001–2021 | 2001–2021 | United Arab Emirates | 2012–2021 | 2012–2021 |
| Israel | 2001–2021 | 2001–2021 | United Kingdom | 2001–2021 | 2001–2021 |
| Italy | 2001–2021 | 2001–2021 | United States | 2001–2021 | 2001–2021 |
| Jamaica | 2001–2021 | 2001–2021 | Uruguay | 2001–2021 | 2001–2021 |
| Japan | 2001–2021 | 2001–2021 | Vietnam | 2012–2021 | 2012–2021 |
| Kazakhstan | 2012–2021 | 2012–2021 | | | |

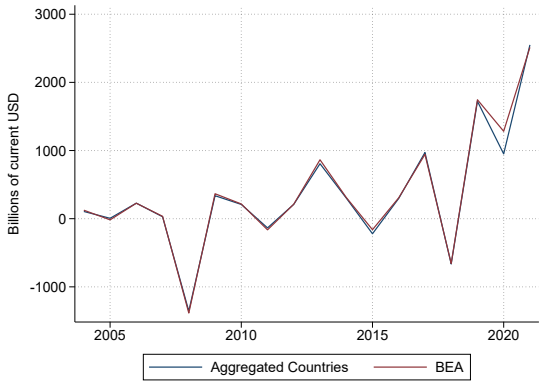
[a] Aggregate of Cayman Islands, British Virgin Islands, Montserrat and Turks and Caicos

[b] Aggregate of Aruba, Netherlands Antilles, Bonaire, Curacao, and Sint Maarten

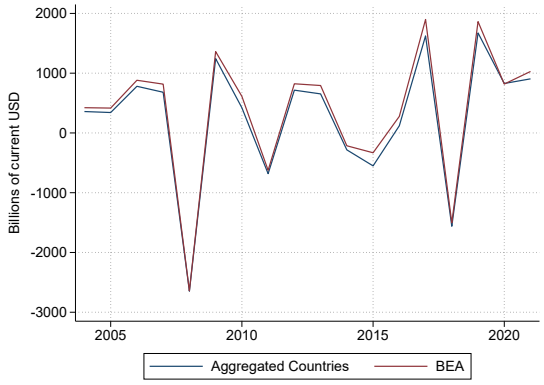
Figure A.4: Comparison of Capital Gains: Aggregated Country-Level Data vs. BEA



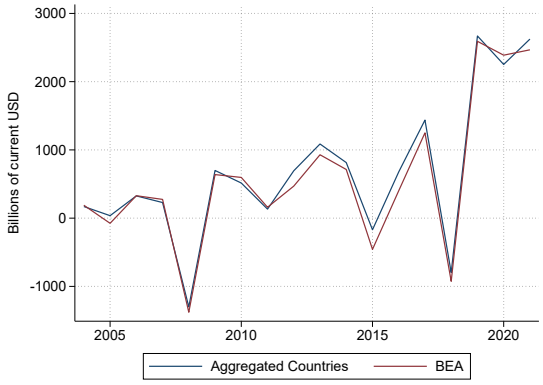

(a) FDI: Assets



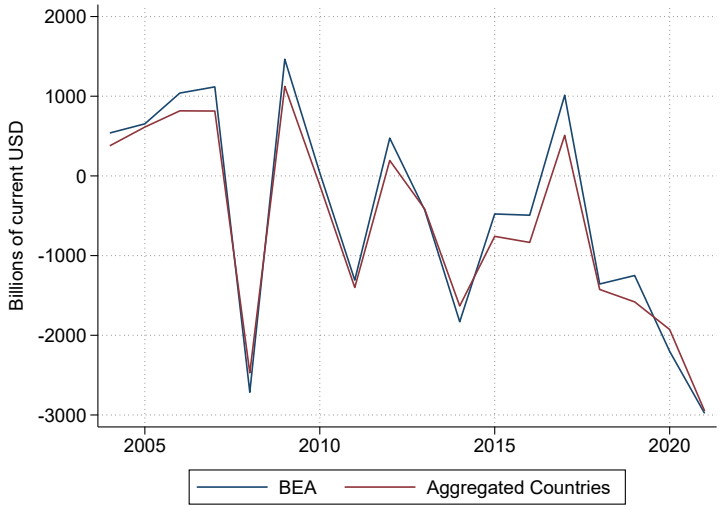

(b) FDI: Liabilities




(c) Portfolio Investment: Assets




(d) Portfolio Investment: Liabilities




(e) Total Capital Gains

Notes: This figure compares the capital gains in the BEA's international economic accounts to the aggregated bilateral data (corrected for tax evasion). Panels (a)-(d) compare capital gains across asset classes and different sides of the U.S. external balance sheet. Panel (e) shows the total capital gains.

## A.3 Valuation Gains and Share Repurchases

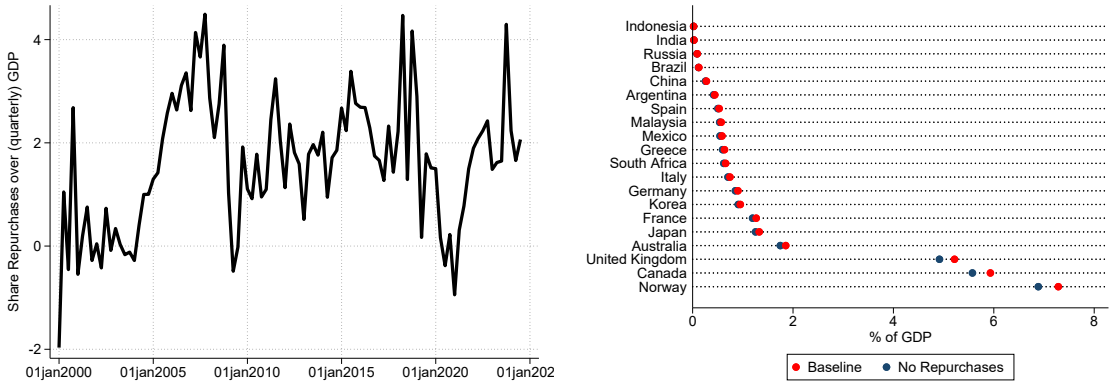
In this section, I provide additional results on share repurchases and their size relative to valuation gains on the U.S. NFA. Share repurchases have recently become a major source of payouts to the owners of U.S. corporations, surpassing dividends in importance (Zeng and Luk, 2020). If a company shifts from paying dividends to repurchasing its own stock, shareholders can replicate the foregone dividend by selling the commensurate amounts of assets. Therefore, share repurchases may not be considered a pure valuation gain in that sense. I construct data on aggregate share repurchases of the non-financial corporate sector in the U.S using the flow-of-funds following Chen et al. (2017). Then, I net out share repurchases from valuation gains for foreign countries to construct valuation gains excluding share repurchases. To do this, I assign share repurchases proportional to aggregate U.S. equity holdings. Figure A.5 provides the results of this exercise. Panel (a) replicates Chen et al. (2017) and extends their result to the present. It shows that share repurchases measured as a percentage of U.S. GDP are consistently positive since the financial crisis. However, as a fraction of GDP, they remain limited and constitute around 2% of U.S. GDP. Combined with the fact that foreigners own only a fraction of the U.S. corporate sector (around 15% in my baseline data, which adjusts for the ownership of U.S. assets through tax havens), this means that implied share repurchases for foreigners are small relative to capital gains, which is shown in panel (b). In most countries, capital gains drop by less than a tenth of a percentage point of GDP for most economies when netting out share repurchases.

## A.4 Tax Haven Adjustments

**Classification of Tax Havens.** I follow the classification of Coppola et al. (2021) to classify tax havens in my data, but add Switzerland. In Coppola et al. (2021), Switzerland is excluded because it is not a major hub for shell companies to issue bonds – what matters for my analysis is also tax havens used to hold foreign assets. Figure A.6 shows the share of foreign assets held in tax havens, which is around 30% in recent years.

**FDI through Shell Corporations.** Many corporations decide to invest abroad through Special

Figure A.5: Impact of Share Repurchases on Main Results




(a) Share repurchases as % of GDP (quarterly)

(b) Capital Gains Net of Repurchases

Notes: Panel (a) shows share repurchases of the U.S. non-financial corporate sector relative over time. Share repurchases are computed as in Chen et al. (2017). Panel (b) shows average annual capital gains in U.S. equities from 2010-2021 for a number of foreign countries as a % of their GDP. The red dots correspond to my baseline estimates while the blue dots net out share repurchases.

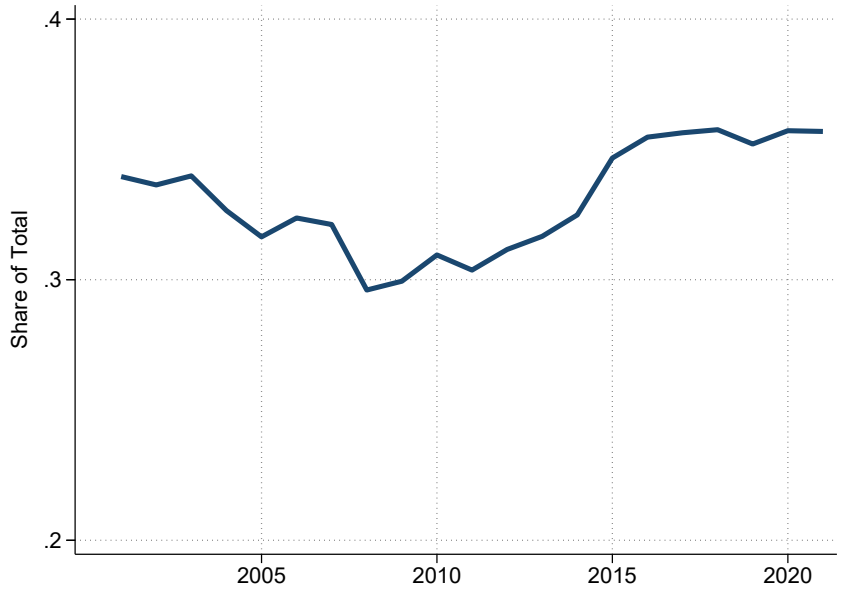
Purpose Entitities (SPEs) located in tax havens. For example, a German company may find it more profitable to set up a shell company in the Cayman Islands and conduct its investment activity from the Caribbean. Fortunately, the BEA produces data on inward investment by 'ultimate beneficial owner' (UBO), the final owner of the tax haven affiliate. The UBO is reported in the BEA's foreign direct investment surveys. Any affiliate operating in the U.S. is asked to report the owner ($> 50\%$ voting stake) of its parent.[38] The data on FDI by UBO allows me to restate FDI to the ultimate country of ownership.[39] In general, the estimates for many large countries such as Germany, the U.K. and China are revised upwards, while tax haven positions are revised downwards. This also accounts for round-tripping, direct investment from the U.S. into itself channeled through a tax haven. Thus some of the supposed foreign investment into the U.S. and the associated valuation gains on these investments are correctly attributed back to Americans.

The data by UBO is only available for the stock of FDI. To restate flows and valuation gains, I assume that asset price gains in tax havens are distributed non-tax haven countries proportionally

[38]For affiliates with multiple parents and UBO's the position is credited to multiple countries depending on the size of the position towards each parent.

[39]In a few countries, there are gaps in the restatement by ultimate beneficial owner, I interpolate these linearly.

Figure A.6: Share of Liabilities held in Tax Havens




Notes: This figure shows the share of total assets held by foreigners in the U.S. that are recorded in tax havens. It also shows the proportions for different asset classes. The classification of tax havens follows Coppola et al. (2021) with the addition of Switzerland.

to the assets that these countries gain through the position restatement. For instance, if a country gets 50% of all assets held in tax havens in the restatement, it also gets 50% of all valuation gains recorded in tax havens. This ensures that I remain consistent with the aggregate valuation gains on FDI. To support this assumption, I show the average implied valuation gains for both tax havens and other countries in figure A.7. They are very similar, indicating that asset price changes don't vary systematically between tax havens and other countries.

More precisely, using the restatement matrices introduced in section 2, the adjustment is:

1. Obtain position vectors of FDI holdings on a residence basis $x^R = (x_i^R)_{i=1...n}$ and nationality basis $x^N = (x_i^N)_{i=1...n}$

2. Obtain the share of assets that remain after restatement for tax havens:
   $\text{restate}_h = x_h^N / x_h^R$ for tax havens $h$

3. Compute the total value of assets that are restated away from tax havens:

Tot Restate $= \sum_{h \in \text{haven}} (x_h^R - x_h^N)$

4. Compute the share of tax haven assets that are re-attributed towards non-havens:

   $\beta_j = (x_j^N - x_j^R)$/Tot Restate for non-tax havens $j$

5. Construct a restatement matrix $\Omega$ as follows, with havens $h$ ordered first and non-havens $j$ ordered second in the position vectors. Note that the columns of $\Omega$ add up to 1, so that all holdings are restated.

$$\Omega = \begin{bmatrix} \text{diag(restate)} & \mathbf{0} \\ \beta_1 \cdot (1 - \text{restate})' & \\ \vdots & \text{diag}(\mathbf{1}) \\ \beta_J \cdot (1 - \text{restate})' & \end{bmatrix}$$

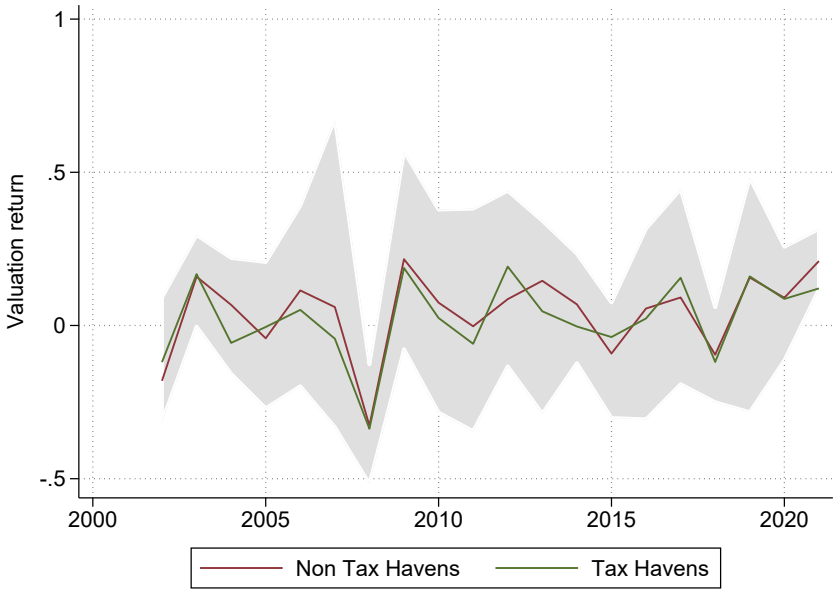
For the outflow of FDI from the U.S. I rely on data collected by Damgaard et al. (2019), which gives FDI holdings of the U.S. abroad on a nationality basis. For the years 2013 to 2017[40], they collect data produced by tax haven statistical agencies, augmented with Orbis firm data to restate international FDI positions. I their data on residence and nationality based outward FDI from the U.S., again reassigning the valuation gains using the same algorithm.

**Portfolio Investment through Tax Havens.** Many U.S. securities are held in well known tax havens. This happens for instance if a French household owns U.S. equity through an offshore Swiss bank account. Guided by the residence principle of the international financial accounts, these assets will be recorded as a U.S. liability towards Switzerland (Zucman, 2013). Tracking the holders of these assets is very hard, as they are never meant to be found in the first place.

I extend the methodology of (Alstadsæter et al., 2018) (henceforth AJZ) to estimate who owns the valuation gains in tax havens. To do so, I construct data on the ownership of bank accounts in tax havens and distribute the TIC securities held in tax havens accordingly using the BIS locational banking statistics to estimate the ownership of tax haven assets. In the BIS data

[40] I extend the data forwards and backwards in time assuming that the ratio of 'true' FDI (restated FDI in their paper) relative to FDI by residence is constant.

Figure A.7: Valuation Gains on FDI: Tax Havens vs All Countries




Notes: This figure shows the average valuation return on FDI for tax havens and non tax havens separately. The valuation return is computed as $VA_t/A_{t-1}$ using FDI data. The shaded area shows the 10th and 90th percentile of the valuation distribution every year.

set, banks report the nationality of their cross-border depositors. I use the country composition of depositors to reassign all positions, valuation gains and flows towards tax havens. This assumes that all investors in these tax havens have an equal propensity to invest in U.S. assets. While this is certainly not fully true, it should be noted that many tax havens are tilted towards specific countries, for example Hong Kong for China, Switzerland to the EU or the Cayman islands for the U.S.. This means that errors are likely not too large as only a few large countries make up the bulk of holdings in most havens.[41] I make one change relative to AJZ, who do not count Ireland as a tax haven. Following Coppola et al. (2021) and Zucman (2013), I consider Ireland as a tax haven.

For each tax haven from 2001-2015, AJZ then give an estimate of the share of cross-border

[41] While data for many well known tax havens, such as Ireland, Hong Kong, Luxembourg or the Channel Islands is available online, data for some tax havens is only available to access confidentially. As I currently do not have this access, for other these tax havens (most importantly the Cayman Islands) I use the data reported in the appendix of AJZ, who have access to the confidential files. In particular, they only report the composition of tax haven wealth in 'Caribbean tax havens' for the year 2007, which consist mostly of the Cayman Islands and Panama. I use these numbers to restate U.S. liabilities towards all Caribbean tax havens. As in 2007 nearly 70% of Caribbean tax haven wealth is estimated to be held by the U.S., this means means most of the valuation gains earned there are restated towards the U.S..

holdings due to tax evasion and should be restated. As these estimate only change very little over time, I assume that the share of tax evasion is constant after 2015.

For two European financial centers with dominant mutual fund industries, Ireland and Luxembourg, Beck et al. (2024) have recently made data on the ownership of these mutual funds available. I use their ownership structure to restate asset holdings in these countries.

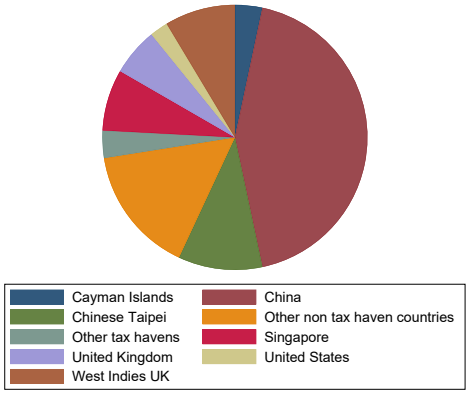
For each tax haven $h$ this leaves me with a vector of ownership of assets in this tax haven $(\omega_{h,j})_j$ that contains the share of assets in the tax haven restated towards country $j$. I use these vectors as rows in the restatement matrix $\Omega$ to restate portfolio investment into the U.S. from tax havens.

For two examples, Ireland and Hong Kong, I show the distribution of deposits in 2021 in figure A.8. For both tax havens, it is clear that they cater towards a certain clientele - China in the case of Hongkong and the U.K. in the case of Ireland. In Hong Kong, as AJZ note, many deposits come from other tax havens. In order to circumvent legislation, tax evaders set up shell companies, who then again hold deposits in other tax havens. As the forensic analysis of tax haven wealth is not the primary goal of this study I take a conservative approach and do not make an attempt reassign the deposits of shell corporations. The findings of AJZ suggest that further disentangling these positions would lead to larger valuation gains in rich economies.

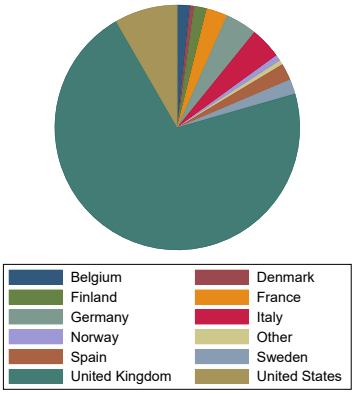
There are two concerns with this approach. The first is that the BIS banking statistics on bank deposits may be imperfectly correlated with holdings of total foreign assets. However, many of these tax havens cater towards specific economies (Alstadsæter et al., 2018), which are reflected by the locational banking statistics. The second issue is that increasingly, bank deposits in tax havens are recorded as coming from other tax haven, creating an even more complex financial architecture for researchers and authorities to pierce. My approach is conservative and I do not attempt to restate these holdings.

**Details on adjustment using the data of Coppola et al. (2021).** Coppola et al. (2021) provide restatement matrices, which give the cross-border position in equities and bonds after restatement. For the U.S. assets abroad I apply the restatement matrices using their baseline 'Fund Holdings'

Figure A.8: The ownership structure of tax haven wealth in 2021




(a) Ownership of tax haven wealth: Hongkong




(b) Ownership of tax haven wealth: Ireland

Notes: This figure shows the foreign ownership shares of deposits in Hongkong and Ireland based on the BIS data (Hongkong) as well as Beck et al. (2024) (Ireland) for the year 2021. The figure shows all depositors accounting for more than 2% of tax evading assets. The other countries are aggregated into tax havens and other non tax haven countries.

methodology.[42] I again assume that flows and valuation gains in tax havens are also redistributed using the reallocation matrices.

I apply this restatement to the asset side of the U.S. external balance sheet, i.e. portfolio investment flowing out of the U.S.. One aspect that is therefore not captured in my estimates is issuance of U.S. corporations in tax havens that is bought by the rest of the world. If U.S. corporations issue assets in tax havens, this means that portfolio investment from the rest of world into the U.S. is larger than in the U.S. national accounts, hence my estimates become a lower bound for the true exposure of the rest of the world to the U.S. equity boom. In practice however, U.S. corporations do not issue many assets in tax havens. Using data from Coppola et al. (2021), I compute that accounting for securities issued by the U.S. in tax havens would increase the U.S. foreign liabilities by around 5%-10%, with valuation gains likely increasing proportionally. In keeping with the U.S. national accounts, I do not make this adjustment to my data.

**Details on the tax haven restatement following Gourinchas et al. (2012).** As a robustness

[42]The TIC data I use only distinguish bonds and equity on the asset side, whereas the restatement matrices distinguish three kinds of bonds (corporate bonds, government bonds and asset backed securities). I use the matrices for corporate bonds to restate bond portfolios, as those are the securities most commonly issued in tax havens.

check, I construct an alternative estimate of holdings in tax havens following the method of Gourinchas et al. (2012). They assume that holdings in tax havens are distributed following the ex-tax haven distribution of asset holdings. The ex-tax haven distribution also considers the U.S. itself, with a weight equal to the home bias in assets, that is the share of assets held by the U.S. itself. For equities, I construct U.S. home bias in assets by dividing foreign investment in equities through U.S. stock market capitalization taken from the World Bank. For home bias in bonds, I construct total bonds outstanding using the BIS' debt securities statistics[43] and then again use foreign investment in bonds as the numerator.

Concretely, for ever tax haven $h$, the corresponding row in the restatement matrix becomes $(\omega_{h,j})_j$ with $\omega_{h,j} = \frac{x_j^R}{\text{Total Assets - Tax Haven Assets}}$, i.e. each country gets additional assets proportional to its asset holdings in the distribution excluding tax havens.

## A.5 Heterogeneous Returns

To infer capital gains on portfolio investment, I need to assume that all investor countries earn the same capital gains on their portfolio, which is equal to the capital gain on a benchmark index. In this section, I discuss and provide evidence on the portfolio of international investors.

To study the capital gains different countries earn I rely on evidence from microdata on the portfolios of global investment funds. I obtained these data, which are based on the work in Maggiori et al. (2020) and Coppola et al. (2021), from www.globalcapitalallocation.com. They provide the sectoral allocation of funds from different countries that invest in the U.S. stock market. In figure A.9, panel (a), I show the average sectoral allocation of different countries. On average, portfolios are very similar. Further, these portfolios yield very similar returns to an aggregate stock market index. To show this, I compute the capital gains on the S&P 500[44] using quarterly Compustat data and compare them to a portfolio that instead uses the sectoral weights of the different countries in panel (b). The capital gains on these portfolios are very similar and deviate

[43]The debt securities statistics only report total bonds outstanding (including issued abroad) and those issued abroad, so I take the difference. For the U.S., the vast majority of bonds are issued in domestic markets.

[44]I compare returns to the S&P 500, as the sectoral composition here is most easily available.

from the market by only a few basis points.[45]

Finally, in figure A.9, panels (c), (d) and (e) , I provide direct evidence on sovereign funds using the portfolio of large sovereign funds. Panel (c) focuses on the Norwegian sovereign wealth fund. The fund publishes its annual returns, with an additional breakdown of returns by geography since 2015. In the figure I compare the returns the fund earns in the U.S. to the total return on the S&P 500, they are nearly identical. Panels (d) and (e) show capital gains for the Japanese Government Pension Fund, one of the worlds' largest pension funds. The fund publishes its holdings at the security level annually. Using the security-level data, I construct a price index for the pension fund.[46] I compare this index with a benchmark market index in panel (d). Panel (e) shows the consequences of applying the capital gains the pension fund earns to Japanese holdings in the U.S. in my data. The implied capital gains are very close to benchmark capital gains in my data.

These results are consistent with Alok et al. (2022) who study the allocation of investment funds and find that they track benchmark market indices closely, with a correlation of 0.95. Bertaut et al. (2023) use the micro-level data underlying the TIC to study returns on foreign holdings. They also find that index-based returns correlate very strongly with returns computed using security level data. From 2005-2020, index based returns on U.S. assets abroad are 7.78 on average and micro-level returns are 7.97, for foreign holdings in the U.S. the numbers are 6.05 (index) and 6.11 (micro data). Figures 29 and 30 of their October 2023 draft also show that index based returns track the dynamics of micro-level returns extremely closely.

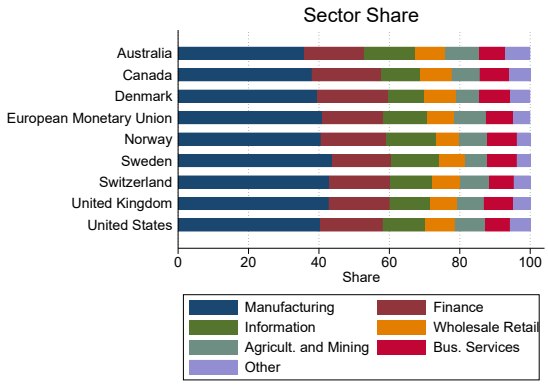
## A.6 Custodial Bias and Comparison with the CPIS

Data from the TIC is subject to a custodial bias. To get an idea of the size of this bias, I compare holdings of specific countries in figure A.10, panel (a). It compares equity holdings of the ten largest holders in the CPIS to TIC data and my preferred estimate, in which TIC holdings in

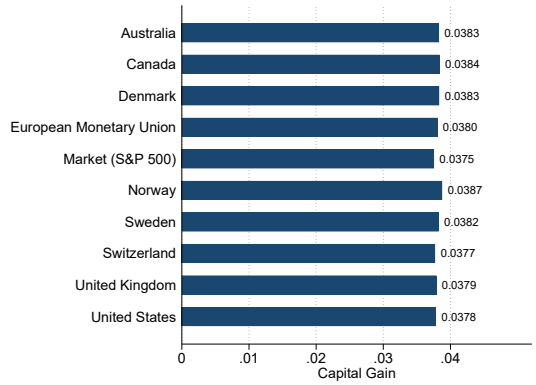
[45]These figures only show the average portfolio and capital gain. Comparing portfolios and capital gains in the time series yields very similar results.

[46]To construct the indices, I assume that security holdings are rebalanced at the end of each year and draw on security-level prices from Refinitiv.

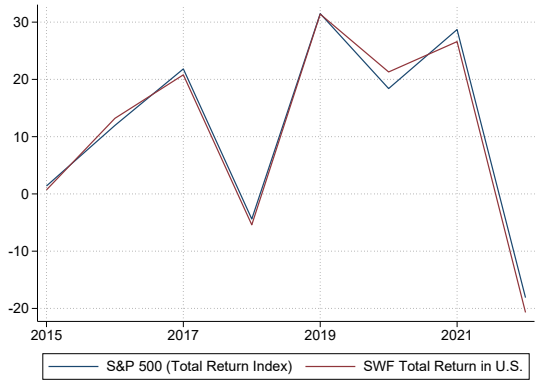
Figure A.9: Evidence on Country Portfolios



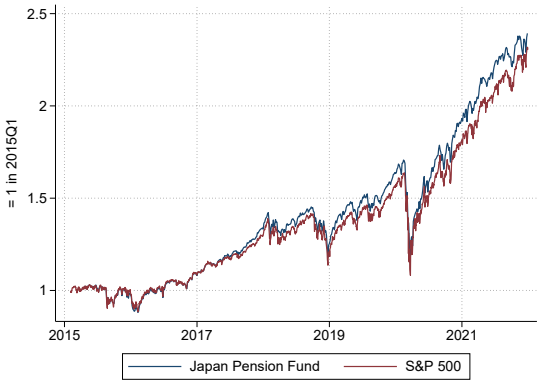

(a) Sector Shares by Country



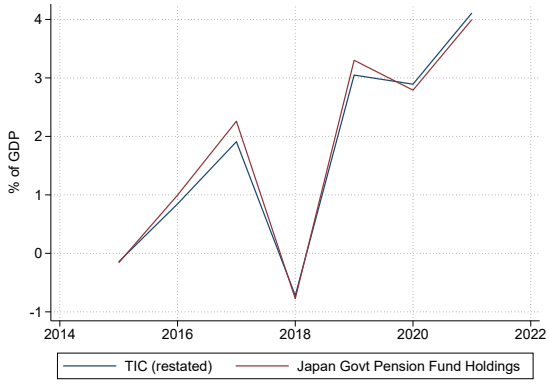

(b) Implied Average Quarterly Capital Gains




(c) Return Comparison SWF




(d) Japan Govt Pension Fund Index



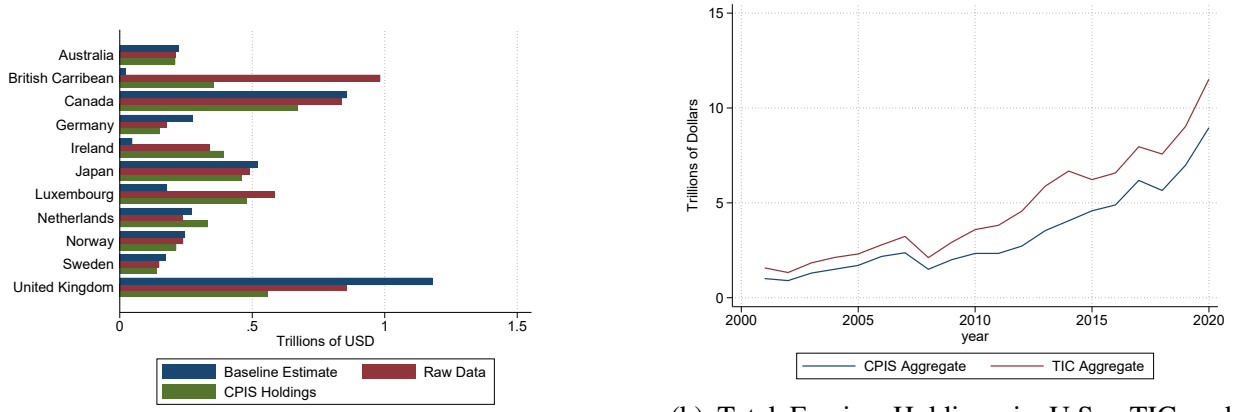

(e) Implied Capital Gains

Notes: This figure provides evidence on the portfolios of different countries investing in the U.S. equity market. Figure (a) plots the sectoral shares of mutual funds from different countries when investing in the U.S. equity market. Panel (b) plots the implied average quarterly capital gain and compares it to the S&P 500. The sample for both figures is 2010-2019, the time period for which portfolios for all countries are available. Panel (c) the returns earned by the Norwegian sovereign wealth fund to the S&P 500. Returns on the Norwegian SWF are taken from the fund's annual reports, returns on the S&P 500 correspond to the S&P 500 total return index. Panel (d) compares a price index implied by the holdings of the Japanese government pension fund with a benchmark index. Finally, panel (e) compares the capital gains obtained by applying this index to the capital gains used in my benchmark analysis.

tax havens are restated to the ultimate owners. Both the TIC and the CPIS put large weights on financial centers and tax havens, such as the Cayman Islands (British Caribbean), Ireland and Luxembourg. After restating tax havens to their ultimate owners as described in section 2.3 holdings of tax havens fall strongly, while holdings of non-tax havens such as Germany increase.

It is noteworthy that even for non tax-havens holdings in the TIC are often larger than in the CPIS. I attribute this to better coverage in the TIC data, which is based on direct reporting of financial institutions. Instead, the quality of data collected by countries reporting to the CPIS can vary and some countries (such as China) only start reporting very recently in 2015. This can be seen quite clearly in figure A.10, panel (b), which compares the aggregate foreign holdings of equity in the CPIS and the TIC. These should be unaffected by custodial bias, but nevertheless aggregate equity holdings in the TIC are consistently around 30% higher than CPIS holdings. This means that using CPIS data *understates* foreign equity ownership in the U.S..

Figure A.10: Comparison to the CPIS




(a) Equity Holdings by Country

(b) Total Foreign Holdings in U.S.: TIC and CPIS

Notes: This figure compares my estimates of equity holdings with those in the raw data and the CPIS. In panel (a), numbers are averaged over the period 2010-2021 for the countries considered. Panel (b) compares the aggregate foreign holdings of U.S. equity in the CPIS and the TIC data.

# B Appendix: Results

This section offers additional results supporting those in the main text.

## B.1 Additional Results - Geographic Distribution

I offer several other ways to draw the world map presented in figure 1, which I show in figure B.1. These are (i) using raw TIC and FDI data in panel (a), (ii) restating tax haven portfolio investment using the method of Gourinchas et al. (2012) as described in Appendix A.4 in panel (b) and (iii) measuring portfolio equity using the CPIS in figure panel (c). For the CPIS data, I revalue equities and bond holdings of other countries in the U.S. using annualized versions of equity and bond price indices in the TIC data.[47]

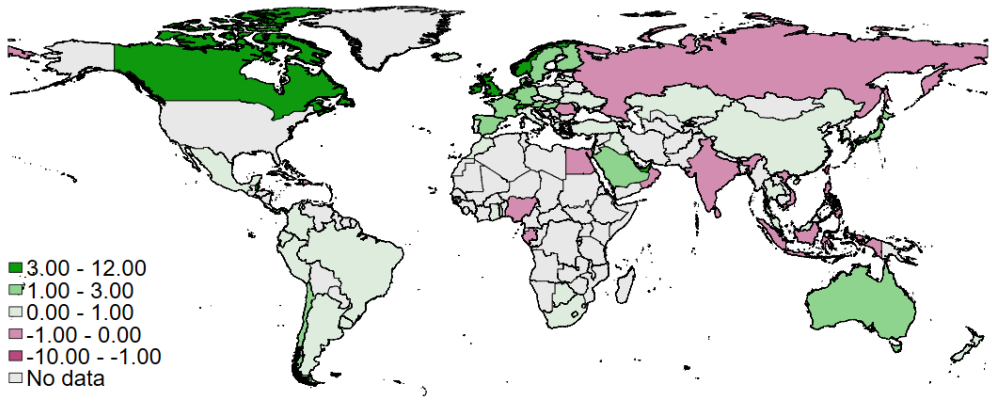
Next, I also show a breakdown of valuation gains into both components of portfolio investment, equity and bond valuation gains in figure B.2. Consistent with the findings at the aggregate level in Atkeson et al. (2024), the portfolio equity component dominates for nearly all countries.

Finally, I compute the valuation gains on both sides of the U.S. external balance sheet. On the asset side, these valuation gains correspond to valuation gains on the assets that the U.S. owns in countries abroad. On the liability side, these are gains that foreigners make on their U.S. holdings. The net valuation gains for the rest of the world presented in figure 1 are the gains on liability side of the U.S. NFA less the gains on the asset side. As mentioned in the main text, the choice of currency influences the gross valuation gains (but *not* net valuation gains). My data is in dollars, so that exchange rate movements change the valuation gains the U.S. earns abroad. Over my sample period, the dollar appreciation creates valuation losses on the U.S. external assets, but not on external liabilities which are nearly entirely dollarized. If my data was in foreign currency, the appreciation would be recorded as a asset price gain on the U.S. external liabilities. From this it can be seen that currency choice does not matter for net gains, but it will only change on which side of the balance sheet valuation gains from currency movements are recorded.

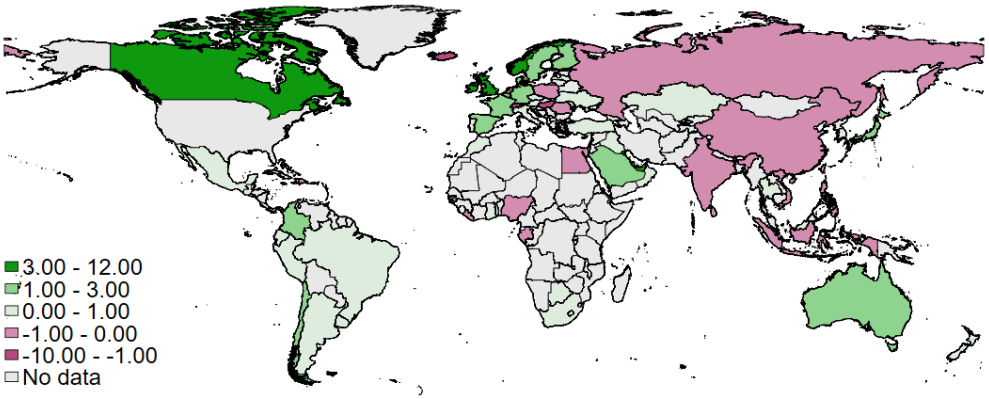
Figure B.3 reports the result of this exercise. On the asset side, the U.S. made most gains in northern European countries and Canada. Many investments in emerging markets, especially in Latin America yielded negative capital gains, often linked to exchange rate depreciations in these

[47] As there are multiple categories of bonds in TIC data, the bond price index corresponds to a weighted average for each country.

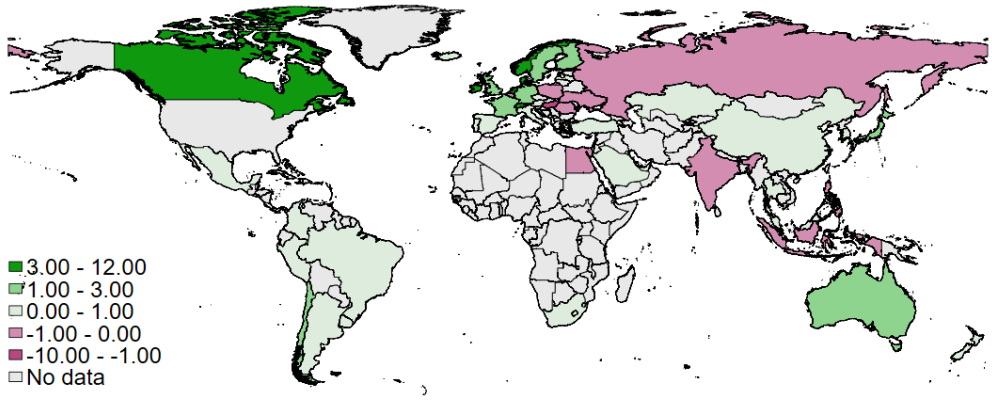
Figure B.1: World Map of Valuation Gains: Robustness




(a) Robustness: Raw data without any adjustment for tax havens



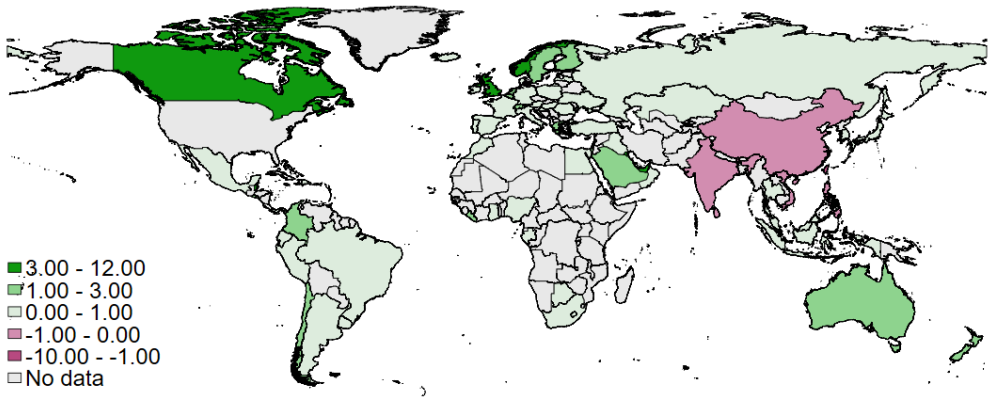

(b) Robustness: Redistributing portfolio investment following Gourinchas et al. (2012)



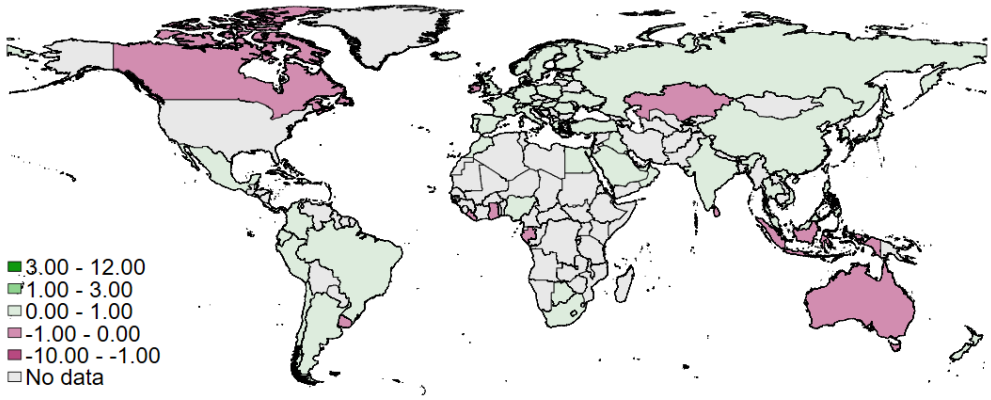

(c) Robustness: Measuring portfolio investment using the CPIS

Notes: This figure shows the global distribution of valuation gains from figure 1 of the main text under a variety of robustness checks regarding the distribution of tax havens. First, I show the raw valuation gains in panel (a). Next, I redistribute portfolio investment to tax havens using the assumptions of Gourinchas et al. (2012) in panel (b). Finally, I measure portfolio investment using the CPIS in panel (c). In the last two specifications, FDI is distributed by UBO, as in the baseline map. All numbers underlying the figure can be found in table B.1.

Figure B.2: World Map of Valuation Gains: Components of Portfolio Investment




(a) Valuation Gains in Portfolio Equity



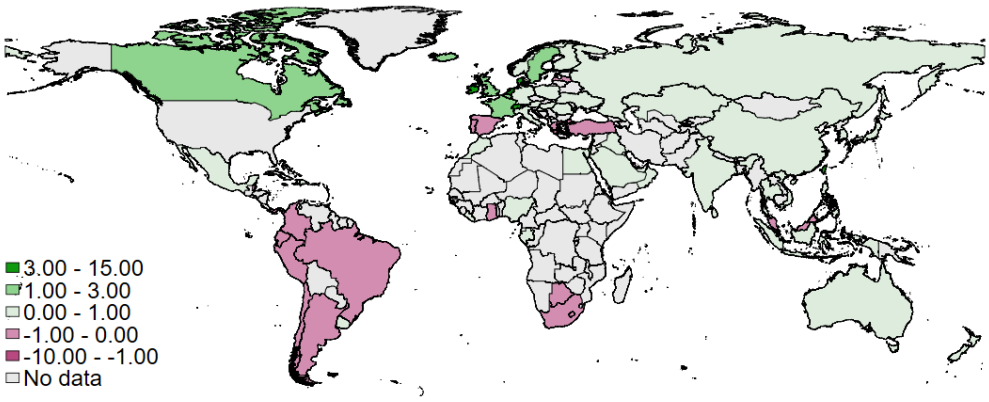

(b) Valuation Gains in Portfolio Bonds

Notes: This figure shows the global distribution of the average annual valuation gains by of the U.S. external balance sheet, normalized by country GDP for two asset classes. Panel a) shows valuation gains in equity holdings, while panel b) shows those in bond holdings. Holdings in tax havens are redistributed using baseline adjustment outlined in section 2. All numbers underlying the figure can be found in table B.1.

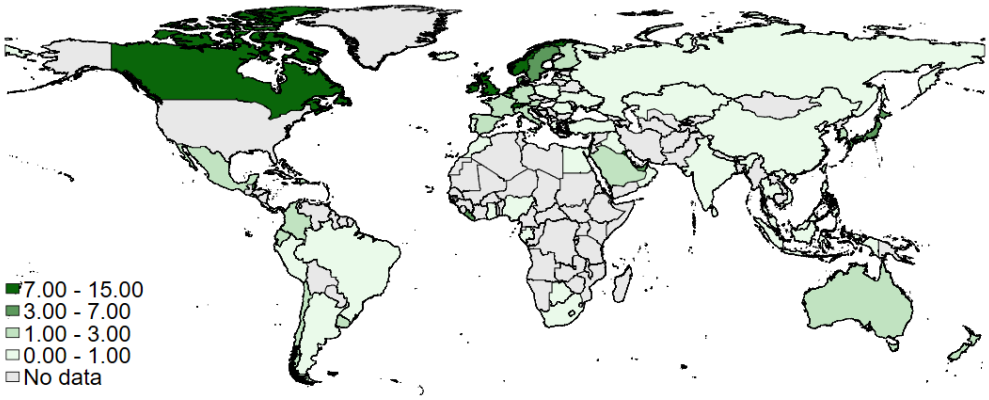
economies. The highest capital gains for foreign investors investing in the U.S. accrued to investors from rich economies, with emerging markets often getting close to zero valuation gains.

**Cayman Island Holdings.** The Cayman Islands offer a particular difficulty in assessing the ownership of U.S. assets. In 2021, around 2 trillion assets are recorded as being owned in the Caymans, a prominent location for investment funds. As explained above, I restate holdings in the Caymans using data on bank deposit ownership following Alstadsæter et al. (2018). In levels, foreign deposits in the Caymans can account for around 30% of the Cayman Islands holdings in the U.S. on average over my sample. However, this figure is declining over time and stands

Figure B.3: World Map of Valuation Gains: Asset and Liability Side




(a) Valuation Gains on the Asset Side of the U.S. External Balance Sheet




(b) Valuation Gains on the Liability Side of the U.S. external balance sheet

Notes: This figure shows the global distribution of the average annual valuation gains on the asset and liability side of the U.S. external balance sheet, normalized by country GDP. First, I show the valuation gains on the asset side (U.S. holdings abroad) in panel a). Next I show the valuation gains on the liability side (foreign holdings in U.S.) in panel b). Holdings in tax havens are redistributed using baseline adjustment outlined in section 2. Data is recorded in USD, so that valuation changes arising from exchange rate movements are found on the mostly on the asset side, given that nearly all foreign holdings in the U.S. are dollar denominated. Note the difference in color scheme, which is chosen to match size and sign of gross valuation effects. All numbers underlying the figure can be found in table B.1. The maps in the main text show the difference of b) less a).

at only around 8% at the the end of the sample. Figure B.4 plots the distribution implied by this restatement, along with three other scenarios and their implication for total capital gains. In practice, my restatement means that around 70% of these assets are attributed back to the United States, so that most of the valuation gains that are recorded in the Cayman Islands in the raw data are not recorded with any other foreign country. Other large beneficiaries are the U.K and a number of Latin American economies, such as Mexico or Argentina. Given the well known gravity

structure in international finance (Portes and Rey, 2005), the proximity of the Caymans to Latin America and colonial ties to the U.K., this does not seem implausible. This is also consistent with investment fund reports released by local authorities (Cayman Islands Monetary Authority, 2019).

I consider three other scenarios to understand how sensitive my results are to the asset holdings in the Cayman Islands. First, I consider a scenario in which all Cayman holdings are restated back to the U.S.. This would generate valuation gains for the U.S. on order of 0.6% of GDP annually. In other words, if this is the case, of the total valuation losses on the NFA of more than 4% of U.S. GDP annually 2010–2021, around 15% would be artificial losses that actually belong to U.S. citizens through Cayman Island holdings. Second, I construct restatement matrices using the CPIS. I here consider one case in which I distribute valuation gains using the *outward* holdings of the Caymans in the CPIS, that is the countries the Cayman Islands are investing in. I additionally consider a case in which I restate gains using the opposite, foreign investors in the CPIS in the Caymans. Clearly both approaches have limitations, but the idea is to offer a sense of the countries closely linked to the Caymans in international financial markets.[48] For most countries discrepancies are on the order of 0.1% of GDP.

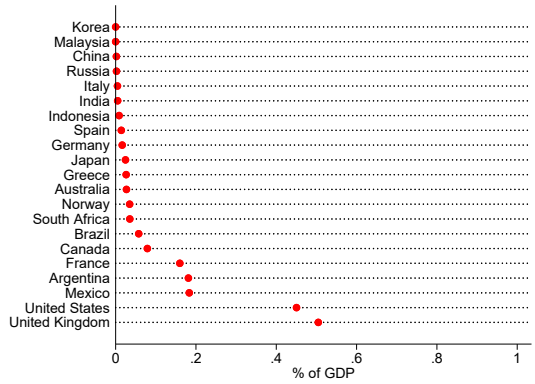
Larger discrepancies exist for the U.K. and Japan, on the order of 0.3% of GDP for Japan and 0.5% of GDP for the U.K. per year. I discuss the limitations of the U.K. data in the main text. For the U.K., the other restatements indicate that my headline figure of around 4% average annual valuation gains for the U.K. may carry an upward bias. For Japan, my headline figure of around 2.5% may carry a small downward bias.

However, this stresses that my results are not driven by the allocation of capital gains in the Cayman Islands. Indeed, figure B.4 shows how my baseline estimates of valuation gains would change when varying the allocation of Cayman Islands valuation gain from panel (a). Quantitatively, the changes are small and in line with the uncertainty shown in figure 3 in the main text.

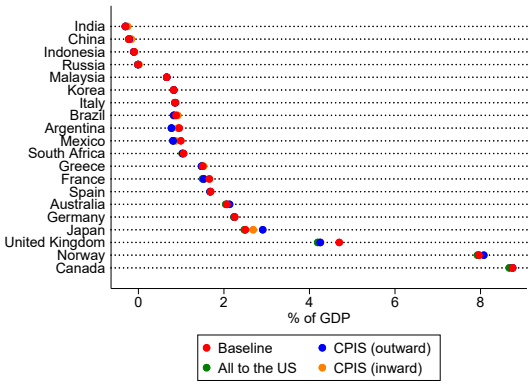
**Flows.** Flows are computed directly together with the bilateral capital gains using the accumula-

[48]Concretely, using outward investment from the Caymans means relying on the numbers reported by the Cayman islands on their own portfolio allocation. Using inward investment into the Cayman faces the challenge that many countries report only incomplete data in the CPIS and that much investment into the Caymans is likely bonds, where the Caymans are a major place for emerging markets to raise capital (Coppola et al., 2021).

Figure B.4: Robustness: Cayman Islands Assets




(a) Allocation of Average Annual Capital Gains in the Cayman Islands




(b) Change in aggregate distribution

Notes: This figure shows the implied restatement for the capital gains recorded in the Cayman Islands for a number of countries. The red dots in (a) correspond to my baseline restatement using the BIS locational banking statistics as in Alstadsæter et al. (2018). The blue dots in (b) represent an alternative measurement using the distribution of outward investment from the Cayman Islands. The green dots assign all assets in the Caymans to the U.S.. The yellow dots use the distribution of investors *into* the Cayman Islands in the CPIS to reassign holdings there.

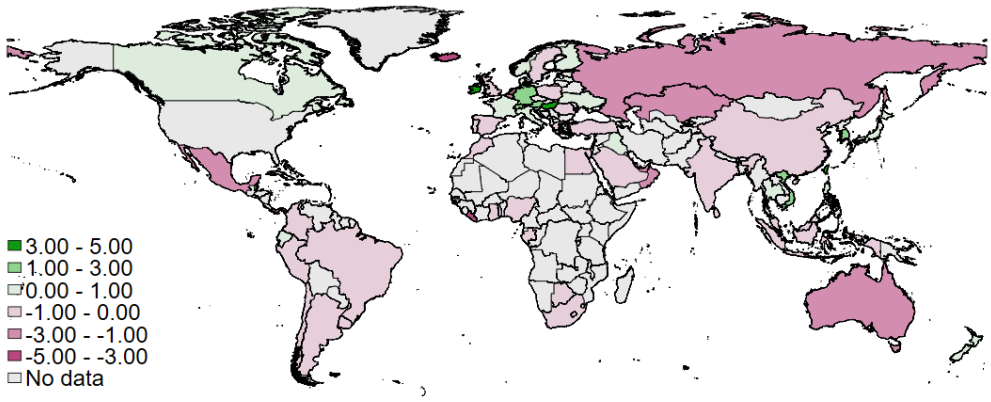
tion equation 1. In figure B.5 I show the bilateral financial transactions. During the time frame I study, the transactions are generally smaller than the capital gains, so I adjust the legend of the map to reflect this. Many emerging countries are observed as having slightly negative financial transactions, which means that they were net sellers vis-a-vis the U.S. over this time period. In contrast, rich countries tend to be net buyers. Overall, the map shows that transactions were generally small relative to the large capital gains made by many economies.

## B.2 Additional Results: Comparison to Aggregate Wealth Growth

I compare the valuation gains of each country vis-a-vis the U.S. to their aggregate wealth growth in table B.1. Data on wealth aggregates is obtained from the World Inequality Database. For many countries, valuation gains on their U.S. external assets contributed significantly to aggregate wealth growth. This is most striking in the case of Norway, where the sovereign wealth fund stands out.

The table also offers a comparison of different estimates of valuation gains. First I show my baseline numbers, accounting for tax evasion as described in section 2. Then, in columns 5, 6 and

Figure B.5: World Map of Flows




Notes: This figure shows the global distribution of the average annual current account transactions, normalized by country GDP. Holdings in tax havens are redistributed using baseline adjustment outlined in section 2. Note the difference in color scheme, which is chosen to match size and sign of flows. All numbers underlying the figure can be found in table B.1.

7, I show the valuation gains taken directly from the data, without adjusting for tax havens, the valuation gains computed using the assumption of Gourinchas et al. (2012) and finally valuation gains computed from each country's reported positions in the CPIS.

Table B.1: Aggregate Wealth Growth and Annual Valuation Gains 2010-2021

| | W/Y Growth | Val Gains (Base) | Of this: PF Inv | Of PF Inv: Equity | Of PF Inv: Bonds | Of this: FDI | Val Gains (Raw) | Val Gains (GRT) | Val Gains (CPIS) | Val Gains (Liab) | Val Gains (Ass) | Net Flows | Of this: PF Inv | Of this: FDI | Net Flows: Raw Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Russia | –9.93 | –0.01 | 0.05 | 0.04 | 0.01 | –0.06 | –0.01 | –0.10 | –0.11 | 0.13 | 0.14 | –1.27 | –1.16 | –0.11 | –0.93 |
| Mexico | –2.87 | 0.99 | 0.60 | 0.53 | 0.07 | 0.39 | 0.67 | 0.79 | 0.41 | 1.18 | 0.19 | –1.41 | –0.76 | –0.65 | –1.24 |
| Chile | 2.41 | 1.92 | 1.59 | 1.56 | 0.03 | 0.32 | 1.86 | 1.76 | 2.39 | 1.71 | –0.21 | –0.95 | –0.48 | –0.47 | –1.17 |
| Turkey | 3.12 | 0.45 | 0.38 | 0.32 | 0.06 | 0.07 | 0.35 | 0.34 | 0.32 | 0.18 | –0.27 | –0.27 | –0.16 | –0.11 | –0.25 |
| Egypt | 3.81 | –0.19 | 0.23 | 0.18 | 0.05 | –0.42 | –0.14 | –0.35 | –0.38 | 0.22 | 0.41 | –0.85 | –0.23 | –0.62 | –0.53 |
| Thailand | 4.36 | 0.11 | 0.13 | 0.04 | 0.09 | –0.01 | 0.12 | 0.03 | –0.18 | 0.50 | 0.39 | 0.79 | 1.15 | –0.36 | 0.89 |
| Indonesia | 4.47 | –0.10 | –0.04 | 0.00 | –0.04 | –0.06 | –0.08 | –0.11 | –0.13 | 0.04 | 0.14 | –0.30 | –0.19 | –0.11 | –0.30 |
| India | 5.44 | –0.30 | –0.30 | –0.30 | 0.00 | –0.00 | –0.30 | –0.29 | –0.33 | 0.10 | 0.40 | –0.06 | 0.12 | –0.19 | 0.05 |
| Argentina | 5.65 | 0.95 | 0.71 | 0.47 | 0.24 | 0.25 | 0.53 | 0.64 | 0.88 | 0.81 | –0.15 | –0.30 | –0.29 | –0.01 | –0.34 |
| Saudi Arabia | 5.68 | 2.28 | 2.11 | 1.99 | 0.12 | 0.17 | 1.81 | 2.37 | 1.00 | 2.37 | 0.09 | –0.35 | –0.10 | –0.26 | –0.15 |
| South Africa | 5.78 | 1.06 | 0.94 | 0.86 | 0.08 | 0.12 | 0.70 | 0.76 | 1.02 | 0.95 | –0.11 | –0.40 | –0.35 | –0.05 | –0.31 |
| UAE | 10.42 | 6.06 | 4.30 | 4.20 | 0.10 | 1.77 | 4.56 | 6.04 | 1.76 | 6.36 | 0.30 | –2.94 | –1.96 | –0.98 | –1.92 |
| China | 17.27 | –0.22 | –0.21 | –0.30 | 0.08 | –0.01 | 0.31 | –0.17 | –0.54 | 0.42 | 0.65 | –0.87 | –0.80 | –0.07 | –0.50 |
| Spain | –5.61 | 1.69 | 0.86 | 0.76 | 0.10 | 0.83 | 1.31 | 1.31 | 1.28 | 1.38 | –0.31 | –0.30 | –0.47 | 0.17 | –0.31 |
| Italy | –5.41 | 0.86 | 0.81 | 0.71 | 0.10 | 0.04 | 0.40 | 0.28 | 0.26 | 1.06 | 0.20 | 0.00 | 0.01 | –0.01 | –0.12 |
| Greece | 1.66 | 1.50 | 1.30 | 1.17 | 0.13 | 0.20 | 0.91 | 0.96 | 0.81 | 0.88 | –0.63 | –0.76 | –0.79 | 0.03 | –0.80 |
| Japan | 2.48 | 2.50 | 0.76 | 0.66 | 0.10 | 1.74 | 2.43 | 2.75 | 2.34 | 3.31 | 0.81 | 0.97 | 0.34 | 0.63 | 0.98 |
| UK | 5.79 | 4.70 | 5.19 | 4.87 | 0.31 | –0.49 | 3.33 | 3.72 | 1.60 | 7.22 | 2.53 | –0.31 | 0.90 | –1.21 | 0.22 |
| France | 6.84 | 1.66 | 0.63 | 0.53 | 0.10 | 1.03 | 1.15 | 1.30 | 0.73 | 2.67 | 1.01 | 0.41 | –0.07 | 0.48 | 0.35 |
| Austria | 7.91 | 1.10 | 0.55 | 0.51 | 0.03 | 0.56 | 1.12 | 0.96 | 0.90 | 1.24 | 0.14 | 2.94 | 0.34 | 2.59 | 0.36 |
| Korea | 12.31 | 0.83 | 0.40 | 0.34 | 0.05 | 0.43 | 0.88 | 0.99 | 0.67 | 1.55 | 0.72 | 1.09 | 0.95 | 0.14 | 1.19 |
| Australia | 13.74 | 2.07 | 1.60 | 1.63 | –0.03 | 0.47 | 2.21 | 2.31 | 2.20 | 2.83 | 0.76 | –1.11 | –0.71 | –0.41 | –0.94 |
| Denmark | 17.22 | 1.51 | 0.77 | 0.73 | 0.04 | 0.74 | 1.86 | 1.91 | 1.59 | 4.82 | 3.31 | 0.13 | 2.19 | –2.06 | 2.52 |
| Sweden | 17.77 | 2.95 | 2.71 | 2.59 | 0.12 | 0.24 | 2.88 | 2.94 | 2.10 | 5.32 | 2.37 | –0.26 | –0.10 | –0.16 | 0.79 |
| Germany | 20.01 | 2.25 | 0.68 | 0.59 | 0.09 | 1.57 | 1.32 | 1.97 | 1.78 | 2.89 | 0.64 | 1.27 | 0.29 | 0.98 | 0.75 |
| Canada | 22.61 | 8.75 | 4.82 | 4.83 | –0.01 | 3.93 | 8.12 | 9.69 | 7.64 | 10.12 | 1.37 | 0.18 | –0.29 | 0.47 | 0.22 |
| Norway | 29.11 | 7.96 | 7.31 | 7.20 | 0.11 | 0.65 | 7.98 | 9.25 | 7.74 | 8.40 | 0.44 | 0.96 | 1.20 | –0.25 | 1.60 |

This table compares the net valuation effects on the external position of select countries vis-a-vis the U.S. to their aggregate wealth growth. All numbers are expressed as a percentage of GDP and averaged over the period 2010-2021. The first column shows average wealth growth over GDP. The second column shows my baseline estimate of valuation gains as outlined in section 2 (again as a percentage of GDP). Columns 3, 4, 5 and 6 decompose the baseline estimate into valuation gains in Portfolio investment (and its components) and FDI. Column 7 shows the estimates without adjusting the TIC and FDI data for the presence of tax havens. In column 8, valuation gains on portfolio equity are distributed following the assumption of Gourinchas et al. (2012). In column 9 valuation gains are computed through using the reported portolio equity holdings of different countries in the CPIS. Columns 10 and 11 show the gains on the asset side of the U.S. balance sheet (U.S. holdings abroad) and the liability side (Foreign Holdings in the U.S.) separately. Column 12 shows by baseline estimate for the net flows, with columns 13 and 12 decomposing into portfolio investment and FDI. Column 14 shows flows computed from the raw data, that is making no adjustment for tax havens.

## B.3 Construction of Currency Exposure Shares

I now briefly describe the construction of bilateral currency exposure shares.

The liability side of the U.S. external balance sheet is overwhelmingly dollarized. As there is no information on the denomination of equity I assume that all FDI and portfolio equity investment into the U.S. is denominated in dollars, consistent with Lane and Shambaugh (2010). The overwhelming amount of U.S. bonds held by foreigners are dollar bonds, however there are some foreign currency corporate bonds not denominated in dollars.[49] I use data from the Coppola et al. (2021) and Maggiori et al. (2020) for the currency exposure shares.[50]

On the other hand, the U.S. holds significant amounts of foreign currency assets abroad. I use TIC data to determine the currency composition of bond holdings abroad. For equity and FDI I again assume denomination in domestic currency, except for assets issued through tax havens, which are assumed to be dollar denominated in dollars as in Gourinchas et al. (2012).[51] The assumption underlying these construction is that all currency movements are hedged within these countries (e.g. French firms use French banks to hedge currency risk), as in Lane and Shambaugh (2010); Bénétrix et al. (2015). If this is not the case, valuation gains from currency movements would become smaller, in that sense this maps offers an upper bound.

Figure B.6 shows the world map of valution gains on the net foreign asset position induced by currency movements.

## B.4 Additional Results: Decomposition

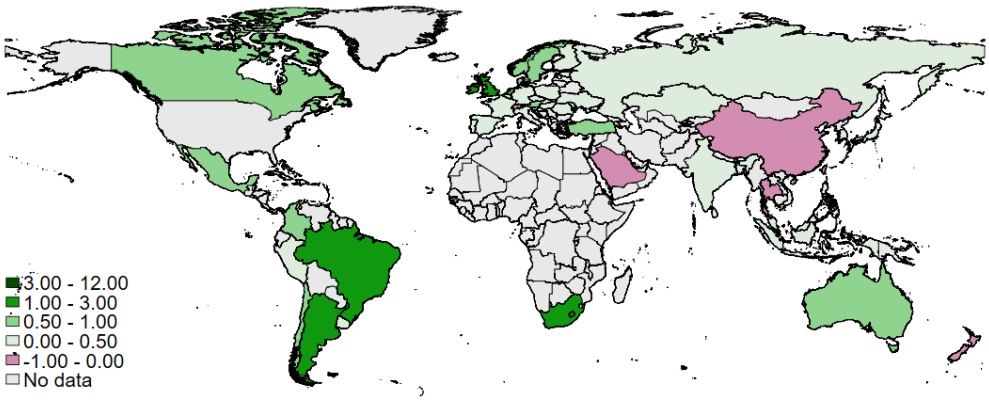
I show the results of the decomposition of valuation effects in equation 3 in the main text for high income and other countries separately in table B.2. The classification of high-income economies

[49] In 2021, the largest non-USD currencies are the Euro (13.7%), and the pound with 2.6%.

[50] They only provide a share for the entire EMU, I assume this share is the same for all EMU members, I further assume that all countries not in MNS sample only hold USD corporate bonds.

[51] Consistent with the fact that I am using TIC data to generate currency exposure shares, I only apply the valuation changes from the exchange rate to assets not held in tax havens. In the TIC data the vast majority of U.S. investments in bonds issued in tax havens is dollarized, supporting this assumption.

Figure B.6: Valuation Gains from Exchange Rate Movements




Notes: This figure shows the annual net valuation effects coming from exchange rate movements vis-a-vis the U.S. from 2010-2021 as a percent of GDP for each country. Note the change in the color scheme made to capture the data better. Data construction and tax haven restatement is as in section 2. The exposure to exchange rate is computed as described in the text.

Table B.2: Decomposition Valuation Effects 2010-2021

| | Total | U.S. Timing | Foreign Timing | Return Effect | Composition Effect |
|---|---|---|---|---|---|
| Other Countries | 0.47% | 0.06% | –0.05% | 0.78% | –0.42% |
| High-Income Countries | 2.52% | –0.26% | –0.26% | 2.06% | 0.46% |

is from the World Bank.[52] We can see that the return effect accounts for most of the difference between those country groups. It is large and positive for both groups, but around double the size for high-income countries. The composition effect is negative for non high-income countries, again hinting at a portfolio tilt towards bonds, which is confirmed in table B.2.

# C Appendix: Wealth Changes and Welfare Changes

In this section, I provide the proofs and data to implement the sufficient statistic.

[52]High-income economies are: Australia, Austria, Belgium, Canada, Chile, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Japan, Korea, Kuwait, Latvia, New Zealand, Norway, Poland, Portugal, Saudi Arabia, Slovakia, Spain, Sweden, United Arab Emirates, United Kingdom, and Uruguay.

## C.1 Proof of Main Theorem

The optimization problem is

$$V = \max_{C_t, B_t, N_{t,k}, N_{t,l}} \sum_{t=0}^{\infty} \beta^t U(C_t^{\text{agg}})$$

subject to the initial holdings $B_{-1}$, $N_{k,-1}$, $N_{l,-1}$ and the budget constraint

$$\begin{aligned}
&\sum_{k=1}^{K} \Delta N_{t,k} P_{t,k} s_t + \sum_{l=1}^{L} \Delta N_{t,l} P_{t,l} + Q_t B_t + C_{H,t} P_{H,t} + C_{F\$,t} P_{F\$,t} s_t + \mathcal{X}_t \\
&\quad = C_{H,t} P_{H,t} + C^*_{H\$,t} P_{H,t} s_t + \sum_{k=1}^{K} D_{t,k} N_{t-1,k} s_t + \sum_{l=1}^{L} D_{t,l} N_{t-1,l} + B_{t-1}
\end{aligned}$$

**Proof of Proposition 1.** The Lagrangian associated with the household problem is

$$\begin{aligned}
\mathcal{L} = &\sum_{t=0}^{\infty} \beta^t U(C_t^{\text{agg}}) + \\
&\sum_{t=0}^{\infty} \lambda_t \Bigg( C_{H,t} P_{H,t} + C^*_{H\$,t} P_{H,t} s_t + \sum_{k=1}^{K} D_{t,k} N_{t-1,k} s_t + \sum_{l=1}^{L} D_{t,l} N_{t-1,l} + B_{t-1} \\
&- C_{H,t} P_{H,t} - C_{F\$,t} P_{F\$,t} s_t - \sum_{k=1}^{K} (N_{t,k} - N_{t-1,k}) P_{t,k} s_t - \sum_{l=1}^{L} (N_{t,l} - N_{t-1,l}) P_{t,l} - B_t Q_t \Bigg).
\end{aligned}$$

The relevant first order conditions are

$$\beta^t U'(C_t^{\text{agg}}) = \lambda_t P_t^{\text{agg}} \quad (\partial \mathcal{L} / \partial C_t^{\text{agg}})$$

$$\lambda_t Q_t = \lambda_{t+1} \quad (\partial \mathcal{L} / \partial B_t)$$

The envelope theorem give the response of the value function as the sum of the perturbations to domestic asset prices, foreign asset prices and the exchange rate.

$$\mathrm{d}V = \sum_{t=0}^{\infty} \left( \sum_{k=1}^{K} \frac{\partial \mathcal{L}}{\partial P_{t,k}} \mathrm{d}P_{t,k} + \sum_{l=1}^{L} \frac{\partial \mathcal{L}}{\partial P_{t,l}} \mathrm{d}P_{t,l} + \frac{\partial \mathcal{L}}{\partial s_t} \mathrm{d}s_t \right).$$

Computing each derivative yields

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial P_{t,k}} &= \lambda_t (N_{t-1,k} - N_{t,k}) s_t, \\
\frac{\partial \mathcal{L}}{\partial P_{t,l}} &= \lambda_t (N_{t-1,l} - N_{t,l}), \\
\frac{\partial \mathcal{L}}{\partial s_t} &= \lambda_t \Bigg( \sum_{k=1}^{K} \big( (N_{t-1,k} - N_{t,k}) P_{t,k} + N_{t-1,k} D_{t,k} \big) + (C^*_{H\$,t} P_{H,t} - C_{F\$,t} P_{F\$,t}) \Bigg).
\end{aligned}$$

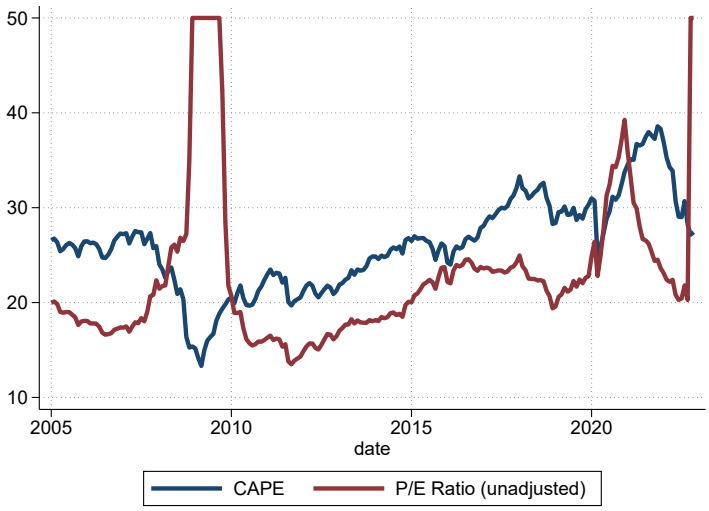
The first two derivatives make clear that what matters are trades, not holdings. The third derivative shows the dual role of the exchange rate: It is an asset price, which revalues trades and income from abroad, but also goods prices. Using the first order condition for $B_t$ we get that $\lambda_t = \lambda_0 \cdot Q_0 \cdots Q_{t-1}$. We normalize the initial price index $P_0^{\text{agg}}$ to 1 and hence we get that $\lambda_t = R_{0\to t}^{-1} \lambda_0 = R_{0\to t}^{-1} U'(C_0^{\text{agg}})$. Putting it all together yields

$$\begin{aligned}
\mathrm{d}V &= \sum_{t=0}^{\infty} \lambda_t \Bigg( \sum_{k=1}^{K} (N_{t-1,k} - N_{t,k})(s_t \mathrm{d}P_{t,k} + P_{t,k} \mathrm{d}s_t) + D_{t,k} N_{t-1,k} \mathrm{d}s_t \\
&\quad + \sum_{l=1}^{L} (N_{t-1,l} - N_{t,l}) \mathrm{d}P_{t,l} + (C^*_{H\$,t} P_{H,t} - C_{F\$,t} P_{F\$,t}) \mathrm{d}s_t \Bigg) \\
&= U'(C_0^{\text{agg}}) \sum_{t=0}^{\infty} R_{0\to t}^{-1} \Bigg( \sum_{k=1}^{K} (N_{t-1,k} - N_{t,k})(s_t \mathrm{d}P_{t,k} + P_{t,k} \mathrm{d}s_t) + D_{t,k} N_{t-1,k} \mathrm{d}s_t \\
&\quad + \sum_{l=1}^{L} (N_{t-1,l} - N_{t,l}) \mathrm{d}P_{t,l} + (C^*_{H\$,t} P_{H,t} - C_{F\$,t} P_{F\$,t}) \mathrm{d}s_t \Bigg)
\end{aligned}$$

■

**The role of invoicing currency.** In the proposition, I assume that all goods are invoiced in dollars, consistent with my data treatment, which considers only trade invoiced in dollars. I make this simplification, because trade invoiced in other currencies has no first-order effects on welfare. To see this, consider that there are two types of imports, foreign goods invoiced in dollars $F_{\$}$, and foreign goods invoiced in local currency $F_{\text{lc}}$. Then the total cost of imports is $C_{F_{\$}} P_{F_{\$}} s_t + C_{F_{\text{lc}}} P_{F_{\text{lc}}}$. The cost of imports invoiced in local currency does not move directly with exchange rates or asset prices, so it does not enter welfare in proposition 1.

Figure C.1: CAPE and Unadjusted PE Ratio




Notes: This figure illustrates two different measures of the valuation of the U.S. corporate sector, the cyclically adjusted price earnings ratio and the price earnings ratio (without adjustment). Without adjustment, the price-earnings ratio can be very high or even negative during times of low profits, so it is truncated at 50. Data is taken from Robert Shiller.

**Changes in short term interest rate.** The proposition holds the short term interest rate fixed. I show how to account for changes in the short term interest rate in section D.2.

## C.2 Details on Asset Valuations

For the U.S., my main measure of price deviations are computed using the *cyclically adjusted price-earnings ratio (CAPE)* of Robert Shiller. This carries a number of advantages relative to unadjusted price-dividend ratios. First, using earnings instead of dividends means that my measure is invariant to the corporate dividend policy. Earnings are the sum of dividends and retained earnings, which have been rising strongly around the world in recent decades with many large corporations even paying out no dividends (Chen et al., 2017). Secondly, CAPE constructs a moving average of earnings of the past decade. It is thereby invariant to large swings in earnings (or negative earnings during crises). Nevertheless, both CAPE and the unadjusted PE ratio have grown strongly over the past decade, indicating rising valuations of U.S. corporations relative to their fundamentals. This is illustrated in figure C.1, where both valuation measures roughly double from 2010-2021.

Importantly, the sufficient statistic applies only to price changes due to movements in prices relative to earnings. In an accounting sense, we can decompose the change in prices relative to 2010 into growth in the price-earnings ratio and earnings growth, i.e.

$$\frac{P_t}{P_0} = \frac{P_t/E_t}{P_0/E_0} \cdot \frac{E_t}{E_0}. \tag{6}$$

In additive terms, we can approximate the growth rate of equity prices as the sum of the growth rate of price-earnings ratios and earnings.

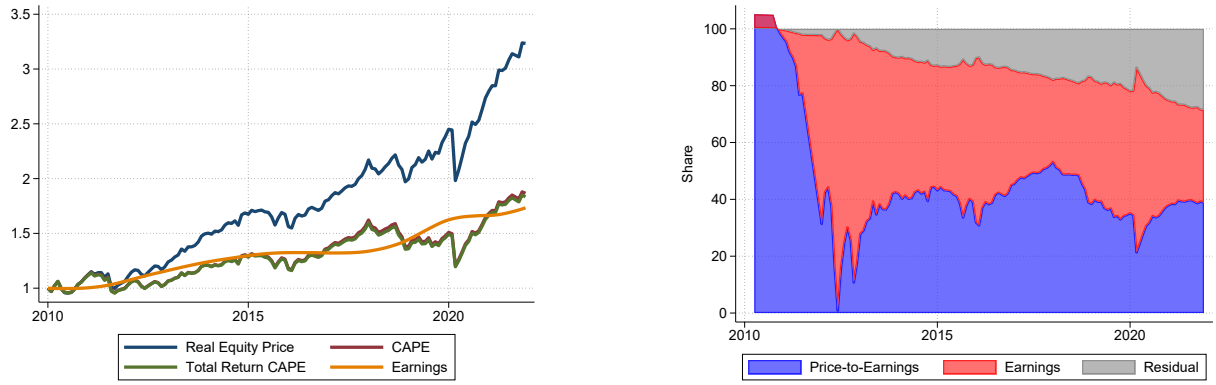
$$\frac{P_t}{P_0} - 1 \approx \left(\frac{P_t/E_t}{P_0/E_0} - 1\right) + \left(\frac{E_t}{E_0} - 1\right). \tag{7}$$

Figure C.2 plots these two decompositions. Panel (a) shows the rise in real equity prices from 2010 to December 2021, together with the rise in earnings and price-earnings ratios. Note that this figure uses real equity prices to take out the effect of inflation, in contrast to figure 5 in the main text. This only matters for price and earnings growth. Over the sample, both measures of valuation growth roughly equally, with slightly more growth in price-earnings ratios. Panel (a) also shows an alternative measure of the growth in price-earnings ratios, the total-return price-earnings ratio of Jivraj and Shiller (2017), which adjusts for share repurchases but moves closely in line with the baseline measure. Panel (b) uses the additive decomposition (7) to shed more light on this and shows that in numbers, price-earnings ratios can account for roughly 40% of increase in prices at the sample while earnings account for around 30%.

For foreign equity prices, I take data on the P-E ratio from *Global Financial Data*. One issue is that due to the financial crisis and the associated drop in earnings, Price/Earnings ratios are high in most countries before 2010. I construct a cyclically adjusted p-e-ratio for other economies to smooth out earnings fluctuations.

Price deviations for exchange rates and bond prices are deviations from the 2010 values. Figure C.3 presents the trends for a categories of U.S. bonds covered in the TIC data in panel (a), foreign bond indices in panel (b) and exchange rates in panel (c). Finally, panels (d) and (e) present

Figure C.2: Decomposition of Price Increases




(a) U.S. Equity Prices and Components

(b) Contribution to Price Movements

Notes: This figure decomposes the increase in the real price of U.S. equities into growth in price earnings ratios and earnings growth. Panel (a) plots the decomposition introduced in equation 6. Panel (b) plots the relative contribution of each component, together with a residual term, as introduced in equation 7.

stock market valuation metrics for various foreign stock markets. Panel (d) presents the unadjusted price-earnings ratio taken from global financial data. Next, panel (e) presents the valuation metric I use to construct price deviations, the cyclically adjusted price-earnings ration, which uses the earnings averaged over the past decade in the denominator.

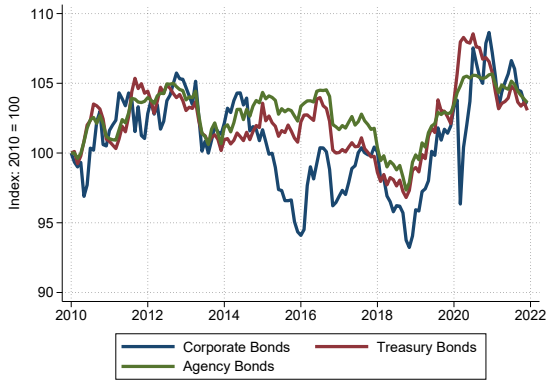
# D Appendix: Welfare Gains

## D.1 Details and Robustness of the Sufficient Statistic

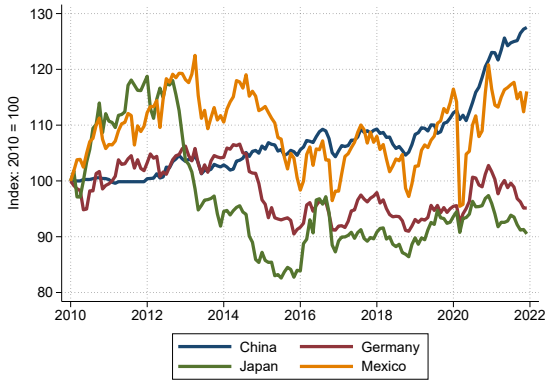
In this section I provide further details on the sufficient statistic. Key inputs to the sufficient statistic are shown in table D.1. The asset price deviations for U.S. assets which are not covered in the table for conciseness are shown in figure C.3. Import shares of GDP are taken from the World Bank, the share of imports invoiced in U.S. dollar is taken from Boz et al. (2022). I construct the sufficient statistic for all countries in which I observe all components for the full sample, but exclude tax havens and countries which defaulted on their debt.

In figure D.1, I separate high-income countries and emerging markets. As suggested by the

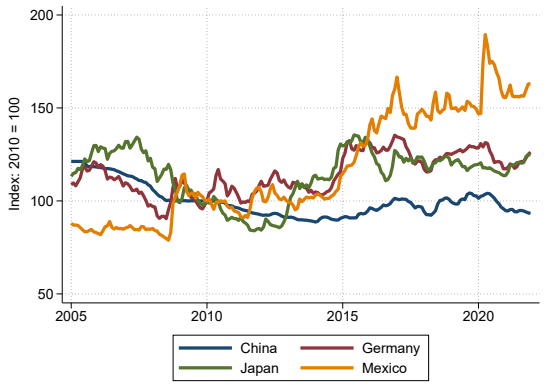
Figure C.3: Price Deviations



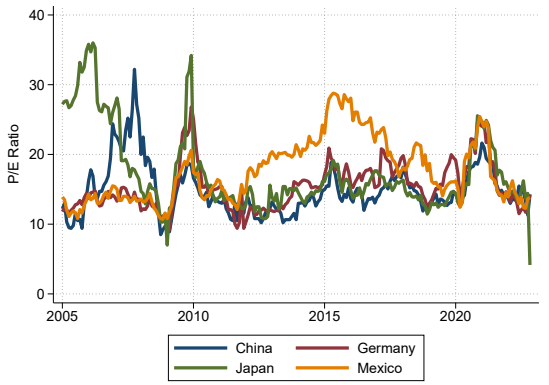

(a) U.S. Bond Price Indices



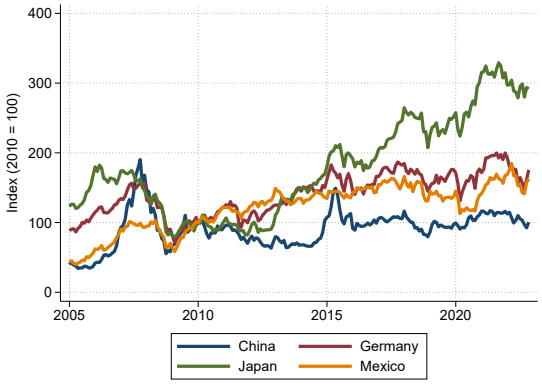

(b) Foreign Bond Price Indices




(c) Exchange Rate Indices




(d) Price-to-Earnings Ratios

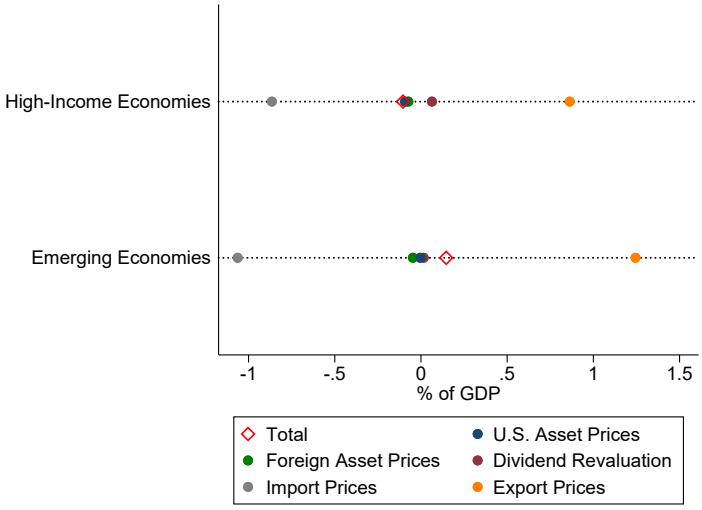



(e) CAPE for various countries

Notes: This figure illustrates price deviations for a number of asset classes and countries. Panel (a) illustrates the evolution of U.S. bond prices for a number of asset categories. Panel (b) shows the local currency prices of bonds for a number of foreign countries. Panel (c) illustrates price movements of exchange rates. Panel (d) illustrates movements in the price/earnings ratio. Panel (e) illustrates movements in the cyclically adjusted price-earnings ratio (CAPE) as a measure of valuation of foreign stock market indices.

country-by-country results, the emerging markets are more exposed to dollar fluctuations through trade invoicing, because they have a higher propensity to invoice in dollars and faced larger currency movements. On net, they tend to see small welfare gains. For advanced economies, the portfolio rebalancing effects are slightly negative, however, they have tended to earn important dividends on their U.S. assets which increased in value through the dollar appreciation.

Figure D.1: Welfare Gains for Emerging and High-Income economies



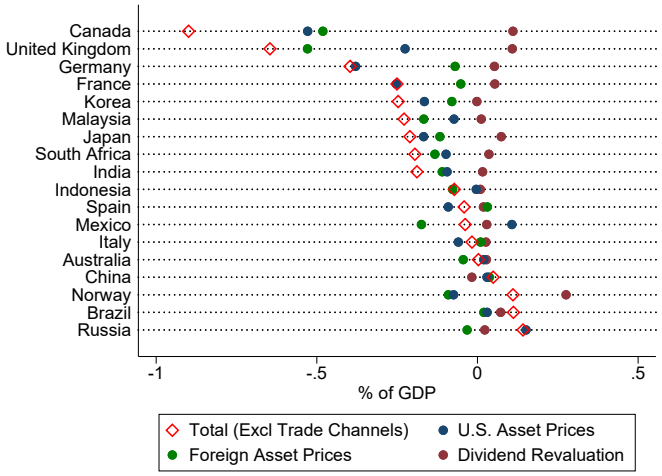

Notes: This figure shows the results of the sufficient statistic from proposition 1 computed seperately for high-income and emerging markets. The numbers are unweighted averages of these country groups. The classification of countries follows the World Bank.

In figure D.2, I include purchases and sales of FDI in the sufficient statistic. Consistent with the valuation in the U.S. national accounts and the data presented in section 3, FDI is valued using equity price indices from the respective economies. When including FDI, welfare gains from the U.S. asset price boom generally remain small. The picture changes a bit for some large FDI investors, such as Germany, who have been major buyers of U.S. corporate assets. These buyers of expensive assets suffer in welfare terms.

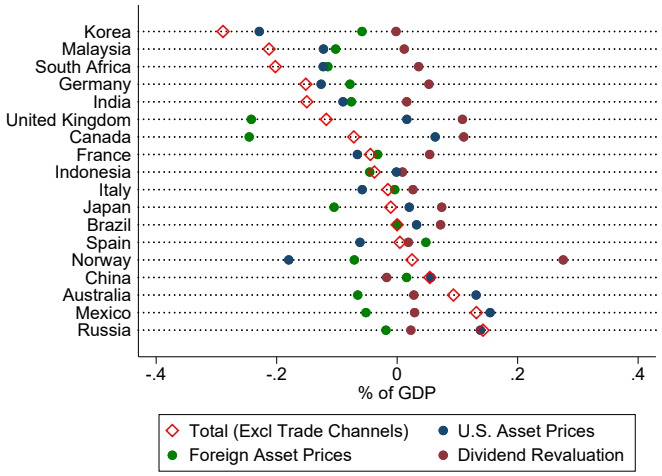
I similarly show welfare gains when using deviations from a constant asset price for equity. My baseline estimates use deviations from a constant PE-ratio to measure movements in equity prices, consistent with my theoretical framework. Alternatively, one could use just the price index to calculate price deviations, which I do in panel (b) of figure D.2. Both charts do not show the

welfare gains from changes in goods prices as these are unchanged by these modifications.

Figure D.2: Robustness: Sufficient Statistic




(a) Welfare Gains from Price Changes, including FDI




(b) Welfare Gains from Price Changes, alternative price index

Notes: This figure presents welfare gains computed through the sufficient statistic from proposition 1, varying the effects of asset returns. The red squares represent the aggregate welfare gain, while the dots represent the components of the welfare gain as shown in proposition 1. In panel (a), FDI is included in the revaluations and transactions. In panel (b), I use a pure price index (instead of one based on P/E ratios). Both panels exclude changes in goods prices for better visual comparability. Total welfare gains exclude trade channels.

## Table D.1: Inputs into the Sufficient Statistic

| Country | Avg Annual Welfare Gains, excl trade channels | Avg Annual Welfare Gains | Equity Flow to U.S. | Bond Flow to U.S. | Equity Flow from U.S. | Bond Flow from U.S. | Price Dev, Foreign Bonds | Price Dev, Foreign Equity | Price Dev, Currency | Imports/GDP | USD Invoicing Share, Imports | Exports/GDP | USD Invoicing Share, Exports |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | 0.04 | 0.34 | –0.31 | 0.13 | 0.50 | 0.03 | 6.87 | 14.50 | 8.70 | 21.04 | 54.76 | 21.38 | 82.61 |
| Austria | –0.07 | –0.08 | 0.27 | 0.07 | 0.10 | –0.10 | 2.83 | 8.84 | 14.56 | 50.92 | 6.80 | 53.96 | 6.19 |
| Brazil | 0.10 | 0.27 | 0.03 | 0.25 | 0.32 | 0.27 | 11.22 | –15.49 | 34.91 | 13.88 | 84.59 | 13.27 | 94.54 |
| Canada | –0.11 | –0.60 | 0.04 | 1.56 | 1.19 | 0.70 | 4.50 | 21.83 | 11.03 | 32.70 | 88.11 | 31.04 | 70.00 |
| Chile | 0.17 | 0.49 | –0.60 | 0.95 | 0.12 | 0.71 | 8.04 | 14.39 | 16.57 | 30.97 | 85.25 | 31.64 | 94.50 |
| China | 0.04 | | –0.15 | –0.22 | 0.35 | 0.08 | 6.28 | –10.96 | –4.68 | 19.74 | | 22.00 | |
| Denmark | –0.72 | –0.76 | 2.48 | 0.06 | 0.33 | 0.02 | 1.25 | 43.36 | 14.65 | 49.23 | 28.89 | 55.35 | 24.68 |
| Finland | –0.17 | –0.37 | 0.39 | 0.41 | 0.46 | 0.27 | 1.65 | 15.60 | 14.56 | 38.37 | 27.53 | 38.05 | 22.30 |
| France | –0.04 | –0.07 | 0.03 | 0.41 | 0.31 | 0.20 | 2.40 | 16.03 | 14.56 | 31.73 | 23.03 | 30.85 | 22.46 |
| Germany | –0.12 | –0.10 | 0.22 | 0.23 | 0.30 | –0.15 | –1.98 | 30.60 | 14.56 | 35.69 | 19.96 | 41.71 | 17.04 |
| India | –0.15 | –0.48 | 0.00 | 0.59 | 0.40 | 0.07 | 1.81 | 35.62 | 24.47 | 24.71 | 88.45 | 21.36 | 86.88 |
| Indonesia | –0.04 | 0.22 | 0.00 | 0.09 | 0.11 | 0.17 | 12.77 | 44.20 | 21.31 | 21.18 | 81.22 | 21.80 | 93.75 |
| Israel | –0.15 | –0.24 | 0.69 | 1.32 | 0.72 | 0.16 | –1.70 | 14.42 | –2.66 | 29.47 | 70.15 | 31.33 | 83.10 |
| Italy | –0.01 | –0.29 | 0.07 | 0.20 | 0.18 | 0.08 | 7.59 | –5.09 | 14.56 | 26.93 | 26.32 | 28.83 | 14.42 |
| Japan | –0.01 | –0.20 | –0.07 | 1.13 | 0.41 | 0.31 | –4.62 | 36.40 | 9.18 | 16.99 | 70.29 | 16.49 | 50.62 |
| Korea | –0.16 | | 0.69 | 0.54 | 0.34 | –0.06 | 8.29 | 20.82 | –0.97 | 40.66 | | 44.75 | |
| Malaysia | –0.17 | –1.11 | 0.24 | –0.20 | 0.56 | –0.06 | 13.67 | 22.04 | 7.58 | 63.69 | 60.75 | 72.77 | 86.35 |
| Mexico | 0.10 | | –0.17 | –0.11 | 0.06 | 0.42 | 8.27 | 25.75 | 18.92 | 36.17 | | 34.92 | |
| New Zealand | –0.22 | –0.31 | 0.68 | 0.25 | 0.32 | 0.01 | 7.91 | 32.76 | –0.87 | 26.85 | 49.25 | 27.32 | 59.44 |
| Norway | 0.07 | 1.30 | 0.31 | 1.15 | 0.34 | –0.08 | 6.83 | 21.02 | 20.21 | 30.46 | 24.86 | 38.67 | 49.74 |
| Russia | 0.14 | 1.78 | 0.01 | –0.83 | 0.11 | 0.23 | 8.20 | 24.54 | 34.21 | 20.59 | 38.80 | 27.69 | 72.86 |
| South Africa | –0.16 | | 0.25 | –0.09 | 0.32 | 0.19 | 4.04 | 38.93 | 32.25 | 27.14 | | 27.88 | 52.00 |
| Spain | 0.03 | –0.31 | 0.10 | 0.06 | 0.41 | 0.22 | 4.11 | –21.02 | 14.56 | 30.09 | 31.89 | 32.34 | 20.24 |
| Thailand | –0.13 | –0.14 | 0.18 | 1.21 | 0.15 | 0.09 | 13.29 | 46.99 | –2.81 | 58.51 | 78.73 | 64.80 | 77.89 |
| Turkey | 0.04 | –1.04 | 0.00 | –0.13 | 0.03 | 0.00 | –1.93 | 25.17 | 45.67 | 29.35 | 60.98 | 26.70 | 44.19 |
| United Kingdom | –0.19 | –0.46 | –0.30 | 2.97 | 1.28 | 0.49 | 3.40 | 22.62 | 10.34 | 31.11 | 42.16 | 29.95 | 28.58 |

Notes: This table shows results and inputs to the sufficient statistic for the countries in which I have sufficient data to compute all components. First, I show average annual welfare gains as a percentage of GDP the sufficient statistic computed using proposition 1. The first column shows the first three components, pertaining to the direct effect of revalutions, while the next column adds the effects of Goods price changes. Then, I display the purchases of U.S. equity and bonds as a percentage of the country's GDP. The next two columns show the opposite flows, i.e. U.S. purchases of foreign country bonds and equity. Both account for the presence of tax havens. The next three columns show the price deviations (in percentage points) of the country's equity prices, bond prices and exchange rate. The final columns show the importance of trade (as a percentage of GDP) and the extent to which trade is invoiced in dollars. All numbers are averaged over the period 2010-2021.

## D.2 Extensions to Proposition 1

The setting for proposition 1 can be extended in several ways to account for additional channels in which price movements affect welfare.

**Incomplete Price Stickiness.** The sufficient statistic assumes that the prices of goods invoiced in dollars are sticky and move with the dollar exchange rate. Consequently, fluctuations in exchange rates are directly reflected in the real prices paid at the border. Empirical evidence using micro data on border prices supports this assumption and generally finds large pass-through into border prices (Gopinath et al., 2020; Auer et al., 2021; Gopinath and Itskhoki, 2022). The pass-through is measured by the cumulative change in import prices, denoted as $\kappa$, in response to exchange rate movements for goods invoiced in the currency. Empirical estimates for $\kappa$ are consistently high, ranging from approximately 0.8 (Gopinath et al., 2020) to up to 0.95 (Auer et al., 2021).

To account for incomplete pass-through in the sufficient statistic, the pass-through can be parameterized by a function $\kappa(s_t)$ such that the cost of imports invoiced in dollars is $C_{F\$,t}P_{F\$,t}\kappa(s_t)$, or similarly for exports. When pass-through is incomplete, we have that $\kappa'(s_t) < 1$, the baseline case in the paper corresponds to $\kappa(s_t) = s_t$, i.e. $\kappa' = 1$. The sufficient statistic becomes

$$\frac{\mathrm{d}V}{U'(C_0^{\text{agg}})} = \sum_{t=0}^{\infty} R_{0\to t}^{-1}\Bigg( \sum_{k=1}^{K}(N_{t-1,k} - N_{t,k})(s_t \mathrm{d}P_{t,k} + P_{t,k}\mathrm{d}s_t) + D_{t,k}N_{t-1,k}\mathrm{d}s_t \\ + \sum_{l=1}^{L}(N_{t-1,l} - N_{t,l})\mathrm{d}P_{t,l} + (C^*_{H\$,t}P_{H,t} - C_{F\$,t}P_{F\$,t})\kappa'(s_t)\mathrm{d}s_t.\Bigg)$$

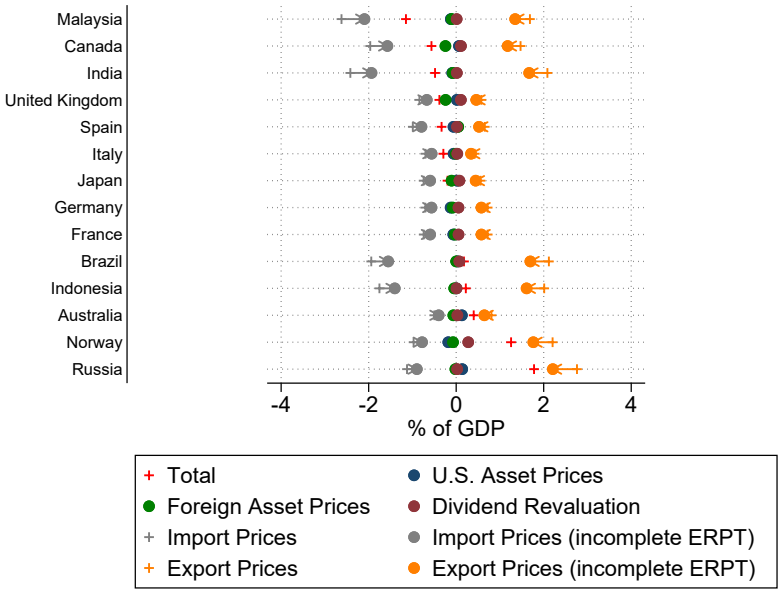
This can be seen because the derivative of the Lagrangian with respect to the exchange rate in the proof in section C.1 becomes

$$\frac{\partial \mathcal{L}}{\partial s_t} = \lambda_t\Bigg( \sum_{k=1}^{K}\big((N_{t-1,k} - N_{t,k})P_{t,k} + N_{t-1,k}D_{t,k}\big) + (C^*_{H\$,t}P_{H,t} - C_{F\$,t}P_{F\$,t})\kappa'(s_t)\Bigg).$$

Figure D.3 presents the welfare gains from changes in the exchange rate through the import price channel under a range of values for $\kappa'$ from $\kappa' = 0.8$ to $\kappa' = 1$, corresponding to the baseline case.

**Changes in Interest Rates.** I now add changes in the price of the one-period bond, which can

Figure D.3: Partial Pass-through




Notes: This figure presents the results of the sufficient statistic when accounting for partial-pass through of the exchange rate into import and export prices. Dots indicate the sufficient statistic after partial pass-through, while crosses are the baseline values. Details on the construction are in section D.2.

be interpreted as changes in short-term interest rates and quantify their consequences for welfare gains. Changes in short-term interest rates enter the welfare calculations differently than normal asset-price changes, because the one-period bond is continuously rolled over. Therefore, transactions and holdings coincide (Fagereng et al., 2024).

Concretely, consider the following modified problem for the country, which is now allowed to trade in 1-period bonds issued by the U.S., $B_{t,US}$ as well as a bond issued by the country itself $B_t$. The price of the bond is $Q_{t,US}s_t$ for the U.S. bond and $Q_t$ for the domestic bond.

$$V = \max_{C_t, B_{t,US}, B_t, N_{t,k}, N_{t,l}} \sum_{t=0}^{\infty} \beta^t U(C_t^{\text{agg}})$$

subject to the initial holdings $B_{-1,US}, B_{-1}, N_{k,-1}, N_{l,-1}$ and the budget constraint

$$\sum_{k=1}^{K} \Delta N_{t,k} P_{t,k} s_t + \sum_{l=1}^{L} \Delta N_{t,l} P_{t,l} + Q_{t,US} s_t B_{t,US} + Q_t B_t + C_{H,t} P_{H,t} + C_{F\$,t} P_{F\$,t} s_t + \mathcal{X}_t$$
$$= C_{H,t} P_{H,t} + C^*_{H\$,t} P_{H,t} s_t + \sum_{k=1}^{K} D_{t,k} N_{t-1,k} s_t + \sum_{l=1}^{L} D_{t,l} N_{t-1,l} + s_t B_{t-1,US} + B_{t-1}.$$

The difference to the setting in the main text is that we now have liquid one-period bonds denominated in U.S. dollars. These bonds mature in the next period, so as noted above transactions coincide with holdings.[53] Proposition 3 extends the sufficient statistic to this setting, considering a change in asset prices as well as the prices of the short-term U.S. bond $\mathrm{d}Q_{t,US}$.[54] This results in a new term pertaining to the revaluation of short term bond holdings. An increase in bond prices (or a equivalently, a fall in short-term interest rates) hurts welfare as it increases the cost of rolling over these holdings. The exchange rate further revalues the payouts of the bond.

**Proposition 3 (Welfare Gain with Changing Price of Short-Term Debt)** *The welfare gain coming from a price deviation* $\{\mathrm{d}s_t, \{\mathrm{d}P_{t,k}\}_k, \{\mathrm{d}P_{t,l}\}_l, \mathrm{d}Q_{t,US}\}_{t=0}^{\infty}$ *is*

$$\text{Welfare gain} = \sum_{t=0}^{\infty} R_{0\to t}^{-1} \Bigg( \underbrace{\sum_{k=1}^{K} (N_{t-1,k} - N_{t,k})(s_t \mathrm{d}P_{t,k} + P_{t,k} \mathrm{d}s_t)}_{\text{Asset Revaluation (Foreign in U.S.)}} + \underbrace{D_{t,k} N_{t-1,k} \mathrm{d}s_t}_{\text{Dividend Revaluation}}$$
$$+ \underbrace{\sum_{l=1}^{L} (N_{t-1,l} - N_{t,l}) \mathrm{d}P_{t,l}}_{\text{Asset Revaluation (U.S in Foreign)}} + \underbrace{(C^*_{H\$,t} P_{H,t} - C_{F\$,t} P_{F\$,t}) \mathrm{d}s_t}_{\text{Goods Price Change}}$$
$$- \underbrace{B_{t,US} s_t \mathrm{d}Q_{t,US} - (B_{t,US} Q_{t,US} - B_{t-1,US}) \mathrm{d}s_t}_{\text{U.S. Bond Revaluation}} \Bigg)$$

[53] Implicitly, I also assume a small transaction cost for U.S. bonds so that there is no arbitrage between U.S. and domestic bonds, which would otherwise be identical in the setting without risk.

[54] Domestic bond holdings don't enter the NFA. There is only limited information available about the maturity structure of foreign bond holdings by U.S. investors.

**Proof of Proposition 3.** The Lagrangian now becomes

$$\begin{aligned}\mathcal{L} = &\sum_{t=0}^{\infty} \beta^t U(C_t^{\text{agg}}) + \\ &\sum_{t=0}^{\infty} \lambda_t \Bigg( C_{H,t}P_{H,t} + C^*_{H\$,t}P_{H,t}s_t + \sum_{k=1}^{K} D_{t,k}N_{t-1,k}s_t + \sum_{l=1}^{L} D_{t,l}N_{t-1,l} + B_{t-1} + s_t B_{t-1,US} \\ &- C_{H,t}P_{H,t} - C_{F\$,t}P_{F\$,t}s_t - \sum_{k=1}^{K}(N_{t,k} - N_{t-1,k})P_{t,k}s_t - \sum_{l=1}^{L}(N_{t,l} - N_{t-1,l})P_{t,l} - B_t Q_t \\ &- B_{t,US}Q_{t,US}s_t \Bigg).\end{aligned}$$

The derivatives that change relative to C.1 are

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial Q_{t,US}} &= -\lambda_t B_{t,US} s_t \\ \frac{\partial \mathcal{L}}{\partial s_t} &= \lambda_t \Bigg( \sum_{k=1}^{K} D_{t,k}N_{t-1,k} + B_{t-1,k} - \sum_{k=1}^{K}(N_{t,k} - N_{t-1,k})P_{t,k} - (B_{t,US}Q_{t,US} - B_{t-1,US}) \Bigg),\end{aligned}$$

where the red part is new in the second derivative. ■

**Implementation.** The implementation of proposition 3 is more challenging, because it requires data on the amount of debt holdings that are continuously rolled over. This is hard to determine without security-level holdings data, so I construct an upper bound using data on the maturity structure of foreign holdings in the U.S.. Specifically, I consider the number of securities with a maturity less than one year as an upper bound for the debt that is continuously rolled over,[55] which I construct directly using additional tables from TIC.[56] I do not consider the revaluation of holdings of domestic bonds of the economy (French holdings of French Bonds), because they do not enter the foreign asset position. For foreign holdings in the U.S., only the amount of short term treasury debt holdings is available bilaterally, but these constitute most of short term debt holdings by foreigners in the U.S. in the aggregate (Figure D.4, Panel a)). Price deviations correspond to

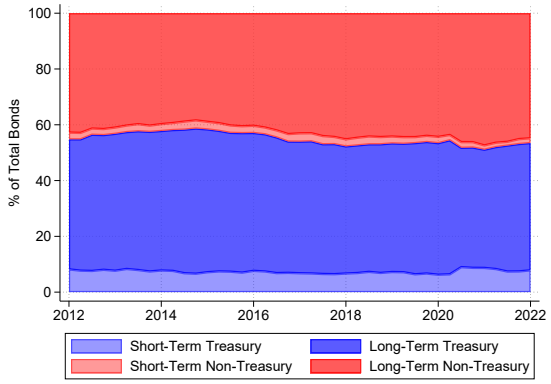
[55] I consider this an upper bound because not all securities that mature are replaced by the holders.

[56] Specifically, I use table 3D: U.S. Treasury Securities Held by Foreign Residents, Total U.S. Banking and Securities Liabilities by Type of Liability and Holder.

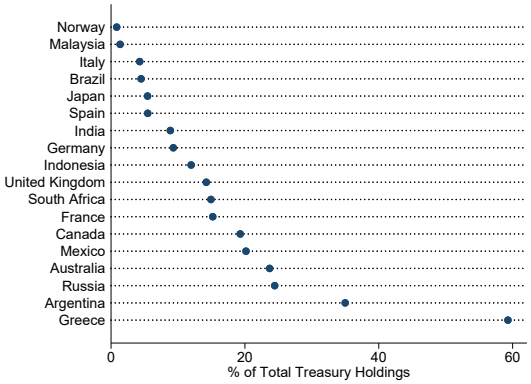
changes in the price of treasury bonds, see figure C.3 panel a).

I show summary statistics in figure D.4. Panels a) and b) focus on foreign debt holdings in the U.S.. Panel a) displays the maturity structure of all bond holdings by foreigners in the U.S.. It shows that the vast majority (around 15% in most years) of debt holdings are long–term (maturity $>$ 1 year). Panel (b) shows the maturity structure of foreign treasury holdings at the bilateral level. There are important differences across countries, with emerging economies more tilted towards short-term assets.

Figure D.4: Maturity Structure of Debt Holdings




(a) Maturity Structure of Foreign Debt Holdings in U.S.




(b) Share of U.S. Treasury Debt with Maturity less than 1 year by country

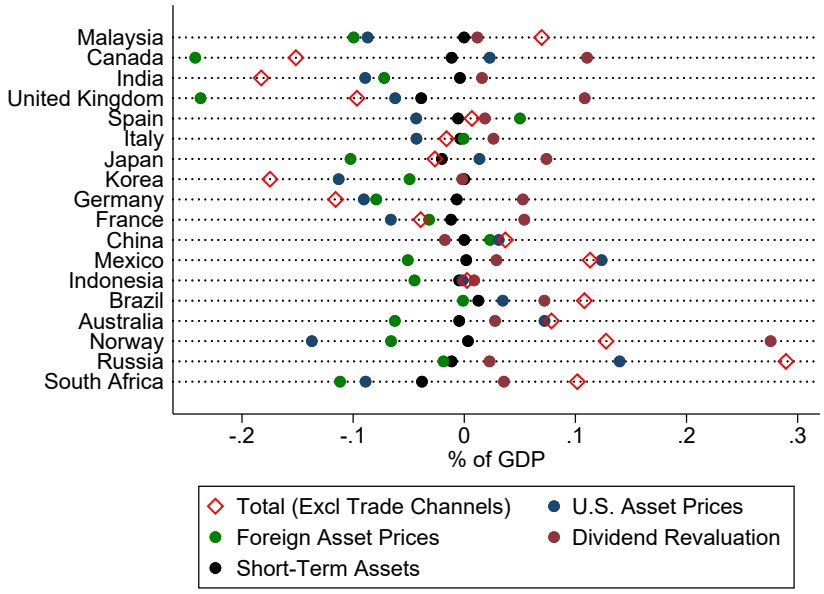
Notes: This figure provides evidence on the maturity structure of cross-border debt holdings. Panel (a) plots plots the maturity structure of total holdings of U.S. bonds. Short-term refers to a maturity of less than 1 year. Panel (b) plots the share of treasury holdings that are short term by country, averaged over 2012-2021.

**Sufficient Statistic.** The formula I take to the data is

$$\begin{aligned}\text{Welfare gain} = \sum_{t=0}^{\infty} R_{0\to t}^{-1}\Bigg( &\sum_{k=1}^{K}(N_{t-1,k}-N_{t,k})(s_t\Delta P_{t,k}+P_{t,k}\Delta s_t)+D_{t,k}N_{t-1,k}\Delta s_t \\ &+\sum_{l=1}^{L}(N_{t-1,l}-N_{t,l})\Delta P_{t,l}+(C^*_{H\$,t}P_{H,t}-C_{F\$,t}P_{F\$,t})\Delta s_t \\ &-B_{t,US}(s_t\Delta Q_{t,US}+Q_{t,US}\Delta s_t)+B_{t-1,US}\Delta s_t\Bigg).\end{aligned}$$

Figure D.5 shows the results of the extended sufficient statistic. Adding the new component de-

Figure D.5: Sufficient Statistic including Short-Term Debt




Notes: This figure presents the results of the sufficient statistic when accounting for changes in short-term interest rates. The black dots indicate the novel welfare gains and losses from rolling over short-term asset holdings. Details on the construction are in section D.2.

creases welfare gains slightly, but does not change overall welfare results much. This is a function of two facts: First, movements in interest rates are a lot smaller over the period I consider than movements in the price of risky assets (see figure C.3). Second, most assets foreign economies own in the U.S. are not short term assets, so the size of the asset stock that is rolled over is not very large for most economies. However, some countries that saw large depreciations see additional welfare losses, for example Japan or South Africa.

## D.3 External Adjustment and Welfare Going Forward

The sufficient statistic only considers welfare gains up to the end of my sample in 2021. Welfare gains going forward depend both on future valuation gains as well as future asset transactions. In this setting, there is a natural way of forecasting the magnitude of both at the aggregate level using the methodology introduced in Gourinchas and Rey (2007b). In this section, I briefly describe their approach, the details and derivations can be found in their paper.

Concretely, the mathematical core is the following equation, in which $r_t$ is the return on the U.S. net foreign asset position, $\Delta nx_t$ is the change in the trade balance and $nxa_t$ is the cyclical external imbalance. Roughly speaking, $nxa_t$ describes the imbalance in the U.S. external position that needs to be closed. Under minimal assumptions, it holds that

$$nxa_t \approx -\sum_{j=1}^{\infty} \rho^j E_t\big[r_{t+j} + \Delta nx_{t+j}\big], \tag{8}$$

which shows that the current imbalance is the sum of returns and future export surpluses.[57]

In a first step, I construct the U.S. cyclical external imbalance $nxa$. To do so, I use quarterly data on imports, exports and the size of the asset and liability side of the U.S. external balance sheet.[58] After taking out slow moving trends in these variables, $nxa$ is given as a composite of the trend deviations in these variables. Figure D.6 shows my estimates of $nxa$ and compares them to GR. Results are close but not exactly the same as the HP filter applied to the data depends on sample. It is notable that current imbalances are almost as large as in the early 2000's, implying significant adjustment going forward.

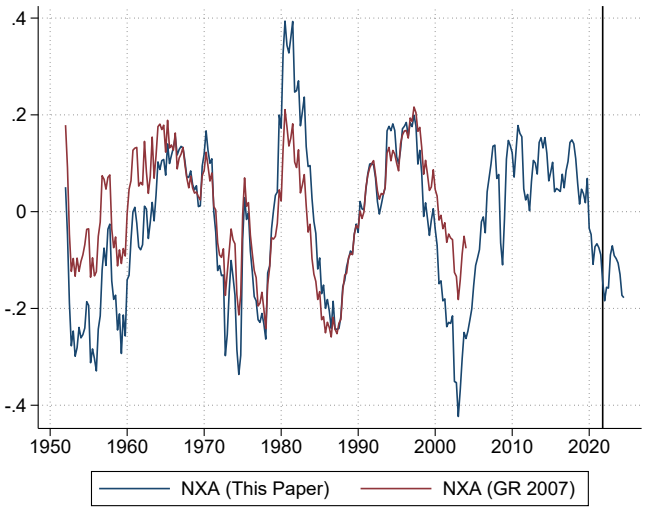
I then regress $k$-horizon averaged outcome variables $y_{t,k} = (\sum_{i=1}^{k} y_{t+i})/k$ between $t$ and $t+k$ on $nxa_t$. Table D.2 reports the regression results for select horizons and compares them to GR. Results are broadly similar, with a slight decrease in forecast power. Yet, forecast accuracy (as measured by $R^2$) remains large. The trends remain consistent: At short horizons, external imbalances are closed through movements in valuation gains, while at medium term horizons the trade channel becomes stronger. For the present situation, this means that world markets are predicted to outperform U.S. markets, with a mild adjustment in the U.S. current account.[59]

[57] Note, that in this part I consider net exports rather than the current account. The difference between the two is (mainly) the net foreign income balance, which corresponds to the yield component of the returns. This makes no difference as the construction of $nxa$ is the same under both formulations and I only use $nxa$ as a predictor in my forecasting regression. The framework I use for assessing welfare gains in this part only is laid out in Appendix D.5 and abstracts from differences between the current account and net exports. In practice, net exports and the current account track each other closely.

[58] The pre-2004 data is taken from Gourinchas and Rey (2007b), afterwards data is from the BEA.

[59] Consistent with the literature, I use the nominal broad U.S. dollar index against advanced economies as my measure of the exchange rate.

Figure D.6: Estimate of $nxa$




Notes: This figure presents the cyclical external imbalance $nxa$ and compares it to the one obtained in Gourinchas and Rey (2007b). The line marks 2021Q4, the end of my sample and the beginning of my forecasts.

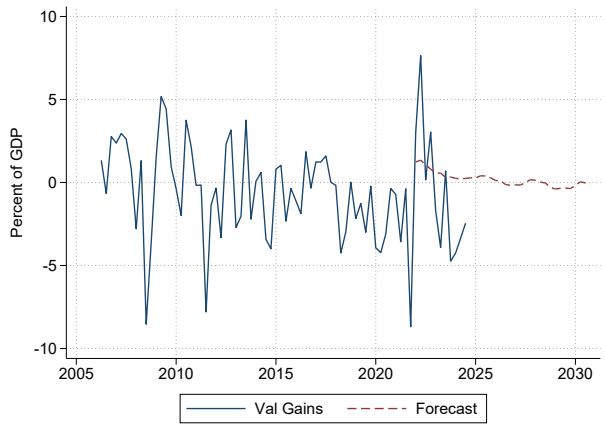
Table D.2: Return forecast and comparison with GR

| | Forecast Horizon (Quarters) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 8 | 12 | 16 | 24 | 36 |
| | **A. Real Total Net Portfolio Return** $r_{t,k}$ | | | | | | | | |
| nxa | -0.23 | -0.23 | -0.22 | -0.21 | -0.15 | -0.11 | -0.09 | -0.06 | -0.04 |
| se | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 | 0.06 |
| $R^2$ | 0.10 | 0.16 | 0.19 | 0.21 | 0.16 | 0.12 | 0.09 | 0.05 | 0.03 |
| nxa (GR) | -0.36 | -0.35 | -0.35 | -0.33 | -0.22 | -0.14 | -0.09 | -0.04 | |
| se | 0.07 | 0.05 | 0.04 | 0.04 | 0.03 | 0.03 | 0.02 | 0.02 | |
| $R^2$ | 0.11 | 0.18 | 0.24 | 0.26 | 0.21 | 0.13 | 0.09 | 0.02 | |
| | **B. Net Growth of the Net Exports** $\Delta nx_{t,k}$ | | | | | | | | |
| nxa | -0.07 | -0.07 | -0.06 | -0.06 | -0.05 | -0.05 | -0.04 | -0.03 | -0.02 |
| se | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| $R^2$ | 0.05 | 0.09 | 0.12 | 0.15 | 0.22 | 0.28 | 0.34 | 0.31 | 0.18 |
| nxa (GR) | -0.08 | -0.08 | -0.07 | -0.07 | -0.07 | -0.06 | -0.06 | -0.04 | |
| se | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | |
| $R^2$ | 0.05 | 0.10 | 0.13 | 0.17 | 0.31 | 0.44 | 0.53 | 0.58 | |
| | **C. FDI-Weighted Effective Nominal Rate of Depreciation** $\Delta e_{t,k}$ | | | | | | | | |
| nxa | -0.05 | -0.05 | -0.05 | -0.05 | -0.04 | -0.03 | -0.02 | -0.01 | 0.00 |
| se | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| $R^2$ | 0.11 | 0.16 | 0.21 | 0.25 | 0.27 | 0.20 | 0.17 | 0.04 | 0.00 |
| nxa (GR) | -0.08 | -0.08 | -0.08 | -0.08 | -0.07 | -0.06 | -0.04 | -0.02 | |
| se | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | |
| $R^2$ | 0.09 | 0.16 | 0.28 | 0.31 | 0.41 | 0.41 | 0.33 | 0.12 | |

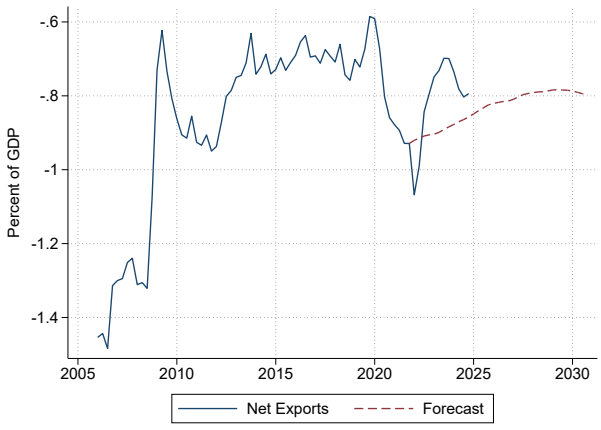
Notes: This table shows the results of the forecasting regressions of the form $y_{t,k} = \alpha + \beta_k nxa_t + \epsilon_{t,k}$, where $y_{t,k}$ is the k-period mean of the dependent variable. The first row reports the point estimate of $\beta_k$, the next row the (Newey-West) standard error and the final row the $R^2$. The next rows show the results obtained in Gourinchas and Rey (2007b, Table 3).

Using these forecasts, the value of $nxa$ at the end of 2021 predicts the future evolution of returns and net exports. To forecast valuation gains, I use the return forecast and apply it to the NFA in 2021q4.[60] The forecasts are shown in figure D.7. As the forecast starts in 2022Q1, we can evaluate its performance since then using recent data. The forecast performs relatively well for valuation gains and net exports. For exchange rates, it misses the large dollar appreciation in 2022, but captures the same trends thereafter.

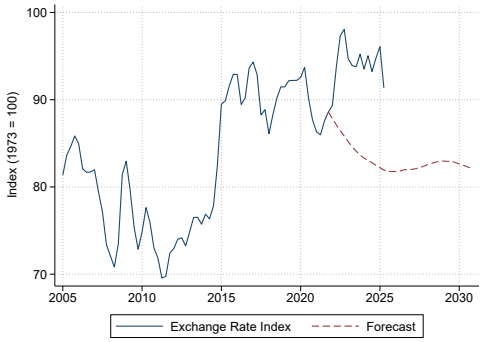
Figure D.7: Forecast Input into the Sufficient Statistic




(a) Forecast for the Valuation Gains




(b) Forecast for Net Exports




(c) Forecast for the Exchange Rate

I then apply the sufficient statistic to determine the implied welfare gains for the rest of the world. Appendix D.5 presents the details of the sufficient statistic in this setting. As the forecast does not predict returns and adjustment within asset classes or countries, I predict the adjustment

[60] Implicitly, this conflates the dividend yield and capital gain component of returns. Gourinchas and Rey (2007a) show that capital gains make up a larger component of returns on the NFA and are more volatile.

Table D.3: Welfare Gains for RoW Going Forward

| Time Horizon | Welfare Gain (% of GDP) | Of this: Valuation Changes | Of this: Export Prices | Of this: Import Prices |
|---|---|---|---|---|
| 2010–2021 | 0.024 | 0.006 | 0.263 | –0.244 |
| 2010–2030 | 0.095 | 0.077 | 0.258 | –0.240 |

Notes: This table shows the average annual welfare gains for the rest of the world using the forecast. The first line shows the aggregate welfare gain for the time period considered in the main part of the paper. The second line shows welfare gains when also taking into account the period up to 2030 using the forecast from Gourinchas and Rey (2007b) as an input in future years as explained in the text.

of the NFA.

The welfare gains for the rest of the world taking into account the future adjustment are presented in table D.3. For the period considered in the main part of the paper, welfare gains are slightly positive, driven by the fact that increases in export revenues are slightly larger than losses from rising import costs. When extending the time period forward, aggregate welfare gains remain relatively unchanged. Welfare gains from valuation changes average only around 0.05% of GDP annually up to 2030, much smaller than the wealth gains, which often exceed 1% of GDP in the period I study (2010-2021). Welfare gains from valuation changes become slightly larger when extending to the future, with foreigners realizing more of their asset price gains, while goods price effects from the dollar appreciation recede a bit as the forecast indicate a depreciation going forward.

In summary, this forecast suggests that it is unlikely that foreigners will see large welfare gains going forward. To generate these welfare gains, the RoW would need to run a large current account deficit, capitalizing on their wealth gains and turning the U.S. into a surplus country. Although the U.S. current account deficit is forecast to shrink, the magnitudes are quantitatively not large enough to generate large welfare gains.

## D.4 Welfare Gains at the Country Level Going Forward

While section D.3 offers a prediction of future welfare gains based on a canonical forecast, it does not predict adjustment at the bilateral level. In this section, I consider two simple scenarios, which offer bounds for welfare gains going forward at the bilateral level. In the first scenario, I

consider an adjustment of valuation gains, holding transactions constant. In the second scenario, transactions adjust, while valuations are held fixed. I simulate both scenarios ten years out.

Concretely, in the first scenario, I assume that future asset transaction are held fixed and equal to their sample averages for each country and asset class. On the other hand, price deviations are forecast to decay exponentially to their initial value in 2010. In numbers, for each asset class and country, I assume that

$$\Delta N_t = \sum_{s=2010}^{2021} \Delta N_s/12; \qquad \Delta P_t = \Delta P_{2021} \cdot \rho^{t-2021} \quad \text{if } t > 2021 \,.$$

The exponential decay is assumed to happen at rate $\rho = 0.95$.[61]

In the second scenario, countries undo their valuation gains through evenly spaced asset transactions, while prices are held fixed after 2021. Denoting by $VA_t$ the valuation gains in year $t$,

$$\Delta N_t = -\sum_{s=2010}^{2021} VA_s/12; \qquad \Delta P_t = \Delta P_{2021} \quad \text{if } t > 2021 \,.$$

I then use these two scenarios in the sufficient statistic (1) at the country level, figure D.8 shows the resulting average annual welfare gains from valuation channels.[62] The forecast only affects welfare gains through the valuation channels (i.e. the first and third component of the sufficient statistic in 1), the dots refer to the net welfare gains through these channels. The red dots show the average annual welfare gains through valuation channels, which are negative for many countries who have been net buyers of U.S. assets.

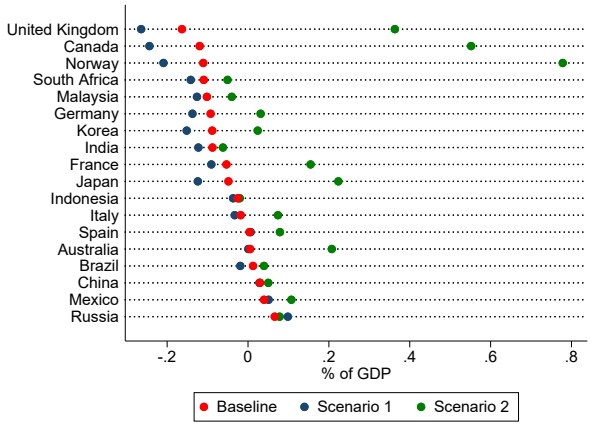
Under scenario 1, welfare gains are forecast to remain small or even negative, as countries keep buying expensive U.S. assets. On the other hand, under scenario 2, welfare gains going forward are sizeable.[63] However, this scenario implies U.S. current account surpluses, as it predicts large asset sales by the foreigners who earned valuation gains on their U.S. holdings.

[61] Assuming faster decay of prices results in smaller future valuation gains.

[62] I compute average annual valuation gains using a forecast of GDP growth of 2% annually for future output, the results are not sensitive to this figure.

[63] Note that these average annual welfare gains include the initial period, i.e. a 10-year string of negative or small welfare gains.

Figure D.8: Sufficient Statistic including post-2021 period under two scenarios




Notes: This figure shows average annual welfare gains under different scenarios. Wefare gains refer only to the components through valuation changes, i.e. the first and third component in the sum of 1. The red dots refer to average annual welfare gains up to 2021. The blue dots refer to scenario 1, in which valuations adjust, while green dots refer to scenario 2 with adjustment through transactions. See text for details.

The difference between these two scenarios underscore the implications of U.S. external adjustment for global welfare going forward. If adjustment happens largely through valuation channels, welfare gains will remain small. On the other hand, if adjustment happens through asset transactions, foreigners will benefit in welfare terms.

## D.5 Welfare Gains in a Model with One Asset

In this section, I show how to derive a similar sufficient statistic within a framework without multiple assets and dividends. This will be the setting applied to the aggregate forecast. Hence, now consider the RoW net foreign asset position as a portfolio which is long in U.S. assets and short in RoW assets. Buying one unit $\text{NFA}_t$ of this portfolio costs $P_t^{\text{NFA}}$. The accumulation equation is

$$\text{NFA}_{t+1}P_{t+1}^{\text{NFA}} = \text{NFA}_t P_t^{\text{NFA}} + \underbrace{(P_{t+1}^{\text{NFA}} - P_t^{\text{NFA}})\text{NFA}_t}_{\text{VA}} + \underbrace{P_{t+1}^{\text{NFA}}(\text{NFA}_{t+1} - \text{NFA}_t)}_{\text{CA}},$$

with current account $P_{t+1}^{\text{NFA}}(\text{NFA}_{t+1} - \text{NFA}_t)$. The gross return on the net foreign asset position then is defined as $R_{t+1} = P_{t+1}^{\text{NFA}}/P_t^{\text{NFA}}$. For simplicity, there are no dividends in this setting to

focus purely on the effect of price changes. Further, as in the baseline model there are transaction costs for the purchase of foreign assets as well as a one-period local currency bond, and imports and exports.

**Derivation of the Sufficient Statistic.** The household problem for the RoW in this economy becomes

$$V = \max_{C_t, B_t, NFA_t} \sum_{t=0}^{\infty} \beta^t U(C_t)$$

subject to the initial holdings $B_{-1}$, $N_{k,-1}, N_{l,-1}$ and the budget constraint

$$\Delta \text{NFA}_t P_t^{\text{NFA}} + Q_t B_t + C_{H,t} P_{H,t} + C_{F\$,t} P_{F\$,t} s_t + \mathcal{X}_t = C_{H,t} P_{H,t} + C^*_{H\$,t} P_{H,t} s_t + B_{t-1}.$$

Adapting proposition 1 to the present setting yields the sufficient statistic

$$\text{Welfare gain} = \sum_{t=0}^{\infty} R_{0\to t}^{-1} \Bigg( \underbrace{(NFA_{t-1} - NFA_t) \mathrm{d} P_t^{\text{NFA}}}_{\text{Asset Price Movements}} - \underbrace{(C^*_{H\$,t} P_{H,t} - C_{F\$,t} P_{F\$,t}) \mathrm{d} s_t}_{\text{Goods Price Change}} \Bigg). \quad (9)$$

As earlier, what is crucial for the welfare gains is the current account. Here, the welfare from valuation gains depends on the change in the price index of the NFA. While this price index is not observed, we can rewrite in terms of the returns $R_t$ on the U.S. NFA

$$\Delta P_t^{\text{NFA}} = P_t^{\text{NFA}} - P_0^{\text{NFA}} \quad \Longrightarrow \quad \frac{\Delta P_t^{\text{NFA}}}{P_t^{\text{NFA}}} = \frac{R_1 \cdots R_t - 1}{R_1 \cdots R_t},$$

where $R_1 \cdots R_t$ are the cumulated returns on the NFA. Thus we can measure the first component of the sufficient statistic using the current account and the cumulated return on the U.S. NFA,

$$(\text{NFA}_{t-1} - \text{NFA}_t) \cdot \Delta P_t^{\text{NFA}} = \underbrace{(\text{NFA}_{t-1} - \text{NFA}_t) P_t^{\text{NFA}}}_{\text{Current account}} \cdot \underbrace{\frac{R_1 \cdots R_t - 1}{R_1 \cdots R_t}}_{\text{Cumulated Returns}}.$$

Note that in the present setting without dividends the current account is equal to net exports.

Table D.4: Valuation and Welfare Gains during the 'Privilege' (1973-2004)

| Time Horizon | Welfare Gain (% of GDP) | Valuation Gain (% of GDP) |
|---|---|---|
| 1973–2004 | 0.27 | 0.43 |

Notes: This table presents the average annual welfare and valuation gains for the U.S. from 1973-2004.

**Parameter Calibration for the Rest of the World.** The parameter calibration follows the one for the individual countries in the main section. Concretely, the discount factor $\beta$ is set to 0.96 at annual frequency, the dollar invoicing share is set to 0.53 for imports (and 0.57 for exports), the unweighted country average over the period 2010-2021, the trade share of GDP is set to 0.3. Moreover, I calculate net exports and valuation gains as a percentage of U.S. GDP, which is translated to RoW GDP by assuming that the ratio of U.S. to World GDP is 1 to 5, the average from 2010-2021.

## D.6 Welfare Gains for the U.S. During the Exorbitant Privilege

The sufficient statistic for the one-asset model from equation 9 can be used to determine the welfare gains the U.S. enjoyed during the exorbitant privilege. Here, this refers to the period prior to the financial crisis, in which the U.S. experienced high valuation gains while running a large current account deficit at the same time. Using replication data from Gourinchas and Rey (2007b), I calculate the cumulated returns from 1973Q1 to 2004Q1, along with measures of the current account deficit. I then apply sufficient statistic 9 to compute the average annual welfare gains alongside the average annual valuation gains. As my focus here is on valuation gains, I compute only the part of the sufficient statistic pertaining to these. Effects from rising import prices are likely small as the U.S. invoices nearly all its trade in dollars.

Table D.4 presents the results. It is notable that for this time period welfare gains are nearly as large as the valuation gains. Whereas the average capital gain was around 0.43% of U.S. GDP over this horizon[64], the average annual welfare gains are almost as large at 0.33% annually. This is because the U.S. dissaved against its large capital gains, unlike the countries in my main sample.

[64]This is much smaller than capital gains today as gross positions have become larger over this time period.

## D.7 Response of the Current Account to Valuation Gains

In this section, I test a milder hypothesis. As stated above, capital gains could also work through collateral channels, allowing countries to borrow against these gains. Thus, I test a simple hypothesis: Did countries respond to valuation gains by decreasing their current account position?

To analyze this, I estimate panel local projections of the response of the current account to valuation gains vis-a-vis the U.S. on the sample of non tax-havens. This addresses limitations in the setup underlying proposition 1, as it does not rely on a first order approximation and considers the full current account, not just transactions with the U.S.. I estimate a local projection of the current account evolution (normalized by GDP) in response to the valuation gains. Here, I consider the entire current account, not just financial transactions with the U.S.. Concretely, I estimate

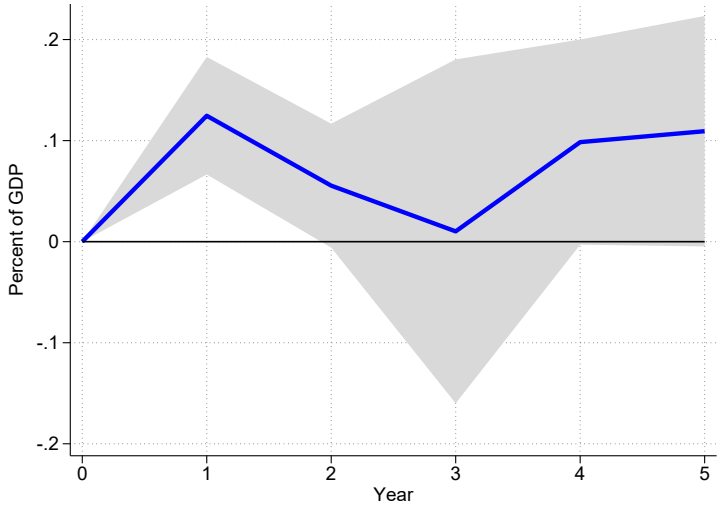
$$CA_{i,t+h} - CA_{i,t-1} = \alpha_i + \beta_h \text{Val}_{i,t} + \gamma_h X_{i,t} + \epsilon_{i,t+h}, \quad h = 0 \dots 5 \tag{10}$$

where $CA_{t+h}$ is a country's current account relative to GDP at time $t+h$, $\text{Val}_{i,t}$ is the country's valuation gain and $X_{i,t}$ is a vector of macro controls. Time is annual and the included controls are contemporaneous and two lags of log-GDP and the net foreign asset position over GDP, which are known to influence the current account (Gourinchas and Rey, 2014), as well as country fixed effect. The coefficient $\beta_h$ measures the response of the current account to a valuation gain of one percent of the country's GDP at horizon $h$.

Figure D.9 presents the results. Due to the short sample, coefficients are estimated imprecisely. For most horizons they are positive, which means that countries with high valuation gains did not see a deterioration of their current account. If anything, their current account balance increased – countries with high valuation gains on their U.S. assets respond by saving *more* externally. Taken together, this supports the claim that welfare gains from asset price movements are small. It means that countries with high valuation gains did not cash in by decreasing their current account positions – They did not sell their U.S. equities, nor did they decrease net foreign saving.

In figure D.10, I show the robustness of this result with respect to the different estimates of

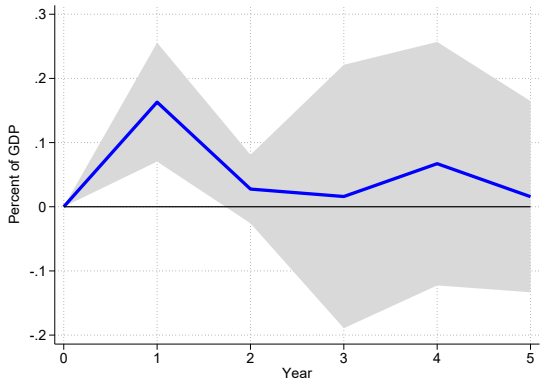
Figure D.9: Response of the Current Account to Valuation Gains



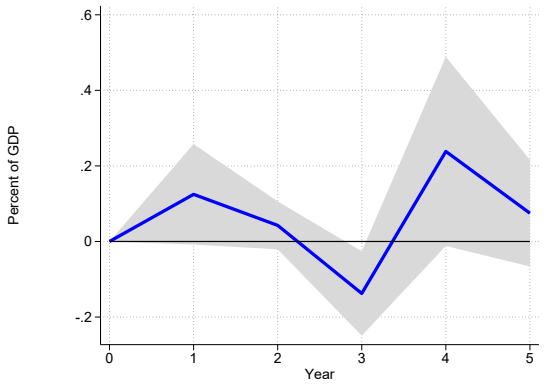

Notes: This figure presents the coefficients $\beta_h$ from regression equation 10. The coefficient $\beta_h$ measures the response of the current account to a valuation gain (vis-a-vis the U.S) of 1% of GDP, with the gray area indicating 90% confidence intervals. The sample is 2010-2021 and excludes tax havens. Data on current accounts and GDP comes from the Lane-Milesi Ferretti Database and the valuation gains are constructed as outlined in section 2.

valuation gains as well as a specification without controls. Results are very similar - countries tend to increase their current account balance after earning valuation gains. The results also hold when I extend the sample backwards to the period 2001-2021.

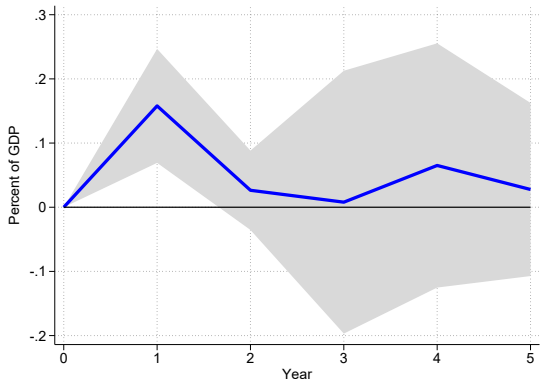
Figure D.10: Robustness: Local Projections from figure D.9



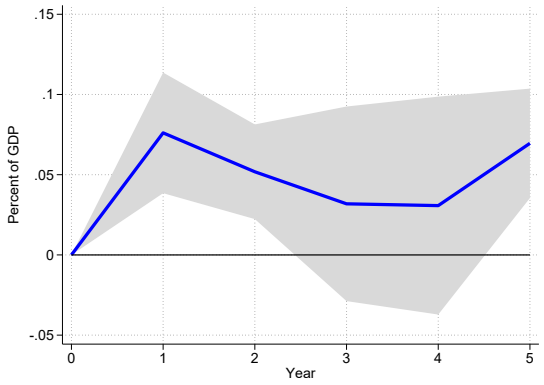

(a) Robustness: Valuation gains from raw data without any adjustment for tax havens



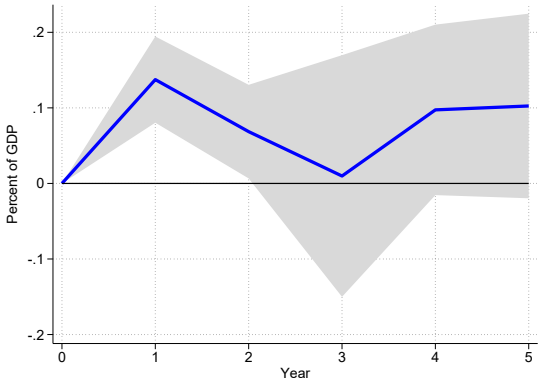

(b) Robustness: Valuation gains from the CPIS




(c) Robustness: Valuation gains constructed using assumptions of Gourinchas et al. (2012).




(d) Robustness: Estimation Period 2001-2021




(e) Robustness: No Controls

Notes: This figure shows that the impulse responses from figure D.9 are robust to different assumptions on the construction of valuation gains. First, I show the raw valuation gains in panel (a). Next, I show the result with gains on portfolio equity constructed from the CPIS in panel (b) and the assumptions of Gourinchas et al. (2012) in panel (c). Finally, I estimate the local projection on the full sample starting in 2001 in figure (d). Shaded areas indicate 90% confidence intervals.