The End of Privilege: A Reexamination of the Net Foreign Asset Position of the United States[*]

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April 2022

Abstract

The US net foreign asset position has deteriorated sharply since 2007 and is currently negative 65 percent of US GDP. This deterioration primarily reflects changes in the relative values of large gross international equity positions, as opposed to net new borrowing. In particular, a sharp increase in equity prices that has been US-specific has inflated the value of US foreign liabilities. We develop an international macro finance model to interpret these trends, and we argue that the rise in equity prices in the United States likely reflects rising profitability of domestic firms rather than a substantial accumulation of unmeasured capital by those firms. Under that interpretation, the revaluation effects that have driven down the US net foreign asset position are associated with large, unanticipated transfers of US output to foreign investors.

JEL Classification Numbers: F30,F40

Key Words: Current account, Global Imbalances, Markups

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1 Introduction

Figure 1 plots the net foreign asset position of the United States, as a fraction of GDP, from 1992 until 2021. This position is measured as the market value of the assets US residents hold abroad minus the market value of US assets held by foreigners. For the period from 1992 to 2007, and in the decades before 1992, the United States maintained a relatively small negative net position. In sharp contrast, from 2007 into 2021, the US net foreign asset (henceforth NFA) position has declined precipitously — by 60 percentage points of US GDP. In this paper, we examine two questions regarding this decline. The first is a data question: What, in a purely accounting sense, has driven this steep downturn in the US NFA position? The second is a question of interpretation: What underlying shocks have driven this downturn in the US NFA position?

Figure 1: The US Net Foreign Asset Position: 1992-2021

In answering our first question, we build on the seminal work of Gourinchas and Rey (2007) and Gourinchas and Rey (2014) in decomposing the change in the NFA position into a component due to the flows of trade and factor incomes measured by the current account, a component due to measured revaluations of the market values of outstanding gross assets of US residents held abroad less revaluations of the market values of gross US assets held by foreigners, and a statistical discrepancy term. We update the Gourinchas and Rey analysis.

In doing so, we benefit from the recent work that the US Bureau of Economic Analysis and the US Treasury have done in improving their measures of US cross-border asset flows and positions and the incorporation of these improved data in the *Financial Accounts of the United States* and the associated *Integrated Macroeconomic Accounts*.

These new data lead us to reassess the conventional wisdom from a decade ago regarding the drivers, in an accounting sense, of the US NFA position. Gourinchas and Rey (2007) documented that during the decades leading up to 2007, the United States seemed to enjoy a special "privilege" shaping its NFA position. In particular, despite the fact that the US ran large current account deficits for decades, its NFA position did not deteriorate. It even improved in the early 2000s, because realized net revaluation effects consistently favored US residents. Research following Gourinchas and Rey (2007) attributed this pattern of favorable realized revaluations to an asymmetry in the composition of the US gross external asset position: in earlier data, US residents appeared to be long in high-return equity assets abroad, while foreign claims on the US appeared to consist mostly of low-return bonds; see, for example, Mendoza, Quadrini, and Rios-Rull (2009).

The newly available data in the *Integrated Macroeconomic Accounts* overturn both aspects of this conventional wisdom. Since 2007, foreigners have enjoyed a dramatic boom in the value of the assets that they hold in the United States, while US residents have enjoyed only modest revaluations of the assets that they hold abroad. As a result, the net impact of asset revaluations accounts for most of the deterioration in the US NFA position shown in Figure 1. In fact, as we show below, the negative impact of these revaluations has been so large that it has erased any "privilege" that US residents enjoyed from 1992 to the present — the US NFA position is now worse than it would have been if no asset revaluations had occurred at all over this time period.[1] Given this reversal of fortunes, we see the past decade as signaling "the end of privilege" in the external position of the United States.[2]

The newly available data also lead us to reassess the conventional wisdom regarding the

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[1]Other authors have also highlighted the large boom in the value of US assets and its impact on the US NFA position; see, for example, Jiang, Richmond, and Zhang (2020) and Milesi-Ferretti (2021)

[2]This is only one among various possible notions of privilege. One alternative notion is that the US enjoys persistently higher returns on its foreign assets relative to the returns it pays on its liabilities. Higher relative returns might show up in the international accounts as stronger valuation gains for US-owned assets abroad relative to US liabilities. But they might alternatively present as higher income yields on US assets relative to liabilities. We discuss relative income yields in detail in Appendix F. For equity, we find that it is difficult to measure relative returns, primarily because of important open questions about how to interpret high income yields on US outward foreign direct investment. For non-equity assets and liabilities, we find little evidence of persistent rate of return privilege: yields on US non-equity assets and liabilities appear to be very similar throughout our sample period. Our findings confirm previous results in Curcuru, Dvorak, and Warnock (2008). See Curcuru, Thomas, and Warnock (2013) and Fried (2021) for a detailed discussion of the research on the apparent discrepancy between the data on the US international investment position and income flows.

composition of US gross external assets and liabilities. In particular, and contrary to the prior view, recent data indicate that US gross external equity liabilities are very large, with a similar market value to that of US gross external equity assets (see also Setser 2018, Setser 2019, and Milesi-Ferretti 2021). We show that the gross revaluations of US external assets and liabilities are driven almost entirely by revaluations of these gross equity positions. This implies that, in a purely accounting sense, whether revaluation effects in the US NFA position favor US residents depends on whether US equities outperform foreign equities in dollar terms. In the early 2000s, revaluation effects favored Americans because foreign equities substantially outperformed US equities in dollar terms, with a large part of those revaluations reflecting a depreciating US dollar over that period. In contrast, since 2007, the value of US equities has risen dramatically, while foreign equity values have risen only modestly. Changes in the dollar exchange rate have had only a modest impact on these more recent revaluations.

These data lead us to our second question: What factors underlie this deterioration of the US NFA position over the past decade? To address this question requires a theory of the forces behind the boom in the valuation of US corporate equity over this time period. We turn to the growing macro-finance literature on this question, including work by Caballero, Farhi, and Gourinchas (2017), Gutierrez and Philippon (2017), Crouzet and Eberly (2021), Greenwald, Lettau, and Ludvigson (2021) and many others.

We extend the work of Farhi and Gourio (2018) in particular by building an open-economy model to account for changes in key asset pricing ratios in the past decade relative to the period before 2007. These ratios include, for the US corporate sector, the ratio of the market value of US corporations to US GDP, Tobin's Q, the total payout yield, and the price-earnings ratio. We use the model to explore the implications of alternative theories for the boom in US asset values not only for these key ratios but also for the US current account, for cross border financial flows, and for the revaluations of US external assets and liabilities.

We use the model to examine the implications of two candidate hypotheses regarding the primary drivers of the boom in valuations of US resident corporations in the past decade. The first hypothesis is that there has been a large, unanticipated rise in the profitability of US corporations. We model this as an increase in equilibrium firm markups of prices over marginal cost. See Crouzet and Eberly (2019), Philippon (2019), De Loecker, Eeckhout, and Unger (2020), Akcigit et al. (2021) and many others for discussions of this hypothesis.

The second hypothesis that we consider is an unexpected rise in the importance of unmeasured capital in the production function for US corporations. See, for example, Hall (2001), McGrattan and Prescott (2005), McGrattan and Prescott (2010), Crouzet and Eberly (2019), and Belo et al. (2022) for discussions of this hypothesis.

Both specifications of our model account well for the observed changes in the key macroe-

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conomic and asset pricing ratios that we study. In fact, we find that using only those asset price metrics, it may be difficult to distinguish between these two hypotheses. We find, however, that these two specifications of our model have strikingly different implications for changes in the US current account, for gross financial flows, for the US NFA position, and for the welfare of US residents.

In the specification of our model with an unexpected rise in markups, the boom in the valuation of US firms is the result of a large, unexpected increase in the share of income that is payable to investors, and a simultaneous decline in the share of GDP paid to labor. If US residents owned all of US equity, this shock would not have a significant impact on the US NFA position, current account, or welfare. Households would see declines in their labor income, but those would be mostly offset by higher asset income.[3] Larger distortions associated with a larger monopoly wedge would translate into a second order, negative impact on US welfare.

But the implications of this shock to markups for the US international position and for US welfare are very different if foreign residents own a great deal of US equity, as they do in the data. In this case, after the shock to markups occurs, foreigners enjoy higher dividends from their investments in US corporations, and that benefit is reflected immediately in a large positive revaluation of their equity claims in the US. The welfare of US residents falls following the shock, because they now command a smaller share of US GDP. In fact, in terms of welfare, an unanticipated increase in US markups is isomorphic to a model in which the US government levies a value added tax and gifts foreigners a share of the tax revenue in proportion to their ownership of US equity. Thus, the negative welfare impact of the markup shock for US residents is increasing in the share of US firms owned by foreigners.

At the same time, after the shock to markups, the market value of foreigners' equity claims on US corporations rises by the product of their share in total US equity times the rise in the value of US corporations. In our calibration, we set this foreign equity share to 30 percent and the rise in the value of US corporations to 132 percent of GDP. Thus, this specification implies a revaluation of foreigners' holdings of US equity of 40 percent of US GDP. This direct revaluation effect drives all of the predicted decline in the US NFA position in the model with rising markups.

Now consider the second specification of the model in which the boom in the valuation of US corporations is a result of a shift in the production function that increases the importance of unmeasured capital.[4] Following this shock, the value of US corporations rises because they

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[3]In practice, there is heterogeneity in the shares of income that different US households receive from labor versus capital, and thus changes in the shares of income accruing to different factors imply redistribution across households.

[4]The capital has to be unmeasured. If it were measured, the boom in equity prices would be accompanied

invest in and accumulate a much larger stock of this unmeasured capital.

After the shock to the production function, the model US trade balance deteriorates sharply as US firms dramatically raise expenditures on unmeasured investment. In fact, the US NFA position deteriorates nearly one for one with the increase in the value of US corporations, regardless of the extent of foreign ownership of US equities. Thus, this version of the model yields starkly counterfactual implications for the US NFA position.

We argue that the different implications of the two alternative specifications of our model for the US NFA position and US welfare are driven, economically, by the different assumptions embedded in these alternative hypotheses for whether the boom in the value of US corporations was the result of an unexpected positive excess return on US equity for incumbent shareholders (as implied by an unexpected rise in markups) or alternatively whether the boom reflected accumulated unmeasured investments with no excess returns on US equity properly measured (as implied by the unmeasured capital hypothesis). We conjecture that this distinction is critical for assessing the welfare implications for US residents of any contemplated shock driving asset booms.

The remainder of the paper is organized as follows. In Section 2, we present data on the US NFA position and the drivers of changes in that position since 1992. In this section and in the Appendix, we also discuss several concerns with the data presented in the *Integrated Macroeconomic Accounts*, with a particular focus on concerns regarding the valuation of direct investment. In Section 3, we present our model with markups and develop its implications for the valuation of the US corporate sector, for key asset price ratios, and for the US current account and NFA position, both on a balanced growth path and in response to a shock. In Section 4, we discuss our financial data, which are used in Section 5 to calibrate the model and to simulate shocks to markups, as well as to the discount factor and the trend growth rate. In Section 6, we present the model with unmeasured capital, compare its implications for asset prices on a balanced growth path with those of our model with markups, and report results from our model experiment shocking the importance of unmeasured capital.

We describe our data sources and present additional data analyses in the Appendix.

2 The Evolution of the US NFA Position: 1992-2021

In this section, we briefly discuss some measurement concepts and then document the evolution of the US NFA position in more detail, focusing on the changes in NFA arising from the current account versus those from valuation effects and on the source of those valuation effects.

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by a boom in capital-output ratio, which is not observed in the data.

Measurement of Gross and Net Foreign Assets Our data analysis benefits tremendously from the work that the Bureau of Economic Analysis has done over the past ten years in assembling the *Integrated Macroeconomic Accounts*. In these data, for various sectors of the economy including the rest of the world, economic and financial flows and balance sheet positions are integrated so that all changes in positions between two points in time are fully explained by the recorded flows, changes in valuation, and other volume changes. Regarding the key distinction between US versus foreign assets, we follow the Bureau Of Economic Analysis (2014) and focus on the definition of *residence*.[5] The main source of data for this section is Table S.9 of the *Integrated Macroeconomic Accounts*, which we use to measure the gross and net foreign assets and liabilities held by residents of the United States (both individuals and institutions).[6] The source data for this table are primarily from the Bureau of Economic Analysis's *International Transactions Accounts*, *International Investment Position Accounts*, and *Activities of Multinational Enterprises*. In principle, whenever feasible, these US international economic accounts use market prices as the basis for valuation.

The NFA and its components The starting point of our analysis is accounting identity (1) below, showing that the change in the NFA position between the end of periods $t-1$ and t is the sum of three components. The first, (CA_t), is the balance of the current account during period t; this term captures net US lending abroad, measured as the sum of net exports and net income receipts. The second term, (VA_t), captures the net change in the valuations of the existing assets that compose the gross positions. The third term, (RES_t), is a residual, which reconciles the changes in the NFA position resulting from measured financial transactions and asset positions with the ones resulting from current account transactions.[7]

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[5]Individuals who reside or intend to reside in the United States for one year or more are considered US residents. Business enterprises and nonprofits are treated as residents of the country in which they are located, operated, organized, or incorporated. US resident entities consist of all for-profit and nonprofit institutions established under US laws; their foreign affiliates — subsidiaries, branches, partnerships, and sole proprietorships — are considered residents of the countries in which they are located. Similarly, all affiliates — subsidiaries, branches, partnerships, and sole proprietorships — of foreign for-profit and nonprofit institutions that operate in the United States are considered US residents. As described below, the application of the residence principle has a significant impact on our measurement.

[6]Table S.9 is presented from the point of view of the Rest of World (ROW) as an economic sector, so we multiply all data by -1 to present it from the perspective of US residents.

[7]In Table S.9, by construction, the change in the net foreign asset position (on line 104) is the sum of net lending (line 13) measured from the current account less capital transfers, nominal revaluations (line 103), and total other volume changes (line 70). We use the label "residual" as a shorthand for "total other volume changes". Total other volume changes in Table S.9 is equal to "other volume changes," (line 71), which captures discrepancies arising from the different measures of international portfolio positions and flows, less the "statistical discrepancy," (line 72), which captures the difference between net lending measured from the current account (line 13) and net lending measured from recorded financial transactions (line 69). See Curcuru, Dvorak, and Warnock (2008), section 3, for a discussion of these discrepancies arising from differences in the measurement of international financial flows and positions.

Thus,

$$NFA_t - NFA_{t-1} = \underbrace{CA_t}_{\text{net lending abroad}} + \underbrace{VA_t}_{\text{valuation effects}} + \underbrace{RES_t}_{\text{residual term}} . \qquad (1)$$

Summing (1) from period 1 to period t yields

$$NFA_t = NFA_0 + \underbrace{\sum_{j=1}^{t} CA_j}_{\text{cumulated CA}} + \underbrace{\sum_{j=1}^{t} VA_j}_{\text{cumulated valuations}} + \underbrace{\sum_{j=1}^{t} RES_j}_{\text{cumulated residuals}} , \qquad (2)$$

showing that the NFA position in any period can be expressed as the cumulated sums of the three terms described above.

Figure 2 shows the evolution of the three components in equation (2) divided by US GDP in each year t, from 1992 until 2021 Q3. The figure shows three different phases in the evolution of the US NFA position. During the first phase (1992–2002), the NFA position closely tracked current account dynamics. The NFA position declined from negative 5 percent to negative 18 percent of US GDP, and most of this decline reflects cumulated current account deficits.

During the second phase (2002–2007), the current account continued to deteriorate, but the NFA position improved, owing to a combination of positive valuation effects and positive statistical discrepancies. This period was the focus of Gourinchas and Rey (2007) and Gourinchas and Rey (2014), who noticed that valuation effects, which increased the value of foreign assets held by US residents relative to the value of US assets held by foreigners, acted as a stabilizing counterweight to growing current account deficits. During this period the US enjoyed the privilege of being able to finance its trade deficits using the high dollar returns it was earning on investments abroad.

The third and final phase (2007–2021) shows the end of this privilege. Over this period the US NFA position declined by 60 percent of GDP, despite a fairly stable (relative to GDP) cumulated current account.[8] In fact, by the end of 2020, the US NFA position was *more* negative than cumulated current accounts over the entire 1992 to 2020 period. Three quarters of the decline of the US NFA position in this third phase was driven by negative valuation effects, meaning that during this period, US residents experienced consistently lower capital gains on their foreign asset holdings than those enjoyed by foreigners on their US assets.[9]

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[8]Between 2010 and 2020, the US ran relatively modest current account deficits of around 2 percent of GDP each year. Figure H.1 displays a plot of these current account deficits relative to GDP. With a NFA to GDP ratio of negative 50 percent in the late 2010s, nominal GDP growth of 4 percent per year was shrinking the NFA to GDP ratio by a very similar amount: $0.5 \times 0.04 = 2$ percent. Thus, current account deficits in this period contribute relatively little to the decline in the NFA to GDP ratio.

[9]In the Appendix, in Figure H.2, we present an alternative decomposition of the cumulated change in the
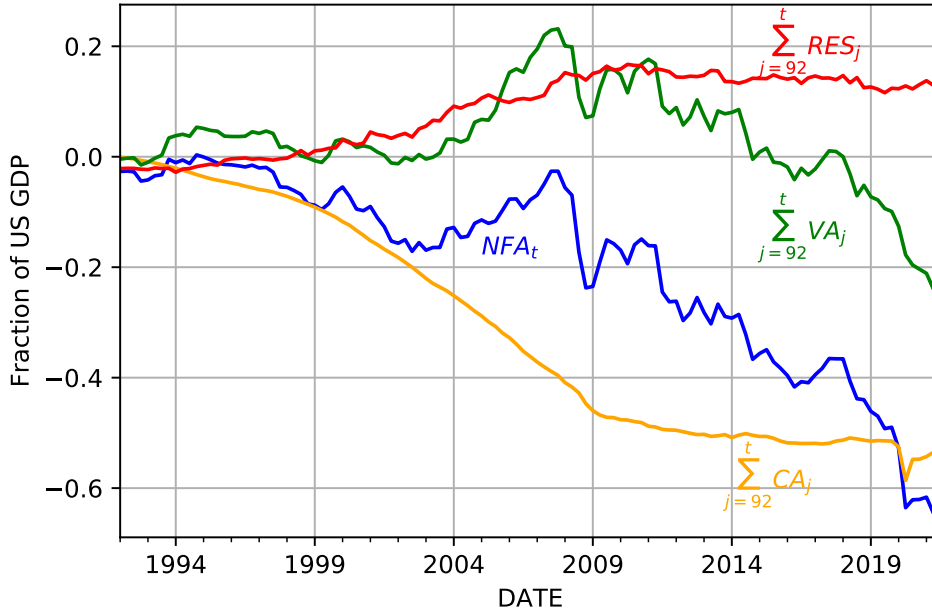
Figure 2: Decomposition of Changes in US Net Foreign Assets over GDP

Decomposing valuation effects Since cumulated valuation effects are an important determinant of the evolution of the US NFA position, we now proceed to analyze in more detail the sources and the impacts of these valuation changes. As a matter of accounting, valuation effects are given by

$$VA_t = FA_{t-1} \times g_t^{P*} - FL_{t-1} \times g_t^P,$$

where FA_{t-1} and FL_{t-1} are gross US net foreign asset and liability positions at the end of $t-1$, and g_t^{P*} and g_t^P are the net growth rates in the dollar values of those positions between the end of $t-1$ and the end of period t. It is immediate from this expression that there are two necessary conditions for valuation effects to matter quantitatively: (1) gross positions must be large, and (2) the values of foreign assets and foreign liabilities cannot co-move too closely. We now document that both these conditions have been satisfied in the past decade.

It is useful to divide US foreign positions into two broad categories: equity and non-equity investments. Equity investment includes portfolio investment in corporate equities and the equity component of direct investment.[10] At the beginning of our sample, when

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US NFA position, in which we show the change due to cumulated net lending measured from measured net financial transactions. Note that using measured net financial transactions to measure net lending reduces the decline in the NFA position due to US borrowing from abroad but does not change the overall measure of the NFA. Thus, overall, it makes the end of the privilege appear even starker.

[10]According to the Bureau Of Economic Analysis (2014), "Direct investment is related to control or a

international equity markets were still relatively underdeveloped, direct investment was the main component of both inward and outward equity investment, accounting for 80 percent of both positions. Toward the end of our sample, with large and active international equity markets, portfolio and direct equity investment have roughly equal shares.

Non-equity assets include debt securities, loans, and currency and deposits. Over the period 1992–2021, debt securities and loans account for 61 percent of US non-equity assets abroad and for 85 percent of foreign non-equity assets in the US. Figure 3 plots the evolutions of these categories of US foreign assets and liabilities as fractions of US GDP.
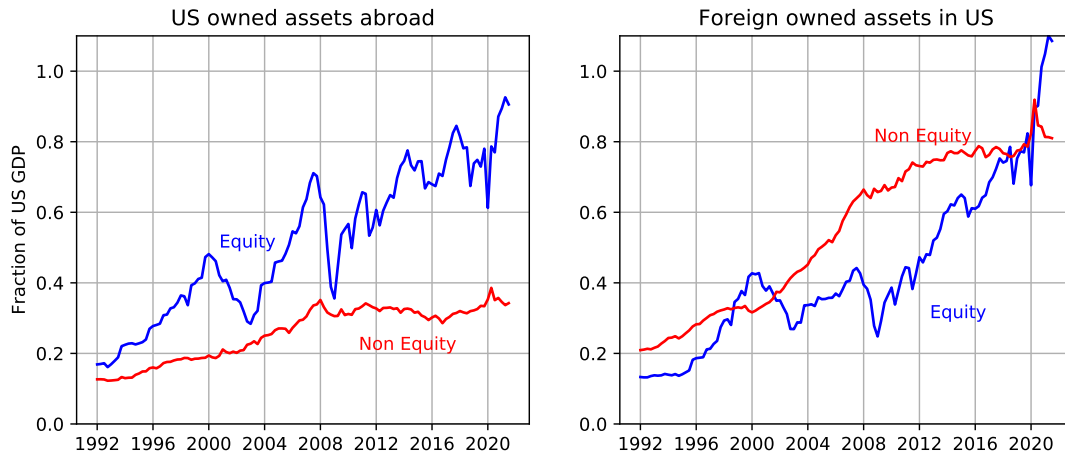

Figure 3: Gross Equity and Non-equity Positions

The first key message from Figure 3 is that by 2007, all the gross positions are large (ranging from 30 percent to 70 percent of US GDP), and thus changes in the prices of the assets composing these positions can potentially generate significant valuation effects. The second key message is that over the past decade, US equity liabilities have been large and similar in size to that of US equity foreign assets. By the end of our sample period, foreign equity holdings in the US exceed 100 percent of US GDP and also exceed foreign non-equity holdings in the US.[11] Thus, changes in the price of US equity that are not matched by identical changes in the price of foreign equity will have large effects on the US NFA position.[12]

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significant degree of influence and is usually associated with a lasting relationship. In contrast, portfolio investors typically have a much smaller role in the operations of the enterprise, with potentially important implications for future flows and for the volatility of the price and volume of positions."

[11]Note from these figures that it is still the case that non-equity claims are a larger share of total foreign claims on the US than they are of total US claims on the rest of the world.

[12]These valuation effects will also be much larger than they were in the past. Consider the following simple example. Suppose the price of foreign equity unexpectedly rises by 10 percent while the price of US equity

Figure 4 decomposes the cumulated valuation effects plotted in Figure 2 into valuation effects arising from equity and non-equity positions. The figure shows that net valuation changes arise almost exclusively from the equity positions. Although in principle both categories are subject to relative valuation changes (due to both price changes and to exchange rate movements for assets denominated in different currencies), these effects are quantitatively much more important for the equity positions.[13] Note that prior to 2002 valuation effects were relatively small. The reason is that gross international equity positions were relatively small in the early part of our sample (Figure 3), so international differentials in equity price dynamics did not translate into large effects on the value of the NFA position.

Figure 5 plots the evolution of net positions in equity and non-equity, alongside the cumulated valuation changes and the cumulated current account (as plotted in Figure 2). The figure shows a striking separation in US NFA position dynamics. The net non-equity position mirrors cumulated current accounts, while the net equity position tracks cumulated valuation changes. The figure also shows that the overall composition of the US foreign asset position has changed radically since the Great Recession, mostly because of valuation effects in the equity net position. Before 2009, the United States had a substantial negative non-equity position (over 30 percent of GDP), compensated for partly by a positive position in equity (20 percent of GDP). By 2021, the positions in both equity and non-equity assets were strongly negative.

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remains unchanged. Today, gross international equity positions are around 100 percent of US GDP, so this will improve the US NFA to GDP ratio by 10 percentage points. In the mid 1990s, gross equity positions were only around 20 percent of US GDP, so the same shock to valuations would improve the NFA position by only 2 percent of GDP.

[13]One reason why valuation effects for non-equity assets are so small is that foreign bonds owned by Americans tend to be dollar-denominated, as are bond liabilities (see Maggiori, Neiman, and Schreger 2020). In the Appendix, we break down the cumulated valuation changes for equity into those coming from FDI equity versus those from portfolio investment in equity; see Figure G.1. Cumulated valuation effects for equity are roughly equally split between the two components.
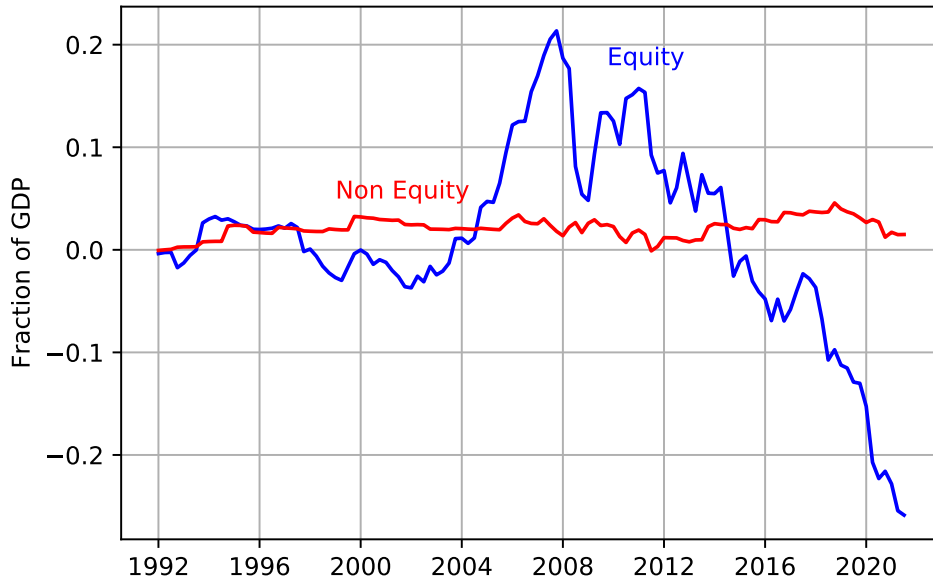
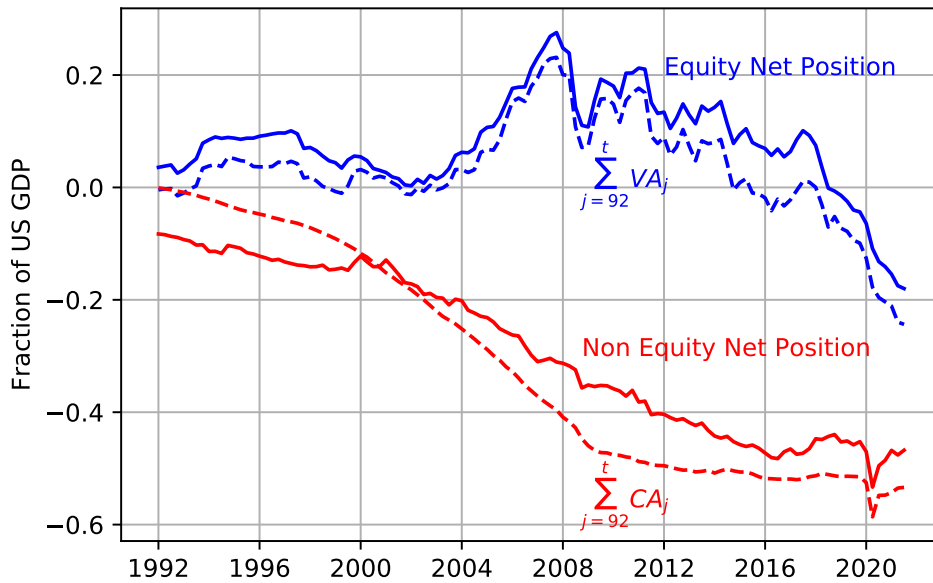Figure 4: Cumulated Valuation Changes in Equity and Non-equity Positions

Figure 5: Net Positions, Cumulated Valuations and Current Accounts

Valuations, exchange rates and stock prices   As discussed in Bureau Of Economic Analysis (2014), changes in net valuations can arise from two sources: changes in the prices of the underlying assets, and changes in exchange rates, when assets and liabilities are denominated in different currencies. In this subsection, we show the role played by these two channels in the two salient valuation episodes we have documented: the positive valuation effects experienced by the United States before the 2008 crisis (2002–2007), and the negative valuation effects after the crisis (2008–2021). Figure 6 plots three stock prices indexes: the first is a price index for the United States; the second and third are price indexes for foreign stocks in local currency and in dollars, respectively.[14] These indexes help us understand the contributions toward valuation effects of asset price movements in local currency versus those of exchange rate changes.

Focus first on the top panel, which describes the earlier valuation episode from 2002 to 2007. This panel shows that US equity and foreign equity performed similarly in local currency, but in dollar terms the foreign equity index substantially outperformed the US index. This means that depreciation of the US dollar against the basket of currencies that compose the foreign equity index was largely responsible for the positive valuation effect experienced by the US.

Moving now to the bottom panel, we can see that the later valuation episode was different. During that period, the foreign and US equity indexes diverged dramatically when measured in their respective currencies. Comparing the foreign indexes in local currency and in dollars indicates some appreciation of the US dollar, but this appreciation accounts for only a small portion of the differential in dollar returns. Rather, the dominant factor was that the US equity price index more than tripled over the period, while equity prices in the rest of the world increased by only around 25 percent in local currency terms. We conclude that the dominant factor behind the negative valuation effects experienced by the United States since 2007 is simply that US equities have massively outperformed their foreign counterparts. In Section 4, we will explore what might account for this divergence.

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[14]For the United States we use the Morgan Stanley Capital Index (MSCI) US Index. For the rest of the world, we use the MSCI ACWI ex USA Index, which comprises stock market indexes for 22 developed economies and 27 emerging markets, weighted by market capitalization in dollars and in local currency. These indices are available from the MSCI website: see https://www.msci.com/end-of-day-data-search.
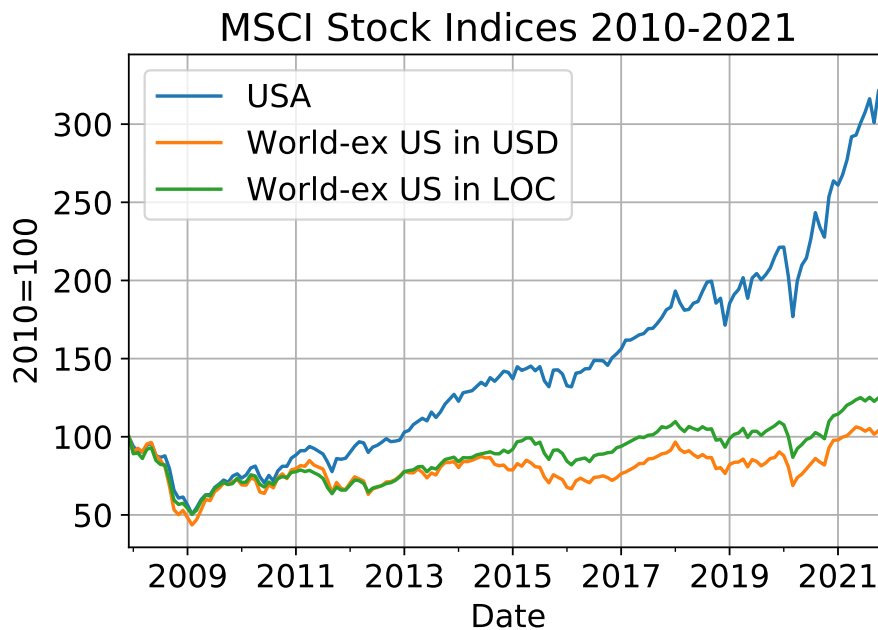
MSCI Stock Indices 2002-2007

MSCI Stock Indices 2010-2021

Figure 6: Two Valuation Episodes

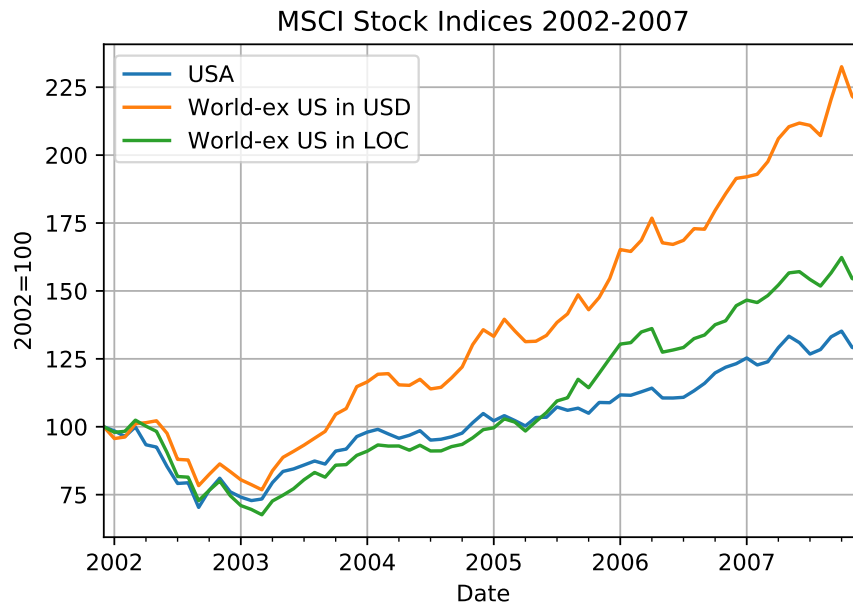**Data issues** The findings documented so far rely on standard BEA data. The BEA continues to refine its methodology and now focuses on estimates at market prices for its headline net foreign asset position presentations. However, there are many challenging measurement issues, which we now briefly discuss.

First, while valuing traded assets such as bonds and public equity is relatively straight-

forward, valuing foreign direct investment is more difficult. The BEA's valuation model uses US stock price indexes to revalue foreign firms' direct investment into the United States. The idea is that if Toyota owns a subsidiary in the United States, the value of that subsidiary should track the value of a US-owned car producer. That assumption is consistent with the economic model we will develop in Section 3. Milesi-Ferretti (2021) argues that it may be more appropriate to value foreign firms' direct investment in the United States using foreign stock indices and vice-versa for US direct investment abroad. In Appendix G Figure G.1, we show the cumulated net valuation effects separately for portfolio equity and for direct investment equity. In Figure G.2, we show the US NFA position relative to GDP with direct investment equity measured at market value and at current cost. In these figures, we see that the approach to measuring the value of direct investment equity does have a substantial impact on the magnitude of the measured decline in the US NFA position over the past decade. This measurement question merits further study.

A second, related issue is the long-standing puzzle that while the US net foreign asset position is large and negative, US primary income from abroad as measured in the current account remains positive. That discrepancy would be concerning if it indicated mismeasurement of the US net foreign asset position. In Appendix F, we show that strong net primary income mostly reflects (1) relatively low income on foreign holdings of US portfolio equity, and (2) relatively high income on US direct investment abroad. See also Curcuru, Thomas, and Warnock (2013) and Fried (2021) for a similar analysis. A natural and innocuous explanation for the first finding is that an important way in which US firms return income to shareholders is stock buybacks, which do not show up as primary income on the current account.

The income discrepancy for direct investment remains an active topic of research. Curcuru, Thomas, and Warnock (2013) offer a decomposition of the income discrepancy into components due to tax avoidance, a risk differential, and differences in the age of US and foreign subsidiaries. A number of more recent papers argue that a significant portion of this discrepancy reflects US multinationals overreporting income from their overseas subsidiaries for tax purposes. See, for example, Setser (2017), Setser (2019), Torslov, Weir, and Zucman (2020), Guvenen et al. (2021), and Garcia-Bernardo, Jansky, and Zucman (2021). Guvenen et al. (2021) argue that this overreporting of foreign income by US multinationals affects the division of the US current account between net exports and net foreign income but does not necessarily distort overall measurement of the current account.[15]

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[15]The idea is that US firms understate value added in the US and overstate value added in low-tax jurisdictions. Correcting the accounts would increase US exports (US firms would charge more to foreign subsidiaries for the use of intellectual property) and would reduce earnings on US direct investment abroad by the same amount.

One final data issue concerns the measurement of the size of the gross international claims shown in Figure 3. As discussed in Bertaut, Bressler, and Curcuru (2019), measurement of financial claims on a residence basis, as in the BEA's Integrated Macroeconomic Accounts, likely overstates the extent of gross international financial claims on a nationality basis. These authors analyze the gross measures of US claims on the rest of the world as a case study of this discrepancy between reporting on a residence and nationality basis and point to three possible distortions affecting measures of gross claims by US residents on foreigners.

First, US multinationals have increasingly chosen to incorporate in offshore tax havens in what are called "corporate inversions." As a result, a growing share of what are reported as cross-border equity holdings are, in fact, primarily claims on what are economically US firms held by US equity investors through their claims on the parent firm located in the offshore tax haven.

Second, firms are issuing a growing volume of bonds through offshore subsidiaries. Since some US firms follow this practice, a portion of what is recorded as US investors' holdings of foreign corporate bonds is, in fact, a claim on what is economically a US firm.

Third, US investors increasingly invest in foreign mutual funds and other managed investment funds. These funds are classified as an equity investment even if the mutual or managed fund invests in bonds, and much of the investment of these funds is in the equity and bonds of US firms. Since both the outward and inward investments associated with these transactions are counted as part of gross international positions, such gross positions are overstated from a functional point of view.

Bertaut, Bressler, and Curcuru 2019 estimate that roughly $2 trillion of the total $12 trillion US outward investment abroad in 2017, or 16 percent, was actually exposure to the US. It is unclear what the total adjustment of the estimated gross claims by foreigners on the US would be if similar methods were applied to these data.

Summing up   This section has documented the evolution of the US NFA over the past 30 years. The novel observation is that between 2007 and 2021, the US NFA position fell by a very large amount (60 percent of GDP) and most of this fall can attributed to negative cumulated revaluations of international equity positions. These revaluations in turn have been driven by growth of US equity prices that has been much faster than that of equity prices in the rest of the world, in the context of very large gross international equity positions. Thus, rapid growth in US equity prices, which is typically interpreted as a sign of confidence in the economy, has also contributed to a large negative external imbalance, which is typically seen as a potential concern. In order to better understand the implications of these developments, we now develop a simple model of equity pricing in an open economy.

3   Model

We now develop a simple international macro finance model that we can use to simulate the effects of an increase in US asset prices. The model builds on Farhi and Gourio (2018) and Greenwald, Lettau, and Ludvigson (2021) but extends those frameworks to an international setting to include international positions and flows in the model. The objective is to construct a framework that can accommodate a variety of alternative rationales for rising domestic asset values and to trace out their implications for the US current account, the US net foreign asset position, and welfare for American households. The first version of the model we lay out focuses on the hypothesis that rising US equity values reflect higher monopoly profits. In Section 6, we consider an alternative version designed to explore the hypothesis that higher equity values reflect greater unmeasured investment.

The model has two regions: a domestic economy we think of as the United States, and a foreign economy that stands in for the rest of the world. Each region is populated by a continuum of identical households. Heterogeneous firms in each economy produce a continuum of non-tradable intermediate varieties. These intermediates are combined to produce a single composite final good that is traded internationally and used for consumption and investment. Intermediates-producing firms enjoy pricing power and make monopoly profits. Households receive labor income, dividends from holdings of corporate equity, and interest income from a risk free bond that is traded internationally. We will describe an economy without uncertainty and later describe how we generate asset price movements via unanticipated shocks to technology and preferences.

In our baseline model specification, we will assume that foreign households are risk-neutral. That assumption allows us to characterize equilibrium allocations in closed form and to illustrate the economic mechanisms at work as transparently as possible. We also assume that both countries produce and consume the same final good, so the terms of trade and the real exchange rate in the model will always be equal to one. Recall that exchange rate movements account for only a small portion of the valuation effects in the NFA position between 2010 and 2021. In Section 6.3 and Appendix K, we will discuss a generalization of the model in which domestically and foreign produced goods are imperfect substitutes, in which case shocks to monopoly power and/or productivity have the potential to affect the terms of trade.

3.1   Firms

In each country there is a unit mass of different intermediate varieties indexed by $i \in [0, 1]$. Let Y_{it} denote total production of variety i at date t. Domestic output of the final good is

given by

$$Y_t = \left(\int\limits_0^1 Y_{it}^{\left(\frac{\varepsilon-1}{\varepsilon} \right)} di \right)^{\frac{\varepsilon}{\varepsilon-1}}, \tag{3}$$

where $\varepsilon > 1$ is the elasticity of substitution in production between different varieties.

This measure of domestic output Y_t corresponds to GDP for the United States in our model. We have the usual accounting identity relating domestic consumption, investment, and net exports of goods and services to GDP,

$$C_t + K_{t+1} - (1 - \delta)K_t + NX_t = Y_t.$$

Within each country there are two sorts of firms that can produce a given variety of intermediate good: a single leader firm with productivity z_{Ht}, and a fringe of identical follower firms, each with productivity $z_{Lt} \leq z_{Ht}$. An intermediate firm with productivity z_{jt} that rents capital k_{jt} and labor l_{jt} produces output y_{jt} given by

$$y_{jt} = z_{jt}k_{jt}^{\alpha} \left(Z_t l_{jt} \right)^{1-\alpha},$$

where Z_t is economy-wide labor productivity. These productivity values for leader and follower firms are common across all varieties.

Bertrand price competition between the leader firm and the follower firms for each variety determines the markup of price over marginal cost charged by the leader firm, as in Bernard et al. (2003), Atkeson and Burstein (2007), and Peters (2020). Specifically, let R_t and W_t denote the domestic rental rates for capital and labor. Cost-minimizing unit production costs for intermediate-variety producing firms are given by

$$cost_t(z_{jt}) = \frac{1}{z_{jt}} \left(\frac{W_t}{Z_t(1-\alpha)} \right)^{1-\alpha} \left(\frac{R_t}{\alpha} \right)^{\alpha}.$$

Leader firms producing each variety move first and set a price p_{it}. If these firms did not face any latent competition from follower firms, they would solve the standard monopolistic competition profit maximization problem,

$$\max_{p_{it}} \left\{ p_{it} y_{it}(p_{it}) - cost_t(z_{Ht}) y_{it}(p_{it}) \right\},$$

taking as given the demand curve for variety i implied by the CES specification (eq. 3):

$$y_{it}(p_{it}) = \left(\frac{P_t}{p_{it}} \right)^{\varepsilon} Y_t. \tag{4}$$

However, the leader firm also recognizes that if it sets $p_{it} > cost_t(z_L)$, then latent competitors will be able to profitably enter and will in fact corner the market. Thus, the leader firm effectively faces an additional constraint on pricing, one which ensures that competitors do not enter and the leader retains a 100 percent market share:

$$p_{it} \leq cost_t(z_{Lt}). \tag{5}$$

There are two possible solutions to the leader's problem, depending on whether constraint (5) binds. Without that constraint, the first order condition to the firm's problem would yield the standard Dixit-Stiglitz optimal price markup to cost expression,

$$p_{it} = \frac{\varepsilon}{\varepsilon - 1} cost_t(z_{Ht}).$$

However, if this solution violates eq. (5), then the limit pricing constraint must bind, implying $p_{it} = cost_t(z_L)$. Thus, the equilibrium markup μ_t is given by

$$\mu_t = \frac{p_{it}}{cost_t(z_H)} = \min\left\{\frac{\varepsilon}{\varepsilon - 1}, \quad \frac{cost_t(z_{Lt})}{cost_t(z_{Ht})} = \frac{z_{Ht}}{z_{Lt}}\right\}. \tag{6}$$

We will assume that $\frac{z_{Ht}}{z_{Lt}} < \frac{\varepsilon}{\varepsilon - 1}$ for all t, so that markups are always driven by the threat of potential competition, $\mu_t = \frac{z_{Ht}}{z_{Lt}}$.

Note that because all varieties are symmetric, equilibrium prices, markups, labor, capital and output are identical across varieties, $p_{it} = P_t$, $k_{it} = K_t$, $l_{it} = L_t$, and

$$y_{it} = Y_{it} = Y_t = z_{Ht} K_t^\alpha \left(Z_t L_t\right)^{1-\alpha}. \tag{7}$$

Without loss of generality, we will normalize $P_t = 1$ for all t. Output from intermediate firms is divided between rental payments to labor and capital and pure profits. Profits and the dividends of intermediate goods producers are given by

$$\Pi_t = \left(\frac{\mu_t - 1}{\mu_t}\right) Y_t,$$

while the shares of income going to labor and capital are

$$\frac{W_t L_t}{Y_t} = \frac{(1-\alpha)}{\mu_t}, \tag{8}$$

$$\frac{R_t K_t}{Y_t} = \frac{\alpha}{\mu_t}. \tag{9}$$

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In addition to intermediates-producing firms, a second set of competitive firms holds and rents out capital and makes investment choices. These competitive investment firms choose investment to maximize the expected present value of dividends. Dividends from these firms are given by

$$D_{Xt} = R_t K_t - [K_{t+1} - (1 - \delta)K_t].$$

Dividends are discounted back to date 0 using the sequence for the world interest rate $\{r_t^*\}$. Thus, investment firms solve

$$\max_{\{K_{t+1}\}_{t=0}^{\infty}} \left\{ D_{X0} + \sum_{t=1}^{\infty} \frac{D_{Xt}}{\Pi_{j=1}^t (1 + r_j^*)} \right\}$$

given an initial capital stock K_0.

For the optimal investment choice to have an interior solution, it must be the case that

$$R_t - \delta = r_t^* \tag{10}$$

for all $t \geq 1$. We will assume that K_0 is such that this condition is also satisfied at $t = 0$.

3.2   Households

Lifetime utility for the domestic representative infinitely lived household is given by

$$\sum_{t=0}^{\infty} \left(\frac{1}{1 + \rho} \right)^t u_t(C_t, L_t), \tag{11}$$

where the flow utility function is given by the following Greenwood, Hercowitz, and Huffman (1988) specification:

$$u_t(C_t, L_t) = \frac{\left(C_t - Z_t \frac{L_t^{1+\sigma}}{1+\sigma} \right)^{1-\gamma}}{1 - \gamma}.$$

We choose this specification because it is tractable. In particular, it allows us to solve for the allocation of capital and labor independently of the net wealth of the domestic country. The Frisch elasticity of labor supply is $1/\sigma$, and the parameter $\gamma \geq 1$ controls risk aversion and the household's willingness to substitute intertemporally.

The assets in this economy are shares in domestic and foreign firms and a one period bond denominated in units of the final good. In the absence of risk, all these assets must pay the same return in equilibrium, and optimal bond-equity portfolios are indeterminate. We will assume that international equity portfolios are diversified, but the extent of diversification is

fixed. Domestic households own a fixed fraction λ of shares in domestic intermediate-good-producing firms and investment firms (foreign households own fraction $1 - \lambda$). Domestic households also own a fixed fraction λ^* of foreign firms. Changes in domestic and foreign demand for savings are accommodated by free international trade in the bond, whose net return is r_t^*. Thus, the flow budget constraint for the domestic representative household is

$$C_t + B_{t+1} = W_t L_t + \lambda D_t + \lambda^* D_t^* + (1 + r_t^*) B_t, \tag{12}$$

where D_t and D_t^* denote payouts to domestic and foreign equity holders respectively, and are given by

$$
\begin{aligned}
D_t &= \Pi_t + D_{Xt}, \\
D_t^* &= \Pi_t^* + D_{Xt}^*.
\end{aligned}
$$

Domestic households choose sequences for C_t, L_t and B_{t+1} to maximize (11) subject to a sequence of budget constraints of the form (12), given an initial bond position B_0. Their first order condition for labor supply is

$$L_t = \left(\frac{W_t}{Z_t}\right)^{\frac{1}{\sigma}}, \tag{13}$$

and the condition for bond purchases is

$$\left(C_t - Z_t \frac{L_t^{1+\sigma}}{1+\sigma}\right)^{-\gamma} = \frac{1 + r_{t+1}^*}{1+\rho}\left(C_{t+1} - Z_{t+1} \frac{L_{t+1}^{1+\sigma}}{1+\sigma}\right)^{-\gamma}. \tag{14}$$

Foreign households are symmetric to domestic ones, except that we assume they have linear utility ($\gamma^* = 0$) and a discount factor ρ^*. Because foreign households are infinitely willing to substitute consumption intertemporally, the world interest rate is pinned down at

$$r_t^* = \rho^*. \tag{15}$$

3.3 Equilibrium

An equilibrium is a sequence for the world interest rate $\{r_t^*\}_{t=0}^{\infty}$ and sequences for domestic and foreign factor prices $\{R_t, W_t\}_{t=0}^{\infty}$ and $\{R_t^*, W_t^*\}_{t=0}^{\infty}$ such that when households and firms take these prices as given and solve their maximization problems, markets clear. Because bonds are in zero net supply, bond market clearing requires $B_t + B_t^* = 0$.

Our assumptions on preferences eliminate wealth effects on labor supply and on the world

demand for savings. It is therefore possible to characterize the production side of the model in closed form. In particular, equations (15), (35), (7), (8), (9), (10) and (13) can be used to solve in closed form for r_t^*, μ_t, Y_t, L_t, K_t, R_t and W_t. A similar set of equations pins down the foreign production allocation. The domestic allocation is given by

$$\frac{K_t}{Z_t} = z_{Lt}^{\frac{1+\sigma}{\sigma(1-\alpha)}} (1-\alpha)^{\frac{1}{\sigma}} \left(\frac{\alpha}{r^*+\delta}\right)^{\frac{\sigma+\alpha}{\sigma(1-\alpha)}} \tag{16}$$

$$L_t = z_{Lt}^{\frac{1}{\sigma(1-\alpha)}} (1-\alpha)^{\frac{1}{\sigma}} \left(\frac{\alpha}{r^*+\delta}\right)^{\frac{\alpha}{\sigma(1-\alpha)}} \tag{17}$$

$$\frac{Y_t}{Z_t} = z_{Ht} \times z_{Lt}^{\frac{1+\alpha\sigma}{\sigma(1-\alpha)}} (1-\alpha)^{\frac{1}{\sigma}} \left(\frac{\alpha}{r^*+\delta}\right)^{\frac{\alpha(1+\sigma)}{\sigma(1-\alpha)}} \tag{18}$$

$$R_t = r^*+\delta \tag{19}$$

$$W_t = Z_t L_t^{\sigma} \tag{20}$$

$$\frac{K_t}{Y_t} = \frac{z_{Lt}}{z_{Ht}} \left(\frac{\alpha}{r^*+\delta}\right) = \frac{1}{\mu_t} \left(\frac{\alpha}{r^*+\delta}\right). \tag{21}$$

3.4 Asset Pricing

The ex dividend price of a share in the domestic investment firm is simply the value of the capital the firm holds, as in the standard growth model:[16]

$$V_{Kt} = \sum_{j=1}^{\infty} \frac{D_{X,t+j}}{(1+r^*)^j} = K_{t+1}.$$

The ex dividend price of a share of all domestic intermediate-good-producing firms is the present value of the future stream of monopoly profits these firms will earn:

$$V_{\Pi t} = \sum_{j=1}^{\infty} \frac{\Pi_{t+j}}{(1+r^*)^j}.$$

The market price of all domestic firms is $V_t = V_{Kt} + V_{\Pi t}$.

We will explore our model's implications for the following standard valuation ratios:

1. The ratio of firm value V_t to GDP, V_t/Y_t, which is known as the *Buffett indicator.*

---

[16]Note that the return to these shares is

$$\frac{V_{K,t+1} + D_{X,t+1}}{V_{Kt}} = \frac{RK_{t+1} + (1-\delta)K_{t+1} - K_{t+2} + K_{t+2}}{K_{t+1}}$$
$$= 1+r^*.$$

2. The *dividend yield* measured as the ratio of dividends to value D_t/V_t, where dividends are defined as revenue payable to firm owners: $D_t = Y_t - W_t L_t - X_t$.

3. The *price earnings ratio* measured as the ratio V_t/E_t, where earnings are defined as output less payments to labor and depreciation: $E_t = Y_t - W_t L_t - \delta K_t$.

4. The *capital-output ratio* measured as K_t/Y_t, which is given by (21).

Note that Tobin's Q defined as $Q_t = V_t/K_{t+1}$ can be computed from the Buffett indicator, the capital-output ratio, and the growth rate of output.

3.5 Balanced Growth Path

Suppose labor productivity Z_t grows at a constant rate g_Z and that multi-factor productivity for leaders and followers is constant, $z_{Ht} = z_H$ and $z_{Lt} = z_L$. The markup will then be constant, $\mu_t = \mu = \frac{z_H}{z_L}$, and capital, output, profits and the wage will also grow at rate g_Z, while hours worked will be constant.[17]

On the balanced growth path, firm values are given by

$$V_{\Pi t} = \sum_{j=1}^{\infty} \frac{(1+g_Z)^j}{(1+r^*)^j}\Pi_t = \left(\frac{1+g_Z}{r^* - g_Z}\right)\left(\frac{\mu-1}{\mu}\right)Y_t$$

$$V_{Kt} = K_{t+1} = \frac{1}{\mu}\left(\frac{\alpha}{r^*+\delta}\right)(1+g_Z)Y_t,$$

and thus the total value of domestic corporations is given by

$$V_t = \frac{1}{\mu}\left(\frac{\alpha}{r^*+\delta}\right)(1+g_Z)Y_t + \left(\frac{1+g_Z}{r^*-g_Z}\right)\left(\frac{\mu-1}{\mu}\right)Y_t.$$

The balanced growth path ratio of dividends to output is

$$\frac{D}{Y} = (r^* - g_Z)\frac{K}{Y} + \frac{\Pi}{Y} = (r^*-g_Z)\frac{1}{\mu}\left(\frac{\alpha}{r^*+\delta}\right) + \frac{\mu-1}{\mu}.$$

Our reference valuation measures are thus as follows:

Buffett indicator	$\frac{V}{Y}$	$(1+g_Z)\left(\frac{1}{\mu}\left(\frac{\alpha}{r^*+\delta}\right) + \left(\frac{1}{r^*-g_Z}\right)\left(\frac{\mu-1}{\mu}\right)\right)$
Dividend yield	$\frac{D}{V}$	$\frac{r^*-g_Z}{1+g_Z}$
Price to earnings ratio	$\frac{V}{E}$	$\frac{1+g_Z}{r^*-g_Z+\frac{g_Z}{Q}}$ where $Q = \frac{(V/Y)}{(K/Y)(1+g_Z)}$
Capital to output ratio	$\frac{K}{Y}$	$\frac{\alpha}{\mu(r^*+\delta)}$

---

[17]The absence of a trend in hours worked, notwithstanding growth in wages and the absence of income effects, reflects the presence of Z_t in the period utility specification.

These expressions are readily interpretable. First, the dividend yield is the inverse of the valuation multiple that one would expect given that on the balanced growth path, dividends grow at rate g_Z and are discounted at rate r^*.

Second, the value of stocks relative to output (the Buffett indicator) is the sum of the (next period) capital to output ratio (the value of investment firms) plus the present value of monopoly profits (the value of intermediate producers), which in turn is the share of income going to profits times the valuation multiple implied by the price-dividend ratio. Changes in the markup μ have a direct impact on firm value in proportion to this valuation multiple.

Note that the capital-output ratio corresponding to the first term in the expression for the Buffett indicator is much less responsive to changes in markups μ than is the value of monopoly profits relative to output corresponding to the second term in the indicator. Thus, increases in monopoly markups μ raise Tobin's Q.

Finally, consider the price-earnings ratio. This ratio is equal to the inverse of the discount rate $(1/r^*)$ when either (i) there are no monopoly profits so that Tobin's Q is equal to one $(V_t = K_{t+1})$, or (ii) when the growth rate $g_Z = 0$. But when Tobin's Q exceeds one and there is positive growth $(g_Z > 0)$, the price-earnings ratio is larger than $1/r^*$ and is increasing in Q and thus in μ.

3.5.1 Balance of Payments Accounting

To solve for the current account, we must solve for the consumption of domestic households. We assume that the discount factor for domestic households satisfies

$$1 + \rho = (1 + r^*)(1 + g_Z)^{-\gamma}. \tag{22}$$

Given this assumption, domestic consumption will grow at rate g_Z on the balanced growth path.[18]

The domestic resource constraint is

$$
\begin{aligned}
C_t + K_{t+1} + NX_t &= Y_t + (1 - \delta)K_t \\
&= W_t L_t + D_t + (1 - \delta)K_t,
\end{aligned}
$$

---

[18]The balanced growth path ratio of domestic consumption to output is given by

$$
\begin{aligned}
\frac{C_t}{Y_t} &= \frac{W_t L_t}{Y_t} + \lambda \frac{D_t}{Y_t} + \lambda^* \frac{D_t^*}{Y_t} + (r^* - g_Z)\frac{B_t}{Y_t} \\
&= \frac{1 - \alpha}{\mu} + \lambda \frac{\mu - 1}{\mu} + \lambda^* \frac{\mu^* - 1}{\mu^*}\frac{Y_t^*}{Y_t} + (r^* - g_Z)\left(\lambda \frac{K_t}{Y_t} + \lambda^* \frac{K_t^*}{Y_t^*}\frac{Y_t^*}{Y_t} + \frac{B_t}{Y_t}\right)
\end{aligned}
$$

where $\frac{K_t}{Y_t} = \frac{1}{\mu}\left(\frac{\alpha}{r^* + \delta}\right)$ and $\frac{B_t}{Y_t} = \frac{B_0}{Y_0}$ is the initial bond to GDP ratio.

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where NX_t denotes net exports of goods and services.

Combining this with the domestic households budget constraint gives

$$B_{t+1} - B_t = NX_t + r_t^* B_t - (1 - \lambda)D_t + \lambda^* D_t^*, \tag{23}$$

where $B_{t+1} - B_t$ is the flow of financial transactions financing the current account surplus (net lending abroad) and $r_t^* B_t - (1 - \lambda)D_t + \lambda^* D_t^*$ is net factor income from abroad.

We define the net foreign asset position as the sum of the net bond and equity positions

$$NFA_t = B_{t+1} + \lambda^* V_t^* - (1 - \lambda)V_t.$$

Thus, the change in the net foreign asset position is given by

$$NFA_t - NFA_{t-1} = (B_{t+1} - B_t) + \lambda^* \left(V_t^* - V_{t-1}^*\right) - (1 - \lambda)\left(V_t - V_{t-1}\right), \tag{24}$$

where the first term on the right hand side is the current account surplus, and the second and third terms capture valuation effects. This is exactly the model analogue of equation (1), with no statistical discrepancy.

3.6 Nature of Experiments

We think of the United States before the Great Recession as being on the balanced growth path of the economy just described. We then consider a one-time, unanticipated shock to model parameters that is designed to replicate observed changes in key valuation metrics.

On the initial balanced growth path, the domestic and foreign economies are assumed to share identical production technologies and to be of equal size. On this initial balanced growth path, the only asymmetries between regions are (i) households in the foreign economy have linear preferences and a different discount factor, and (ii) the initial net bond position is not necessarily equal to zero.

The key component of the shock we simulate is a permanent change in the values for domestic leader and follower productivities, $\{z_H, z_L\}$, which in turn generates a permanent increase in the domestic markup, $\mu = z_H/z_L$. We will assume no change in the foreign markup.

Our timing assumption is as follows. At date T households and firms anticipate that from date $T+1$ onward, markups will be given by a new value $\hat{\mu}$. But no productivity values or markups change at T. Thus, factor prices and monopoly profits at date T are exactly as households expected at $T-1$. Because foreign households are assumed to have linear utility, they are willing to adjust consumption as needed at date T to finance the jump to the new

balanced growth path values for domestic and foreign capital at $T + 1$.

Domestic households enter period T with claims to fractions λ and λ^* of domestic and foreign monopoly profits, and they also own B_T bonds and $\lambda K_T + \lambda^* K_T^*$ units of capital. Domestic labor supply at each date is given by (13). To characterize the equilibrium path for domestic consumption, we use the intertemporal first order conditions (eq. 14) and the present value budget constraint, which is

$$C_T + \sum_{j=1}^{\infty} \frac{C_{T+j}}{(1+\hat{r})^j} = W_T L_T + \sum_{j=1}^{\infty} \frac{W_{T+j} L_{T+j} + \lambda \Pi_{T+j} + \lambda^* \Pi_{T+j}^*}{(1+\hat{r})^j}$$

$$+ \lambda \left(\Pi_T + (1+r)K_T - K_{T+1} \right) + \lambda^* \left(\Pi_T^* + (1+r)K_T^* - K_{T+1}^* \right) + \lambda V_{KT} + \lambda V_{KT}^* + (1+r)B_T,$$

where the second line captures dividends at date T plus the ex dividend resale value of investment-producing firms. Note that $V_{KT} = K_{T+1}$ and $V_{KT}^* = K_{T+1}^*$.

Given our balanced growth property, consumption, earnings and profits will all grow at rate $\hat{g}_Z = g_Z$ from date $T + 1$ onward. Because markups change between T and $T + 1$, labor earnings and hours worked grow at a different rate between T and $T + 1$. And because hours and consumption enter in a non-separable manner in utility, consumption also grows at a different rate between T and $T + 1$. Given the solutions for consumption, the path for equilibrium bond holdings is given by the sequential budget constraint, eq. (12).[19]

---

[19]Equilibrium consumption values are given by

$$C_T = \frac{(\hat{r} - \hat{g}_Z)}{(1+\hat{r})} (I_T + A_T) + \frac{1}{(1+\hat{r})} I_{T+1} + \frac{(1+\hat{g}_Z)}{(1+\hat{r})} \frac{Z_T}{1+\sigma} \left(L_T^{1+\sigma} - L_{T+1}^{1+\sigma} \right) \tag{25}$$

$$C_{T+1} = \frac{(1+\hat{g}_Z)(\hat{r} - \hat{g}_Z)}{(1+\hat{r})} (I_T + A_T) + \frac{(1+\hat{g}_Z)}{(1+\hat{r})} I_{T+1} - \frac{(1+\hat{g}_Z)(\hat{r} - \hat{g}_Z)}{(1+\hat{r})} \frac{Z_T}{1+\sigma} \left(L_T^{1+\sigma} - L_{T+1}^{1+\sigma} \right), \tag{26}$$

where

$$I_T = W_T L_T + \lambda \Pi_T + \lambda^* \Pi_T^*$$
$$A_T = (1+r)(\lambda K_0 + \lambda^* K_0^* + B_0).$$

These consumption values imply the following path for bonds:

$$B_{T+1} = I_T + A_T - \lambda K_{T+1} - \lambda^* K_{T+1}^* - C_T$$
$$B_{T+2} = I_{T+1} + (1+\hat{r})B_{T+1} + \lambda \left((1+\hat{r})K_{T+1} - (1+\hat{g}_Z)K_{T+1} \right) + \lambda^* \left((1+\hat{r})K_{T+1}^* - (1+\hat{g}_Z)K_{T+1}^* \right) - C_{T+1}.$$

4 Valuation Metrics for the US Corporate Sector

When mapping our model to the data, we will interpret our model as capturing the corporate sector of the US economy.[20] We now describe our empirical measures for the US corporate sector corresponding to the model flows of dividends D_t and earnings E_t, the stock of capital K_t, and the value of these corporations V_t.

We use Tables S.5 and S.6 of the Integrated Macroeconomic Accounts to measure the flows and balance sheets of the US corporate sector. Table S.5 presents data for the non-financial corporate business sector, and Table S.6 presents data for the financial business sector. The overwhelming portion of foreign portfolio and direct investment into the United States is directed toward these two sectors. We combine these two accounts into an aggregated corporate sector.

The use of the residence principle has a substantial impact on the measurement of economic activity in the corporate sector relative to what one would get if one were to instead associate the economic activity of affiliates of multinational enterprises with the country in which the multinational is headquartered. For example, the BEA reports that in 2018, majority-owned US affiliates of foreign multinational enterprises contributed $1.1 trillion, or 7.1 percent of US business sector value added and accounted for 6.0 percent of total private industry employment in the United States. Likewise, in 2018, US multinationals produced $5.7 trillion of value added, $4.2 trillion of which was produced by US resident operations with 28.6 million employees, and $1.5 trillion of which was produced by majority-owned affiliates abroad with 14.4 million employees. Using the residence principle, the Integrated Macroeconomic Accounts include that $1.1 trillion of value added by US affiliates of foreign multinationals as a flow attributed to the US corporate sector and do not include the $1.5 trillion produced by foreign affiliates of US multinational enterprises in this category.

We measure the size of the corporate sector relative to the economy as a whole by comparing the aggregate of gross value added for the non-financial corporate business sector and the financial business sector relative to gross value added for the economy as a whole. The gross value added of these sectors is divided into four categories of income in Tables S.5 and S.6: consumption of fixed capital (depreciation), compensation of employees, taxes on production and imports less subsidies, and net operating surplus. We measure the *earnings* of the corporate sector as net operating surplus less current taxes on income and wealth. We measure the *dividends* of the corporate sector as net operating surplus less current taxes on

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[20]In practice, a portion of economic activity occurs outside the corporate sector, where residential real estate and consumer durables are the key assets. But international residential real estate diversification is minimal, implying that changes in house prices will have a minimal impact on the US net foreign asset position.

income and wealth less net capital formation.

This measure of dividends corresponds to the after-tax cash flow from operations of corporations resident in the United States that is available to be paid out to investors in the debt and equity of those corporations.[21] Note that in practice, only some of this cash flow is actually paid out to investors, while the rest of it is used to acquire, on net, financial assets (as accounted for in Tables S.5 and S.6). Thus, our empirical measures of earnings and dividends correspond to what those objects would be if firms were 100 percent equity financed and maintained no financial assets, as in our simple model above. As discussed below, following Modigliani and Miller, we assume that the valuation of the corporate sector is invariant to its financial policy regarding financing (debt versus equity) as well as regarding what firms do with cash flow (actual payouts to investors versus net acquisition of financial assets).

Our goal in measuring positions is to place a value on these flows of economic activity, which we refer to as earnings and dividends for corporations resident in the United States. Thus, we make several adjustments to the balance sheet data for the corporate sector presented in Tables S.5 and S.6. The following stylized balance sheet for the US corporate sector is useful for organizing our discussion of these adjustments. Recall that this balance sheet is an aggregate of both US firms with overseas subsidiaries (i.e., the parent firm is in the US) and US resident subsidiaries of foreign multinationals.

Corporate Sector Balance Sheet

Assets	Liabilities
Non-financial assets	Equity
(replacement or enterprise value)	(measured at market value)
Financial assets	Financial liabilities
(includes US FDI in ROW)	(debt, bank loans, etc., including ROW FDI in US)

Our specific aim is to value the non-financial assets held by US resident corporations, corresponding to the first entry in the left column of this balance sheet. We consider two measures of this value. The first of these is a measure of the *replacement value* of these non-financial assets. This measure corresponds to the variable K_t in our model. The second is a measure of what we term the *enterprise value* of these non-financial assets.[22] This measure corresponds to the variable V_t in our model. We describe these two measures in turn. In the appendix, we describe in detail the series that we use in our analysis of flows and positions

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[21]This measure is also known as *free cash flow*.

[22]Our measurement concept for the value of corporations is roughly similar to the concept of *enterprise value* used as a valuation benchmark for individual companies.

in the US corporate sector.

In Tables S.5 and S.6, the non-financial assets of the corporate sector are measured at replacement cost, using a perpetual inventory method to cumulate investment with the valuation of investment done using an investment price deflator.[23] We use this as our empirical counterpart to K_t in the model.

We measure the value that financial markets attach to corporate non-financial assets located in the United States, both measured and unmeasured, as the sum of the market value of resident corporations' equities plus the value of their financial liabilities (both on the right side of the balance sheet above) less the value of financial assets on the left side of this balance sheet.[24] We refer to this estimate of value as the *enterprise value* of the US corporate sector.[25]

The financial assets of these firms, listed as the second entry on the left side of this balance sheet, include the usual financial instruments as well as the debt and equity components of US parent firms' foreign direct investment abroad. The financial liabilities of these firms, listed as the second item on the right side of this balance sheet, include the usual financial instruments plus the debt and equity components of the direct investment of foreign parent firms into their US subsidiaries. Note that excluding US FDI in the rest of the world from enterprise value but including rest of world FDI into the United States accomplishes two things: (i) it ensures we are valuing US resident businesses (see footnote 5), and (ii) it ensures we are excluding financial assets and liabilities from our valuation measure. The equity entry that is the first entry on the right side of this balance sheet is measured by an estimate of the market value of outstanding corporate equities. The market value of the equity component of FDI into the United States is also estimated using US stock market indices.

4.1 Flows and Positions for the US and Foreign Corporate Sectors

We now consider the evolution over time of the data analogs to our key model valuation metrics. We show these metrics first for the United States and then for the main partner of US international financial trade, the European Union.

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[23]This measure also includes accounting for the value of real estate owned by the corporate sector.

[24]Note that it would not be appropriate to equate the value of US-located firms to the value of equity alone, because some fraction of firms' future cash flow is pledged to debt holders and bank lenders, and thus some fraction of firm value is reflected in the value of those liabilities.

[25]We describe the specific series we use in measuring the enterprise value of the US corporate sector in Appendix C.
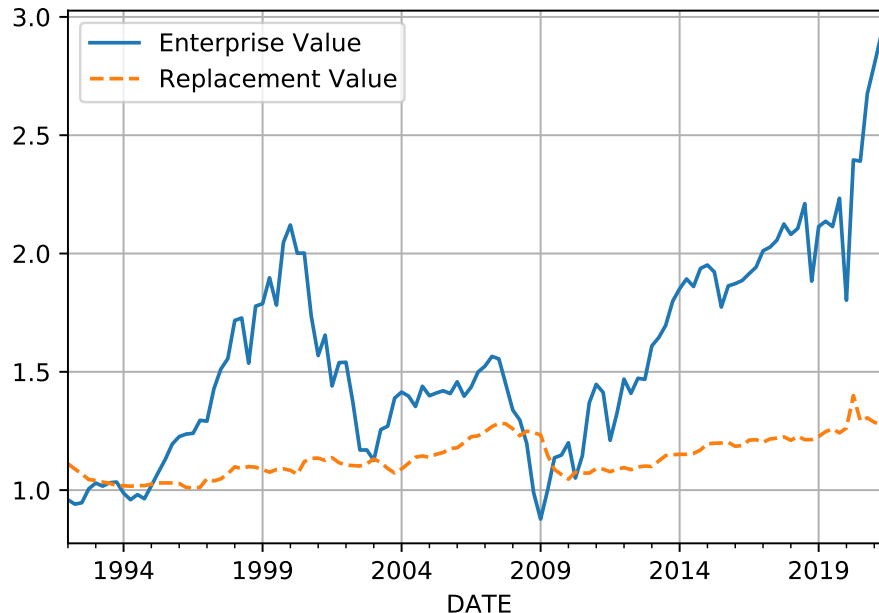
Figure 7: Enterprise and Replacement Values, Ratios to GDP, US Corporate Sector

4.1.1 United States

In Figure 7, the blue solid line shows the data analog of the Buffett indicator, V_t/GDP_t, where V_t is our measure of the *enterprise value* of the non-financial assets of the US corporate sector. The orange dashed line shows our empirical measure of K_t/GDP_t, where K_t is the *replacement value* of the non-financial assets of the US corporate sector.[26] The figure indicates that the capital-output ratio has been quite stable over time, while the enterprise value of US corporations has risen dramatically. A direct implication of the divergence between these two lines is that Tobin's Q for the US corporate sector, V_t/K_{t+1}, has risen substantially over the past decade.

We now consider data on dividend yields corresponding to D_t/V_t in our model. In Figure 8, we construct a measure of the dividend or payout yield for the US corporate sector based on the ratio of the after-tax cash available to pay to investors to our measure of the enterprise value of this sector. What is striking about this figure is that compared with the period before 2007, the ratio of payouts to value has not changed much in recent years.

One immediate implication of Figure 8 is that our measure of dividends relative to GDP must have risen substantially since 2007 to match the increase in the ratio of the enterprise

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[26]We reproduce this figure for the financial business sector and non-financial corporate business sector separately in the Appendix in Figures C.2 and C.3 respectively.
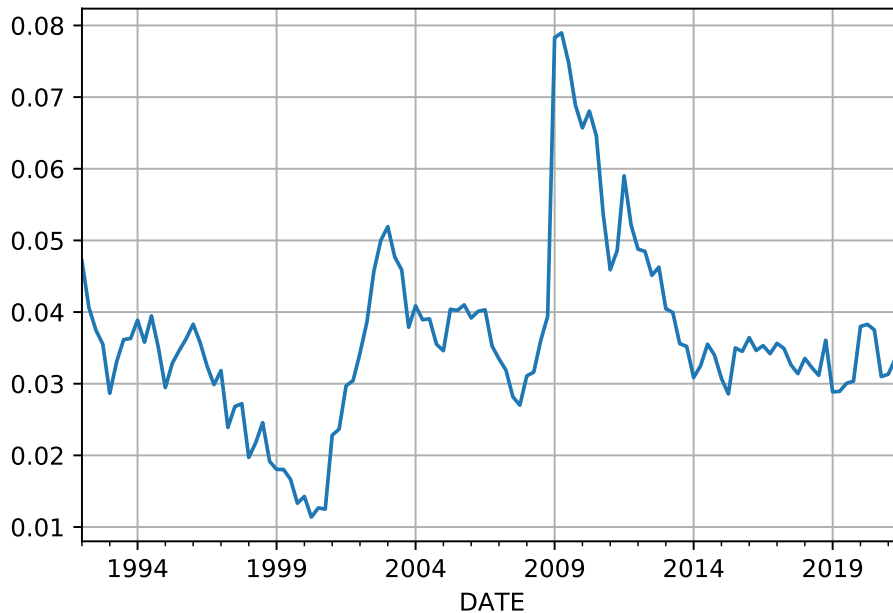
Figure 8: Payouts to Enterprise Value Ratio, US Corporate Sector

value of corporations in the US relative to GDP shown in Figure 7.

In Figure 9, we examine the ratio of this measure of D_t to GDP. We see that compared with the period before 2007, this ratio has indeed risen substantially over the past 14 years. Thus, it appears that a substantial portion of the increase in the ratio of the value of US corporations to GDP can be accounted for by an increase in payouts D_t.

We finally consider data on the price-earnings ratio, corresponding to V_t/E_t in our model. Figure 10 plots the ratio of the enterprise value of US corporations to our measure of their after-tax earnings. The figure shows that the price-earnings ratio has risen substantially over the past decade.

4.1.2 European Union

We now document that the sharp increases in corporate enterprise value and payouts just described are US-specific phenomena and that similar increases have not occurred in the European Union. In Figure 11 we plot, for the period 2002–2020, the ratio of the enterprise value of the corporate sector to GDP in the United States and in the European Union. The figure highlights the divergence between the US and European ratios since the Great Recession, with the US value rising by over 100 percent of GDP relative to its pre Great Recession level, while the European value was essentially constant over the same time span.
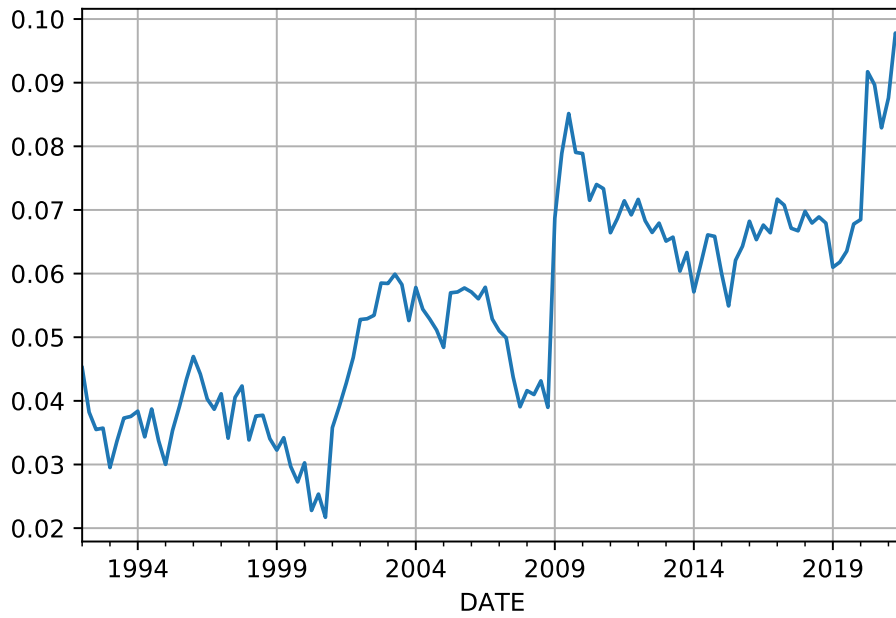
30

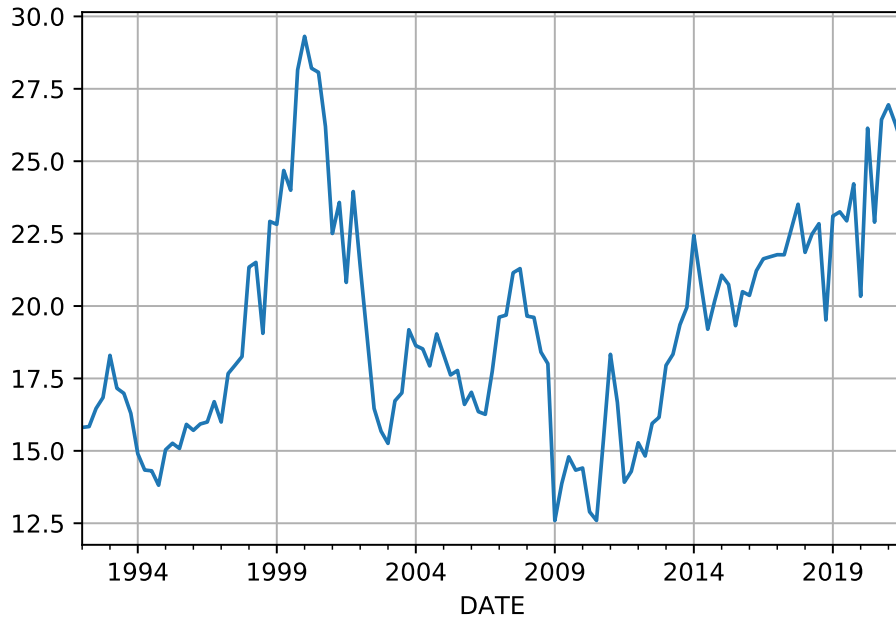Figure 9: US Corporate Sector Payouts, Ratio to US GDP

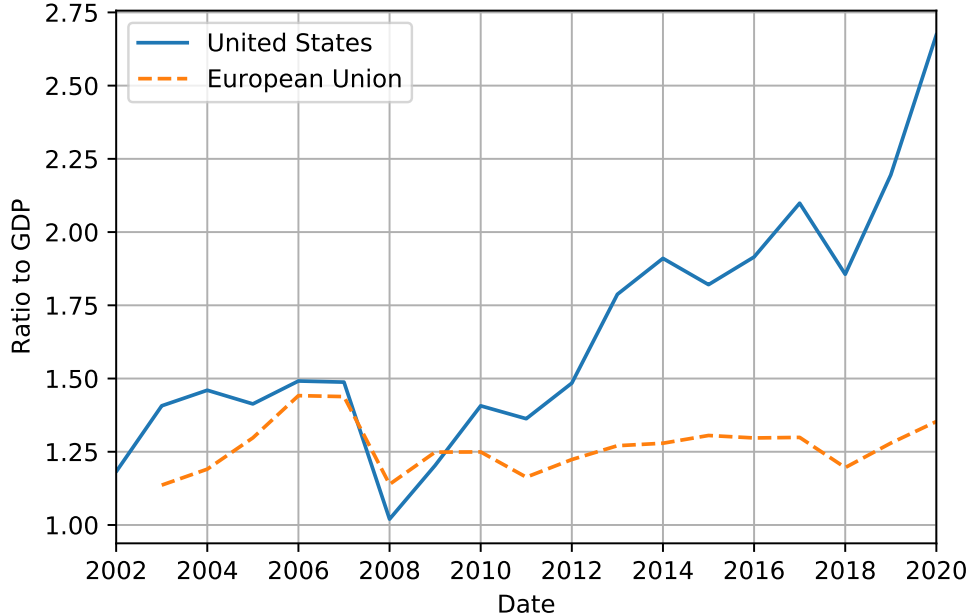Figure 10: Enterprise Value to Earnings Ratio, US Corporate Sector

Figure 11: Corporate Enterprise Value in the United States and the European Union

As documented above in Figures 9 and 8, our main hypothesis is that the large increase in the US corporate enterprise value reflects an increase in the payout rate of the US corporate sector. Figure 12 provides supporting evidence for this hypothesis, showing that the diverging patterns in enterprise value between the United States and the European Union are indeed mirrored by diverging paths in their respective payout ratios, with payouts over the 2007-2020 period increasing in the US but not in the EU. The figure suggests that differential dynamics of payouts are key to explaining the differential behavior of US and European equity markets.[27]

This evidence that outside the United States, firm profits payable to investors have not risen, relative to GDP, is consistent with other studies. See, for example, Lequiller and Blades (2014, Chapter 3), Philippon (2019, Chapter 5), and Gutierrez and Philippon (2020). Gutierrez and Piton (2020) find evidence of labor's share declining much more in the United States than in other advanced economies. However, De Loecker and Eeckhout (2021), using the Worldscope dataset of firm financial statements, argue that markups and profits have risen in Europe as well as in the United States.

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[27]Details on how we constructed data in Figures 11 and 12 are in Appendix D. The appendix also illustrates Buffett ratios and payout ratios constructed for a larger aggregate of US financial partners, including the United Kingdom, Canada and Japan. Results for this aggregate are very similar to those for the European Union alone.
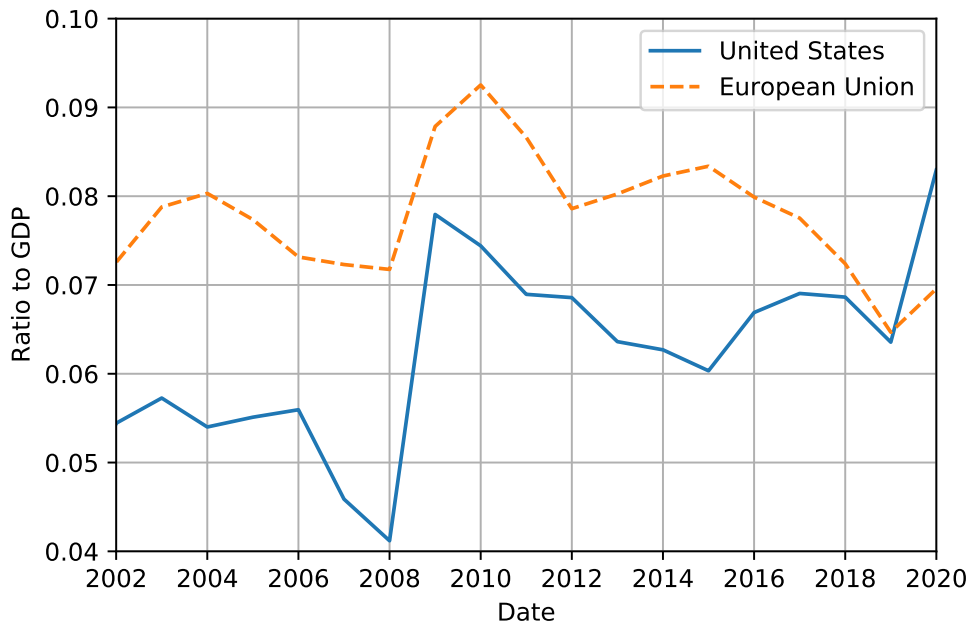
Figure 12: Corporate Payouts in the United States and the European Union

5 Calibration and Results

We first describe our calibration of the pre-shock balanced growth path. We then describe how we engineer a shock to markups to generate a transition to a new balanced growth path with higher US asset values.

The preference parameters are the domestic representative household's risk aversion parameter γ, the domestic and foreign discount rates ρ and $\rho^* = r^*$ (recall that we set $\gamma^* = 0$), and a common labor supply elasticity parameter σ. We set $\gamma = 1$, so domestic household utility is logarithmic in consumption. Given choices for g_Z and r^* described below, we set $\rho = \frac{1+r^*}{1+g_Z} - 1$, so that on the pre-shock balanced growth path, domestic consumption will grow at rate g_Z. We set $\sigma = 2$, implying a Frisch elasticity of labor supply of 0.5.

On the firm side, we normalize pre-shock leader productivity to $z_H = 1$, which implies $z_L = 1/\mu$. We set the depreciation rate to $\delta = 0.1$. Recall that we interpret our model as capturing the corporate sector of the US economy. In order to report model asset values (and the net foreign asset position) relative to total US GDP, we will rescale model output by a constant factor κ. We set $\kappa = 0.58$, which is the average share of corporate sector value added in GDP over the 1992 to 2021 period (see Figure C.1 in the appendix.)[28]

---

[28]We simply assume that total GDP is model output divided by κ. One way to microfound this assumption

This leaves four technology parameters that we calibrate internally: (i) trend labor productivity growth, g_Z, (ii) the world interest rate, r^*, (iii) the markup, μ, and (iv) the technology exponent on capital, α. We set these four parameters to target the four asset valuation ratios discussed above: the Buffett ratio V/Y, the dividend yield D/V, the price-earnings ratio V/E, and the capital to output ratio, K/Y. We identify the pre-shock balanced growth path values for those ratios with their average values in 2007, which is the last year before the Great Recession.[29] These valuation ratios and the implied parameter values are reported in Table 1.

In our baseline experiment, we consider a permanent, unanticipated shock to μ, with no change in any other parameter values. We set the new value for μ so that the model replicates the growth in the Buffett ratio from 2007 to the third quarter of 2021 (the most recent quarter in our sample). Over this period, the Buffett ratio almost doubled, with the value of the corporate sector rising from 152 to 284 percent of US GDP. The model replicates this given a rise in the gross markup from $\mu = 1.012$ to $\hat{\mu} = 1.093$. Recall that we hold fixed the foreign markup, an assumption that is consistent with the absence of any growth in the Buffett indicator for the European Union.

Note that our baseline calibration does not target any of the other valuation metrics for 2021. The shock to markups does not change the model dividend yield, a property that is consistent with the absence of any change in the US dividend yield over this period (see Table 1 or Figure 8 for a longer perspective). The US price-to-earnings ratio did increase between 2007 and 2021, from 20.4 to 25.5. Perhaps surprisingly, the model replicates this increase, notwithstanding a constant dividend yield. To understand why, note that the price-to-(forward)-earnings ratio for investment firms is r^{*-1}, while the ratio for intermediate-good-producing monopolists is $(r^* - g)^{-1}$ (for these firms, there is no distinction between dividends and earnings). An increase in the markup μ shifts aggregate enterprise value toward intermediate-goods firms – which have a high V/E ratio – and away from capital-producing firms – which have a lower V/E ratio – thereby driving up the aggregate price-earnings ratio.

---

is to posit that the economy contains two sectors producing two different goods. The corporate sector corresponds to the sector we model explicitly, and produces corporate output that is traded internationally. The non-corporate sector produces a non-tradable good that enters separably in utility (e.g., housing services and publicly-provided goods). Output of the non-corporate good is an exogenous endowment that grows at rate g_Z.

[29] The four parameter values are identified recursively as follows:

$$g = \frac{\frac{V}{Y}}{\frac{K}{Y}}\left(\frac{1}{\frac{P}{E}} - \frac{D}{P}\right), \qquad r = (1+g)\frac{D}{P} + g,$$

$$\mu = \frac{1}{1 - \left(\left(\frac{V}{\kappa Y} - (1+g)\frac{K}{\kappa Y}\right)\frac{r-g}{1+g}\right)}, \qquad \alpha = \frac{\mu\frac{K}{\kappa Y}}{r+\delta}.$$

34

The rise in markups generates a small decline in the model corporate capital to GDP ratio as firms reduce capital to restrict supply (see 21), while this ratio changed little in the data between 2007 and 2021 (see also Figure 7). Higher markups translate into a large share of corporate income accruing as profits and a smaller share of corporate income going to labor (eq. 8). Profit's share of corporate income rises from 1.2 percent to 8.5 percent, while labor's share declines from 65.3 percent to 60.4.[30] Corporate dividends as a share of total GDP rise from 4.6 percent to 8.6 percent, very much in line with the growth in dividends reported in Figure 9.

Overall, Table 1 indicates that a positive shock to markups can explain most of the key changes in US asset valuation metrics since the Great Recession. Note that one could alternatively generate a boom in the Buffett ratio by contemplating a rise in the valuation multiple $(r^* - g_Z)^{-1}$ used to value future monopoly profits, but such an explanation would be at odds with the lack of evidence of a downward trend in the dividend yield. Thus, rising markups, in the context of this model, must be central to a theory of rising asset values.

There is one more technology parameter to pin down. The new markup is given by $\hat{\mu} = \hat{z}_H/\hat{z}_L$. The model can generate an increase in markups via an increase in z_H, or a decline in z_L, or a range of intermediate alternatives. These different alternatives will have identical implications for all the balanced growth path ratios but different implications for the dynamics of the net foreign asset position and for welfare.[31] We have chosen to scale the new value $\hat{z}_H$ so that equilibrium output between T and $T+1$ grows at the trend productivity growth rate: $Y_{T+1} = (1 + g_Z)Y_T$. This choice is motivated by the absence of any clear divergence between US and European output over this period (see Panel A of Figure D.2 in the Appendix). This requires setting $\hat{z}_H = (\hat{\mu}/\mu)^{\alpha + \frac{1-\alpha}{1+\sigma}} z_H$.

In terms of initial asset portfolios, we set the initial value for B_t to deliver a net foreign asset position equal to negative 5.2 percent of US GDP, which is the 2007 value. We assume a symmetric initial net equity position, so $\lambda^* = 1 - \lambda$.

Figure 13 shows foreign holdings of equity in the US corporate sector, measured as rest of world portfolio holdings of US corporate equities plus FDI equity, relative to our estimate of the enterprise value of the US corporate sector. By this measure, foreign equity ownership of US firms has risen steadily over time. Recall, however, that there are a range of measurement issues associated with measuring cross-border equity positions, as discussed in Section 2. We

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[30]There is a large literature documenting a decline in labor's share of income in recent decades (see, e.g., Figure 3 in Smith et al. 2021). The decline in labor's share that our calibration delivers is consistent with the magnitude of the decline that others have documented, though the decline in labor's share in the data begins around 2001.

[31]One might interpret a fall in z_L with no change in z_H as a pure shock to the markup μ that leaves productivity (of producing firms) unchanged, while a parallel proportional increase in z_H and z_L can be interpreted as a pure shock to productivity that leaves the markup unchanged.

Parameters to Match Valuations:

$$\alpha = 0.340, g_Z = 0.0226, r^* = 0.0534, \mu = 1.0118, \hat{\mu} = 1.0932$$

Valuation Metrics	2007 Model = Data	2021:3 Data	2021:3 Model
V/GDP	$1.523^{\dagger}$	$2.843^{\dagger}$	2.843
D/V	$0.030^{\dagger}$	0.033	0.030
V/E	$20.44^{\dagger}$	25.53	25.35
K/GDP	$1.269^{\dagger}$	1.291	1.175

Other Parameters:

Preferences	Technology
$\rho = \frac{1+r^*}{1+g_Z} - 1 = 0.030, \ \rho^* = r^*$	$\delta = 0.10$
$\gamma = 1, \ \gamma^* = 0$	$\kappa = 0.58$
$\sigma = \sigma^* = 2$	$\lambda^* = 0.3$

Table 1: Parameter Values. Targeted valuation metrics are denoted with a †

will therefore report results for a wide range of possible values for λ. But as a baseline we set $\lambda^* = 1 - \lambda = 0.3$, so that foreign households hold 30 percent of domestic equity.
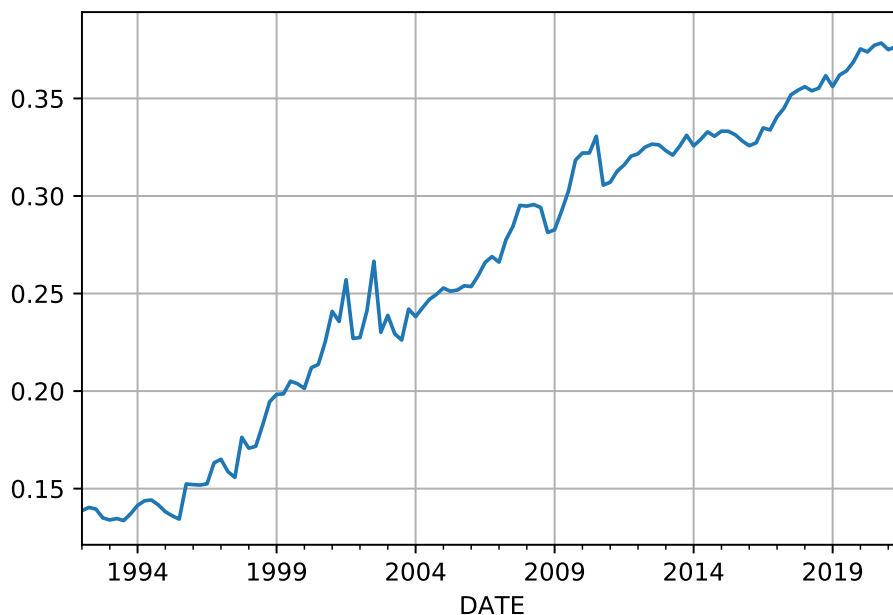

Figure 13: ROW Portfolio and Direct Investment Equity in the US, Share of US Corporate Enterprise Value

5.1 Results

First, we explore how the shock changes the net foreign asset position. From eqs. (23) and (24), the change in the NFA position between $T-1$ (pre shock) and T (post shock) is

$$NFA_T - NFA_{T-1} = CA_T + \lambda^* \Delta V_T^* - (1-\lambda)\Delta V_T,$$

where $\Delta V_T^* = V_T^* - V_{T-1}^*$ reflects the revaluation of foreign assets at T and $\Delta V_T = V_T - V_{T-1}$ is the revaluation of domestic assets. If we iterate backward to a date 0 far in the past, the NFA position at T reflects the sum of past current accounts and valuation effects:

$$
\begin{aligned}
NFA_T &= \sum_1^T CA_t + \lambda^* \sum_1^T \Delta V_t^* - (1-\lambda)\sum_1^T \Delta V_t + NFA_0 \\
&= (B_{T+1} - B_1) + \lambda^* (V_T^* - V_0^*) - (1-\lambda)(V_T - V_0) + NFA_0
\end{aligned}
$$

Our focus is on the change in the NFA to GDP ratio, which we decompose as[32]

$$
\frac{NFA_T}{GDP_T} - \frac{NFA_{T-1}}{GDP_{T-1}} = \underbrace{\frac{B_{T+1}}{GDP_T} - \frac{B_T}{GDP_{T-1}}}_{\text{current account}} + \lambda^* \underbrace{\left(\frac{V_T^*}{GDP_T} - \frac{V_{T-1}^*}{GDP_{T-1}}\right)}_{\text{foreign asset revaluation}} - (1-\lambda)\underbrace{\left(\frac{V_T}{GDP_T} - \frac{V_{T-1}}{GDP_{T-1}}\right)}_{\text{foreign liability revaluation}}
$$

$$(27)$$

Figure 14 shows that the model predicts large changes in the net foreign asset position. When $\lambda^* = 1 - \lambda = 0.3$, the decline in the net foreign asset to GDP ratio is 33.9 percent. This decline comprises a 39.6 percent decline driven by revaluation of US liabilities, which is partially offset by a +5.7 percent current account surplus. Recall that our calibration targeted a balanced growth path rise in US asset values equal to 132 percent of US GDP. When $\lambda = 0.7$, this implies an increase in the liabilities to GDP ratio of $-(1-\lambda)(V_T/GDP_T - V_{T-1}/GDP_{T-1}) = -0.3 \times 1.32 = -0.396$.[33]

---

[32]More precisely,

$$
\begin{aligned}
&\frac{NFA_T}{GDP_T} - \frac{NFA_{T-1}}{GDP_{T-1}} \\
&= \left(\frac{B_{T+1} - B_1}{GDP_T} - \frac{B_T - B_1}{GDP_{T-1}}\right) + \lambda^* \left(\frac{V_T^* - V_0^*}{GDP_T} - \frac{V_{T-1}^* - V_0^*}{GDP_{T-1}}\right) - (1-\lambda)\left(\frac{V_T - V_0}{GDP_T} - \frac{V_{T-1} - V_0}{GDP_{T-1}}\right) + \\
&\frac{NFA_0}{GDP_T} - \frac{NFA_0}{GDP_{T-1}}.
\end{aligned}
$$

But when either (i) $GDP_{T-1} = GDP_T$ or (ii) B_1/GDP_T, V_0^*/GDP_T and V_0/GDP_T are very small, this decomposition simplifies to the one in the text. Note that the decomposition plotted in Figure 2 is identical to the one presented here.

[33]Our calibration targets the change in this ratio from the initial to the final balanced growth path. As we
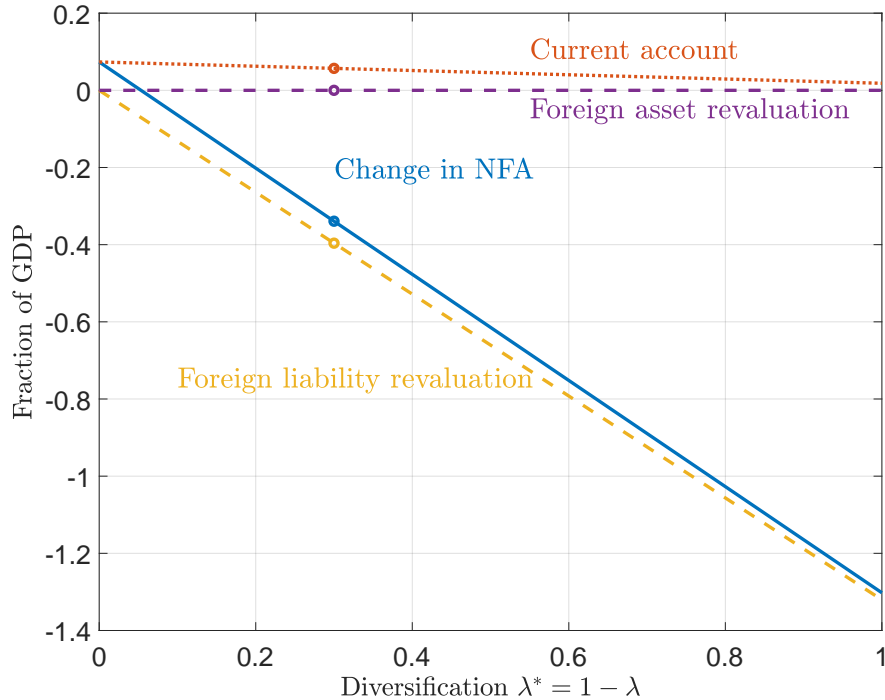
Figure 14: Change in US Net Foreign Assets to GDP

Table 2 compares the response of the net foreign asset position in the model to the response documented for the US economy in Figures 1 and 2. The size of the revaluation effect in the model is similar to the one observed in the data. The model predicts an improvement in the current account in response to the markup shock, and that prediction is directionally consistent with observed dynamics: the US current account deficit narrowed quite substantially following the Great Recession (see Figure H.1). However, the model does not explain why the US runs persistent current account deficits, an important question since at least Lucas (1990). Those persistent deficits in the data have dragged down the US NFA position over time, and as a result, the markup model underpredicts the observed fall in the NFA to GDP ratio.

The model current account surplus reflects a decline in domestic investment at date T,

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have discussed, while the shock is announced at T, markups do not actually change until $T+1$, so it is not immediate that the ratio V_T/GDP_T is equal to the new balanced growth path value. However, recall that we set the post-shock value for leader firm productivity $\hat{z}_H$ so that equilibrium model output grows at the new balanced growth path rate $\hat{g}_Z$ between T and $T+1$. Asset values (ex dividend) jump to their new BGP values at T and thus also grow at rate $\hat{g}_Z$ between T and $T+1$. It follows that $V_T/GDP_T = V_{T+1}/GDP_{T+1}$, which is the new BGP value.

	Δ NFA/GDP	Curr. Acc.	Net Reval.	Stat Disc.
Data	-59.6	-15.0	-46.3	1.3
Markup Model	-33.9	+5.7	-39.6	0
Unmeasured K	-130.2	-90.6	-39.6	0

Table 2: Summary NFA Dynamics: Data, baseline markups model and alternative unmeasured capital economy. Components correspond to those in equation (27). Data changes correspond to those shown in Figure 2 for 2021Q3 minus the average values for 2007. Model responses are for $\lambda^* = 0.3$.

because higher domestic markups depress the equilibrium capital stock. When domestic capital is domestically owned, domestic households sell capital and accumulate bonds, translating into a current account surplus. As λ^* is increased, this portfolio rebalancing channel weakens, and the current account surplus shrinks (see Figure 14).[34]

The size of the predicted net foreign asset decline is very sensitive to the degree of diversification λ^*. When $\lambda^* = 0$, so that stocks are wholly domestically owned, the NFA position actually improves slightly. When there is no diversification, there are no valuation effects, so this change entirely reflects the current account surplus at date T. As λ^* is increased, the decline in the US net foreign asset position rises. The logic is that when a larger share of US equity is foreign owned, the same increase in US asset values translates into a larger increase in the value of US foreign liabilities.

Figure 15 plots the response of domestic consumption to the shock and illustrates how this response varies with diversification. The blue line plots consumption at date T relative to consumption in a no-shock counterfactual, while the red line plots the same object at $T + 1$.[35] We plot both because our utility function is non-separable between consumption and hours worked, and hours worked do not respond to the shock until $T + 1$, which is when markups actually change. The key message from the plot is that while domestic consumption increases when there is zero diversification, the same shock – with the same impact on equilibrium output and factor prices – leads to consumption declines for high levels of diversification. The reason is that higher domestic markups reshuffle domestic output from workers to shareholders. When shareholders and workers are the same people ($\lambda^* = 1$), this reshuffling does not impact domestic consumption. But when diversification is quite extensive, higher markups essentially reshuffle output from domestic workers to foreign

---

[34]Note that when domestic households hold only foreign assets, the shock still triggers a small current account surplus. The reason is that domestic households anticipate that labor earnings at T are higher than they will be at $T + 1$, so they want to increase savings a little bit in order to smooth consumption.

[35]Here we plot the percentage change in model consumption. Recall that this should be interpreted as consumption of output produced in the corporate sector. We have not modeled the impact of a shock to markups in the corporate sector on output and consumption in the non-corporate sector.
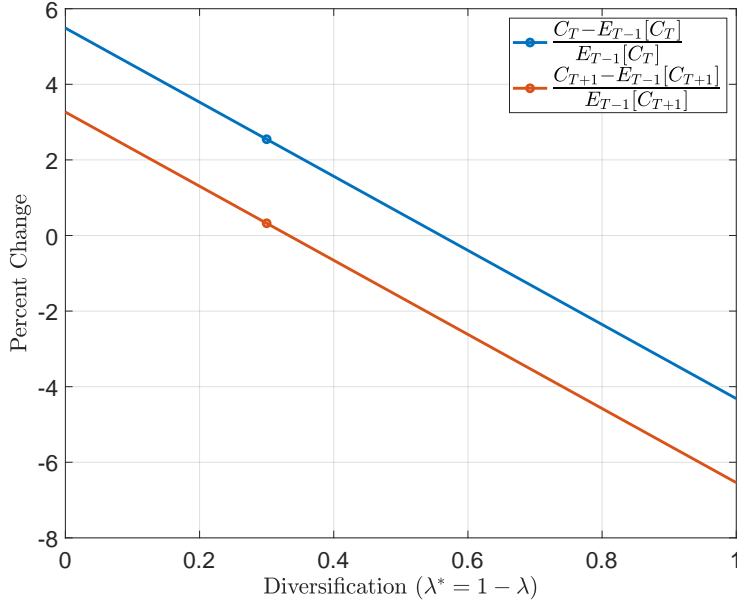
Figure 15: Change in US Consumption

shareholders, thus reducing domestic consumption. More precisely, one can show (using eq. 26) that the change in consumption at $T+1$ is approximately equal to the equilibrium change, relative to the no-shock scenario, in the value of labor earnings plus domestic households' shares of domestic and foreign profit income. When $\lambda^* = 0$, this change is positive, since higher post-shock domestic profits more than compensate for lower labor earnings. But as λ^* is increased, this change becomes first smaller and then negative.[36]

Finally, we turn to the welfare effects of the rise in US asset values. Let ω denote the percentage amount by which a planner would need to permanently increase the argument of period utility in the economy with the original values for μ, so that a domestic household is indifferent between living in that economy and learning at date T that markups will increase to $\hat{\mu}$. In our economy, given logarithmic utility, ω is given by

$$\log(1 + \omega) = \log\left(\frac{\hat{C}_T - \hat{Z}_T \frac{\hat{L}_T^{1+\sigma}}{1+\sigma}}{C_T - Z_T \frac{L_T^{1+\sigma}}{1+\sigma}}\right),$$

where $\hat{C}_T$ and $\hat{L}_T$ denote consumption and labor supply at date T under the shock scenario

---

[36]Why do income and consumption increase in response to the shock when $\lambda^* = 0$? Recall that in our calibration, the shock does not change the level of domestic output. However, labor earnings plus profit income account for a larger share of output when μ goes up – that share is $1 - \alpha/\mu$.

and C_T and L_T denote their counterparts under the no shock scenario. Note that given our timing assumption, $\hat{Z}_T = Z_T$ and $\hat{L}_T = L_T$. The welfare expression captures how the shock changes flow utility at date T, and this effect is summarized by the impact on consumption. Thus, the higher is diversification, the less favorable are the welfare effects of the shock. And the effect is quantitatively large: welfare rises by 7.8 percent of consumption when $\lambda^* = 0$, but by only 3.6 percent when $\lambda^* = 0.3$. These smaller welfare gains directly mirror the smaller consumption increases plotted in Figure 15.

6   Unmeasured Capital Model

An alternative theory of rising US asset values is that they reflect rising investment in forms of productive capital that are not measured in the national accounts. Under such a theory, the observed increase in the enterprise value of US corporations has resulted from firms' response to a change in the production function, which has caused them to be more intensive in new forms of capital that are not well captured in our current accounting frameworks.

We now describe such a model with unmeasured capital. Output is produced with two types of capital. One type of capital investment is measured, while the other is not. This is a competitive model in which markups are always equal to zero. True corporate output is given by

$$Y_t = A_t K_{Ut}^{(1-v)} \left(K_{Mt}^{\alpha}(Z_t L_t)^{1-\alpha} \right)^v, \tag{28}$$

where K_{Mt} and K_{Ut} denote installed measured and unmeasured capital stocks, and $1 - v$ is the share of income flowing to unmeasured capital. The resource constraint for this economy is

$$C_t + I_{Mt} + I_{Ut} + NX_t = Y_t,$$

where I_{Mt} and I_{Ut} denote investments in measured and unmeasured capital, and where investments augment the corresponding capital stocks in the usual way.

$$
\begin{aligned}
K_{M,t+1} &= (1 - \delta_M)K_{Mt} + I_{Mt}, \\
K_{U,t+1} &= (1 - \delta_U)K_{Ut} + I_{Ut}.
\end{aligned}
$$

Note that under current accounting standards, expenditures on unmeasured investment I_{Ut} are recorded as expenditures by firms on intermediate inputs rather than final investment expenditures. Thus, measured final expenditures and gross value added satisfy

$$C_t + I_{Mt} + NX_t = Y_{Mt} = Y_t - I_{Ut},$$

where Y_{Mt} is measured gross value added.

Investment firms hold both types of capital and make investment decisions to maximize the present value of dividends:

$$\max_{\{K_{M,t+1},K_{U,t+1}\}_0^\infty} \left\{ D_0 + \sum_{t=1}^\infty \frac{D_t}{\Pi_{j=1}^t(1+r_j^*)} \right\}$$

where

$$D_t = R_{Mt}K_{Mt} + (1-\delta_M)K_{Mt} - K_{M,t+1} + R_{Ut}K_{Ut} + (1-\delta_U)K_{Ut} - K_{U,t+1}.$$

Interior solutions to this problem require

$$R_{Mt} - \delta_M = r^*, \tag{29}$$
$$R_{Ut} - \delta_U = r^*. \tag{30}$$

Competitive firms rent both types of capital and labor and produce gross output Y_t given the production function (28). The first order conditions for those firms are

$$R_{Mt} = v\alpha\frac{Y_t}{K_{Mt}}, \tag{31}$$
$$R_{Ut} = (1-v)\frac{Y_t}{K_{Ut}}, \tag{32}$$
$$W_t = v(1-\alpha)\frac{Y_t}{L_t}. \tag{33}$$

Households in this economy are identical to those in our baseline economy, implying the same first order condition for labor supply (13). Equations (29), (30), (13) and (31), (32), (33) can be combined to solve in closed form for K_{Mt}, K_{Lt}, L_t, R_{Mt}, R_{Ut}, and W_t. In particular, $R_{Mt} = r^* + \delta_M$ and $R_{Ut} = r^* + \delta_U$.

Because there are no monopoly profits nor any investment adjustment costs in this model, the same argument that delivers the result that Tobin's Q should be one in a standard model delivers the result that the enterprise value of firms in this economy is the total value of both types of capital that these firms hold:

$$V_t = K_{M,t+1} + K_{U,t+1}.$$

This economy has a balanced growth path, along which both types of capital stock, output, consumption and wages grow at the rate g_Z, while rental rates and hours worked are

constant.

6.1 Comparing Balanced Growth Paths

Along the balanced growth path, this unmeasured capital model is isomorphic to the economy with markups in terms of its implications for key macroeconomic ratios and asset pricing benchmarks.

Proposition 1 *Consider the implications of the model with markups and those of the model with unmeasured capital for the ratios of labor income to measured output, measured investment to measured output, measured capital to measured output, the Buffett indicator, Tobin's Q, dividend yields, and earnings yields. Assume that these two models are calibrated to the same values of r^*, g_Z, δ_M and α. Let δ_U in the unmeasured capital model be given separately. Then, these two models have the same implications for these key macroeconomic and asset pricing ratios on a balanced growth path if the markup μ in the markup economy and the share of unmeasured capital in the production function υ in the unmeasured capital economy are related by*

$$\frac{1}{\mu} = \frac{\upsilon}{1 - \left(\frac{g_Z + \delta_M}{\delta_U + r^*}\right)(1 - \upsilon)}. \tag{34}$$

Corollary 2 *Changes in balanced growth path macroeconomic and asset valuation ratios in the economy with markups that follow from shocks to r^*, g_Z, and μ can be perfectly replicated by the same shocks to r^*, g_Z and the corresponding shock to υ given from equation 34 in the economy with unmeasured capital.*

This proposition is proved by direct comparison of formulas for these macroeconomic ratios and asset pricing implications. See Appendix I for details.

6.2 Comparing Transitions

While the markup economy and the unmeasured capital economy are observationally equivalent in terms of their implications for key macroeconomic and asset pricing ratios along a balanced growth path, the two economies exhibit different dynamics in response to shocks to μ or υ, respectively. We now compare the implications of these two models for the transition from one balanced growth path to another.

In our model experiments, we assume that the model economy in each case is on a balanced growth path for all periods $t < T$ with given values of either μ or υ. In period $t = T$, news arrives that the parameters $\hat{\mu}$ and $\hat{\upsilon}$ in the two alternative economies will take

on new values starting at $T + 1$. Because this is effectively a small open economy, these economies immediately reach new balanced growth paths in period $T + 1$.

We assume that the parameters on the old and new balanced growth paths satisfy equation (34) so that these two economies have the same implications for our key macroeconomic and asset valuation ratios on the old and new balanced growth paths. We also assume that these economies share the same paths for labor augmenting technical change Z_t for all dates t, and we assume that productivity parameters z_H, $\hat{z}_H$, A, and $\hat{A}$ are chosen so that the levels of measured output Y_{Mt} for these two model economies are identical in all periods $t < T$ and $t \geq T + 1$. We also assume that the two economies share the same value for domestic bond holdings B_T entering the period of the shock.

One can show that under these assumptions, these two model economies share the same time paths for wages W_t, labor supply L_t, measured investment I_{Mt}, and asset values V_t in the domestic economy for all dates t, including the transition date $t = T$. The only observables for which the two models differ are measured output at T, Y_{MT}, the trade balance at T, NX_{MT}, the bond and NFA positions, B_{t+1} and NFA_t for all dates $t \geq T$, and the path for consumption C_t from date T onward.

In particular, in the unmeasured capital economy, the domestic economy sees a collapse in measured output at T. In fact, measured model output goes negative! True output does not fall, but anticipating a higher production weight on unmeasured capital from $T + 1$ onward, domestic firms undertake huge unmeasured investments at T. In the national accounts these are (inappropriately) recorded as huge purchases of intermediate inputs, which drastically reduce measured value added. To the extent that domestic households own domestic firms, they must finance these investments, implying a huge current account deficit at date T. When $\lambda^* = 0.3$, the current account deficit at T is 91 percent of expected GDP at T.[37] Note that this is approximately equal to λ times the increase in the balanced growth path capital to output ratio: $0.7 \times 1.32 = 0.92$. Consumption from date T onward is lower than in the markup economy because this larger debt implies larger interest payments for domestic households.

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[37]We measure this relative to expected GDP at T because actual measured GDP at T is negative.
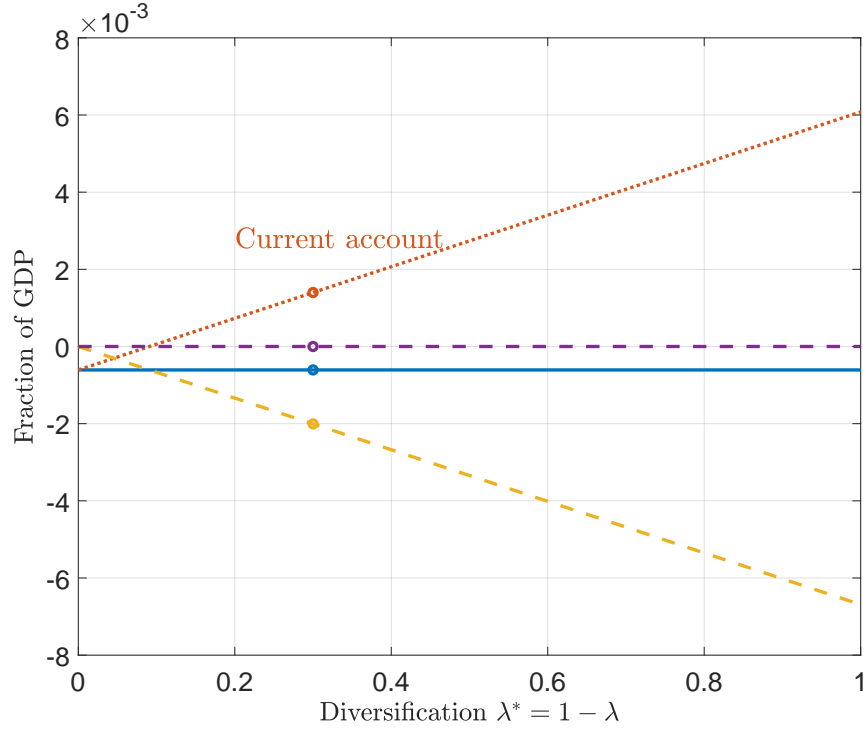
Figure 16: Change in US Net Foreign Assets to GDP, Unmeasured Capital Economy

Figure 16 displays the change in the net foreign asset position at date T in the unmeasured capital economy. This figure should be compared with Figure 14 to see the different implications of this model compared with the model with a shock to markups.

To better understand these plots, we combine equations (23) and (24) to express the change in the net foreign asset position at T as

$$
\begin{aligned}
NFA_T - NFA_{T-1} & = NX_T + r^* B_T - (1 - \lambda) D_T + \lambda^* D_T^* \\
& \quad - (1 - \lambda)(V_T - V_{T-1}) + \lambda^* (V_T^* - V_{T-1}^*).
\end{aligned}
$$

Without the arrival of news at T, the values of domestic and foreign firms at T would have been $\tilde{V}_T = (1 + g_Z) V_{T-1}$ and $\tilde{V}_T = (1 + g_Z) V_{T-1}^*$, with associated values for dividends $\tilde{D}_T = (r^* - g_Z) V_{T-1}$ and $\tilde{D}_T^* = (r^* - g_Z) V_{T-1}^*$. We can subtract and add $(1 - \lambda)\left(\tilde{V}_T + \tilde{D}_T\right) = (1 - \lambda) r^* V_{T-1}$ and $\lambda^* \left(\tilde{V}_T^* + \tilde{D}_T^*\right) = \lambda^* r^* V_{T-1}^*$ from the right side of the above expression to

45

get

$$NFA_T - NFA_{T-1} = NX_T + \underbrace{r^*}_{\text{expected return from } T-1 \text{ to } T} \times \underbrace{NFA_{T-1}}_{\text{wealth at } T}$$

$$- \underbrace{\left[\frac{D_T + V_T}{V_{T-1}} - (1 + r^*)\right]}_{\text{excess return on domestic equity}} \times \underbrace{(1 - \lambda)V_{T-1}}_{\text{foreign holdings of domestic equity}}$$

$$+ \underbrace{\left[\frac{D_T^* + V_T^*}{V_{T-1}^*} - (1 + r^*)\right]}_{\text{excess return on foreign equity}} \times \underbrace{\lambda^* V_{T-1}^*}_{\text{US holdings of foreign equity}} \quad .$$

The first line represents the sum of the trade balance and expected net factor income at T given an expected rate of return r^* on wealth carried out of period $T - 1$. The second line captures unexpected excess returns on domestic equity earned by foreign shareholders, while the third line captures excess returns earned by domestic residents on their equity abroad. This decomposition offers an illuminating comparison across the baseline "markup" and alternative "unmeasured capital" economies.

Note first that bond holdings B_T and corporate valuations V_{T-1} and V_{T-1}^*, together with the old rate of return r^*, are predetermined and identical across the two models. Instead, all differences in the models' implications for the change in net foreign assets center on the impact of a shock on net exports in the first line and unexpected capital gains or losses in the second.

In the model with markups, the news shock at T generates a large excess return to domestic equity, which drastically depresses the domestic net foreign asset position. The shock has very little impact on net exports.

In contrast, in the model with unmeasured capital, the news shock produces no unexpected excess returns. Because the shock generates no unexpected excess returns, the extent of diversification λ is irrelevant for the impact of the shock on consumption, welfare, and the net foreign asset position (see Figure 16). The only respect in which the portfolio position matters is in determining whether the decline in the net foreign asset position reflects a current account deficit or an increase in the value of foreign liabilities. When domestic stocks are entirely domestically owned, the decline in the NFA position wholly reflects the current account. As λ^* is increased, the current account response is reduced, but the rise in the value of domestic liabilities implies an identical net foreign asset decline.[38]

To sum up, while the two models we have considered are indistinguishable along a bal-

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[38]Note that valuation effects are perfectly consistent with the absence of excess returns. The model-measured upward revaluation of liabilities is simply offset in the return calculation by very negative cash flows to foreign investors D_T at the date of the shock.

anced growth path, they exhibit very different transitions in response to a shock that increases asset values. The transition in response to a rise in markups features a rise in US liabilities that reflects a period of unanticipated excess returns to US firms. The shock induces relatively small responses in investment and net exports. In contrast, an increase in the importance of unmeasured capital generates a transition in which the rise in US equity values reflects a surge in unmeasured investment, with no excess returns. While this unmeasured investment is not measured directly, it shows up indirectly in the form of a period of low or negative measured output and a current account deficit that is 90 percent of GDP (see Table 2). That massively exceeds the observed cumulative current account deficit since 2007 (see Figure H.1).

To what extent are these large current account deficits an artifact of our having assumed that households in the rest of the world are risk neutral? In Appendix J we consider a version of the model in which both model regions have identical logarithmic preferences. In that specification, when the share of unmeasured capital in the United States rises, US current account deficits are smaller, since both countries now finance the rise in desired investment. However, current account deficits remain much larger than those observed in the data. Moreover, an additional counter-factual prediction emerges, which is that the world interest rate rises and remains elevated as unmeasured capital investment surges.

We conclude that while rising unmeasured capital might be a factor behind the rise in US asset values over the past decade, it is unlikely to be the dominant factor. In contrast, the rising markups story appears broadly consistent with the dynamics of all standard macroeconomic aggregates.

6.3   Incorporating Terms of Trade Effects

In the economies described above, the outputs produced by domestic and foreign firms are perfect substitutes. How would things change if domestic and foreign goods were imperfectly substitutable? If that were the case, a rise in markups for US firms could affect the terms of trade. In particular, in the pure markup scenario in which higher markups reflect a decline in z_L, US leader firms reduce production when they gain pricing power. When domestic and foreign outputs are imperfectly substitutable, the equilibrium terms of trade will then move in favor of the US, ameliorating the negative welfare consequences for Americans. However, if higher markups reflect a combination of changes to z_H and z_L such that the equilibrium level of US output is unaffected (our calibration assumption), then the terms of trade will not move, and the positive and normative impacts of higher markups will be exactly as in our baseline one-good model. We prove this result formally in Appendix K.

7 Conclusions

We have shown that the US net foreign asset position declined sharply between 2007 and 2021. This decline primarily reflects a very large increase in the value of foreign holdings of US corporate assets, which in turn reflects a sharp and US-focused run up in equity values. We have considered two alternative theories for this rise in equity values. In both theories, higher asset values capitalize higher expected cashflows from US businesses. In our preferred model, higher cashflows reflect an unexpected rise in the profitability of the US corporate sector, which reduces the share of value added going to labor and capital and increases the share going to the owners of monopolistically competitive firms. That model replicates a near doubling in corporate asset values relative to GDP when corporate monopoly rents rise permanently by 4.3 percent of GDP. Given that foreigners own around 30 percent of the US corporate sector, this rise in markups translates to a permanent additional flow of income abroad of 1.3 percent of US GDP, which is a pure windfall gain to foreign investors. Thus, the welfare costs of a rise in market power are much larger in an economy featuring realistic international financial diversification than they would be in a financially closed economy.

We also considered an alternative theory for the rise in US asset values, according to which they reflect massive unmeasured investment by US firms. Under this alternative interpretation, there are no windfall gains to foreign investors: higher US asset values simply reflect higher investment, and higher future cashflows reflect a normal return to the shareholders who financed the investment. However this alternative theory implies that in order to finance very large unmeasured investment, the United States should have been running a current account deficit an order of magnitude larger than the observed one.

Our quantitative analysis is designed to offer a simple framework for thinking through the positive and normative implications for alternative drivers of rising US asset values in an open economy. There are many possible directions in which one can extend our work.

First, one could consider a richer set of models for rising US asset values. By considering a larger set of countries and longer time series, one could bring more evidence to bear to differentiate between alternative theories.

Second, our model does not explicitly analyze the international diversification decision but rather imposes the level of diversification observed in the data. In the context of a stochastic environment in which agents understand that the world is subject to country-specific shocks that generate country-specific fluctuations in asset values, transfers from the United States to the rest of the world may be the result of a portfolio decision engineered to achieve international risk sharing (see, for example, Heathcote and Perri 2013 or Gourinchas, Rey, and Govillot 2017). It would be interesting to assess whether transfers of the size we

highlighted could be consistent with international risk sharing agreements.

Third, we do not incorporate valuation effects stemming from exchange rate changes. In earlier valuation episodes, the exchange rate played an important role, so it would instructive to consider models that can speak to those large exchange rate movements.

Finally, we abstracted from the impact of rising asset values on the distribution of welfare across different agents within the United States. The ex-ante welfare costs of an increase in markups are likely smaller in our framework than they would be in a model that incorporated within-country heterogeneity in capital ownership.

However, we do not believe that any of these possible model extensions would change our central result: that the welfare costs to Americans from an increase in the profitability of US firms have become much larger now that foreigners own a large share of US equity.

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A Appendix (Not For Publication)

We use data from the following quarterly version of tables in the Z1 release dated March 2021:

- Table S.1 *Selected Aggregates for Total Economy and Sectors* of the Integrated Macroeconomic Accounts

- Table S.5 *Non Financial Corporate Business* sector of the Integrated Macroeconomic Accounts

- Table S.6 *Financial Business* sector of the Integrated Macroeconomic Accounts

- Table S.9 *Rest of World* sector of the Integrated Macroeconomic Accounts

We download data from the Board of Governors Data Download Program. Series identifiers can be found in the "Federal Reserve Statistical Release Z.1. Financial Accounts of the United States." The line numbers reported below refer to the version of that publication dated December 9, 2021, available at https://www.federalreserve.gov/releases/z1/20211209/z1.pdf

The Python code for downloading and constructing our figures is available upon request. We download quarterly nominal GDP from the FRED database at the Federal Reserve Bank of St. Louis (identifier "GDP").

We first describe the series we use to measure the levels of the gross and net foreign asset position for the United States and decomposition of changes in those positions into flows and revaluation effects. We then describe our measures of flows for the corporate sector and valuation of the corporate sector. Finally, we present our measure of the extent of foreign ownership of US equities, including the equity for foreign parent firms in their US subsidiaries.

B Gross and Net Foreign Assets, Flows, and Valuations

Gross and net foreign assets: Data on gross and net foreign assets are taken from Table S.9. The total market value of financial claims of the US on the ROW is given in line 134 of Table S.9 in series FL264194005. The total market value of financial claims of the ROW on the United States (US) is given on line 105 of Table S.9 in series FL264090005. These two series constitute the gross foreign asset positions used in our study, with the NFA position of the US being the difference between the market value of US claims on the ROW and ROW claims on the US, which corresponds to (the negative of) line 158, series FL262090095, in Table S.9.

We take ratios of these and subsequent series relative to nominal GDP (FRED identifier "GDP"). Note that this series for GDP is in billions of dollars, whereas many of the other series are in millions of dollars, so we multiply this series by 1000.

The current account, the capital account, and valuation changes: Using data from Table S.9 we decompose nominal changes in the US net foreign asset position according

to the following accounting identity

$$NFA_t - NFA_{t-1} = \underbrace{CA_t}_{\text{net lending abroad}} + \underbrace{VA_t}_{\text{valuation changes}} + \underbrace{RES_t}_{\text{residual term}} .$$

Table S.9 is presented from the perspective of the rest of the world. We consider flows and net foreign assets from the perspective of the United States. Thus, we typically take the negative of the series noted below. The variables NFA_{t-1} and NFA_t are the end of previous period and end of current period net foreign asset positions of the US computed as Table S.9 line 134 (FL264194005) minus line 105 (FL264090005). The change $NFA_t - NFA_{t-1}$ is reported (with the opposite sign) on line 104 (FC262090095). The current account CA_t corresponding to "net lending abroad" measured from the goods and services flow side is the negative of line 13 (FA265000905). Note that this series is annualized, so we divide the quarterly data by 4. "Valuation changes" VA_t is the negative of line 103 (FR265000005). What we term the "residual term" RES_t is given by the negative of line 70 (FV268090185). Note that line 70 in Table S.9 is called "total other volume changes" and consists of "other volume changes" in line 71 minus the official "statistical discrepancy" in line 72 between net lending abroad measured from the goods and services flow side and from observed net financial flows.

Note that in Table S.9 the following accounting identity holds

$$\underbrace{NFT_t}_{\text{net financial transactions}} = \underbrace{CA_t}_{\text{net lending abroad}} - \underbrace{SD_t}_{\text{statistical discrepancy}}$$

where the left-hand side is "net lending on the financial account" reported in line 69 (FA265000005) and the right-hand side is the sum of line 13 (FA265000905) minus line 72 (FU267005005). Note that line 69 is annualized in quarterly data, just like line 13, so we divide it by 4.

Thus, an alternative decomposition of the cumulated change in the US NFA position is

$$NFA_t - NFA_{t-1} = \underbrace{NFT_t}_{\text{net financial transactions}} + \underbrace{VA_t}_{\text{valuation changes}} + \underbrace{OV_t}_{\text{other volume changes}} ,$$

where "other volume changes" (OV_t) is line 71 (FV268090085) in Table S.9.

Note that these decompositions of cumulated changes in the US net foreign asset position are invariant to measurement issues in the current account relating to the measurement of US exports and factor income as discussed in Guvenen et al. (2021).

The equity component of gross and net foreign assets: We measure the equity component of gross and net foreign assets of the US using the sum of portfolio investments in equity and the equity component of foreign direct investment. The market value of US portfolio equity investment in the ROW is given on line 152 of Table S.9, "corporate equities including foreign investment fund shares" (LM263164100). The market value of ROW portfolio equity investment in the US is given by the sum of lines 125, "corporate equities" (LM263064105), and 126, "mutual fund shares" (LM263064203).

The market value of the equity component of US foreign direct investment in the ROW is given by Table S.9, line 154 (LM263192101), and the market value of the equity component of ROW foreign direct investment in the US is given by Table S.9, line 127 (LM263092101).

We compute market values of non-equity gross and net foreign assets and liabilities as

the difference between the the measures of the total positions and the equity component of those positions as described above.

The corresponding valuation changes of the market valuations of the equity component of portfolio investment and of foreign direct investment are as follows. The revaluation of US portfolio equity investment in the ROW is given on line 99 of Table S.9, "corporate equities," (FR263164100). The revaluation of ROW portfolio equity investment in the US is given by the sum of lines 83, "corporate equities," (FR263064105) and 84, "mutual fund shares," (FR263064203). The revaluation of the equity component of US foreign direct investment abroad is line 100, (FR263192101). The revaluation of the equity component of ROW foreign direct investment in the US is line 85, (FR263092101).

We measure the valuation changes for non-equity assets and liabilities as the difference between the total valuation changes and the valuation changes for the equity assets and liabilities discussed above.

We use a measure of the value of the equity component of foreign direct investment at current cost in several plots. We use the following series for these alternative plots. A valuation of the equity component of US foreign direct investment abroad at current cost is given in series FL263192161 and the current cost valuation of the equity component of ROW foreign direct investment in the US is given in series FL263092161.

C   Measurement of the US Corporate Sector

We now detail exactly which series we use for each entry.

Gross value added The breakdown of gross value added by sector in the Integrated Macroeconomic Accounts is given in Table S.2. Gross value added for the non-financial corporate business sector is given in line 4 of that table (FA106902501) and that for the financial business sector on line 5 (FA796902505). Gross value added for the economy as a whole is given on line 1 of that table in series FA896902505. We compute the fraction of Gross Value Added in the corporate sector as the sum of that in the non-financial corporate business sector and in the financial business sector, all divided by gross value added for the economy as a whole.

In Figure C.1, we show the share of economy-wide gross value added that is produced in the US corporate sector. The model parameter κ is to set equal to the average value for this series over the 1992 to 2021 period.
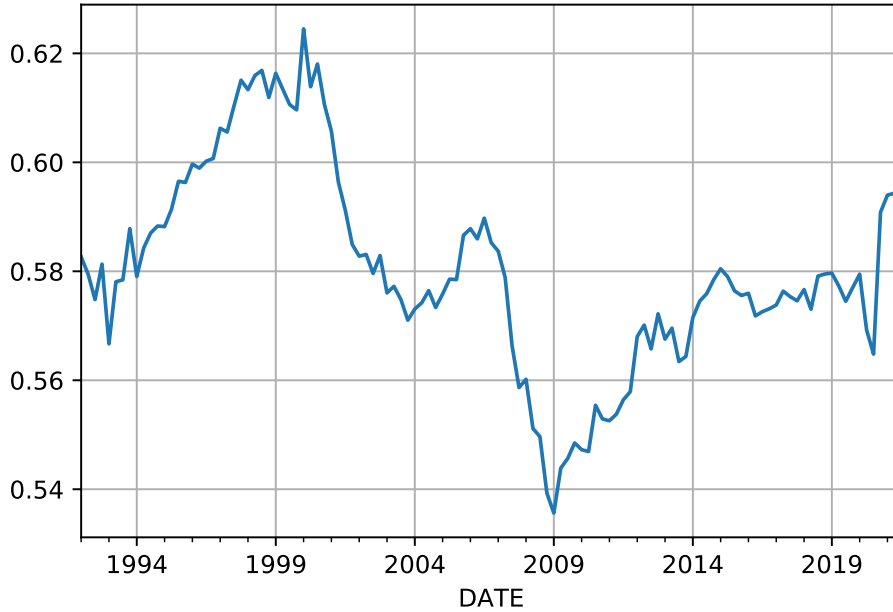
Figure C.1: US Corporate Sector Gross Value Added Share of GDP

Dividends The variable in the model is D_t, which is a comprehensive measure of payouts to investors in the corporate sector from operations. We abstract from taxes in our model, so to make measures of such payouts from the non-financial corporate sector and the financial business sector, we use the following data from Tables S.5 and S.6. For the non-financial corporate business sector, we measure payouts using the following lines from Table S.5: we take operating surplus, net in line 8 (FA106402101) less current taxes on income, wealth, line 21 (FA106220001) less net capital formation in line 28 (FA105050985). For the financial business sector, we measure payouts from the following lines in Table S.6. We take operating surplus, net in line 8 (FA796402101) less current taxes on income, wealth, line 23 (FA796220001) less capital formation, net in line 30 (FA795015085).

Earnings: The variable E_t in the model is a comprehensive measure of the operating earnings of the US corporate sector. In the model $E_t = D_t + I_t - \delta K_t$. We construct this measure using our constructed measure of dividends above, adjusted using the following series from Tables S.5 and S.6. For the non-financial corporate business sector, we add net capital formation, as recorded in line 28 (FA105050985), to our measure of dividends. For the financial sector, we add net capital formation, as recorded in line 30 (FA795015085), to our measure of dividends.

Replacement value of non-financial assets The variable K_{t+1} in the model is the replacement value of non-financial assets at the end of period t. This is the sum of such values across the non-financial business sector and the financial business sector. We construct this measure as the sum of line 109 (LM102010005) on Table S.5 and line 105 (LM795013865) on Table S.6.

Market or enterprise value of corporate non-financial assets The variable V_t in

the model is the market or enterprise value of non-financial assets at the end of period t. This is the sum of such values across the non-financial corporate sector and the financial business sector. We construct this measure for the non-financial corporate business sector as the sum of "Liabilities," line 144 (FL104194005), less "Financial Assets," line 114 (FL104090005) on Table S.5 (note that this series is in billions of dollars). Note as well that line 144 includes both the market value of corporate equities and ROW FDI investment in the US non-financial corporate sector. Line 114 includes the value of US FDI investment by the non-financial corporate sector in the ROW.[39]

For the financial business sector, our aim is to measure the enterprise value of banks, insurance companies, and other financial services firms resident in the United States, but to exclude the value of pure financial intermediaries such as mutual funds, closed end funds, and exchange traded funds (ETFs), as we assume that these pure financial intermediaries by definition have no enterprise value. To construct this measure, we compute the sum of corporate equity issues (LM793164105 from line 143 of Table S.6) and "Foreign Direct Investment in the United States: Equity" (LM793192105 from line 146 on Table S.6) less "US Direct Investment Abroad: Equity" (LM793092105 from Line 126 on Table S.6). We then subtract from this measure the value of corporate equities in closed end funds (LM554090005 line 7 of Table L.123) and exchange traded funds (LM564090005 line 8 of Table L.124). Note that the value of mutual fund shares is already excluded from this measure and reported separately on line 144 of Table S.6.

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[39]Given this use of market values to measure the equity entries in the balance sheet of the US corporate sector, the entries on the two sides of this balance sheet do not add up in the standard sense of having the sum of the left side and right side equal. In the Integrated Macroeconomic Accounts, an additional entry called "*Net Worth*" is included as the bottom of this balance sheet to reconcile the two sides (line 166 on Table S.5 and line 153 on Table S.6). This entry does not correspond to the standard accounting notion of net worth or to the measure of net worth in Table B.103. This accounting difference occurs because the Integrated Macroeconomic Accounts are compiled under the UN System of National Accounts, which differs in several respects from the US NIPA. See https://www.bea.gov/national/sna-and-nipas for more information.
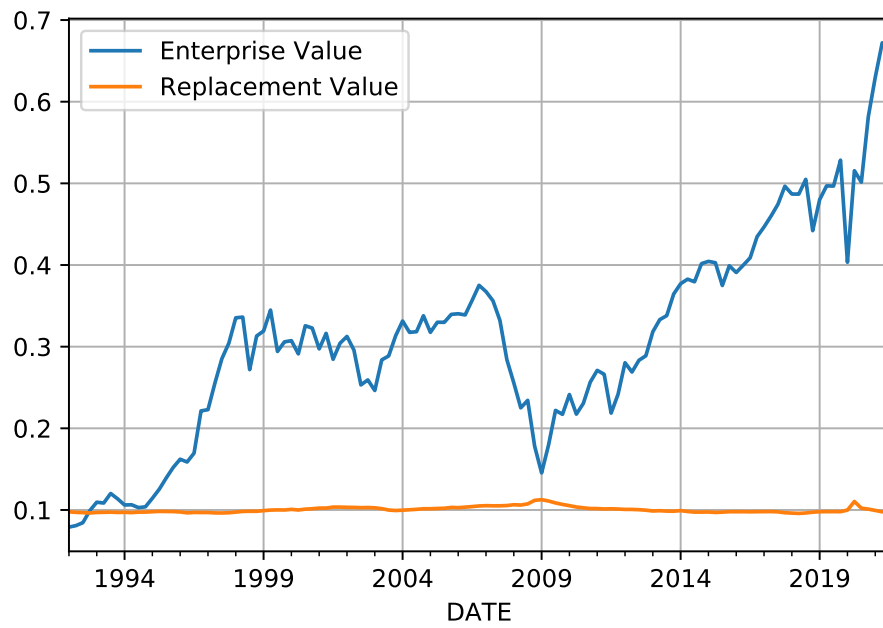
Figure C.2: Ratio of Enterprise and Replacement Values of US Financial Business Sector Non-financial Assets to GDP
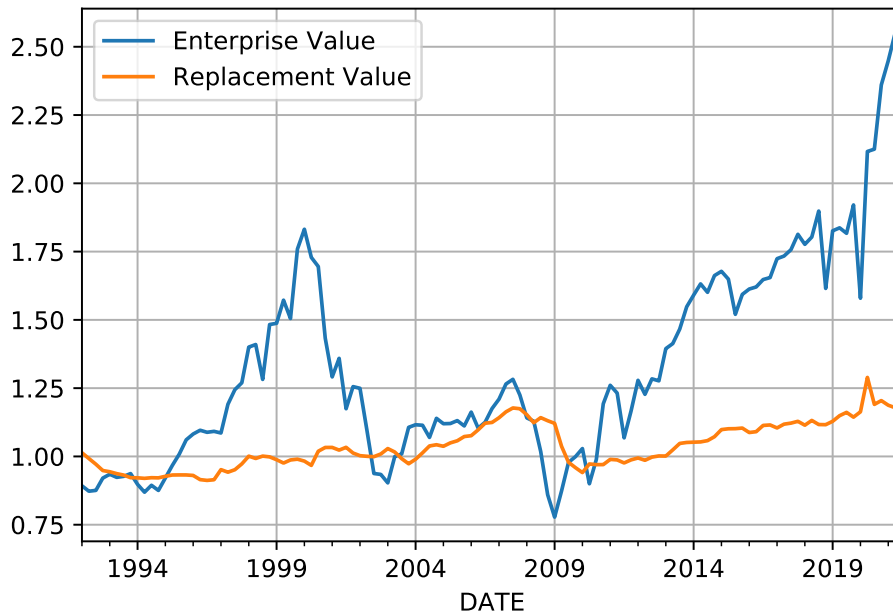
Figure C.3: Ratio of Enterprise and Replacement Values of US Non-financial Corporate Sector Non-financial Assets to GDP

C.1 Comparison of Measurement of Enterprise Value to That in Crouzet and Eberly 2021

Our measurement of the market value of the corporate sector is related to that in Crouzet and Eberly (2021). They use a valuation equation similar to ours, given in their equation (3), decomposing firm value into a replacement value of the capital stock and a valuation of the rents earned by the firm. Their aim is to compare this valuation with measures of "enterprise value" conceptually related to ours.

In Appendix 3 of that paper, they construct a measure of the "enterprise value" of non-financial corporations that differs from ours in two important respects. First, they follow a procedure developed in Hall (2001) to construct a market value of the bonds issued by the non-financial corporate sector. We have not followed this procedure.

Second, they subtract only liquid financial assets from the sum of the market values of the equity and liabilities of the firms in this sector. This list of liquid assets corresponds to the sum of lines 2 through 11 of Table L.103. We treat the remaining financial assets on this table (rows 12 through 19) as negative debt and subtract these as well. This difference in procedures implies that the measure of enterprise value used in Crouzet and Eberly (2021) includes both foreign direct investment into the US and US direct investment abroad.

C.2 Comparison of Measurement of Earnings to That in Green-wald, Lettau, and Ludvigson 2021

Greenwald, Lettau, and Ludvigson (2021) conduct a valuation exercise that is related to ours, but they organize the measurement differently. Specifically, they look to value the equity issued by the US non-financial corporate sector. This implies that they are interested in the cash flows available to be paid specifically to equity inclusive of the earnings of US corporations on their foreign operations. See Bertaut, Bressler, and Curcuru (2020) for a related measurement of the worldwide exposures of an investor into the equities of US multinationals.

D Measurement of the Foreign Corporate Sector

In Figure 11 the series for the enterprise value of the corporate sector in the United States and in the European Union are computed as the sum of enterprise value of non-financial corporations (for the US, from Table S.5.a of the Financial Accounts of the United States, for the European Union from OECD Dataset 720, Non-consolidated Financial Accounts) plus the sum of the market value of the equity of monetary financial institutions and of insurance corporations (both from OECD Dataset 720). Note that for the United States, we do not use the OECD Dataset 720 to compute the net worth of non-financial corporations, as figures in that dataset include the net worth of non-financial non-corporate businesses, so the OECD's US figures are not consistent with their analogues for other OECD countries. In Figure 12, we compute payouts using data from OECD Dataset 13: Simplified Non-financial Accounts. Payouts are measured as net operating surplus minus taxes on income and wealth minus net capital formation for the whole business sector. The US series for enterprise value and payouts in Figures 11 and 12 are the same as the ones plotted in Figures 7 and 9, with the only difference being that the former are annual, whereas the latter are quarterly. Figure D.1 adds to Figures 11 and 12 a line that reports enterprise values and payouts computed for an aggregate of the European Union, Canada, Japan and the United Kingdom. Data for the three additional countries are from the same OECD source as the European Union data and are aggregated using nominal exchange rates. The figure shows how enterprise value and payouts for the European union and for the larger aggregate behave in a very similar fashion (and quite differently from the corresponding US series).
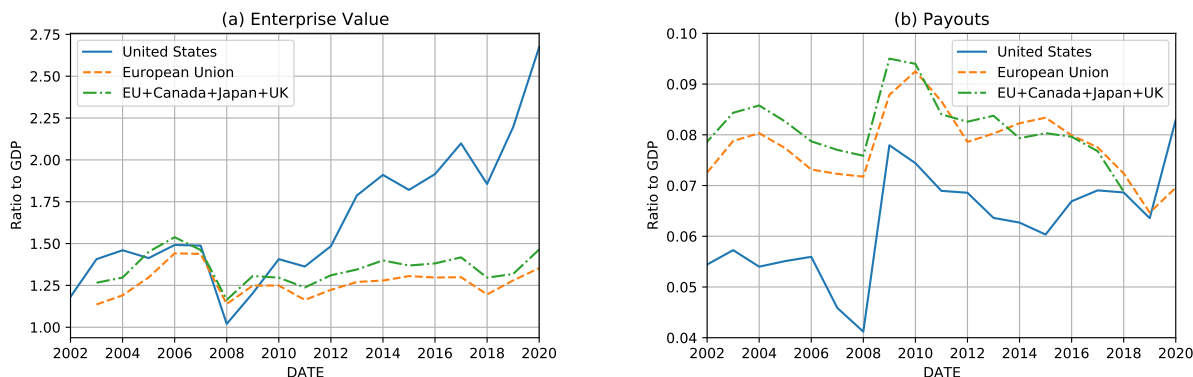
Figure D.1: Enterprise Value and Payouts in a Larger Aggregate of Foreign Economies

Finally, Figure D.2 shows two additional measures of the performance of the US economy over the past 12 years relative to the European Union. Panel (a) shows the ratio of GDP per capita (measured in constant PPP dollars, from the OECD Annual National Accounts) between the US and the EU, while panel (b) plots the same ratio for the employment-population ratio (from the OECD Annual Labor Force Statistics). The main message from the figure is that relative GDP has been quite stable over the last decade, while employment in the United States has declined relative to employment in Europe.
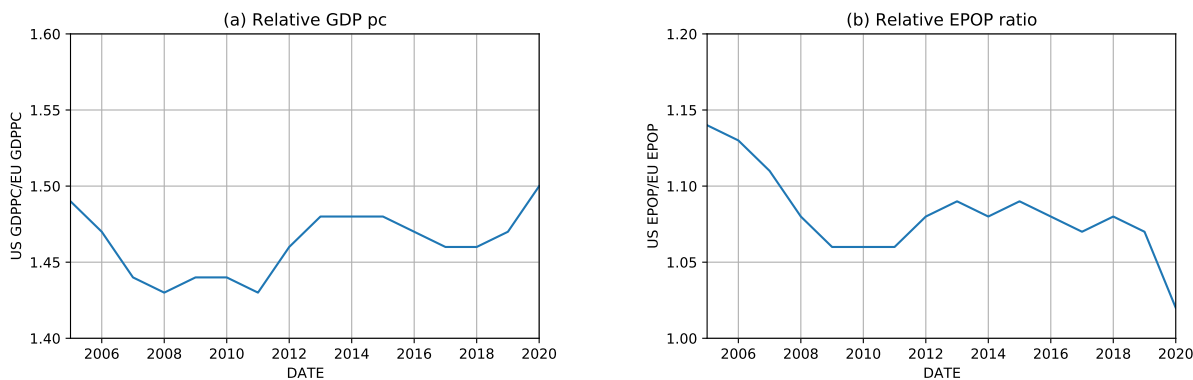

Figure D.2: GDP and Employment Per Capita: United States / European Union

E   Foreign Ownership of US Equity

Our baseline measure is a ratio with the numerator equal to a comprehensive measure of ROW ownership of US equity assets and the denominator equal to our measure of the market or enterprise value of corporate non-financial assets, as defined above. Here, the numerator is computed as the gross ROW equity claims on the US described above as the sum of Table S.9 lines 125 "Corporate Equities" (LM263064105), and 126 "Mutual Fund Shares" (LM263064203), and the market value of the equity component of ROW foreign direct investment in the US is given by Table S.9 line 127 (LM263092101).

F   Income Yields on US External Assets and Liabilities

Our empirical decomposition focuses on decomposing changes in the US net foreign asset position into contributions of current account deficits versus valuation effects. We have documented that realized valuation effects used to favor the US, and the US was therefore able to borrow heavily without accumulating much debt. That is one notion of privilege, and we have shown that form of privilege has ended.

But, more broadly, one could think about a country being privileged in international financial markets if the residents of that country persistently earn higher expected excess returns on their gross foreign assets than they pay on their gross liabilities. These differences in expected excess returns on different types of assets can show up in relatively high income yields on foreign assets (relative to liabilities) or relatively high expected valuation effects. Our previous analysis focused on measured realized valuation effects, but we now briefly discuss data on income yields. See also Setser (2017) and Setser (2018).

Here, it is useful to decompose income yields on US gross foreign assets and liabilities into those on non-equity assets and liabilities, portfolio investment equity assets and liabilities, and direct investment equity assets and liabilities.[40]

Non-equity assets and liabilities consist of debt associated with direct investment, portfolio investment, debt securities, other investment, and reserve assets. These non-equity liabilities include US currency, deposits in US banks, and US Treasury debt, all of which likely have lower income yields than other forms of debt assets and liabilities. Thus, one might expect that the observed income yield on US non-equity assets might be higher than the income yield on US non-equity liabilities. We find, however, that when these non-equity assets and liabilities are taken together, this is not the case. Specifically, we calculate implicit income yields on the aggregate of these non-equity assets and liabilities on an annual basis by dividing the total income received (or paid) by the total stock of these assets (or liabilities) and show these implicit income yields in Figure F.1. We see in this figure that when averaged across categories of non-equity assets and liabilities, the income yields on US non-equity assets and liabilities have been very similar since 1999.

In Figure F.2, we show the income yields on US portfolio equity assets and liabilities from 1999 through 2020. We see in this figure that over the past ten years, the income yield on US portfolio equity assets has been roughly one percentage point higher than the income yield on US portfolio equity liabilities. Note that these portfolio equity income yields correspond to the dividend yields on these equity assets and liabilities. These may differ for assets and liabilities even if expected excess returns do not if these differences are due to differences in US and foreign firms payout policies or differences in expected growth rates of dividends across countries.

In Figure F.3, we show the income yields on US direct investment equity assets and liabilities from 1999 through 2020. We see in this figure that, over the past ten years, the income yield on US direct investment equity assets as been roughly five percentage points higher than the income yield on US direct investment equity liabilities. This gap between the income yields on US direct investment equity assets and liabilities, together with growing

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[40]The income and positions on these various gross assets and liabilities are listed in the BEA's International Transactions Table 4.1, "*US International Transactions in Primary Income*" and International Investment Position Table 1.2, " *US Net International Investment Position at the End of the Period, Expanded Detail.*"
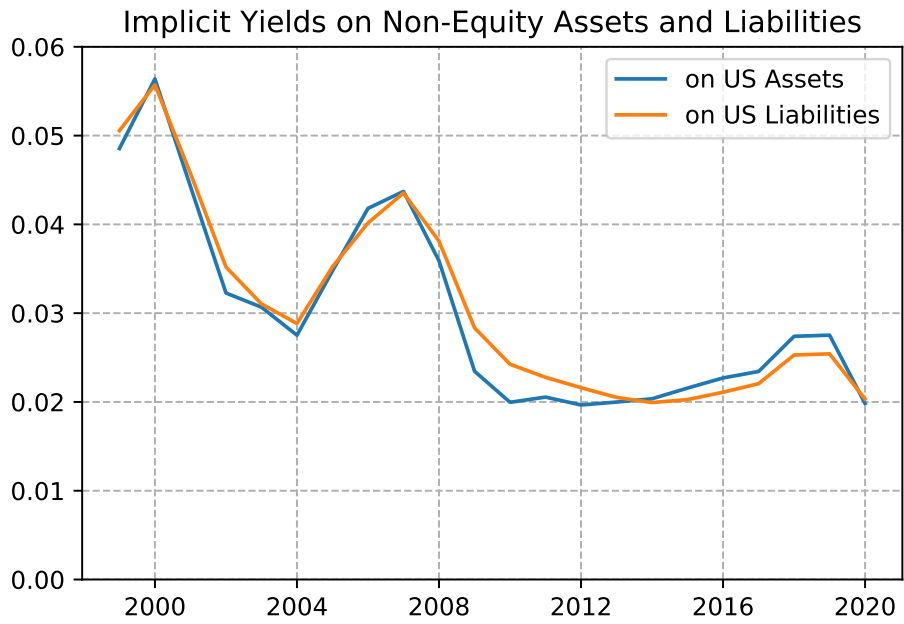
Figure F.1: Implicit Income Yields on US Non Equity Assets and Liabilities
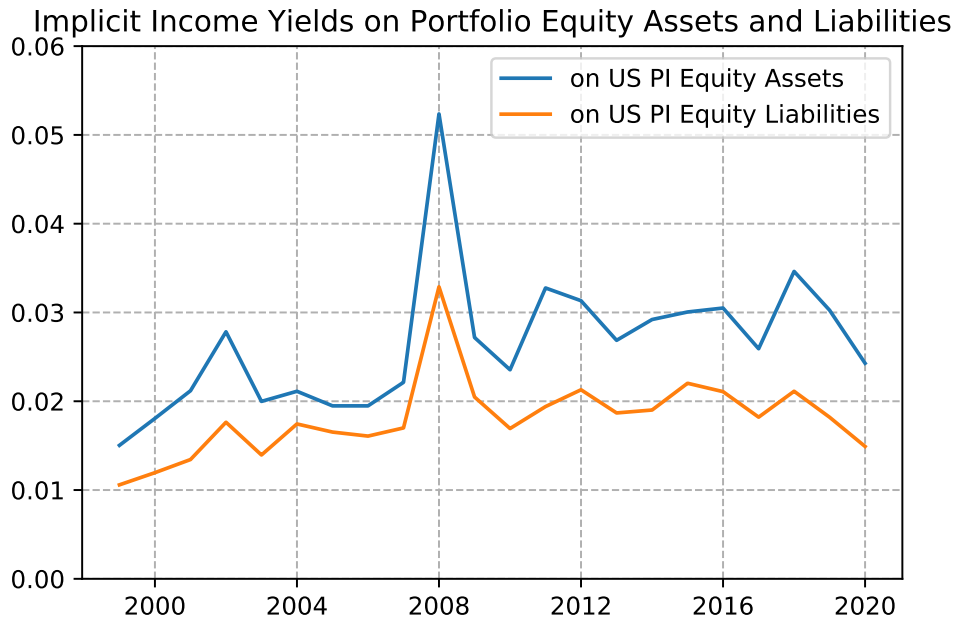

Figure F.2: Implicit Income Yields on US Portfolio Equity Assets and Liabilities
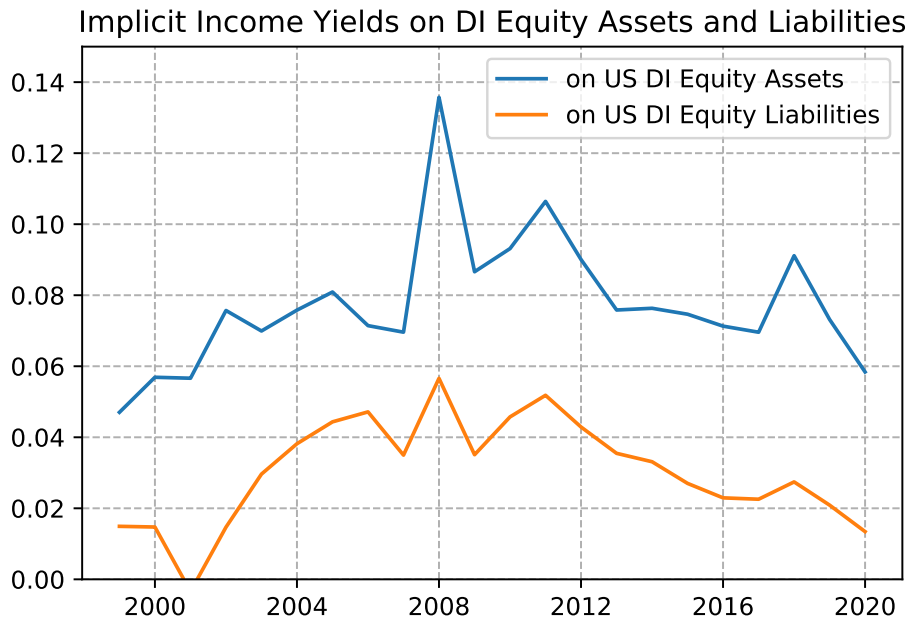
Figure F.3: Implicit Income Yields on US Direct Investment Equity Assets and Liabilities

gross direct investment equity positions, accounts, mechanically, for most of the gap between US net factor income from Abroad and the net factor income that one might predict from the US net foreign asset position.

In the literature, there has been considerable discussion of this gap between the income yields on US direct investment assets and liabilities.

One hypothesis is that the valuation of US direct investment equity assets recorded in the BEA's International Investment Position tables is too low, thus resulting in a high income yield as a matter of mismeasurement of the denominator of that ratio. This is often referred to as the "Dark Matter" hypothesis. See Hausmann and Sturzenegger (2007). See also Kozlow (2006) and the following discussion from the BEA: https://www.bea.gov/help/faq/202. Note from these discussions that the measured income yield on direct investment equity is a ratio of corporate income net of taxes to the value of the corporation, not a measure of dividend yields as is the case for portfolio equity.

Another hypothesis regarding this gap in income yields for Direct Investment Equity Assets and Liabilities is that for fiscal reasons, multinational firms tend to overreport income from foreign affiliates and underreport income generated in the United States. See, for example, Curcuru, Thomas, and Warnock (2013), Setser (2017), Setser (2019), Torslov, Weir, and Zucman (2020), Guvenen et al. (2021), and Garcia-Bernardo, Jansky, and Zucman (2021). According to this hypothesis, the numerator of the ratio that is the income yield is mismeasured. The upshot of some of these papers is that that these concerns affect the division of the current account between net exports and net foreign income but distort neither the measurement of the US NFA position nor the current account.
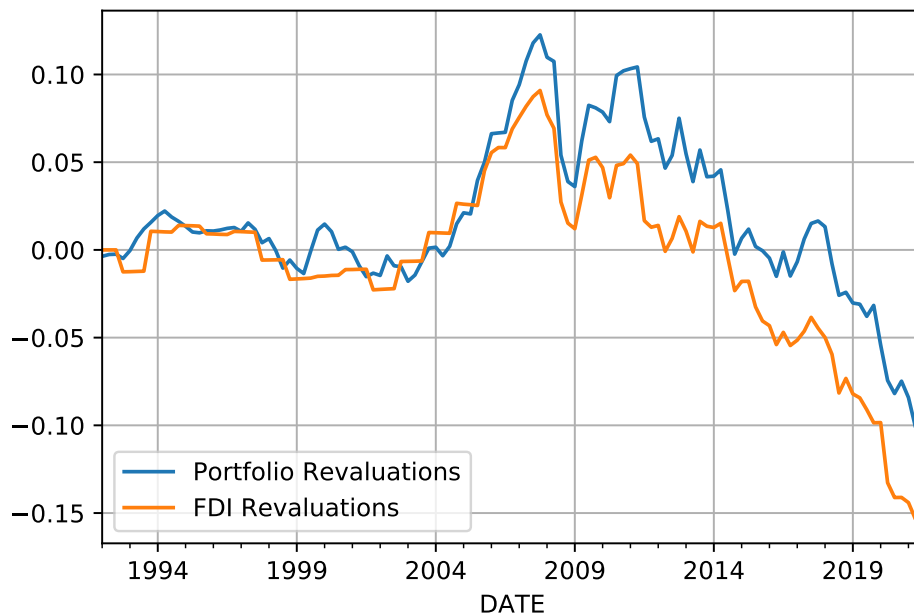
Figure G.1: Cumulated Valuation Effects for Portfolio Equity and FDI Equity over GDP

G   Market Valuation of FDI Equity

Milesi-Ferretti (2021) raises concerns with the market valuation of ROW direct investment in US resident corporations and the market valuation of US residents' direct investment in corporations resident in the ROW estimated in Table S.9 and Table L.230. In these tables, the market value of ROW direct investment in US resident corporations is estimated using US stock market indices and the market value of US residents' direct investment in corporations resident in the ROW is estimated using foreign stock market indices. One might argue that it is more appropriate to use foreign stock market indices to value foreign direct investment equity in the United States and US stock market indices to value US direct investment equity in the rest of the world. In Figure G.2, we show the evolution of US net foreign assets with foreign direct investment into and out of the United States valued at current cost, as it was in the *Financial Accounts of the United States* until 2019. This could be viewed as an intermediate case between the current method for valuing FDI and the alternative suggested above. The figure shows that valuating FDI at current cost has an impact on the measured evolution of the US NFA position. In particular, negative valuations no longer apply to FDI, which accounts for about 50 percent of the gross equity positions. So, not surprisingly, the size of the decline of the US NFA position is smaller (40 percent of GDP instead of 60 percent). Nevertheless the main fact we highlight remains: since 2007, the US NFA position has declined primarily because of negative valuation effects.
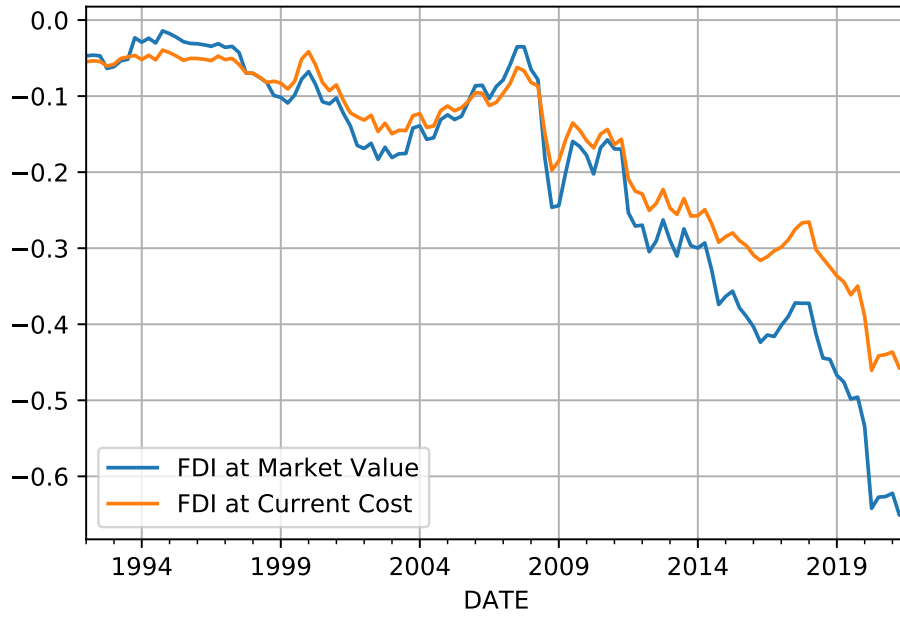
Figure G.2: US NFA over GDP with FDI Equity Valued At Market Value and At Current Cost

H   Additional Figures

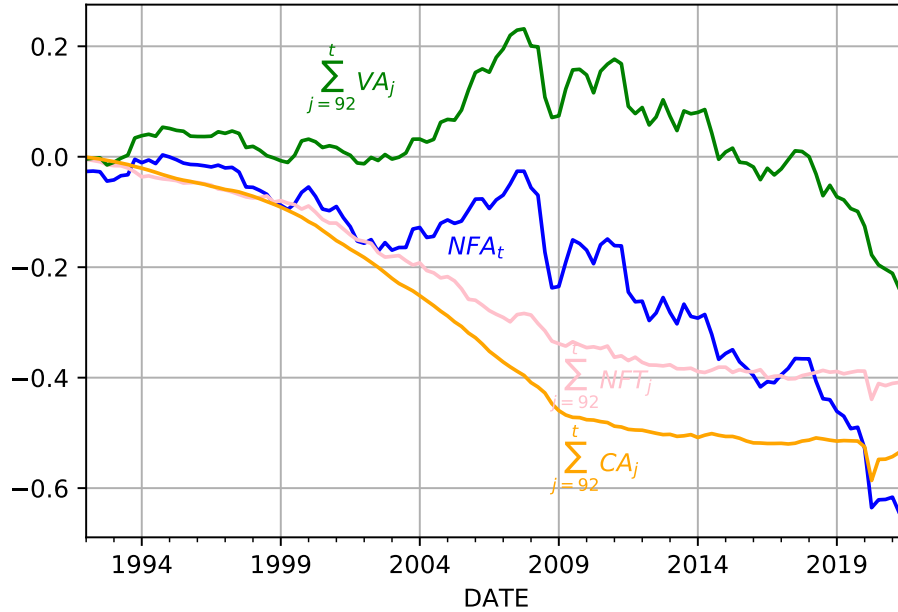Figure H.1: US Current Account over GDP

Figure H.2: Alternative Decomposition of Changes in US Net Foreign Assets over GDP

I   Proof of Proposition 1

Proposition: Consider the two economies we have explored: the baseline model with markups, and the alternative with unmeasured capital. Suppose the two economies share the same values for r^*, for g_Z, and for α. Suppose $\delta = \delta_M$ and suppose

$$\frac{1}{\mu} = \frac{\nu}{1 - \frac{(g_Z + \delta_U)}{r^* + \delta_U}(1 - \nu)}. \tag{35}$$

Then, in a closed economy, on a balanced growth path, the two economies share the same values, relative to measured output, for earnings, for rental income to (measured capital), for (measured) investment, for dividends, for earnings, for (measured) capital, and for the value of equity.

Proof: Take the economy with unmeasured capital. In that economy, the ratio of unmeasured capital to true output on the balanced growth path is

$$\frac{K_U}{Y} = \frac{(1 - \nu)}{r^* + \delta_U}.$$

Thus, unmeasured investment relative to true output is given by

$$\frac{I_U}{Y} = (g_Z + \delta_U)\frac{(1 - \nu)}{r^* + \delta_U}.$$

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Let θ denote measured output as a share of total output:

$$\theta = \frac{Y - I_U}{Y} = \frac{Y_M}{Y} = 1 - (g_Z + \delta_U)\frac{(1 - \nu)}{r^* + \delta_U}.$$

Thus, the income shares of labor and measured capital in measured output are given by

$$\frac{WL}{Y_M} = \frac{\frac{WL}{Y}}{\frac{Y_M}{Y}} = \frac{\nu(1 - \alpha)}{\theta},$$

$$\frac{R_M K_M}{Y_M} = \frac{\frac{R_M K_M}{Y}}{\frac{Y_M}{Y}} = \frac{\nu\alpha}{\theta},$$

and the share of measured investment in measured output is

$$\frac{I_M}{Y_M} = \frac{(g_Z + \delta_M)\frac{\nu\alpha}{r^* + \delta_M}}{\theta}.$$

Compare these expressions to their counterparts in the model with markups:

$$\frac{WL}{Y} = \frac{(1 - \alpha)}{\mu},$$

$$\frac{RK}{Y} = \frac{\alpha}{\mu},$$

$$\frac{I}{Y} = \frac{(g_Z + \delta)}{\mu}\frac{\alpha}{r^* + \delta}.$$

Comparing across models, labor's share of income and (measured) capital's share of income and (measured) investment's share of ouptut will all be equated when $\delta_M = \delta$ and $\frac{\nu}{\theta} = \frac{1}{\mu}$. But note that

$$\frac{\nu}{\theta} = \frac{\nu}{1 - (g_Z + \delta_U)\frac{(1-\nu)}{r^* + \delta_U}} = \frac{1}{\mu}$$

is simply assumption 35.

Next, note that if capital's share of income is the same in the two models, and the rental rate $R = r^* + \delta_M = r^* + \delta$ is the same in the two models, then the measured capital to measured output ratio is also equated across models.

Next, note that on a balanced growth path, the following accounting identities hold in both models:

$$\frac{C}{Y_M} = 1 - \frac{I_M}{Y_M},$$

$$\frac{D}{Y_M} = 1 - \frac{WL}{Y_M} - \frac{I_M}{Y_M},$$

$$\frac{E}{Y_M} = 1 - \frac{WL}{Y_M} - \delta_M\frac{K_M}{Y_M}.$$

Thus, if the measured investment share, the measured labor share, and the measured capital-

output ratio are equated across models, so must be the shares in output attributed to consumption, to dividends, and to earnings.

It remains only to compare equity prices across models. In the model with unmeasured capital we have

$$\frac{V}{Y_M} = \frac{K'_M + K'_U}{Y_M} = (1 + g_Z)\left(\frac{\frac{\nu\alpha}{r^* + \delta_M}}{\theta} + \frac{\frac{(1-\nu)}{r^* + \delta_U}}{\theta}\right).$$

In the model with markups we have

$$\frac{V}{Y} = \frac{K' + V_\Pi}{Y} = (1 + g_Z)\left(\frac{1}{\mu}\frac{\alpha}{r^* + \delta} + \frac{1}{r^* - g_Z}\frac{\mu - 1}{\mu}\right).$$

Now, when $\frac{\nu}{\theta} = \frac{1}{\mu}$ (condition 35 in the Proposition) the first components of enterprise value, corresponding to the value of measured capital are equated across the two models. It remains to show that the value of unmeasured capital in the economy with unmeasured capital is equal to the value of claims to future monopoly profits in the markups economy.

Note that assumption 35

$$\nu = \frac{\theta}{\mu} = \frac{1 - (g + \delta_U)\frac{(1-\nu)}{r^* + \delta_U}}{\mu}$$

implies

$$\nu = \frac{1 - \frac{(g + \delta_U)}{r^* + \delta_U}}{\mu - \frac{(g + \delta_U)}{r^* + \delta_U}}$$

and thus

$$\frac{1 - \nu}{\nu} = \frac{\mu - 1}{1 - \frac{(g + \delta_U)}{r^* + \delta_U}}.$$

Thus, the value of unmeasured capital can be expressed as

$$\frac{K'_U}{Y_M} = (1 + g_Z)\left(\frac{\frac{(1-\nu)}{r^* + \delta_U}}{\theta}\right) = (1 + g_Z)\left(\frac{\frac{\nu}{r^* + \delta_U}\left(\frac{\mu - 1}{1 - \frac{(g + \delta_U)}{r^* + \delta_U}}\right)}{\theta}\right),$$

which, using $\nu = \frac{\theta}{\mu}$, can be written as

$$\begin{aligned}\frac{K'_U}{Y_M} &= (1 + g_Z)\frac{\mu - 1}{\mu}\left(\frac{1}{r^* + \delta_U}\left(\frac{1}{1 - \frac{(g + \delta_U)}{r^* + \delta_U}}\right)\right)\\ &= (1 + g_Z)\frac{\mu - 1}{\mu}\left(\frac{1}{r^* - g_Z}\right)\\ &= \frac{V_\Pi}{Y}.\end{aligned}$$

Thus, equity values are also equated across the two economies.

J   Symmetric Risk Aversion

The goal of this section is to compare equilibrium model dynamics in response to a rise in the production share of unmeasured capital in our baseline model – in which foreign households are risk-neutral – against an alternative model in which foreign households have the same concave utility function as Americans. This alternative model does not have a closed form solution, and we must therefore solve the model numerically. Note, however, that it is only the transition that differs: for a given value for the unmeasured capital share $(1 - v)$ the balanced growth path values for production and for asset values are independent of the choices for domestic and foreign risk aversion, γ and γ^*.

We consider a sequence of shocks to the parameter v so that over a period of 14 years, v_t declines linearly from $v_{2007} = 0.944$ to $v_{2021} = 0.682$, which are the values dictated by equation (34) given the markup values μ and $\hat{\mu}$ reported in Table 1. This ensures that the model will replicate the observed growth in the Buffett ratio over this period. We also assume that TFP adjusts over the same period, from $A_{2007} = 0.939$ to $A_{2021} = 0.888$, so that at each date t the balanced growth path value for US measured output given (A_t, v_t) is equal to its foreign counterpart.

A computational issue we need to address is that the cumulative change in v implies a large change in equilibrium capital stocks, so a standard local approximation may not be accurate. Instead, we use a sequence of local approximations. In particular, at each date t along the simulation path we resolve for equilibrium decision rules around the steady state corresponding to the date t values for A_t and v_t and the simulation value for the net bond position B_t.[41] In these local linear approximations, A_t and v_t are modeled as unit root stochastic processes.

Our key objective here is to compare the same shock simulation for the baseline and alternative unmeasured capital models. Table 3 reports some key model statistics for 2007 and for 2021. The two models imply very similar values for the Buffett ratio in 2021, and for the net equity position. The net bond position is less negative in 2021 in the symmetric preferences specification, reflecting smaller current account deficits between 2007 and 2021. However, that model also implies a much higher interest rate in 2021, since capital is only accumulated gradually when all households want to smooth consumption over time. We conclude that the hypothesis that a rising US-specific share of unmeasured capital was the primary driver of rising asset values over this period is difficult to reconcile with modest observed US current account deficits, and with generally declining global real interest rates.

K   Extended Model with Terms of Trade Effects

In our simple baseline model, all domestic intermediate varieties have the same price, and because domestic and foreign final output are the same good, the prices of domestic and foreign intermediates are identical. Thus, in that model, a rise in markups for US firms does not change the price that consumers pay for US-produced relative to foreign-produced goods.

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[41]Note that when models in this class are approximated using a linear local approximation, bond dynamics follow a unit root process.

	2007	2021	
		baseline model	symmetric prefs
		$\gamma^* = 0$	$\gamma^* = 1$
Buffett ratio	1.52	2.84	
NFA / GDP	-0.05	-1.30	
Net equity / GDP	0.00	-0.40	
Net bond / GDP	-0.05	-0.90	
Interest rate	0.053	0.053	

Table 3: Impact of rise in share of unmeasured capital: Baseline model and alternative with symmetric risk aversion

We now briefly consider an extended version of the model, in which domestically produced intermediates produce a composite domestic good A, while foreign intermediates are combined to produce a composite foreign final good B. Goods A and B are traded and used symmetrically in each country as imperfectly substitutable inputs in the production of final consumption and investment goods. In this extended model, the equilibrium price of good B relative to good A – the terms of trade – will depend on how much of good B is produced relative to good A. Thus, whether a rise in US markups improves or worsens the terms of trade will depend on whether the rise in US markups is associated with an expansion or a contraction in US production.

A pure markup shock – one in which markups go up because follower firms become less productive and z_L falls – will be associated with a decline in US output and an increase in the price of US-produced goods relative to foreign ones. This terms of trade effect will ameliorate the negative welfare consequences of a pure markup shock for US consumers. This is an optimal tariff argument: just like a tax on exports, a pure increase in domestic markups reduces the supply of US-produced goods and increases their relative price. However, note that an increase in US markups may be associated with either a decline or a rise in the production of US goods, depending on whether the rise in markups reflects a decline in z_L (which reduces US output) or a rise in z_H (which boosts US output). In our baseline calibration of our baseline model, we constructed a combination of changes to z_L and z_H with the property that the rise in US markups neither expands nor reduces US output. We now show that if we were to follow the same strategy in the extended model in which goods A and B are imperfect substitutes, there would be no change in the equilibrium terms of trade. And in the absence of such a change, all the positive and normative implications of the increase in markups would be identical to those in the baseline model described in the main text.

In particular, consider an extension of the baseline model in which domestically produced varieties are combined to produce a composite domestic intermediate A and a composite foreign intermediate B, where the quantites of these composites are denoted by Y_A and Y_B.

Thus,

$$Y_A = \left[\int_0^1 Y_i^{(\theta-1)/\theta} di\right]^{\theta/(\theta-1)}$$

$$Y_B = \left[\int_0^1 Y_i^{*(\theta-1)/\theta} di\right]^{\theta/(\theta-1)}$$

These two composites are combined to produced the final conusmption and investment goods using a CES aggregator function G. Let A and A^* and B and B^* denote the quantities of the two composite goods used in producing the final consumption and investment goods in the two countries. Thus,

$$C + K' - (1 - \delta)K = G(A, B)$$
$$C^* + K^{*\prime} - (1 - \delta)K^* = G^*(A^*, B^*).$$

Assume the aggregators for producing final goods are identical in the two economies:

$$G(A, B) = 2^{\frac{1}{1-\varepsilon}} \left[A^{(\varepsilon-1)/\varepsilon} + B^{(\varepsilon-1)/\varepsilon}\right]^{\frac{\varepsilon}{\varepsilon-1}}$$
$$G^*(A^*, B^*) = 2^{\frac{1}{1-\varepsilon}} \left[A^{*(\varepsilon-1)/\varepsilon} + B^{*(\varepsilon-1)/\varepsilon}\right]^{\frac{\varepsilon}{\varepsilon-1}}.$$

Here, the parameter ε defines the elasticity of substitution between locally produced intermediates and foreign-produced ones.

Market clearing requires

$$Y_A = A + A^*$$
$$Y_B = B + B^*.$$

Let P_A and P_B denote the prices of good A and B relative to the domestic final consumption good and similarly for P_A^* and P_B^*. Given that all intermediate varieties are symmetric, in equilibrium $Y_A = Y_i$, $Y_B = Y_i^*$, $P_A = P_i$ and $P_B^* = P_i^*$.

Note that because the aggregators for producing domestic and foreign consumption goods are identical, the relative price of foreign to domestic conusmption (the real exchange rate) in this model is one, and thus $P_A = P_A^*$ and $P_B = P_B^*$.

The first order conditions for intermediate-good-producing firms in this economy are identical to those in the baseline model. But we cannot immediately equate the prices P_A and P_B to the price of the final consumption good, which is normalized to one. Rather, these prices are pinned down by two conditions. First, the first-order conditions for final-good-producing firms ties the relative price of B to A to the relative quantities produced:

$$\frac{Y_B}{Y_A} = \frac{B}{A} = \frac{B^*}{A^*} = \left(\frac{P_B}{P_A}\right)^{-\varepsilon}. \tag{36}$$

Second, final-good-producing firms are competitive, so that the price of producing one unit of final consumption must equal the price of one unit of consumption (which is normalized to one). If domestic firms are producing one unit of output, then the quantities A and B

must satisfy

$$G(A, B) \quad = \quad 1 = 2^{\frac{1}{1-\varepsilon}} \left[A^{(\varepsilon-1)/\varepsilon} + B^{(\varepsilon-1)/\varepsilon} \right]^{\frac{\varepsilon}{\varepsilon-1}}$$

$$1 \quad = \quad 2^{\frac{1}{1-\varepsilon}} A \left[1 + \left(\frac{B}{A} \right)^{(\varepsilon-1)/\varepsilon} \right]^{\frac{\varepsilon}{\varepsilon-1}},$$

which, given (36), implies

$$A = 2^{\frac{-1}{1-\varepsilon}} \left[1 + \left(\frac{P_B}{P_A} \right)^{1-\varepsilon} \right]^{\frac{-\varepsilon}{\varepsilon-1}}.$$

So the cost of producing one unit of the final consumption good is

$$P_A 2^{\frac{-1}{1-\varepsilon}} \left[1 + \left(\frac{P_B}{P_A} \right)^{1-\varepsilon} \right]^{\frac{-\varepsilon}{\varepsilon-1}} + P_i^* 2^{\frac{-1}{1-\varepsilon}} \left[1 + \left(\frac{P_B}{P_A} \right)^{1-\varepsilon} \right]^{\frac{-\varepsilon}{\varepsilon-1}} \left(\frac{P_B}{P_A} \right)^{-\varepsilon}$$

$$= \quad 2^{\frac{-1}{1-\varepsilon}} \left(P_A^{1-\varepsilon} + P_B^{1-\varepsilon} \right)^{\frac{1}{1-\varepsilon}}.$$

If this cost is to equal to the price of consumption, which is one, then

$$P_A^{1-\varepsilon} + P_B^{1-\varepsilon} = 2. \tag{37}$$

Proposition 3 *If*

$$\frac{z_H^*}{z_H} = \left(\frac{\mu^*}{\mu} \right)^{\alpha + \frac{1-\alpha}{1+\sigma}}, \tag{38}$$

then $P_A = P_B = 1$ and allocations are independent of ε and are identical to those in the one good model in the main text.

Proof:
Bertrand competition among intermediate-good-producing firms gives the same price expressions as in the one-good model, which we reproduce here:

$$P_A \quad = \quad \frac{\mu}{z_H} \left(\frac{W}{Z(1-\alpha)} \right)^{1-\alpha} \left(\frac{R}{\alpha} \right)^{\alpha}$$

$$P_B \quad = \quad \frac{\mu^*}{z_H^*} \left(\frac{W^*}{Z(1-\alpha)} \right)^{1-\alpha} \left(\frac{R^*}{\alpha} \right)^{\alpha}.$$

Taking the ratio of these two prices (and recalling that $R = R^*$), we get

$$\frac{P_B}{P_A} = \frac{\mu^*}{\mu} \left(\frac{z_H^*}{z_H} \right)^{-1} \left(\frac{W^*}{W} \right)^{(1-\alpha)}. \tag{39}$$

From the two FOCs for labor supply, we have

$$\frac{L^*}{L} = \left(\frac{W^*}{W}\right)^{1/\sigma}.$$

Thus, the ratio of foreign to domestic output is

$$\frac{Y_B}{Y_A} = \frac{z_H^*}{z_H} \left(\frac{K^*}{K}\right)^\alpha \left(\frac{L^*}{L}\right)^{1-\alpha} = \frac{z_H^*}{z_H} \left(\frac{K^*}{K}\right)^\alpha \left(\frac{W^*}{W}\right)^{(1-\alpha)/\sigma}. \tag{40}$$

Multiplying together expressions (39) and (40), we get

$$\frac{P_B}{P_A} \times \frac{Y_B}{Y_A} = \frac{\mu^*}{\mu} \left(\frac{K^*}{K}\right)^\alpha \left(\frac{W^*}{W}\right)^{(1-\alpha)(1+\sigma)/\sigma}. \tag{41}$$

From equation (9 at home and abroad, with a common value of $R = R^*$, we have

$$\frac{K^*}{K} = \frac{\mu}{\mu^*} \frac{P_B}{P_A} \frac{Y_B}{Y_A} = \left(\frac{K^*}{K}\right)^\alpha \left(\frac{W^*}{W}\right)^{(1-\alpha)(1+\sigma)/\sigma}.$$

or

$$\frac{K^*}{K} = \left(\frac{W^*}{W}\right)^{(1+\sigma)/\sigma}$$

Substituting this into (41) gives

$$\frac{P_B}{P_A} \frac{Y_B}{Y_A} = \frac{\mu^*}{\mu} \left(\frac{W^*}{W}\right)^{(1+\sigma)/\sigma}$$

or, using eq. (36) to substitute out Y_B/Y_A,

$$\left(\frac{P_B}{P_A}\right)^{1-\varepsilon} = \frac{\mu^*}{\mu} \left(\frac{W^*}{W}\right)^{(1+\sigma)/\sigma}. \tag{42}$$

Now we can combine eqs. (39) and (42) to solve for $\frac{W^*}{W}$ as a function of exogenous parameters:

$$\frac{W^*}{W} = \left(\left(\frac{z_H^*}{z_H}\right)^{-(1-\varepsilon)} \left(\frac{\mu^*}{\mu}\right)^{-\varepsilon}\right)^{\frac{1}{\frac{(1+\sigma)}{\sigma} - (1-\alpha)(1-\varepsilon)}} \tag{43}$$

Now recall eq. (37),

$$P_A^{1-\varepsilon} + P_B^{1-\varepsilon} = 2,$$

which can be written as

$$P_A^{1-\varepsilon} \left(1 + \left(\frac{P_B}{P_A}\right)^{1-\varepsilon}\right) = 2.$$

Using eq: (42) again and then substituting in eq: (43) gives

$$P_A^{1-\varepsilon}\left(1+\frac{\mu^*}{\mu}\left(\frac{W^*}{W}\right)^{(1+\sigma)/\sigma}\right) = 2$$

$$P_A^{1-\varepsilon}\left(1+\frac{\mu^*}{\mu}\left(\left(\frac{z_H^*}{z_H}\right)^{-(1-\varepsilon)}\left(\frac{\mu^*}{\mu}\right)^{-\varepsilon}\right)^{\frac{\frac{1+\sigma}{\sigma}}{\frac{(1+\sigma)}{\sigma}-(1-\alpha)(1-\varepsilon)}}\right) = 2.$$

Now substitute in the expression for $\frac{z_H^*}{z_H}$ in the statement of the Proposition, eq. (38), which gives

$$P_A^{1-\varepsilon}(2) = 2,$$

which implies $P_A = 1$. Eq. (37) then implies $P_B = 1$.

Given $P_B = P_A = 1$, it is immediate that the budget constraints for domestic and foreign households are identical to the baseline one-good model and thus that all equilibrium allocations are identical.