Dollar, US Fiscal Capacity and the US Safety Puzzle*

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August 13, 2023

ABSTRACT

The United States (US) seems safe relative to the rest of the world (ROW). Her macro quantities, asset prices and wealth share all rise relative to the ROW during global downturns. These novel US safety facts challenge the traditional view that the US exorbitant privilege, the large average excess returns on the US external portfolio, is a risk premium that compensates the US for her role as the global insurance provider. Furthermore jointly accounting for countercyclical dollar and global risk premium dynamics alongside the US exorbitant privilege requires the US to suffer a worse recession than the ROW during global downturns, an implication also at odds with these facts. To resolve this puzzle, I emphasise a novel source of US specialness: her excess fiscal capacity vis-a-vis the ROW. I study the joint dynamics between the US fiscal condition, global innovation and growth, international risk-sharing, the dollar and global risk premia in a quantitative model with risk-sensitive preferences that takes this excess US fiscal capacity as given. The framework quantitatively resolves the US safety puzzle, as well as other stylised facts in international macro-finance. These results therefore tie the excess US fiscal capacity to key puzzling phenomena within the modern global financial system, a novel insight that has received surprisingly little emphasis thus far and has important implications for policy moving forward.

Keywords: International Finance, US Fiscal Policy, Dollar, Global Financial System
JEL Codes: E0, F3, F4, G1

* ***Acknowledgements***: This paper would not have been possible without the mentorship and support of my PhD dissertation committee: Dimitris Papanikolaou (Co-Chair), Torben Andersen (Co-Chair), Zhengyang Jiang and Winston Wei Dou. I also thank for insightful comments: Federico Gavazzoni (WFA Discussant), Walker Ray (EFA Discussant), Charles Martineau (FIRS Discussant), Maxime Sauzet (MFA Discussant), Rohan Kekre, Robert Richmond, Tony Zhang, Hengjie Ai, Uday Rajan, Jesse Schreger, Nancy Xu, Ian Martin, Ivan Shaliastovich, Charles Engel, Nicolas Crouzet, Lawrence Christiano, Martin Eichenbaum, Giorgio Primiceri, Matthew Rognlie, Bryan Seegmiller and seminar and conference participants at the Western Finance Association (WFA, 2022), European Finance Association (EFA, 2023), Financial Intermediation Research Society (FIRS, 2022), the Society for Economic Dynamics (SED, 2023), Midwest Finance Association (MFA, 2023), Macro-Finance Society Workshop (MFS, 2022), Econometric Society Meetings (Asia, Europe, 2023), American Finance Association PhD Poster Session (AFA, 2022), LBS Trans-Atlantic Doctoral Conference (TADC, 2023), Junior Academic Research Seminar in Finance (JARS, 2023), Financial Management Association (FMA, 2022), Midwest Economics Association (MEA, 2022), Southwestern Finance Association (SWFA, 2022), NW Kellogg Finance Brownbag, NW Macro Lunch and the UW Madison Finance Brownbag. This paper was awarded the ***WFA*** *Brattle Group PhD Candidate Award for Academic Excellence* at the 2022 WFA Meeting.

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1 Introduction

Modern international macro-finance models emphasise the central role that the United States (US) plays in driving key international asset pricing dynamics, namely i) the countercyclical dollar (Maggiori, 2017), ii) global financial cycle in risky asset prices (Miranda-Agrippino and Rey, 2015) and iii) the US exorbitant privilege: the large average excess returns on the US external portfolio (Gourinchas and Rey, 2007a,b). At the heart of these models is the role of the US as the global insurance provider: due to her greater risk-bearing capacity, the US insures the ROW by holding a wealth portfolio that is i) levered in global risky assets and ii) short dollar safe assets (Gourinchas et al, 2017; Maggiori, 2017; Sauzet, 2022).

Since the US is levered in global risky assets, this framework rationalises the US exorbitant privilege as a risk premium that compensates the US for her role as the global insurance provider. This risk-based interpretation of the US exorbitant privilege drives modern understandings of international asset pricing. Since the US is more risk-tolerant and loses wealth share during global downturns, this equilibrium risk-sharing scheme naturally generates the countercyclical global risk premium dynamics at the heart of the *global financial cycle* (Miranda-Agrippino and Rey, 2020). Furthermore since the US economy suffers a worse recession during times of global stress under this framework, the dollar's countercyclical dynamics can also be reproduced, overcoming the *reserve currency paradox* (Kekre and Lenel, 2021; Sauzet, 2022).

Underpinning these models is therefore a strong prediction about US global shock exposures. To rationalise the US exorbitant privilege as a risk premium, the US must be bound by an ***exorbitant duty***: her macro quantities and global wealth share must both fall relative to the ROW during global downturns (Gourinchas et al, 2017; Maggiori, 2017; Sauzet, 2022). Are these implications consistent with the data? Using a wealth of publicly available data, I uncover a set of novel stylised facts that fundamentally challenges this key implication.

In specific terms, my findings suggest that the US is not bound by an exorbitant duty at all. I document that rather than being a risky country, the US seems safe relative to the ROW. She extracts a macro premium from the ROW, enjoying higher consumption and GDP growths on average relative to the ROW. This mirrors the US exorbitant privilege, the large historical excess return on the US external portfolio, and is earned *even though the US economy is relatively insulated during periods of global stress*. This latter fact challenges the traditional risk based interpretation of the US exorbitant privilege advanced by the standard models (Maggiori, 2017; Gourinchas et al, 2017; Kekre and Lenel, 2021; Sauzet, 2022).

Moving onto international asset prices, two important results are uncovered. Firstly, the

US stock market is a hedge against global macro risk: US equities consistently outperform the ROW during global downturns. Secondly, and most importantly, the US global wealth share rises during major periods of global stress. These latter two facts are linked: due to home bias in wealth portfolios, a direct mapping exists between countercyclical US equity outperformance and the countercyclical US wealth share.

Taken together, these novel stylised facts suggest that the US exorbitant privilege is worse than you can even imagine: not only does the US extract a premium from the ROW on average, as documented by Gourinchas and Rey (2007), she continues to do so *even during times of global stress*. It is this latter point that presents a natural challenge to the canonical models that emphasise the US role as the global insurance provider: relative US safety is clearly at odds with the traditional risk-based interpretation of the US exorbitant privilege implied by these models (Maggiori, 2017; Gourinchas et al, 2017). Furthermore jointly accounting for countercyclical dynamics in i) the dollar and ii) global risk premia in these models requires the US economy to suffer a worse recession during global downturns than the ROW (Kekre and Lenel, 2021), an implication that is also at odds with these US safety facts. Thus a ***US safety puzzle*** naturally arises: how can we jointly account for my novel US safety facts alongside i) the countercyclical dollar, ii) countercyclical global risk premia and iii) the US exorbitant privilege?

To resolve the puzzle, I deviate from traditional theories that emphasise the greater US risk-bearing capacity vis-*á*-vis the ROW. Instead, I build a framework that emphasises a different source of US specialness entirely: *the US has greater fiscal capacity than the ROW*. The excess US fiscal capacity has been the subject of active academic discussion in recent years, with recent work by Jiang et al (2019) demonstrating that the US is able to borrow more than her fiscal/macro fundamentals would warrant, a source of asymmetry that the US can exploit by running more countercyclical fiscal policy than the ROW. My framework takes this excess fiscal capacity as the key source of asymmetry between the US and the ROW, instead of the excess US risk bearing capacity emphasised by the traditional literature (Maggiori, 2017; Kekere and Lenel, 2021; Sauzet, 2022), and explores its global ramifications for international quantities and prices such as i) the dollar, ii) global risk premia and iii) global macro fluctuations.

The framework is a quantitative two-country model that features i) Epstein-Zin (EZ) preferences, ii) endogenous growth that is driven by two sources. Firstly local R&D effort as in Romer (1990) and Kung and Schmid (2012). Secondly the process of international technology adoption allows foreign innovation to be used as intermediate inputs into local final goods production, though the final goods production technology features home bias towards local innovation. Finally governments in each country follow an exogenous fiscal rule whereby expansionary fiscal policies are instituted during business cycle troughs and low expected growth environments. The model features two asymmetries. Firstly, the US is the global innovation leader: her technology is adopted by the ROW to a greater extent than she adopts ROW technology. This source of asymmetry is not necessary for resolving the US safety puzzle but does allow the model to reproduce important stylised facts regarding the unique global footprint of US fiscal policy that I document in a companion paper to this one (Kim, 2022b). Secondly, and most importantly for the US safety puzzle, the US has excess fiscal capacity vis-*á*-vis the ROW. Exploiting this excess fiscal capacity, the US runs more countercyclical fiscal policy than the ROW which is modelled in reduced form by assuming that the US having a larger fiscal cyclicality coefficient.

Taking the excess US fiscal capacity as given, I show that this framework can reproduce i) my novel US safety facts, ii) the US exorbitant privilege and iii) the dollar's countercyclical dynamics, resolving the US safety puzzle. It can also reproduce countercyclical global risk premium dynamics: the observed predictability patterns in dollar (Lustig, Roussanov and Verdelhan, 2014) and global equity excess returns (Miranda-Agrippino and Rey, 2020). The key mechanism driving these successes is the interaction between the fiscal theory, global innovation, endogenous growth and the international risk-sharing of expected growth shocks that occurs during times of global stress.

To see this mechanism in action, consider how model dynamics evolve in response to a bad global TFP shock. Due to her larger fiscal cyclicality coefficient, the US fiscal response is larger than the ROW. Since the US government prefers to smooth the tax burden associated with this fiscal expansion over time, the excess US spending is associated with an acceleration in the stock of US government debt. This financing choice has implications for the future path of fiscal policy: the intertemporal government budget constraint (IGBC) requires that the real value of government debt equate a properly risk-adjusted present value of future government surpluses. Thus there must be a path of persistently higher distortionary taxes to enforce the IGBC over long-run.

This fiscal theory mechanism has distortionary real effects: high expected future taxes levied on the corporate sector depress the market value of US patents, depressing US innovation intensity and consequently US growth prospects. Since the ROW adopts US innovation, this slowdown in US innovation also has ramifications for global growth: the depressed market values for US innovation also lowers market values for foreign adoption of US innovation, depressing innovation and growth prospects outside the US as well. Since preferences are recursive and agents fear variation in expected future growth prospects, both US and ROW marginal utility are adversely impacted by the relative US fiscal expansion.

One should note however that US growth prospects and consequently US marginal utility are ***more*** adversely impacted because foreign production features home bias in intermediate good preferences. Thus the US endogenously emerges as the riskier country: when global growth prospects deteriorate during global downturns, US growth prospects are adversely impacted. Due to recursive preferences, these expected global growth risks are priced, resulting in the US extracting a risk premium from the ROW and leading to the US economy and stock market outperforming the ROW on average. Thus the model rationalises the US exorbitant privilege/macro premium as a risk premium for her adverse exposure to expected global growth, or global ***long-run*** *risks*. This contrasts with standard models that interpret the US exorbitant privilege as a risk premium for contemporaneous global macro risks, or global ***short-run*** *risks* (Maggiori, 2017; Gourinchas et al, 2017; Kekre and Lenel, 2021).

This alternative risk-based view of the US exorbitant privilege is entirely consistent with both my novel US safety facts and the dollar's countercyclical dynamics. Since financial markets are internationally complete, and marginal utility growths must always be equalised in equilibrium (Backus, Foresi and Telmer, 2001), the relative deterioration in US growth prospects during global downturns has two important implications: times of global stress feature i) a dollar appreciation and ii) a transfer of resources from the ROW to the US. Thus the US is a global insurance ***receiver*** rather than a global insurance ***provider*** in my model, another point of distinction with the traditional literature.

This novel risk-sharing arrangement results in the relative safety of the US economy: the flow of capital goods into the US frees up resources for consumption and investment, increasing US relative consumption, investment and GDP growths relative to the ROW during global downturns, consistent with my empirical evidence. Countercyclical dynamics for i) US stock market outperformance and ii) US wealth share also emerge naturally in this framework. Since the stock market is a risky claim to the endogenous local output, the outperformance of the US economy and the dollar appreciation are complementary cash flow and discount rate forces that increase US relative stock market valuations during times of global stress. Due to portfolio home bias, this countercyclical US stock market outperformance then maps directly into countercyclical US wealth share dynamics, consistent with my empirical evidence.

Furthermore I show that the model reproduces countercyclical global risk premium dynamics that are consistent with the data. Here the interaction between global growth expectations, the global fiscal cycle and global policy uncertainty is important. Since governments engage in more expansionary fiscal policy during low growth environments, the deterioration in expected future global growth prospects during times of global stress causes fiscal conditions to deteriorate worldwide. Since governments smooth the local tax burden associated with these fiscal expansions over time by accumulating more government debt, these global fiscal deteriorations raise uncertainty over future global tax policy and consequently global long-run growth prospects. Since preferences are recursive, this variation in uncertainty over future global growth prospects is priced into global risky asset prices, generating countercyclical global risk premium dynamics that are at the heart of the global financial cycle (Miranda-Agrippino and Rey, 2015).

To conclude the theory section, I show that the model can also explain other novel stylised facts regarding the international transmission of US fiscal policy into global risky asset prices. In particular, the model quantitatively matches evidence from a companion paper of mine (Kim, 2022b) that documents that the US fiscal policy has a unique global footprint: ***deteriorations*** in the US fiscal condition coincide with i) ***depressed*** global risky asset prices and ii) ***higher*** future equity returns moving forward. I also demonstrated in that paper that this global footprint of US fiscal policy is unique: *once the US fiscal condition is controlled for, foreign fiscal conditions play a limited role in driving risky asset prices,* ***including their own***.

Key to reproducing this novel stylised fact is the second source of asymmetry in the model: *US role as global innovation leader*. This US centrality to global innovation empowers the US fiscal policy with an outsized influence over expected future global growth prospects, generating a unique mapping between the US fiscal condition, global innovation, the global fiscal cycle, global policy uncertainty and consequently global risk premia in the model. Since foreign innovation is far less central, this mechanism is unique to the US fiscal policy, reproducing the unique international transmission of US fiscal policy into global risky asset prices in the data.

Taken together, the theoretical results shed new light on the relevant sources of US specialness driving puzzling phenomena in global financial markets. Whilst traditional models based on the US global insurance provider role emphasise greater US risk-bearing capacity (Gourinchas et al, 2017; Maggiori, 2017), my model suggests an alternative source of asymmetry: the excess fiscal capacity available to the US relative to the ROW. This new source of asymmetry is in principle distinct from the greater US risk-bearing capacity: since my model can reconcile countercyclical dollar dynamics with my novel US safety facts in a way that EP theory cannot, my theoretical results can be interpreted as implying that excess US fiscal capacity vis-*á*-vis the ROW is a more relevant source of US specialness than the risk-tolerance mechanism emphasised by the canonical models.

To conclude the paper, I use my model to explore the global ramifications of the excess US fiscal capacity. Recent models such as Kekre and Lenel (2021) and Jiang, Krithnamurthy and

Lustig (2020a) suggest that more aggressive US fiscal policy responses during global downturns can be a force for good that lubricates the global economy by increasing the supply of world's safe asset during these periods of global stress. In contrast, my model implies the exact opposite: by exploiting her excess fiscal capacity during global downturns, the US can drive up global sources of risk during global downturns, amplifying fluctuations in global macro quantities and the dollar exchange rate during these times of global stress. Thus my model suggests that the excess US fiscal capacity may be a destabilising, rather than a stabilising influence on the global economy during these periods of global stress, a novel insight that my paper is bringing to the table that should inform policy moving forward.

Related Literature: My paper connects to a vast literature emphasising the special role that the US plays in driving global risk pricing. Most relevant is the exorbitant privilege (EP) literature that emphasises the greater risk-bearing capacity of the US: as the world's most risk tolerant country, the US transfers wealth abroad during global bad times (Gourinchas et al, 2017; Maggiori, 2017). Whilst EP theory can rationalise many features of the international financial system, it falls prey to the reserve currency paradox: the dollar counterfactually depreciates during global downturns (Maggiori, 2017). Recent work has considered a simple resolution to this puzzle: the US economy suffers a worse recession than the ROW during global downturns (Kekre and Lenel, 2021). My paper's main empirical findings challenge this mechanism.

My paper also contributes to the EP literature in a more subtle way. EP models have historically used the procyclical US NFA position as motivation for their view that the US is the global insurance provider (Maggiori, 2017; Gourinchas et al, 2017; Kekre and Lenel, 2021). Implicit in EP models is therefore the assumption that *the US NFA and the US wealth share are the same object*. My wealth share evidence challenges this contention: whilst the US NFA is indeed procyclical, due to the countercyclical US stock market outperformance, the US wealth share is actually countercyclical. This empirical dichotomy therefore constitutes an important new asset pricing moment that should discipline EP models moving forward. This is a tension that is currently unresolved by such a framework.

My paper is also related to recent work studying the cyclical properties of the US wealth share. Jiang, Krithnamurthy and Lustig (2020) show theoretically that the US wealth share can rise during periods of global stress due to a convenience yield mechanism. In a similar vein Dahlquist et al (2022) use a deep habits mechanism to jointly account for countercyclical dynamics for i) the US wealth share, ii) US stock market outperformance and iii) the dollar. On the empirical front, this paper also confirms my result that the US wealth share is countercyclical w.r.t the global economy. My paper is also related to Sauzet (2022) who also empirically investigates the cyclical properties of the US wealth share.

My paper is also intimately connected to a vast asset pricing literature that explores the role of i) EZ preferences and ii) correlated growth prospects in an international context. This literature uses a multi-country framework with i) EZ preferences, ii) correlated growth prospects, or long-run risks, and iii) international trade to resolve many international finance puzzles such as the FX volatility puzzle (Colacito and Croce, 2011; Bansal and Shaliastovich, 2013); Backus-Smith and UIP puzzles (Colacito and Croce, 2013), the carry trade anomaly (Colacito et al, 2018) and the volatility disconnect (Colacito et al, 2021). This literature largely focuses on endowment economy settings: they exogenously impose a correlation structure in long-run risks: my paper unmasks this dark matter. My paper connects these correlated growth prospects to the US fiscal policy, an insight new to the literature.

Regarding fiscal policy, my paper is most related to an established literature studying the joint dynamics between fiscal shocks, risk premia and macro quantities from a recursive utility perspective. Most related are the contributions of Croce et al (2012a, 2012b) who study the welfare implications of US fiscal policy. I differ from these works by studying the global implications of US fiscal policy, in particular its implications for the US exorbitant privilege, the dollar, relative macro quantities between US and the ROW and global risk premia.

Finally my paper is related to a small but growing literature studying the international transmission of US fiscal policy into global risky asset prices. The most closely related paper is a companion paper of mine: Kim (2022b) which explores the tight link between the US fiscal condition and the global financial cycle (GFC) in risky asset prices. Another closely related paper is Jiang (2021) who also explores the link between US fiscal policy and the dollar, though from a completely different perspective. Whilst my model links the US fiscal policy to dollar dynamics through a global long-run risk mechanism that operates through innovation, Jiang (2021) links these variables through an intermediary mechanism whereby US fiscal policy drives the dollar risk premium through an intermediary reserve constraint that features dollar specialness.

2 Data Sources

ROW: In my baseline analysis I define the ROW using a diverse sample of developed countries.[1] This includes the following 21 countries: Austria, Australia, Belgium, Canada, Denmark, Fin-

[1] In the online appendix I consider robustness w.r.t a larger sample that includes emerging market countries as well. This includes large holders of US debt such as China and India.

land, France, Germany, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Sweden, Portugal, Spain, Switzerland and the United Kingdom.

Macro and Financial Data: I obtain country level data for consumption, GDP, investment from the OECD at the quarterly frequency. Following Colacito et al (2018), I use the volume index of private consumption and GDP expenditure as the consumption and GDP series for each country. Net exports is the difference between the volume indices for exports and imports of goods and services. Investment is defined as gross fixed capital formation (GFCF). The full dataset is an unbalanced panel for the 22 developed countries (US and ROW) from 1983Q1 to 2021Q1. Finally, I obtain data on government primary surpluses from Oxford Economics via Datastream. The data is unbalanced, but there is no missing observation after each country's time series starts. Equity returns data comes from the MSCI total return indices available via MSCI Global through Thomson Datastream. For ROW returns, I use the MSCI global ticker ***ROW ex US*** that covers the MSCI World Index excluding the US. This incorporates 23 developed countries, including the 21 developed countries included in my ROW category.

Wealth Framework: To measure the US wealth share I use a two country framework where the two countries are the United States (US) and the rest of the world (ROW). I collapse the 21 non-US developed countries described in the previous section into the ROW category and treat the collective as a single investor country. Each country's wealth portfolio is invested across four assets: US equities, ROW equities, US bonds and ROW bonds:

$$\mathcal{W}_t^i = \underbrace{\mathcal{Q}_{US,t}^{E,i} + \mathcal{Q}_{ROW,t}^{E,i}}_{Equities} + \underbrace{\mathcal{Q}_{US,t}^{D,i} + \mathcal{Q}_{ROW,t}^{D,i}}_{Bonds}, i \in \{US, ROW\} \tag{1}$$

$\mathcal{Q}_{US,t}^{E,i}$: *country i holdings of US equities*
$\mathcal{Q}_{ROW,t}^{E,i}$: *country i holdings of ROW equities*
$\mathcal{Q}_{US,t}^{D,i}$: *country i holdings of US debt*
$\mathcal{Q}_{ROW,t}^{D,i}$: *country i holdings of ROW debt*

US Wealth Share: US wealth share ω_t^{US} is defined as the *US share of global wealth*:

$$\omega_t^{US} = \frac{\mathcal{W}_t^{US}}{\mathcal{W}_t^{US} + \mathcal{W}_t^{ROW}} \tag{2}$$

US Relative Wealth: I also define a dollar measure of relative wealth changes. $\tilde{\mathcal{W}}_t$ measures US relative wealth vis-á-vis the ROW:

$$\tilde{\mathcal{W}}_t = \mathcal{W}_t^{US} - \mathcal{W}_t^{ROW} \tag{3}$$

Since both $\tilde{\mathcal{W}}_t$ and ω_t^{US} are highly persistent variables, I work with growth rates: $\Delta\tilde{\mathcal{W}}_t$, $\Delta\omega_t^{US}$ in my empirical implementation.

External Holdings Data: External portfolio positions between the US and non-US (foreign) countries are publicly observable from US treasury data. In particular, I make use of two sources of official data from the US treasury: the Treasury International Capital (TIC) survey and the Treasury SLT Form. The TIC data comprises of two annual investor surveys: an external liabilities survey and an external claims survey. The TIC liabilities survey reports the stock dollar value of foreign country i's aggregate holdings of US equity and debt ($\mathcal{Q}_{US,t}^{E,i}$, $\mathcal{Q}_{US,t}^{D,i}$) at the aggregate asset class level. Conversely the TIC claims survey reports the stock dollar value of US holdings of country i's equity and debt ($\mathcal{Q}_{i,t}^{E,US}$, $\mathcal{Q}_{i,t}^{D,US}$) at the aggregate asset class level. Both surveys report these stock dollar values at the end of June of each year.

I complement the annual TIC data with the Treasury SLT filings which report monthly flow position changes in external portfolio holdings. As with the TIC data, there are two components to the SLT filing: an external liabilities and an external claims component. The external liabilities component reports aggregate monthly purchases and sales of US equity and debt by foreign countries at an aggregate asset class level. Conversely the external claims component reports aggregate monthly purchases and sales of foreign equity and debt by the US at an aggregate asset class level.

The external portfolio holdings data from US treasury relate to *publicly* traded securities. Equity holdings relate to *portfolio equity*: public equity claims to US, ROW stock markets. Bond holdings relate to claims to the total debt outstanding of US and ROW. They are aggregated across a range of publicly issued debt instruments: treasury bonds, agency bonds and corporate bonds. The coverage of foreign countries against which US portfolio positions are reported is extensive. It includes 44 countries, including the 21 developed countries comprising the ROW.

Relationship with other Data Sources: The TIC data represents a comprehensive set of data on US and ROW external portfolio holdings at the quarterly level. It compares favourably with other traditional data sources using for empirical analyses of wealth dynamics (Jiang, Richmond and Zhang, 2021). The online appendix contains more detailed discussion about the comprehensiveness of the TIC data and its relationship with other data sources such as the flow of funds and the BEA integrated macro accounts.

2.0.1 Internal Holdings Data

Following Jiang, Richmond and Zhang (2021), I estimate internal holdings by subtracting observed external holdings positions from observed market values:

$$
\begin{aligned}
\mathcal{Q}^{E,US}_{US,t} &= \mathcal{Q}^{E}_{US,t} - \sum_{i \neq US} \mathcal{Q}^{E,i}_{US,t} \\
\mathcal{Q}^{E,ROW}_{ROW,t} &= \mathcal{Q}^{E}_{ROW,t} - \sum_{i \notin ROW} \mathcal{Q}^{E,i}_{ROW,t} \\
\mathcal{Q}^{D,US}_{US,t} &= \mathcal{Q}^{D}_{US,t} - \sum_{i \neq US} \mathcal{Q}^{D,i}_{US,t} \\
\mathcal{Q}^{D,ROW}_{ROW,t} &= \mathcal{Q}^{D}_{ROW,t} - \sum_{i \notin ROW} \mathcal{Q}^{D,i}_{ROW,t}
\end{aligned} \tag{4}
$$

$\mathcal{Q}^{E}_{i,t}$: *Dollar market value of country i's stock market capitalisation*
$\mathcal{Q}^{D}_{i,t}$: *Dollar market value of country i's debt outstanding*

To best approximate US internal holdings, the non-US world includes all countries in the TIC data, even though the ROW only includes the non-US developed world. Similarly ROW internal holdings calculation uses all available countries in the TIC data when defining the non-ROW world.

Market Cap Data: I obtain equity market capitalisation data ($\mathcal{Q}^{E}_{US,t}$, $\mathcal{Q}^{E}_{ROW,t}$) from datastream using the MV ticker. I obtain debt outstanding data ($\mathcal{Q}^{D}_{US,t}$, $\mathcal{Q}^{D}_{ROW,t}$) from Bank of International Settlements (International Debt Statistics). Whilst holding data and datastream data are monthly, BIS data is only available at a quarterly frequency.

3 US Safety Facts

Macro Premium: Here I formally present the central empirical point of this paper: the US seems safe relative to the ROW. Table 1 clearly indicates that the US economy outperforms the ROW on average: both US consumption and GDP growths outperform their ROW counterparts by approximately 0.94% and 0.51% on annualised basis over the full sample, a relatively modest but economically meaningful magnitude. Furthermore this result is robust to splitting the sample into the pre-2007 and post-2007 periods, indicating that this fact is not driven by outlier events such as the global financial crisis and the COVID epidemic.

Table 1: *US Macro Premium*

Description: This table constructs sample statistics for $\Delta c_t^{US} - \Delta c_t^{ROW}$ and $\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$. Numbers are in percentage points. I perform a blockwise bootstrap using 1 year (4 quarter) blocks for 5000 replications and report the bootstrapped means. The reported p-values are associated with testing the null that on average US consumption and GDP growths are equal to the ROW against the alternative that they are higher.

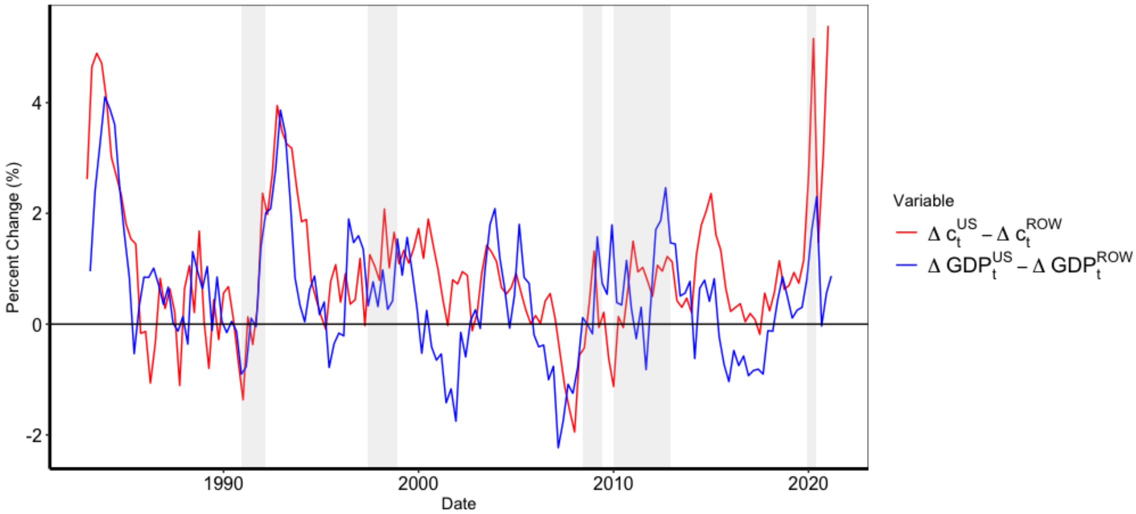
	Original Data	*Mean*	*P-Value*	*90% CI*
	Panel (a): Full Sample			
$\Delta c_t^{US} - \Delta c_t^{ROW}$	0.94	0.94***	0.00	[0.64, 1.18]
		(0.18)		
$\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$	0.51	0.51***	0.01	[0.26, 0.77]
		(0.15)		
	Panel (b): Pre-2007			
$\Delta c_t^{US} - \Delta c_t^{ROW}$	0.96	0.97***	0.00	[0.60, 1.32]
		(0.22)		
$\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$	0.57	0.57***	0.01	[0.22, 0.93]
		(0.22)		
	Panel (c): Post-2007			
$\Delta c_t^{US} - \Delta c_t^{ROW}$	0.90	0.90***	0.00	[0.51, 1.29]
		(0.23)		
$\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$	0.39	0.39*	0.076	[0.08, 0.70]
		(0.19)		

Note: *p<0.1; **p<0.05; ***p<0.01

US Safety and US Exorbitant Privilege: What explains this US macro premium? Modern theories based on the US role as the global insurance provider would argue that this is simply another manifestation of the US exorbitant privilege. Due to her greater risk-bearing capacity, the US takes a levered position in global risky assets and insures the ROW by going short dollar bonds (Gourinchas and Rey, 2007b; Gourinchas et al, 2017). Thus the US macro premium is simply a manifestation of the risk premium that the US earns on her external portfolio as compensation for her role as the global insurance provider. The problem with this risk-based interpretation of the US exorbitant privilege is that it implies that the US is bound by an *exorbitant duty*: as the global insurance provider, the US must transfer wealth abroad during periods of global stress, implying that her macro quantities are adversely affected by such episodes. Figure 1 suggests that the reverse is actually true: even during the global financial crisis (GFC) of 2008-2009 and the recent COVID epidemic, the US was able to extract a premium from the ROW, as evidenced by the fact that both $\Delta c_t^{US} - \Delta c_t^{ROW}$ and $\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$ rose during these global episodes.

Figure 1: *US Macro Outperformance*

Description: I plot $\Delta c_t^{US} - \Delta c_t^{ROW}$ (red) and $\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$ (blue) from 1983Q1-2021Q1. The grey bars corresponding to the following periods of global stress: 1990s global recession (1990Q4-1991Q4), Asian Financial Crisis (1996Q2-1997Q4), Global Financial Crisis (2008Q2-2009Q2), European Debt Crisis (2010Q1-2012Q4) and COVID (2020Q1-2020Q2).



Global Risk Exposures: To formally establish relative US safety, I extract global risk exposures using a blockwise bootstrap approach.[2] In each of the 5000 replications, I extract US global risk exposures by running the following time series regression:

$$\Delta c_t^{US} = \alpha_{US}^C + \beta_{US}^C \left(\frac{1}{N}\sum_{i=1}^{N} \Delta c_t^i\right) + \epsilon_{US,t} \tag{5}$$

$$\Delta GDP_t^{US} = \alpha_{US}^{GDP} + \beta_{US}^{GDP} \left(\frac{1}{N}\sum_{i=1}^{N} \Delta GDP_t^i\right) + \epsilon_{US,t} \tag{6}$$

To extract the ROW loading, I run the following panel regression with country fixed effects for the non-US component of each bootstrapped sample:

$$\Delta c_t^{i} = \alpha_{i}^C + \beta_{ROW}^C \left(\frac{1}{N}\sum_{i=1}^{N} \Delta c_t^i\right) + \epsilon_{i,t} \tag{7}$$

$$\Delta GDP_t^{i} = \alpha_{i}^{GDP} + \beta_{ROW}^{GDP} \left(\frac{1}{N}\sum_{i=1}^{N} \Delta GDP_t^i\right) + \epsilon_{i,t} \tag{8}$$

[2] This strategy uses a one year (four quarter) panel block of size $NT = 22 \times 4$ where $N = 22$ is the number of countries in the original data. The procedure resamples data from each panel block. These resampled blocks are then stitched together to form a single bootstrapped sample. This is done for 5000 replications.

Table 2: *US Relative Safety Analysis*

Description: This table reports the bootstrapped distribution for $\beta^{US}_{C} - \beta^{ROW}_{C}, \beta^{US}_{GDP} - \beta^{ROW}_{GDP}$ when the ROW is defined including and excluding emerging countries instead. Bootstrapped SEs are in parentheses. CIs are constructed from the percentiles of the bootstrapped distributions. The reported p-values are associated with a one-sided test of the null that the US and ROW have equal betas against the alternative that the US beta is lower.

	Original Data	*Mean*	*90% CI*	*P-Value*
		$\beta^{US}_{C} - \beta^{ROW}_{C}$		
Developed	-0.207	-0.222^{***} (0.083)	[-0.299, -0.027]	0.006
Emerging	-0.507	-0.555^{**} (0.175)	[-0.908, -0.343]	0.020
		$\beta^{US}_{GDP} - \beta^{ROW}_{GDP}$		
Developed	-0.123	-0.128^{**} (0.059)	[-0.228, -0.043]	0.035
Emerging	-0.331	-0.356^{**} (0.111)	[-0.563, -0.228]	0.024

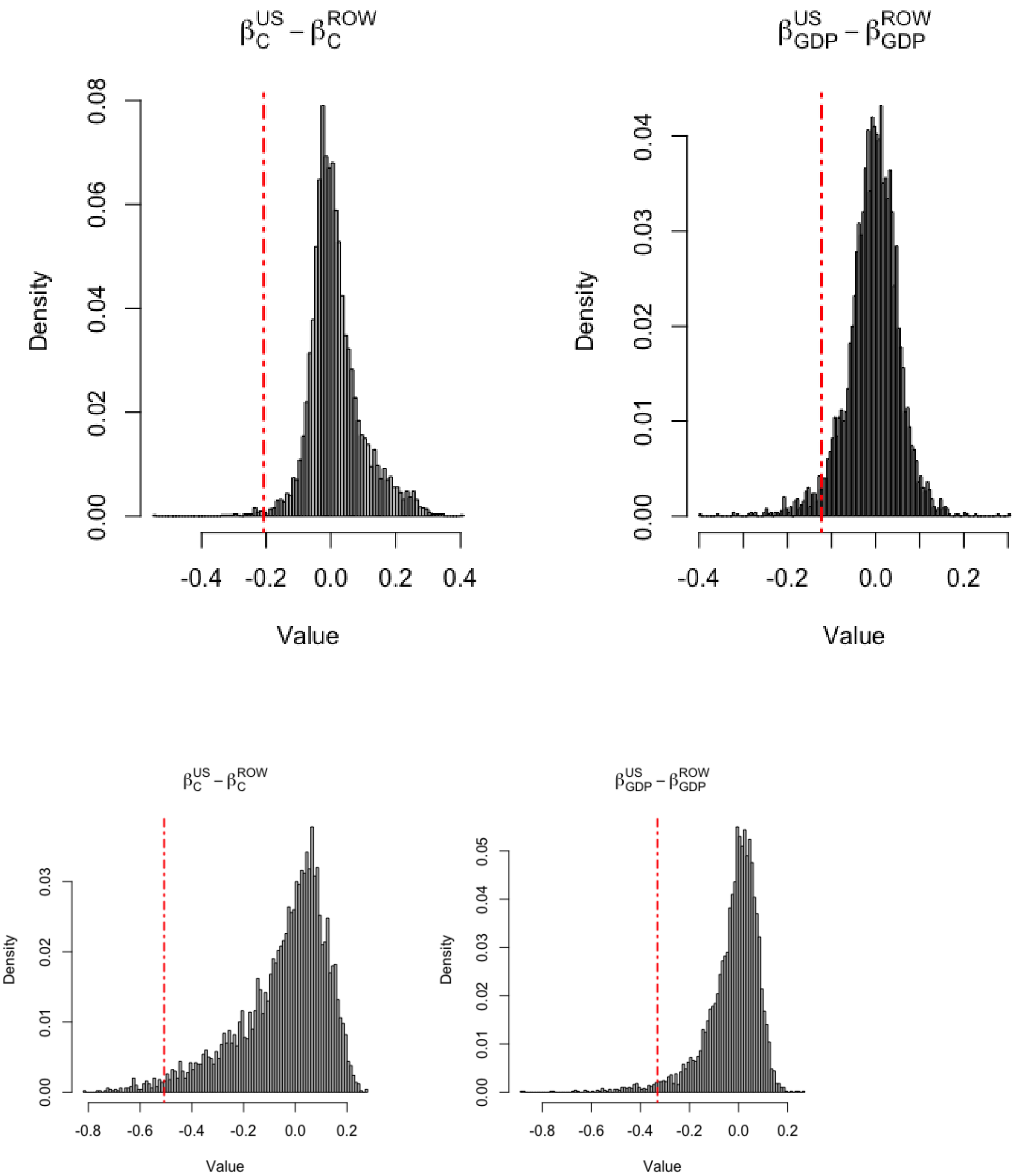
Note: *p<0.1; **p<0.05; ***p<0.01

Statistics for the bootstrapped sampling distribution of $\beta^{US}_{GDP} - \beta^{ROW}_{GDP}, \beta^{US}_{C} - \beta^{ROW}_{C}$ are displayed in table 2. To formally establish that this difference is statistically significant, I use the bootstrapped distributions to test the null hypothesis that US and ROW betas are identical against the alternative that the US beta is lower. This indicates that at a 5% significance level we can reject the null in favour of the alternative that the US is indeed less exposed to traditional sources of global macro risk than the ROW. Figure 29 visualises these baseline results by plotting the boostrapped null distributions of $\beta^{US}_{GDP} - \beta^{ROW}_{GDP}, \beta^{US}_{C} - \beta^{ROW}_{C}$.

Notice that the results are robust to the inclusion of EME countries in the ROW construction. In fact, my results in this regard are actually stronger: when emerging market countries are included, the global consumption and GDP beta differentials between the US and the ROW are actually more negative. This result is intuitive: given the highly dollarised nature of emerging market economies (Bruno and Shin, 2017), systematic dollar appreciations during periods of global stress amplify the effect of global macro fluctuations for these countries (Obstfeld and Zhou, 2022). Thus adding emerging markets to my analysis reinforces my results, rather than mitigating them.

Figure 2: *Bootstrapped Null Distribution for* $\beta_C^{US} - \beta_C^{ROW}$, $\beta_{GDP}^{US} - \beta_{GDP}^{ROW}$

Description: This figure plots the histogram for the bootstrapped distributions for $\beta_C^{US} - \beta_{ROW}^{US}$ and $\beta_{GDP}^{US} - \beta_{GDP}^{ROW}$ under the null hypothesis that $\beta_C^{US} = \beta_C^{ROW}$ and $\beta_{GDP}^{US} = \beta_{GDP}^{ROW}$. The first panel plots the baseline result when ROW is limited to developed countries. The second panel plots results when EME countries are included in the ROW construction. The red dotted line signals the observed data value. The mass to the left of this line coincides with the reported p-values in table 2.



US Stock Market Outperformance: Having formally established US relative macro safety, I now move onto asset prices and the historical outperformance of the US stock market vis-*á*-vis the ROW in table 3. Two comments are in order. Firstly, like consumption and GDP growth, the US stock market has earned a premium over the ROW.

Table 3: *US Stock Market Outperformance*

Description: This table constructs sample statistics for US stock market outperformance: $r_t^{US} - r_t^{ROW}$. Numbers are in percentage points. Reported CIs are computed using a blockwise bootstrap for 5000 replications. The reported p-values are associated with testing the null that the return differential is zero against the alternative that they are higher.

	Original Data	*Mean*	*P-Value*	*90% CI*
	$r_t^{US} - r_t^{ROW}$			
Full Sample	2.03	2.03** (1.01)	0.025	[0.91, 4.31]
Pre-2007	0.37	0.37 (1.01)	0.37	[-1.26, 3.01]
Post-2007	6.23	6.23*** (0.15)	0.00	[4.42, 6.02]

Note: *p<0.1; **p<0.05; ***p<0.01

Secondly, the US stock market has global hedging properties: figure 3 clearly illustrates that it has consistently outperformed the ROW in every global downturn over the last forty years (1983-2021). To identify the key economic drivers behind the US stock market's hedging properties, I decompose $r_t^{US} - r_t^{ROW}$ into a dollar component $Dollar_t$ and a local equity return component $\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$ that is orthogonal to $Dollar_t$. Table 4 reveals an interesting dichotomy: pre-GFC $\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$ seems to have been the key economic force driving the countercyclical US stock market outperformance. However post-GFC the dollar component has become more prominent.

Table 4: *US Stock Market Outperformance Regressions*

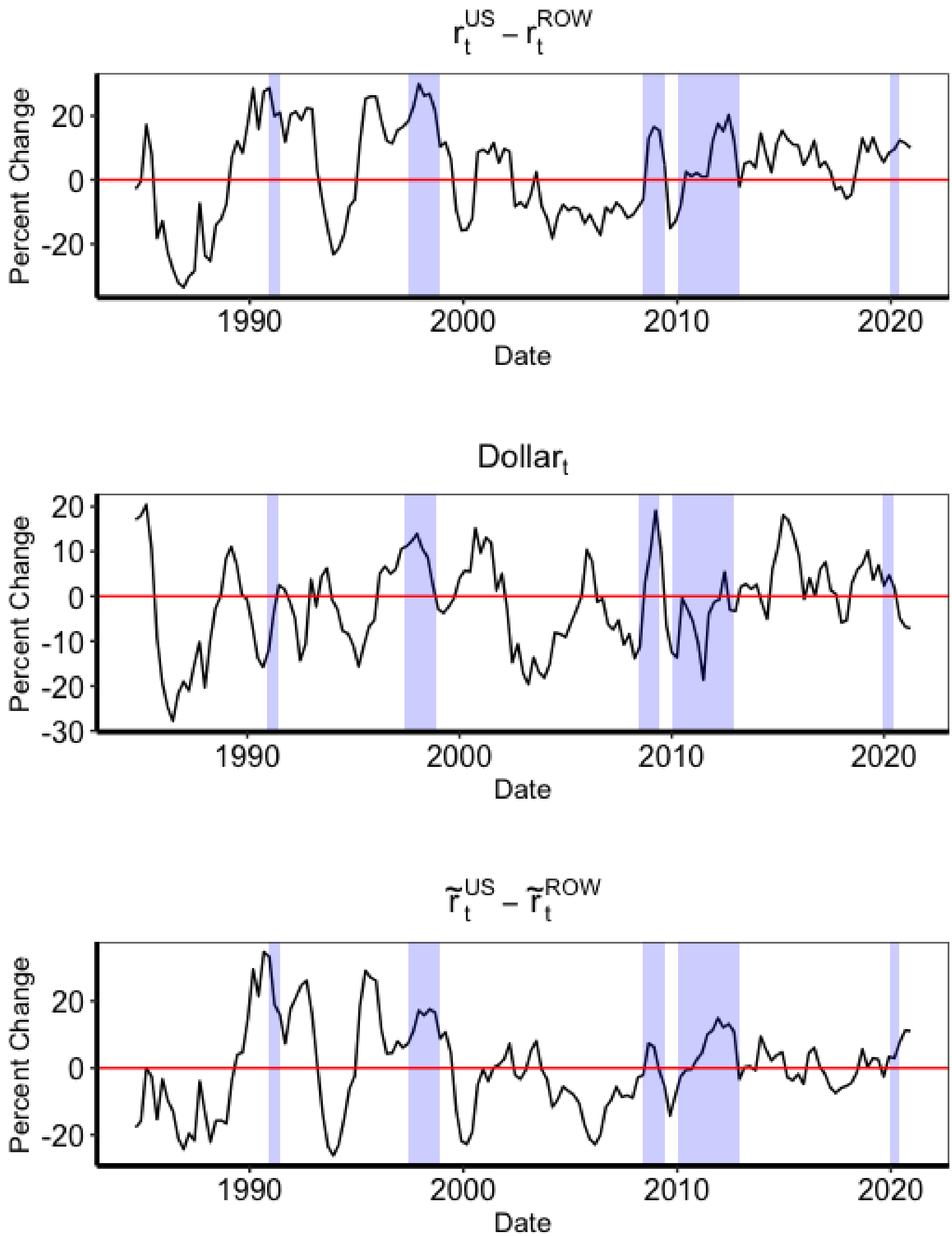
Description: I regress $r_t^{US} - r_t^{ROW}$, Dollar_t and $\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$ against global consumption growth Δc_t^G. Market returns and consumption growths are defined as the yearly (four quarter) log changes. The full sample is from 1983Q1 - 2021Q1.

	US Stock Market Outperformance and Decomposition								
	$r_t^{US} - r_t^{ROW}$			Dollar_t			$\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$		
	Full	Pre-2007	Post-2007	Full	Pre-2007	Post-2007	Full	Pre-2007	Post-2007
Δc_t^G	-4.610**	-9.865***	-5.780***	1.965*	1.717	-0.262***	-4.965***	-9.717***	-0.987*
	(1.875)	(1.929)	(2.209)	(1.107)	(1.621)	(0.102)	(1.108)	(1.621)	(0.421)
Constant	0.149***	0.326***	0.072**	-0.046***	-0.035	0.011***	-0.046***	-0.035	0.011***
	(0.032)	(0.061)	(0.004)	(0.032)	(0.061)	(0.004)	(0.027)	(0.061)	(0.004)
Observations	153	100	53	153	100	53	153	100	53
Adjusted R^2	0.150	0.262	0.147	0.054	0.010	0.051	0.095	0.245	0.061

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 3: *US Stock Market Outperformance*

Description: This figure plots $r_t^{US} - r_t^{ROW}$ and its dollar component $Dollar_t$ and local return component $\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$ over time. Blue bands correspond to the following global episodes: 1990s global recession (1990Q4-1991Q4), Asian Financial Crisis (1996Q2-1997Q4), Global Financial Crisis (2008Q2-2009Q2), European Debt Crisis (2010Q1-2012Q4) and COVID (2020Q1-2020Q2).



Countercyclical US Wealth Share: I now move onto the US wealth share. Figure 4 plots the time-series evolution of the four-quarter changes in i) the US wealth share $\Delta\omega_t^{US}$ and ii) US relative wealth vis-á-vis the ROW: $\Delta\tilde{\mathcal{W}}_t$. It also suggests a countercyclical pattern: both $\Delta\omega_t^{US}$ and $\Delta\tilde{\mathcal{W}}_t$ rose during the two most prominent global crises: the global financial crisis (2008Q2-2009Q2) and the recent COVID epidemic (2020Q1-2020Q2). It is worth noting however that this countercyclical trend has been relatively muted during other periods of global stress such as the Asian Financial Crisis and the European Debt Crisis.

To confirm that the US wealth share is indeed countercyclical, table 5 presents a battery of regressions confirming this result.[3] Digging deeper, what drives the countercyclical US wealth share? Column 2 of table 5 suggests that it is the US stock market outperformance itself, with the inclusion of $r_t^{US} - r_t^{ROW}$ in the regression increasing the R^2 from 7% to 58% and driving out global consumption growth from the regression. Columns 3-5 breaks $r_t^{US} - r_t^{ROW}$ into its dollar and local return components, showing that the dollar component is driving this link between US stock market outperformance during global bad times and the countercyclical US wealth share.

Table 5: *US Wealth Share Regressions*

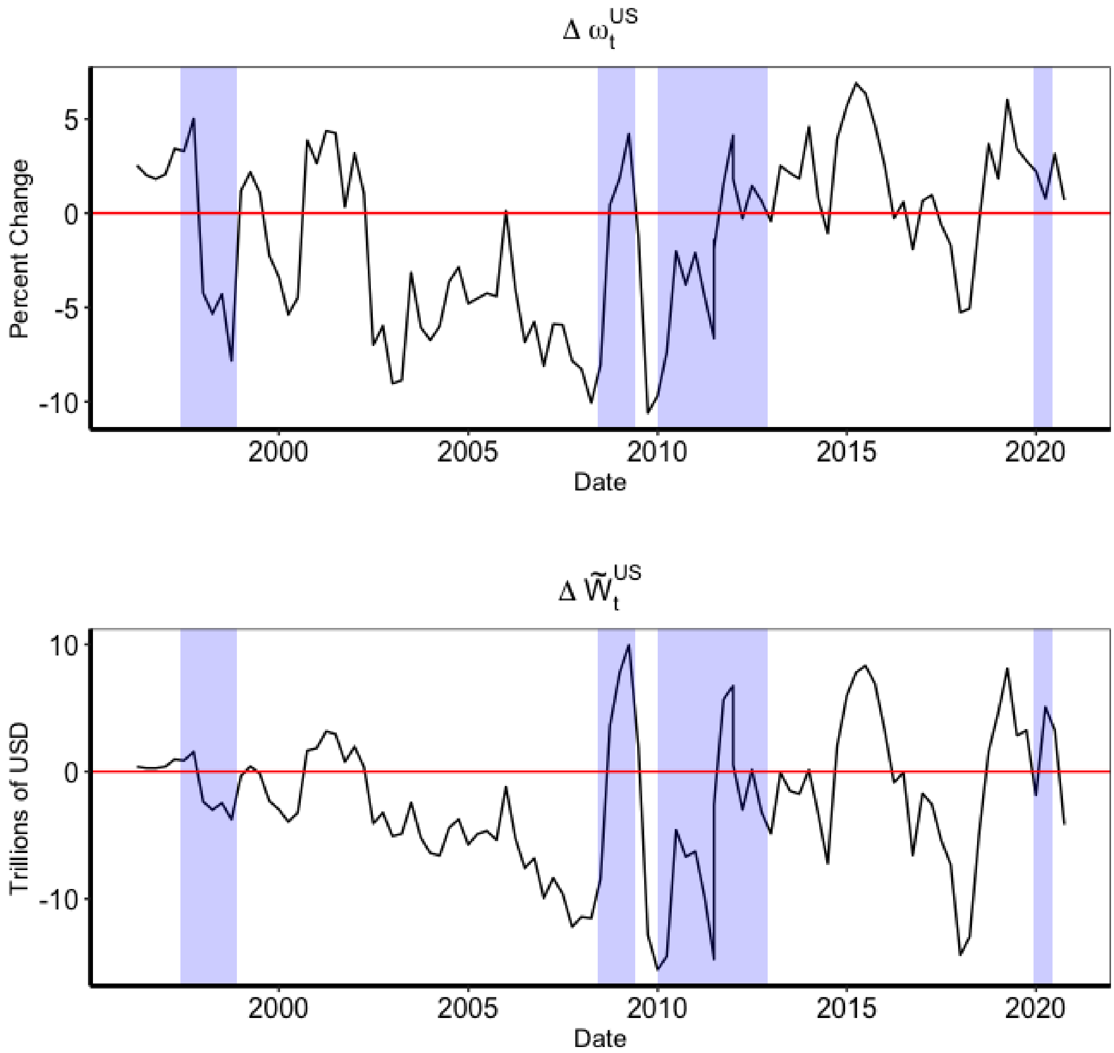
Description: $\Delta\omega_t^{US}$ is the change in the US wealth share. Δc_t^G is average global consumption growth. $r_t^{US} - r_t^{ROW}$ is US stock market outperformance, $Dollar_t$ and $\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$ are its dollar and local equity return components. The first five columns include the global financial crisis (GFC) from 2008Q2-2009Q2. The next five columns compute the same regressions after omitting the GFC dates.

	Dependent Variable: $\Delta\omega_t^{US}$									
	With GFC					Without GFC				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δc_t^G	-0.170^{***}	-0.082	-0.066	-0.151^{**}	-0.028	-0.174^{**}	-0.009	-0.124^{**}	-0.159^{**}	-0.083
	(0.060)	(0.071)	(0.046)	(0.060)	(0.043)	(0.068)	(0.037)	(0.050)	(0.069)	(0.059)
$r_t^{US} - r_t^{ROW}$		0.562^{***}					0.762^{***}			
		(0.090)					(0.110)			
$Dollar_t$			0.363^{***}		0.390^{***}			0.360^{***}		0.387^{***}
			(0.040)		(0.037)			(0.040)		(0.039)
$\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$				0.092^{**}	0.151^{***}				(0.048)	0.123^{***}
				(0.046)	(0.034)				(0.050)	(0.036)
Observations	100	100	100	100	100	96	96	96	96	96
Adjusted R^2	0.066	0.579	0.489	0.089	0.570	0.055	0.562	0.488	0.059	0.541
Note:	*p<0.1; **p<0.05; ***p<0.01									

[3]The online appendix shows that this countercyclicality is preserved when the ROW definition is extended to include emerging markets as well.

Figure 4: *US Wealth Share* (Full Sample)

Description: This figure plots the four quarter changes in the US wealth share growth $\Delta\omega_t^{US}$ and US relative wealth $\Delta\tilde{\mathcal{W}}_t$. Pink bands correspond to the following periods of global stress: Asian Financial Crisis (1996Q2-1997Q4), Global Financial Crisis (2008Q2-2009Q2) and European Debt Crisis (2010Q1-2012Q4) and COVID (2020Q1-2020Q2).



Decomposition: To further validate this link between US stock market outperformance and the US wealth share, I follow Jiang, Richmond and Zhang (2021) and decompose country level wealth into a valuation component $\mathcal{V}_t^i$ and a flow component $\mathcal{D}_t^i$:

$$\mathcal{W}_t^i = \underbrace{\mathcal{W}_{t-1}^i \pi_{t-1}^i{}' R_t}_{\mathcal{V}_t^i} + \mathcal{D}_t^i \tag{9}$$

This decomposition implies that US relative wealth $\tilde{\mathcal{W}}_t = \mathcal{W}_t^{US} - \mathcal{W}_t^{ROW}$, can be similarly decomposed into a valuation and flow component:

$$\tilde{\mathcal{W}}_t = \underbrace{\mathcal{V}_t^{US} - \mathcal{V}_t^{ROW}}_{\tilde{\mathcal{V}}_t} + \underbrace{\mathcal{D}_t^{US} - \mathcal{D}_t^{ROW}}_{\tilde{\mathcal{D}}_t} \tag{10}$$

This implies the following variance decomposition of US relative wealth:

$$var(\Delta\tilde{\mathcal{W}}_t) = var(\Delta\tilde{\mathcal{V}}_t) + var(\Delta\tilde{\mathcal{D}}_t) + 2cov(\Delta\tilde{\nu}_t, \Delta\tilde{\mathcal{D}}_t) \tag{11}$$

Table 6: *Variance Decomposition* of $\Delta\tilde{\mathcal{W}}_t$

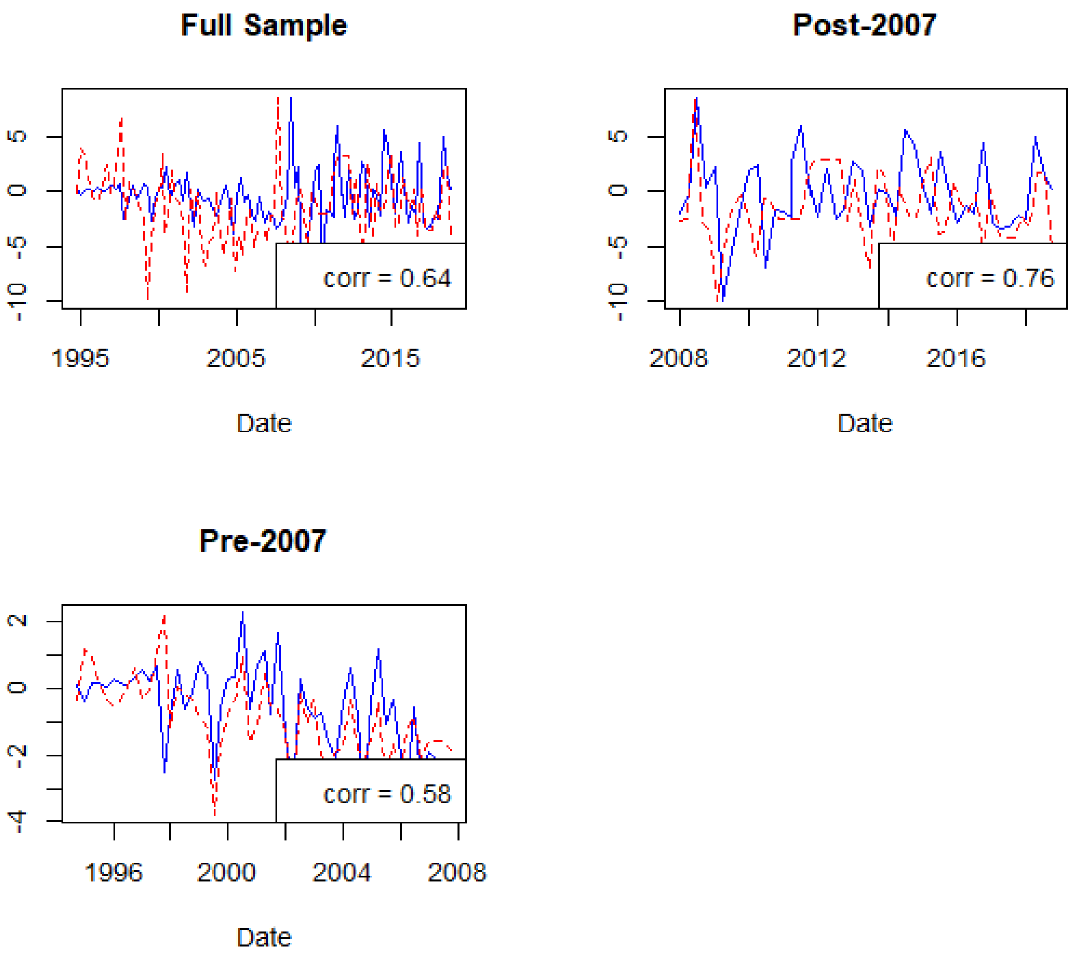
This table reports the results from estimating the variance decomposition implied by (11). By construction, the sum of the three components equals one.

Sample	$\frac{var(\Delta\tilde{\mathcal{V}}_t)}{var(\Delta\tilde{\mathcal{W}}_t)}$	$\frac{var(\Delta\tilde{\mathcal{D}}_t)}{var(\Delta\tilde{\mathcal{W}}_t)}$	$\frac{2cov(\Delta\tilde{\mathcal{V}}_t,\Delta\tilde{\mathcal{D}}_t)}{var(\Delta\tilde{\mathcal{W}}_t)}$
Full Sample	0.741	0.309	-0.050
Pre 2007	0.817	0.128	0.055
Post 2007	0.727	0.343	-0.070

US Equity Outperformance and Valuation Channel: Table 6 demonstrates that the valuation component explains over 70% of the variation in US relative wealth changes. Now I connect this valuation component to US equity outperformance: $r_t^{US} - r_t^{ROW}$. Figure 5 plots the tight connection between the valuation component ($\Delta\tilde{\mathcal{V}}_t$) and US equity outperformance ($r_t^{US} - r_t^{ROW}$). Across the full sample, the correlation between the two variables is high (0.64), with this correlation reaching 0.76 in the post-GFC sample. This strongly indicates that US equity outperformance during global recessions is a central economic force driving the countercyclical US wealth share.

Figure 5: *US Stock Market Outperformance and Valuation Component*

Description: This figure plots US equity outperformance $r_t^{US} - r_t^{ROW}$ against the valuation component $(\Delta\tilde{\mathcal{V}}_t)$ and reports the correlation. Correlations are reported in the bottom right of each panel. The graph is produced for the full sample, the pre-2007 and the post-2007 samples separately.



US Wealth Share vs US NFA Position: My empirical findings about the US wealth share have important implications for existing models based on US exorbitant privilege. Motivated by the procyclical US NFA position (Gourinchas and Rey, 2007a,b), these models argue that the US insures the ROW by transferring wealth abroad during global bad times when global risky asset prices are low. Implicit in these models is an assumption that the US NFA position and the US wealth share are the same object.

My results indicate that in the data these two objects actually have wildly different cyclical properties: whilst the US NFA position is procyclical, the US wealth share is countercyclical w.r.t the global economy. At the heart of this difference is that the US wealth share also captures relative wealth shifts that are coming from internal portfolio positions. To demonstrate the subtlety of this point, I decompose US relative wealth $\tilde{W}_t$ in terms of the US NFA position NFA_t and an internal holdings component I_t:

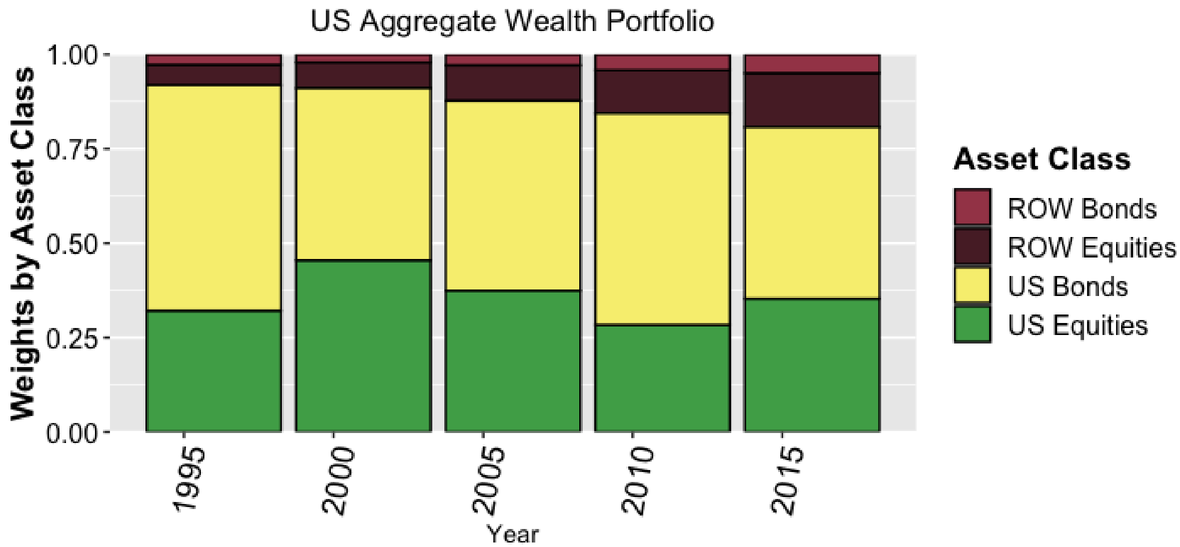
$$\begin{aligned}\tilde{W}_t =& W_t^{US} - W_t^{ROW} \\ =& \underbrace{(Q^{E,US}_{ROW,t} - Q^{E,ROW}_{US,t}) + (Q^{D,US}_{ROW,t} - Q^{D,ROW}_{US,t})}_{NFA_t} + \underbrace{(Q^{E,US}_{US,t} - Q^{E,ROW}_{ROW,t}) + (Q^{D,US}_{US,t} - Q^{D,ROW}_{ROW,t})}_{I_t}\end{aligned} \tag{12}$$

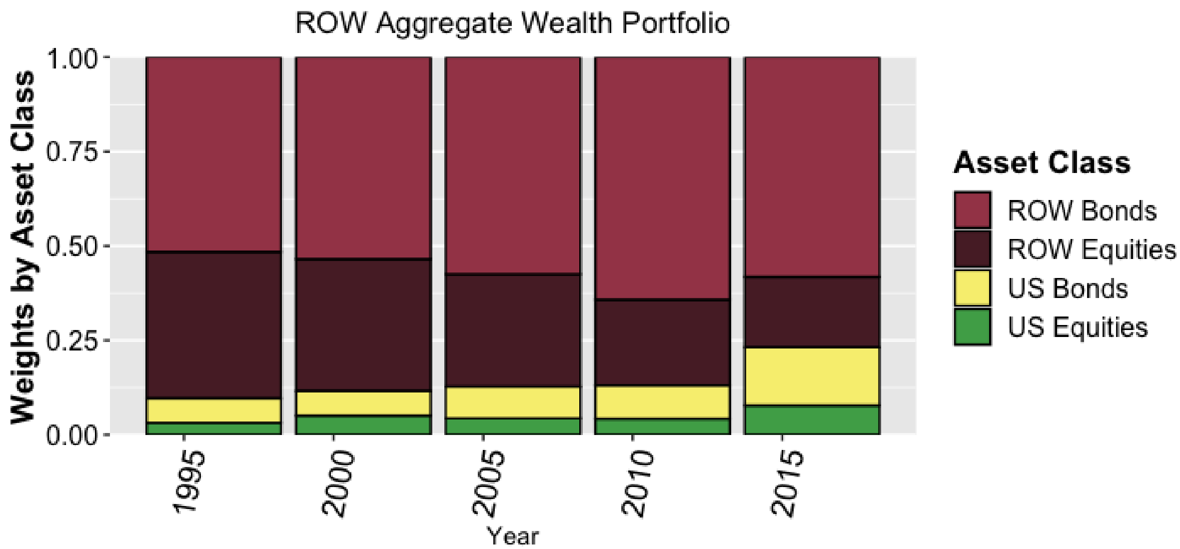
(12) suggests that a countercyclical US wealth share is not necessarily inconsistent with a procyclical US NFA position. Even if the NFA position deteriorates during global bad times ($NFA_t \downarrow$), US relative wealth can still rise ($\tilde{W}_t \uparrow$) if the value of US internal holdings rises relative to ROW internal holdings ($I_t \uparrow$). This is exactly what happens in the data: as section 3 demonstrated, US internal assets (US stocks) consistently outperform ROW internal assets (ROW stocks) during global downturns. As figure 6 demonstrates, these internal portfolio positions dominate the overall wealth portfolios, explaining why the US wealth share is countercyclical whereas the US NFA position is procyclical.

This compositional effect is important for my wealth share findings: using different wealth data from Davies (2008), Davies et al (2011) and Credit Suisse (2021), Sauzet (2022) finds the opposite result that the US wealth share is procyclical w.r.t the global economy. This result is driven by the less comprehensive nature of the domestic wealth coverage in these data, reducing the influence of internal positions in driving overall US wealth share dynamics. Thus using these alternative data sources leads to the US NFA position playing a more important role in driving overall wealth share dynamics, resulting in the exact opposite conclusion being reached by Sauzet (2022).

Figure 6: *Aggregate Wealth Portfolios*

Description: This figure plots the flow composition of the US and ROW wealth portfolios at five specific points in time: 1995, 2000, 2005, 2010 and 2015. The sum of the green and yellow components measure the internal share of the US wealth portfolio. The sum of the dark and light brown components similarly measure the internal share of the ROW wealth portfolio. By construction the portfolio weights sum to 1.





Robustness: The online appendix contained in section 10 provides many robustness checks on my US safety results. Firstly section 10.4 explores how sensitive my macro results are to extending the definition of ROW to include emerging economies as well. My results in this regard are actually stronger: when emerging market countries are included, the global consumption and GDP beta differentials between the US and the ROW are actually more negative. This result is intuitive: given the highly dollarised nature of emerging market economies (Bruno and Shin, 2017), systematic dollar appreciations during periods of global stress amplify the effect of global macro fluctuations for these countries (Obstfeld and Zhou, 2022). Thus adding emerging markets to my analysis reinforces my results, rather than mitigating them.

Secondly, section 10.4.1 explores the relation between my US safety facts and previous empirical findings by Colacito, Croce, Gavazzoni and Ready (2018) (CCGR). These authors explore the cross-section of exposures to global endowment risk and find that the US has average exposure to this global risk factor.[4] At first glance, these results seem to be at odds with my US safety findings. To reconcile my facts with CCGR, I point out that their analysis is far narrower from mine along many dimensions. Firstly, they use a much smaller cross-section: whilst I use a large cross-section of 22 developed countries, CCGR only look at the G9 countries for a much shorter time series that ends in 2013. Section 10.4.1 replicates CCGR's findings using their original sample and shows that even with this narrower sample, my findings of lower US global consumption betas relative to the ROW remains.

Finally section 10.5 presents some robustness on my finding that the US wealth share is countercyclical. Firstly, I confirm the robustness of this finding with respect to a broader definition of ROW that includes emerging market economies, in particular large holders of US debt such as China and India. Secondly I confirm the sensitivity of my wealth results to alternative assumptions about the treatment of internal debt holdings. In my baseline analysis I include these internal positions following the framework of Jiang, Richmond and Zhang (2020). However an alternative perspective is that dollar debt is a zero net supply asset from a US perspective and hence the entire supply of US debt is the foreign supply: $\mathcal{Q}^{D,US}_{US,t} = \mathcal{Q}^{D,ROW}_{ROW,t} = 0$ (Koijen and Yogo, 2019). This does not alter my conclusion that the US wealth share is countercyclical w.r.t the global economy.

[4] Colacito et al (2018) define country level endowments as consumption plus net exports. Thus global endowment risk is defined as an equally weighted cross-sectional average of these country level endowments.

4 Theory

Excess US Fiscal Capacity: To resolve the puzzle, I move away from the excess US risk-bearing capacity as the key source of asymmetry driving dynamics within the global financial system. Instead, I focus on a new source of US specialness: *her excess* ***fiscal*** *capacity* vis-*á*-vis the ROW. This issue has been the subject of active academic discussion in recent years, with recent work by Jiang et al (2019) demonstrating that the US is able to borrow more than her fiscal/macro fundamentals would suggest, a source of asymmetry that the US can exploit during times of global stress by running more countercyclical fiscal policy then the ROW. I provide additional suggestive evidence in favour of this excess US fiscal capacity via figures 7 and 8 which demonstrates that times of global stress feature a larger fiscal response in the US relative to the ROW.

Figure 7: *Excess US Fiscal Capacity (Dollar Changes)*

Description: Here I plot dollar changes in the US surplus (taxes minus spending) and the US government debt outstanding relative to the ROW. The ROW is computed as an equally weighted average of dollar changes in surpluses and debt across the non-US world which comprises the 17 developed countries in the baseline sample. The blue bars correspond to the Global Financial Crisis (2008Q2-2009Q2) and the recent COVID recession (2020Q1-2020Q2). Data is from IMF global debt database.

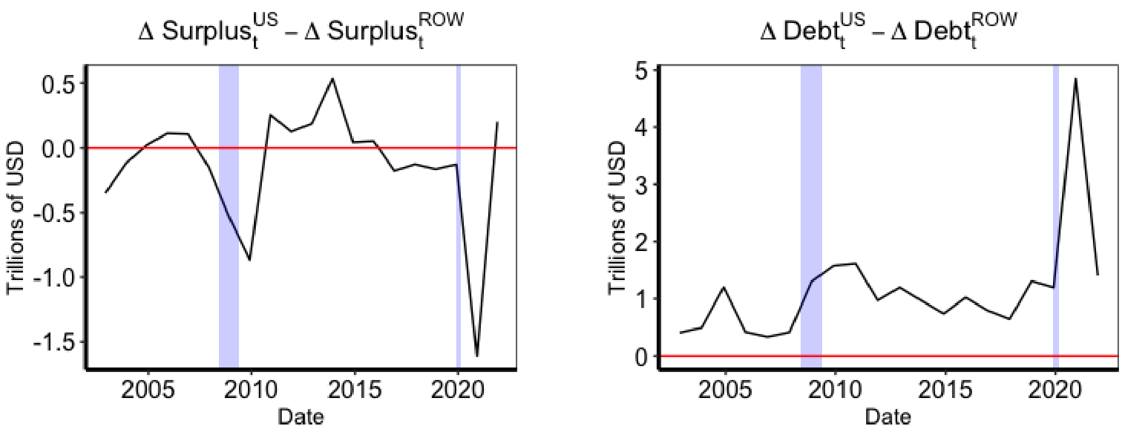
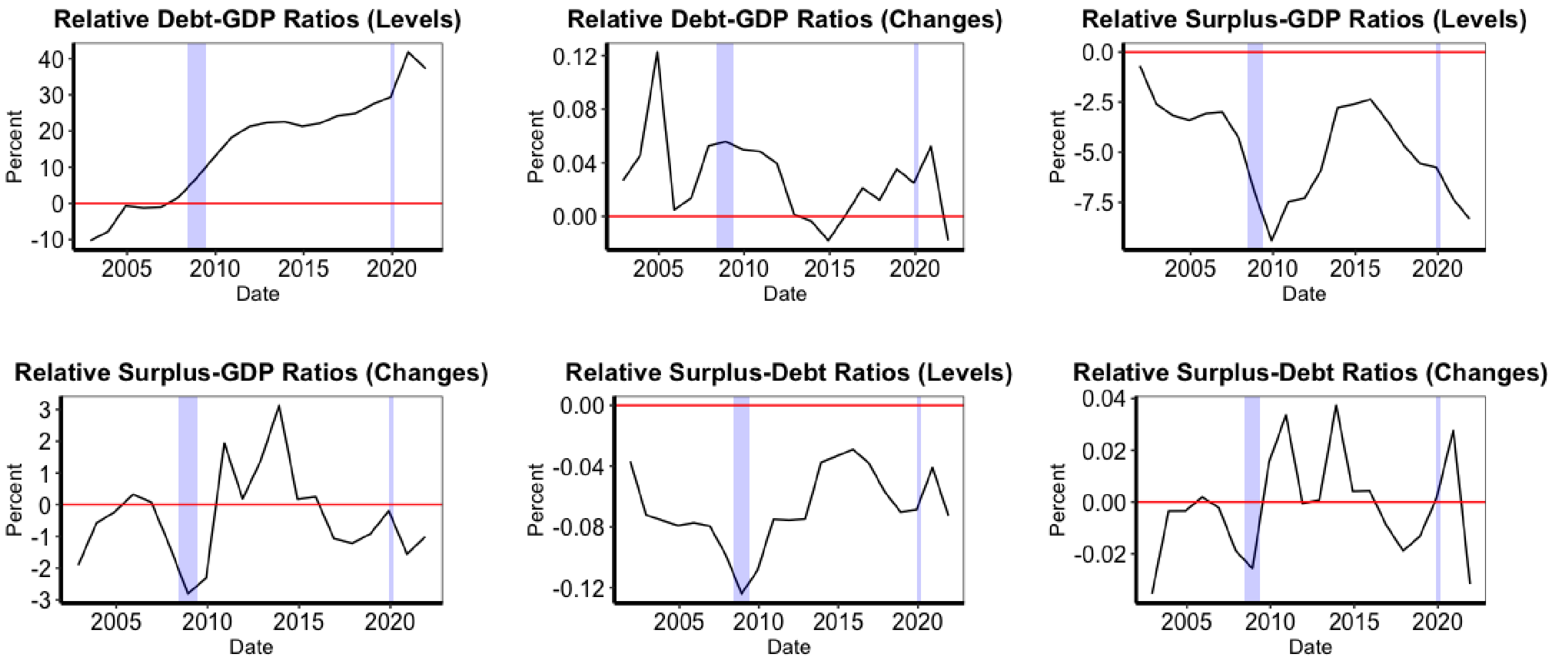


Figure 8: *Excess US Fiscal Capacity (Fiscal Ratios)*

Description: Here I plot the time series evolution of relative fiscal ratios between the US and ROW in levels and changes. The ROW is computed as an equally weighted average of the ratios in levels and changes across the non-US world which comprises the 17 developed countries in the baseline sample. The blue bars correspond to the Global Financial Crisis (2008Q2-2009Q2) and the recent COVID recession (2020Q1-2020Q2). The data is the IMF global debt database.



5 Framework

Overview: In this section, I show that embedding this excess fiscal capacity inside a two country endogenous growth model where the accumulation of US government debt has distortionary effects on both US and foreign innovation and growth prospects can resolve the US safety puzzle, simultaneously reconciling my novel US safety facts alongside countercyclical dynamics in i) the dollar, ii) global risk premia as well as the US exorbitant privilege. Key to these successes is the interaction between the fiscal theory, global innovation, expected future global growth and the international risk-sharing scheme for expected global growth shocks operating in my model during global downturns.

5.1 Model

Structure: There are two countries indexed by $i \in \{H, F\}$. Home (H) is the model analogue to the United States and foreign (F) represents the ROW. Both countries have a representative household with EZ preferences, a government sector and a production process that involves four sectors: final goods, intermediate goods, R&D and a foreign adoption sector. The intermediate good sector is populated by monopolistically competitive firms that produce a differentiated good variety that is used for final good production.

Growth is endogenously driven by two sources. Firstly local innovators in a perfectly competitive R&D sector invest resources into R&D and create new patents that the intermediate good sector converts into new intermediate good varieties. Secondly foreign intermediate goods developed abroad can also be made available locally for use as an input in local productiom through the process of international adoption. This is made possible by a separate perfectly competitive adoption sector that invests resources in foreign adoption. Finally governments institute expansionary fiscal policies during i) troughs in local and global business cycles and ii) low expected growth environments.

There are two asymmetries in the model. Firstly, US production features greater home bias in intermediate good preferences. This captures the idea that the US is the global innovation leader: ROW adopts US innovation to a greater degree than the US adopts foreign technology. Secondly, and most importantly, the US has excess fiscal capacity which it exploits during global downturns by running more countercyclical fiscal policy than the ROW. This will be modelled in reduced form as the US having a larger average fiscal cyclicality coefficient β_i.

5.1.1 Fiscal Policy Block

Tax Base: Tax $\text{Base}_{i,t}$ constitutes the profits from all production sectors in country i including i) final good sector (D_t^i), ii) intermediary good sector across all local varieties j ($\sum_{j=1}^{N_{i,t}^i} \Pi_{j,t}^i$). $N_{i,t}^i$ is the number of local intermediate good varieties that endogenously varies in accordance with the process of innovation and foreign adoption described later. To focus attention on the distortionary impact of corporate taxes, I abstract from labor and other taxes. g_t^i is an exogenous spending rate process that captures a lump-sum transfer to the household: TR_t^i.[5]

$$
\begin{aligned}
TR_t^i =& g_t^i * \text{Tax Base}_{i,t} \\
=& g_t^i * \underbrace{(D_t^i}_{\text{Final Good Sector Profits}} + \sum_{j=0}^{N_{i,t}^i} \underbrace{\Pi_{j,t}^i)}_{\text{Intermediate Good Firm } j \text{ Profits}}
\end{aligned}
$$

Fiscal Rule: The exogenous fiscal rule governing g_t^i requires local governments around the world to initiate more expansionary policies in response to i) troughs in the global business cycle and ii) low expected growth environments:

$$
\begin{aligned}
g_t^i &= \frac{1}{1+e^{-\omega_t^i}} \\
\omega_t^i &= (1-\rho)\mu_\tau + \rho_T \omega_{t-1}^i - \sigma_{t-1}^i \underbrace{(\beta_t^i \epsilon_t^G}_{\text{Cyclicality}} + \underbrace{\mu - \mathbb{E}_t \Delta c_{t+1}^i)}_{\text{Growth}} + \sigma_{s,t-1} \underbrace{\epsilon_{s,t}^i}_{\text{Spending}} \\
\sigma_t^i &= \nu_\nu \sigma_{t-1}^i + \sigma^i w_t^i \\
\sigma_{s,t} &= \nu_\nu \sigma_{w,t-1} + \sigma_s w_{s,t}^i \\
\epsilon_t^i, \epsilon_{s,t}^i, w_t^i &\sim i.i.d\ N(0,\,1)
\end{aligned}
\tag{13}
$$

The formulation of g_t^i guarantees that it lies in the open interval (0,1). ω_t^i is the exogenous local fiscal process which has persistence ρ_T. μ_r captures the average tax rate and will be calibrated to equal the average global tax rate. μ is the mean growth rate of the economy. $\sigma_t^i, \sigma_{s,t}$ are the fiscal volatility shocks with persistence ν_ν. σ^i is allowed to vary across countries and it is assumed that $\sigma^{US} > \sigma^{ROW}$.[6] Furthermore, fiscal volatility is allowed to move differentially in response to local fiscal shocks ($\epsilon_{s,t}^i$) with volatility $\sigma_{w,t}$ where $\sigma_s > \sigma^i$. This helps match the fact that fiscal processes, such as the surplus-debt ratio and the debt-GDP ratios, are more volatile

[5] This assumption rules out negative wealth effects of fiscal shocks that counterfactually generate consumption declines in response to positive fiscal shocks in models where taxes are not remitted back to households (Monacelli and Perotti, 2010).

[6] This asymmetry helps the model captures patterns in countercyclical dollar risk premia. It is also consistent with empirical evidence documenting larger US fiscal volatility during global downturns due to the US exercising her excess fiscal capacity.

than business cycles, a standard modelling approach in the related literature(Croce, Kung and Schmid, 2012; Croce, Nguyen, Raymond and Schmid, 2019; Nguyen, 2022; Liu, 2021).

An interpretation of the exogenous fiscal rule captured by the second line of (13) is in order. The law of motion of ω_t^i captures the idea that fiscal policies are driven by two key forces. Firstly it is driven by exogenous local fiscal shocks ($\epsilon_{s,t}^i$). These local fiscal shocks can be thought of as representing the effect of local political cycles whereby governmental transitions that involve fluctuations in political philosophy can lead to sharp fluctuations in fiscal uncertainty (Pastor and Veronesi, 2017). Secondly, they are also an endogenous response to i) the state of the global economy proxied by the global TFP shock ϵ_t^G and ii) expected growth prospects captured by $\mathbb{E}_t \Delta c_{t+1}^i$. This captures the conventional automatic stabiliser role function of conventional fiscal policies.

Fiscal Cyclicality: β_t^i captures the degree of countercyclicality in country i's fiscal policy. This follows a slow-moving AR(1):

$$\beta_t^i = \beta_i + \tau \beta_{t-1}^i + \xi_t \tag{14}$$

I impose the assumption that $\beta_{US} > \beta_{ROW}$ to capture the key mechanism in this model that the US fiscal policy is more aggressive on average during times of global stress than the ROW. This is a reduced form way of capturing the key assumption in the model that the US has excess fiscal capacity vis-*á*-vis the ROW and hence can run more countercyclical fiscal policy.

One obvious way to microfound this fiscal mechanism is to think of this excess US fiscal capacity as coming from the special role of the dollar in the global financial system (Jiang, Krithnamurthy and Lustig, 2020). This role allows the US to extract seignorage revenue from the ROW through the convenience yields on dollar safe assets, loosening the US external budget constraint relative to the ROW, an asymmetry that the US exploits by running more countercyclical fiscal policy responses during global downturns. The model simply takes this excess fiscal capacity as a given and explores its implications for important international prices and quantities such as i) the dollar, ii) global risk premia and iii) global macro variables.

IGBC: Local tax rate τ_t^i is a choice variable for country i's government. This implies that the total tax flow is:

$$T_t^i = \tau_t^i * \text{Tax Base}_t^i \tag{15}$$

Local fiscal policy (tax and debt policy) is pinned down by two equations in this model. Firstly, there is the intertemporal government budget constraint (IGBC) which implies that each government can finance expenditure shocks (g_t^i) through a mix of taxes T_t^i and debt B_t^i:

$$\begin{aligned} B_t^i =& R_{b,t-1}^i B_{t-1}^i + TR_t^i - T_t^i \\ =& R_{b,t-1}^i B_{t-1}^i + \underbrace{(g_t^i - \tau_t^i) * \text{Tax Base}_t^i}_{\text{Country } i\text{'s Deficit}} \end{aligned} \tag{16}$$

$R_{b,t}^i$ is the return on government debt and B_t^i is the stock of government debt. Recall that g_t^i is the exogenous spending rate process for country i whereas τ_t^i is the optimal tax rate policy choice made by country i's government. Thus $(g_t^i - \tau_t^i) * \text{Tax Base}_t^i$ captures the local budget deficit.

Debt Process: The second relevant equation is the exogenous debt accumulation process. To rule out unsustainable paths for the debt to output ratio $\frac{B_t^i}{Y_t^i}$, I impose the following debt accumulation rule to guarantee stationarity of the debt to output ratios (Bi and Leeper, 2010):

$$\frac{B_t^i}{Y_t^i} = \rho_G \frac{B_{t-1}^i}{Y_{t-1}^i} - \phi_G(\beta_t^i \epsilon_t^G + \mu - \mathbb{E}_t \Delta c_{t+1}^i) \tag{17}$$

The parameter $\rho_G \in (0, 1)$ measures the speed of repayment of debt: the higher the value of ρ_G, the slower the repayment of debt relative to output. Furthermore $\phi_G \in (0, 1)$ captures the fraction of the fiscal expansion financed by higher debt. Together, (16) and (17) pin down financing choices for fiscal policy in this model. The key parameter determining how much of the fiscal expansion is financed via distortionary taxes (T_t^i) and government debt (B_t^i) is the parameter ϕ_G.

If $\phi_G = 0$, the government chooses a zero deficit policy ($g_t^i = \tau_t^i, \forall t$) where there is no tax smoothing: taxes are raised immediately to finance the entire fiscal expansion and there is no accumulation of government debt: $B_t^i = 0$, $\forall t$.[7] Since $\phi_G \in (0, 1)$, the government does not pursue a zero-deficit strategy in this model, choosing to smooth the tax burden over time by accumulating government debt in the process. As will become clear in the next section, it is ultimately the accumulation of government debt, rather than the distortionary taxes themselves, that drives the key model dynamics that lead to the resolution of the US safety

[7] To see this note that if $\phi_G = 0$ then only $B_t^i = 0$ $\forall t$ satisfies (17). Combining this with (16) then implies that $g_t^i = \tau_t^i$ $\forall t$. In other words $\phi_g = 0$ corresponds with a zero-deficit policy where all fiscal expansions ($\epsilon_{s,t}^i \uparrow$ are financed via tax increases). For any $\phi_G \in (0, 1)$, the accumulation of government debt (B_t^i) forms a part of the mechanism.

puzzle.

Fiscal Variables: Country i's fiscal capacity is measured by the surplus-debt ratio:

$$\text{Country } i\text{'s Surplus-Debt Ratio} = \frac{(\tau_t^i - g_t^i)\text{Tax Base}_t^{US}}{B_{t-1}^i} \tag{18}$$

Global Fiscal Cycle_t is the common surplus factor as defined by Jiang (2022):

$$\text{Global Fiscal Cycle}_t = \frac{1}{N}\sum_{i=1}^{N}\text{Country } i\text{'s Surplus-Debt Ratio} \tag{19}$$

A further comment is in order about the global fiscal cycle. Since both countries enact expansionary fiscal policies during global downturns ($\epsilon_t^G \downarrow$) and when future growth prospects are also deteriorating ($\mathbb{E}_t \Delta c_{t+1}^i \downarrow$), my model reproduces empirical evidence from Jiang (2022) documenting the existence of a global fiscal cycle: common fluctuations in surplus-debt ratios worldwide. This variable will be important as the interaction between the US fiscal condition, the global fiscal cycle and global policy uncertainty drives risk premia in the model.

Non-Policy Block: Having finished my description of the model's policy block, I move to the non-policy block. Sections 5.1.2, 5.1.3 and 5.1.4 describes the final good, intermediate good, innovation and adoption sectors respectively. Finally 5.1.5 describes the household sector.

5.1.2 Final Goods Sector

Production Function: Final goods production is perfectly competitive. Country i's final good producer uses physical capital (K_t^i), labor (L_t^i) and a composite of intangible capital goods (G_t^i) to produce a nontraded final good Y_t^i. The production function is Cobb-Douglas:

$$Y_t^i = [(K_t^i)^\alpha (\Omega_t^i L_t^i)^{1-\alpha}]^{1-\xi}(G_t^i)^\xi \tag{20}$$

α: Physical Capital Share

ξ: Intangible Good Share

Shocks: The exogenous TFP shock $a_t^i = log(\Omega_t^i)$ follows an AR(1):

$$a_t^i = \psi a_{t-1}^i + \rho_{ec}(a_{F,t-1} - a_{H,t-1}) + \sigma^i \epsilon_t^i + \sigma^G \epsilon_t^G \tag{21}$$

Notice that since the TFP shock is stationary and the sector is perfectly competitive, the final goods sector has zero growth in equilibrium. Thus all equilibrium growth in either country emanates from intermediate goods sector, just as in standard endogenous growth models like Romer (1990) and Kung and Schmid (2012). The cointegration parameter ρ_{ec} is necessary to ensure that the perturbation techniques adopted in this paper results in a well-defined distribution of pareto weights in this model, an issue already well understood in this class of models (Colacito and Croce, 2013; Colacito et al, 2018, 2021; Gavazzoni and Santacreu, 2020).

Intangible Capital: The composite of intangible capital goods G_t^i is defined as:

$$G_t^i = [h^i(\sum_{j=1}^{N_{F,t}^F}(X_{F,j,t}^i)^\nu) + (1-h^i)(\sum_{j=1}^{N_{H,t}^H}(X_{H,j,t}^i)^\nu)]^{\frac{1}{\nu}} \tag{22}$$

$X_{F,j,t}^i, X_{H,j,t}^i$ capture the amount of foreign and domestically produced intermediate good j that is used for country i's final production. $N_{H,t}^H, N_{F,t}^F$ are the number of local and foreign intermediate good varieties that endogenously varies in accordance with the process of innovation and foreign adoption described later. ν is the elasticity of substitution across intermediate good varieties. $h^i > \frac{1}{2}$ is the home bias parameter.

US as Global Innovation Leader: I allow $h^H > h^F$: this captures the idea that the US is the global innovation leader. When the US innovates, the ROW follows her lead by adopting her technology to a greater extent than the US adopts ROW technology. This asymmetry is necessary for reproducing unique international transmission of US fiscal policy into global risky asset prices that I uncover in a companion paper to this one (Kim, 2022a).

Problem: Final good producers own the physical capital stock and choose physical capital, labor, investment and intermediate goods to maximise shareholder value s.t the production technology (20):

$$\max_{\{I_{i,t}^i, L_t^i, K_{t+1}^i, X_{H,j,t}^i, X_{F,j,t}^i\}_{t=0}^\infty} \mathbb{E}_0[\sum_{t=0}^\infty M_t^i(1-\tau_t^i)D_t^i] \tag{23}$$

$$s.t. \qquad D_t^i = Y_t^i - w_t^i L_t^i - \sum_{t=0}^{N_{H,t}^i} P_{H,j,t}^i X_{H,j,t}^i - \sum_{t=0}^{N_{F,t}^i} P_{F,j,t}^i X_{F,j,t}^i - I_t^i \tag{24}$$

I_t^i is investment in physical capital and $P_{H,j,t}^i, P_{F,j,t}^i$ is the price of a home (foreign) produced intermediate good variety j that is used for country i's final production. M_t^i is the local stochastic discount factor (SDF). The local numeraire is units of the local final good. Law of motion for physical capital is standard:

$$K_{t+1}^i = (1-\delta)K_t^i + \Lambda(\frac{I_t^i}{K_t^i})K_t^i \tag{25}$$

$\delta \in (0,1)$ is the depreciation rate and $\Lambda(\frac{I_t^i}{K_t^i})$ denotes convex capital adjustment costs that follows Jermann (1998):

$$\Lambda(\frac{I_t^i}{K_t^i}) = (\frac{\alpha_1}{\zeta})(\frac{I_t^i}{K_t^i})^\zeta + \alpha_2 \tag{26}$$

As in Kung and Schmid (2015), α_1, α_2 are chosen to ensure there are no adjustment costs in the deterministic steady state and $\frac{1}{1-\frac{1}{\zeta}}$ is the investment elasticity w.r.t Tobin's Q.

5.1.3 Intermediate Goods Sector

Overview: Intermediate good producers in each country use a specific patent accumulated by the independent R&D sector described later to build one unit of intermediate good using one unit of the local final good. They face a downward-sloping demand curve implied by the cost-minimization of the final goods producer.

Profits: The maximising profit level for intermediate good producers in country i solves:

$$\Pi_t^{i,*} = \max_{P_{H,t}^H, P_{F,t}^H} P_{H,t}^H X_{H,t}^H(P_{H,t}^H) + P_{F,t}^H \mathcal{E}_t X_{F,t}^H(P_{F,t}^H \mathcal{E}_t) - X_{H,t}^H(P_{H,t}^H) - X_{F,t}^H(P_{F,t}^H) \tag{27}$$

In equilibrium, $P_{H,t}^H = P_{F,t}^F = \frac{1}{\nu}$ and $P_{F,t}^H = \frac{1}{\nu}\mathcal{E}_t$ where $\mathcal{E}_t$ is the real exchange rate defined as foreign consumption per units of home consumption. Thus $\mathcal{E}_t$ tracks the real dollar appreciation rate.

5.1.4 Innovation and Adoption Sectors

R&D: In each country, endogenous growth is driven by two sources. Firstly innovation is conducted in a local R&D sector that features perfect competition. Innovators use the local final good to conduct R&D expenditure S_t^i and accumulate stock of intermediate goods or patents:

$$N_{i,t+1}^i = \vartheta_t^i S_t^i + (1-\phi)N_{i,t}^i \tag{28}$$

ϕ: Innovation Depreciation Rate

ϑ_t^i: local innovation productivity

Innovation Productivity: Following Jermann (1998), ϑ_t^i follows:

$$\vartheta_t^i = \chi(\frac{S_t^i}{N_{i,t}^i})^{\eta-1} \tag{29}$$

$\chi > 0$ is a scale parameter and $\eta \in (0,1)$ is the elasticity of patents (new intermediate goods) w.r.t R&D. This specification is intuitive: it indicates a love of variety effect for innovation ($\frac{\partial \vartheta_t^i}{\partial N_{i,t}^i} > 0$) and decreasing returns to scale for R&D expenditure ($\frac{\partial \vartheta_t^i}{\partial S_t^i} < 0$).[8]

Adoption Process: The second source of endogenous growth is the process of international technology adoption that makes foreign intermediate good varieties available to local final good producers for use as intermediate inputs. This process is conducted by an independent foreign adoption sector that is perfectly competitive. Foreign adopters in country j invests $h_{i,t}^j$ units of the local final good to adopt 1 unit of local innovation from country i and are successful with probability $\vartheta_{i,t}^j$. Following Santacreu (2015), this follows:

$$\vartheta_{i,t}^j = \chi_\alpha(\frac{h_{i,t}^j(N_{i,t+1}^i - N_{i,t}^j)}{N_{i,t}^j})^{\eta_\alpha}, \ \forall i,j \in \{H, F\} \tag{30}$$

$\chi_\alpha > 0$ is a scaling parameter and $\eta_\alpha \in (0,1)$ is the elasticity of adoption w.r.t investment in adoption. The law of motion for home produced intermediate goods that can be adopted by the foreign final good producer evolves according to:

$$N_{i,t+1}^j - (1-\phi)N_{i,t}^j = \vartheta_{i,t}^j(1-\phi)(N_{i,t+1}^i - N_{i,t}^j), \ \forall i,j \in \{H, F\} \tag{31}$$

ϕ is the innovation depreciation rate.

5.1.5 Households

Preferences: Each country is populated by a representative household who have EZ utility:

$$U_t^i = [(1-\delta)(C_t^i)^{1-\frac{1}{\psi}} + \delta(E_t {U_{t+1}^i}^{1-\gamma})^{\frac{1-\frac{1}{\psi}}{1-\gamma}}]^{\frac{1}{1-\frac{1}{\psi}}}, i \in \{H, F\}$$

[8] Notice that I do not allow for international technology diffusion: the local innovation productivity ϑ_t^i is only a function of the local R&D intensity: $\frac{S_t^i}{N_t^i}$. This allows me to focus on trade, through the process of international technology adoption, to be the key conduit through which US FP drives endogenous global growth dynamics in the model.

SDF: As shown by Epstein and Zin (1991), the stochastic discount factor (SDF) is:

$$M^i_{t+1} = \beta(\frac{C^i_{t+1}}{C^i_t})^{\theta-1}(\frac{U^i_{t+1}}{\mathbb{E}_t[(U^i_{t+1})^{1-\gamma}]^{\frac{1}{1-\gamma}}})^{1-\theta-\gamma} \tag{32}$$

Budget Condition: They are subject to the following budget constraint

$$C^i_t + P^i_t s^i_t + B^i_t = (P^i_t + D^i_t)s^i_{t-1} + B^i_{t-1}R^i_{b,t} + w^i_t L^i_t + TR^i_t \tag{33}$$

5.1.6 Asset Prices

Stock Market: The stock market is a risky claim to the combined production of all sectors. Thus the dividend $\mathcal{D}^i_t$ is the after-tax combined profits across all sectors:

$$\mathcal{D}^i_t = (1 - \tau^{*,i}_t)[D^i_t + \sum_{j=1}^{N^i_{i,t}} \Pi^i_{j,t}] - S^i_t - h^i_{j,t}, \ \forall i,j \in \{H, F\} \tag{34}$$

Each stock market is priced by the local SDF through the standard euler equation:

$$P^i_t = \mathbb{E}_t[M^i_{t+1}(P^i_{t+1} + \mathcal{D}^i_{t+1})] \tag{35}$$

Bonds: Interest rate pinned down by:

$$\frac{1}{R^i_{f,t}} = \mathbb{E}_t M^i_{t+1} \tag{36}$$

Exchange Rate: Frictionless benchmark requires:

$$\Delta\mathcal{E}_t = log(M^H_t) - log(M^F_t) \tag{37}$$

5.1.7 Equilibrium System

Resource Constraint: The local final good Y^i_t is used for i) consumption (C^i_t), investment in ii) physical capital (I^i_t), iii) R&D (S^i_t), iv) adoption ($h^i_{j,t}$) and v) intermediate inputs ($X^i_{i,t}, X^i_{j,t}$):

$$Y^i_t = C^i_t + I^i_t + S^i_t + h^i_{j,t} + N^i_{i,t}X^i_{i,t} + N^j_{i,t}X^j_{i,t}, \ \forall i,j \in \{H, F\} \tag{38}$$

FOCs for Consumption and Labor: Optimal labor and investment follow:

$$W_t^i = (1-\alpha)(1-\zeta)\frac{Y_t^i}{L_t^i} \tag{39}$$

$$q_t^i = \frac{1}{(\alpha_1)(\frac{I_t^i}{K_t^i})^{\zeta-1}} \tag{40}$$

$$1 = \mathbb{E}_t[M_{t+1}^i(\frac{1}{q_t^i}(\alpha(1-\zeta)\frac{Y_{t+1}^i}{K_{t+1}^i} + q_{t+1}^i(1-\delta) - \frac{I_{t+1}^i}{K_{t+1}^i} + q_{i,t+1}\Lambda_{t+1}^i))] \tag{41}$$

Demand for local and foreign intermediate goods for country $i \in \{H, F\}$ follow:

$$X_{i,t}^i = (h^i \nu Y_t^i (G_t^i)^\nu)^{\frac{1}{1-\nu}} \tag{42}$$

$$X_{j,t}^i = X_{i,t}^i(\mathcal{E}_t \frac{h^i}{h^j})^{\frac{1-\nu}{\nu}} \tag{43}$$

Pareto Weight and Risk Sharing: Risk-sharing in intermediate goods markets is driven by the US pareto weight, or US share of global resources S_t. This follows the law of motion:

$$S_t = S_{t-1}(\frac{M_t^H}{M_t^F})(\frac{C_t^H/C_{t-1}^H}{C_t^F/C_{t-1}^F}) \tag{44}$$

S_t governs the risk-sharing scheme that is operative in the intermediate goods market in the model. When US marginal utility rises relative to the ROW and the dollar appreciates ($\Delta\mathcal{E}_t$), the ROW transfers intermediate goods to the US ($X_{F,t}^H \uparrow$). Conversely the transfer of intermediate goods goes the other way when ROW marginal utility is adversely impacted.[9]

FOCs for Optimal Innovation and Adoption: Since the innovation and adoption sectors are perfectly competitive, the free entry conditions pins down optimal local investment in R&D:

$$S_t^i = \mathbb{E}_t[M_{t+1}^i \mathcal{V}_{i,t+1}^i](N_{i,t+1}^i - (1-\phi)N_{i,t}^i) \tag{45}$$

The first order condition for investment in adopting country i's technology by country j is:

$$h_{i,t}^j(N_{i,t+1}^i - N_{i,t}^j) = \eta_a(1-\phi)\vartheta_{i,t}^j \mathbb{E}_t[M_{t+1}^j(\mathcal{V}_{i,t+1}^j - \mathcal{J}_{i,t+1}^j)] \tag{46}$$

[9]This risk-sharing arrangement is a common feature of international long-run risk models with international trade (Colacito and Croce, 2013; Colacito et al, 2018). The difference here is that the risk-sharing takes place in the intermediate goods market, not the consumption market. These previous models are cast in endowment economy setting where there is no intermediate good sector.

Value Functions: $\mathcal{V}_{i,t}^{i}$ is the value for country i's local innovation and $\mathcal{V}_{i,t}^{j}$ is the value to adopter in foreign country j that adopts a technology developed in the country i:

$$\mathcal{V}_{i,t}^{i} = (1-\tau_t^i)\Pi_{i,t}^{i} + (1-\phi)\mathbb{E}_t[M_{t+1}^{i}\mathcal{V}_{i,t+1}^{i}] \tag{47}$$

$$\mathcal{V}_{i,t}^{j} = \Pi_{i,t}^{j}(1-\tau_t^j) + (1-\phi)\mathbb{E}_t[M_{t+1}^{j}\mathcal{V}_{i,t+1}^{j}] \tag{48}$$

Finally, $\mathcal{J}_{i,t}^{j}$ is the value of technology invented in country i at time t that has yet to be adopted by the country j:

$$\mathcal{J}_{i,t}^{j} = \max_{h_{i,t}^{j}} - h_{i,t}^{j} + [(1-\phi)\mathbb{E}_t(M_{t+1}^{j}(\vartheta_{i,t}^{j}V_{i,t+1}^{j} + (1-\vartheta_{i,t}^{j})\mathcal{J}_{i,t+1}^{j}))],\ \forall i,j \in \{H,F\} \tag{49}$$

Innovation Stock: Optimal investment in R&D (S_t^i) and adoption ($h_{i,t}^{j}$) defined by (45) and (46) and the following laws of motion pins down stocks of local innovation ($N_{i,t}^{i}$) and foreign adoption ($N_{i,t}^{j}$):

$$N_{i,t+1}^{i} = \vartheta_t^i S_t^i + (1-\phi)N_{i,t}^{i} \tag{50}$$

$$N_{i,t+1}^{j} - (1-\phi)N_{i,t}^{j} = \vartheta_{i,t}^{j}(1-\phi)(N_{i,t+1}^{i} - N_{i,t}^{j}) \tag{51}$$

Local innovation productivity $\vartheta_{i,t}^{i}$ and rate of foreign adoption $\vartheta_{i,t}^{j}$ is:

$$\vartheta_t^i = \chi\left(\frac{S_t^i}{N_{i,t}^{i}}\right)^{\eta-1} \qquad \vartheta_{i,t}^{j} = \chi_\alpha\left(\frac{h_{i,t}^{j}(N_{i,t+1}^{i} - N_{i,t}^{j})}{N_{i,t}^{j}}\right) \tag{52}$$

Solution Method: I use third order perturbation methods to solve the model (Colacito et al, 2018; Gavazzoni and Santacreu, 2020). Taking at least a third order approximation is necessary to explore risk premium dynamics. I approximate the equilibrium system: (13)-(52) to third order around a deterministic steady state close to the zero debt ($\overline{B}^i = 0,\ \forall i$), zero deficit ($\overline{\tau}^{*,i} = \overline{\tau}^i$) steady state where tax rates are at the average global rate: $\overline{\tau}^i = \overline{\tau}$.[10] The baseline calibration is described in table 27 and preferences and production parameters are motivated by the international long-run risk (LRR) literature (Gavazzoni and Santacreu, 2020). Fiscal parameters are set to match standard unconditional moments of fiscal processes (Croce, Kung and Schmid, 2012; Croce, Nguyen, Raymond and Schmid, 2019; Nguyen, 2022).

[10] The steady state debt-GDP ratio $\frac{\overline{B}}{\overline{Y}} = (\frac{\phi_G \mu}{1-\rho_G})$ and $\overline{\tau} = \frac{1}{1+e^{\frac{\rho-1}{1-\rho_T}}}$. Thus steady state debt-GDP ratio is indexed by steady state growth rate μ which I set to a number close to zero. This closely approximates the zero deficit, zero debt steady state explored in the literature (Croce, Kung and Schmid, 2012; Croce, Nguyen, Raymond and Schmid, 2019; Nguyen, 2022). I don't exactly use this steady state because the surplus-debt ratio is not defined with zero debt.

Table 7: *Baseline Calibration*

	Panel A: Preference Parameters	
Parameter	Description	Value
γ	Relative Risk Aversion	10
ψ	Intertemporal Elasticity of Substitution	2
β	Discount Factor	0.99
	Panel B: Production Parameters	
Parameter	Description	Value
$\mu * 4$	Steady State Growth Rate	0.02
α	Physical Capital Share	0.33
ξ	Intangible Capital Share	0.50
η	Intangible Capital Elasticity w.r.t R&D	0.83
δ	Physical Capital Depreciation Rate	0.02
ζ	Physical Capital Adjustment Costs, Elasticity	13.30
$\frac{1}{1-\frac{1}{\vartheta}}$	Investment Adjustment Cost	0.03
ν	Elasticity of Demand (Mark up)	0.4
h^H	US Home Bias	0.98
h^F	ROW Home Bias	0.96
	Panel C: Exogenous Processes	
Parameter	Description	Value
φ	TFP Autocorrelation	0.98
ρ_{ec}	TFP Cointegration	0.04
σ	TFP Volatility	0.02
σ^H	US Fiscal Volatility w.r.t Global TFP Shock	0.15
σ^F	ROW Fiscal Volatility w.r.t Global TFP	0.08
σ_s	Local Fiscal Uncertainty Shock	0.3
	Panel D: Innovation and Adoption Parameters	
Parameter	Description	Value
χ	Innovation Scale	0.424
χ_a	Adoption Scale	1.428
ϕ	Innovation Depreciation Rate	0.05
ϑ_H^F	International Adoption (Steady State)	0.05
η_a	Elasticity of Adoption w.r.t R&D	0.30
	Panel E: Fiscal Parameters	
Parameter	Description	Value
τ	Fiscal Cyclicality Persistence	0.99
μ_τ	Average Global Tax Rate	0.20
ρ_T	Fiscal Persistence	0.70
ρ_G	Debt Persistence	0.70
ϕ_G	Debt elasticity w.r.t fiscal Shock	0.30

6 Equilibrium Analysis

6.1 Fiscal Mechanism

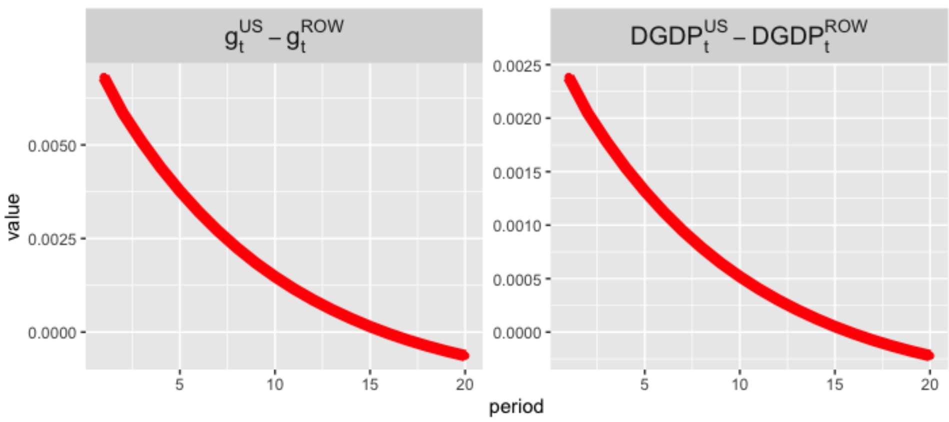
Overview: At the core of this mechanism is the interaction between the fiscal theory, global innovation, expected future global growth prospects and the international risk-sharing of these expected global growth shocks in times of global stress. To communicate the economics clearly, I walk through each component of the mechanism in great detail here.

6.1.1 Excess US Fiscal Capacity, Government Debt and the Fiscal Theory

Excess US Fiscal Capacity: To see this model mechanism in action, consider model dynamics during times of global stress which is captured by a one standard deviation bad global TFP shock ($\downarrow \epsilon_t^G$). Due to her larger fiscal cyclicality coefficient, the US fiscal response is larger than the ROW which she has to finance via a combination of distortionary corporate taxes and more government debt. Since the US government prefers to smooth the tax burden associated with this fiscal expansion over time, the excess US spending is at least partially associated with an acceleration in the stock of US government debt. Figure 9 illustrates this fact, demonstrating that both US relative spending and debt-GDP ratios rise in response to the bad global TFP shock.

Figure 9: *Excess US Fiscal Capacity During Times of Global Stress*

Description: This figure plots the impulse responses to a 1 S.D bad global TFP shock ($\epsilon_t^G \downarrow$) for the relative spending response ($g_t^{US} - g_t^{ROW}$) and relative debt-GDP ratios ($DGDP_t^{US} - DGDP_t^{ROW}$).



Fiscal Theory: This rapid accumulation of US government debt during times of global stress has implications for the future path of fiscal policy. To see this, note that we can iterate forward the IGBC (16) and impose the following transversality condition that requires the risk-adjusted present value of US government surpluses to grow slower than the US SDF:

$$\lim_{T\to\infty} \mathbb{E}_t[m^{US}_{t,t+T}(\sum_{k=t+T}^{\infty} m^{US}_{t+T,k} s^{US}_{t+T})] = 0 \tag{53}$$

Here $m^{US}_{t,t+k}$ is the log US SDF and $s^{US}_{t+k} = (\tau^{US}_{t+k} - g^{US}_{t+k}) * \text{Tax Base}^{US}_{t+k}$ is the US primary surplus. This yields the standard fiscal theory equation that links the concurrent value of government debt to the present value of future government surpluses:[11]

$$B^{US}_t = \mathbb{E}_t \sum_{k=0}^{\infty} m^{US}_{t,t+k} s^{US}_{t+k} \tag{54}$$

(53) illustrates the fiscal mechanism at play: when the US government accumulates more debt to finance its larger relative fiscal response during global downturns ($\uparrow B^{US}_t$), this necessitates an adjustment in the expected future path of fiscal policy: $\{s^{US}_{t,t+k} = (\tau^{US}_t - g^{US}_t) * \text{Tax Base}^{US}_t\}^{\infty}_{k=0}$. Since the exogenous spending process (τ^{US}_t) is not persistent in the model,[12] this requires higher future taxes moving forward: $\{\tau^{US}_{t+k}\}^{\infty}_{k=0} \uparrow$.

6.1.2 Fiscal Theory and Global Growth Prospects

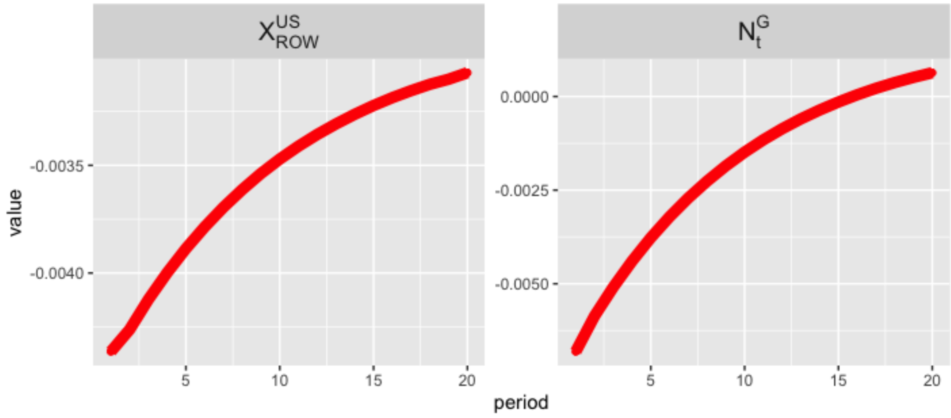
Global Growth Prospects: As demonstrated by figure 10, the higher expected future path of corporate taxes has distortionary implications for foreign incentives to adopt US technology ($X^{US}_{ROW,t}$), the global innovation stock (N^G_t) and consequently expected future global growth prospects. This is because the higher expected future path of corporate tax hikes implied by the fiscal theory depresses the market value of US innovation. This depresses both incentives to innovate within US and foreign incentives to adopt US technology, lowering growth prospects moving forward in both the US and ROW.

[11] In standard fiscal theory, the path of future primary surpluses is discounted using the term structure of interest rates (Cochrane, 2020). My model follows the formulation from Jiang et al (2019) which allows for aggregate risk in primary surpluses by discounting using a properly risk-adjusted SDF.

[12] Fiscal persistence parameter ρ_T is set to 0.7, as documented in table 27

Figure 10: *Fiscal Theory and Global Growth Prospects*

Description: This figure plots the impulse responses to a 1 S.D bad global TFP shock ($\epsilon_t^G \downarrow$) for foreign demand for US innovation ($X_{ROW,t}^{US}$) and the global innovation stock (N_t^G).



To see this point analytically, note that when we combine (45), (29) and (26), we can connect the R&D intensity $\frac{S_t^i}{N_t^i}$ to the expected present value of future monopoly profits:

$$\frac{1}{\chi}(\frac{S_t^i}{N_{i,t}^i})^{1-\eta} = [\mathbb{E}_t[\sum_{k=1}^{\infty}(1-\phi)^{k-1}M_{t+k}^i(1-\tau_{t+k}^i)\Pi_{t+k}^i]^{\frac{\eta}{1-\eta}}] \tag{55}$$

Here Π_{t+k}^i denotes monopoly profits for country i's innovators at time $t+k$. This can further be expressed as a function of innovation:

$$\Pi_t^i = \underbrace{(\frac{1}{\nu}-1)}_{\text{Mark-Up}}\underbrace{[\xi\nu((K_t^i)^{\alpha}(\Omega_t^i)^{1-\alpha})^{1-\xi}\mathcal{N}_t^i]^{\frac{1}{1-\xi}}}_{\text{Demand: } X_t^i} \tag{56}$$

Where:

$$\mathcal{N}_t^i = (N_{i,t}^i + N_{j,t}^i(\frac{h^i}{h^j}\mathcal{E}_t))^{\frac{1-\nu}{\nu(1-\nu)}}, \ \ i,j \in \{H,F\} \tag{57}$$

(55) can be interpreted as a Q-theory equation for R&D: it equates optimal R&D intensity $\frac{S_t^i}{N_{i,t}^i}$ to the discounted present value of after tax profits. The equation makes clear the distortionary impact that the higher expected future path of corporate taxes required by the fiscal theory can have on US innovation. Persistently higher taxes moving forward lowers the present value of future monopoly profits (right hand side of (55)) in the local innovation sector. To enforce (55), local R&D intensity $\frac{S_t^i}{N_t^i}$ falls in response to a decline in the expected present value of future monopoly profits.

Through the law of motion for $N_{i,t}^{i}$ (50), this decline in R&D effort maps directly into lower US innovation stock ($N_{US,t}^{US} \downarrow$) and also depressed US growth prospects. This latter point can be seen by noting that country i's output in the model follows:

$$Y_t^i = (Z_t^i L_t^i)^{1-\alpha}(K_t^i)^{\alpha} \tag{58}$$

where:

$$Z_t^i = (\xi\nu)^{\frac{\xi}{1-\xi}} \mathcal{N}_t^i \tag{59}$$

Thus the depresssed US innovation effort endogenously depresses US growth through the term $\mathcal{N}_t^i$ which is a function of the local innovation stock $N_{i,t}^{i}$, as can be seen through (57). The distortionary impacts of the US fiscal policy are not limited to US innovation: it also has ramifications for global innovation and growth prospects. Due to the network structure in global innovation operating in the model, the ROW adopts US innovation as a primary input in her own local innovation. Thus the lower market values for US innovation also depresses foreign incentives to adopt US technology ($h_{ROW,t}^{US} \downarrow$). This can be seen by (46) which ties optimal investment in foreign adoption of US innovation: $h_{ROW,t}^{US}$ to the discounted present value of future monopoly profits in US innovation through the value function $\mathcal{V}_{i,t}^{j}$ given by (48). Since this present value is also depressed by the higher expected future path of US corporate tax, $h_{ROW,t}^{US}$ is depressed as well.

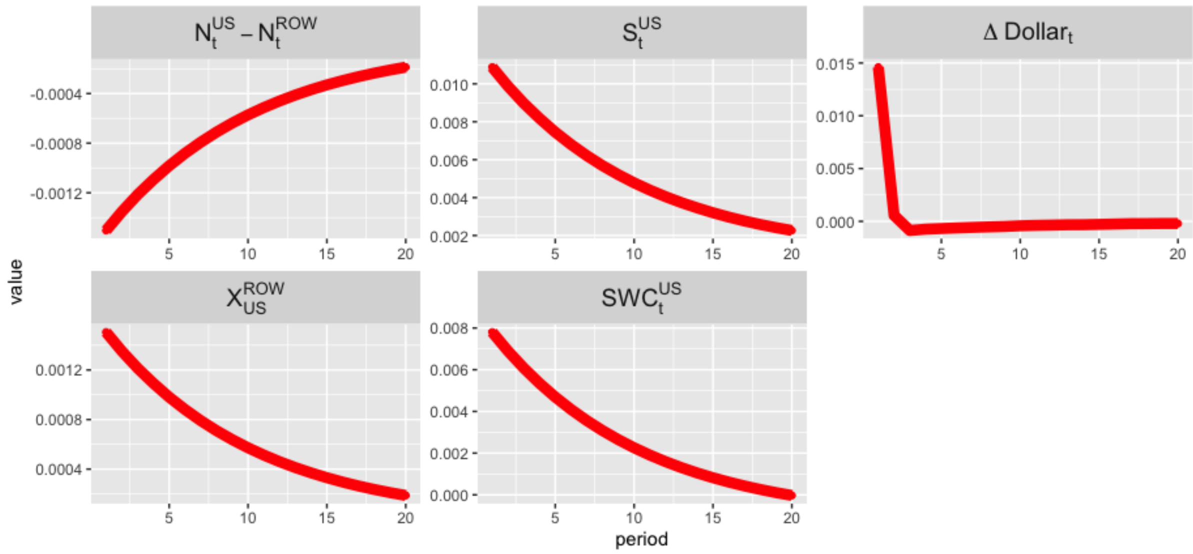
This slowdown in adoption investment maps directly into i) depressed foreign innovation stock through the law of motion for adoption ($N_{j,t}^{i}$) given by (51) and ii) depressed foreign growth prospects through (58). This explains the model dynamics contained in figure 10 which demonstrate that a consequence of the US exploiting her excess fiscal capacity during times of global stress is that the global innovation stock (N_t^G) declines persistently over the next 20 quarters (five years), with the international transmission driven by the slowdown in foreign use of US intermediate goods ($X_{ROW,t}^{US} \downarrow$).

6.1.3 Fiscal Mechanism, Risk-Sharing and the US Safety Facts

Long Run Risk Exposures: Whilst both country's future growth prospects are negatively impacted during times of global stress, what is important is that *US growth prospects are adversely impacted.* The top left panel of figure 11 implies that the US innovation stock is adversely impacted ($N_{US,t}^{US} - N_{ROW,t}^{ROW} \downarrow$), adversely impacting US growth prospects relative to the ROW during times of global stress.

Figure 11: *Relative Expected Growth Prospects, the Dollar and Risk-Sharing*

Description: This figure plots the impulse responses to a 1 S.D bad global TFP shock ($\epsilon_t^G \downarrow$) for relative innovation stocks ($N_t^{US} - N_t^{ROW}$), the US pareto weight (S_t^{US}), dollar appreciation rate (ΔDollar_t), US demand for foreign intermediate goods ($X_{US,t}^{ROW}$) and the US global consumption share ($SWC_t^{US} = \frac{C_t^{US}}{C_t^{US} + C_t^{ROW}\mathcal{E}_t^{-1}}$).



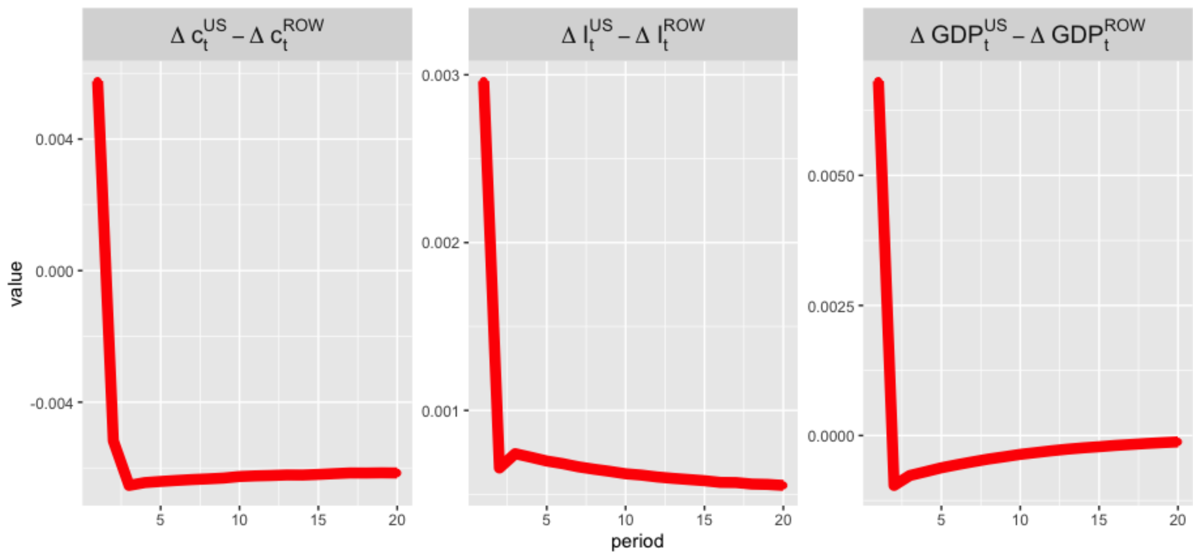
Since preferences are recursive, and agents fear variation in expected future growth prospects, US marginal utility growth rises relative to the ROW during global downturns. This is captured by the rise in the US relative pareto weight $S^{US}t$ in the top middle panel, which capture relative changes in marginal utility growths ((13.13)). Thus *the US emerges endogenously as the **riskier** country in this model: she is adversely exposed to expected global growth or global **long-run** risks relative to the ROW.* This is the source of the US macro premium/exorbitant privilege in my model and explains why the US economy and stock market outperforms the ROW *on average*. This contrasts with standard models that interpret the US exorbitant privilege as a risk premium for contemporaneous global macro risks, or global ***short-run** risks* (Maggiori, 2017; Gourinchas et al, 2017; Kekre and Lenel, 2021).

Risk-Sharing and the US Safety Puzzle: The advantage of this alternative risk-based interpretation of the US exorbitant privilege is that it is entirely consistent with i) my novel US safety facts and ii) the dollar's countercyclical dynamics. The reason for this straight forward: US marginal utility rises relative to the ROW during global downturns. This has two important equilibrium implications. Since financial markets are internationally complete and marginal utility growths must be equalised in equilibrium, as required by (37), the dollar appreciates on impact ($\Delta Dollar_t \uparrow$). This is documented in the top right panel of figure 11. Secondly equilibrium risk-sharing requires capital to flow to the country with the higher marginal utility growths during times of global stress, which is the US in my model. Since international trade is limited to intermediate goods markets in this model, this transfer of resources from the ROW to the US takes place in the intermediate goods markets, leading to a transfer of ROW intermediate goods to the US. This risk-sharing arrangement is depicted in the bottom panels of figure 11 which shows that i) US demand for ROW intermediate goods ($X_{US,t}^{ROW}$) and ii) the US global consumption share (SWC_t^{US}) both rise during times of global stress.

This risk-sharing arrangement reproduces the relative safety of the US economy during times of global stress, in line with my empirical evidence. This inflow of capital goods into the US frees up resources for consumption and investment, helping to insulate US macro quantities vis-*á*-vis the ROW during global downturns. To see this, notice from figure 12 that US relative consumption ($\Delta c_t^{US} - \Delta c_t^{ROW}$), investment ($\Delta I_t^{US} - \Delta I_t^{ROW}$) and GDP growths ($\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$) all rise in response to the bad relative US fiscal deterioration. Thus the model's fiscal mechanism resolves the US safety puzzle, alleviating the tension between the dollar's countercyclical dynamics and my novel US safety facts that emerges from EP theory.

Figure 12: *Fiscal Mechanism, Risk Sharing and US Safety*

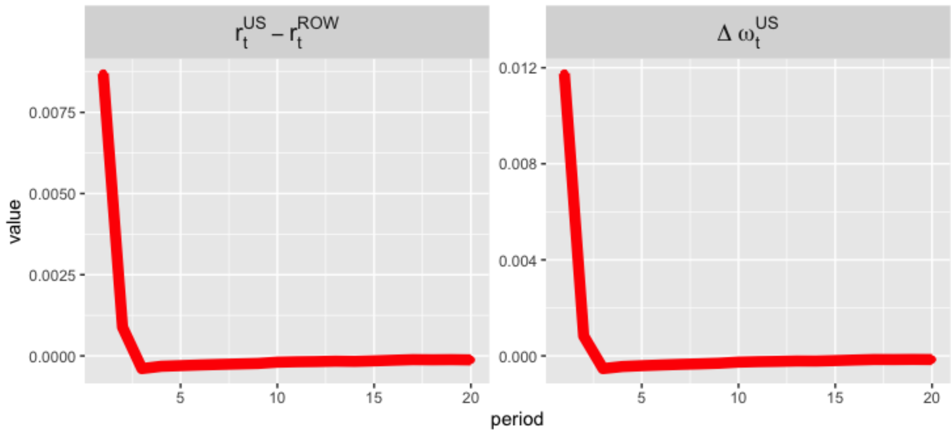
Description: This figure plots the impulse responses to a 1 S.D bad global TFP shock ($\epsilon_t^G \downarrow$) for relative consumption growths ($\Delta c_t^{US} - \Delta c_t^{ROW}$), relative investment growths ($\Delta I_t^{US} - \Delta I_t^{ROW}$) and relative GDP growths ($\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$).



US Stock Market Outperformance and US Wealth Share: Moving onto asset prices, figure 13 reveals that the fiscal mechanism can also reproduce my other US safety facts, namely the countercyclicality of i) US stock market outperformance ($r_t^{US} - r_t^{ROW}$) and ii) the US wealth share ($\Delta\omega_t^{US}$) w.r.t the global economy. These model successes are graphically displayed in figure 13 respectively.

Figure 13: *Fiscal Mechanism, Risk Sharing, US Wealth Share Dynamics*

Description: This figure plots the impulse responses to a 1 S.D bad global TFP shock ($\epsilon_t^G \downarrow$) for relative equity returns ($r_t^{US} - r_t^{ROW}$) and US wealth share growth rate ($\Delta\omega_t^{US}$).

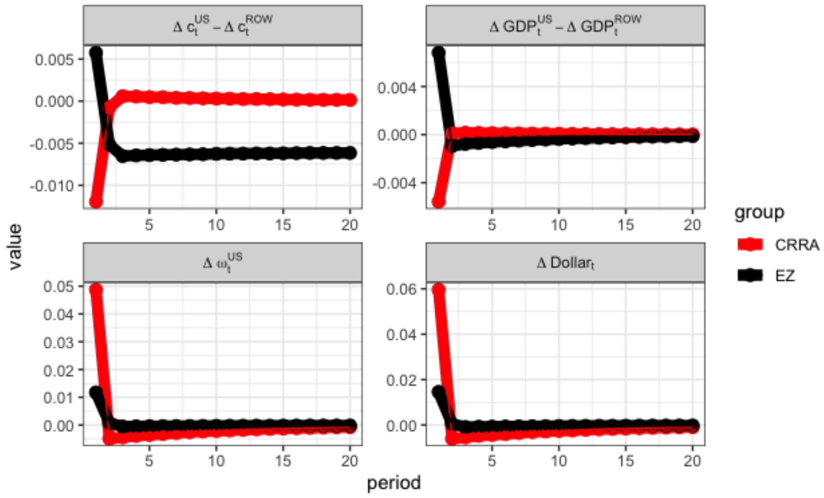


To understand how the model reproduces countercyclical dynamics for $r_t^{US} - r_t^{ROW}$, note that in this model the stock market is a risky claim to the profits across all production sectors in the local economy. Since the stock market is a risky claim to the endogenous local output, the relative outperformance of the US economy during global downturns and countercyclical dollar dynamics are complementary cash flow (discount rate) forces that increase US relative stock market valuations during global downturns. The mapping with the countercyclical US wealth share is then immediate: due to total portfolio home bias in my model, countercyclical US stock market outperformance directly leads to countercyclical US wealth share dynamics.

EZ vs CRRA: Before moving on to the quantitative performance of the model, I highlight the important role that preferences play in the model's fiscal mechanism and the US safety puzzle. Figure 14 compares model dynamics in the baseline model with EZ preferences against the special case where the CRRA benchmark ($\gamma = \frac{1}{\psi}$) is imposed. Notice that EZ preferences is essential to the operation of the risk-sharing scheme driving the model's success: under CRRA preferences, the puzzle re-emerges. Whilst the model reproduces countercyclical dollar dynamics, it does so by having the US economy underperform the ROW during global downturns. This is exactly the puzzle that I documented in the empirical parts of my paper.

Figure 14: *US Safety Puzzle and Role of Preferences*

Description: This figure plots the impulse responses of the equilibrium system to a 1 S.D bad global TFP shock ($\epsilon_t^G \downarrow$) under the baseline EZ model (black) and the special case where the CRRA benchmark is imposed (red). I show the responses of the following endogenous variables under each case: relative consumption growths ($\Delta c_t^{US} - \Delta c_t^{ROW}$), GDP growths ($\Delta GDP_t^{US} - \Delta GDP_t^{ROW}$), US wealth share growth rate ($\Delta \omega_t^{US}$), dollar appreciation rate (ΔDollar_t).



Why does the US economy underperform the ROW during global downturns in the CRRA case? At the heart of this result is a simple fact: fluctuations in expected future growth prospects does not directly move marginal utility growth. Hence the relative US fiscal expansion during global downturns does not influence relative marginal utility growths, as evidenced by the fact that the US pareto weight S_t remains constant in the CRRA case. Hence the risk-sharing mechanism is not active with CRRA preferences and resources do not flow from ROW to US, as in the baseline EZ model.

Instead relative macro fluctuations are driven by a different force entirely. Since US growth prospects are adversely impacted during global downturns, US consumers feel relatively poorer, generating standard wealth effects in favour of lower relative US consumption growth (top left). Since preferences are CRRA, these wealth effects dominate the offsetting substitution effects, resulting in lower US relative consumption and GDP growths. The relative GDP response is weaker because relative investment growths move in the opposite direction, a result standard in the international RBC literature (Backus, Kehoe, Kydland and Smith, 1992)

6.2 Quantitative Performance

6.2.1 US Safety Facts

Simulated Moments: Theoretical analysis thus far has demonstrate that the model ***qualitatively*** resolves the US safety puzzle. I now demonstrate that it can do so ***quantitatively***. I start by comparing simulated and data moments for the relevant US safety facts in table 8. To highlight role of the fiscal uncertainty shock, I compare the baseline model against the case where the fiscal uncertainty shock is removed. I also compare the baseline model against a simpler endowment economy model where lower (larger) US exposure to global short-run (long-run) risks is exogenously imposed. I relegate the details of this endowment economy model to theory appendix section 13. This provides strong evidence that the model quantitatively resolves the US safety puzzle: it matches the degree of countercyclicality in i) US macro outperformance, ii) US stock market outperformance and iii) the dollar observed in the data.

US Macro Premium/Exorbitant Privilege: Here I return to an earlier important point: whilst the US is safer than the ROW during global downturns, she still extracts a risk premium from the ROW in the model. As indicated by panel A of table 8, the US economy and stock market outperforms the ROW *on average as well as during global recessions*, consistent with my empirical evidence. This dichotomy remains a challenge for US exorbitant privilege models which imply that the macro premium/US exorbitant privilege compensates the US for her role as the global insurance provider. Hence her economy should underperform the ROW during times of global stress but overperform on average, an implication clearly at odds with my evidence.

The reason for this success is subtle: even though her economy does better during global downturns, the US is still a risky country in the model because when global growth prospects deteriorate, her growth prospects are adversely exposed. Thus the US earns a risk premium for her adverse exposure to expected global growth risks, or global ***long-run*** *risks*. This results in the US economy and stock market outperforming the ROW both on average and during global recessions, as in the data.

Table 8: *Simulated vs Data Moments*

Description: This table compares data moments with simulated model moments. I compare the data against my baseline GE model and a simpler endowment economy model presented in section 13 where lower (larger) US exposure to global short-run (long-run) shocks is exogenously imposed. Parentheses capture 90% bootstrapped CIs for the data moments. Data moments for $\mathbb{E}_t \Delta GDP^G_{t,t+4}$ are computed using OECD survey data: it is defined as a cross-sectional average of country level one-year ahead growth forecasts.

	Original Data	*Baseline Model*	*No Vol*	*Endowment Economy Model*
	Panel (a): Unconditional Moments			
$\mathbb{E}_t \Delta GDP^G_{t,t+4}$	2.50	2.00	2.20	2.50
	[2.20, 2.98]			
$\Delta c^{US}_t - \Delta c^{ROW}_t$	0.94	1.68	1.88	1.14
	[0.64, 1.18]			
$r^{US}_t - r^{ROW}_t$	2.03	2.24	0.80	1.45
	[0.91, 4.31]			
	Panel (b): US Safety Facts			
$corr_t(r^{US}_t - r^{ROW}_t, \Delta c^G_t)$	-0.44	-0.61	-0.88	-0.25
	[-0.24, -0.69]			
$corr_t(\Delta\omega^{US}_t, \Delta c^G_t)$	-0.33	-0.50	-0.87	-0.13
	[-0.10, -0.41]			
$corr_t(\Delta Dollar_t, \Delta c^G_t)$	-0.40	-0.60	-0.78	-0.11
	[-0.08, -0.60]			
	Panel (c): Backus-Smith + UIP Puzzles			
$corr_t(\Delta c^{US}_t - \Delta c^{ROW}_t, \Delta Dollar_t)$	-0.04	-0.261	-0.383	-0.37
	[-0.08, 0.29]			
$corr_t(i^{US}_t - i^{ROW}_t, \Delta Dollar_t)$	-0.07	-0.21	-0.35	-0.31
	[-0.24, 0.08]			

Table 9: *Asset Pricing Regressions (Model vs Data)*

Description: This table compares the implied cyclical dynamics for US stock market outperformance ($r^{US}_t - r^{ROW}_t$) and the US wealth share (ω^{US}_t) in the data vs the model via regressions. In both the model and the data, US wealth share growth rate ($\Delta\omega^{US}_t$) is used in the regressions. No vol corresponds to the case where the fiscal volatility shock (ω^i_t) is removed from the baseline model.

	Coefficient	*Data*	*Baseline Model*	*No Vol*	*Endowment Model*
		Specifications			
$r^{US}_t - r^{ROW}_t = \alpha + \beta\Delta c^G_t + \epsilon$	β	-0.400	-0.787	-0.676	-0.48
		(0.137)			
$\Delta\omega^{US}_t = \alpha + \beta\Delta c^G_t + \epsilon$	β	-0.16	-0.859	-0.700	-0.580
		(0.052)			
Note:	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$				

Backus-Smith and UIP Puzzles: A final comment is in order about the model's performance regarding the well documented Backus and Smith (1992) and UIP puzzles, shown in panel C of table 8. Qualitatively, the signs are consistent with the data: the dollar exchange rate is negatively correlated with both relative consumption growths and interest rate differentials. Quantitatively however, the correlations are too negative, in both cases lying outside the empirical confidence intervals.

This result is related to recent work by Colacito, Croce, Liu and Shaliastovich (2022) who also find in a two country endowment economy framework with i) EZ preferences, ii) correlated growth prospects and iii) international trade that the sign of the Backus-Smith coefficient is too negative relative to the data. They explain this result as being caused by the recursive risk-sharing scheme for expected growth shocks: since agents that suffer good relative expected growth shocks have an incentive to lower their global consumption shares, relative variances are negatively correlated in such a framework. Thus the negativity of the Backus-Smith and UIP coefficients are too large, an issue that they fix by adding stochastic endowment volatility shocks. This is also consistent with my analysis, as panel C of table 8 also demonstrates when fiscal uncertainty shocks are part of the simulation.

6.3 Inspecting the Mechanism

Overview: Having shown that the model can quantitatively resolve the US safety puzzle, I now take a moment to empirically inspect the mechanism driving this model success. At the heart of the model mechanism are three key implications. Firstly, the fiscal part of the mechanism implies that the more aggressive accumulation of US government debt during times of global stress incresses the expected future path of distortionary US taxes, depressing global innovation and consequently expected future global growth. Secondly when the US pursues more aggressive fiscal action during times of global stress, US innovation and growth prospects are *more* adversely impacted. Finally, since preferences are recursive, the relative decline in US R&D and consequently US expected future growth prospects ensures that US marginal utility growths rise relative to the ROW during global downturns, facilitating a transfer of resources from the ROW to the US. Thus the US global consumption share rises during times of global stress. Are these three implications consistent with the data?

Fiscal Mechanism: To test the fiscal part of the mechanism, I follow Campbell et al (2023) and use a VAR approach to forecast future surplus and tax-debt ratios. This involves a simple state vector that includes the US surplus-debt ratio, the US spending-debt rtio, the US tax-debt ratio and the US debt-GDP ratio:

$$z_{t+1} = \mu + \Gamma z_t + \Psi \xi_{t+1}$$
$$z_t^i = \left[\frac{s_t^{US}}{B_{t-1}^{US}} \quad \frac{\tau_t^{US}}{B_{t-1}^{US}} \quad log(\frac{B_{t-1}^{US}}{GDP_t^{US}}) \right]$$

Define $e_1 = [1,0,0], e_2 = [0,1,0]$ as the vectors that selects the surplus-debt and tax-debt ratios from the VAR system. Then the surplus and tax forecasts are estimated as: US Surplus-Debt$_t^{\text{Forecast}} = \mathbb{E}_t \sum_{k=1}^{\infty}$ US Surplus-Debt$_{t+k} = e_1' \lambda \Gamma z_t$ and US Tax-Debt$_t^{\text{Forecast}} = \mathbb{E}_t \sum_{k=1}^{\infty}$ US Tax-Debt$_{t+k} = e_2' \lambda \Gamma z_t$ respectively. Here $\lambda = \kappa\Gamma(I - \kappa\Gamma)^{-1}$. I is an $N \times N$ identity matrix and Γ is an $N \times N$ matrix of parameters associated with the VAR system. Finally κ is a log-linearization parameter that is calibrated to match the average surplus-debt ratio: $-log\kappa = \mathbb{E}log(1 + \frac{S_t^{US}}{B_{t-1}^{US}})$. I follow Campbell et al (2017) and set $\kappa = 0.995$. With these forecasts in hand, I show in table 10 that when the US surplus is expected to increase (US Surplus-Debt$_t^{\text{Forecast}} \uparrow$), due to the expected future path of US distortionary taxes rising (US Tax-Debt$_t^{\text{Forecast}} \uparrow$), global innovation and growth decline up to a 10 year horizon. This distortionary impact is consistent with the model's fiscal mechanism.

Table 10: *US Surplus and Tax Forecasts, Global Innovation, Consumption and GDP Growths*

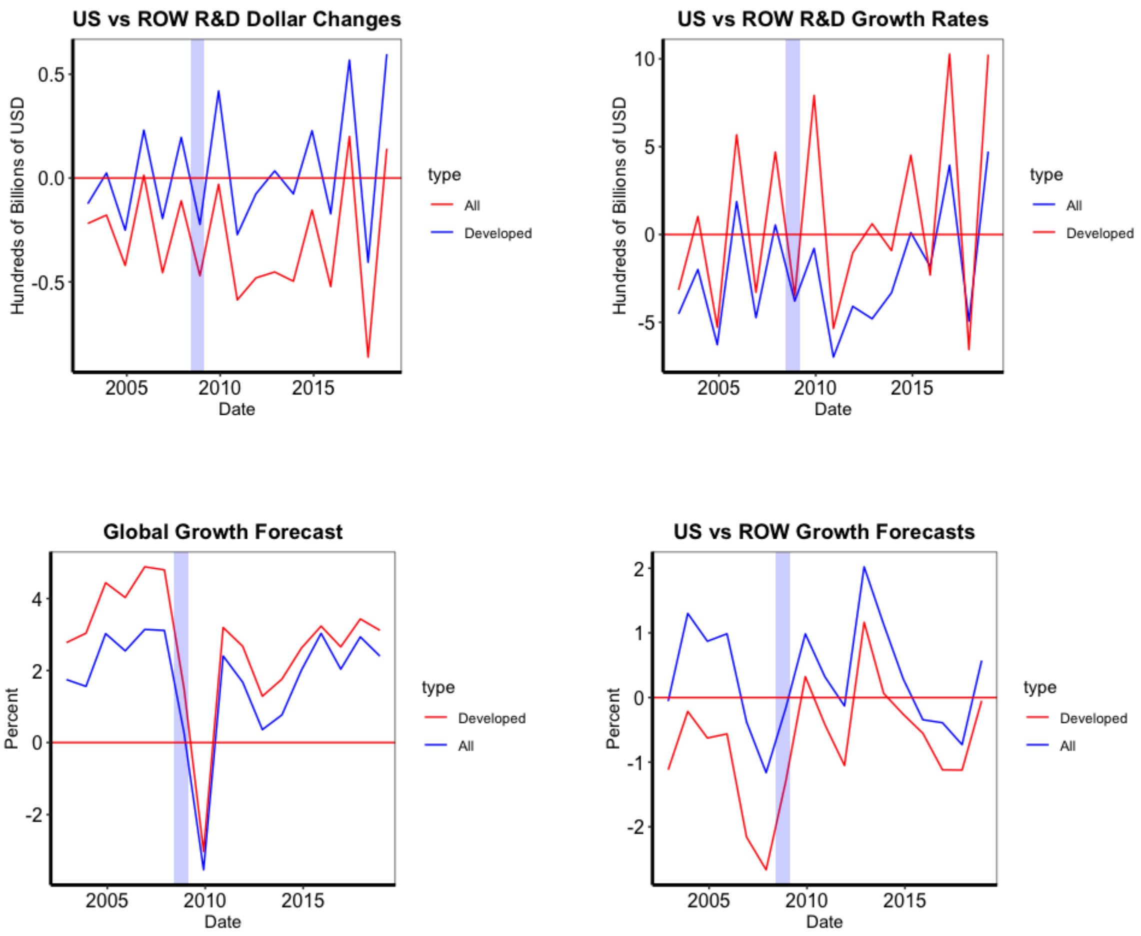
This table estimates the predictability of US tax and surplus-debt forecasts for future R&D, consumption and GDP growths for non-US countries. Data is annual from 1980-2021 and only includes non-US countries. Standard errors contained in parentheses are blockwise bootstrapped using country blocks of length $N = 38$ (All countries) and computed using 5,000 iterations. Country fixed effects are included and I use the surplus-debt in levels and changes (panel a) and the tax-debt ratio in levels and changes (panel b) as controls.

	Surplus Forecast								
	R&D Growth$_{t,t+k}$			Consumption Growth$_{t,t+k}$			GDP Growth$_{t,t+k}$		
	1YR	5YR	10YR	1YR	5YR	10YR	1YR	5YR	10YR
US Surplus-Debt Forecast$_t$	-3.548^{***}	-6.496^{***}	-7.645^{***}	-0.068^{***}	-0.294^{***}	-0.145	-0.076^{***}	-0.178^{***}	-0.179
	(0.392)	(0.523)	(0.611)	(0.019)	(0.061)	(0.161)	(0.020)	(0.056)	(0.137)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	629	560	464	629	560	464	629	560	464
Adjusted R^2	0.108	0.224	0.238	0.017	0.015	0.022	0.050	0.011	0.014
	Tax Forecast								
	R&D Growth$_{t,t+k}$			Consumption Growth$_{t,t+k}$			GDP Growth$_{t,t+k}$		
	1YR	5YR	10YR	1YR	5YR	10YR	1YR	5YR	10YR
US Tax-Debt Forecast$_t$	-0.992^{***}	-1.412^{***}	-1.148^{***}	0.025^{***}	-0.072^{***}	0.030	0.004	-0.129^{***}	-0.118^{***}
	(0.158)	(0.204)	(0.224)	(0.009)	(0.024)	(0.034)	(0.009)	(0.024)	(0.032)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	629	560	464	629	560	464	629	560	464
Adjusted R^2	0.124	0.191	0.227	0.011	0.033	0.004	0.035	0.036	0.008
Note:				*p<0.1; **p<0.05; ***p<0.01					

Relative R&D and Expected Growth Prospects: Next I move onto the model's predictions for relative R&D and expected future growth. Consistent with the model, figure 15 demonstrates that US R&D, both in real dollar changes and growth rates, was indeed adversely impacted during the global financial crisis, which is depicted by the blue bars. Furthermore US R&D remained depressed relative to the ROW for several years after the crisis, indicating that the relative decline in US R&D effort was persistent, a fact that is also consistent with the model.

Figure 15: *US vs ROW R&D and Growth Forecasts during Global Financial Crisis*

Description: This figure plots US R&D and growth prospects relative to the ROW. The top left plots the relative dollar changes between US and ROW R&D expenditures, where ROW R&D is the aggregate dollar expenditure outside the US. The top right plots the relative difference in R&D growth rates. The bottom left plots global growth forecasts defined as an equally weighted average of all countries 1 year (four quarter ahead) growth forecasts from OECD survey data. R&D data is from the World Bank's World Development Indicator (WDI) and forecasts are from OECD survey data.



Moving to the bottom left and right panels of figure 15, I also provide suggestive evidence that US *expected* future growth prospects were adversely impacted during the GFC. Using four quarter ahead OECD growth forecasts to proxy for expected future growth rates, these panels clearly demonstrate that when global growth expectations deteriorated during the GFC (bottom left), US growth prospects were adversely impacted (bottom right). These results are robust to the inclusion of EME countries into the analysis.

Risk Sharing and Global Consumption Shares: Finally, I investigate model implications regarding the behaviour of the US global consumption and output shares during times of global stress. In the model, the US is a global insurance receiver, receiving resources from the ROW during times of global stress. This insurance is persistent: to compensate her relative deterioration in long-run growth prospects, the US global consumption shares must increase persistently over the long-run in response to the bad global TFP shock. Did this occur during the GFC and the post period?

Figure 16: *US Global Consumption and Output Shares during the post-GFC period*

Description: This figure plots the annualised (four quarter) change in the US global consumption and output shares. The global consumption and output shares are defined as US consumption and output over total global consumption and output. The blue bar corresponds with the global financial crisis (2008Q2-2009Q2).

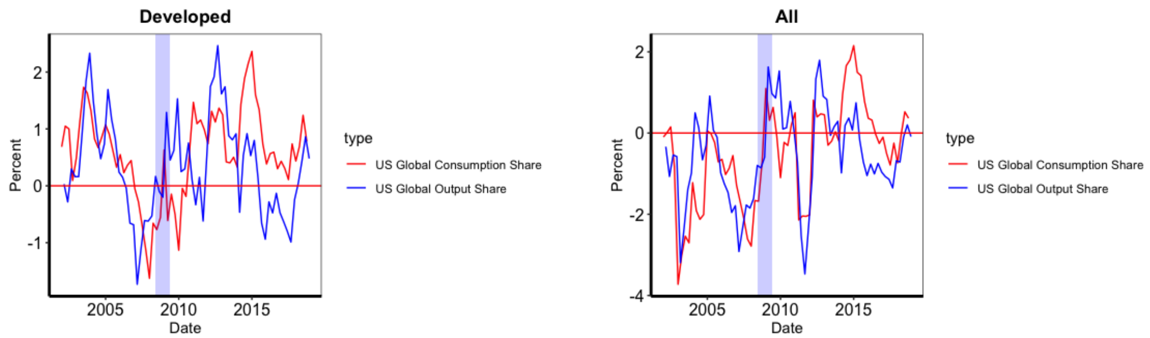


Figure 16 provides suggestive evidence in favour of this model implication: US global consumption shares rose during the global financial crisis and have generally remained positive post-GFC, mirroring the result from earlier on that US relative consumption growths have remained positive post-2010. Thee post-crisis patterns of the US global consumption share are consistent with recent work by Atkeson, Heathcote and Perri (2021) documenting a corresponding outperformance of the US stock market post-crisis and are consistent with my risk-sharing interpretation of international macro-finance dynamics post-GFC implied by my model.

6.4 Fiscal Mechanism and the Global Financial Cycle

Overview: I now move onto risk premium dynamics in the model. My model reproduces countercyclical global risk premia through countercyclical fluctuations in the *quantity* of global risk. In particular, the deterioration in expected future global growth prospects drives up the quantity of global long-run risk during times of global stress. Central to this global long-run risk mechanism is the accumulation of government debt during global downturns: this common smoothing of the tax burden over time across countries increases uncertainty over future global tax policies and consequently global long-run growth prospects.

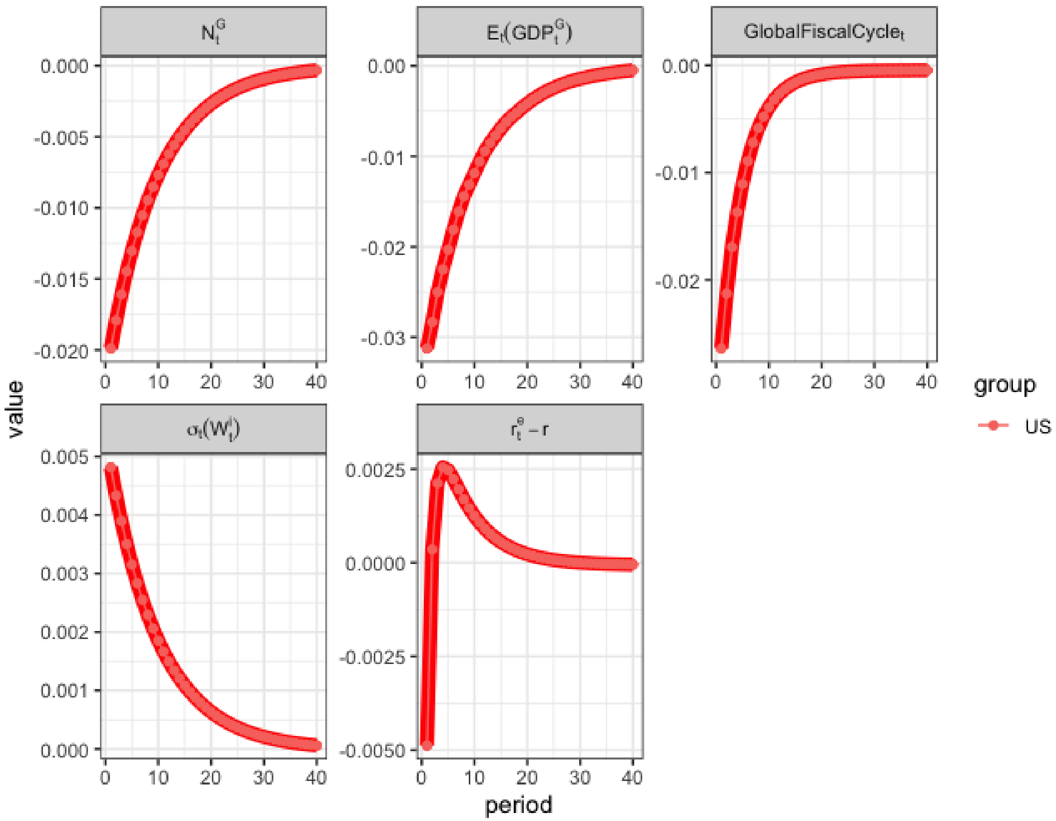
Simulation: Figure 17 demonstrates this global long run risk mechanism. The relative US fiscal deterioration during global downturns worsens i) global innovation flows (top left panel) and ii) global growth prospects (top middle panel) due to the distortionary impacts of US taxation on US innovation adopted overseas. The mapping between these depressed global growth prospects and global risky asset prices is then driven by the exogenous fiscal rules: recall from (13) that local governments in the model respond with more expansionary fiscal policy during depressed growth environments. Thus times of global stress are associated with common deteriorations in fiscal deteriorations around the world, consistent with empirical evidence from Jiang (2021).

This model implication is clearly shown in the middle left panel of figure 17 which depicts the relatively sharp decline in the global fiscal cycle in response to a bad global TFP shock in the model. Linking this decline in the global fiscal cycle to higher global risk premia requires understanding the role of government debt in the fiscal mechanism. Since governments smooth the local tax burden by accumulating more government, these global fiscal deteriorations raise uncertainty over future global tax policy and consequently global long-run growth prospects.

This can be seen in the middle right panel of figure (17) which documents that uncertainty about future global growth, or global wealth volatility rises in response to the US fiscal expansion. Since preferences are recursive, this increase in endogenous global long-run risk is priced in global risky asset prices, generating a rise in global risk premia. This manifests itself via a drop in global risky asset prices on impact followed by higher future global returns moving forward (middle right panel of figure 17). Thus the model reproduces my empirical evidence tying US fiscal deteriorations to i) depressed global growth expectations, ii) higher global uncertainty and iii) depressed global risky asset prices and higher global risk premia.

Figure 17: *Fiscal Mechanism and Global Risk Premia*

Description: This figure plots the impulse responses of global innovation stock ($N_{G,t}$), global growth expectation ($\mathbb{E}_t GDP^G_{t+1}$), Global Fiscal Cycle (GFC_t), country level wealth volatilities ($\sigma_t(W^i_t)$) and excess equity returns ($r^e_t - r_f$) to a 1 S.D bad global TFP shock (ϵ^G_t) under baseline calibration. Global Fiscal Cycle is defined as average surplus-debt ratio across the two countries in the model, as defined by Jiang (2022).



Global Footprint of US Fiscal Policy: Having demonstrated the model's fiscal mechanism can reproduce countercyclical global risk premium dynamics, I now move onto the global footprint of US fiscal policy. In a companion paper: Kim (2022b), I demonstrate that the US fiscal policy has a unique global footprint. ***Deteriorations*** in the US fiscal condition coincide with i) ***depressed*** global risky asset prices and ii) ***higher*** future equity returns moving forward. I also demonstrated in that paper that this global footprint of US fiscal policy is unique: *once the US fiscal condition is controlled for, foreign fiscal conditions play a limited role in driving risky asset prices,* ***including their own****.*

I now show that the model can reproduce these facts regarding the unique global footprint of US fiscal policy. Here the second source of asymmetry in the model, US role as global innovation leader, becomes important. Recall that in the model, this is modelled simply as the US final good production having a greater degree of home bias towards their local innovation relative to the ROW. This ensures that the US fiscal policy has a larger distortionary impact on global innovation in the model, driving a unique link between the US fiscal condition, global innovation, the global fiscal cycle, global policy uncertainty and consequently global risk premia in this model. To show that the model's novel fiscal mechanism can quantitatively reproduce the unique global footprint of US fiscal policy, I produce IRFs to a 1 SD US fiscal shock in this model ($\epsilon_{s,t}^{US} \uparrow$) in red. I plot the corresponding IRF for foreign fiscal shock in the model in black. Since the US is the global innovation leader, the US fiscal shock has a larger international transmission into global risky asset prices. This US centrality to global innovation gives the US fiscal policy an outsized influence over the global innnovation stock and consequently expected global growth.

Table 11: *Model vs Simulated Regressions (Horserace Valuation Regressions)*

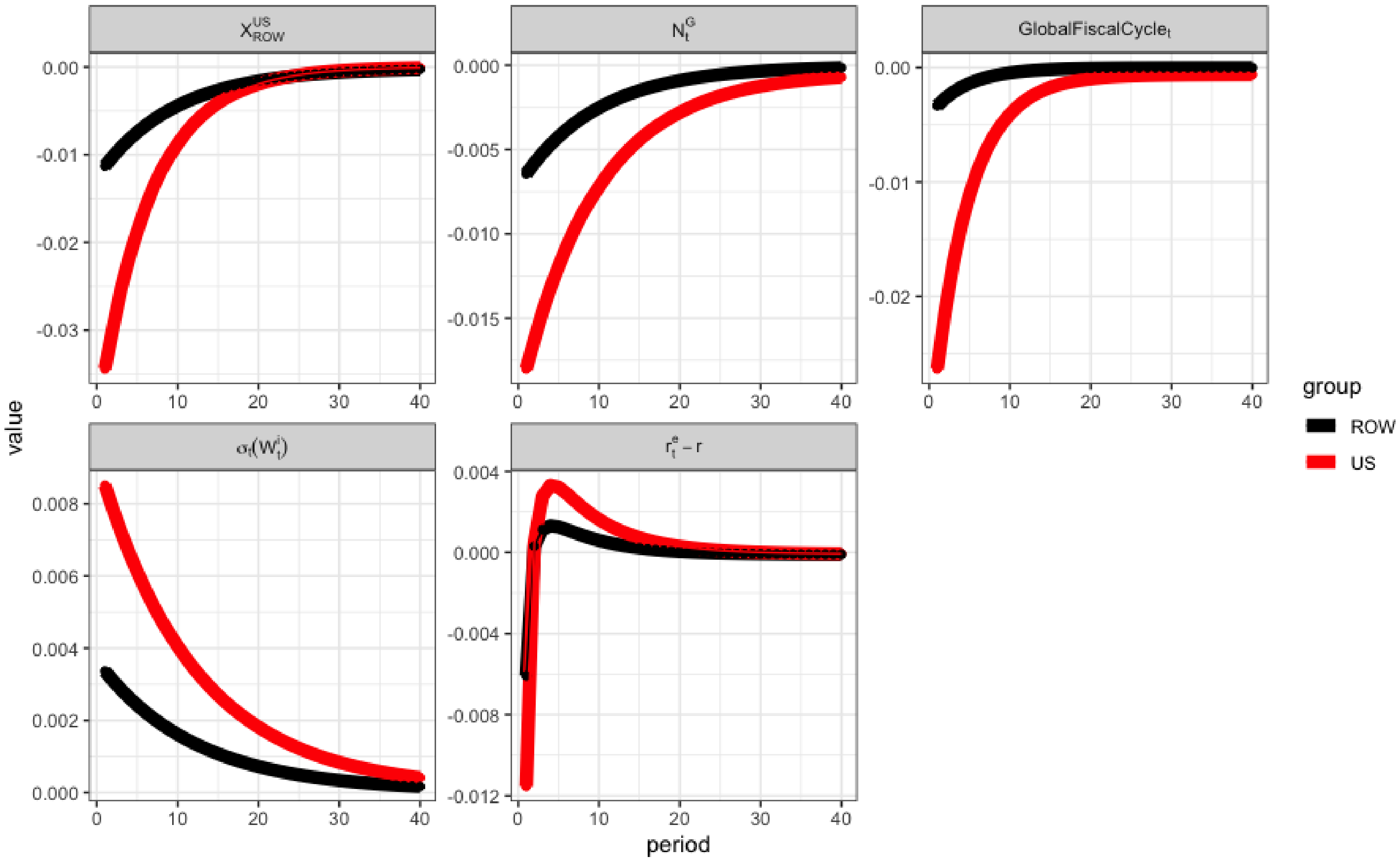
Description: Data columns reproduce empirical results from previous sections. To map the model to my empirical analysis, ΔUS Surplus-Debt Ratio$_t$ is used as the fiscal variable. For the model regressions, $\frac{(\tau_t^{US} - \tau_t^{*,US})\text{Tax Transfer}_t^{US}}{B_{t-4}^{US}}$ represents the US surplus-debt ratio. Model regressions are computed as the average results over 1,000 simulations for 1000 quarters each.

	Dependent variable: ΔDY_t^i		*Dependent variable:* r_t^i	
	Data	Model	Data	Model
ΔUS Surplus-Debt Ratio$_t$	−10.236	−3.000	10.133	2.832
	(1.719)		(1.261)	
ΔCountry i's Surplus-Debt Ratio$_t^{US}$	1.220	−0.481	0.66	0.307
	(0.388)		(0.285)	
Global Fiscal Cycle$_{i,t}^{US}$	−3.110	−1.204	−0.803	0.710
	(1.248)		(0.916)	

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Figure 18: *Global Footprint of US Fiscal Policy*

Description: This figure plots the impulse responses of global innovation growth ($N_{G,t}$), global growth expectations ($\mathbb{E}_t GDP_t^G$), the global fiscal cycle (Global Fiscal Cycle$_t$), global wealth volatility ($\sigma_t(W_t^G)$) and excess global equity returns ($r_t^e - r_f$) to a 1 S.D bad US fiscal shock ($\epsilon_{s,t}^{US} \downarrow$).



Correlation Evidence: Digging deeper, I show in table 11 that my model can reproduce the result from my companion paper that the US fiscal condition drives out both i) the local fiscal condition and ii) the global fiscal cycle in explaining local risky asset prices. The model broadly captures this relative ordering, revealing that the US fiscal condition is indeed the key fiscal driver of global risky asset prices in the model, in line with the data.

Predictability Regressions: To show that the model's novel fiscal mechanism can quantitatively reproduce global return predictability consistent with the data, I generate model regressions where I evaluate the predictive power of the US fiscal condition using simulated data. The model is a quarterly calibration where the average results over 1,000 simulations of 100 quarters each is used to estimate the model regressions. I compare these results to the predictability results documented in this paper.

Table 12: *Global Equity Return Predictability Regressions*

Description: This table compares the US fiscal condition's predictability for future dollar returns in the data and in the model. Data and model regressions use US Surplus-Debt Ratio$_t$ as the relevant US fiscal variable. No vol corresponds to the case where the fiscal volatility shock (ω_t^i) is removed from the baseline model. Model regressions are computed as the average results over 1,000 simulations for 1000 quarters each.

	Coefficient	*Data*	*Model*	*No Vol*
Panel (a): Global Equity Return Predictability				
$\mathrm{r}^W_{t,t+4} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t) + \epsilon$	β	1.935	-3.883	-1.400
		(0.800)		
$\mathrm{r}^w_{t+4,t+8} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	-6.123	-9.291	-0.80
		(0.821)		
$\mathrm{r}^w_{t+8,t+12} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	-7.853	-7.342	-0.48
		(0.721)		
$\mathrm{r}^w_{t+12,t+16} = \alpha + \beta(\text{US Surplus-Debt ratio})_t + \epsilon$	β	-11.873	-5.238	-0.22
		(0.758)		
$\mathrm{r}^w_{t+16,t+20} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	-4.932	-3.8120	0.00
		(0.152)		
Note:	*p<0.1; **p<0.05; ***p<0.01			

Decomposition: To provide further validation of the model's predictability results, I decompose the global stock market return, in the model and data, into a i) risk-free rate, ii) cash flow and risk-premium component using the first-order approximation:

$$r_t^W - \mathbb{E}_{t-1} r_t^W \approx (\mathbb{E}_t - \mathbb{E}_{t-1})[\underbrace{\sum_{\tau=0}^{\infty} \rho^\tau r^W_{F,t+\tau}}_{\text{Risk Free Rate}} + \underbrace{\sum_{\tau=0}^{\infty} \rho^\tau \Delta d_{t+\tau}}_{\text{Cash Flow}} + \underbrace{\sum_{\tau=0}^{\infty} \rho^\tau (r^W_{t+\tau} - r^W_{F,t+\tau})}_{\text{Risk Premium}}]$$

For the data, I follow Campbell (1991) and Campbell and Ammer (1993) and use a p lag VAR to model the news terms:

$$z_{t+1} = \Lambda z_t + \phi \Delta \text{US Surplus-Debt Ratio}_t^{Orth} + w_{t+1} \tag{60}$$

ΔUS Surplus-Debt Ratio^{Orth} is the four quarter change in the US surplus-debt ratio orthogonalised w.r.t US and global business cycle and the global fiscal cycle. In other words it is the residuals from the regression:

$$\Delta \text{US Surplus-Debt Ratio}_t = \alpha + \beta_1 \Delta IP_t^{US} + \beta_2 \Delta IP_t^{W} + \beta_3 \text{Global Fiscal Cycle}_t + \epsilon_t \tag{61}$$

This implies that the revisions in expectations for each component can be written as:

$$\begin{aligned}
\mathcal{N}_{R_F} &= \sum_{\tau=0}^{\infty} \rho^j r_{F,t+\tau}^W = s_r (1-\rho A)^{-1} w_{t+1} \\
\mathcal{N}_{R_P} &= \sum_{\tau=0}^{\infty} \rho^j (r_{t+\tau}^W - r_{F,t+\tau}^W) = s_y \rho A (1-\rho A)^{-1} w_{t+1} \\
\mathcal{N}_R &= r_t^W - \mathbb{E}_{t-1} r_t^W = s_r w_{t+1} \\
\mathcal{N}_{CF} &= \sum_{\tau=0}^{\infty} \rho^j \Delta d_{t+\tau} = \mathcal{N}_R - \mathcal{N}_{R_P} - \mathcal{N}_{R_F}
\end{aligned} \tag{62}$$

s_y, s_r are appropriate $1 \times np$ selection matrices that isolate the world excess return $r_t^W - r_{F,t}^W$ and the risk free rate $r_{F,t}^W$ from the VAR system. $\rho = 0.995$ is chosen in line with the literature (Campbell, 1991). Thus the transmission of US fiscal shocks into i) risk-free rate component ($\mathcal{F}_{R_F}$), ii) cash flow component (($\mathcal{F}_{CF}$)) and iii) risk-premium component ($\mathcal{F}_{R_P}$) is:

$$\begin{aligned}
\mathcal{F}_{R_F} &= s_r (1-\rho A)^{-1} \phi \\
\mathcal{F}_R &= s_y \phi \\
\mathcal{F}_{R_P} &= s_y \rho A (1-\rho A)^{-1} \phi \\
\mathcal{F}_{CF} &= \mathcal{F}_R - \mathcal{F}_{R_P} - \mathcal{F}_{R_F}
\end{aligned} \tag{63}$$

The results of this decomposition are presented in table 13. Confidence intervals for the data moments are constructed using the wild bootstrap methodology advanced by Gertler and Karadi (2015) and Mertens and Ravn (2013). The results underscore again the importance of fiscal uncertainty: in the absence of the fiscal volatility shock, the cash flow component

Table 13: US Fiscal Transmission Variance Decomposition (Model vs Data)

Component	Data	C.I	Model	No Vol
Risk-Free Rate ($\mathcal{F}_{R_F}$)	7.4%	[-20%, 17%]	4.0%	3.7%
Cash Flow ($\mathcal{F}_{CF}$)	35.8%	[17%, 62%]	60.23%	77.23%
Risk-Premium ($\mathcal{F}_{R_P}$)	56.8%	[32%, 95%]	35.77%	19.97%

Note: Empirical CIs constructed using wild bootstrap with 5,000 iterations

dominates (over 70%) of the variance decomposition due to the endogenous global long-run risk mechanism that operates in the model. This is in contrast to the data the risk premium component is the strongest single contributor to the global return variance. Adding the fiscal volatility shock brings the model closer to the data, though the cash flow news component is still the single largest contributor. The results are however contained within the empirical CIs.

Dollar Predictability: I now explore the model's performance in matching predictability in dollar excess returns. In the model, the relative US fiscal deterioration drives down the dollar risk premium, resulting in i) a dollar *appreciation* on impact during global downturns and ii) an expected future dollar *depreciation* moving forward, consistent with the data (Lustig, Roussanov and Verdelhan, 2014). This implication is also consistent with recent work by Jiang (2022) who shows that the US fiscal condition lowers the dollar risk premium.

These model results are shown below in table 14 below. Dollar predictability is shown up to a 5 year (20 quarter) horizon. Two results are worth noting. Firstly, the model broadly captures the degree of dollar predictability in the data, though in the data it takes at least 2 years (8 quarters) for the dollar to start depreciating, something not captured in the baseline model. Secondly, the results underscore the important role that fiscal uncertainty plays in driving the dollar predictability results: removes the fiscal volatility shock (ω_t^i) significantly reduces the degree of predictability in the baseline model.

Table 14: *Dollar Predictability Regressions*

Description: This table compares the US fiscal condition's predictability for future dollar returns in the data and in the model. Data and model regressions use US Surplus-Debt Ratio$_t$ as the relevant US fiscal variable. No vol corresponds to the case where the fiscal volatility shock (ω_t^i) is removed from the baseline model. Model regressions are computed as the average results over 1,000 simulations for 1000 quarters each.

	Coefficient	*Data*	*Baseline Model*	*No Vol*	*Endowment Model*
Panel (a): Dollar Carry Trade Returns					
$rx^{Dollar}_{t,t+4} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	4.720	-2.412	-1.998	-1.300
		(1.90)			
$rx^{Dollar}_{t+4,t+8} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	1.690	-4.581	-1.383	-0.80
		(2.480)			
$rx^{Dollar}_{t+8,t+12} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	-1.920	-6.338	-0.888	-0.498
		(2.41)			
$rx^{Dollar}_{t+12,t+16} = \alpha + \beta(\text{US Surplus-Debt atio})_t + \epsilon$	β	-3.990	-5.223	0.420	0.00
		(2.100)			
$rx^{Dollar}_{t+16,t+20} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	-5.220	-4.223	0.00	0.00
		(2.400)			
Note:	*p<0.1; **p<0.05; ***p<0.01				

Inspecting the Mechanism: Here I discuss steps I take to validate the mechanism that reproduces the global financial cycle in my model and the unique international transmission of US fiscal policy. Specifically the model mechanism assumes that the US is the global innovation leader and ties the US fiscal policy to i) global growth prospects, ii) global fiscal cycle and iii) global policy uncertainty. This gives rise to the following testable prediction:

1. **US leads the Global Innovation Network**: US drives the global innovation cycle: When the US innovates, ROW follows by adopting her innovation.
2. **US Fiscal Condition, US Innovation and Global Growth**: Deteriorations in US fiscal condition predict both i) lower US innovation and ii) global innovation growth
3. **Global LRR Exposures**: When expected future global growth prospects deteriorate during global downturns, US growth prospects are adversely impacted relative to the ROW
4. **US FP, Global Fiscal Cycle and Global Policy Uncertainty**: US Fiscal Policy leads the global fiscal cycle: a US fiscal deterioration drives common deteriorations in global fiscal conditions, generating rises in global policy uncertainty and consequently higher global risk premia.

I empirically confirm each of these testable implications. To accommodate space, I relegate this analysis to empirical appendix section 12

7 Other Results

7.1 Post-2010 and End of Privilege

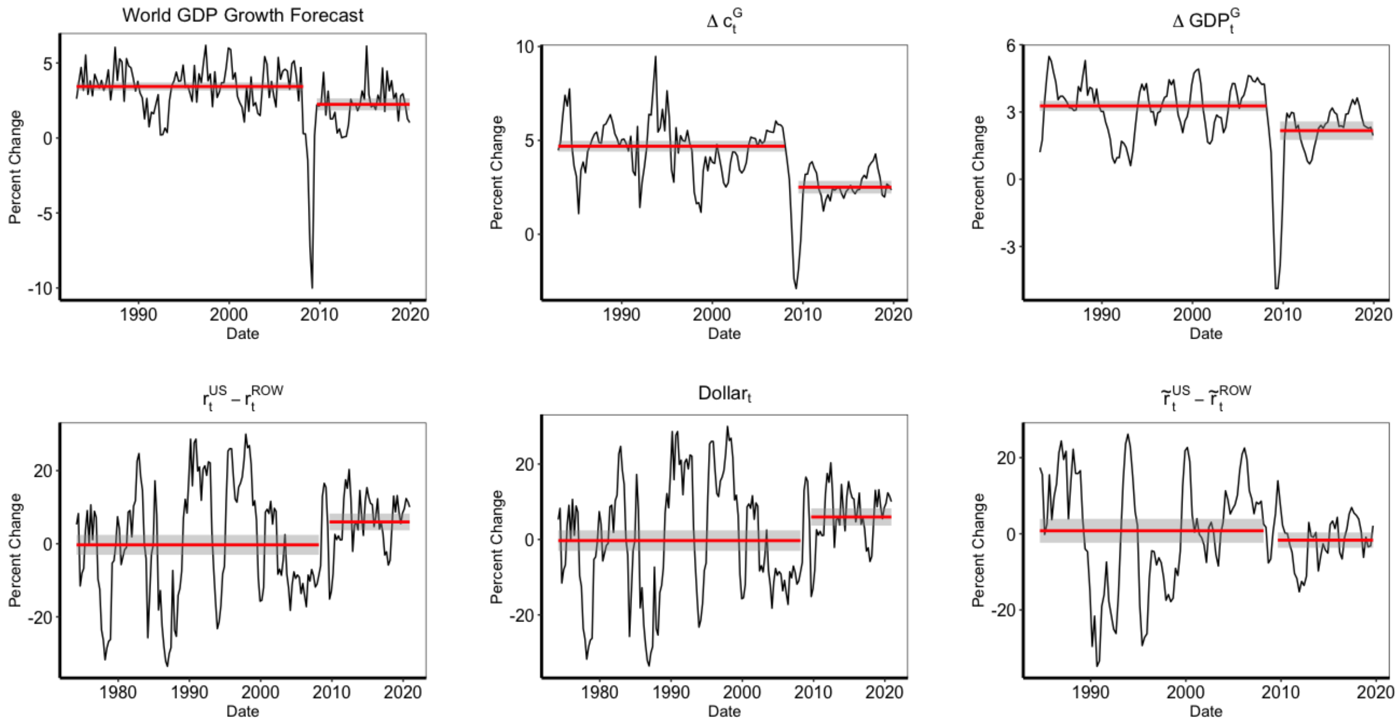
GFC Experiment: To provide further validation for my model, I now show that it can explain the recent deterioration in the US exorbitant privilege post-GFC, which was largely driven by US stock market outperformance vis-*á*-vis the ROW (Atkeson, Heathcote and Perri, 2022). Whilst Atkeson, Heathcote and Perri (2022) emphasise ex-post return innovations caused by mark-up shocks, my model emphasises an ex-ante risk premium story. As shown by figure 3, the post-GFC period featured a transition towards lower expected global growth, with OECD global GDP growth forecasts declining from a 3.4% average pre-GFC to a 1.6% average post-GFC.

Triggered by more countercyclical US fiscal responses post-GFC, my model implies that US became conditionally more riskier during this period. Since US growth prospects were adversely exposed to the deterioration in expected global growth prospects, my model predicts a rise in the relative risk premium on the US stock market vis-*á*-vis the ROW, reproducing the US stock market outperformance during this period. This risk based interpretation is consistent with the data: figure 3 shows that the dollar appreciated against the ROW by approximately 4.46% and the US stock market outperformed the ROW by 5.96% during the post-GFC as opposed to approximately zero for both quantities pre-GFC. It is also consistent with recent evidence from Corsetti et al (2023) documenting a rise in the US permanent (long-run) risk premium vis-*á*-vis the ROW.

Experiment: To formalise this intuition, I use the model to capture the regime switch from a high global growth environment pre-GFC to a low global growth environment post-GFC by varying the relative differential in fiscal cyclicality coefficients between US and ROW: $\beta^{DIFF} = \beta^{US} - \beta^{ROW}$. I model this regime switch through a one time shift in the parameter β^{DIFF}, the key variable driving endogenous fluctuations in expected global growth in the model. In particular, I consider two values for $\beta^{DIFF} \in \{\beta_L^{DIFF}, \beta_L^{DIFF}\}$. I model the pre-GFC period as a high global growth environment: $\beta^{DIFF} = \beta_H^{DIFF}$ and the post-GFC period is a low global growth environment: $\beta^{DIFF} = \beta_L^{DIFF}$. $\beta_H^{DIFF}, \beta_L^{DIFF}$ are calibrated to target the unconditional mean for global growth expectations pre and post-GFC computed using OECD survey data. The simulation results reported in table 15 and suggests that the model's recursive mechanism can quantitatively account for international asset pricing dynamics post-GFC.

Figure 19: *Global Growth Regime Switch*

Description: The top panel plots macro variables: OECD global growth forecast, global consumption and GDP growths: $\Delta c_t^G, \Delta GDP_t^G$. Global variables are constructed as an equally weighted average of country-level variables. The bottom panel documents US stock-market outperformance $r_t^{US} - r_t^{ROW}$ and its dollar and local equity return components: $Dollar_t, \tilde{r}_t^{US} - \tilde{r}_t^{ROW}$. The red lines document the conditional means before and after the global financial crisis (2008Q2-2009Q2). The grey bands represent 90% bootstrapped confidence intervals using a blockwise approach with 1 year (four quarter) blocks.



Discussion: The simulation results reported in table 15 implies that my fiscal risk story largely explains the behaviour of international asset prices post-GFC. Due to the regime switch that led to the US fiscal response being more aggressive during global downturns post-GFC, the world transitioned from a high global growth environment to a low global growth environment. The US is compensated for their adverse exposure to this permanently lower global growth in the post-GFC period. In the model this largely happens through the local equity return component: $\tilde{r}_t^{US} 0 \tilde{r}_t^{ROW}$, as opposed to the dollar component which depreciates modestly in the post-GFC period. This is broadly consistent with the finding in Atkeson, Heathcote and Perri (2022) that the US stock market outperformance post-GFC has largely been driven by the local equity return component.

Table 15: *GFC Model Experiment*

Description: This table reports simulation results from my experiment. Bootstrapped SEs are reported in parentheses and 90% bootstrapped confidence intervals for data moments are reported in third column. This procedure is a blockwise bootstrap using 1 year (4 quarter) blocks for 5000 replications.

	Original Data	*90% CI*	*Model*
Panel (a): Pre-GFC			
$\mathbb{E}_t \Delta GDP^G_{t,t+4}$	3.43	[3.10, 3.76]	3.43
	(0.19)		
$r_t^{US} - r_t^{ROW}$	-0.30	[-4.30, 3.90]	0.88
	(2.04)		
$Dollar_t$	2.19	[-0.89, 5.39]	0.47
	(1.88)		
$\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$	0.79	[-5.30, 3.90]	-0.28
	(2.86)		
Panel (b): Post-GFC			
$\mathbb{E}_t \Delta GDP^G_{t,t+4}$	1.60	[1.36, 2.28]	1.60
	(0.28)		
$r_t^{US} - r_t^{ROW}$	5.96	[3.08, 8.50]	2.68
	(1.67)		
$Dollar_t$	1.46	[0.88, 3.06]	-1.03
	(0.25)		
$\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$	-1.66	[-0.90, 4.02]	3.81
	(1.58)		
Note:	*p<0.1; **p<0.05; ***p<0.01		

Validation: In contrast to Atkeson, Heathcote and Perri (2021), my model ties the post-2010 *ex-post* US stock market outperformance to *ex-ante*, rather than *ex-post*, return shocks. In particular, the model makes the case that US risk premia rose relative to the ROW during this period. Here I provide suggestive evidence in favour of this interpretation. To measure *ex-ante* expected returns on US and foreign equity markets, I follow Campbell et al (2017) and model country i's aggregate equity returns $r^i_{m,t+1}$ as being jointly determined by a heteroskedastic first order VAR system. In specific terms, the state system z^i_t is driven by the following process:

$$z^i_{t+1} = \mu_i + \Gamma(z^i_t - \mu_i) + \sigma^i_t \xi^i_{t+1} \tag{64}$$

$$\xi^i_{t+1} \sim i.i.d\ N(0,\ I) \tag{65}$$

Under this structural assumption, expected returns: $E^i_{D,t} = \mathbb{E}_t \sum_{s=1}^{\infty} \rho^s r^i_{m,t+1+s}$ and shocks to expected returns: $N^i_{D,t+1} = (\mathbb{E}_{t+1} - \mathbb{E}_t) \sum_{s=1}^{\infty} \rho^s r^i_{m,t+1+s}$ are affine in the state vector z^i_t and the VAR shock vector ξ^i_{t+1}:

$$E^i_{D,t+1} = (e_1'\lambda)\sigma^i_t z^i_{t+1} \tag{66}$$

$$N^i_{DR,t+1} = (e_1'\lambda)\sigma^i_t \xi^i_{t+1} \tag{67}$$

Here $\lambda = \kappa\Gamma(I - \kappa\Gamma)^{-1}$. I is an $N \times N$ identity matrix and Γ is an $N \times N$ matrix of parameters associated with the VAR system. e_1 is a vector that include one as its first element and zero for all other elements: $e_1 = [1, 0, 0, ..., 0]^T$. In other words e_1 picks out $r^i_{m,t+1}$ from the state vector z^i_{t+1}. Finally κ is a log-linearization parameter that captures the average dividend yield or the average consumption-wealth ratio. I follow Campbell et al (2017) and set $\kappa = 0.95^{\frac{1}{12}} = 0.995$. The choice of the state vector z^i_{t+1} also follows Campbell et al (2017).[13]

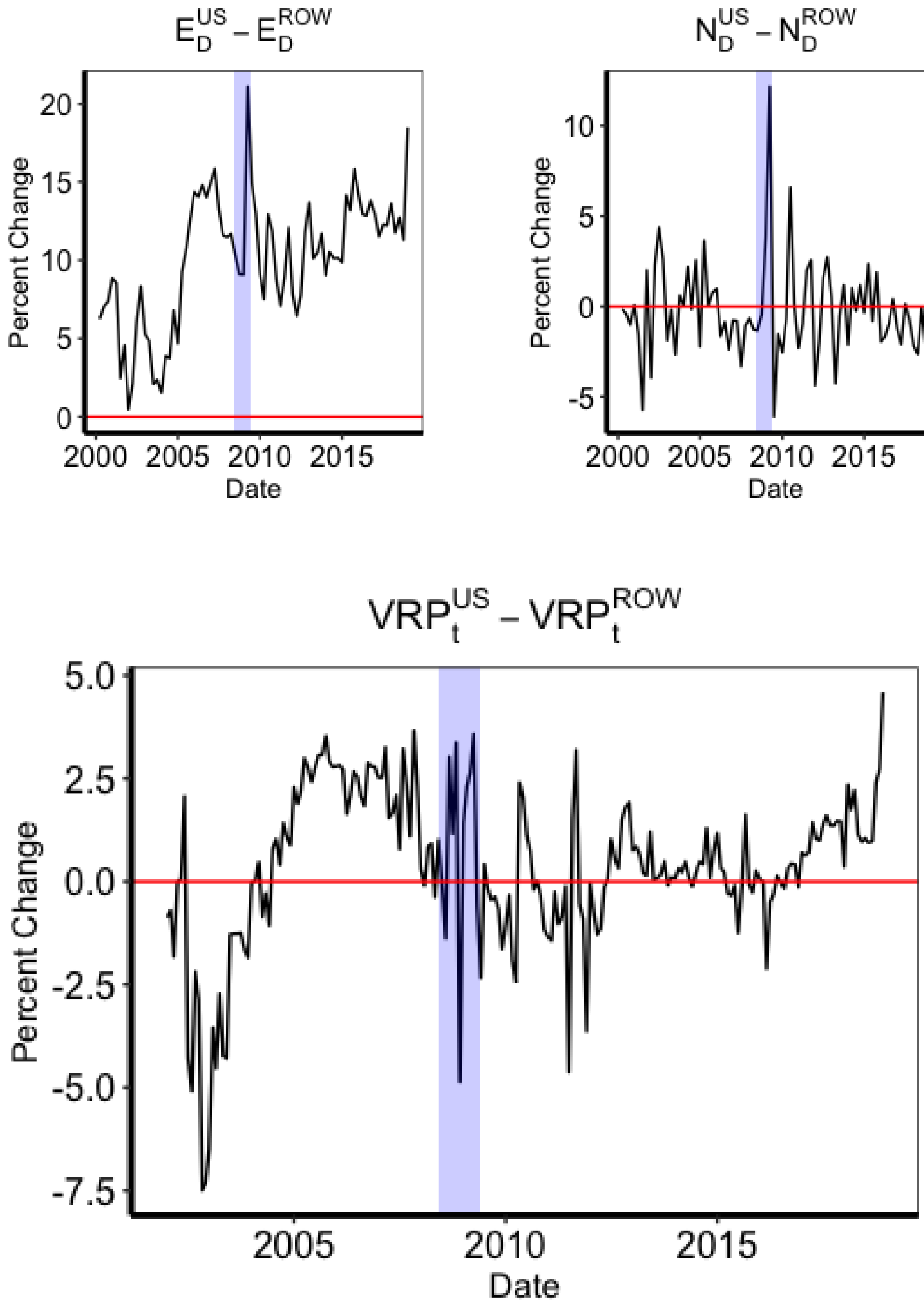
I plot the estimated series of $E^{US}_{D,t+1} - E^{ROW}_{D,t+1}$ and $N^{US}_{D,t+1} - N^{ROW}_{D,t+1}$ in figure 20. Whilst US relative expected returns have always been higher than the ROW, even before the GFC, the figure clearly indicates that they rose markedly relative to the ROW during the global financial crisis. This is consistent with recent work by Corsetti et al (2023) who also find using an alternative projection approach pioneered by Farhi and Gourio (2018) that US ex-ante excess returns rose relative to the ROW and have continued to rise during the post-GFC period. Further validating the implication that US relative risk has risen post-GFC, the bottom of figure 20 shows that the US variance risk premium (VRP) also spiked relative to the ROW during the GFC and has persisted post-crisis as well.[14]

[13] I follow these authors and use the following four state variables when I estimate the VAR country by country: i) market excess returns, ii) dividend yields, iii) term spreads and iv) equity volatility.

[14] Following Bollerslev, Tauchen and Zhou (2009), VRP is defined as the difference between option

Figure 20: *US Relative Expected Returns and Variance Risk Premiums*

Description: In the top left, I plot the difference in the expected return series ($E^{US}_{D,t+1} - E^{ROW}_{D,t+1}$) between US and the ROW. In the top right I plot the corresponding figure for shock to expected returns: ($N^{US}_{D,t+1} - N^{ROW}_{D,t+1}$). The bottom plot is the relative variance risk premiums between US and ROW. To focus on the GFC, I focus the plots on the periods: 2000Q1-2018Q4 where the GFC was the main global stress episode. This period is plotted in the blue bars.



implied market volatilities and conditional market variance. Conditional market variances are measured using the approach of Londondo (2011).

7.2 Counterfactuals

Overview: To conclude the paper, I use the model to explore the global ramifications of the US excess fiscal capacity. Recall that my model has powerful implications for policy: it attributes a central role to the US fiscal policy in driving i) the dollar's countercyclical dynamics, ii) the US exorbitant privilege and iii) the global financial cycle through its outsized influence on global innovation and consequently expected future global growth. This insight suggests that the extent to which the US exploits her excess fiscal capacity can play a key role in driving the severity of global downturns.

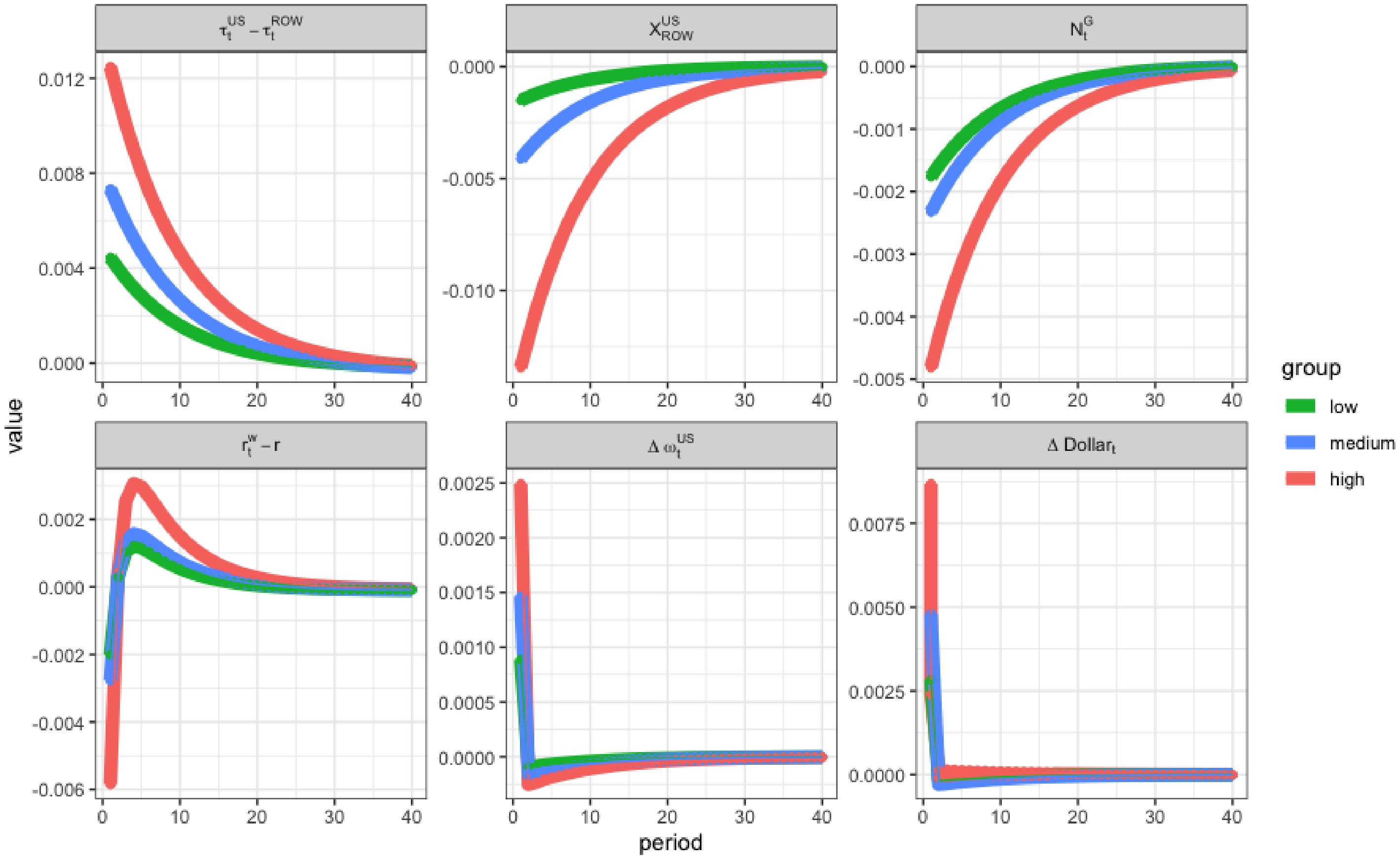
This point is elucidated through policy counterfactuals plotted in figure 21 which evaluates impulse responses of key equilibrium variables under varying degrees of US fiscal policy aggressiveness relative to the ROW. As the US increases its exploitation of its excess fiscal capacity ($\beta^{DIFF} = \beta^{US} - \beta^{ROW} \uparrow$), the conditional volatility of the dollar rises: the magnitude of the dollar appreciation in response to the bad global TFP shock becomes greater. This manifests itself in a bigger rise in the US wealth share during these times of global stress, an outcome that benefits the US at the expense of the ROW.

These results clearly indicate the destabilising influence of the US fiscal policy on the global economy in the model. By exploiting her excess fiscal capacity during global downturns, the US can drive up global sources of risk during global downturns, amplifying fluctuations in global macro quantities and the dollar exchange rate during these times of global stress. This contrasts with recent models such as Kekre and Lenel (2021) and Jiang, Krithnamurthy and Lustig (2020a) suggest that more aggressive US fiscal policy responses during global downturns can be a force for good that lubricates the global economy by increasing the supply of world's safe asset during these periods of global stress.

Moreover, this counterfactual analysis also suggests a tension between the US and the ROW: whilst the US gains wealth share at the expense of the ROW by exploiting its extra fiscal capacity, it is in the interest of the ROW for the US to not pursue this action. This policy tradeoff suggests that it is in the global welfare interest for the US to internalise the global ramifications of her policy actions by running a less countercyclical fiscal policy during global downturns. This novel tradeoff is distinct from the tradeoff between US bondholders and US taxpayers emphasised by Jiang et al (2020) and is undeniably something that US fiscal authorities should consider moving forward.

Figure 21: *Fiscal Policy Counterfactuals*

Description: This figure plots the impulse responses to a 1 S.D bad global TFP shock ($\epsilon_t^G \downarrow$) for different levels of relative fiscal exposures $\beta^{DIFF} = \beta^{US} - \beta^{ROW}$.



8 Conclusion

In conclusion, this paper uncover a novel stylised fact: the United States (US) seems safe relative to the ROW. Her macro quantities, asset prices and wealth share all rise relative to the ROW during global downturns, a result that presents a natural challenge for modern international macro-finance models that stress the US role as global insurance provider (Maggiori, 2017; Gourinchas et al, 2017). These relative US safety facts clearly challenges notions of risk and return implied by these canonical models that interpret the US exorbitant privilege as a risk premium that compensates the US for her role as the global insurance provider. Furthermore to jointly account for i) the countercyclical dollar and ii) countercyclical global risk premia as well, these models require the US economy to suffer a worse recession during global downturns (Kekre and Lenel, 2021; Sauzet, 2022), a mechanism clearly at odds with my stylised facts.

These facts therefore give rise to a ***US safety puzzle***: how can we reconcile relative US safety with i) the countercyclical dollar, ii) countercyclical global risk premia and iii) the US exorbitant privilege? To resolve this puzzle, I build a model that emphasises the greater US fiscal capacity vis-*á*-vis the ROW. Here I take this excess fiscal capacity as given and explore its implications for the joint dynamics between key international prices and quantities such as i) the dollar, ii) global risk premia and iii) global macro variables. This exercise reveals that a relative US fiscal shock during global downturns can i) resolve the US safety puzzle and ii) reproduce observed predictability patterns in dollar and global equity excess returns that are consistent with the data (Lustig, Roussanov and Verdelhan, 2014; Miranda-Agrippino and Rey, 2015). Key model implications are also confimed by the data.

Taken together, these novel theoretical results are exciting because they shed new light on the relevant sources of US specialness driving puzzling phenomena in global financial markets. Whilst traditional models based on the US global insurance provider role emphasise greater US risk-bearing capacity (Gourinchas et al, 2017; Maggiori, 2017), my model suggests an alternative source of asymmetry: the excess fiscal capacity available to the US relative to the ROW. This new source of asymmetry is in principle distinct from the greater US risk-bearing capacity: since my model can reconcile countercyclical dollar dynamics with my novel US safety facts in a way that EP theory cannot, my theoretical results can be interpreted as implying that excess US fiscal capacity vis-*á*-vis the ROW is a more relevant source of US specialness than the risk-tolerance mechanism emphasised by the canonical models.

To conclude the paper, I use my model to explore the global ramifications of the excess US fiscal capacity. Recent models such as Kekre and Lenel (2021) and Jiang, Krithnamurthy and

Lustig (2020a) suggest that more aggressive US fiscal policy responses during global downturns can be a force for good that lubricates the global economy by increasing the supply of world's safe asset during these periods of global stress. In contrast, my model implies the exact opposite: by exploiting her excess fiscal capacity during global downturns, the US can drive up global sources of risk during global downturns, amplifying fluctuations in global macro quantities and the dollar exchange rate during these times of global stress. Thus my model suggests that the excess US fiscal capacity may be a destabilising, rather than a stabilising influence on the global economy during these periods of global stress, a novel insight that my paper is bringing to the table.

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10 Online Appendix

10.1 Detailed Data Discussion

Flow of Funds: One common question I routinely get asked is how does the TIC data I am currently utilising relate to the flow of funds data compiled by the BEA? The answer is simple: they are very correlated. The TIC reporting system is one of the primary inputs that the BEA uses when compiling the *Integrated Macroeconomic Accounts* and the *Financial Accounts of the United States*. Whilst the flow of funds data does extend back towards the beginning of the post WWII era, the vast majority of the data coverage comes from the post-1980s period that coincided with the introduction of the modern TIC reporting system. Thus my dataset is a comprehensive coverage of modern public data regarding US and ROW portfolio trends. For more discussion of this, consider this Q&A: https://home.treasury.gov/data/treasury-international-capital-tic-system-home-page/frequently-asked-questions-regarding/ticfaq2q3.

Comprehensiveness: Here I discuss the comprehensiveness of the TIC reporting system. This system requires an *US resident entity* to report any cross-border investment. These are most likely US financial institutions that perform cross-border transactions on behalf of clients: For example, Morgan Stanley may purchase shares in a foreign ADR on behalf of a US resident client looking for foreign portfolio equity exposure. This transaction would be captured by the TIC system as a flow increase in US external assets (US holding of ROW equities). Conversely the TIC system also captures transactions regarding US external liabilities so long as a US resident entity is involved. For example a US bank may purchase US equities on behalf of foreign clients as part of its custodial duties. This purchase would also be reported to TIC as a flow increase in US external liabilities (ROW holding of US equities).

I argue that this reporting system comprehensively captures flow movements in US external assets and liabilities: the only way that a transaction is missed by the TIC system is if a US resident entity is not involved in the transaction. This would require either foreigners buying US securities through a non-US financial institution or Americans buying foreign securities through a non-US financial institution. Both of these scenarios are highly unlikely as recent literature emphasise the huge monopoly that US banks exercise in the provision of global liquidity (Correa et al, 2021).

10.1.1 Bond Treatment

Overview: Another comment I frequently receive is about the inclusion of bonds in my measurement of wealth. The TIC data is not sufficiently granular to distinguish between holdings of treasuries vis-*á*-vis corporate bonds: it simply captures holdings of bonds as an aggregate asset class. Nonetheless one may naturally think of bonds, both corporate and treasuries, as being assets held in zero net supply. Thus inclusion of bonds in the wealth calculations may seem inappropriate. Here I push back against this view.

I take the view that bonds are held in positive net supply: both corporate and treasury bonds are safe claims to the cash flows of real assets (corporate profits and government primary surpluses). Thus bond holdings of any category should be seen as contributing to the net wealth of a country and thus should be included in the net wealth measure.

Ricardian Equivalence: A more nuanced criticism of bond inclusion involves sovereign bonds and ricardian equivalence logic. If governments are expected to eventually redeem sovereign debt, it will do so by taxing its own citizens, reclaiming internal sovereign bond wealth in the future. Thus one could argue that internal sovereign bond holdings should not be thought of as contributing to the real wealth of countries.

Whilst these concerns are valid in a frictionless setting where ricardian equivalence and Modigliani and Miller (MM) logic hold, they are less valid in a more realistic setting where neither proposition holds. In reality, internal sovereign holdings drive movements in relative wealth across countries. For example, foreign exchange interventions that shift these sovereign bond holdings are documented to have large valuation effects on asset prices such as the exchange rate (Auer et al, 2020) and equity prices (Cieslak et al, 2019). Thus inclusion of internal sovereign bond holdings in my measure of country specific wealth is appropriate.

10.1.2 Asset Coverage

Overview: Finally I address concerns that my definition of wealth is too restrictive and ignores many important components of aggregate wealth portfolios. For example, I focus specifically on financial wealth: human capital wealth is ignored in my analysis due to data issues. Perhaps more seriously, I ignore private equity holdings in my analysis: my wealth measure only considers public security holdings. This is again for data reasons: I can only obtain a comprehensive time series of private equity holdings for the US. Obtaining such data for other foreign countries is more difficult. Furthermore I contend that the exclusion of FDI from my analysis is not problematic so long as the time series of FDI holdings evolves similarly to the portfolio equity holdings. At least for the US this seems to be a reasonable assumption, as suggested by Atkeson, Heathcote and Perri (2022).

10.2 Portfolio Weights

Figure 22: US Wealth Portfolio

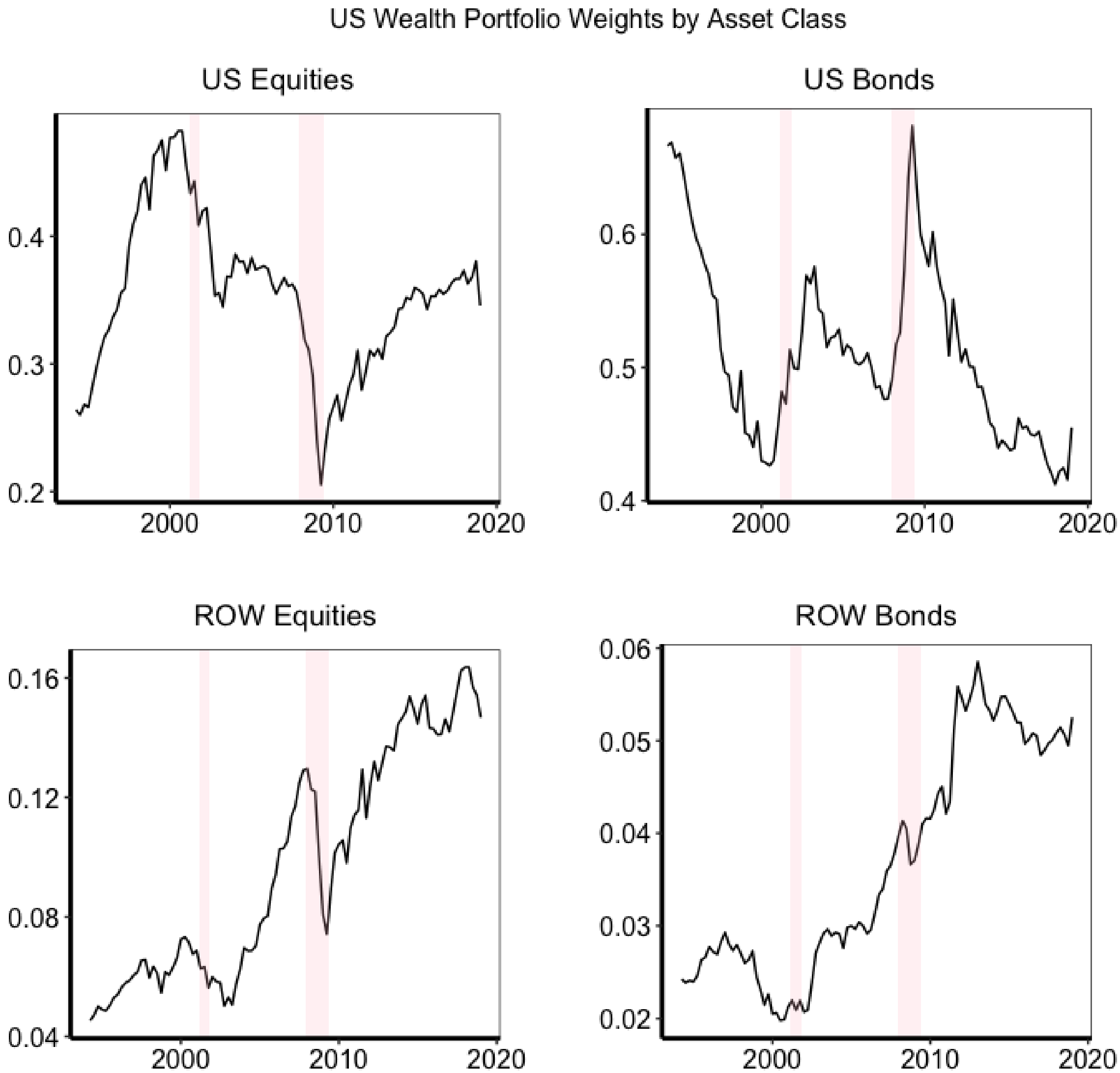
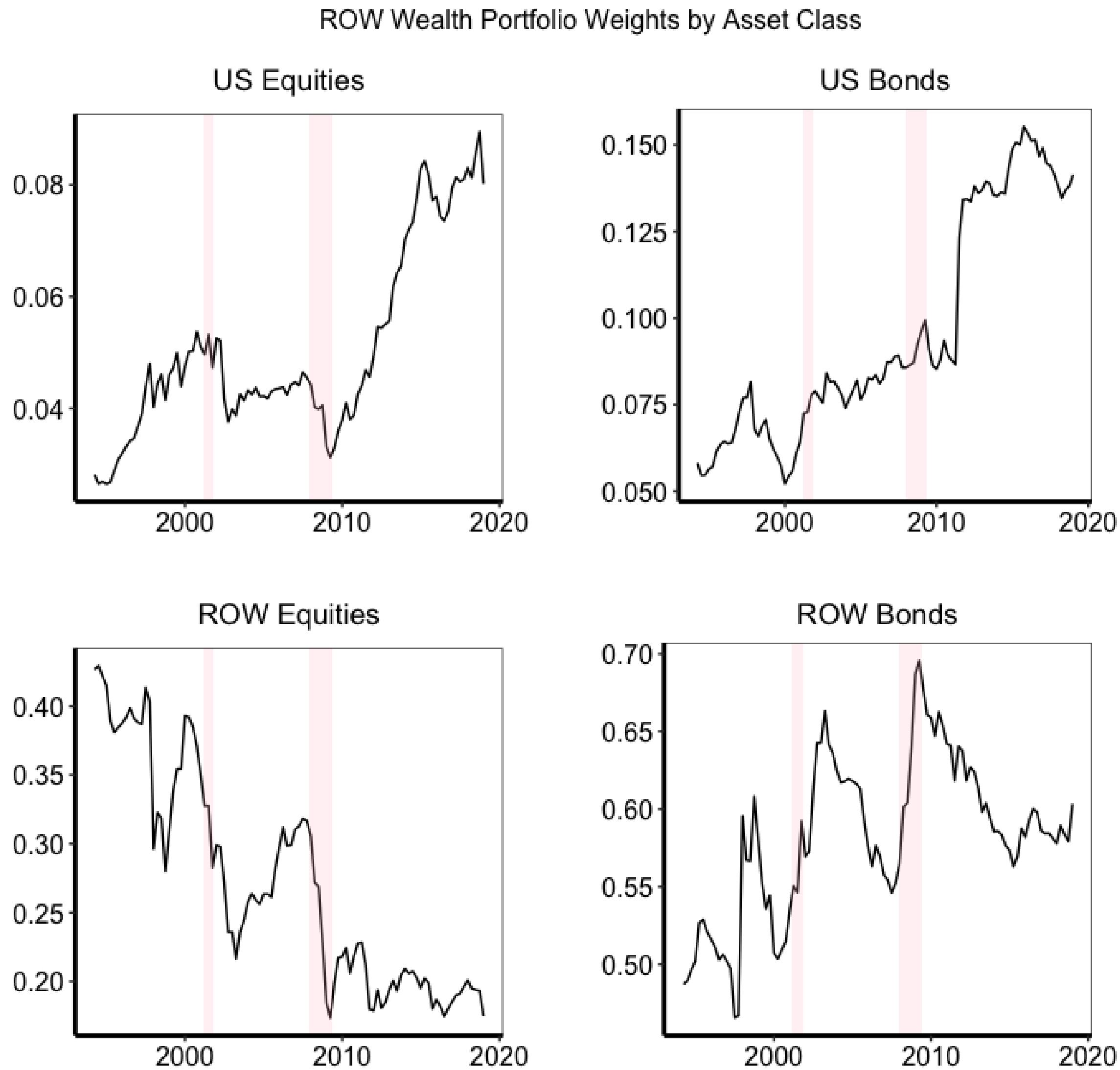


Figure 23: ROW Wealth Portfolio



10.3 SVAR

SVAR: Taking stock, the evidence presented thus far provides striking evidence that the US is relatively insulated against disturbances in the global economy vis-*á*-vis the ROW. One could certainly argue however that this evidence largely speaks to ***unconditional*** relationships in the data, as opposed to ***conditional*** responses to identified global macro shocks.

To provide formal evidence in this regard, I estimate a structural vector autoregression (SVAR) system that investigates the conditional response of US relative variables to an identified global macro shock. In particular, I estimate the following four variable, one lag system that is ordered as follows:

$$z_t = \left[\Delta c_t^G, \quad Dollar_t, \quad r_t^{US} - r_t^{ROW}, \quad \omega_t^{US} \quad \Delta \omega_t^{US} \right]^T \tag{10.1}$$

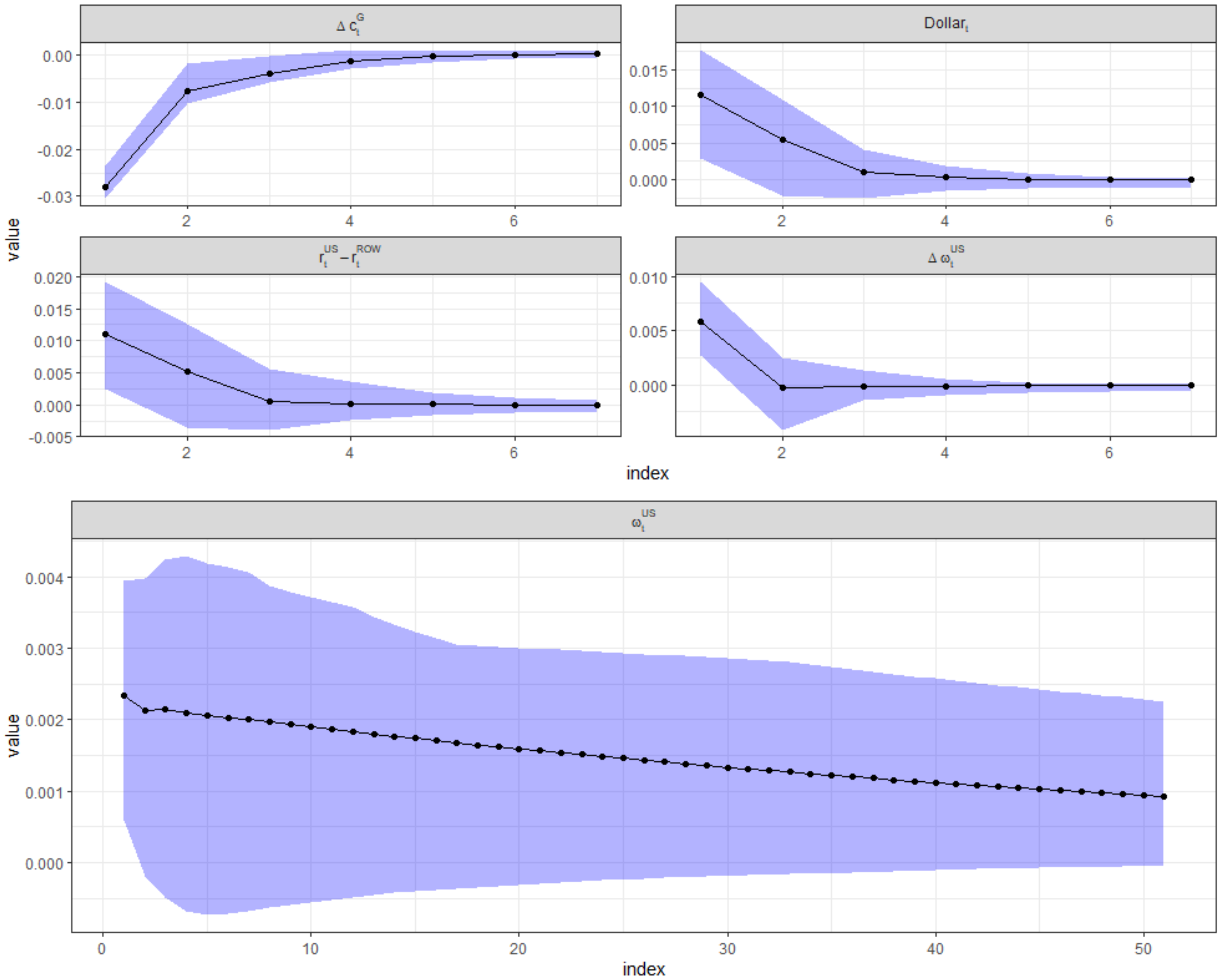
Δc_t^G is global consumption growth. $Dollar_t$ is the dollar carry trade return, $r_t^{US} - r_t^{ROW}$ is the return differential between US and ROW stock markets, ω_t^{US} is the US wealth share level and $\Delta \omega_t^{US}$ is the US wealth share growth rate.

Following literature, I identify conditional responses to the global macro variable (c_t^G) using a recursive ordering assumption. The structure I impose assumes that the global consumption growth shock (Δc_t^G) moves first. The rest of the recursive ordering follows (10.1): the dollar ($Dollar_t$) moves next, followed by equity return differentials ($r_t^{US} - r_t^{ROW}$), US wealth share level (ω_t^{US}) and finally the US wealth share growth rate ($\Delta \omega_t^{US}$). Thus the recursive ordering assumption implies that asset market variables respond contemporaneously to the global consumption shock, whereas global consumption only responds to the asset market variables with a lag. Thus the SVAR identifies the response of the system to an orthogonalised shock to global consumption growth.

Figure 24 depicts the estimated impulse responses. They confirm the US safety facts documented thus far: in response to a 1 S.D bad global consumption growth shock, i) the dollar appreciates by approximately 1%, ii) the US stock market outperforms the ROW by approximately 1.2% and iii) the US wealth share increases by approximately 25 and 50 basis points in levels and growth rates respectively. Section 10.3 in the online appendix shows that these conditional responses are robust to rotations in the recursive ordering assumption. These results reinforce the US safety facts established earlier in this section. The US is relatively insulated during periods of global stress, evidenced by the fact that her relative stock market performance vis-*á*-vis the ROW and her wealth share both rise during these periods.

Figure 24: *Conditional Responses to a bad global macro shock*

Descriptions: IRFs below depicts dynamic response of the augmented SVAR system to a bad 1 standard deviation (SD) shock to Δc_t^G. The bottom panel zooms in on the response of the US wealth share level ω_t^{US}. The blue areas indicate 95% confidence intervals. Standard errors were generated using 10,000 Monte Carlo simulations. The VAR is estimated using ***quarterly*** data from 1994Q1 to 2020Q1.



Order Rotation: Here I rotate the recursive ordering of the baseline VAR to confirm robustness w.r.t the ordering assumption. The state vector takes the following form:

$$z_t = \left[\Delta c_t^G, \quad Dollar_t, \quad \omega_t^{US}, \quad \Delta \omega_t^{US} \right]^T \tag{10.2}$$

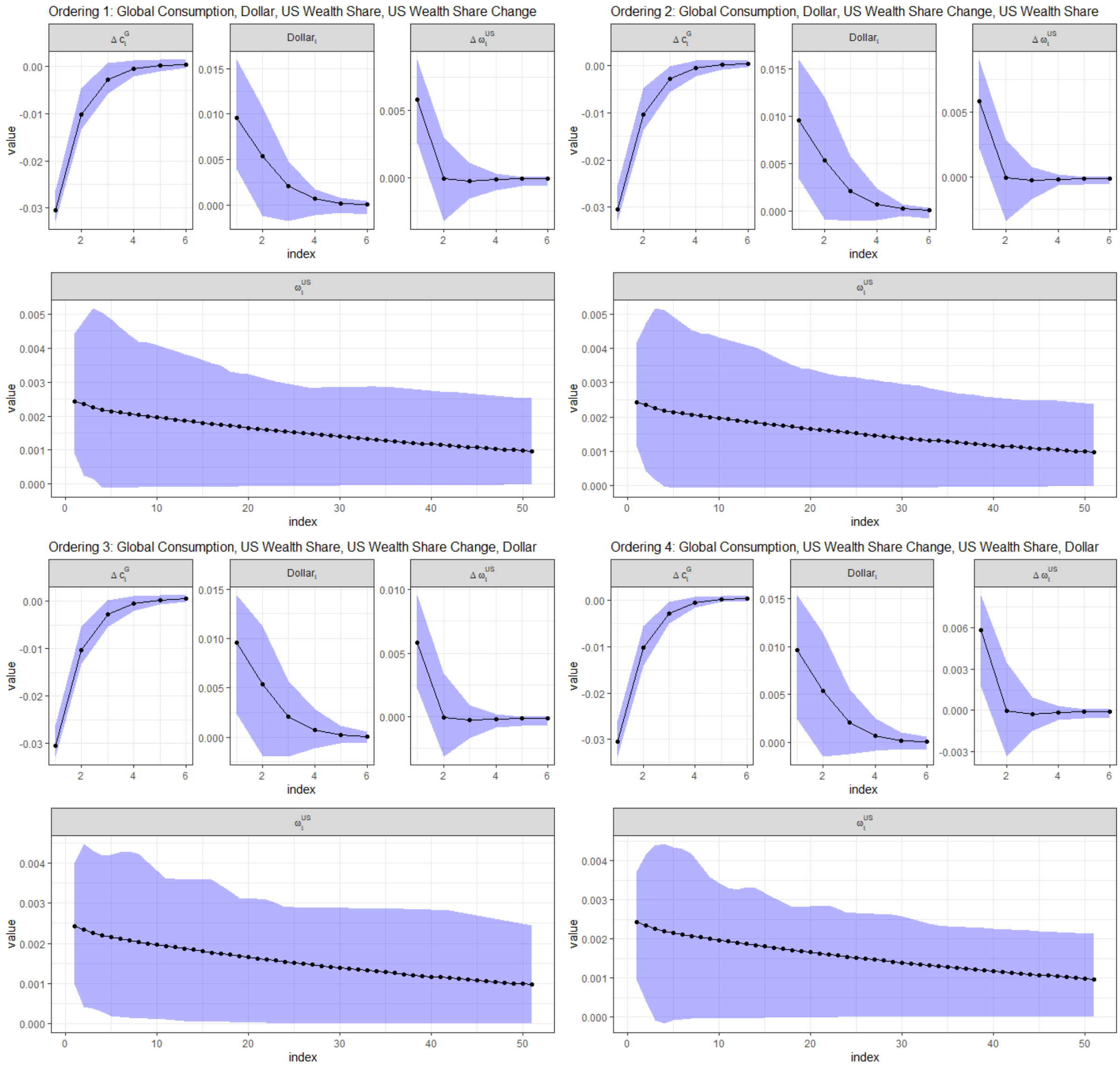
State System: Δc_t^G is global consumption growth. $Dollar_t$ is the dollar carry trade return. ω_t^{US} is the US wealth share level and $\Delta \omega_t^{US}$ is the US wealth share growth rate.

Ordering Assumption: As before the identification of orthogonalised shocks assumes that Δc_t^G moves first. However I also rotate the ordering to ensure that the results are not sensitive to the recursive ordering assumption. In all cases global consumption is ordered first to ensure that asset market variables (dollar exchange rate and the US wealth share) respond instantaneously to global macro shocks. Thus the SVAR system identifies the response of the US wealth share and the dollar to a structural global macro shock that is orthogonal w.r.t asset prices. In this way the SVAR system provides a way of identifying the joint dynamics between the US wealth share, dollar and global economy.

Impulse Responses: The impulse responses across all the recursive orderings is displayed in figure 25. In all cases, the US wealth share ***rises*** in response to a bad global consumption, confirming the countercyclical properties identified in the main text.

Figure 25: *Baseline VAR Impulse Responses (Order Rotation)*

Descriptions: IRFs below depicts dynamic response of system of the SVAR system described in 10.2 to a bad 1 standard deviation (SD) shock to Δc_t^G. The four panels estimates the IRFs using a different recursive ordering that is labelled in the figure. The blue areas indicate 95% confidence intervals. Standard errors were generated using 10,000 Monte Carlo simulations. Sample is from 1994Q1-2020Q1.



10.4 Macro Robustness Results

US Safety Decomposition: To dig a little deeper into the key economic forces driving relative US safety, I now perform a decomposition of global GDP risk. In specific terms, I apply the blocked bootstrap approach from before to compute US and ROW betas w.r.t global consumption, global investment, global net exports and global fiscal risk. As before, US betas are extracted via time series regressions within each bootstrapped sample:

$$\Delta c_t^{US} = \alpha_{US}^{C} + \beta_{US}^{C}(\frac{1}{N}\sum_{i=1}^{N}\Delta c_t^i) + \epsilon_{US,t} \tag{10.3}$$

$$\Delta NX_t^{US} = \alpha_{US}^{NX} + \beta_{US}^{NX}(\frac{1}{N}\sum_{i=1}^{N}\Delta NX_t^i) + \epsilon_{US,t} \tag{10.4}$$

$$\Delta \mathrm{I}_t^{US} = \alpha_{US}^{\mathrm{I}} + \beta_{US}^{I}(\frac{1}{N}\sum_{i=1}^{N}\Delta \mathrm{I}_t^i) + \epsilon_{US,t} \tag{10.5}$$

$$\Delta G_t^{US} = \alpha_{US}^{G} + \beta_{US}^{G}(\frac{1}{N}\sum_{i=1}^{N}\Delta G_t^i) + \epsilon_{US,t} \tag{10.6}$$

Δc_t^{US} and $\Delta \mathrm{I}_t^{US}$ are four-quarter log changes in consumption and investment whereas $\Delta NX_t^{US}, \Delta G_t^{US}$ are four quarter changes in the net exports to GDP and primary surplus to GDP ratios respectively. As before, I run panel fixed effect regressions within each bootstrapped sample to extract the ROW loadings:

$$\Delta c_t^i = \alpha_i^C + \beta_{ROW}^C(\frac{1}{N}\sum_{i=1}^{N}\Delta c_t^i) + \epsilon_{i,t} \tag{10.7}$$

$$\Delta NX_t^i = \alpha_i^{NX} + \beta_{ROW}^{NX}(\frac{1}{N}\sum_{i=1}^{N}\Delta NX_t^i) + \epsilon_{i,t} \tag{10.8}$$

$$\Delta \mathrm{I}_t^i = \alpha_i^{\mathrm{I}} + \beta_{ROW}^{\mathrm{I}}(\frac{1}{N}\sum_{i=1}^{N}\Delta \mathrm{I}_t^i) + \epsilon_{i,t} \tag{10.9}$$

$$\Delta G_t^i = \alpha_i^G + \beta_{ROW}^G(\frac{1}{N}\sum_{i=1}^{N}\Delta G_t^i) + \epsilon_{i,t} \tag{10.10}$$

Table 16: *US Safety Decomposition*

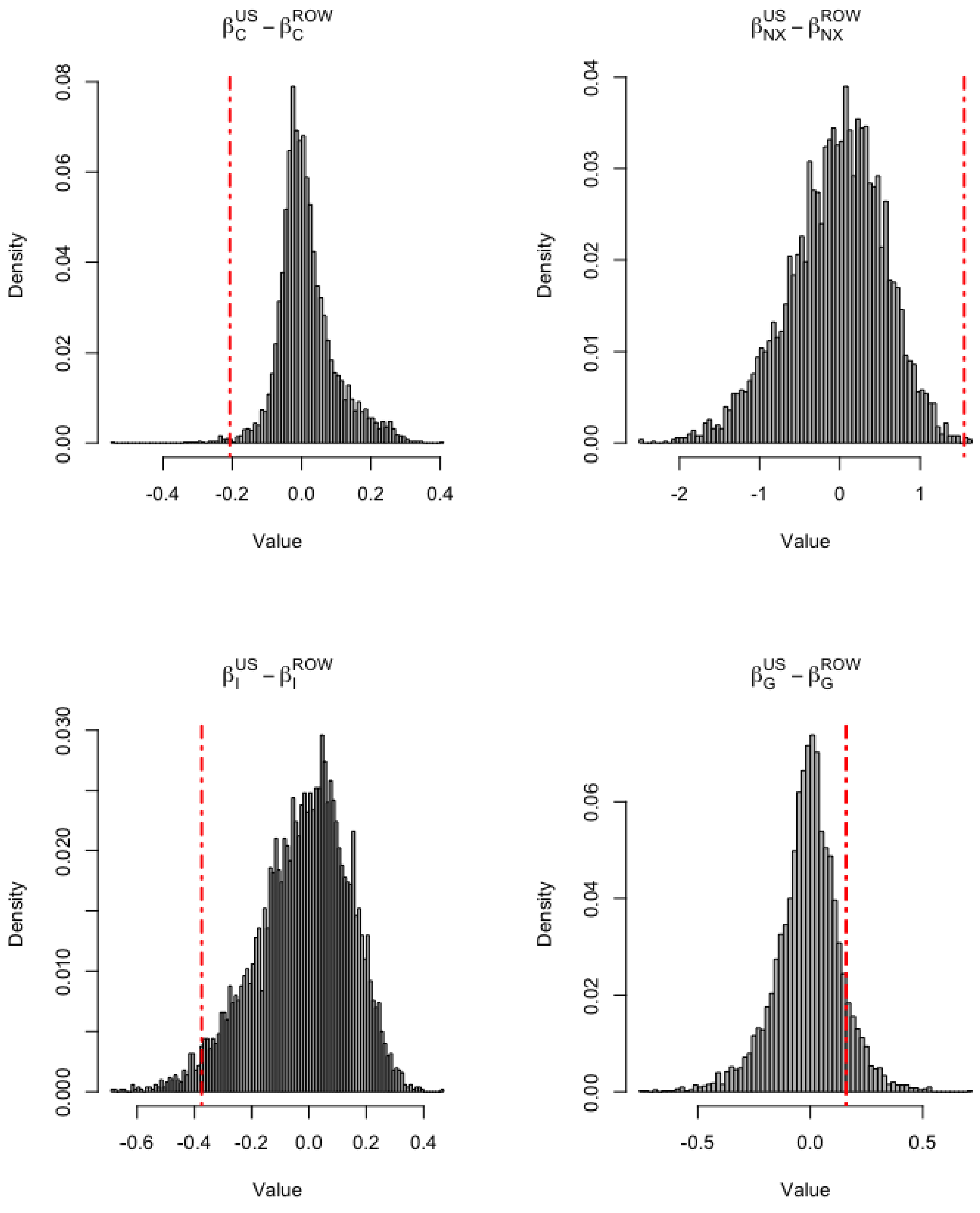
Description: This table reports the bootstrapped sampling distribution for the beta differentials by component. Reported p-values are associated with one sided tests of the null that the US and ROW betas are identical. For consumption and investment, the alternative is that the US beta is lower. For NX and fiscal, the alternative is that the US beta is higher.

	Original Data	*Mean*	*90% CI*	*P-Value*
		Global Consumption Risk		
$\beta_C^{US} - \beta_C^{ROW}$	-0.207	-0.222^{***}	[-0.299, -0.027]	0.006
		(0.083)		
		Global NX, Investment, Fiscal Risks		
$\beta_{NX}^{US} - \beta_{NX}^{ROW}$	1.553	1.513^{***}	[0.431, 2.413]	0.000
		(0.618)		
$\beta_I^{US} - \beta_I^{ROW}$	−0.375	-0.355^{**}	[-0.694, -0.158]	0.028
		(0.127)		
$\beta_G^{US} - \beta_G^{ROW}$	0.160	0.1596^{*}	[-0.101, 0.381]	0.098
		(0.150)		
		Global GDP Risk		
$\beta_{GDP}^{US} - \beta_{GDP}^{ROW}$	−0.123	-0.128^{**}	[-0.228, -0.043]	0.035
		(0.059)		

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 26: *Bootstrapped Distributions for Beta Differentials by Component*

Description: This figure plots the histogram for the bootstrapped sampling distribution for: $\beta_C^{US} - \beta_C^{ROW}$, $\beta_{NX}^{US} - \beta_{NX}^{ROW}$, $\beta_I^{US} - \beta_I^{ROW}$, $\beta_G^{US} - \beta_G^{ROW}$ under the null hypothesis that the US and ROW betas are equal. The red dotted line corresponds to the data value.



Principal Components Analysis: Here I confirm my baseline results about lower US global shock exposure using PCA analysis. I start by documenting the common global factor structure in all macro variables: the first PC explains close to 60% of cross-country variable in consumption growth, net exports to GDP, investment growth, surplus to GDP and GDP growths.

Figure 27: *Principal Components Variance Decomposition*

Descriptions: Here I plot a variance decomposition of the principal components for consumption and GDP growths. I also look at the principal components for other components of GDP: investment and net exports.

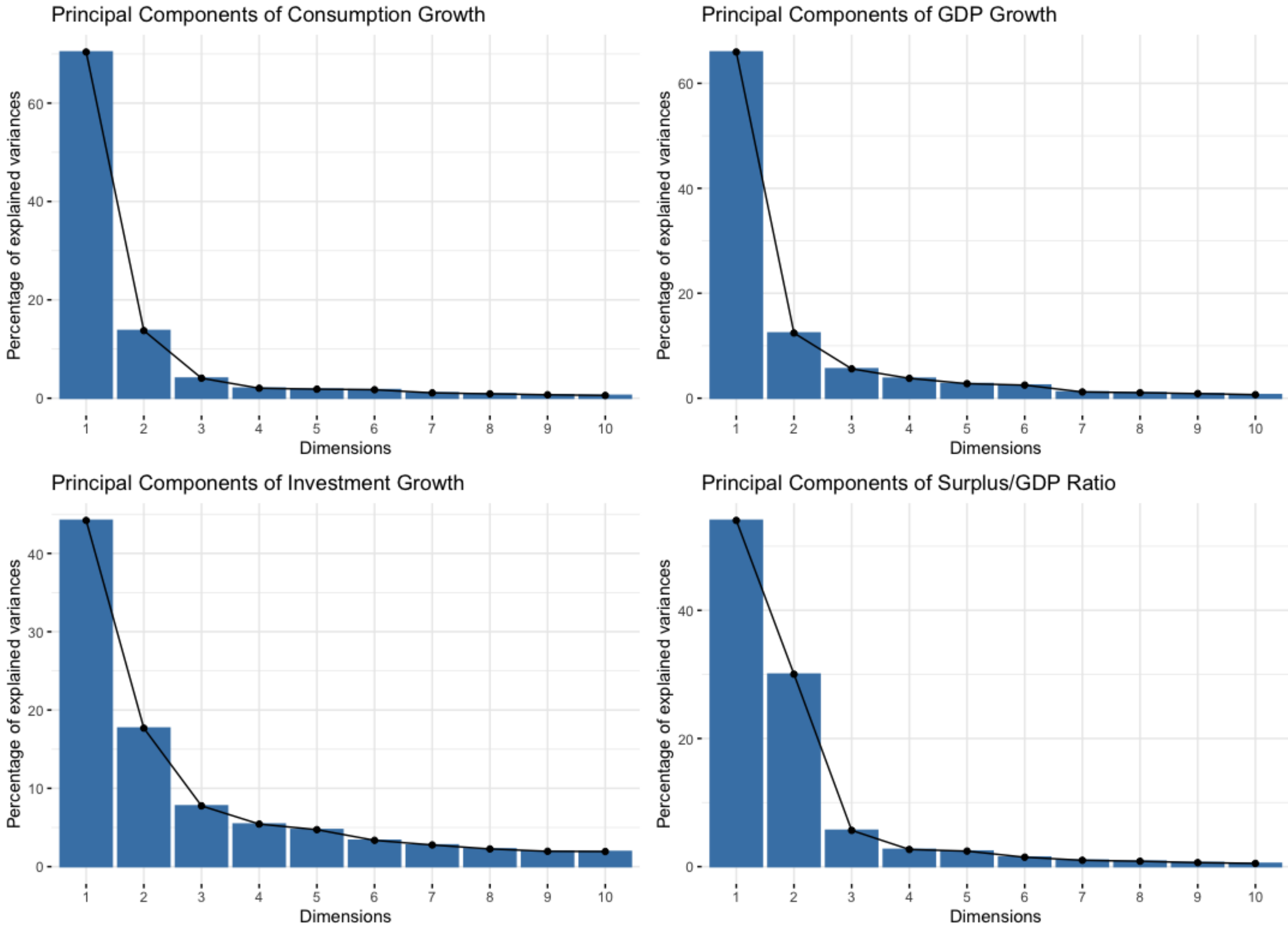
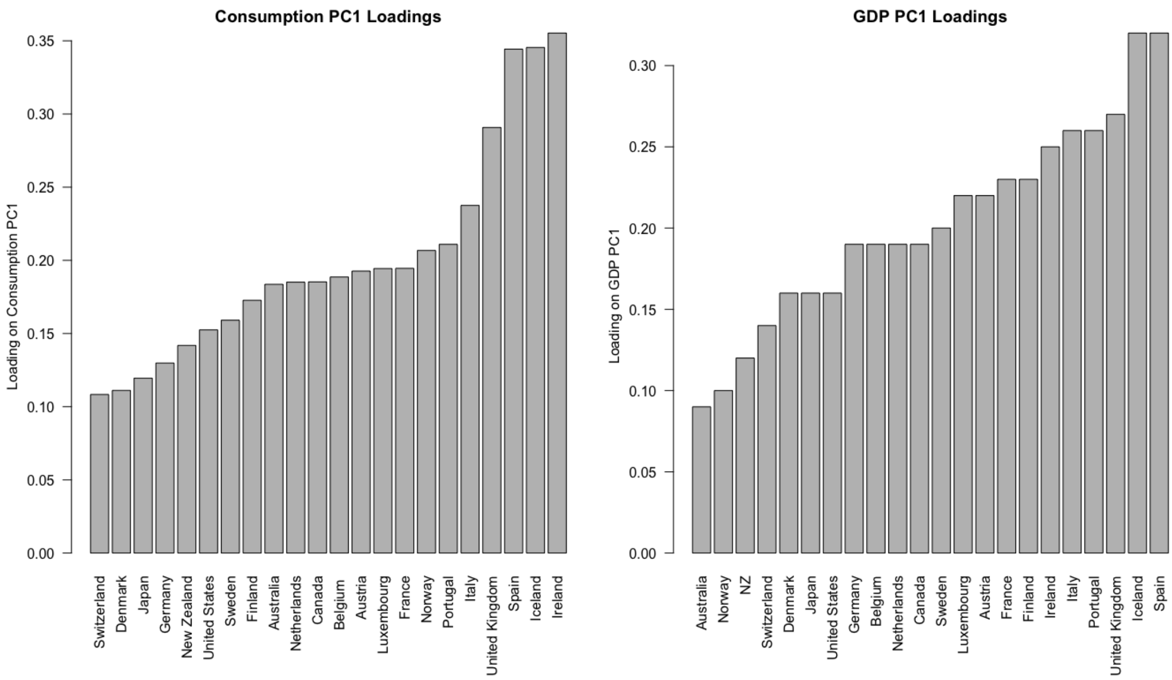


Figure 29 below reveals that the US loading on the first PC of consumption and GDP is below average. Table 28 performs a Wilcoxon signed rank test that tests the null that the US loading is equal to the median foreign loading against the null that the US loading is lower. The test rejects the null in favour of the alternative at a 10% level for both consumption and GDP.

Figure 28: *Principal Components of Consumption and GDP growth*

Description: The first figure plots country level loadings on the first principal component (PCA) of consumption and GDP growths respectively. The bottom panel performs a one sample Wilcoxon signed rank test that evaluates the null that the US PCA loading is equal to the median foreign country: H_0 : Median$(\beta^i_G) = \beta^i_{US}$ against the alternative that it is lower: H_1 : Median$(\beta^i_G) - \beta^i_{US} > 0$.

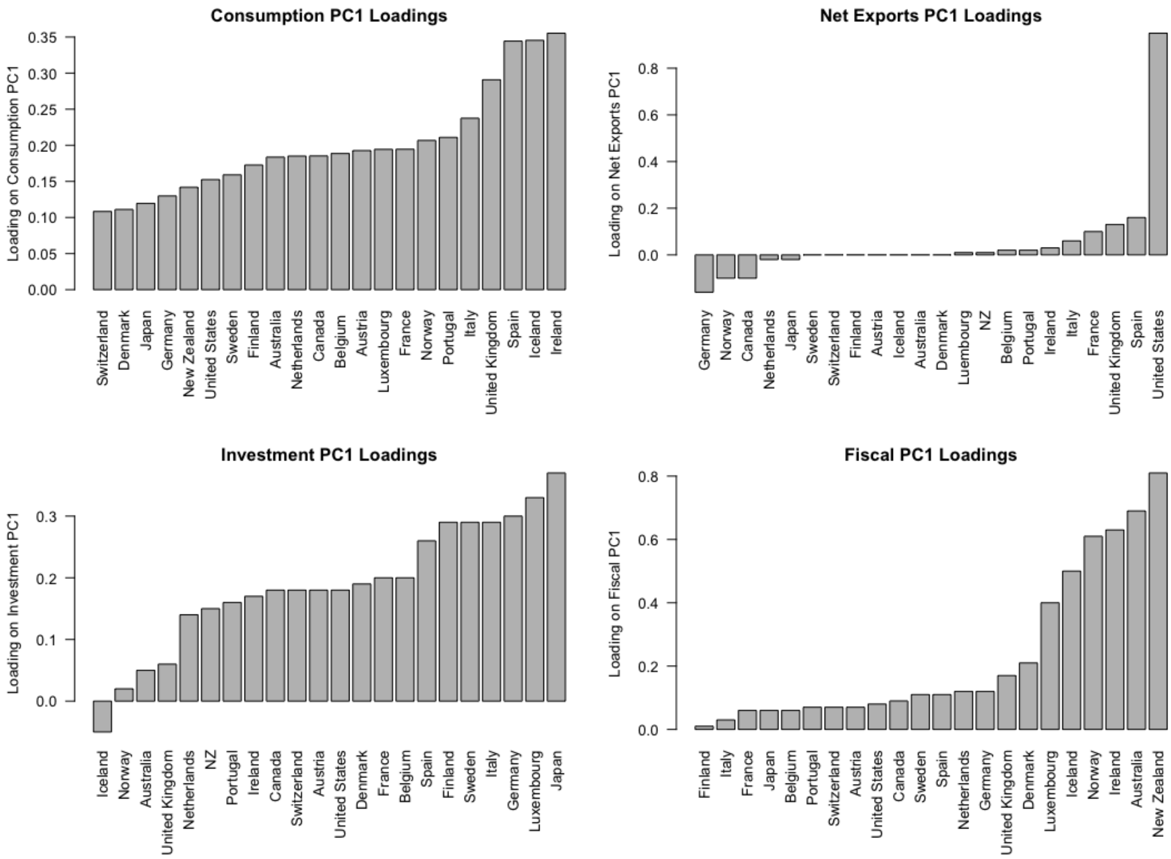


Principal Components Loading Test: $H_0 : median(PC^1_i) = PC^1_{US}$		
Variable	Statistics	
	Median $(PC^1_i - PC^1_{US})$	P-Value
Consumption	0.04*	0.089
GDP	0.05*	0.094

Here I confirm my US safety decomposition results using the PCA analysis. Figure 29 confirms that the US has i) below average exposure to global consumption and investment risk and ii) above average exposure to global net exports and fiscal risk.

Figure 29: *Principal Components of GDP growth and its constituent components*

Description: This figure plots country level loadings on the first principal component (PCA) of the components of GDP: consumption, net exports, investment and government surplus (fiscal).



10.4.1 Colacito et al (2018)

Overview: Here I demonstrate that my results are not inconsistent with Colacito et al (2018) (CCGR). This paper demonstrates that the US has average exposure to global GDP risk, whereas my analysis suggests that the US has below average exposure to global GDP risk. To make sense of this difference, I point out that their analysis departs from mine along many dimensions. Firstly, they use a much smaller cross-section: whilst I use a large cross-section of 22 developed countries, CCGR only look at the G9: Australia, Canada, Japan, New Zealand, Norway, Sweden, Switzerland, United Kingdom and the United States. Secondly, they define consumption and GDP growth rates at a much higher frequency: one quarter log changes as opposed to four quarter log changes in my analysis. Finally they look at a different time series: 1970Q1-2013Q1 whereas I look at the period from 1983Q1-2021Q1. I argue that these four departures are key to explaining the difference in our results.

Methodology: To demonstrate this point, I use the same blockwise bootstrap procedure as in the main text to compute a cross-sectional distribution for global consumption and GDP beta differentials between US and ROW. As before, US betas are extracted via time series regressions within each bootstrapped sample:

$$\Delta c_t^{US} = \alpha_{US}^{C} + \beta_{US}^{C}\left(\frac{1}{N}\sum_{i=1}^{N}\Delta c_t^i\right) + \epsilon_{US,t} \tag{10.11}$$

$$\Delta GDP_t^{US} = \alpha_{US}^{GDP} + \beta_{US}^{E}\left(\frac{1}{N}\sum_{i=1}^{N}\Delta GDP_t^i\right) + \epsilon_{US,t} \tag{10.12}$$

Δc_t^{US}, ΔGDP_t^{US} are one-quarter changes in log consumption and GDP respectively. As before, I run panel fixed effect regressions within each bootstrapped sample to extract the ROW loadings:

$$\Delta c_t^i = \alpha_i^{C} + \beta_{ROW}^{C}\left(\frac{1}{N}\sum_{i=1}^{N}\Delta c_t^i\right) + \epsilon_{i,t} \tag{10.13}$$

$$\Delta GDP_t^i = \alpha_i^{GDP} + \beta_{ROW}^{GDP}\left(\frac{1}{N}\sum_{i=1}^{N}\Delta GDP_t^i\right) + \epsilon_{i,t} \tag{10.14}$$

Table 17: *Bootstrapped distribution for* $\beta_C^{US} - \beta_C^{ROW}$, $\beta_{GDP}^{US} - \beta_{GDP}^{ROW}$

Description: I report the bootstrapped sampling distribution for $\beta_C^{US} - \beta_C^{ROW}$, $\beta_{GDP}^{US} - \beta_{GDP}^{ROW}$ using the CCGR sample. Bootstrapped SEs are in parentheses. Reported p values are the proportion of times the US beta is greater than or equal to zero.

	Original Data	*Mean*	*90% CI*	*P-Value*
		Global Consumption Risk		
$\beta_C^{US} - \beta_C^{ROW}$	-0.500	-0.497^{***} (0.133)	[-0.750, -0.264]	0.000
		Global GDP Risk		
$\beta_{GDP}^{US} - \beta_{GDP}^{ROW}$	-0.04	-0.06 (0.129)	[-0.280, 0.131]	0.320
Note:		*p<0.1; **p<0.05; ***p<0.01		

Discussion: Bootstrapped distributions for the global beta differentials are displayed in table 17. The results demonstrate two findings. Firstly, even for the sample that Colacito et al (2018) consider, the lower procyclicality of US consumption is still robust. The null that $\beta_C^{US} - \beta_C^{ROW}$ is zero can be rejected in favour of the alternative hypothesis that it is negative, even at the 1% significant level. Secondly, this finding is not inconsistent with Colacito et al (2018)'s original finding that US has average exposure to global GDP risk. Panel (d) shows that the bootstrapping distribution for $\beta_{GDP}^{US} - \beta_{GDP}^{ROW}$ is centered around zero: I cannot reject the null that this differential is zero.

To provide further evidence of this, I attempt to replicate the cross-sectional distribution of global GDP loadings reported in Colacito et al (2018). This involves running the following country level regression

$$\Delta GDP_t^i = \alpha + (1 + \beta_{GDP}^i)(\frac{1}{N}\sum_{i=1}^{N} \Delta GDP_t^i) + \xi_t^i \tag{10.15}$$

Table 18: *Global GDP Loadings*

Description: I report extracted global GDP betas obtained by estimating (10.15). SEs in parentheses are heteroskedasticity and autocorrelation consistent.

	Panel (a): My estimates									
	NZ	AUS	UK	GER	CAN	NOR	JPN	SUI	US	SWE
β^i_{GDP}	0.154	-0.212**	0.027	0.268	-0.109	0.142*	0.329*	-0.259*	-0.060	-0.127
	(0.209)	(0.108)	(0.095)	(0.240)	(0.182)	(0.079)	(0.184)	(0.139)	(0.082)	(0.125)
	Panel (a): Colacito et al (2018)									
	NZ	AUS	UK	GER	CAN	NOR	JPN	SUI	US	SWE
β^i_{GDP}	−0.28	−0.18	0.05	-0.12	0.14	0.61**	0.15	-0.11	-0.11	-0.16
	(0.299)	(0.234)	(0.164)	(0.218)	(0.085)	(0.269)	(0.269)	(0.177)	(0.104)	(0.199)
Note:	*p<0.1; **p<0.05; ***p<0.01									

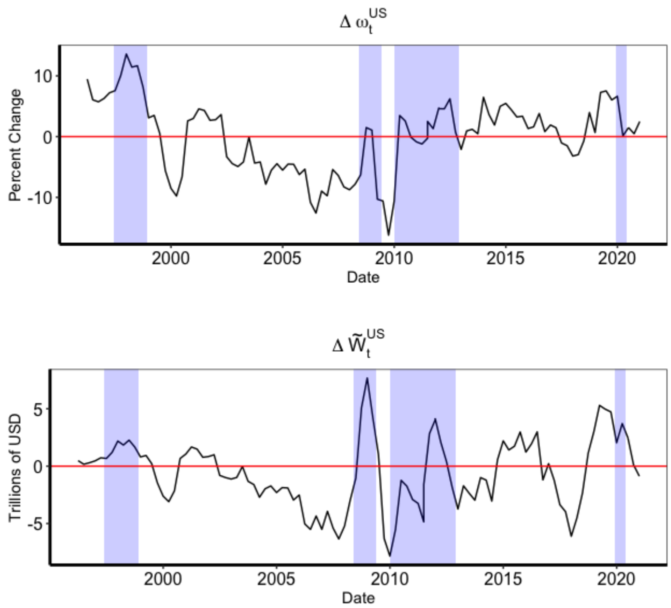
The results are broadly in line with those reported by CCGR. Thus I am able to replicate their basic result that US seems to have average exposure to global GDP risk during their studied sample.

10.5 Wealth Robustness Checks

Internal Debt Holdings: In my baseline framework, I allow internal holdings of debt ($\mathcal{Q}^{D,US}_{US,t}$) to contribute to wealth in this framework. This is because I am following the accounting framework of Jiang, Richmond and Zhang (2022). This is not uncontroversial however: an alternative perspective is that dollar debt as a zero net supply asset from a US investor's perspective. Thus the supply of US debt should simply be demand from foreigners: $\mathcal{Q}^{D,US}_{US,t} = \mathcal{Q}^{D,ROW}_{ROW,t} = 0$ (Koijen and Yogo, 2019). The figure below recomputes the wealth share after accounting for this alternative bond treatment:

Figure 30: *US Wealth Share* (No Internal Debt Holdings)

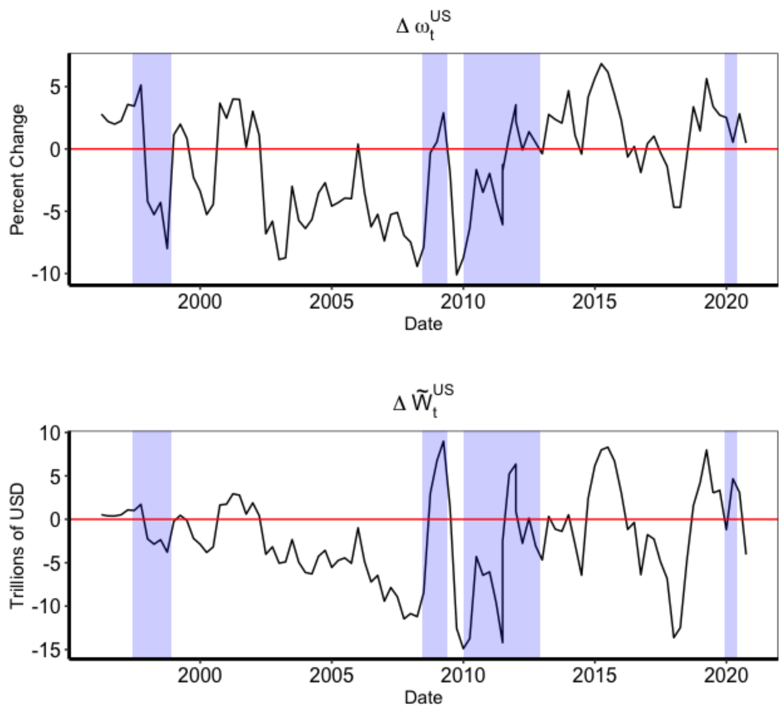
Description: This figure plots the US wealth share growth rate $\Delta\omega_t^{US}$ and US relative wealth changes $\Delta\tilde{\mathcal{W}}_t$. Pink bands correspond to the following periods of global stress: Asian Financial Crisis (1996Q2-1997Q4), Global Financial Crisis (2008Q2-2009Q2) and European Debt Crisis (2010Q1-2012Q4) and COVID (2020Q1-2020Q2).



Broader Sample: In the main text, I focus on a sample of 22 developed countries. Here I investigate how things change with a broader sample that including major holders of US treasuries such as China and India. For this exercise, I define the ROW as the following sample of 30 countries: Australia, Austria, Belgium, Brazil, Canada, China, Denmark, Finland, France, Germany, Greece, India, Italy, Ireland, Israel, Hungary, Luxembourg, Mexico, Norway, New Zealand, Philippines, Poland, Portugal, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, United Kingdom.

Figure 31: *US Wealth Share* (Expanded Sample)

Description: This figure plots US wealth share growth and US relative wealth changes for the expanded sample. Pink bands correspond to Asian Financial Crisis (1996Q2-1997Q4), Global Financial Crisis (2008Q2-2009Q2) and European Debt Crisis (2010Q1-2012Q4).



11 Resolutions to the US Safety Puzzle

Overview: To summarize, the previous section documented a striking set of facts about US relative safety: despite the large premium that the US extracts from foreigners *on average*, the US seems safe relative to the ROW. Her macro quantities, such as consumption and GDP growths, rise during periods of global stress as well as on average. This challenges the traditional risk-based interpretation of the US exorbitant privilege implied by standard models that emphasise the US role as global insurance provider (Maggiori, 2017; Gourinchas et al, 2017). Furthermore they also challenge the ability of these models to explain the observed countercyclicality of i) the dollar and ii) global risk premia. To make sense of these dynamics, these models require the US economy to underperform the ROW during times of global stress (Kekre and Lenel, 2021; Sauzet, 2022), a mechanism that is also at odds with my novel stylised facts. Thus a ***US safety puzzle*** naturally arises: how can we reconcile my novel US safety facts with i) the countercyclical dollar, ii) countercyclical global risk premia and iii) the US exorbitant privilege?

11.1 US Safety Puzzle and Convenience Yields

Overview: One natural resolution to this US safety puzzle is a convenience yield mechanism: recent theoretical work by Jiang, Krithnamurthy and Lustig (2020) ties countercyclical dollar and US wealth share dynamics to rising convenience yields on dollar safe assets during global downturns. According to this view, the US exorbitant privilege is not a risk premium but a ***liquidity*** *premium*. Due to the dollar's status as the global reserve currency, the US earns seignorage revenue, or convenience yields, for providing global liquidity to the ROW by producing dollar safe assets. Since this global reserve currency status is not state contingent, the US can always extract this liquidity premium from the ROW, even during times of global stress. Thus a convenience yield mechanism provides a plausible explanation for my US safety facts.

One important implication for this theory however, is that bond convenience yields drive countercyclical dynamics in i) US stock market outperformance and consequently ii) the US wealth share. The intuition is simple: convenience yields attached to US safe assets rise during global recessions, lowering the dollar's risk premium and inducing i) immediate dollar appreciation and ii) expected future dollar depreciation. Since the US wealth portfolio is short the dollar against foreign currencies, this expected future dollar depreciation increases the present value of future cash flows on the US wealth portfolio, resulting in i) rising US equity valuations and ii) a rising US wealth share during global recessions. Thus US convenience yields are the key force driving the US wealth share and should drive out equity return differentials $r_t^{US} - r_t^{ROW}$ as a source of US wealth share variance in a horserace regression.

To evaluate this implication, I run such a horserace regression using the US treasury premium variable constructed by Du, Im and Schreger (2017) as a proxy for US convenience yields. It measures the average CIP deviation for the G9 currencies and is a measure of systematic changes in the convenience yield assigned to US treasuries by foreign investors. I denote this variable as $premium_t$ and use it as a covariate in a horserace regression alongside US equity outperformance $r_t^{US} - r_t^{ROW}$ where the valuation component $\Delta\tilde{\mathcal{V}}_t$ is the dependent variable. These results are presented in panel B of table 19.

Table 19: *US Equity Outperformance and the Valuation Channel*

Description: Panel A regresses the valuation component $\Delta\tilde{\mathcal{V}}_t$ against $r_t^{US} - r_t^{ROW}$ and Dollar_t. Panel B regresses $r_t^{US} - r_t^{ROW}$ against the US treasury premium Premium_t. The full sample is from 1994Q1 - 2018Q4. Global consumption Δc_t^G is defined as a *GDP weighted average* of consumption growths across the world. Finally $Dollar_t$ is the dollar carry trade return as constructed by Lustig and Verdelhan (2011) and Verdelhan (2018).

	Panel A: US Wealth Share and US Equity Outperformance					
	Dependent variable: $\Delta\tilde{\mathcal{V}}_t$					
	Full	Full	Pre-2007	Pre-2007	Post-2007	Post-2007
premium_t	0.002**	0.008	-0.001	-0.012	0.024**	0.004
	(0.007)	(0.006)	(0.009)	(0.007)	(0.001)	(0.007)
$r_t^{US} - r_t^{ROW}$		0.309***		0.150***		0.516***
		(0.039)		(0.029)		(0.071)
Constant	-0.008***	-0.010***	-0.003	-0.004	-0.008*	-0.013***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.005)	(0.004)
Observations	100	100	53	53	47	47
Adjusted R^2	0.042	0.405	0.025	0.344	0.082	0.561
Note:	*p<0.1; **p<0.05; ***p<0.01					

The results indicate that equity return differentials, not the convenience yield, are the driving force behind the valuation component $\Delta\tilde{\mathcal{V}}_t$. The convenience yield plays a limited role in driving these valuation forces: whilst they have significance in the univariate regressions, the convenience yields are driven out of the bivariate regressions by equity return differentials. This result is robust across all samples. Thus valuation forces in equity, not bond markets are the key driver behind countercyclical US wealth share dynamics. This challenges a convenience yield interpretation of my facts and suggests a risk-based interpretation is still key.

11.2 FX Decomposition Proofs

Risk-Sharing Condition: Since international financial markets are dynamically complete, both the home and foreign SDF will price the wealth portfolios of each country. For simplicity I use the home SDF to price the home wealth portfolio and the foreign SDF to price the foreign wealth portfolio. This implies the following asset pricing restrictions hold:

$$\mathbb{E}_t[e^{m^H_{t+1}+r^H_{m,t+1}}] = 1 \tag{11.1}$$

$$\mathbb{E}_t[e^{m^F_{t+1}+r^F_{m,t+1}}] = 1 \tag{11.2}$$

SDF: For recursive utility, the equilibrium SDF for country i follows:

$$m^i_{t+1} = \theta ln\delta - \frac{\theta}{\psi}\Delta c^i_{t+1} + (\theta-1)r^i_{m,t+1} \tag{11.3}$$

Utilizing the Campbell-Shiller (1989) approximation, $r^H_{m,t+1}$ follows:

$$r^i_{m,t+1} = \kappa_0 + \kappa_1 wc_{i,t+1} - wc_{i,t} + \Delta c^i_{t+1} \tag{11.4}$$

$wc_{i,t}$ is the log wealth-consumption ratio for country i. Plugging (13.59) into (13.59) implies that SDF shocks follow:

$$\tilde{m}^i_{m,t+1} = \underbrace{(\theta - 1 - \frac{\theta}{\psi}}_{-\gamma})\Delta\tilde{c}^i_{t+1} + (\theta-1)\kappa_1\tilde{wc}_{i,t+1} \tag{11.5}$$

Notice that the log wealth-consumption ratio $wc_{i,t+1}$ can be decomposed into a wealth and consumption component:

$$wc_{i,t+1} = \omega_{i,t+1} - c^i_{t+1} \tag{11.6}$$

$\omega_{i,t}$ is the log wealth for country i. Plugging this back into yields:

$$\tilde{m}^i_{t+1} = -\eta\Delta\tilde{c}^i_{t+1} - \kappa_1(1-\theta)\tilde{\omega}_{i,t+1} \tag{11.7}$$

η follows:

$$\eta = \gamma - \kappa_1(1-\theta) \tag{11.8}$$

Exchange Rates: Since international financial markets are dynamically complete, the following perfect international risk sharing condition must hold:

$$\tilde{\mathcal{E}}_t = \tilde{m}^F_{t+1} - \tilde{m}^H_{t+1} \tag{11.9}$$

Substituting (13.62) back into (13.58) and substituting in endowment processes yields the desired result:

$$\tilde{\mathcal{E}}_{t+1} \approx \eta(\xi^H_{t+1} - \xi^F_{t+1} + (\kappa_F - \kappa_H)\xi^G_{t+1}) + \kappa_1(1-\theta)\underbrace{(\tilde{\omega}^H_{t+1} - \tilde{\omega}^F_{t+1})}_{\tilde{W}_{t+1}} \tag{11.10}$$

12 Model Validation

12.1 US leads the Global Innovation Network

Validation: One of the central model implications is that the US leads the global innovation cycle: when the US innovates, the ROW follows by adopting her innovation. This is why US fiscal policy has an outsized influence on i) global innovation and consequently expected future global growth in the model. Table 20 confirms this prediction, demonstrating strong predictive power of the US R&D growth rate for i) global innovation growth and ii) future global growth.

Table 20: *US Innovation leads Global Innovation and Global Growth*

This table estimates panel specification using annual data from 1980-2021. Standard errors contained in parentheses are blockwise bootstrapped using country blocks of length $N = 21$ (Developed Only), $N = 17$ (Emerging Only) and $N = 38$ (All countries) and computed using 5,000 iterations. Country fixed effects are included in all regressions and the US is omitted from each dependent variable. Global R&D Growth$_t^{US}$ is global R&D growth orthogonalised w.r.t US R&D growth.

	Dependent Variable: R&D Growth$_{t,t+k}$								
	All Countries			*Developed Only*			*Emerging Only*		
	1YR	5YR	10YR	1YR	5YR	10YR	1YR	5YR	10YR
US R&D Growth$_t$	0.464***	0.694***	0.823***	0.410***	0.630***	0.723***	0.612***	0.854***	1.097***
	(0.083)	(0.146)	(0.200)	(0.131)	(0.289)	(0.203)	(0.231)	(0.243)	(0.234)
Global R&D Growth$_t^{US}$	0.723***	1.482***	1.222***	0.618***	0.641***	1.388***	0.684***	1.514***	1.325***
	(0.114)	(0.240)	(0.354)	(0.151)	(0.230)	(0.189)	(0.194)	(0.300)	(0.482)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,068	925	751	1,068	925	751	1,068	925	751
Adjusted R^2	0.135	0.238	0.313	0.159	0.293	0.340	0.106	0.071	0.140
	Dependent Variable: Consumption Growth$_{t,t+k}$								
	All Countries			*Developed Only*			*Emerging Only*		
	1YR	5YR	10YR	1YR	5YR	10YR	1YR	5YR	10YR
US R&D Growth$_t$	0.012***	0.072***	0.104***	0.010***	0.056***	0.074***	0.019***	0.115***	0.183***
	(0.003)	(0.015)	(0.028)	(0.003)	(0.008)	(0.019)	(0.004)	(0.028)	(0.056)
Global R&D Growth$_t^{US}$	0.038***	0.078***	0.059***	0.033***	0.043***	0.188***	0.071***	0.164***	0.245***
	(0.006)	(0.019)	(0.022)	(0.005)	(0.012)	(0.058)	(0.028)	(0.034)	(0.081)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,068	925	751	1,068	925	751	1,068	925	751
Adjusted R^2	0.015	0.069	0.087	0.016	0.087	0.079	0.030	0.088	0.153
	Dependent Variable: GDP Growth$_{t,t+k}$								
	All Countries			*Developed Only*			*Emerging Only*		
	1YR	5YR	10YR	1YR	5YR	10YR	1YR	5YR	10YR
US R&D Growth$_t$	0.013**	0.067***	0.097***	0.019**	0.057***	0.075***	0.009***	0.057***	0.071***
	(0.004)	(0.019)	(0.032)	(0.004)	(0.008)	(0.019)	(0.003)	(0.018)	(0.013)
Global R&D Growth$_t^{US}$	0.037***	0.089***	0.117***	0.027***	0.071***	0.100***	0.027***	0.071***	0.100***
	(0.007)	(0.023)	(0.040)	(0.005)	(0.013)	(0.039)	(0.007)	(0.024)	(0.021)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,068	925	751	1,068	925	751	1,068	925	751
Adjusted R^2	0.020	0.084	0.101	0.021	0.110	0.123	0.021	0.110	0.123
Note:	*p<0.1; **p<0.05; ***p<0.01								

12.2 US Fiscal Policy, Global Innovation and Global Growth

Validation: Here I provide direct evidence linking the US fiscal policy to expected future global growth. To start, I plot the link between the US fiscal condition and global growth expectations in figures 32 and 32. Global growth expectations are proxied using an equally weighted average of four quarter ahead country level growth forecasts, as in Andrews et al (2021). In support of the model, the two plots illustrate that when the US fiscal condition deteriorate, global growth prospects moving forward deteriorate as well.

Digging deeper, table 22 investigates the direct fiscal instruments driving this result. It shows that both the US tax-GDP and US debt-GDP ratio has strong predictive power for i) global innovation growth, proxied by global R&D growth, ii) global consumption growth and iii) global GDP growth up to a 10 year horizon. This is consistent with the model's fiscal mechanism that connects deteriorating global growth expectations to the US fiscal condition through both distortionary taxes and accumulation of US government debt.

To add further validation for this model implied link between US fiscal condition and global growth prospects, I compare quantitatively how well my model matches the data in this regard via predictability regressions. Table 21 displays the US fiscal condition's predictability for global consumption growth in the model and the data. The model can broadly capture the link between the US fiscal condition and global long run risk: the common predictive component in consumption growths across countries.

Table 21: *Model vs Simulated Regressions (Global Consumption Predictability)*

Description: The empirical regressions use an equally weighted average of consumption growths as my measure for global consumption growth. As in my empirical analysis, ΔUS Surplus-Debt Ratio$_t$ is used as the fiscal variable. For the model regressions, I use $\frac{(\tau_t^{US}-\tau_t^{*,US})\text{Tax Base}_t^{US}}{B_{t-4}^{US}}$ as the US fiscal variable. The last column computes results when the fiscal volatility shock is removed from the model (ω_t^i). Model regressions are computed as the average results over 1,000 simulations for 1000 quarters each.

	Coefficient	*Data*	*Model*	*No Vol*
Panel (a): Global Consumption Growth Predictability				
$\Delta c^W_{t,t+4} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	1.034	-0.413	-1.231
		(0.330)		
$\Delta c^w_{t+4,t+8} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	1.932	0.901	0.961
		(0.480)		
$\Delta c^w_{t+8,t+12} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	1.938	1.441	1.645
		(0.878)		
$\Delta c^w_{t+12,t+16} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	0.873	1.880	1.771
		(0.558)		
$\Delta c^w_{t+16,t+20} = \alpha + \beta(\text{US Surplus-Debt Ratio})_t + \epsilon$	β	0.488	1.850	1.880
		(0.252)		

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 32: *US Fiscal Condition and Global Growth Expectations*

Description: This figure plots ΔUS Surplus-Debt Ratio$_t$ (red) against the global GDP growth forecast (blue). The sample period is from 1980Q1-2018Q4.

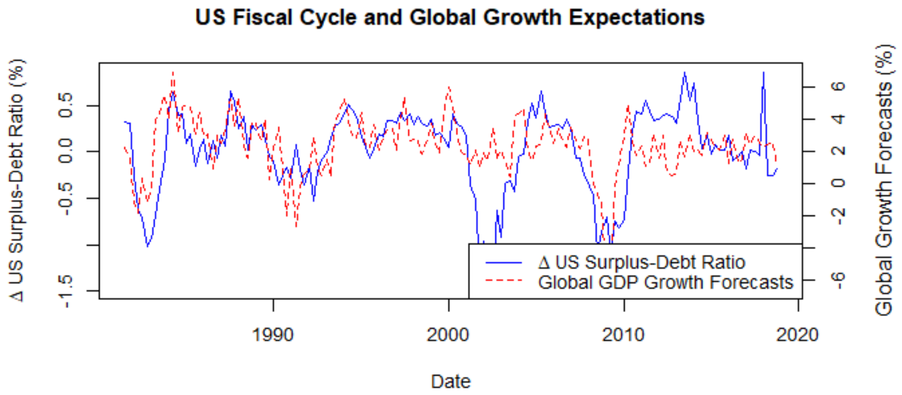


Figure 33: *US Fiscal Condition and Global Growth Expectations*

Description: This figure plots the levels and changes in the US surplus-debt ratio against global GDP growth forecasts. Sample period is from 1980Q1-2018Q4.

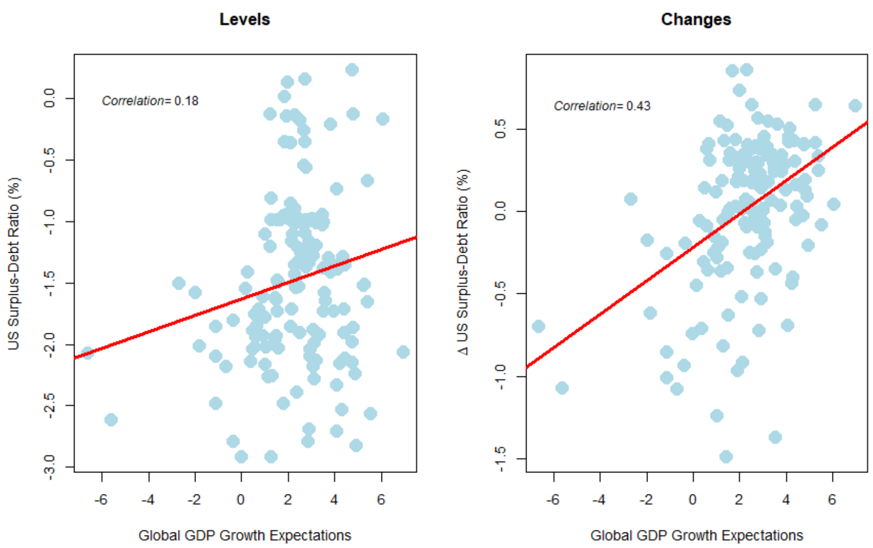


Table 22: *US Fiscal Policy, Global Innovation and Global Growth*

This table estimates panel specification using annual data from 1980-2021. Standard errors contained in parentheses are blockwise bootstrapped using country blocks of length $N = 38$ (All countries) and computed using 5,000 iterations. Country fixed effects are included in all regressions and the US is omitted from each dependent variable. Global Tax-GDP Ratio$_t^{US}$ is the average non-US tax-GDP ratio orthogonalised w.r.t US tax-GDP ratio.

	All Countries								
	R&D Growth$_{t,t+k}$			Consumption Growth$_{t,t+k}$			GDP Growth$_{t,t+k}$		
	1YR	5YR	10YR	1YR	5YR	10YR	1YR	5YR	10YR
US Tax-GDP Ratio$_t$	-0.954^{**}	-2.224^{***}	-3.535^{***}	-0.07^{***}	-0.222^{***}	-0.746^{***}	-0.07^{***}	-0.184^{***}	-0.564^{***}
	(0.209)	(0.582)	(0.692)	(0.021)	(0.060)	(0.111)	(0.022)	(0.055)	(0.076)
Global Tax-GDP Ratio$_t^{US}$	-0.578^{**}	-0.883^{**}	-0.477^{***}	-0.084^{***}	-0.155^{***}	-0.262^{***}	-0.138^{***}	-0.120^{***}	-0.282^{***}
	(0.235)	(0.332)	(0.482)	(0.033)	(0.041)	(0.128)	(0.033)	(0.048)	(0.108)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,068	925	751	1,068	925	751	1,068	925	751
Adjusted R^2	0.031	0.024	0.086	0.069	0.015	0.0899	0.012	0.017	0.140

	All Countries								
	R&D Growth$_{t,t+k}$			Consumption Growth$_{t,t+k}$			GDP Growth$_{t,t+k}$		
	1YR	5YR	10YR	1YR	5YR	10YR	1YR	5YR	10YR
US Debt-GDP Ratio$_t$	-0.823^{**}	-1.531^{**}	-2.132^{***}	-0.182^{***}	-0.233^{***}	-0.338^{***}	-0.200^{***}	-0.344^{***}	-0.581^{***}
	(0.238)	(0.223)	(0.244)	(0.085)	(0.078)	(0.141)	(0.029)	(0.088)	(0.114) h168
Global Debt-GDP Ratio$_t^{US}$	-0.249^{**}	-0.198^{**}	-0.433^{***}	-0.126^{***}	-0.181^{***}	-0.343^{***}	-0.132^{***}	-0.173^{***}	-0.391^{***}
	(0.388)	(0.492)	(0.689)	(0.071)	(0.088)	(0.133)	(0.032)	(0.066)	(0.171)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,068	925	751	1,068	925	751	1,068	925	751
Adjusted R^2	0.048	0.044	0.111	0.049	0.075	0.119	0.032	0.037	0.160

Note: *p<0.1; **p<0.05; ***p<0.01

12.3 US vs ROW Growth Prospects

Overview: An important part of the risk-sharing mechanism is that the US is more exposed to expected global growth or global long-run risk. This is the reason why the US is the global insurance receiver in my model.

Identification: I do not shy away from the difficulty in verifying this recursive mechanism: long-run risks are a source of dark matter that isn't directly observable (Chen, Dou and Kogan, 2019). Thus to show robustness in my results here, I employ several identification schemes considered in the literature. Firstly, I apply the traditional projection approach of Bansal, Kiku and Yaron (2010) and Colacito and Croce (2011, 2013). Using the same blockwise bootstrap strategy as before, I project annualized (four quarter) consumption growths onto a control vector $F_{j,t}$:

$$\Delta c^i_{t,t+4} = \beta_i' F_{j,t} + \epsilon_{i,t+1}, \ j = 1, 2 \tag{12.1}$$

Here I consider two different control vectors:

$$F_{1,t} = [pd^i_t] \qquad F_{2,t} = [pd^i_t, rf^i_t, \Delta c^i_{t,t-4}, VOL_{i,t}] \tag{12.2}$$

To demonstrate that US expected future growth prospects are more adversely impacted during global downturns when global growth prospects deteriorate, I estimate global long-run risk beta differentials between the US and the ROW using the same blockwise bootstrap approach as before. For each of the four identification schemes, I extract US and ROW global long-run risk loadings $\beta^{US}_{LRR}, \beta^{ROW}_{LRR}$ by running the following time series and panel fixed effect regressions for the US and non-US components of each bootstrapped sample:

$$\begin{aligned} z^{US}_t &= \alpha_{US} + \beta^{US}_{LRR}(\frac{1}{N}\sum_{i=1}^{N} z^i_t) + \epsilon^{US}_t \\ z^i_t &= \alpha_i + \beta^{ROW}_{LRR}(\frac{1}{N}\sum_{i=1}^{N} z^i_t) + \epsilon^i_t \end{aligned} \tag{12.3}$$

Discussion: Table 23 confirms that the US has above average exposure to expected global growth or global long risks relative to the ROW. The differential in global long-run risk betas are statistically significant for all four measures at the 10% level, indicating that whilst the US is less exposed to contemporaneous global risk, she seems to be more exposure to global long-run risks. I visualise these results in figure 34 which plots the bootstrapped null distributions for

$\beta^{US}_{LRR} - \beta^{ROW}_{LRR}$ across each of the four measures.

Table 23: *Bootstrapped Distribution for* $\beta^{US}_{LRR} - \beta^{ROW}_{LRR}$

Description: This table reports the bootstrapped sampling distribution for $\beta^{US}_{LRR} - \beta^{ROW}_{LRR}$ across the four identified schemes. I perform a blockwise bootstrap using one year panel blocks of size $NT = 22 \times 4 = 88$ with 5000 replications. I test the null that US and ROW have equal betas against the alternative that the US beta is higher. The reported p-values correspond to the proportion of times the US LRR beta is less than or equal to the ROW LRR beta.

	Original Data	*Mean*	*90% CI*	*P-Value*
	Panel (a): Full Sample			
Projection I	0.213	0.231*** (0.101)	[0.090, 0.401]	0.007
Projection II	0.320	0.341* (0.153)	[0.095, 0.620]	0.056
Cumulative 10yr Consumption Growth	0.422	0.443** (0.163)	[0.125, 0.6555]	0.012
OECD Growth Forecasts	0.336	0.332* (0.167)	[0.019, 0.600]	0.075
Note:	*p<0.1; **p<0.05; ***p<0.01			

Figure 34: *Bootstrapped Null Distributions for $\beta^{US}_{LRR} - \beta^{ROW}_{LRR}$ by Identification Scheme*

Description: This figure plots the histogram for the bootstrapped distributions for $\beta^{US}_{LRR} - \beta^{ROW}_{LRR}$ under the null hypothesis that US and ROW LRR betas are identical. Projection I uses state vector $F_{1,t} = [pd^i_t]$ whereas projection II uses $F_{2,t} = [pd^i_t, rf^i_t, \Delta c^i_{t,t-4}, VOL_{i,t}]$. Density refers to the proportion out of the total 5,000 replications that each value of $\beta^{US}_{LRR} - \beta^{ROW}_{LRR}$ was observed. Red dotted line correspond to observed data values.

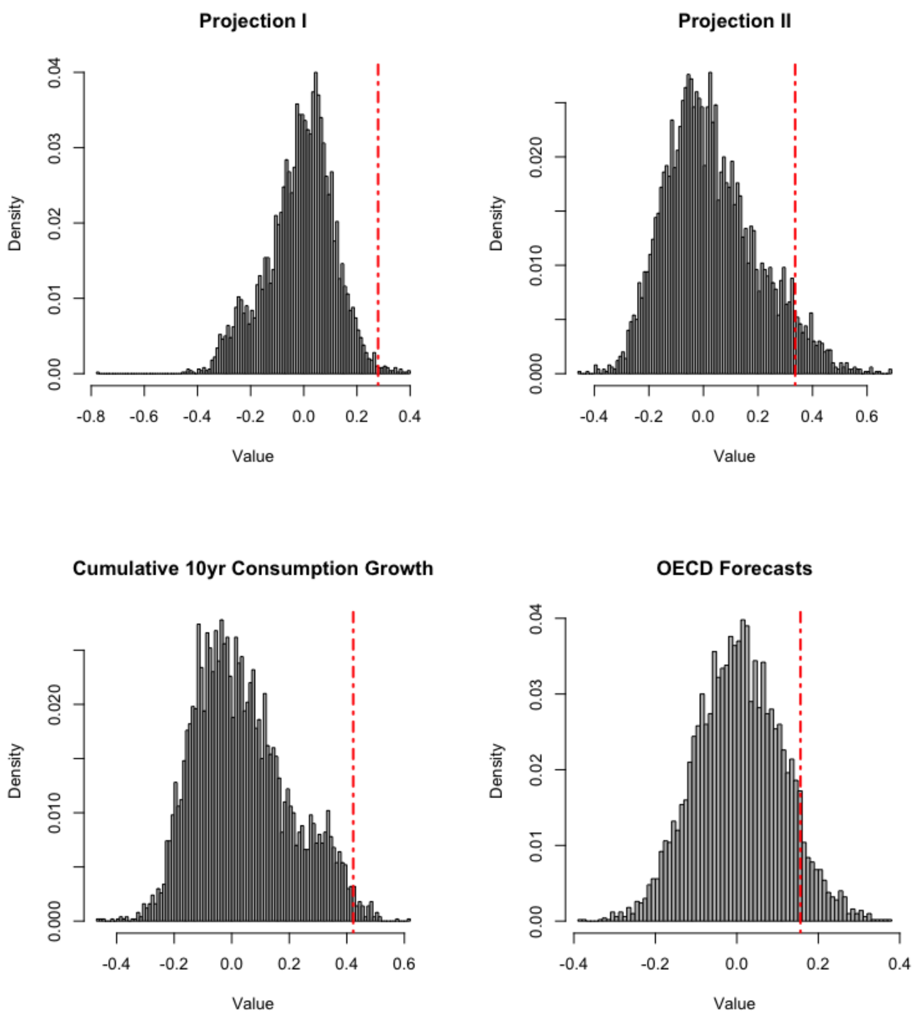


Figure 35: *Global Short Run vs Global Long Run Risk Exposures*

Description: This figure plots global consumption betas (β^i_G) against global long run risk betas (β^i_{LRR}). The top panel uses global LRR betas extracted when country level LRRs are estimated using the univariate control vector $F_{1,t} = [pd^i_t]$. The bottom panel uses the multivariate control vector $F_{2,t} = [pd^i_t, rf^i_t, \Delta c^i_{t,t-4}, VOL^i_t]$. The blue dashed lines correspond to the position of the US in each graph.

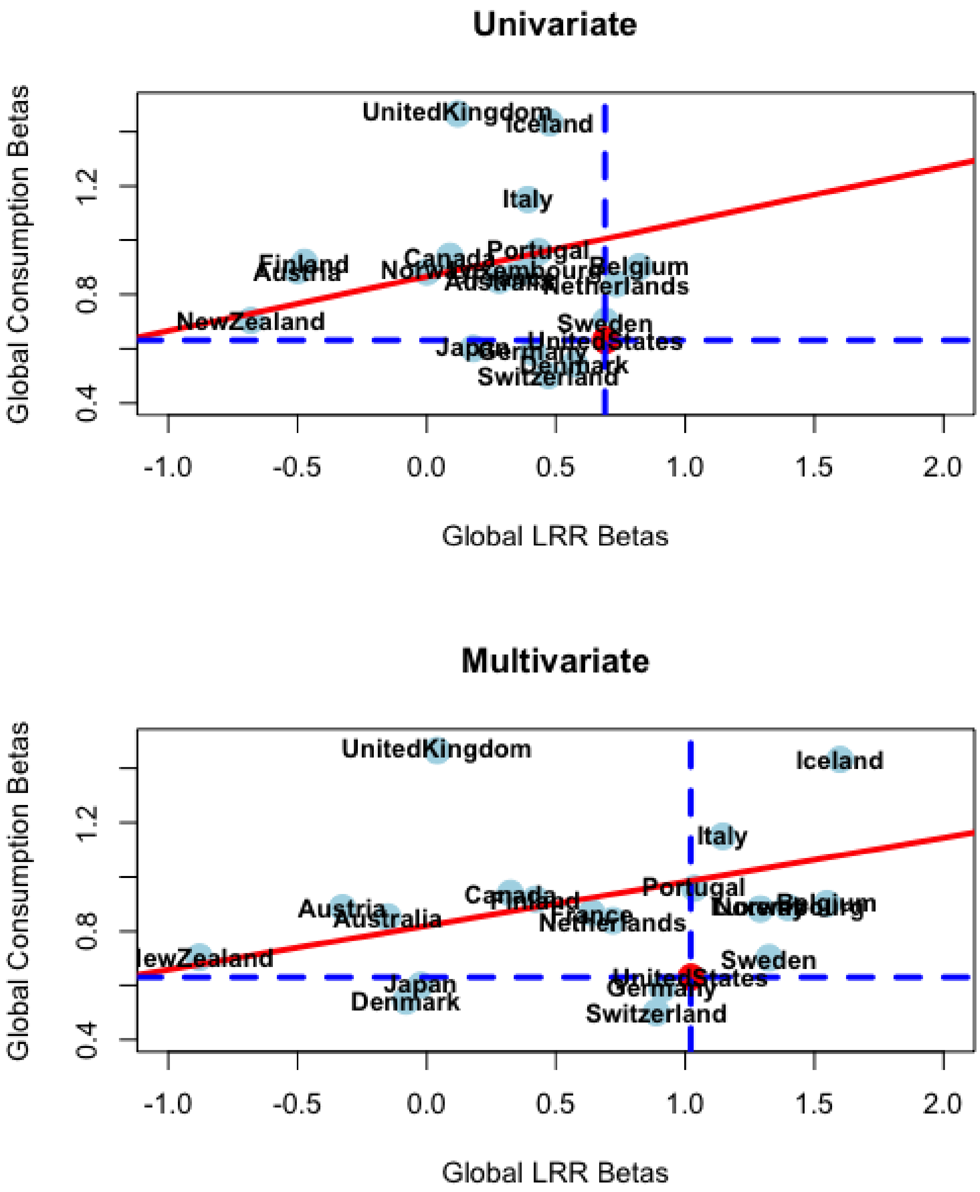
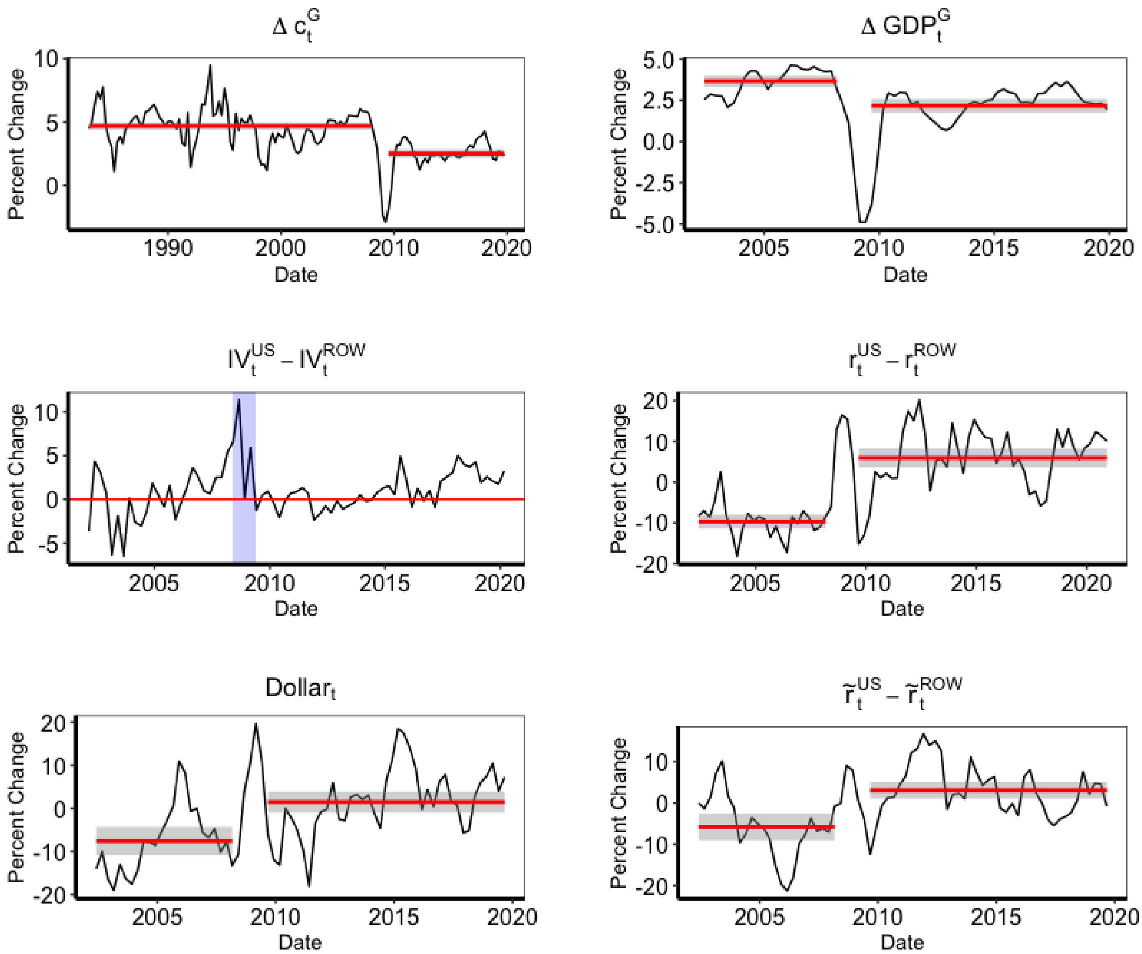


Figure 36: *Global Growth Prospects, Global Uncertainty and US Stock Market Outperformance*

Description: This figure plots the time series evolution of global consumption growth (Δc_t^G) and global GDP growth (ΔGDP_t^G), relative option implied stock market volatilities ($IV_t^{US} - IV_t^{ROW}$), US stock market outperformance ($r_t^{US} - r_t^{ROW}$) and its dollar ($Dollar_t$) and local equity return component ($\tilde{r}_t^{US} - \tilde{r}_t^{ROW}$) from 2002Q1-2020Q1. Sample period is limited by data availability of option implied IVs across non-US countries. Options data for implied IV is from Dew-Becker and Giglio (2020).



These results support my recursive resolution to the US safety puzzle. Whilst the US may seem safe due to her relative insulation against contemporaneous global macro risk, she is highly exposed to a hidden source of global risk: expected global growth or *global* ***long-run*** *risks*. When global growth prospects deteriorate during times of global stress, US growth prospects are adversely impacted relative to the ROW. This is the source of global risk that drives the US exorbitant privilege according to this hypothesis. This dichotomy in global risk exposures is visualised in figure 35 which plots global consumption betas (β_G^i) against global long run risk betas (β_{LRR}^i). The blue dashed lines isolate the position of the US. Clearly the US lies in the bottom right quadrant: she has ***below*** average exposure to global ***short-run*** consumption risk but ***above*** average exposure to global ***long-run*** consumption risk.

As suggested by figure 36, the recent global financial crisis supports my interpretation. The top two panels of figure 36 indicate that the global financial crisis can be interpreted as a regime switch that transitioned the world towards a low global growth environment. The US was adversely exposed to this negative expected global growth shock: her long-run growth prospects become more uncertain relative to the ROW. This is captured by the fact that option implied volatilities of the S&P 500 relative to foreign stock markets (bottom left panel) increased markedly during the global financial crisis.[15] In a framework with EZ preferences, this naturally results in a relative rise in US risk premia during the global financial crisis, explaining the US stock market outperformance post-2010.[16]

[15] Option implied market volatilities capture ex-ante market expectations of future stock market volatility. Since the stock market is a risky claim to future output, these option IVs can be viewed as a proxy for the market's expectation for the uncertainty of that country's future growth prospects.

[16] Atkeson, Heathcote and Perri (2020) also study this phenomenon, though their explanation abstracts from risk premia. They link it to ex-post return innovation forces associated with US mark-up shocks.

12.4 US FP, Global Fiscal Cycle and Global Uncertainty

Overview: The final testable prediction I take to the data is the endogenous link between US fiscal capacity, the global fiscal cycle and global uncertainty implied by the model. This link endogenously generates predictability in the model: Since i) the US fiscal policy drives down global growth prospects and ii) local fiscal authorities enact more expansionary policy when growth prospects are low, a deterioration in the US fiscal condition leads to a common deterioration in fiscal conditions worldwide. In other words *the US leads the global fiscal cycle*: (US Surplus-Debt Ratio$_t \downarrow \implies$ Global Fiscal Cycle$_t \downarrow$).

Since the IGBC allows the local tax burden associated with these global fiscal expansions to be smoothed over time through the accumulation of government: these common fiscal deteriorations raise uncertainty about future tax policy, increasing global policy uncertainty and consequently the quantity of global long-run risk. This is the channel through which time varying global risk premia is generated in the model. In this section, I empirically verify this mechanism, confirming the positive relationship between the US fiscal condition, the future global fiscal cycle and global policy uncertainty.

US Leads the Global Fiscal Cycle: Table 24 evaluates the link between the US fiscal condition and global fiscal cycle: consistent with the model, the US leads the global fiscal cycle. Foreign governments respond to US fiscal deteriorations by deteriorating their own fiscal conditions for up to a 1 year horizon, as suggested by the positive coefficient on the 1 year change in the global fiscal cycle. The effect mean-revert around the 5 year horizon before effectively dying out after 10 years. These results linking the US fiscal condition to foreign fiscal conditions are not driven by other fiscal factors, such as the global fiscal cycle.

To further butress this point, figure 37 plots ΔUS Surplus-Debt Ratio$_t$ against the future 1 year change in the global fiscal cycle (ΔGlobal Fiscal Cycle$_t$). It clearly indicates a strong positive correlation, suggesting that foreign governments do indeed adopt the US fiscal policy stance by deteriorating their fiscal conditions in response to US fiscal deteriorations.

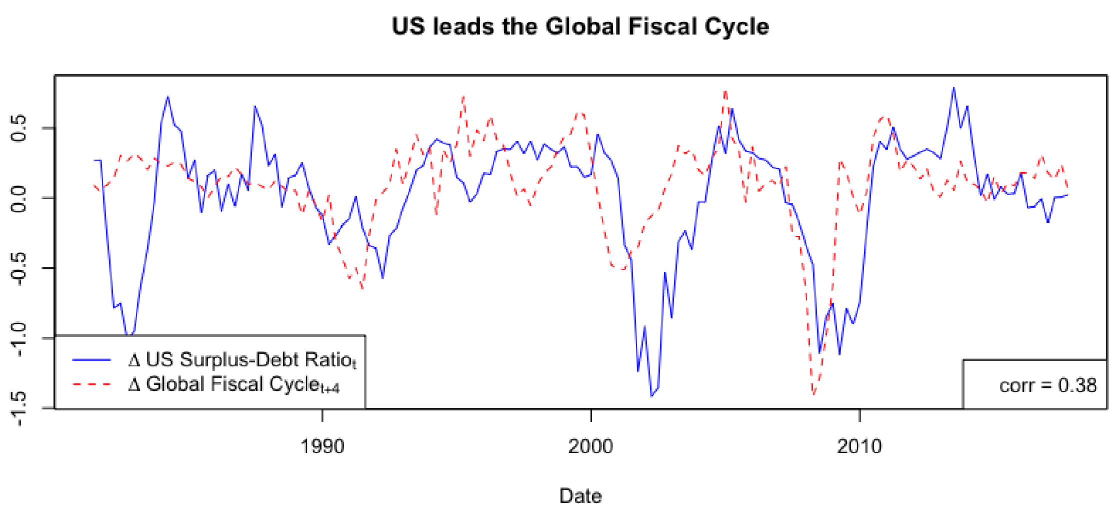
Table 24: *US Fiscal Policy and the Global Fiscal Cycle*

This table estimates panel specification using quarterly data from 1980-2021. Standard errors are blockwise bootstrapped using panel blocks of length $NT = 38$.

	Dependent Variable: Foreign Fiscal Conditions		
	ΔCountry i's Surplus-Debt Ratio$_{t,t+k}$		
	1YR	5YR	10YR
ΔUS Surplus-Debt Ratio$_t$	0.764^{***}	-0.813^{***}	-0.13
	(0.109)	(0.202)	(0.232)
Global Fiscal Cycle$_t^{US}$	-0.115	-0.473^{**}	-1.200^{***}
	(0.183)	(0.139)	(0.382)
Country FE	✓	✓	✓
Observations	1,388	1,228	1,028
Adjusted R^2	0.027	0.018	0.036
Note:			*p<0.1; **p<0.05; ***p<0.01

Figure 37: *US leads the Global Fiscal Cycle*

Description: This figure plots ΔUS Surplus-Debt Ratio$_t$ (blue) against the future 1 year change in the global fiscal cycle:



US FP and Global Uncertainty: Having shown that the US drives the global fiscal cycle, I now move to establish that the US fiscal policy drives global uncertainty and consequently global risk premia through this channel. Figure 38 confirms this model implication tying together the US fiscal condition and global uncertainty visually. Table 25 demonstrates that this correlation is robust via a regression approach.

Figure 38: *US Fiscal Cycle and Global Uncertainty*

Description: This figure plots the levels and changes in the US surplus-debt ratio against two proxies for global uncertainty: global stock market volatility defined as a cross-sectional average of realized stock market volatility as in Lustig and Verdelhan (2011) and the logarithm of the VIX. The sample period for all graphs is 1980Q1-2017Q2.

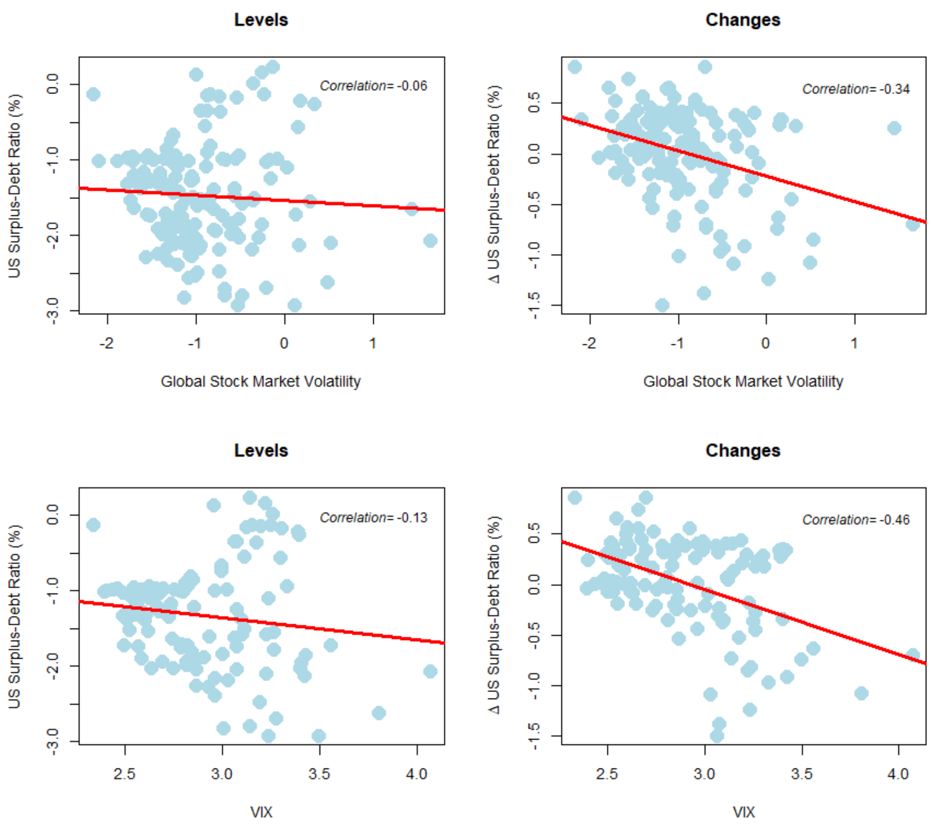


Table 25: *US Fiscal Condition and Global Uncertainty*

This table documents estimation results associated with running the following estimation:

$$\text{Global Uncertainty}_t = \alpha + \beta_1 \Delta \text{US Surplus-Debt Ratio}_t + \beta_2 \text{Global Fiscal Cycle}_t^{US} + \delta' Macro_t + \epsilon_{i,t}$$

Description: The global fiscal cycle is orthogonalised w.r.t the US. In addition to global market uncertainty proxies, I also look at the global economic policy uncertainty index (GEPU) constructed by Davis (2016) which is a GDP weighted average of EPU indexes for 16 countries obtained from Baker, Bloom and Davis (2016). GDP weights are computed using both current prices and a PPP adjustment. The sample period is from 1980Q1-2018Q4.

	Dependent variable: Global Market Uncertainty					
	Global Stock Market Volatility			VIX		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ US Surplus-Debt Ratio$_t$	-0.431***	-0.454***	-0.455***	-0.286***	-0.306***	-0.280***
	(0.11)	(0.10)	(0.12)	(0.06)	(0.06)	(0.07)
Global Fiscal Cycle$_t^{US}$	-0.166**	-0.182**	-0.182**	-0.038	-0.059	-0.031
	(0.081)	(0.071)	(0.089)	(0.049)	(0.039)	(0.051)
Global Consumption Growth$_t$	-0.021			-0.028		
	(0.050)			(0.034)		
Global GDP Growth$_t$		0.0001			-0.003	
		(0.005)			(0.004)	
Global IP Growth$_t$			-0.0003			-0.010
			(0.001)			(0.01)
Observations	150	150	150	115	115	115
Adjusted R^2	0.136	0.135	0.135	0.210	0.210	0.212
	Dependent variable: Global Economic Policy Uncertainty Index (GEPU)					
	Current Prices			PPP Adjusted		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ US Surplus-Debt Ratio$_t$	-0.159**	-0.158*	-0.178**	-0.165**	-0.163*	-0.183**
	(0.078)	(0.089)	(0.081)	(0.077)	(0.088)	(0.079)
Global Fiscal Cycle$_t^{US}$	0.001	0.001	0.007	0.002	0.002	0.001
	(0.006)	(0.006)	(0.005)	(0.0056)	(0.0061)	(0.005)
Global Consumption Growth$_t$	-0.001			-0.002		
	(0.005)			(0.005)		
Global GDP Growth$_t$		0.001			0.001	
		(0.001)			(0.001)	
Global IP Growth$_t$			0.002			0.002
			(0.001)			(0.002)
Observations	83	83	83	83	83	83
Adjusted R^2	0.025	0.013	0.026	0.030	0.017	0.031
Note:	*p<0.1; **p<0.05; ***p<0.01					

13 A Simple Endowment Economy Model

Overview: Motivated by my empirical evidence, in this section I present a simple two country, two-good endowment model with i) EZ preferences, ii) consumption home bias and iii) frictionless markets where the US good features lower (larger) US exposure to global short-run (long-run) shocks. To highlight the crucial role that this heterogeneity in global risk exposures plays in resolving the US safety puzzle, they are exogenously imposed in this simple framework. They are microfounded as the equilibrium response to more expansionary US fiscal policy vis-*á*-vis the ROW in a richer general equilibrium framework presented in section 5.1.

13.1 Framework

Environment: There are two countries: home and foreign indexed by $i \in \{H, F\}$. The home country is the model analogue to the United States (US) and the foreign country is the corresponding analogue to the rest of the world (ROW). Both are endowment economies that are home to a unique local good that is internationally tradable.

Endowments: The log of each good's endowment features cointegration and is driven by a local shock ξ^i_{t+1} and a global shock ξ^G_{t+1}:

$$\begin{aligned} x^H_{t+1} &= \mu + x^H_t - \beta(x^H_t - x^F_t) + \xi^H_{t+1} + \tau_H \xi^G_{t+1} + \tau_{L,H} z^G_t \\ x^F_{t+1} &= \mu + x^F_{t+1} + \beta(x^H_t - x^F_t) + \xi^F_t + \tau_F \xi^G_{t+1} + \tau_{L,F} z^G_t \end{aligned} \tag{13.1}$$

z^G_t follows an AR(1):

$$z^G_t = \mu_G + \rho_x z^G_{t-1} + \xi^G_{x,t} \tag{13.2}$$

Parameters

μ: Mean Endowment Growth Rate

β: Degree of Cointegration[17]

τ_i: Country i's exposure to global short-run shock

[17] Colacito, Croce and Liu (2019) show that cointegration is required in a two country recursive framework with frictionless trading such as my model to ensure a well-defined ergodic distribution for the pareto weights.

Shocks: $\xi_t = [\xi_t^H, \xi_t^F, \xi_t^G, \xi_{x,t}^G]$ follow a standard normal distribution:

$$\xi_{t+1} \sim i.i.d\ N(0,\ I),\ \forall i \in \{H, F, G\} \tag{13.3}$$

Global Shock Exposure: The home (US) good is less exposed to the global short-run shock: $\tau_H < \tau_F$ but more exposed to the expected global growth shock: $\tau_{L,H} > \tau_{L,F}$. The global long-run shock $\xi_{x,t}^G$ has a positive correlation with the contemporaneous global shock ξ_t^G which is parameterized by $\chi > 0$. All other shock correlations are zero.

Consumption Preferences: Consumption streams for both countries are defined over a general CES aggregator of the two goods:

$$C_t^H = [\alpha^{\frac{1}{\phi}}(C_{H,t}^H)^{\frac{\phi-1}{\phi}} + (1-\alpha)^{\frac{1}{\phi}}(C_{F,t}^H)^{\frac{\phi-1}{\phi}}]^{\frac{\phi}{\phi-1}} \tag{13.4}$$

$$C_t^F = [(1-\alpha)^{\frac{1}{\phi}}(C_{H,t}^F)^{\frac{\phi-1}{\phi}} + (\alpha)^{\frac{1}{\phi}}(C_{F,t}^F)^{\frac{\phi-1}{\phi}}]^{\frac{\phi}{\phi-1}} \tag{13.5}$$

$C_{H,t}^i, C_{F,t}^i$: Country i's consumption of the home and foreign good
α: Preference parameter for domestic good
ϕ: Elasticity of Substitution across both goods

Consumption Home Bias: I assume that $\alpha \in (\frac{1}{2}, 1)$.

Relative Prices: Both the home and foreign consumption goods are internationally tradable at prices p_t^H and p_t^F which are denominated in units of a global numeraire. I fix the home (US) consumption basket as the global numeraire. Denote by Q_t^i the relative price of country i's consumption in units of the global numeraire. By construction:

$$Q_t^i = \begin{cases} \mathcal{E}_t = [(1-\alpha)(p_t^H)^{1-\phi} + \alpha(p_t^F)^{1-\phi}]^{\frac{1}{1-\phi}} & \text{if } i = F \\ 1 & \text{if } i = H \end{cases} \tag{13.6}$$

Preferences: Each country is populated by a representative investor that has Epstein and Zin (1989) and Weil (1989) recursive preferences. These preferences are defined over the local consumption basket C_t^i. Thus, the lifetime utility of investor i satisfies:

$$U_t^i = [(1-\delta)(C_t^i)^{1-\frac{1}{\psi}} + \delta(E_t {U_{t+1}^i}^{1-\gamma})^{\frac{1-\frac{1}{\psi}}{1-\gamma}}]^{\frac{1}{1-\frac{1}{\psi}}}, i \in \{H, F\}$$

δ: *Time Preference*

ψ: *Intertemporal Elasticity of Substitution (IES)*

γ: *Relative Risk Aversion*

Financial markets are dynamically complete: All sources of uncertainty in the world economy are spanned by the global investment opportunity set. Thus real exchange rate growth $\Delta\mathcal{E}_t$ is pinned down by the equality of marginal utility growths (Backus, Foresi and Telmer, 2001):

$$\Delta\mathcal{E}_t = m_t^H - m_t^F \tag{13.7}$$

m_t^i denotes the log stochastic discount factor (SDF) of country i.

Problem: Since markets are dynamically complete, the intertemporal budget constraint can be written in static form. Thus the problem for each country is:

$$\max_{\{C_{H,t}^i, C_{F,t}^i, W_{t+1}^i\}_{t=0}^{\infty}} U_0^i \tag{13.8}$$

$$s.t.\ \mathbb{E}_0 \sum_{t=0}^{\infty} \frac{\Lambda_t}{\Lambda_0} Q_t^i C_t^i \leq \mathbb{E}_0 \sum_{t=0}^{\infty} \frac{\Lambda_t}{\Lambda_0} W_t^i \tag{13.9}$$

$$Q_t^i C_t^i = p_t^H C_{H,t}^i + p_t^F C_{F,t}^i \tag{13.10}$$

Λ_t is the world state price density that prices country i's wealth portfolio in units of the global numeraire.

Market Clearing Conditions: Goods markets clears:

$$X_t^H = C_{H,t}^H + C_{H,t}^F \tag{13.11}$$

$$X_t^F = C_{F,t}^H + C_{F,t}^F \tag{13.12}$$

Equilibrium: Equilibrium is defined as a set of prices: $\{p_t^H, p_t^F\}$, quantities: $\{C_{H,t}^H, C_{F,t}^H, C_{H,t}^F, C_{F,t}^F\}$ and wealths: $\{W_{t+1}^H, W_{t+1}^F\}$ s.t: i) each investor maximises utility (13.8) s.t (13.9) and (13.10), ii) goods markets clear according to (13.11) - (13.12).

13.2 Equilibrium System

Table 26: Equilibrium System

Consumption FOCs
$(A1):\ C^H_{H,t} = X^H_t[1 - \frac{1}{1+S_t\frac{\alpha}{1-\alpha}}]$
$(A2):\ C^H_{F,t} = X^F_t[1 - \frac{1}{1+S_t\frac{1-\alpha}{\alpha}}]$
$(A3):\ C^F_{F,t} = \frac{X^F_t}{1+S_t\frac{\alpha}{1-\alpha}}$
$(A4):\ C^F_{H,t} = \frac{X^H_t}{1+S_t\frac{1-\alpha}{\alpha}}$
Net Exports
$(A5):\ NX^H_t = X^H_t - C^H_{H,t}$
$(A6):\ NX^F_t = X^F_t - C^F_{F,t}$
Consumption Aggregators
$(A7):\ C^H_t = [\alpha^{\frac{1}{\phi}}(C^H_{H,t})^{\frac{\phi-1}{\phi}} + (1-\alpha)^{\frac{1}{\phi}}(C^H_{F,t})^{\frac{\phi-1}{\phi}}]^{\frac{\phi}{\phi-1}}$
$(A8):\ C^F_t = [(1-\alpha)^{\frac{1}{\phi}}(C^F_{H,t})^{\frac{\phi-1}{\phi}} + (\alpha)^{\frac{1}{\phi}}(C^F_{F,t})^{\frac{\phi-1}{\phi}}]^{\frac{\phi}{\phi-1}}$
Relative Prices
$(A9):\ p^H_t = (\alpha\frac{C^H_t}{C^H_{H,t}})^{\frac{1}{\phi}}$
$(A10):\ p^F_t = [(1-\alpha)\frac{C^H_t}{C^H_{F,t}}]^{\frac{1}{\phi}}$
State Variable
$(A11):\ S_t = S_{t-1}(\frac{M^H_t}{M^F_t})^{\phi}(\frac{C^H_t/C^H_{t-1}}{C^F_t/C^F_{t-1}})$
Wealth Processes
$(A12):\ wc^i_t = [\mathbb{E}_t e^{\theta[ln\delta+(1-\frac{1}{\psi})\Delta c^i_{t+1}+log(1+wc^i_{t+1})]}]^{\frac{1}{\theta}},\ \forall i \in \{H,F\}$
$(A13):\ W^i_t = wc^i_t e^{\log C^i_t},\ \forall i \in \{H,F\}$
US Global Consumption and Wealth Shares
$(A14):\ SWC^{US}_t = \frac{C^H_t}{p^H_t X^H_t + p^F_t X^F_t}$
$(A15):\ \omega^{US}_t = \frac{W^H_t}{W^H_t + W^F_t \mathcal{E}^{-1}_t}$
Wealth Returns
$(A16):\ R^i_{m,t+1} = \frac{(1+wc^i_{t+1})e^{\Delta c^i_{t+1}}}{wc^i_t},\ \forall i \in \{H,F\}$
Price-Dividend Ratios
$(A17):\ pd^i_t = \mathbb{E}_t e^{\theta ln\delta - \frac{\theta}{\psi}\Delta c^i_{t+1} + (\theta-1)log(R^i_{m,t+1}) + log(1+pd^i_{t+1}) + \Delta x^i_{t+1} + \Delta p^i_{t+1}},\ \forall i \in \{H,F\}$
Equity Returns
$(A18):\ R^i_{t+1} = \frac{(1+pd^i_{t+1})e^{\Delta x^i_{t+1}}}{pd^i_t},\ \forall i \in \{H,F\}$
SDFs
$(A19):\ M^i_{t+1} = e^{\theta ln\delta - \frac{\theta}{\psi}\Delta c^i_{t+1} + (\theta-1)log(R^i_{m,t+1})},\ \forall i \in \{H,F\}$
Exchange Rate
$(A20):\ \Delta\mathcal{E}_{t+1} = log(\frac{M^H_{t+1}}{M^F_{t+1}})$

Pareto Weight: The equilibrium system of equations is presented in table 26.[18] I follow Anderson (2005) and Colacito and Croce (2013) and recast the equilibrium in terms of S_t, the home country (US)'s relative pareto weight vis-á-vis the foreign country (ROW). The equilibrium system implies that S_t determines equilibrium consumption allocations (A1-A4), relative prices (A9-A10) and as a consequence asset prices (A17, A18). Thus S_t is an endogenous global factor whose volatility drives common variations in SDF volatility and consequently global risk premia.

Solution Method: I numerically approximate the model to third order: taking at least a third order approximation is necessary to explore risk premium dynamics. The approximation point is the symmetric steady state where global resources are equally shared ($S_t = \overline{S} = 1$). At this steady state, $wc_t^H = wc_t^F = pd_t^H = pd_t^F = \overline{\mathcal{P}} = \frac{\delta}{1-\delta}$, $\omega_t^{US} = \overline{\omega} = \frac{1}{2}$, $R_{m,t+1}^i = R_{t+1}^i = \overline{\mathcal{R}} = \frac{1}{\delta}$,$C_{H,t}^H = C_{F,t}^F = \alpha$, $C_{F,t}^H = C_{H,t}^F = 1-\alpha$, $C_t^H = C_t^F = \overline{\mathcal{C}} = 1$, $p_t^H = p_t^F = \mathcal{E}_t = 1$ and $M_t^H = M_t^F = \overline{\mathcal{M}} = e^{\delta}$.

13.3 Calibration

Overview: The baseline calibration is presented below:[19]

Table 27: *Baseline Calibration*

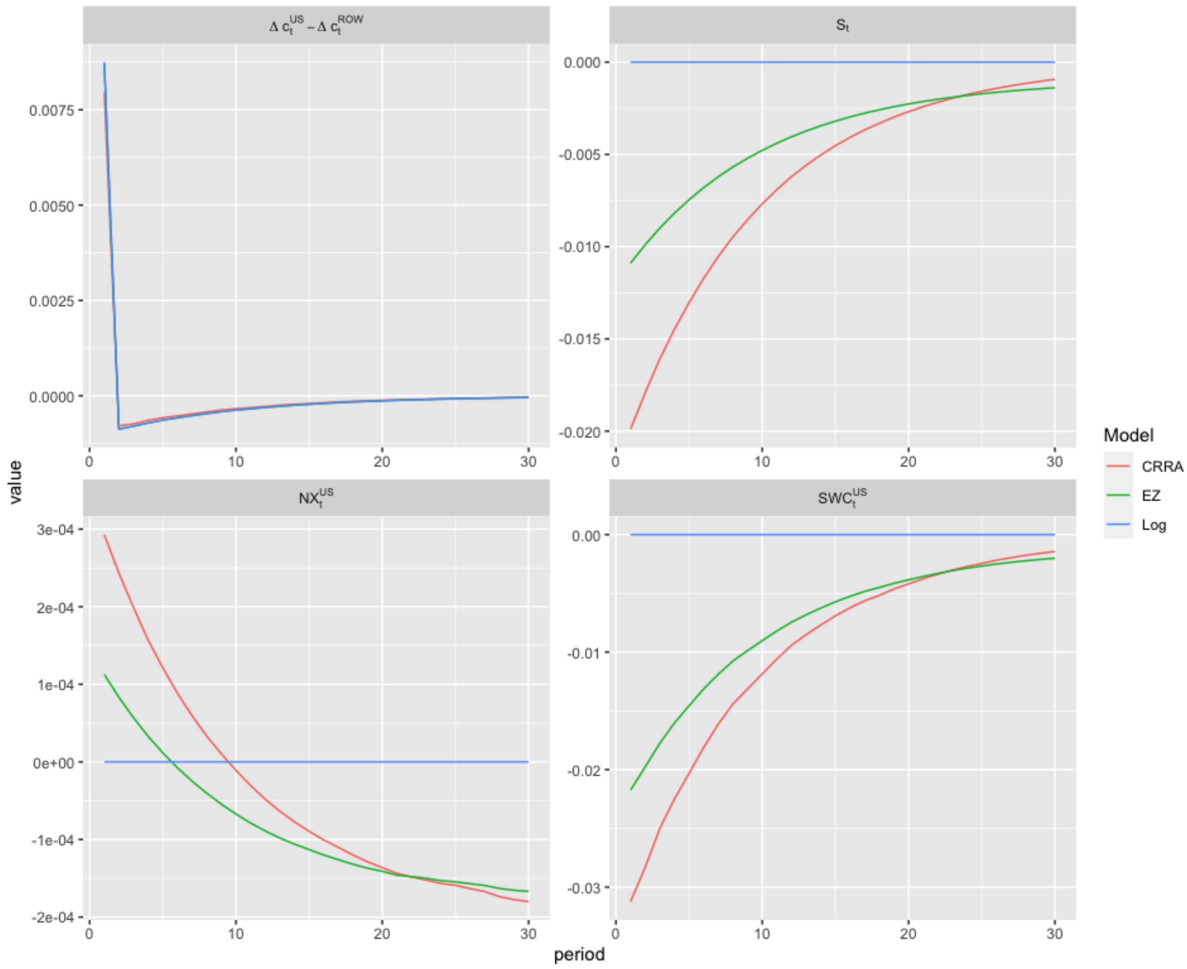
Parameter	Description	Value
	Panel A: Preference Parameters	
γ	Relative Risk Aversion	7.5
ψ	Intertemporal Elasticity of Substitution	2
α	Home Bias Parameter	0.98
δ	Discount Factor	0.99
ϕ	Elasticity of Substitution across Goods	0.2
	Panel B: Endowment Parameters	
Parameter	Description	Value
τ_H	Home Exposure to Global Shock	1.5
τ_F	Foreign Exposure to Global Shock	0.5
μ	Mean Endowment Growth Rate	0.005
β	Cointegration Parameter	0.05

[18] I relegate the proof of this equilibrium system to the online appendix.
[19] Further discussion of calibration choices is relegated to the online appendix

13.4 Model Dynamics

Figure 39: *Quantity Dynamics*

Description: This figure plots the impulse responses of US relative consumption growth: $\Delta c_t^{US} - \Delta c_t^{ROW}$, the US pareto weight: S_t, US net exports: $NX_t^{US} = X_t^H - C_{H,t}^H$, US global consumption share: $SWC_t^{US} = \frac{C_t^H}{p_t^H X_t^H + p_t^F X_t^F}$ to a 1 S.D ***bad*** global endowment shock ($\xi_t^G \downarrow$). The green line reports the results for the baseline EZ model calibration. The red line is the corresponding CRRA model where $\gamma = \frac{1}{\psi}$. Finally the blue line is the log case where $\gamma = \psi = 1$. For the CRRA and log case, all other calibration parameters other than γ, ψ are left unchanged to emphasise the role of preferences.



13.4.1 Quantity Dynamics

Consumption: Notice from the top left panel from figure 39 that US relative consumption: $\Delta c_t^{US} - \Delta c_t^{ROW}$ rises in response to a 1 SD bad global short-run shock (ξ_t^G), consistent with my empirical evidence. This results naturally from the home bias assumption: since the US good is less exposed to the global short-run shock, US consumption is relatively insulated against the contemporaneous global shock.

Note however that the rise in US relative consumption is relatively modest: at 75 basis points. This is driven by the model's equilibrium risk-sharing scheme that requires the US to insure the ROW by transferring global consumption resources abroad during global downturns. The key state variable governing this risk-sharing arrangement is the US pareto weight vis-*á*-vis the ROW: S_t.

S_t: To see this risk-sharing scheme in action, consider how S_t responds to a bad global short-run shock ($\xi_t^G \downarrow$). Since the US good and consequently US marginal utility is less exposed to the global short-run shock, the perfect international risk-sharing condition (A11) requires S_t to decline in order to enforce the equality of marginal utility growths between the US and the ROW. To illustrate this result analytically, I approximate the log US pareto weight s_t to first order by recursively solving backward (A11):

Lemma 13.1. *(Pareto Weight). To a first order, the log US pareto weight: s_t follows*

$$\begin{aligned} s_t = log(S_t) \approx & \phi(1-\gamma)\sum_{j=0}^{t}\Delta y_j - \kappa_1\phi(1-\theta)\sum_{j=0}^{t} wc_{w,j} \\ = & \phi(1-\gamma+\kappa_1(1-\theta))\sum_{j=0}^{t}\Delta y_j - \kappa_1\phi(1-\theta)\sum_{j=0}^{t}\tilde{\mathcal{W}}_j \end{aligned} \tag{13.13}$$

Proof is contained in the online appendix. Here $\Delta y_t = \Delta c_t^H - \Delta c_t^F$, $wc_{w,t} = wc_{c,t}^H - wc_{c,t}^F$ and $\tilde{\mathcal{W}}_t = \mathcal{W}_t^H - \mathcal{W}_t^F$ captures relative changes in consumption growths, log wealth-consumption ratios and log wealths between US and ROW and $1-\theta = \frac{\gamma-\frac{1}{\psi}}{1-\frac{1}{\psi}}$. Finally κ_1 is a constant of log-linearization that captures the average wealth-consumption ratio (Campbell, 1993). (13.13) indicates that the entire past history of two endogenous state variables drives s_t: i) US relative consumption growth: $\{\Delta y_j\}_{j=0}^t$ and ii) US relative wealth: $\{\tilde{\mathcal{W}}_j\}_{j=0}^t$.

Under log preferences ($\theta = 1, \gamma = 1$), s_t is unresponsive to the bad global short-run shock ($\xi_t^G \downarrow$): both the US and ROW consume an equal share of global consumption and wealth resources at every date t, consistent with blue line in the top right panel of figure 39. For generalized CRRA utility ($\theta = 1, \gamma > 1$), s_t declines in response to the bad global short-run shock since it is a strictly declining function of the past history of relative consumption growths ($\sum_{j=0}^{t} \Delta y_j$) in this case. This is illustrated by the red line in the top right panel of figure 39. Finally in the EZ case ($1-\theta > 0, \gamma > 1$), the US pareto weight also decreases in response to the global short-run shock, though the decrease is weaker, as illustrated by the green line in the top right panel of figure 39.

S_t and Risk Sharing Scheme: Since S_t captures the US share of global resources relative to the ROW, the endogenous decline in S_t means that the US insures the ROW by transferring global resources abroad in response to the global short-run shock. In practical terms, this insurance from the US to the ROW manifests itself through the goods market via an increase in US net exports. To demonstrate this goods market insurance analytically, I combine consumption FOCs (A1-A4) with the net exports equations (A5-A6). This implies that the declining US pareto weight generates a reallocation of global consumption resources from the US to the ROW through higher US net exports, as described by lemma 13.2:

Lemma 13.2. *(Net Exports). NX_t^H and NX_t^F satisfy:*

$$NX_t^H = \frac{X_t^H}{1 + S_t{\frac{\alpha}{1-\alpha}}} \tag{13.14}$$

$$NX_t^F = X_t^F[1 - \frac{1}{1 + S_t{\frac{\alpha}{1-\alpha}}}] \tag{13.15}$$

Simple algebra confirms $\frac{\partial NX_t^H}{\partial S_t} < 0, \frac{\partial NX_t^F}{\partial S_t} > 0$. This risk-sharing arrangement is also visualised in the bottom left panel of figure 39 which depicts the impulse responses of US net exports to the bad global short-run shock.

Global Consumption Share: Finally notice from the bottom right panel of figure 39 that this risk-sharing arrangement generates a long run decline in US global consumption share $SWC_t^{US} = \frac{C_t^H}{p_t^H X_t^H + p_t^F X_t^F}$ in response to the global short-run shock. To make sense of the long-lasting nature of this insurance analytically, note that combining consumption FOCs (A1-A4) with the consumption aggregator equations (A5-A6) yields the following lemma about log consumptions:

Lemma 13.3. *(Aggregate Consumption).* Δc_t^H *and* Δc_t^F *satisfy:*

$$c_t^H = \frac{\phi}{1-\phi} log[\alpha^{\frac{1}{\phi}}(X_t^H)^{\frac{\phi-1}{\phi}}(1-\frac{1}{1+S_t\frac{\alpha}{1-\alpha}})^{\frac{\phi-1}{\phi}} + [(1-\alpha)^{\frac{1}{\phi}}(X_t^F)^{\frac{\phi-1}{\phi}}[1-\frac{1}{1+S_t\frac{1-\alpha}{\alpha}}]^{\frac{\phi-1}{\phi}}] \tag{13.16}$$

$$c_t^F = \frac{\phi}{1-\phi} log[\alpha^{\frac{1}{\phi}}(X_t^F)^{\frac{\phi-1}{\phi}}(1+S_t\frac{\alpha}{1-\alpha})^{\frac{1-\phi}{\phi}} + (1-\alpha)^{\frac{1}{\phi}}(X_t^H)^{\frac{\phi-1}{\phi}}[1+S_t\frac{1-\alpha}{\alpha}]^{\frac{1-\phi}{\phi}}] \tag{13.17}$$

Algebra can confirm that $\frac{\partial c_t^H}{S_t} > 0$, $\frac{\partial c_t^F}{S_t} < 0$, suggesting that a persistent decline in s_t caused by the global endowment shock can generate a persistent decrease in US consumption vis-*á*-vis the ROW moving forward. Thus the US global consumption share falls over the long run in response to the bad global endowment shock.

13.5 US Stock Market Outperformance and US Wealth Share

Overview: Having described the quantity dimensions of my US safety facts in detail, I now describe the model's performance in quantitatively matching the key asset pricing dimensions of my US safety facts, namely i) countercyclical US stock market outperformance vis-*á*-vis the ROW and ii) countercyclical US wealth share. I start by simulating data from the model and compare model regressions against the corresponding empirical regressions. I simulate the model economy across 1000 simulations of 100 quarters each. The model output corresponds to the averages across these simulations.

Table 28: *Simulated Model Regressions*

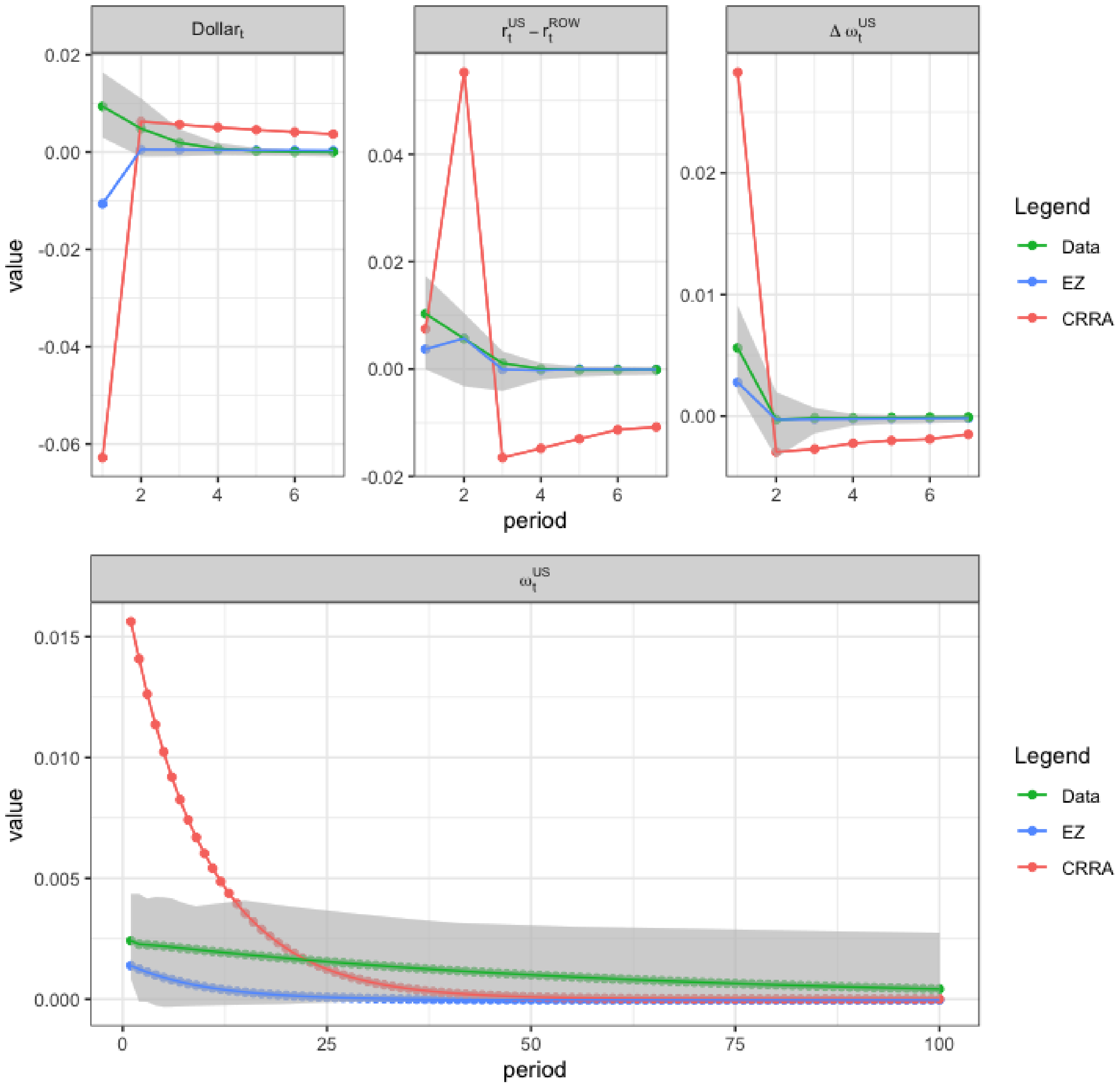
Description: Panel A reports the results from estimating univariate regressions of the US wealth share growth rate $\Delta\omega_t^{US}$ and US stock market outperformance $r_t^{US} - r_t^{ROW}$ against Δc_t^G using simulated data from the model and real data.

	Data	EZ	CRRA
Panel (a): Dependent Variable: $\Delta\omega_t^{US}$			
Δc_t^G	-0.170***	-0.480	-6.480
	(0.052)		
Panel (b): Dependent Variable: $r_t^{US} - r_t^{ROW}$			
Δc_t^G	-0.400***	-0.580	-5.880
	(0.137)		

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 40: *Model vs Empirical IRFs*

Description: This figure plots the IRFs to a 1 SD bad global shock ($\downarrow \xi_t^G$) for the baseline EZ model. The green line produces the empirical IRFs to a global consumption growth shock that recursively orders global consumption growth first. Online appendix contains further details. The blue line reproduces the model IRF from the baseline EZ model. The orange line produces model IRFs from the corresponding CRRA model.



Discussion: The model captures well the moderate countercyclicality of the US wealth share: in response to a 1% global consumption growth shock, $\Delta\omega_t^{US}$ increases by 48 basis points vs 17 basis points in the data. It also captures well the degree of US equity outperformance during global recessions: in response to a 1% decline in global consumption growth, the US stock market outperforms the ROW by 58 basis points versus 40 basis points in the data. Finally, EZ preferences are important: a corresponding CRRA model with low IES $\psi < 1$ does a far poorer job of quantitatively matching my wealth share facts.

Figure 40 provides further suggestive evidence that the model without global long-run risks quantitatively accounts for my novel US safety facts. For both levels and growth rates, the US wealth share increases on impact before subsequently decreasing in response to the bad global shock. The model response for both the US wealth share levels and growth rates is well contained within the 95% confidence bands associated with the empirical IRFs. The reason why the US wealth share rises in global recessions in the model is the same as in the data: the relative outperformance of US equities during the global recessions. This is depicted in the top middle panel of figure 40. US equity outperformance $(r_t^{US} - r_t^{ROW})$ increases on impact before subsequently decreasing, delivering a rising US wealth share during global recessions.

Dollar Dynamics and Global Long-Run Risks: Dollar dynamics are depicted in the top left panel of figure 40. Here the larger US exposure to global long-run risks becomes important: in the absence of this dimension of heterogeneity the model runs into the US safety puzzle, with the dollar counterfactually depreciating by approximately 1% in response to the bad global short-run shock. In the data the dollar appreciates moderately by approximately the same magnitude.

Motivated by my empirical evidence in section 3, I resolve the US safety puzzle by adding global long-run risks to the model. Since they are positively correlated with the global short-run shock, incorporating this additional dimension of heterogeneity inside the framework implies that US marginal utility can rise relative to the ROW during global downturns, even though US macro quantities are relatively insulated. This simple but novel insight is how the model resolves the tension between my US relative safety and countercyclical dollar dynamics. I calibrate the full model with expected global growth shocks and present the model IRFs in figure 41. The calibration choices for the additional parameters are $\mu_G = 0.00625$, $\rho_x = 0.75$, $\chi = 0.5$, $\tau_{L,H} - \tau_{L,F} = 0.5$.[20]

[20] μ_G is calibrated to match the historical mean for global growth expectations measured using OECD survey data. $\tau_{L,H} - \tau_{L,F}$ is calibrated to match the historical US macro premium reported in section 3. Finally ρ_x is moderate to ensure a well-defined ergodic pareto weight distribution.

Figure 41: *Global Long Run Risks Extension (EZ vs CRRA)*

Description: This figure plots the IRFs to a 1 standard deviation bad global shock in the augmented model with global long run shock. I show the response of the EZ model and the corresponding CRRA benchmark.

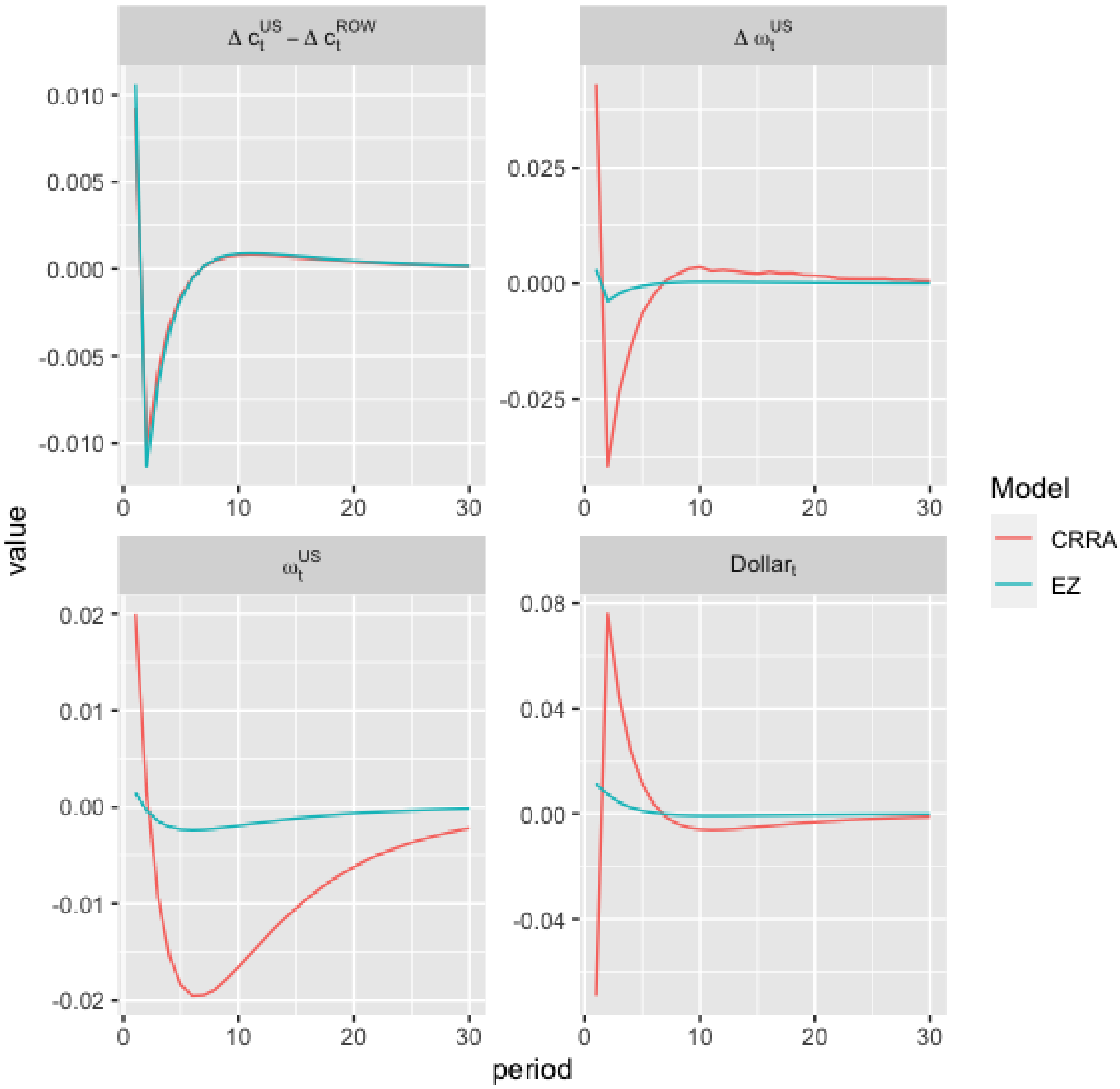


Figure 41 plots the impulse responses from the full model with global long-run risks. In response to a 1 standard deviation bad global short-run shock, the dollar now appreciates by approximately 1.5% before subsequently depreciating. This is consistent with the data: as evidenced by figure 40, the dollar appreciates by approximately 1% in response to a 1SD bad global shock. The model achieves this without compromising its ability to quantitatively match the other stylised facts.

To provide further validation for the full model, I compare model moments against their corresponding data counterparts in table 29. The simulated moments indicate that the model now captures the dollar's countercyclical dynamics: the correlation of -0.16 between the dollar appreciation rate $Dollar_t$ and global consumption growth Δc_t^G in the model is within the 90% bootstrapped confidence bands associated with the data.

Table 29: *Simulated vs Data Moments*

Description: This table compares data moments with simulated model moments. I compare the data against the CRRA benchmark, the baseline EZ model without global growth risks and finally the full EZ model with global growth risks. Parentheses capture 90% bootstrapped CIs for the data moments. Data moments for $\mathbb{E}_t \Delta GDP^G_{t,t+4}$ are computed using OECD survey data: it is defined as a cross-sectional average of country level one-year ahead growth forecasts.

	Original Data	*CRRA*	*EZ (No Global LRRs)*	*EZ (With Global LRRs)*
		Targeted Moments		
$\mathbb{E}_t \Delta GDP^G_{t,t+4}$	2.50	0.00	0.00	2.50
	[2.20, 2.98]			
$\Delta c_t^{US} - \Delta c_t^{ROW}$	0.94	0.00	0.00	1.14
	[0.64, 1.18]			
		Untargeted Moments		
$r_t^{US} - r_t^{ROW}$	2.03	8.12	-2.24	1.45
	[0.91, 4.31]			
$corr_t(r_t^{US} - r_t^{ROW}, \Delta c_t^G)$	-0.44	-0.86	-0.31	-0.25
	[-0.24, -0.69]			
$corr_t(\Delta \omega_t^{US}, \Delta c_t^G)$	-0.33	-0.79	-0.20	-0.13
	[-0.10, -0.41]			
$corr_t(Dollar_t, \Delta c_t^G)$	-0.40	0.80	0.31	-0.11
	[-0.08, -0.60]			
Note:		*p<0.1; **p<0.05; ***p<0.01		

US Macro Premium: In addition to matching the dollar's countercyclicality, the full model with global long-run risks can also generate an unconditional US macro premium, a targeted moment in the simulation exercise. Both the CRRA benchmark and the EZ model without global growth risks produces no difference in average consumption growths between the US and the ROW. The key force driving higher US relative consumption growths in the full model is the parameter μ_G, the unconditional mean of z_t^G: the state variable driving global growth expectations. Since the US good has higher exposure to expected global growth shocks ($\xi_{x,t}^G$), the parameter μ_G can be interpreted as a reduced form way of modelling the unconditional premium the US earns for their adverse exposure to these global long-run risks.

Discussions: Whilst the model is stylised, these simulation results communicate a novel insight. Whilst the US seems safe because of her low exposure to contemporaneous global macro risk, she is really a risky country because of her adverse exposure to a hidden source of global risk: expected global growth or global long-run risks. This section has shown that embedding this asymmetry in global risk exposures inside a two-country, two-good EZ model implies that US marginal utility can rise relative to the ROW during global downturns even though her macro quantities are relatively insulated. This key insight is how the framework can resolve the tension between my novel US safety facts and the dollar's countercyclical relationship with the global economy.

The model's success with dollar dynamics is noteworthy. Given the notorious difficulty in matching countercyclical dollar dynamics, the fact that embedding lower (larger) US exposure to global short-run (long-run) risks inside a simple frictionless EZ framework can reconcile this moment alongside my novel US safety facts is an important theoretical contribution. This recursive resolution of the dollar puzzle has received little emphasis thus far and builds on an existing international long run risk literature that resolves other well-known international finance puzzles using a multi-country, multi-good EZ framework with long run risks (Colacito and Croce, 2011, 2013; Colacito et al, 2018, 2021).

Nevertheless I do not shy away from the fact that the baseline model is stylised. Lower (larger) US exposure to global short-run (long-run) shocks was exogenously imposed as a model primitives in this simple endowment economy model. Establishing a microfoundation for these important model primitivies is undeniably important. In the upcoming section, I do exactly that: I build a richer general equilibrium model where country level growth prospects are endogenously generated by i) local innovation and ii) international technology adoption. This richer model microfounds these heterogenous global risk exposures as the equilibrium response to more aggressive US fiscal policy during global downturns. As will be shown soon, this fiscal mechanism can reconcile the dollar's countercyclical dynamics with all my novel US safety facts.

13.6 Calibration Discussion

Global Shock Exposure: US good is *less* exposed to the global shock: $\tau_H < \tau_F$. I normalise the difference in global shock exposures to 1 for simplicity.

Consumption Home Bias: The baseline calibration assumes a high level of consumption home bias which is consistent with existing empirical evidence in international macroeconomics. My chosen value of 0.98 is in line with standard calibration choices for home bias used in the open economy macro literature (Lewis, 2011).

Elasticity of Substitution: I choose a low elasticity of substitution across goods ϕ of 0.2. This choice is motivated by empirical evidence documenting a low elasticity of substitution across consumption goods (Couerdacier and Rey, 2013).

IES: I choose a high IES value of $\psi = 2$. This choice is motivated by standard calibration choices made in the international asset pricing literature using recursive preferences (Colacito and Croce, 2013; Colacito et al, 2018).

Cointegration: I calibrate the cointegration parameter β to 0.05. This is larger than standard calibrations in the recursive utility literature, where β is set to a smaller number.[21] I choose a slightly higher value to better match the empirical persistence of the US wealth share level.

Other Parameters: I set mean endowment growth $\mu = \mu_H = \mu_F = 0.005$. Since this is a quarterly calibration, this corresponds to an annualized mean growth of 2%, as commonly assumed in conventional calibrations.

[21] In Colacito and Croce (2013), $\beta = 0.005$. These calibration choices are also adopted by Colacito et al, 2018 and Colacito et al (2021)

13.7 Model Proofs

13.7.1 Price Level

Overview: The price level P_t^H for the home country is the solution to the following cost minimization problem:

$$\min_{\{C_{H,t}^H, C_{F,t}^H\}} p_t^H C_{H,t}^H + p_t^F C_{F,t}^H \tag{13.18}$$

subject to the consumption aggregator:

$$C_t^H = [\alpha^{\frac{1}{\phi}}(C_{H,t}^H)^{\frac{\phi-1}{\phi}} + (1-\alpha)^{\frac{1}{\phi}}(C_{F,t}^H)^{\frac{\phi-1}{\phi}}]^{\frac{\phi}{\phi-1}} \tag{13.19}$$

FOCs with respect to $C_{H,t}^H$ and $C_{F,t}^H$ imply:

$$P_t^F = \lambda_t(\alpha\frac{C_t^H}{C_{F,t}^H})^{\frac{1}{\phi}} \tag{13.20}$$

$$P_t^H = (\frac{C_t^H}{C_{F,t}^H})^{\frac{1}{\phi}} \tag{13.21}$$

This implies that the terms of trade (TOT) take the form:

$$TOT_t = \frac{p_t^H}{p_t^F} = (\frac{\alpha}{1-\alpha}\frac{c_{F,t}^H}{c_{H,t}^H})^{\frac{1}{\phi}} \tag{13.22}$$

Finally simple algebra can confirm that the home price level P_t^H takes the form:

$$\lambda_t = P_t^H = [\alpha(p_t^H)^{1-\phi} + (1-\alpha)(p_t^F)^{1-\phi}]^{\frac{1}{1-\phi}} \tag{13.23}$$

Going through symmetric steps for the foreign country yields:

$$\lambda_t^* = P_t^F = [(1-\alpha)(p_t^H)^{1-\phi} + \alpha(p_t^F)^{1-\phi}]^{\frac{1}{1-\phi}} \tag{13.24}$$

Note that since the home consumption basket as the global numeraire, $P_t^H = 1$. Thus Q_t^i: the relative price of country i's consumption in units of the global numeraire follows:

$$Q_t^i = \begin{cases} \mathcal{E}_t = [(1-\alpha)(p_t^H)^{1-\phi} + \alpha(p_t^F)^{1-\phi}]^{\frac{1}{1-\phi}} & \text{if } i = F \\ 1 & \text{if } i = H \end{cases} \tag{13.25}$$

13.7.2 Consumption FOCs

Overview: Since markets are dynamically complete internationally, I can rewrite the IBC (**??**) in a static form for the home investor:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \frac{\Lambda_t}{\Lambda_0} C_t^H \leq \mathbb{E}_0 \sum_{t=0}^{\infty} \frac{\Lambda_t}{\Lambda_0} W_t^i \tag{13.26}$$

Notice that $P_t^H = 1$ since the home consumption basket is the global numeraire. Λ_t is the world state price density that prices all assets in the world economy. Hence the problem for investor i can be rewritten as a time zero problem:

$$\begin{aligned} &\max_{\{C^i_{H,t}, C^i_{F,t}, W^i_{t+1}\}_{t=0}^{\infty}} U_0^i \\ s.t.\ &\mathbb{E}_0 \sum_{t=0}^{\infty} \frac{\Lambda_t}{\Lambda_0} C_t^H \leq \mathbb{E}_0 \sum_{t=0}^{\infty} \frac{\Lambda_t}{\Lambda_0} W_t^i \\ &C_t^H = p_t^H C_{H,t}^H + p_t^F C_{F,t}^H \end{aligned} \tag{13.27}$$

First order conditions associated with $C_{H,t}^H, C_{F,t}^H, C_{H,t}^F, C_{F,t}^F$ are as follows:

$$[C_{H,t}^H]: \ [\prod_{j=0}^{t-1} V_{2,j}^H] V_{1,t}^H (\alpha \frac{C_t^H}{C_{H,t}^H})^{\frac{1}{\phi}} = \mu^H \frac{\Lambda^t}{\Lambda_0} p_t^H \tag{13.28}$$

$$[C_{F,t}^H]: \ [\prod_{j=0}^{t-1} V_{2,j}^H] V_{1,t}^H [(1-\alpha) \frac{C_t^H}{c_{F,t}^H}]^{\frac{1}{\phi}} = \mu^H \frac{\Lambda^t}{\Lambda_0} p_t^F \tag{13.29}$$

$$[C_{H,t}^F]: \ [\prod_{j=0}^{t-1} V_{2,j}^F] V_{1,t}^F [(1-\alpha) \frac{C_t^F}{c_{H,t}^F}]^{\frac{1}{\phi}} = \mu^F \frac{\Lambda^t}{\Lambda_0} p_t^H \tag{13.30}$$

$$[C_{F,t}^F]: \ [\prod_{j=0}^{t-1} V_{2,j}^H] V_{1,t}^H (\alpha \frac{C_t^F}{C_{F,t}^F})^{\frac{1}{\phi}} = \mu^F \frac{\Lambda^t}{\Lambda_0} p_t^F \tag{13.31}$$

Here $V_{1,t}^i = \frac{\partial U_t^i}{\partial C_t^i}$ and $V_{2,t}^i = \frac{\partial U_t^i}{\partial U_{t+1}^i}$. Combining (13.28) with (13.30) yields:

$$p_t^H = [\prod_{j=0}^{t-1} V_{2,j}^H] V_{1,t}^H [\frac{\alpha C_t^H}{C_{H,t}^H}]^{\frac{1}{\phi}} \frac{1}{\mu^H \frac{\Lambda_t}{\Lambda_0}} = [\prod_{j=0}^{t-1} V_{2,j}^F] V_{1,t}^F [\frac{(1-\alpha) C_t^F}{C_{H,t}^F}]^{\frac{1}{\phi}} \frac{1}{\mu^F \frac{\Lambda_t}{\Lambda_0}} \tag{13.32}$$

$\frac{\Lambda_t}{\Lambda_0}$ can be pinned down by combining (13.28) and (13.29). Multiply both sides of (13.28) by $C^H_{H,t}$ and both sides of (13.29) by $C^H_{F,t}$ and adding the resulting products yield:

$$\mu^H \frac{\Lambda^t}{\Lambda_0}[p^H_t C^H_{H,t} + p^F_t C^H_{F,t}] = [\prod_{j=0}^{t-1} V^H_{2,j}] V^H_{1,t} (C^H_t)^{\frac{1}{\phi}} \underbrace{[\alpha^{\frac{1}{\phi}} (C^H_{H,t})^{\frac{\phi-1}{\phi}} + (1-\alpha)^{\frac{1}{\phi}} (C^H_{F,t})^{\frac{\phi-1}{\phi}}]}_{(C^H_t)^{\frac{\phi-1}{\phi}}}$$

Note by construction $p^H_t C^H_{H,t} + p^F_t C^H_{F,t} = C^H_t$. Further algebra pins down $\frac{\Lambda_t}{\Lambda_0}$:

$$\frac{\Lambda^t}{\Lambda_0} = \frac{[\prod_{j=0}^{t-1} V^H_{2,j}] V^H_{1,t}}{\mu^H} \tag{13.33}$$

As in Colacito and Croce (2013) and Anderson (2005), I write FOCs in terms of pseudo-pareto weight S_t. I define S_t as:

$$S_t = [\frac{(\prod_{j=0}^{t-1} V^H_{2,j}) V^H_{1,t}}{(\prod_{j=0}^{t-1} V^F_{2,j}) V^F_{1,t}} \frac{\mu^F}{\mu^H}]^{\phi} [\frac{C^H_t / C^H_{t-1}}{C^F_t / C^F_{t-1}}] \tag{13.34}$$

Recursively solving backwards yields the following law of motion for S_t:

$$S_t = S_{t-1} (\frac{M^H_t}{M^F_t})^{\phi} [\frac{C^H_t / C^H_{t-1}}{C^F_t / C^F_{t-1}}] \tag{13.35}$$

Combine (13.34) with (13.28) and (13.30). Also combine (13.34) with (13.29) and (13.31). This yields two systems of equations:

$$S_t \frac{\alpha}{1-\alpha} \frac{C^F_{H,t}}{C^H_{H,t}} = 1 \tag{13.36}$$

$$S_t \frac{1-\alpha}{\alpha} \frac{C^F_{F,t}}{C^H_{F,t}} = 1 \tag{13.37}$$

Combining (13.36) and (13.37) with the consumption market clearing conditions yields the presentation of the first order conditions described in the text:

$$C^H_{H,t} = X^H_t [\frac{S_t \frac{\alpha}{1-\alpha}}{1 + S_t \frac{\alpha}{1-\alpha}}] \tag{13.38}$$

$$C^H_{F,t} = X^F_t [\frac{S_t \frac{1-\alpha}{\alpha}}{1 + S_t \frac{1-\alpha}{\alpha}}] \tag{13.39}$$

$$C^F_{F,t} = \frac{X^F_t}{1 + S_t \frac{1-\alpha}{\alpha}} \tag{13.40}$$

$$C^F_{H,t} = \frac{X^H_t}{1 + S_t \frac{\alpha}{1-\alpha}} \tag{13.41}$$

13.8 Relative Prices

To characterise relative prices p_t^H and p_t^F, combine (13.32) and (13.33) yields the following expressions:

$$p_t^H = (\alpha \frac{C_t^H}{C_{H,t}^H})^{\frac{1}{\phi}} \tag{13.42}$$

$$p_t^F = [(1-\alpha)\frac{C_t^H}{C_{H,t}^H}]^{\frac{1}{\phi}} \tag{13.43}$$

13.8.1 S$_t$

In this section I tie S_t directly to two components: relative consumption growths $\mathcal{C}_t$ and the wealth share $\mathcal{W}_t$. I start by noticing that (13.33) is simply the product of past pricing kernels for the home investor up to a proportionality constant (μ^H). To see this note by definition that the home IMRS M_{t+1}^H is:

$$M_t^H = \frac{V_{2,t}V_{2,t-1}}{V_{1,t-1}} \tag{13.44}$$

Hence (13.33) can be rewritten as:

$$\frac{\Lambda^t}{\Lambda_0} = \frac{\prod_{j=0}^t M_j^H}{\mu^H} \tag{13.45}$$

Epstein and Zin (1989, 1991) have shown that $V_{2,t}^H$ and $V_{1,t}^H$ can be substituted out of M_t^H in terms of the aggregate wealth return $R_{m,t}^H$. They show that M_{t+1}^H takes the form:

$$M_t^H = \beta^\theta (\frac{C_t^H}{C_{t-1}^H})^{-\frac{\theta}{\psi}} R_{m,t}^{\theta-1} \tag{13.46}$$

Hence (13.33) can be written as:

$$\frac{\Lambda^t}{\Lambda_0} = \beta^{t\theta}(\frac{C_t^H}{C_0^H})^{-\frac{\theta}{\psi}}(\prod_{j=0}^t R_{m,j})^{\theta-1} \tag{13.47}$$

Hence *the past history of consumption and wealth shocks to the home investor drive the world SDF*. (13.47) can be used to rewrite S_t as:

$$S_t = (Y_t)^{1-\frac{\theta}{\psi}}(\frac{Y_{t-1}}{Y_0})^{-\frac{\theta}{\psi}}\prod_{j=0}^t R_{w,j}^{\theta-1} \tag{13.48}$$

Where:

$$Y_t = \frac{C_t^H}{C_t^F}$$
$$R_{w,t} = \frac{R_{w,t}^H}{R_{w,t}^F} \tag{13.49}$$

In log terms s_t is:

$$s_t = (1 - \frac{\theta}{\psi})y_t - \frac{\theta}{\psi}(y_{t-1} - y_0) + (\theta - 1)\sum_{j=0}^{t} r_{w,j} \tag{13.50}$$

Applying the Campbell-Shiller approximation implies:

$$s_t \approx (1 - \gamma)\sum_{j=0}^{t} \Delta y_j + \kappa_1(\theta - 1)\sum_{j=0}^{j=t} \omega_{w,j} \tag{13.51}$$

This is the expression in the main text.

13.8.2 Steady State Derivations

Wealth Returns: Wealth-consumption ratios is pinned down by the euler equation pricing aggregate wealth portfolios:

$$wc_t^i = \left[\mathbb{E}_t e^{\theta[ln\delta + (1-\frac{1}{\psi})\Delta c_{t+1}^i + log(1+wc_{t+1}^i)]}\right]^{\frac{1}{\theta}} \tag{13.52}$$

This implies that the steady state wealth-consumption ratio $\overline{wc} = \frac{\delta}{1-\delta}$. By construction aggregate wealth returns follow:

$$R_{m,t+1}^i = \frac{(1 + wc_{t+1}^i)e^{\Delta c_{t+1}^i}}{wc_t^i} \tag{13.53}$$

Thus the steady state wealth return $\overline{R}_m^i = \frac{1}{\delta}$.

Risky Asset Returns: Price-dividend ratios are pinned down by the euler equation pricing the endowment claims:

$$pd_t^i = \mathbb{E}_t e^{\theta ln\delta - \frac{\theta}{\psi}\Delta c_{t+1}^i + (\theta-1)log(R_{m,t+1}^i) + log(1+pd_{t+1}^i) + \Delta x_{t+1}^i} \tag{13.54}$$

This implies that steady state price-dividend ratios $\overline{pd} = \frac{\delta^{\theta} e^{(\theta-1)log(\overline{R}^i_m)}}{1-\delta^{\theta} e^{(\theta-1)log(\overline{R}^i_m)}} = \frac{\delta}{1-\delta}$ By construction aggregate wealth returns follow:

$$R^i_{m,t+1} = \frac{(1 + wc^i_{t+1})e^{\Delta c^i_{t+1}}}{wc^i_t} \tag{13.55}$$

Thus the steady state risky asset returns $\overline{\mu}^i = \frac{1}{\delta}$.

13.9 FX Decomposition Proofs

Risk-Sharing Condition: Since international financial markets are dynamically complete, both the home and foreign SDF will price the wealth portfolios of each country. For simplicity I use the home SDF to price the home wealth portfolio and the foreign SDF to price the foreign wealth portfolio. This implies the following asset pricing restrictions hold:

$$\mathbb{E}_t[e^{m^H_{t+1}+r^H_{m,t+1}}] = 1 \tag{13.56}$$

$$\mathbb{E}_t[e^{m^F_{t+1}+r^F_{m,t+1}}] = 1 \tag{13.57}$$

SDF: For recursive utility, the equilibrium SDF for country i follows:

$$m^i_{t+1} = \theta ln\delta - \frac{\theta}{\psi}\Delta c^i_{t+1} + (\theta - 1)r^i_{m,t+1} \tag{13.58}$$

Utilizing the Campbell-Shiller (1989) approximation, $r^H_{m,t+1}$ follows:

$$r^i_{m,t+1} = \kappa_0 + \kappa_1 wc_{i,t+1} - wc_{i,t} + \Delta c^i_{t+1} \tag{13.59}$$

$wc_{i,t}$ is the log wealth-consumption ratio for country i. Plugging (13.59) into (13.59) implies that SDF shocks follow:

$$\tilde{m}^i_{m,t+1} = \underbrace{(\theta - 1 - \frac{\theta}{\psi})}_{-\gamma}\Delta\tilde{c}^i_{t+1} + (\theta - 1)\kappa_1 \tilde{wc}_{i,t+1} \tag{13.60}$$

Notice that the log wealth-consumption ratio $wc_{i,t+1}$ can be decomposed into a wealth and consumption component:

$$wc_{i,t+1} = \omega_{i,t+1} - c^i_{t+1} \tag{13.61}$$

$\omega_{i,t}$ is the log wealth for country i. Plugging this back into yields:

$$\tilde{m}^i_{t+1} = -\eta \Delta \tilde{c}^i_{t+1} - \kappa_1(1-\theta)\tilde{\omega}_{i,t+1} \tag{13.62}$$

η follows:

$$\eta = \gamma - \kappa_1(1-\theta) \tag{13.63}$$

Exchange Rates: Since international financial markets are dynamically complete, the following perfect international risk sharing condition must hold:

$$\tilde{\mathcal{E}}_t = \tilde{m}^F_{t+1} - \tilde{m}^H_{t+1} \tag{13.64}$$

Substituting (13.62) back into (13.58) and substituting in endowment processes yields the desired result:

$$\tilde{\mathcal{E}}_{t+1} \approx \eta(\xi^H_{t+1} - \xi^F_{t+1} + (\kappa_F - \kappa_H)\xi^G_{t+1}) + \kappa_1(1-\theta)\underbrace{(\tilde{\omega}^H_{t+1} - \tilde{\omega}^F_{t+1})}_{\tilde{W}_{t+1}} \tag{13.65}$$

13.10 Comparative Statics

Figure 42: *Role of EZ Preferences*

Description: This figure plots the IRFs to a 1 SD bad global shock ($\downarrow \xi_t^G$) for the baseline EZ model when the IES (ψ) is varied. The orange line ($\gamma = \frac{1}{\psi} \approx 0.14$) corresponds to the CRRA benchmark. The green, blue and purple lines coincide with higher IES cases that imply a preference for early resolution of uncertainty: $\psi = 0.5, 1.5, 2$ respectively.

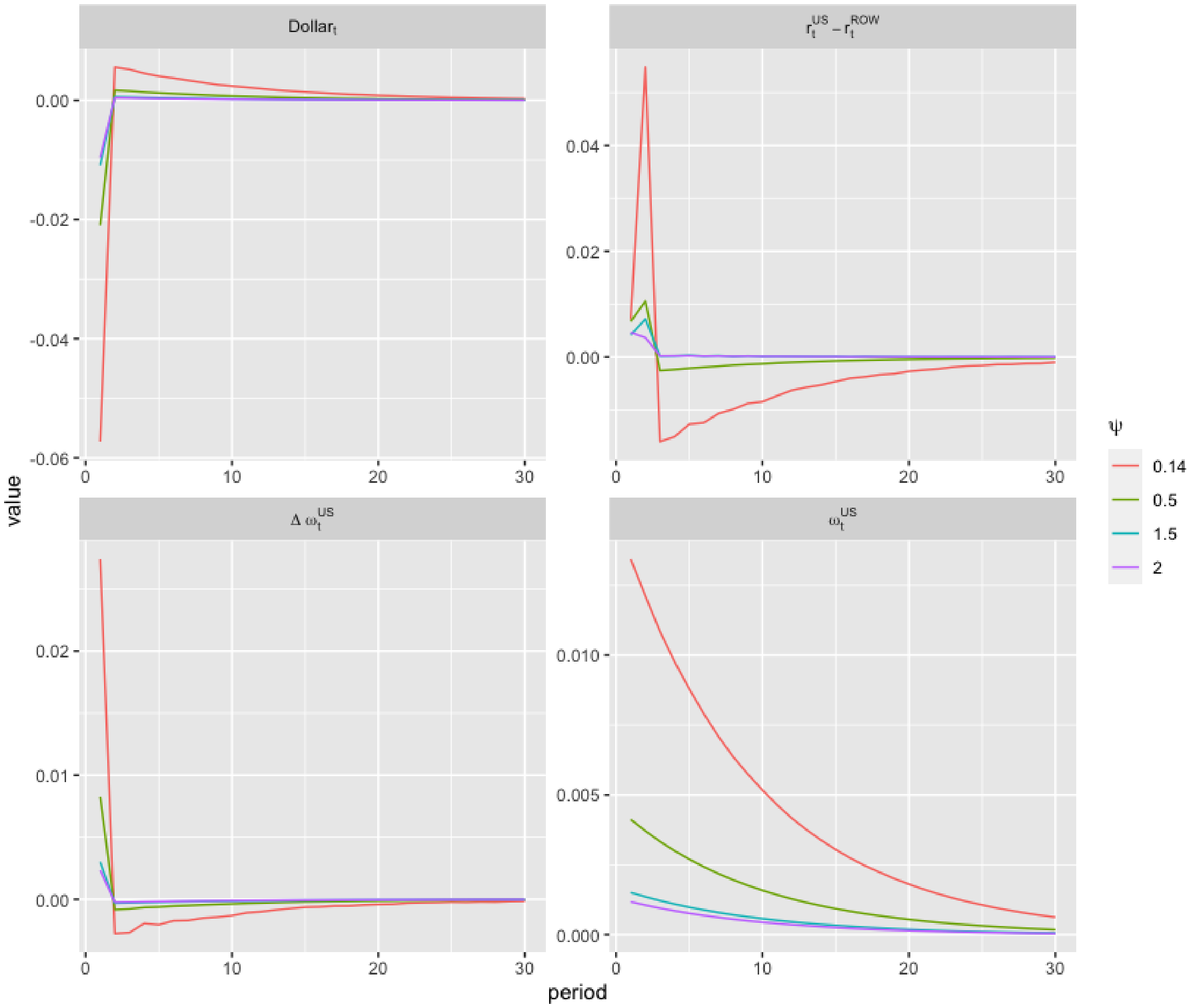


Figure 43: *Role of Consumption home Bias*

Description: This figure plots the IRFs to a 1 SD bad global shock ($\downarrow \xi_t^G$) for the baseline EZ model when the consumption home bias parameter (α) is varied. The orange line, green, blue and purple lines coincide with cases of increasing levels of home bias where $\alpha = 0.75, 0.85, 0.95, 0.995$ respectively.

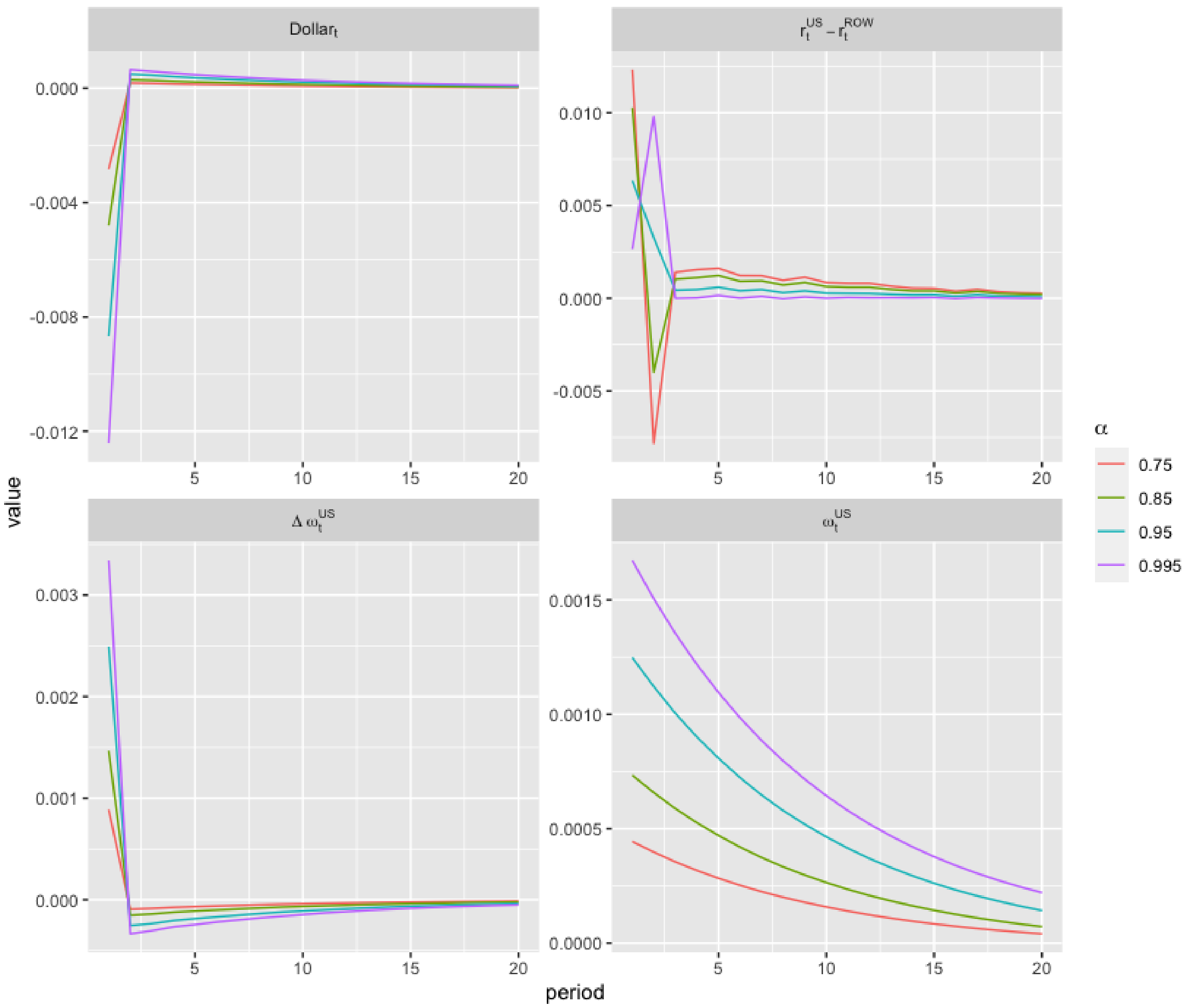
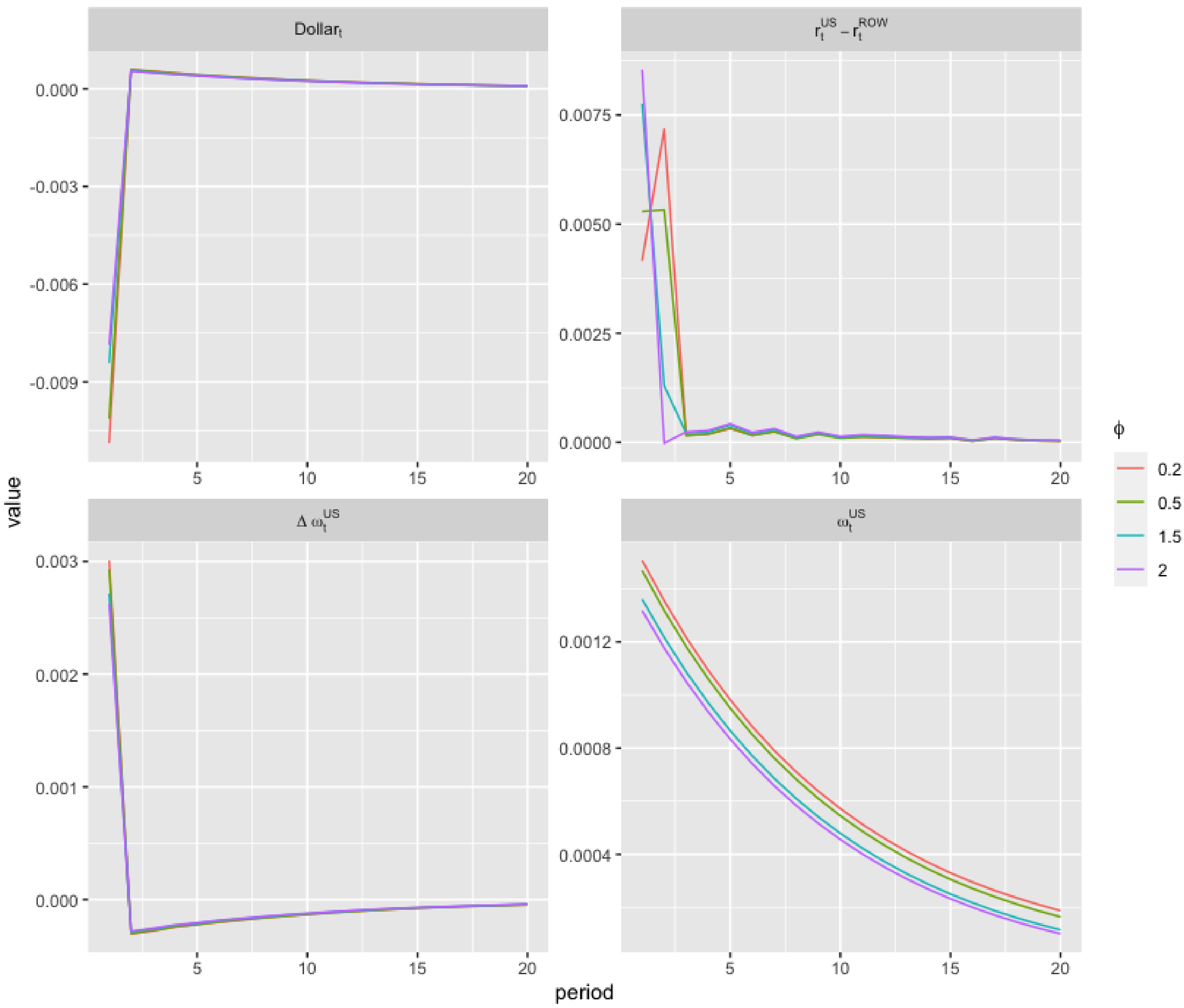


Figure 44: *Role of Elasticity of Substitution Across Goods*

Description: This figure plots the IRFs to a 1 SD bad global shock ($\downarrow\ \xi_t^G$) for the baseline EZ model when the elasticity of substitution across goods (ϕ) is varied. The orange line, green, blue and purple lines coincide with cases of increasing levels of substitution where $\phi = 0.2, 0.5, 1.5, 2$ respectively.

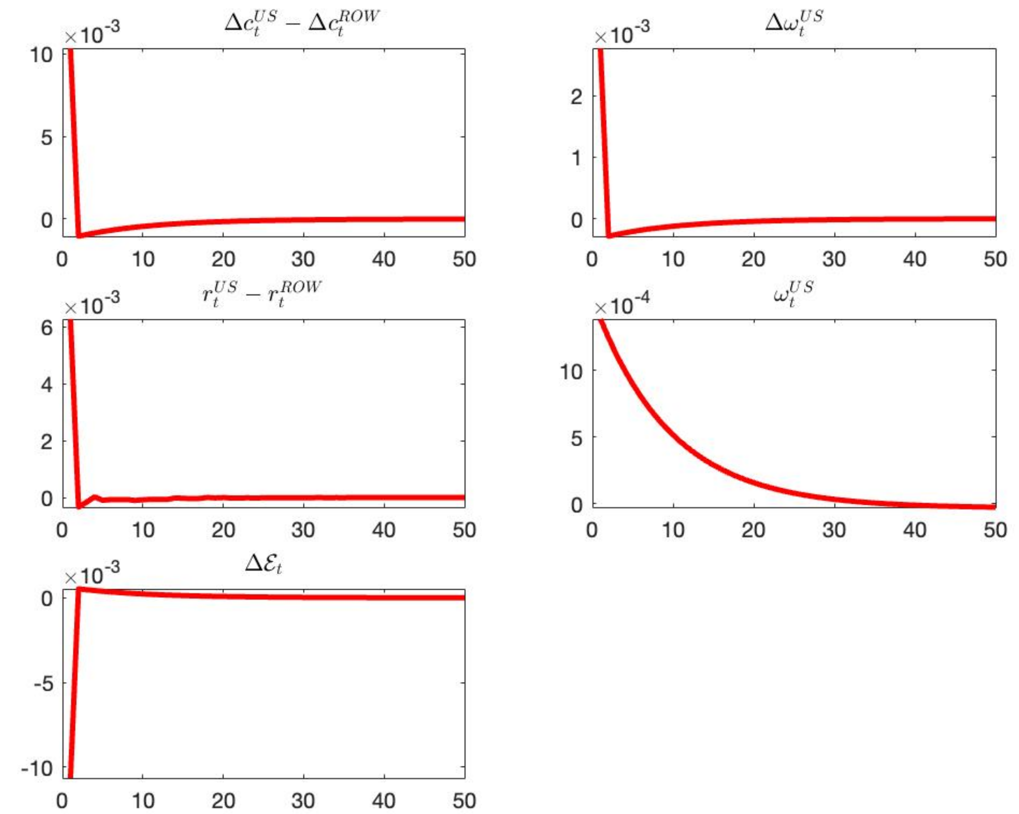


13.11 Other Model Output

13.11.1 IRFs to Bad Home Shock

Figure 45: *Impulse response to a bad home shock for baseline EZ model*

Description: This figure plots the IRFs to a 1 standard deviation bad home shock ($\downarrow \xi_t^H$ by 1%). The left column plots the responses to relative consumption growths ($\Delta c_t^H - \Delta c_t^F$), equity return differentials ($r_t^H - r_t^F$) and exchange rate growth ($\Delta \mathcal{E}_t$). The second column plots the response to US wealth share growth ($\Delta \omega_t^{US}$) and the level of the US wealth share (ω_t^{US})



13.11.2 IRFs to Bad Foreign Shock

Figure 46: *Impulse response to a bad foreign shock in baseline EZ model*

Description: This figure plots the IRFs to a 1% bad home shock ($\downarrow \xi_t^F$ by 1%). The left column plots the responses to relative consumption growths ($\Delta c_t^H - \Delta c_t^F$), equity return differentials ($r_t^H - r_t^F$) and exchange rate growth ($\Delta \mathcal{E}_t$). The second column plots the response to US wealth share growth ($\Delta \omega_t^{US}$) and the level of the US wealth share (ω_t^{US})