Equity Home Bias when Firms are Indebted*

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Abstract

Generally, labor earnings depend on the financial leverage of firms. We account for this to revisit the classical and debated argument according to which equity home bias is the consequence of investors seeking to insure against idiosyncratic changes in their labor income. In an otherwise standard international macro model with portfolio choice, leverage has real effects on the labor market and households' risk sharing motives through the credit spread. Driven by two types of technology shocks and financial shocks, this model suggests that leverage reduces the appetite for domestic equities. This result is consistent with the negative correlation between the change in equity home bias and that in the credit to non-financial corporations found in advanced economies' data for the period 1980 through 2018.

JEL classification: E2, F4, G11, G15
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1 Introduction

The equity home bias puzzle (French and Poterba, 1991), which traditionally refers to countries holding less foreign equities than predicted by the sizes of their stock markets relative to the global stock market capitalization, is one of the major puzzles in international macroeconomics. It reveals extant obstacles to the movement of capital across borders that are at odds with the actual financial globalization, and, as surveyed by Coeurdacier and Rey (2013), the literature examines such obstacles in several ways.

Despite this, little is known about the role played by the capital structure of firms and their financial leverage, while leverage has been under the spotlight during the last couple of decades. Having become one of the primary determinants of advanced economies' business cycle (Jordà et al., 2017), leverage affects the propagation of risk in the economy and can be a source of uncertainty itself. Thus, we attempt to shed some light on how leverage could affect the risk sharing motives behind financial globalization. In particular, we reexamine the debated idea that equity home bias arises from the need of a country's investors to insure against idiosyncratic changes in their labor income (Baxter and Jermann, 1997; Bottazzi et al., 1996; Bretscher et al., 2016) in light of the well-documented effects of leverage on labor market dynamics.[1] We start by providing an empirical motivation, and then we build an open economy portfolio model.

In our empirical analysis, we collect data for the advanced economies over the period 1980 through 2018, measuring their equity home bias and the reliance of their non-financial corporations on external credit. The former tended to decline over time, whereas the latter tended to increase.[2] We estimate standard panel regressions and find signs of a significant, negative conditional correlation between the two variables. Moreover, this negative correlation is not dwarfed by traditional determinants of the equity home bias, such as trade in goods and services, the depth of the stock market, the size of countries or the real exchange rate, and stands other robustness checks as well.

In our theoretical analysis, we move away from the Modigliani-Miller theorem that typically applies in international portfolio models either implicitly or explicitly. Under this assumption, not only is the value of firms independent of the issuance of corporate debt, but also the labor earnings should be uncorrelated with corporate leverage, which is counterfactual (Michaels

[1]See, for instance, Pagano and Pica (2012), Boeri et al. (2013), Petrosky-Nadeau (2014), Chodorow-Reich (2014), Bentolila et al. (2018), Quadrini and Sun (2018), Michaels et al. (2019), Benmelech et al. (2021), Mehrotra and Sergeyev (2021).

[2]The decline in advanced economies' equity home bias was already documented by Coeurdacier and Rey (2013).

et al., 2019). Working on an extension of their two-country model, Coeurdacier et al. (2010) confirm that, if firms issue debt under the Modigliani-Miller theorem, households' preference for domestic stocks is equivalent to that in a model without corporate debt. In particular, households display equity home bias because of the redistributive effects that trade in goods and investment dynamics generate in response to technology shocks, as discussed in the literature. Conversely, we build on Jermann and Quadrini (2012) and assume that corporate debt is not perfectly enforceable, and it involves both bond financing and working capital loans for hiring labor, bond financing being tax advantaged (Hennessy and Whited, 2005) and physical capital being pledged as collateral. For the rest, our model is comparable to that of Coeurdacier et al. (2010): each country sells a differentiated product, there is home bias in tastes, and there are two types of technology shocks, standard productivity shocks and investment specific shocks.

For starters, we consider a baseline version of our model, that is tractable enough to build some analytic intuition. To this end, we assume that equities are the only assets that are traded across the border, and there are no shocks specific to corporate debt; the only shocks are the technology shocks. Therefore, markets are incomplete for two reasons. One is the exogenous incompleteness due to equities being insufficient to hedge against all the aggregate uncertainty. The other is the endogenous incompleteness stemming from the borrowing constraints.

We show that this framework is able to generate a negative relationship between the external credit to firms and the households' appetite for domestic equities because corporate leverage entails risks that affect labor (or the real wage) in equilibrium. Such risks are captured by movements in the credit spread, which turns out to be a determinant of the overall income of a country's households (relative to foreign households) through the (relative) demand for labor. The intuition is that the credit spread can mitigate the effects of technology shocks. For example, a positive technology shock occurring in a country makes it less convenient for that country's firms to finance themselves through bonds rather than equity. On impact, firms have either more revenues (productivity shocks) or less costs (investment shocks) but the same real stock of pledgeable collateral. Therefore, although borrowing would allow firms to quickly take advantage of the favorable cycle by hiring workers and expanding production, lenders recognize that satisfying this demand for credit is risky and charge a high credit spread. As debt is more costly, initially firms rely substantially on retained earnings, deferring debt financing and hiring.

The reason why this mechanism matters for risk sharing is the key assumption that agents' preferences are nonseparable in consumption and leisure, in the sense of Greenwood et al. (1988)

(GHH preferences), and, hence, households' labor effort plays a role in asset pricing.

In an extended version of our model, we introduce two main generalizations. First, we introduce financial shocks to make the liquidation value of capital time-varying and acknowledge that the period spanned by our empirical sample is plenty of severe financial market disruptions. Second, we allow households to trade bonds as well as equities, given that the former are particularly suitable to hedge against changes in the real exchange rate (Fidora et al., 2007; Engel and Matsumoto, 2009; Coeurdacier and Gourinchas, 2016).[3] The most novel result is that the mechanism through which corporate leverage abates the relative demand for domestic stocks is complemented by the stochastic component of leverage, that is, by the financial shocks. The intuition is that the latter shocks compete with the technology shocks in driving firm investment but affect credit spreads in the opposite direction. Moreover, our extensions allow us to remove any potential influence of the size of the shocks on households' portfolio choice, as we can contemplate the case in which markets are incomplete endogenously but not exogenously. However, we do not find this feature to be decisive.

Literature review. This paper is related to several strands of the literature. To start with, there is the extensive literature on equity home bias. To make some examples, the literature attributes the equity home bias to transaction and information costs (e.g., Ahearne et al., 2004; Portes and Rey, 2005; Van Nieuwerburgh and Veldkamp, 2009; Tille and van Wincoop, 2010, 2014; De Marco et al., 2018), the exchange rate risk (e.g., Cooper and Kaplanis, 1994; Fidora et al., 2007; Engel and Matsumoto, 2009; Benigno and Nisticò, 2012; Burger et al., 2018; Maggiori et al., 2020), and trade in differentiated products (e.g., Obstfeld and Rogoff, 2001; Kollmann, 2006; Pavlova and Rigobon, 2007; Coeurdacier, 2009; Heathcote and Perri, 2013; Steinberg, 2018; Khalil, 2019; Hu, 2020). Our paper focuses instead on the contribution of corporate leverage, but in our empirical analysis we control for some of those determinants. Specifically, we control for capital account openness, trade openness and real exchange rates, among others. Moreover, our model embeds the trade channel highlighted by Heathcote and Perri (2013), which rests on product market differentiation, as open economy macro models with homogeneous goods tend to predict a preference for foreign rather than domestic stocks (Baxter and Jermann, 1997). Under the classical assumptions of Cole and Obstfeld (1991), the presence of the trade channel ensures that agents prefer to hold domestic equities because the response of capital accumulation to a productivity shock makes them a good hedge against the labor income risk. However, this result is lost under

[3] To be precise, Engel and Matsumoto (2009) build a model with derivatives. However, these derivatives help in managing the exchange rate risk as well as do bonds. See also Devereux et al. (2020).

more general assumptions, so we recover a strong preference for domestic equities by adding investment shocks and trade in bonds, as in Coeurdacier et al. (2010).

Preferences that are nonseparable in consumption and leisure are not common in international portfolio choice models. Jermann (2002) abstracts from trade in goods but stresses that the nonseparability between consumption and leisure helps in justifying the households' motives to hedge their labor income risk through equity home bias. We also highlight the importance of nonseparable preferences but for completely different reasons. We show that, as in the literature, equity home bias is supported by trade openness and investment dynamics, despite our departure from the standard assumption of separable preferences. GHH preferences are instead a simple way to capture households' concern for corporate leverage.[4] This is consistent with small open economy models where firms face borrowing constraints (Mendoza, 2010).

Our paper is also related to recent corporate finance studies such as that of Michaels et al. (2019), which suggests that entrepreneurs are unwilling to insure their workers against the adverse effects of business cycles, given that labor earnings decrease with financial leverage in the data. A justification for this finding is the determination of wages. Specifically, in Michaels et al. (2019) the bargained wage is decreasing in the default risk entailed in leverage, as is also the case in Quadrini and Sun (2018). We make a related argument, but the channel is more conventional—with corporate credit spreads affecting the working capital—and allows for simple comparisons between the predictions of our model and those of a benchmark that satisfies the Modigliani-Miller theorem.[5] In an interesting analysis of the amplification mechanism of financial frictions, Bocola and Lorenzoni (2020) use the working capital channel to show that high credit spreads discourage entrepreneurs from insuring their workers even in a general equilibrium with complete markets.

The rest of the paper is structured as follows. Section 2 describes the main empirical facts and regression analysis. Section 3 presents the model and builds analytic intuition. Section 4 provides the calibration of the model, and Section 5 shows the results. Section 6 extends the model and the numerical analysis, and, finally, Section 7 concludes the paper.

[4]From this point of view, our work is close in spirit to that on the supply side of labor market responses to cyclical fluctuations and crises (e.g., Galí et al., 2007; Aguiar et al., 2013; Karabarbounis, 2014). Moreover, the assumption of GHH utility functions is supported by the data (e.g., Schmitt-Grohé and Uribe, 2012).

[5]While not widespread in international portfolio choice models, the working capital channel is conventional in the analysis of emerging countries' business cycles since Neumeyer and Perri (2005) and Uribe and Yue (2006), but generally such an analysis does not endogenize the capital structure of firms. Moreover, assuming that firms need to accumulate liquid assets for hiring workers (e.g., Bacchetta et al., 2019) would be a less parsimonious alternative to the working capital channel.

2 Empirical Evidence

In this section, we examine the empirical relationship between equity home bias and non-financial corporate credit, and, to prevent this relationship from being part of others in the literature, we account for several control variables (trade, population, etc.) in our regressions. Non-financial corporate credit (NFCC) is the break-adjusted level of total credit to non-financial corporations as a percentage of GDP. Even though the NFCC is available at the quarterly frequency, the data for estimating home bias and several control variables are annual. Therefore, we average the NFCC over the year. Following Warnock (2002) and subsequent literature, the equity home bias index (EHB) measures the extent to which a country's actual holdings of foreign equities deviate from the level suggested by the size of such a country's stock market relative to the global stock market capitalization. We obtain the portfolio equity flows from the updated Lane and Milesi-Ferretti (2017) dataset, and we detail the construction of the EHB, along with a description of all the variables and data sources, in Appendix A.

Our primary focus is a sample of 19 advanced economies, which spans the period from 1980 to 2018 and, as is customary in the literature, excludes the *financial centers*. Our country classification follows the one of Lane and Milesi-Ferretti (2018). The justification for limiting the analysis to the advanced economies is a mix of analytical design and data availability. First, our attempt is to introduce corporate leverage in the analysis of the international equity portfolio choices made by investors. Therefore, there is a further aspect to consider, which pertains more to the firms: emerging countries borrow substantially in foreign currency. Capturing this well-known fact is not common in the literature, which generally relies on a fair degree of symmetry between countries, and would blur our original goal. Second, limited data availability impedes extending the sample to a relevant number of emerging countries.[6]

We obtain the sample of 19 countries from an original one of 27 countries. We immediately drop Ireland and Luxembourg because they are two outliers in our dataset; their EHBs exceed 100% for all the available years.[7] The number of countries drops further from 25 to 19 when excluding the financial centers: Belgium, Hong Kong, the Netherlands, Singapore, Switzerland, and the United Kingdom. Besides being a practice adopted in the literature, the exclusion of the

[6]Given the need to have sufficient information on both the NFCC and the components of the EHB, there are only five emerging countries that could be included in the analysis (Argentina, Mexico, Poland, Thailand and Turkey). For all of them, the time series span more than half of our sample.

[7]This strategy is similar to that of Fidora et al. (2007), who work with censored data and, as us, need to entirely exclude Ireland and Luxembourg. However, after dropping them and cleaning the data as indicated in Appendix A, there is no need for censoring in our case. The EHBs of the remaining 25 countries are all within 0-100%.

financial centers is intuitively justifiable in our case. That is, one can reasonably expect the home bias of a financial center (or lack of it) to be much less related to the capital structure of the local nonfinancial corporations than the home bias of a country that is not a financial center.

We label the panel of 19 countries as MAIN. Although it is quite comprehensive, MAIN is an unbalanced panel, and one reason for this is that there are countries that have only recently entered the group of advanced economies (e.g., the Czech Republic, Greece and Israel).[8] The time series are shorter in these cases. All in all, to check the robustness of our results, we also consider a mostly balanced sample of 12 countries (BS) and the full sample of 25 countries (FS).

2.1 Stylized Facts and Empirical Model

Our panel regression analysis tests the correlation between EHB and NFCC as follows:

$$\Delta_k EHB_{i,t} = \beta_0 + \alpha_i + \vartheta_t + \beta_1 \cdot \Delta_k NFCC_{i,t} + \boldsymbol{\beta}_2' \cdot \Delta_k \boldsymbol{X}_{i,t} + \varepsilon_{i,t}, \tag{1}$$

which controls for a set of alternative factors ($\boldsymbol{X}_{i,t}$) as well as for both country and time fixed effects (α_i and ϑ_t, respectively). Following Heathcote and Perri (2013), we express the variables in changes over a time window of size k (Δ_k).

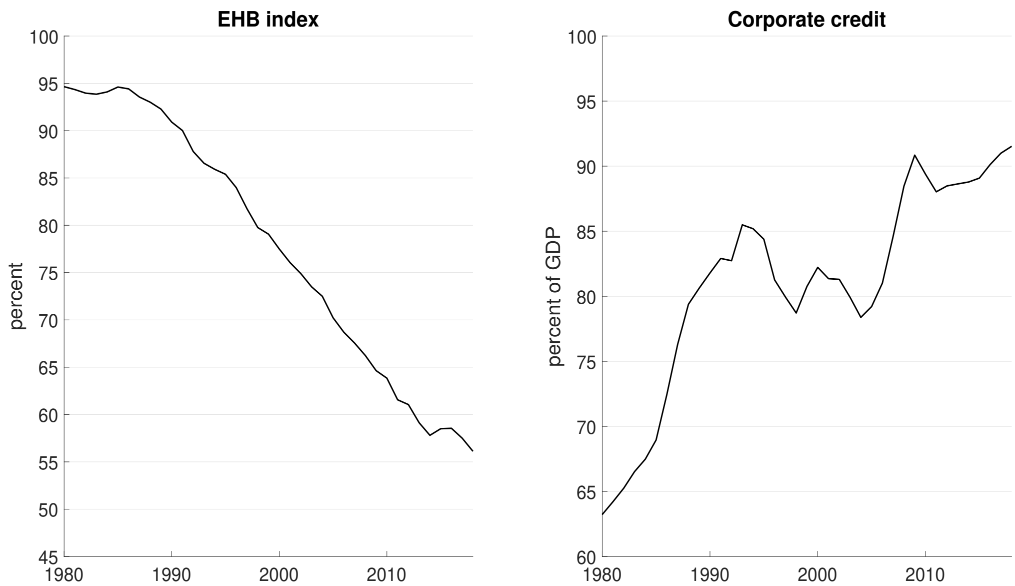


Figure 1: GDP-weighted average EHB and NFCC in the MAIN sample.

[8]Note that Hnatkovska (2019), who relies on a more conventional country classification than us, treats Korea and Israel as emerging countries and confirms the decline in their EHBs.

We work with differenced data to remove clear trends and still conduct a dynamic analysis. Figure 1 shows the average evolution of EHB and NFCC through time, using GDP weights. There is domestic bias in that the average EHB is positive but monotonously decreasing since the late 1980s. The magnitude of the decline is quite significant as EHB decreases from 95% to about 56%, suggesting an important increase in equity investment abroad across the board. Table B.1 shows that the latest available EHB is even smaller for such countries as Germany (47%), Italy (33%), New Zealand (45%) and Portugal (41%). On the other hand, the average NFCC displays a tendency to increase in Figure 1. The increase is again substantial, going from almost 65% to just above 90%, and is almost always continued, except for a few years after the mid-1990s. Overall, there is a potentially negative correlation between EHB and NFCC that is not a purely cross-sectional phenomenon, implying the need to deal with the time trends.

We do so by conducting a fixed-effect analysis on 5-year differenced data (i.e., $k = 5$), while a dynamic GMM estimation is ruled out by the number of countries being smaller than that of years. Also, we check the robustness of our results setting $k = 3$ and $k = 7$ as well.

The control variables $\boldsymbol{X}_{i,t}$ include other possible determinants of equity investment abroad. These are: the trade share (a ratio of exports and imports to GDP); the stock market capitalization (as a ratio of GDP); the Chinn-Ito index of financial openness; the log of population as a proxy for country size; the log of GDP per capita as a proxy for development; the correlation of country i's GDP with that of the other countries in the sample; and the log of the real exchange rate (RER).[9]

2.2 Regression Analysis

To start with, Table 1 shows the estimates of a baseline version of eq. (1), which excludes the control variables. To give a sense of their robustness, the table reports the results not only for the MAIN sample, but also for the alternative samples (FS and BS). All regressions contain country fixed effects and time effects, and the standard errors are double-clustered at the country and year levels. The regression coefficient between EHB and NFCC is negative and highly significant, being -0.27 in our MAIN sample. While the inclusion of the financial centers reduces the point estimate in absolute value, this remains robustly negative and significant. Thus, an increase in stock market investment abroad seems to be correlated with an increase in corporate

[9]We use the Chinn-Ito index, which is a single measure of all capital account restrictions, for convenience. A measure of restrictions that can distinguish between different types of portfolio flows, such as that of Fernández Martin et al. (2016), may perform better, but it spans a short time period. Moreover, it is well known that restrictions that arise from information costs tend to matter more than regulatory restrictions, but controlling for information costs requires the use of specific indicators or gravity models for the analysis of bilateral portfolio flows (see, e.g., Ahearne et al., 2004; Portes and Rey, 2005). This is at odds with the NFCC being inherently country-specific.

debt, besides being similar in size (Figure 1 and Table B.2).

Table 1: Regressions without controls, using 5-year differenced data, for the MAIN and alternative (FS and BS) samples of countries.

VARIABLES	(1) EHB	(2) EHB	(3) EHB
NFCC	-0.267***	-0.187***	-0.299***
	(-3.224)	(-3.059)	(-3.193)
Constant	-0.544	2.732***	-5.325***
	(-1.001)	(5.763)	(-8.171)
Observations	468	601	393
R-squared	0.286	0.226	0.288
SAMPLE	MAIN	FS	BS

*** p<0.01, ** p<0.05, * p<0.1; t-statistics in parentheses; country fixed effects and time effects as well as standard errors clustered by both country and time in all the regressions.

Next, continuing for brevity only with the MAIN sample, let us turn to the full version of eq. (1). Table 2 presents various regressions, as we first include each control variable at a time (columns 1-7) and, then, all of them simultaneously (column 8). The estimated β_1 remains robust both economically and statistically in all the cases.

Regarding the control variables, we expect the EHB to fall as trade openness increases and capital account restrictions are removed (i.e., a higher Chinn-Ito index). Moreover, residents of countries which either comove strongly with other countries in the world, have larger stock markets, or are highly exposed to the RER risk should find investing abroad substantially ineffective in terms of risk sharing. On the contrary, EHB should be small for countries which are relatively smaller in size or more developed, as they tend to be more open. Our results in Table 2 confirm these priors only for stock market capitalization, population and the RER; the effect of all the other variables is statistically insignificant.

Appendix B shows that our results are robust to the use of alternative samples (Table B.4 for FS and Table B.5 for BS) and to the choice of k for differencing the data (Tables B.6-B.7). Two additional findings are worth mentioning. First, the Chinn-Ito index and trade share turn out to be statistically significant, carrying the correct sign, for the BS sample. The BS sample is the one that better approximates the sample in Heathcote and Perri (2013), who emphasize the positive correlation between portfolio diversification and trade openness. Second, the effect of the RER becomes statistically insignificant when differencing the data over the shortest window ($k = 3$). Coherently, Benigno and Nisticò (2012) show that equity home bias can arise as a means

Table 2: Regressions with controls, using 5-year differenced data, for the MAIN sample of countries.

VARIABLES	(1) EHB	(2) EHB	(3) EHB	(4) EHB	(5) EHB	(6) EHB	(7) EHB	(8) EHB
NFCC	-0.268***	-0.283***	-0.265***	-0.323***	-0.270***	-0.267***	-0.248***	-0.315***
	(-3.252)	(-3.425)	(-3.105)	(-3.462)	(-3.293)	(-3.320)	(-3.314)	(-3.832)
Trade share	0.221*							-0.020
	(1.895)							(-0.136)
Chinn-Ito		1.496						-0.430
		(0.468)						(-0.130)
Market cap./GDP			0.073***					0.070***
			(3.596)					(3.422)
Log population				136.848**				142.768**
				(2.596)				(2.815)
GDP correlation					-0.177			-0.179
					(-0.199)			(-0.211)
Log GDP per capita						0.751		6.563
						(0.073)		(0.679)
Log RER							13.236**	13.172**
							(2.834)	(2.359)
Constant	-0.855*	-0.585	4.957***	-4.436***	-0.434	-0.616	-10.308***	-15.103***
	(-1.841)	(-0.975)	(9.625)	(-2.959)	(-0.601)	(-0.667)	(-3.092)	(-3.325)
Observations	468	455	466	468	468	468	468	453
R-squared	0.289	0.297	0.309	0.303	0.286	0.286	0.325	0.372
SAMPLE	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN

*** $p<0.01$, ** $p<0.05$, * $p<0.1$; t-statistics in parentheses; country fixed effects and time effects as well as standard errors clustered by both country and time in all the regressions.

of hedging against the long-run RER risk as opposed to its short-run component. Overall, our findings are more generally connected to the following three results from the empirical works of Fidora et al. (2007) and Khalil (2019) on both equity and bond holdings: the effect of trade is at best marginal when the RER is taken into account; the RER risk has a small effect on the domestic bias in equities as opposed to that in bonds; the effect of trade on foreign equity holdings is less clear than that on foreign bond holdings. In any case, all our estimations speak with a single voice regarding the negative link between NFCC and EHB, which we attempt to rationalize in the rest of this paper, abstracting from country size for simplicity.

3 Model

3.1 Firms

Consider a world made of two countries, Home and Foreign, which are indexed by i (i.e., $i = H, F$). Each country's firms combine internal and external financing to invest and produce internationally differentiated, tradable goods. The price of good i is denoted by $p_{i,t}$.

Each firm has access to both equity and debt financing, with the latter being characterized adapting the debt contract in Jermann and Quadrini (2012). Equities entitle the stockholders to receive a share of the profits of the firm. In turn, debt is subdivided into *intra*temporal liabilities and *inter*temporal liabilities. The latter are zero-coupon bonds, which entitle the bondholders at time t to receive one unit of country i's goods at $t+1$, whereas the former are loans completed within t. Equity shares can be traded across borders.

Debt financing, and in particular bond financing, exhibits different features from equity financing. The foremost difference is that intertemporal borrowing provides a *tax shield* through the tax deductibility of the interests paid on bonds. Given this advantage, bond financing precedes equity financing in the *pecking order*. Bond issuance amounts to $p_{i,t}B_{i,t}/\left(1+r_{i,t}\right)$, where $p_{i,t}/\left(1+r_{i,t}\right)$ is the price paid by *investors* for each unit of firm i's intertemporal debt ($B_{i,t}$), but its unit value for the *firm* is $p_{i,t}/\left[1+r_{i,t}\left(1-\tau_i\right)\right]$. The tax rate $\tau_i > 0$ captures the debt bias.[10]

In addition to the debt bias, which is not sufficient to motivate the choice of an optimal debt-equity financing mix, firms face three frictions. The first friction is the imperfect substitutability between bond and equity financing. Specifically, firms face a convex cost, capturing transactions or agency costs of changing the stock float, when revising their capital structures: $\varkappa_{i,t} = \kappa_i\left(D_{i,t}-\bar{D}_i\right)^2/2$, where $\kappa_i \geq 0$, $D_{i,t}$ is the nominal dividend payout of firm i and $\bar{D}_i$ is a target payout level. The latter is, for simplicity, the steady-state dividend payout, while the former is given by

$$D_{i,t} = p_{i,t}Y_{i,t} - W_{i,t}N_{i,t} - P_{i,t}X_{i,t} + \frac{p_{i,t}}{1+r_{i,t}\left(1-\tau_i\right)}B_{i,t} - p_{i,t}B_{i,t-1}, \tag{2}$$

where $Y_{i,t} := f\left(Z_{i,t}, K_{i,t-1}, N_{i,t}\right) - \varkappa\left(D_{i,t}\right)$ is (net) output, $f\left(Z_{i,t}, K_{i,t-1}, N_{i,t}\right) = e^{Z_{i,t}}K_{i,t-1}^{\alpha}N_{i,t}^{1-\alpha}$ is the production function, $\alpha \in (0,1)$, $Z_{i,t}$ is a stochastic total factor productivity (TFP) level, $K_{i,t}$ is capital, $N_{i,t}$ is labor, $W_{i,t}$ is the nominal wage, and $P_{i,t}X_{i,t}$ is nominal investment. TFP is an AR(1) process with persistence ρ_Z and standard deviation σ_Z. Total investment is a Cobb-Douglas aggregate of domestic (country i's) goods, $x_{ii,t}$, and imported (country j's) goods, $x_{ji,t}$, with $j = H, F$ and $j \neq i$: $X_{i,t} = \left[\gamma^{\frac{1}{\theta}}x_{ii,t}^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}}x_{ji,t}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}$, where γ is the share of domestic goods in the total expenditures and θ is the elasticity of substitution between Home and Foreign goods. As firms display home bias in their investment spending, $\gamma \in (0.5, 1]$. The price index

[10]Differently from Hennessy and Whited (2005), τ_i is meant to capture all the distortions caused by taxation, without a separate role for personal income taxation. Indeed, the International Monetary Fund (2016) documents that certain assets are fully exempt from personal income taxation, and even when this applies, personal income taxation is usually insufficient to eliminate the tax advantage of corporate debt; finally, and most importantly, personal income taxation is found to play a minor role when it comes to international transactions.

associated with $X_{i,t}$ is

$$P_{i,t} = \left[\gamma p_{i,t}^{1-\theta} + (1-\gamma) p_{j,t}^{1-\theta}\right]^{\frac{1}{1-\theta}}, \tag{3}$$

so, from the point of view of the Home country, the terms of trade is $ToT_t := p_{F,t}/p_{H,t}$ and the real exchange rate is $RER_t := P_{F,t}/P_{H,t} = \left\{ \left[\gamma ToT_t^{1-\theta} + 1 - \gamma\right] \Big/ \left[\gamma + (1-\gamma) ToT_t^{1-\theta}\right] \right\}^{\frac{1}{1-\theta}}$.

The second and third frictions characterize the overall access to debt financing. On one side, there is a timing mismatch between revenues and production costs. In particular, labor must be paid before selling the goods and, thus, the firms need to borrow intratemporally. On the other side, there is an imperfect enforceability of debt contracts, which limits leverage.

The timeline is as follows. Each firm enters time t with a given stock of capital, $K_{i,t-1}$, and issues bonds. Additionally, the firm needs liquid funds amounting to $W_{i,t}N_{i,t}$, and the overall liabilities of the firm are $W_{i,t}N_{i,t} + p_{i,t}B_{i,t}/\left(1 + r_{i,t}\right)$. Differently from the intertemporal debt, which is paid back at the beginning of period $t+1$, the working capital loan must be completed within period t without entailing interest payments.[11]

After the realization of revenues but still prior to the end of time t, the firm invests, pays dividends and decides whether to default. Moreover, the firm now has internal liquidity, but this could easily be diverted. Therefore, if the firm defaults, the option for its lenders is that of seizing its capital stock. It is as if the firm retains all the bargaining power in a debt renegotiation. Yet, before the time of the default, the liquidation value of the capital stock is uncertain: the lenders recover $P_{i,t}K_{i,t}$ with probability $\xi_i < 1$ but recover zero otherwise. Thus, the ex-post value of defaulting on a debt contract is:

$$EVD_{i,t} = \xi_i \left[W_{i,t}N_{i,t} + V_{i,t} - D_{i,t} - \left(P_{i,t}K_{i,t} - \frac{p_{i,t}}{1 + r_{i,t}} B_{i,t}\right)\right] + (1-\xi_i)\left[W_{i,t}N_{i,t} + V_{i,t} - D_{i,t}\right], \tag{4}$$

where $V_{i,t}$ is the market value of country i's firm, which is cum-dividend and conditional on the exogenous states at time t. The terms in square brackets on the right hand side are the value of defaulting with and without successful recovery of the liquidated capital stock, respectively.

The enforceability of the debt contract requires $V_{i,t} - D_{i,t} \geq EVD_{i,t}$, which implies that the firm has no incentives to repudiate its debt only if the liquidity does not exceed the expected

[11] A zero interest payment is a feasible equilibrium condition for intraperiod loans under borrowing constraints (Fuerst and Carlstrom, 1998). Moreover, assuming that these loans cover the entire wage bill is reasonable by construction. On one side, Neumeyer and Perri (2005) and Uribe and Yue (2006) analyze small open economy models and show that changing the fraction of the wage bill that is borrowed intratemporally matters just quantitatively but not qualitatively—provided, of course, that such a fraction is not set to zero (i.e., no working capital loans). On the other side, the effect would be even less important in our model. The intuition is that, here, there is uncertainty about the probability to recover the collateral during a liquidation. Therefore, for any given credit-to-output and capital-to-output ratios, changing a parameter that expresses the proportion of the working capital loan would fully translate into a change in the probability ξ_i of recovering the collateral; see eq. (5). When solving the model numerically, we have checked that, although working capital loans matter, their relative size is effectively unimportant.

payment:

$$W_{i,t}N_{i,t} \leq \xi_i \left(P_{i,t}K_{i,t} - \frac{p_{i,t}}{1+r_{i,t}} B_{i,t} \right). \tag{5}$$

Therefore, the problem of the firm can be written as follows:

$$\begin{aligned} V_{i,t}\left(K_{i,t-1}, X_{i,t-1}, B_{i,t-1}\right) &= \max_{K_{i,t}, X_{i,t}, B_{i,t}, N_{i,t}} \left\{D_{i,t} + \mathbb{E}_t m_{i,t+1} V_{i,t+1}\left(K_{i,t}, X_{i,t}, B_{i,t}\right)\right\} \\ & \quad \text{s.t.} \quad (2), (5) \\ K_{i,t} &= (1-\delta) K_{i,t-1} + e^{\zeta_{i,t}} \left[1 - \Psi\left(\frac{X_{i,t}}{X_{i,t-1}}\right)\right] X_{i,t}, \end{aligned} \tag{6}$$

where $m_{i,t}$ is domestic investors' stochastic discount factor (SDF), $\delta > 0$ is the rate of capital depreciation, $\zeta_{i,t}$ is an investment-specific technology (IST) subject to shocks and the function $\Psi(.)$ captures the costs of adjusting investment. By using $m_{i,t}$ to discount the future profits of the firm, we make the standard assumption that, at the beginning, all the assets issued by local producers are owned within country i. Investors have the possibility to diversify their portfolios as soon as financial trade is allowed.[12]

The effective price of investment is $P_{i,t}/e^{\zeta_{i,t}}$ and, thus, the IST shocks affect the dividend (2). As in Coeurdacier et al. (2010), this effect is a source of redistribution from financial to non-financial income, and vice versa, and $\zeta_{i,t}$ is an AR(1) process with persistence ρ_ζ and standard deviation σ_ζ. Moreover, we assume that firms face investment adjustment costs to ensure that the financial constraints are operative. Otherwise, their effectiveness would be impaired by the rapid reallocation of capital across regions caused by country-specific shocks. Formally, $\Psi\left(X_{i,t}/X_{i,t-1}\right) = \psi\left(X_{i,t}/X_{i,t-1} - 1\right)^2/2$, with $\psi \geq 0$.

3.1.1 First Order Conditions

The optimal amount of intertemporal liabilities satisfies

$$1 - \frac{\mu_{i,t}}{\lambda_{i,t}} \xi_i \left[\frac{1 + r_{i,t}\left(1-\tau_i\right)}{1 + r_{i,t}}\right] = \mathbb{E}_t m_{i,t+1} \frac{\lambda_{i,t+1}}{\lambda_{i,t}} R_{b_i,t+1}, \tag{7}$$

where $R_{b_i,t} := p_{i,t}\left[1 + r_{i,t-1}\left(1-\tau_i\right)\right]/p_{i,t-1}$ is the gross interest rate paid on debt, $\mu_{i,t}$ is the Lagrange multiplier associated with constraint (5) and $\lambda_{i,t} = 1/\left(1 + p_{i,t}\varkappa'\left(D_{i,t}\right)\right)$. The second term on the left hand side is the credit spread incurred by firms when accessing the bond market.

[12] See, for instance, Heathcote and Perri (2002). Actually, financial integration generates a strong tendency to the equalization of SDFs across countries even in portfolio macro models where credit market frictions have direct effect on investors' participation to financial markets (Dedola and Lombardo, 2012), including when cross-border risk sharing is subject to shocks (Trani, 2015).

The spread is increasing in $\mu_{i,t}\xi_i/\lambda_{i,t}$, which captures the tightness of the borrowing constraint. We label $\mu_{i,t}/\lambda_{i,t}$ as the *debt-equity multiplier*, as it expresses the cost of borrowing conditional on how easy it is for firms to replace bond with equity financing, and vice versa.

The conditions for the optimal demand for labor and capital are as follows:

$$
\begin{aligned}
W_{i,t}\left(1+\frac{\mu_{i,t}}{\lambda_{i,t}}\right) &= p_{i,t}f_N\left(Z_{i,t},K_{i,t-1},N_{i,t}\right) && (8)\\
q_{i,t}-\frac{\mu_{i,t}}{\lambda_{i,t}}\xi_i &= \mathbb{E}_t m_{i,t+1}\frac{\lambda_{i,t+1}P_{i,t+1}}{\lambda_{i,t}P_{i,t}}\left[\frac{p_{i,t+1}}{P_{i,t+1}}f_K\left(Z_{i,t+1},K_{i,t},N_{i,t+1}\right)+(1-\delta)q_{i,t+1}\right] && (9)\\
\lambda_{i,t} &= q_{i,t}e^{\zeta_{i,t}}\left[1-\Psi\left(\frac{X_{i,t}}{X_{i,t-1}}\right)-\Psi'\left(\frac{X_{i,t}}{X_{i,t-1}}\right)\frac{X_{i,t}}{X_{i,t-1}}\right]\\
&\quad +\mathbb{E}_t m_{i,t+1}\frac{P_{i,t+1}}{P_{i,t}}q_{i,t+1}e^{\zeta_{i,t+1}}\Psi'\left(\frac{X_{i,t+1}}{X_{i,t}}\right)\left(\frac{X_{i,t+1}}{X_{i,t}}\right)^2. && (10)
\end{aligned}
$$

According to eq. (8), the demand for labor is inversely related to the tightness of the financing constraint through the working capital channel. Indeed, the unitary cost of labor is greater, the greater the debt-equity multiplier is. In turn, eq. (9) highlights that capital is ultimately the collateral of the firm. Ceteris paribus, a marginal increase in $\mu_{i,t}\xi_i/\lambda_{i,t}$ must be counterbalanced by an expected marginal fall in the future productivity of capital or in the future value of its real price, $q_{i,t}$. Note that the latter is a standard Tobin's q and differs from the real price of capital under liquidation, which is instead given by the recovery rate ξ_i.

3.1.2 Comparison with a Modigliani-Miller Benchmark

To clarify the behavior of firms in our model, we now focus on the dividend payout and define a benchmark model, highlighting how it compares with our model.

Suppose that $\tau_i, \kappa_i \to 0$. In this case, the bond spread in eq. (7) tends to vanish, for bonds do not provide any tax advantage and are also prompt substitutes for stocks. Put differently, in the absence of any difference between bond and equity financing, the economy attains a steady-state equilibrium where constraint (5) does not bind. It follows that $\mu_i \to 0$, so the optimal input demand functions are not affected by financial frictions and output coincides with $f(.)$. Let $\psi = 0$ temporarily to make the notation more transparent, and use eq. (6) to rewrite the dividend payout (2) as

$$
\begin{aligned}
D_{i,t} &= p_{i,t}f\left(Z_{i,t},K_{i,t-1},N_{i,t}\right)-W_{i,t}N_{i,t}\\
&\quad +(1-\delta)P_{i,t}K_{i,t-1}-\left(P_{i,t}K_{i,t}-\frac{p_{i,t}}{1+r_{i,t}}B_{i,t}\right)-p_{i,t}B_{i,t-1}, && (11)
\end{aligned}
$$

where $[P_{i,t}K_{i,t} - p_{i,t}/(1+r_{i,t})B_{i,t}] > W_{i,t}N_{i,t}/\xi_i$. Then, we can define a Modigliani-Miller (MM) benchmark model as one where $\tau_i, \kappa_i \to 0$ and corporate bonds finance a fraction $l \in [0,1]$ of the capital stock: $p_{i,t}B_{i,t}/\left(1+r_{i,t}\right) = lP_{i,t}K_{i,t}$. As a result, the dividend payout can be rewritten further as

$$D_{i,t} = p_{i,t}f\left(Z_{i,t}, K_{i,t-1}, N_{i,t}\right) - W_{i,t}N_{i,t} - P_{i,t}X_{i,t} + lP_{i,t}K_{i,t} - p_{i,t}B_{i,t-1}. \tag{12}$$

Since the firm is indifferent between the two sources of funds, l can assume any values in its domain.[13]

By contrast, in our model firms choose their bond-equity financing mix optimally, given the state of the economy. Along with the tax shield of debt, the financing constraint prevents the MM theorem from applying. The constraint also embeds a working capital channel, and it is through this channel that it is possible to gain intuition about how bond and equity financing are related. Indeed, using eq. (5) to eliminate the compensation of employees, the dividend payout (2) becomes:

$$\begin{aligned} D_{i,t} &= p_{i,t}Y_{i,t} - P_{i,t}X_{i,t}\left(1+\xi_i\right) - \xi_i P_{i,t}\left(1-\delta\right)K_{i,t-1} \\ &\quad + \frac{p_{i,t}}{1+r_{i,t}}\left[\xi_i + \frac{1+r_{i,t}}{1+r_{i,t}\left(1-\tau_i\right)}\right]B_{i,t} - p_{i,t}B_{i,t-1}. \end{aligned} \tag{13}$$

Hence, if firm i borrows more, other things equal, its dividend payout rises along with the first term in the second row. Since the firm cannot immediately replace equity financing with bond financing ($\kappa_i > 0$), the adjustment occurs slowly, restraining $Y_{i,t}$.

3.2 Households

Country i is populated by a continuum of households with unit mass. Households work for the domestic firms and can invest in internationally traded equities, purchasing a share $s_{ii,t}$ of the value of the expected profits of the domestic firms and a share $s_{ji,t}$ of that of country j's firms, with $j \neq i$. In addition, households purchase the bonds issued by the domestic firms. Therefore,

[13] Our argument remains valid even under other assumptions about how corporate bonds are introduced into the model when the MM theorem applies. We indeed verified that the behavior of the macroeconomic variables and investors' portfolio choice are completely unaffected by the assumption made, considering several alternatives, including the assumption of Coeurdacier et al. (2010) that debt is a fraction of net investment. We have preferred to assume that $p_{i,t}B_{i,t}/\left(1+r_{i,t}\right) = lP_{i,t}K_{i,t}$ because this resembles a simple type of borrowing constraint often used in macro-finance models; it abstracts from both the working capital channel and the uncertainty on the recovery of capital under liquidation. Indeed, both of the latter features of eq. (5) become ineffective as $\tau_i, \kappa_i \to 0$.

the utility maximization problem of the representative agent is:

$$\begin{aligned} U_{i,t}\left(s_{ii,t-1}, s_{ji,t-1}, B_{i,t-1}\right) &= \max_{\substack{C_{i,t}, s_{ki,t}, B_{i,t}, N_{i,t} \\ k=i,j}} \left\{u\left(C_{i,t}, N_{i,t}\right) + \beta_{i,t}\, \mathbb{E}_t\, U_{i,t+1}\left(s_{ii,t}, s_{ji,t}, B_{i,t}\right)\right\} \\ \text{s.t. } P_{i,t}C_{i,t} + \frac{p_{i,t}}{1+r_{i,t}}B_{i,t} + \sum_{k=i,j} V_{s_k,t}s_{ki,t} &= W_{i,t}N_{i,t} + T_{i,t} + p_{i,t}B_{i,t-1} + \sum_{k=i,j}\left(V_{s_k,t} + D_{k,t}\right)s_{ki,t-1} \end{aligned} \tag{14}$$

and a no-Ponzi-game condition. $C_{i,t}$ is consumption, $V_{s_i,t}$ is the price of shares, $T_{i,t}$ denotes nominal transfers, the period utility function is $u\left(C_{i,t}, N_{i,t}\right) = \frac{\left[C_{i,t} - \chi N_{i,t}^{1+\nu}/(1+\nu)\right]^{1-\sigma} - 1}{1-\sigma}$, with $\sigma > 0$ being the risk aversion coefficient, $\nu > 0$ governing the elasticity of labor supply, $\chi > 0$ measuring the disutility of working, and, finally, $\beta_{i,t} = \left[1 + \bar{C}_{i,t} - \chi \bar{N}_{i,t}^{1+\nu}/\left(1+\nu\right)\right]^{-\varphi_i}$, with $\bar{C}_{i,t}$, $\bar{N}_{i,t}$ and $\varphi_i > 0$ being the average household's consumption and labor and the elasticity of discounting to these two variables, respectively. That is, we assume that the subjective discount factor is endogenous to rule out the random walk dynamics caused by market imperfections when models are solved using local methods (Schmitt-Grohé and Uribe, 2003).

Moreover, like investment, consumption is a Cobb-Douglas aggregate of country i's goods, $c_{ii,t}$, and country j's goods, $c_{ji,t}$, with $j \neq i$: $C_{i,t} = \left[\gamma^{\frac{1}{\theta}} c_{ii,t}^{\frac{\theta-1}{\theta}} + \left(1-\gamma\right)^{\frac{1}{\theta}} c_{ji,t}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}$. Note that the degree of expenditure home bias γ and the elasticity of substitution θ are, for simplicity, the same for consumption as for investment. Therefore, eq. (3) is the price index associated with both $X_{i,t}$ and $C_{i,t}$.

Finally, the country i's shareholder receives the following transfer:

$$T_{i,t} = -\frac{p_{i,t}}{1 + r_{i,t}\left(1-\tau_i\right)}B_{i,t} + \frac{p_{i,t}}{1+r_{i,t}}B_{i,t}. \tag{15}$$

3.3 Market Clearing

Country i's equity and goods market clear when

$$\sum_{k=i,j} s_{ik,t} = 1 \tag{16}$$

$$\sum_{k=i,j}\left(c_{ik,t} + x_{ik,t}\right) = Y_{i,t}, \tag{17}$$

where $c_{ii,t} = \gamma(p_{i,t}/P_{i,t})^{-\theta}C_{i,t}$, $c_{ij,t} = \left(1-\gamma\right)\left(p_{i,t}/P_{j,t}\right)^{-\theta}C_{j,t}$, $x_{ii,t} = \gamma(p_{i,t}/P_{i,t})^{-\theta}X_{i,t}$ and $x_{ij,t} = \left(1-\gamma\right)\left(p_{i,t}/P_{j,t}\right)^{-\theta}X_{j,t}$ are the demand functions for consumption and investment goods.

Definition 1. *A competitive equilibrium is a set of allocations* $\{C_{i,t},\ c_{ii,t},\ c_{ij,t},\ N_{i,t},\ K_{i,t},\ Y_{i,t},\ X_{i,t},\ x_{ii,t},\ x_{ij,t},\ s_{ii,t},\ s_{ij,t},\ B_{i,t},\ D_{i,t}\}$ *and prices* $\{p_{i,t},\ P_{i,t},\ V_{i,t},\ r_{i,t},\ W_{i,t},\ \lambda_{i,t},\ \mu_{i,t},\ q_{i,t}\}$, *for* $i, j = H, F$ *and* $j \neq i$, *such that: 1) country i's households maximize their utility subject to their budget constraints; 2) country i's firms maximize their shareholders' value subject to the dividend payout, the financing constraints and the law of motion for capital; 3) all markets clear, as in eq.* (16)-(17).

3.4 Portfolio Choice Problem

Household i's utility maximization problem gives the usual Euler equations:

$$1 = \mathbb{E}_t \widetilde{R}_{b_i,t+1} m_{i,t+1} = \mathbb{E}_t R_{s_k,t+1} m_{i,t+1}, \quad \text{for } k = i, j, \tag{18}$$

where $m_{i,t+1} := \beta_{i,t} \frac{u_C(C_{i,t+1}, N_{i,t+1}) P_{i,t}}{u_C(C_{i,t}, N_{i,t}) P_{i,t+1}}$ is the SDF, $R_{s_i,t} := (V_{i,t} + D_{i,t}) / V_{i,t-1}$ is the rate of return on country i's equities, $\widetilde{R}_{b_i,t} := \frac{R_{b_i,t} - p_{i,t}\tau_i / p_{i,t-1}}{1-\tau_i}$ is the rate of return earned by investors on corporate bonds. Therefore, taking the Foreign equity share as the reference asset, the household's portfolio choice satisfies:

$$0 = \mathbb{E}_t \, R_{s_{\mathcal{R}},t+1} m_{i,t+1}, \tag{19}$$

where $R_{s_{\mathcal{R}},t} = R_{s_H,t} - R_{s_F,t}$ is the excess returns on Home vs. Foreign equities.

Since Home and Foreign agents make analogous portfolio choices, the Home-Foreign relative arbitrage condition is

$$0 = \mathbb{E}_t \, R_{s_{\mathcal{R}},t+1} \frac{P_{H,t}}{P_{H,t+1}} \left(\beta_{H,t} \frac{u_C\left(C_{H,t+1}, N_{H,t+1}\right)}{u_C\left(C_{H,t}, N_{H,t}\right)} - \beta_{F,t} \frac{u_C\left(C_{F,t+1}, N_{F,t+1}\right)}{u_C\left(C_{F,t}, N_{F,t}\right)} \cdot \frac{RER_t}{RER_{t+1}} \right), \tag{20}$$

where we have written the Home-Foreign relative SDF explicitly. Being interested in building intuition for the role of financial frictions, we follow the literature and solve eq. (20) with the local solution methods of Devereux and Sutherland (2010, 2011) and Tille and van Wincoop (2010)—especially the former—and with constraints (5) binding at all times around a symmetric steady state.[14] The solution of eq. (20) pins down the optimal portfolio which satisfies the dynamics of the net foreign assets (NFA). Focusing on the Home country, the budget constraint of the representative household (14) and $T_{H,t}$ imply that the dynamics of the NFA (in units of the

[14]Recently, there have been advances in analyzing country portfolios by applying global solution methods. However, Rabitsch et al. (2015) found that local solution methods are reasonably accurate when countries are fully symmetric in the steady state, as is the case here. Moreover, the literature on the determinants of equity home bias in macro models employs local solution methods, which allows broader analytic intuition to be built. Finally, in the extended version of our model (Section 6) the financing frictions do not have a direct effect on portfolio choice and the excess returns are unaffected by the covariance matrix of the shocks. For all this, and the dimensionality of the problem, we have preferred to rely on local methods.

final good) are given by

$$nfa_{H,t} = nx_{H,t} + \frac{P_{H,t-1}}{P_{H,t}} \left(R_{s_{\mathcal{R}},t}\omega_{t-1} + R_{s_F,t} nfa_{H,t-1} \right), \tag{21}$$

where $nx_{H,t} = (p_{H,t}Y_{H,t})/P_{H,t} - (C_{H,t} + X_{H,t})$ is the trade balance and the remaining terms capture the portfolio flows and the corresponding interest payments. The portfolio $\omega_t := (s_{HH,t} - 1) V_{H,t}/P_{H,t}$ corresponds to the opposite of Foreign investors' holdings of Home equities, and, coherently, $nfa_{H,t} := \omega_t + RER_t s_{FH,t} V_{F,t}/P_{F,t}$. Therefore, the ownership of the Home business sector is internationally diversified so long as $\omega_t < 0$.

Moreover, because of a general equilibrium effect, corporate borrowing is a transfer of resources between firms and households that does not generate wealth. So households earn the dividend *income* $\Pi_{H,t} := D_{H,t} - \mathcal{BO}_{H,t}$, with $\mathcal{BO}_{H,t} = \frac{p_{H,t}B_{H,t}}{1+r_{H,t}(1-\tau_H)} - \frac{\tilde{R}_{b_H,t}p_{H,t-1}B_{H,t-1}}{1+r_{H,t-1}}$. In turn, the fact that households receive just a portion of the dividend payout (2) as usable financial income implies that the Home trade balance can be expressed as

$$nx_{H,t} = \frac{W_{H,t}N_{H,t} + \Pi_{H,t}}{P_{H,t}} - C_{H,t}. \tag{22}$$

All this holds true even under the MM theorem. What differs in this case is that $\tau_H \to 0$ and, hence, $\mathcal{BO}_{H,t} \to \frac{p_{H,t}B_{H,t}}{1+r_{H,t}} - \frac{R_{b_H,t}p_{H,t-1}B_{H,t-1}}{1+r_{H,t-1}}$.

3.4.1 Optimal Portfolios

Although a closed-form solution for portfolios is ruled out by market incompleteness, in this section we examine how corporate leverage affects the insurance provided by equities against the existing sources of risk. We do so only for the optimal exposure of Home investors to domestic equities, as the optimal Foreign portfolio is symmetric. In terms of notation, a *hat* over a variable will denote the percent deviation of such a variable from the steady state, with the steady-state value of variables carrying no subscripts.

Definition 2. *In equilibrium, Home investors are exposed to the expected fluctuations in their income and purchasing power relative to those of Foreign investors such that* $\eta_{W,t+1} := \sum_{k=1}^{\infty} \beta^{k-1} \mathbb{E}_{t+1} \hat{W}_{\mathcal{R},t+k}$ *(with* $\hat{W}_{\mathcal{R},t} = \hat{W}_{H,t} - \hat{W}_{F,t}$*) is the wage risk,* $\eta_{\Pi,t+1} := \sum_{k=1}^{\infty} \beta^{k-1} \mathbb{E}_{t+1} \hat{\Pi}_{\mathcal{R},t+k}$ *(with* $\hat{\Pi}_{\mathcal{R},t} = \hat{\Pi}_{H,t} - \hat{\Pi}_{F,t}$*) is the dividend income risk and* $\eta_{ToT,t+1} := \sum_{k=1}^{\infty} \beta^{k-1} \mathbb{E}_{t+1} \widehat{ToT}_{t+k}$ *is the terms of trade risk.*

Since households supply labor to satisfy

$$\frac{W_{i,t}}{P_{i,t}} = \chi N_{i,t}^{\nu}, \ \forall i, \tag{23}$$

the optimal demand for domestic and Foreign equities and the budget constraint imply the risk-sharing portfolio given by the following proposition.

Proposition 1. *Given eq.* (23)*, a second-order approximation of eq.* (20) *around a symmetric steady state and an approximation of the Home NFA* (21) *relative to an analogous expression for the Foreign NFA imply that the optimal share of the portfolio of the Home household invested in domestic equities is*

$$\begin{aligned} s_{HH} &= 1 - \frac{\Gamma}{2(V/Y)} \beta \frac{\text{Cov}\left(\hat{R}_{s_{\mathcal{R}},t+1}, \eta_{ToT,t+1}\right)}{\text{Var}\left(\hat{R}_{s_{\mathcal{R}},t+1}\right)} \\ &\quad - \frac{\varsigma_{WN}}{2(V/Y)} \beta \frac{\text{Cov}\left(\hat{R}_{s_{\mathcal{R}},t+1}, \eta_{W,t+1}\right)}{\text{Var}\left(\hat{R}_{s_{\mathcal{R}},t+1}\right)} - \frac{\varsigma_{\Pi}}{2(V/Y)} \beta \frac{\text{Cov}\left(\hat{R}_{s_{\mathcal{R}},t+1}, \eta_{\Pi,t+1}\right)}{\text{Var}\left(\hat{R}_{s_{\mathcal{R}},t+1}\right)}, \end{aligned} \tag{24}$$

where $\varsigma_{WN} := WN/Y$ *is the steady-state labor income share,* $\varsigma_{\Pi} := \Pi/Y$ *is the steady-state dividend income-to-output ratio and the coefficient* $\Gamma := (2\gamma - 1)(1 - \varsigma_X)\left[1 - \frac{1-\beta}{\sigma\upsilon_C - \beta\left(\sigma\upsilon_C - \varphi\upsilon_{\beta,C}\right)}\right]$*, with* $\upsilon_C := C\left[C - \chi N^{1+\nu}/(1+\nu)\right]^{-1}$ *being the utility weight of consumption in the steady state,* $\upsilon_{\beta,C} := C \left[1 + C - \chi N^{1+\nu}/(1+\nu)\right]^{-1}$ *being an analogous weight that refers to* β *and* $\varsigma_X := X/Y$ *being the steady-state investment-to-output ratio.*

Proof. See Appendix C.1. □

Therefore, s_{HH} has three determinants. The first is constituted by trade linkages. Since countries produce imperfectly substitutable goods and preferences are biased toward the domestic goods (i.e., $\gamma > 0.5$), changes in the relative aggregate demand lead to changes in the terms of trade and, hence, changes in agents' purchasing power.[15] The second determinant originates from the changes in the dividend *income*. Contrary to many contributions in the literature, changes in the Home-Foreign relative dividend income generate risk in our model because this income does not comove perfectly with the excess return on equities. The latter is a function of the Home-Foreign relative dividend *payout*, which is increasing in the relative bond financing of firms, whereas the relative dividend income does not embed bond financing. Specifically, simple algebra implies that the relative dividend income is less corre-

[15] Without goods home bias ($\gamma = 0.5$), $\Gamma|_{\gamma=0.5} = 0$ in eq. (24) and $\widetilde{\Gamma}|_{\gamma=0.5} = -(1 - \varsigma_{WN}/(1+\nu))$ in eq. (26). Moreover, since the latter stems from the fact that dividend incomes and wages are denominated in different currencies in the two countries, $\widetilde{\Gamma}|_{\gamma=0.5}$ would play no role for $\theta = 1$. See Appendix C.3.

lated with the relative dividend payout, the more the latter comoves with corporate borrowing: $\mathbb{E}_t \hat{D}_{\mathcal{R},t+1} \hat{\Pi}_{\mathcal{R},t+1} = (D/\Pi)\mathbb{E}_t(\hat{D}_{\mathcal{R},t+1})^2 - (\mathcal{BO}/\Pi)\mathbb{E}_t \hat{D}_{\mathcal{R},t+1} \widehat{\mathcal{BO}}_{\mathcal{R},t+1}$. The third determinant is the wage risk, which resembles the more traditional labor income risk, without coinciding with it. The traditional labor income risk stems from the fluctuations in the total compensation of labor—i.e., in both wages ($\hat{W}_{\mathcal{R},t}$) and employment ($\hat{N}_{\mathcal{R},t}$), and the standard argument in the literature is that Home agents can display equity home bias when domestic equities pay more than Foreign equities during times when the domestic compensation of labor is lower than the Foreign one. As shown clearly by eq. (24), in our model this argument applies only to the dynamics of the relative wage. The reason is that, under GHH preferences, agents take into account their leisure when pricing the assets, and the utility value of leisure matches a part of the compensation of labor one-for-one; that made of employment. In turn, this implies that, at the aggregate level, employment—or, equivalently, the real wage (eq. (23))—remains a motive for risk sharing. Indeed, the total nominal (dividend and wage) income of the households sector is

$$\varsigma_{WN} \hat{W}_{\mathcal{R},t} + \varsigma_{\Pi} \hat{\Pi}_{\mathcal{R},t} = [(2\gamma - 1)\varsigma_X - 1]\widehat{ToT}_t + \hat{Y}_{\mathcal{R},t} - \varsigma_{WN} \hat{N}_{\mathcal{R},t} - \varsigma_X \hat{X}_{\mathcal{R},t}. \tag{25}$$

Proposition 2. *Eq. (25) and the demand for labor (8) affect the equilibrium relative employment—or relative real wage—such that the optimal portfolio (24) reduces to*

$$s_{HH} = 1 - \frac{\widetilde{\Gamma}}{2(V/Y)} \beta \frac{\text{Cov}\left(\hat{R}_{s_{\mathcal{R}},t+1}, \eta_{ToT,t+1}\right)}{\text{Var}\left(\hat{R}_{s_{\mathcal{R}},t+1}\right)} - \frac{1}{2(V/Y)} \beta \frac{\text{Cov}\left(\hat{R}_{s_{\mathcal{R}},t+1}, \eta_{y,t+1}\right)}{\text{Var}\left(\hat{R}_{s_{\mathcal{R}},t+1}\right)}, \tag{26}$$

where

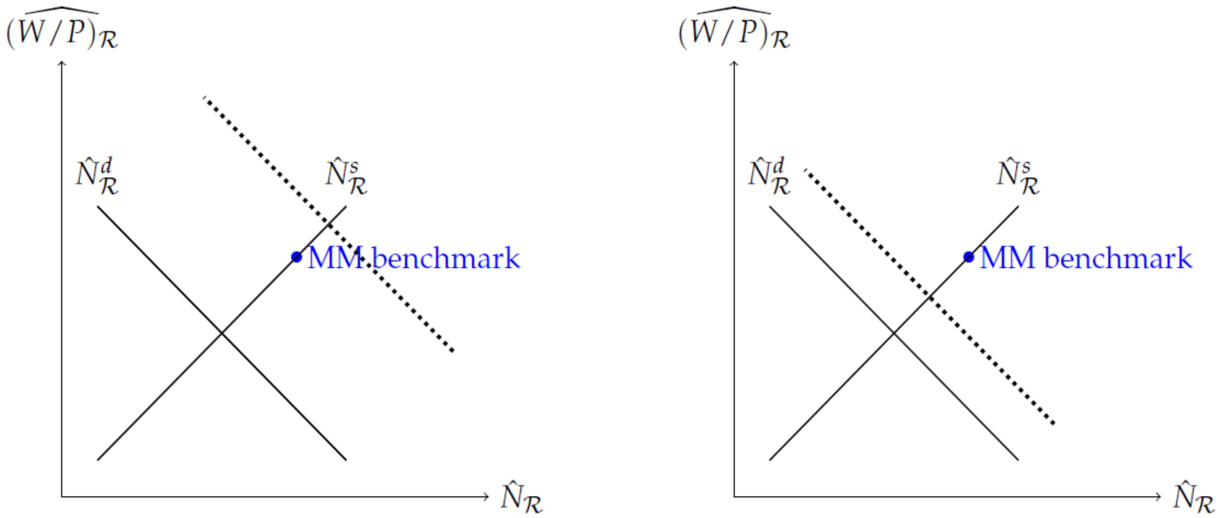
$$\eta_{y,t+1} := \sum_{k=1}^{\infty} \beta^{k-1} \mathbb{E}_{t+1} \left[\left(1 - \frac{\varsigma_{WN}}{1+\nu}\right) \hat{Y}_{\mathcal{R},t+k} - \varsigma_X \hat{X}_{\mathcal{R},t+k} + \frac{\varsigma_{WN}\mu}{(1+\nu)(1+\mu)} \left(\hat{\mu}_{\mathcal{R},t+k} - \hat{\lambda}_{\mathcal{R},t+k}\right) \right] \tag{27}$$

$$\widetilde{\Gamma} := -2\left(1 - \frac{\varsigma_{WN}}{1+\nu}\right)(1-\gamma) - \frac{(2\gamma-1)(1-\varsigma_X)(1-\beta)}{\sigma v_C - \beta(\sigma v_C - \varphi v_{\beta,C})}, \tag{28}$$

with $\eta_{y,t+1}$ being the overall income risk, $\hat{\lambda}_{\mathcal{R},t} = -\kappa D \hat{D}_{\mathcal{R},t}$ and $\widetilde{\Gamma} < 0$. Under the MM theorem ($\mu \to 0$), $\eta_{y,t+1}$ is a function of aggregate income net of the cost of investment. By contrast, when the borrowing constraints bind ($\mu > 0$), $\eta_{y,t+1}$ is augmented by the dynamics of the debt-equity multiplier. Other things equal, $\eta_{y,t+1}$ is magnified by shocks that lead to an increase in the debt-equity multiplier, while it is mitigated by shocks that have the opposite effect.

Proof. See Appendix C.1. □

In other words, Proposition 2 suggests that cross-border risk sharing depends on the capital structure of firms through the debt-equity multiplier, which is a main driver of the credit spread. The two simple diagrams in Fig. 2 help illustrate the underlying mechanism. In both diagrams, the initial equilibrium is at the intersection of the continuous labor supply line ($N^s_{\mathcal{R},t}$) and the continuous labor demand line ($N^d_{\mathcal{R},t}$). Positive technology shocks of any kind occurring in the Home country can increase both the relative employment and the relative real wage, but the extent to which this boost materializes depends on whether the shock relaxes or tightens the credit constraints faced by firms. In the first case, the positive effect is amplified relative to the MM benchmark (diagram (a)): the relative real wage increases by more as firms enjoy cheaper debt financing, and the overall income risk gets correspondingly smaller. This happens despite the fact that the increase in labor costs tends to reduce the dividend income because there is also an increase in firm revenues; given capital, firms can produce more, the more labor they hire. The opposite is instead true in the second case (diagram (b)), that is, when the shock tightens the credit constraints. In this case, the overall income risk is greater than in the MM benchmark.



(a) Debt-equity multiplier falls.

(b) Debt-equity multiplier increases.

Figure 2: A simple diagram of the Home-Foreign labor market.

The other determinants of s_{HH} in eq. (26)-(28) capture the traditional mechanisms in the literature, according to which domestic bias in equities is optimal if domestic equities pay relatively high in times when the domestic return to labor is relatively low. Specifically, there are two traditional mechanisms: the trade in goods and the relative demand for investment ($\hat{X}_{\mathcal{R},t}$). Both can foster domestic bias by reducing the strong correlation between the returns to capital and the returns to labor that is typical of Cobb-Douglas production functions. Under the typical assumptions of Cole and Obstfeld (1991)—separable preferences and $\sigma = \theta = 1$, a positive Home TFP shock can increase the relative labor income and, simultaneously, reduce the relative dividend payout, as the terms of trade depreciate and relative investment increases (Heathcote and Perri, 2013). However, our model rests on more general assumptions (preferences are nonseparable in consumption and leisure for whatever risk aversion σ and elasticity of substitution θ), so IST shocks are needed to capture changes in the distribution of national income as in Coeurdacier et al. (2010). For example, a positive Home IST shock reduces the relative dividend payout by raising $\hat{X}_{\mathcal{R},t}$. Anyway, proposition 2 indicates that here the fluctuations in the debt-equity multiplier can either amplify or attenuate the traditional effects of trade and relative investment on portfolio choice.

Note that we can reach this conclusion without uncovering the explicit effect of θ on eq. (26)-(28). As shown in the literature, the role of θ emerges from the goods market equilibrium condition, but in our case this condition leaves the effect of the debt-equity multiplier on s_{HH} unchanged and does not provide additional intuition either. Previous studies can generally sharpen the intuition by uncovering the role of θ because they maintain perfect risk sharing and separable preferences, which is not the case here. Therefore, we prefer to discuss the role of θ analytically in the appendix (Appendix C.3). In the appendix, we also show that GHH preferences are instead crucial for our results (see Appendix C.4). With standard separable preferences, Proposition 1 does not apply because agents do not account for the value of leisure when pricing the assets traded in the market.

4 Calibration

Our strategy is to set key deep parameters such as those characterizing corporate leverage and trade openness in line with our data—and information on credit spreads in the US—for the period 1980-2018, drawing instead from past literature for the shocks and parameters that assume standard values. Since we follow the macro-finance literature to parameterize the shocks, we calibrate our model at the quarterly frequency used in the literature and, then, annualize the results consistently with the annual frequency of our empirical evidence.[16]

We set the return on corporate debt to the investor ($\widetilde{R}_b$) in line with a credit spread of 2.33% per annum and a tax advantage $\tau = 0.3725$. The former is the average difference between

[16] We have verified that our calibration strategy is consistent with the borrowing constraints being binding throughout the various numerical exercises presented in this paper. See Fig. E.1-E.2 for the results of simulations performed—by increasing the number of periods progressively up to 2500 years—under the baseline calibration.

Moody's Seasoned Baa corporate bonds yield and the 10-year U.S. Treasury bonds yield.[17] Although using credit spread data just for the U.S. is admittedly suboptimal, we are constrained by limited data availability and constructing corporate credit spreads for several advanced economies is outside the scope of our paper. However, authors that take on this challenging task document that euro-denominated corporate bond spreads behaved similarly to U.S. spreads (Krylova, 2016) and that 15 advanced economies' spreads experienced analogous boom-bust cycles over the past century (Krishnamurthy and Muir, 2017; Krishnamurthy and Li, 2020). Several of the countries examined by these authors are part of our sample. In turn, the 37.25% subsidy is consistent with the 30-40% debt tax advantage found by the International Monetary Fund (2016) when analyzing investments that are exempt from personal income taxation in a sample of 35 countries over the period 2005-2012. In particular, our τ is an intermediary value between the 35% tax rate typically used in corporate finance and the 39% tax rate documented by the International Monetary Fund (2017) for a group of advanced countries in 2015. We will show the relevance of our baseline τ—and sensitivity analysis—for portfolio choice in the rest of the paper. Overall, the chosen credit spread and τ imply that $\beta = 0.9846$ and, for the household's first order condition for bonds in eq. (18) to be satisfied, $\varphi = 0.0541$.

Assuming a standard depreciation rate ($\delta = 0.025$), we set α and ξ for the model to be consistent with a standard labor income share of 64% and a corporate debt-to-quarterly output ratio of 3.25, which is roughly the GDP-weighted average value in our sample. As a result, $\alpha = 0.3249$ and $\xi = 0.1051$.

Moreover, risk aversion is $\sigma = 2$, the labor disutility parameter $\chi = 3.2490$ such that agents work for 1/3 of their time, and ν implies a labor supply elasticity of 2, which is a conservative value (Peterman, 2016). Trade openness is $\gamma = 0.185$, which is approximately the GDP-weighted average trade share in our sample, and the elasticity of substitution $\theta = 1$.

As far as the shocks are concerned, we set $\rho_Z = \rho_\zeta = 0.9$ and use values estimated by the literature to set the standard deviations and cross-country correlations. We follow this strategy because we will present an extension of our model where the covariance matrix of the shocks does not influence portfolio choice (Section 6). The standard deviation of TFP shocks is $\sigma_Z = 0.4\%$ and that of IST shock is $\sigma_\zeta = 0.7\%$, in line with the average Bayesian estimates obtained by Kollmann (2013) in the context of an open economy with financial frictions. The cross-country

[17] Our calibration strategy and subsequent sensitivity analysis (see, e.g., Table 3) would go through even if we were to use other measures of the credit spread faced by U.S. corporations. A notable alternative measure is the credit spread by Gilchrist and Zakrajsek (2012). However, the latter displayed larger variations over time than Moody's Baa credit spread, and, in turn, our model is more consistent with the latter than the former.

correlation of TFP shocks generally ranges from 0.25 (Heathcote and Perri, 2004) to 0.45 (Coeurdacier et al., 2010), so $corr(\varepsilon_{Z_H}, \varepsilon_{Z_F}) = 0.3$. In the case of IST shocks, we take the estimate of Coeurdacier et al. (2010): $corr(\varepsilon_{\zeta_H}, \varepsilon_{\zeta_F}) = 0.2$. Finally, we set $\psi = 1.460$ for the volatility of investment relative to that of output to equal a conventional target value of 3, and κ is the average dividend adjustment cost estimated by Jermann and Quadrini (2012) (i.e., 0.285).

5 Results

Under our baseline calibration, the share of domestic equities in Home portfolios, s_{HH}, is 68.19% and, hence, agents prefer to invest in domestic assets. However, this domestic bias is not large if compared with the predictions of standard models. In particular, calibrating the MM benchmark model in the same way as our model, we find that the portfolio share of domestic equities is considerably larger in the former model; that is, 86.51%.[18]

The different portfolio choice in the two models arises from the use of debt financing by firms and the risk that this strategy implies, which is captured by credit spreads. As Proposition 2 indicates, in our model the debt-equity multipliers that drive credit spreads affect households' need to insure against labor market disruptions through the international equity market. By contrast, there is no endogenous credit spread under the MM theorem, reflecting the independence of the decisions of firms from the amount of debt. Using debt or equity financing leaves the firms indifferent, so households do not need to worry about how changes in debt alter the opportunities for risk sharing across the border.

We provide intuition with the exercise shown in Table 3. The tax advantage τ is the key determinant of firm leverage in the equilibrium of our model. In the steady state, an increase in τ induces firms to borrow more by making debt cheaper. The reduction in the cost of debt translates into a higher credit spread because, for given recovery rate ξ, leveraging the business activity expands the potential downside risk of lower-than-expected payoffs. Our baseline calibration sets τ in accordance with the average credit spread and credit-to-output ratio in the data. Starting from this basis, we split the sample period into two subsamples and we change τ to match the average credit spread and credit-to-output ratio in the two subsamples, while keeping all the other parameters unchanged. We track how agents modify their risk-sharing

[18] For the MM benchmark model to satisfy the same calibration targets met by our model, we proceed as follows. We impose that the equilibrium interest rate of the MM benchmark model assumes the same value as $\widetilde{R}_b$ in our model and additionally set $\alpha = 0.36$. As a result, in the MM benchmark model corporate bonds finance a fraction $l = 0.3669$ of the capital stock, and the parameters χ and φ are 3.7813 and 0.0461, respectively. Moreover, we set $\psi = 0.361$.

Table 3: Sensitivity of the equity portfolio, steady-state credit spread and steady-state borrowing/GDP ratio to τ.

Tax advantage	Model	Baseline	Low τ (0.336)	High τ (0.4085)
Sample period	Data	1980-2018	1980-99	2000-18
Borrowing/GDP (% per annum)	Model	81.25	76.65	85.91
	MM benchmark	81.25	76.65	85.91
	Data	81.02	76.66	85.91
Spread (% per annum)	Model	2.33	2.1	2.56
	MM benchmark	N/A	N/A	N/A
	Data	2.33	2.03	2.64
Equity portfolio (%)	Model	68.19	70.93	64.7
	Model, low κ (0.15)	66.81	70.03	62.58
	MM benchmark	86.51	86.1	86.93
	Data	77.84	89.49	65.57

The theoretical equity portfolios in the bottom part of the table are given by s_{HH}, while the empirical equity portfolios are the GDP-weighted average EHBs in the data.

portfolios, comparing our model with both the data and the MM benchmark model, which we feed with the grid for the credit-to-output ratio delivered by our model.

In the data, firms both borrowed more and faced higher credit spreads in the second subsample (2000-18) than in the first one (1980-99). As Table 3 shows, our model matches these facts fairly well through an increase in τ up to a value of just above 40%. The bottom part of the table shows how households react to this increase in corporate leverage. They reduce the share of domestic equities in their portfolios from almost 71% to 64.7%, and such a share would be even smaller if debt and equity financing were better substitutes—i.e., if $\kappa = 0.15$, the smallest of the estimates in Jermann and Quadrini (2012). In such a case, firms can more quickly replace equity with debt financing, making households more worried about how this change in corporate leverage were to affect their overall income if they maintained a certain exposure to domestic firms (see eq. (27)). Through this negative effect of corporate leverage on households' appetite for domestic equities, the portfolios predicted by our model are closer to the average EHB in the second subsample of the data (65.57%), which is smaller than the average EHB in the first subsample (89.49%). On the other hand, the portfolios predicted by the MM benchmark model are closer to the first subsample's EHB and, most importantly, are basically insensitive to the quantity of debt financing used by firms.[19]

We stress that the inverse relationship between corporate leverage and investors' holdings of domestic equities does not stem from the easiness with which the external credit is made

[19]The little increase in s_{HH} predicted by the MM benchmark model and reported in Table 3 is simply due to our simplified assumption that households cannot share the terms of trade risk more efficiently by trading bonds across the border. In Appendix D, we relax this assumption and find that s_{HH} is completely insensitive to the corporate credit-to-output ratio under the MM theorem.

available to firms, which is moreover meant to involve a stochastic component in our complete model (see Section 6).[20] The key factor is instead the preference of firms for bond as opposed to equity financing, which involves credit risk and pushes the bondholders to charge a proportional spread. For a better understanding of this aspect, let us now consider how the main macroeconomic and financial variables react to a one standard deviation increase in Home TFP or Home IST in both our model and the MM benchmark, which is shown by Fig. 3-4. In general, we see that the endogenous reaction of corporate leverage that is present in our model mitigates the real effects of both shocks on impact. This happens because the debt-equity multiplier increases in both cases, although through a dissimilar mechanism and with different persistence. In the case of the TFP shock, Home firms are more productive and their goods are relatively less expensive than Foreign goods, while their pledgeable collateral is given. Therefore, it is convenient for Home firms to initially finance their investment and hiring of labor by reinvesting profits, and resume borrowing in the next period as more collateral becomes available as a result of capital accumulation. The foreign country reacts in an analogous way, albeit to a lesser extent, because the international transmission of the shock is positive.

Next, in the case of an increase in Home IST, Home physical capital investment is particularly attractive as it is relatively cheaper than domestic consumption, generating a flow of investment goods from the Foreign country to the Home country. This opens up the possibility to produce relatively more in the Home country by expanding the local demand for labor, but this occurs substantially sluggishly in our model as Home firms struggle with limited resources. In spite of the fall in the cost of investment, on impact, firms have a given stock of collateral and must also cope with the fact that their goods have become more expensive than Foreign goods. Therefore, firms have limited internal funds and cannot borrow as much as they would like either, as lenders charge a high spread. Of course, the situation eases over time as more collateral becomes available and firms can meet their needs through external credit.

Overall, the capital structure of firms matters in our model, and it reduces the extent to which they can invest in capital and hire labor in response to technology shocks, at least for some periods. Fig. 3 reveals that corporate leverage has particularly strong effects in the case of IST shocks. Labor responds to an increase in Home IST much more sluggishly in our model

[20] In particular, one could think of an increase in corporate borrowing resulting from an increase in the recovery rate ξ of the liquidated capital of defaulted firms. Though interesting, this case tends to reduce the steady-state losses that would materialize in the event of default for whatever credit spread and, therefore, fails to capture a key element of the mechanism we highlight. Conducting numerical exercises, we have verified that changes in ξ have more muted effects on investors' portfolio than changes in τ, which is consistent with the fact that the way portfolio choice depends on shocks to ξ in the extended model is a function of the elasticity of substitution θ (see Appendix D).

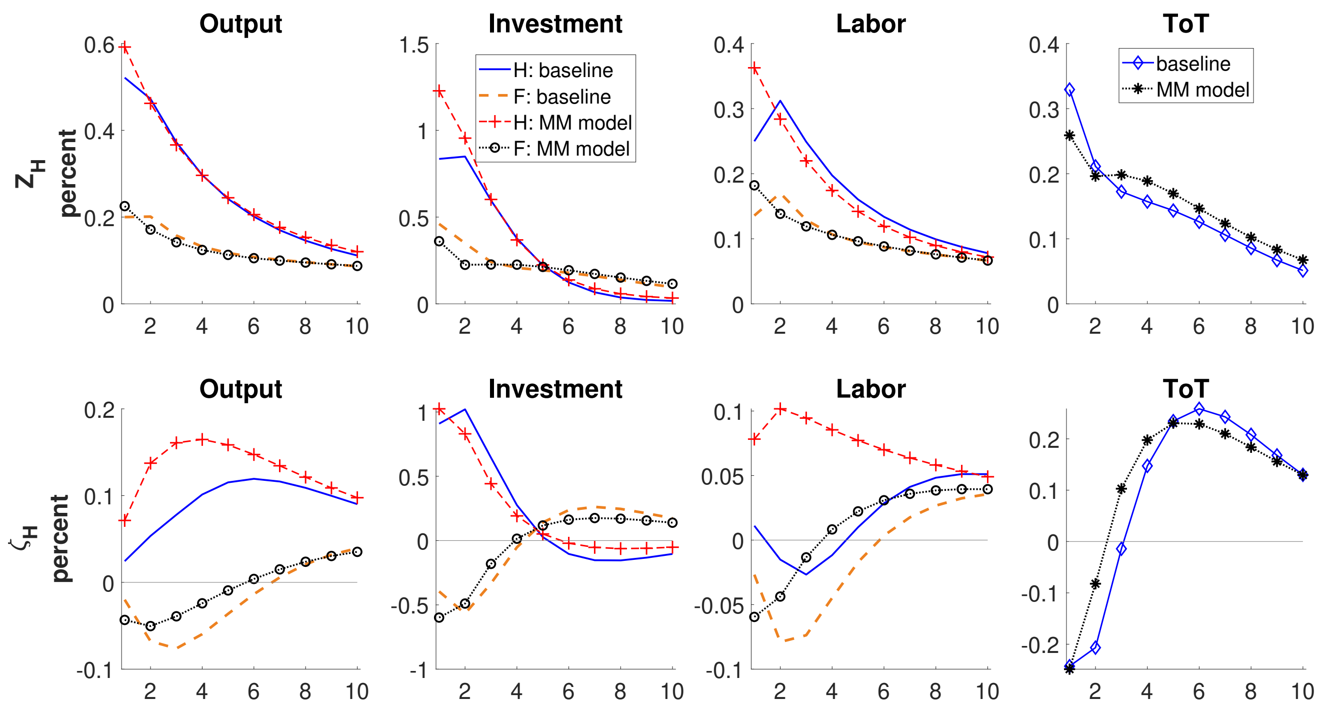


Figure 3: Responses of output, investment, labor and the terms of trade to a positive Home TFP shock (above) or IST shock (below) in the baseline model.

than in the MM benchmark, and, as expected, we find that this difference widens with the tax advantage of debt τ (see Table E.1 in the appendix).[21] However, notice that the response of the Home-Foreign relative labor ($\hat{N}_{\mathcal{R},t}$) is positive in both models and for both shocks. It is the size of $\hat{N}_{\mathcal{R},t}$ that differs across cases.

5.1 Sensitivity to the Elasticity of Substitution Between Goods

So far, we have considered a conservative elasticity of substitution θ of 1, but in this section we start to relax this assumption. The empirical literature offers a wide range of estimates for θ, the micro ones being generally large and the macro ones being conversely small (and possibly below 1). However, there is evidence of in favor of values a little above 1 even for the macro

[21]The mechanism highlighted here is reminiscent of recent studies that, employing Bayesian methods, suggest that financial frictions can mute the effect of IST shocks on the aggregate economy (Christiano et al., 2011, 2014; Kamber et al., 2015). Our results provide a qualification: the borrowing constraints hinder hiring after a positive IST shock as this shock does not generate sufficient investable resources, while the collateral of the firms is given. This qualification follows from the fact that the financial frictions in our model differ from those used in the Bayesian studies. The latter build on Aiyagari and Gertler (1999) and Bernanke et al. (1999), whereas we allow firms to issue both equity shares and bonds in the presence of a pecking order between them as well as imperfect enforcement of debt contracts. Moreover, what is ultimately important in the present context is that IST shocks are less effective in redistributing income such that capital and labor incomes are substantially inversely correlated, which is the condition often stressed in the literature for capturing a large preference bias towards domestic equities.

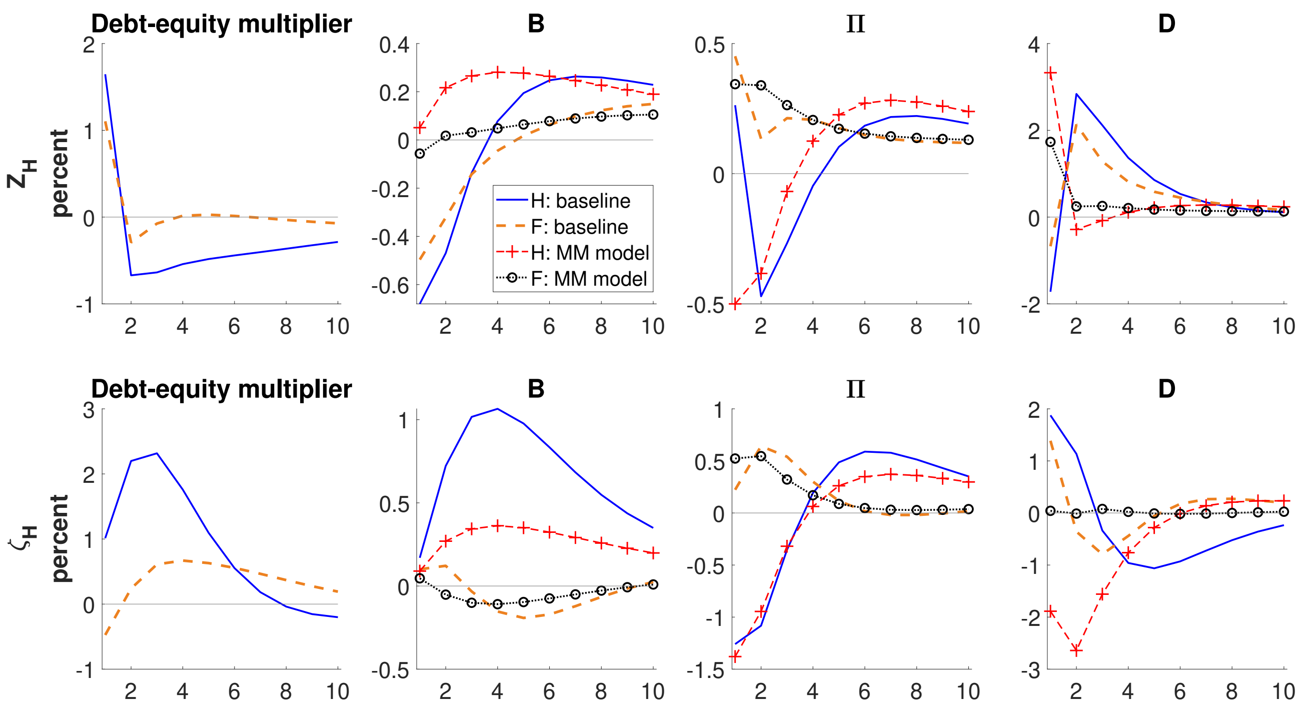


Figure 4: Responses of corporate debt, dividend income and dividend payout to a positive Home TFP shock (above) or IST shock (below) in the baseline model.

elasticities (Feenstra et al., 2018). Theoretically, other things being equal, the terms of trade respond less strongly to shocks, the greater θ is. Therefore, increasing θ shows the extent to which the terms of trade influences portfolio choice, and it also allows for distinguishing the role of TFP and IST shocks in our model.

Fig. 5 shows how the portfolio share s_{HH} changes as θ rises from 0.8—approximately the value that allows macro models to explain the international business cycles (Heathcote and Perri, 2002; Corsetti et al., 2008)—to 2.5. The graph compares the predictions of our model (left diagram) with those of the MM benchmark (right diagram) and reports the sensitivity of s_{HH} not only for the baseline case (baseline σ_ζ), but also for the one in which IST shocks are virtually shut down ($\sigma_\zeta \to 0$). Let us start from the latter case, which suggests that households display equity home bias only for small values of θ. The intuition is that, for $\theta \to 0.8$, Foreign goods are highly expensive after a positive Home TFP shock, which translates into a strong depreciation in the terms of trade as well as a smaller increase in the return to Home stocks than to Foreign stocks. In this case, domestic equities are a good hedge against $\eta_{ToT,t+1}$ (Kollmann, 2006; Coeurdacier and Rey, 2013). Conversely, for $\theta \to 2.5$, there is a moderate depreciation of the terms of trade and the Home-Foreign relative equity return tends to increase, making Foreign equities

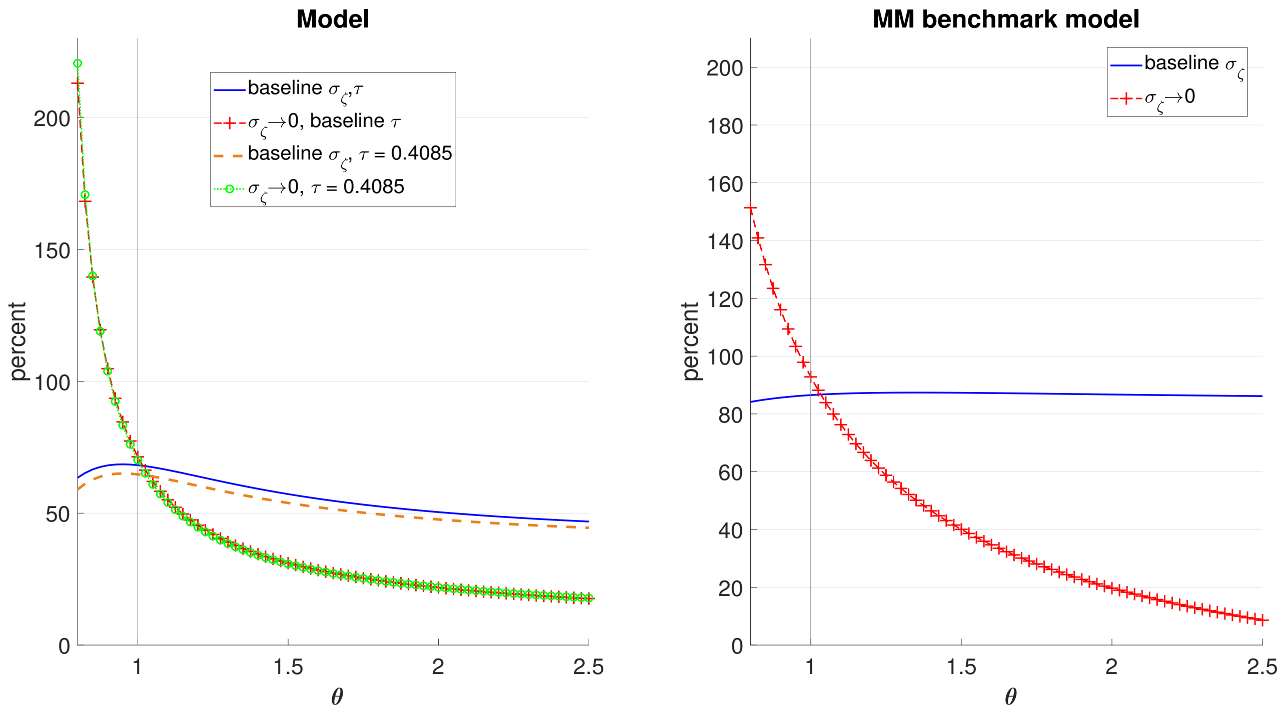


Figure 5: Sensitivity of the portfolio share invested in domestic equities (s_{HH}) to the elasticity of substitution between goods (θ) with and without IST shocks.

more valuable.[22] All this is true in our model as well as in the MM benchmark. However, interestingly, the endogenous response of leverage in our model magnifies the domestic bias for low values of θ but mitigates the foreign bias for high values of θ.

Next, we turn to the baseline σ_ζ case. In this case, households' preference for domestic equities is considerably more stable as θ rises than in the TFP-only case. In particular, Fig. 5 suggests that IST shocks reduce the strong equity home bias fostered by TFP shocks for $\theta < 1$ but make domestic equities more attractive than TFP shocks do for $\theta > 1$. Once again, this effect of IST shocks is present already in the MM benchmark model and is inherited by our model, even though the households' portfolio is smoother relative to θ in the former model than in the latter. However, we also find confirmation of the fact that corporate leverage mitigates the preference for domestic equities in our model. As τ increases, s_{HH} shifts downward in the left diagram.

[22] An additional reason why this happens is that the reduction in the strength with which the terms of trade responds to TFP shocks brought about by increasing values of θ tends to cancel the suitability of domestic equities as a hedge against the labor income risk.

6 Extension

6.1 Extended Model

Here we generalize our analysis to the realistic case of financial shocks and to the risk sharing through bonds emphasized by the literature. An accompanying aspect of this extension is the possibility to focus on situations in which portfolio choice is independent of the size of the shocks, eliminating their effect on the main mechanisms under analysis.

Starting with the firms, we make two simple extensions, leaving their optimization problem unchanged in all other respects. First, we assume that the liquidation value of capital varies according to

$$\ln \xi_{i,t} = (1-\rho_{\xi})\xi_i + \rho_{\xi} \ln \xi_{i,t-1} + \varepsilon_{\xi_i,t}, \tag{29}$$

where ρ_{ξ} measures the persistence and $\varepsilon_{\xi_i,t}$ is a financial shock with standard deviation σ_{ξ}. This shock adds not only a source of uncertainty that generates realistic business cycle fluctuations, but also one that affects corporate leverage differently from TFP and IST shocks. Intuitively, an increase in $\xi_{i,t}$ leads to a fall in the debt-equity multiplier rather than an increase in it, as the higher recovery rate of collateral under liquidation induces lenders to be more generous. Otherwise put, it is especially the effect of a negative $\xi_{i,t}$ shock on labor market dynamics what households worry about. Augmenting the model with this mechanism is important, given that we have found that the portfolio choice induced by TFP and IST shocks depends on the elasticity of substitution θ and, here, we allow for risk sharing through bonds.

Second, following Greenwood et al. (1988), we complete our framework in a standard way with capital utilization, $u_{K_i,t}$. As a result, the new production function is $f\left(Z_{i,t}, \mathcal{KS}_{i,t}, N_{i,t}\right) = e^{Z_{i,t}} \mathcal{KS}_{i,t}^{\alpha} N_{i,t}^{1-\alpha}$, where $\mathcal{KS}_{i,t} := u_{K_i,t} K_{i,t-1}$ are the capital services, and the capital accumulation equation becomes

$$K_{i,t} = \left(1-\delta\left(u_{K_i,t}\right)\right) K_{i,t-1} + e^{\zeta_{i,t}} \left[1 - \Psi\left(\frac{X_{i,t}}{X_{i,t-1}}\right)\right] X_{i,t}, \tag{30}$$

where $\delta\left(u_{K_i,t}\right) = \phi_0 + \phi_1 \left(u_{K_i,t}^{\phi_2} - 1\right)/\phi_2$, with $\phi_0,\ \phi_1 \geq 0$ and $\phi_2 > 1$. Note that, in addition to ensuring that the borrowing constraints are operative, now the investment adjustment costs $\Psi(.)$ are also useful for the equity value of firms $\left(V_{s_i,t}/\left(P_{i,t}K_{i,t} - p_{i,t}B_{i,t}/(1+r_{i,t})\right)\right)$ to react pro-cyclically to financial shocks, which is empirically sound (Jermann and Quadrini, 2012).

Turning to the households, their utility maximization remains basically the same, besides the fact that their portfolio choice problem is more comprehensive than the one analyzed earlier. Households can now trade across the border both stocks and bonds, and there are two types of bonds. One is corporate bonds, with country i's holdings of bonds issued by domestic firms being denoted by $b_{ii,t}$ and its holdings of bonds issued by firms in country j (with $j \neq i$) being denoted by $b_{ji,t}$. The other type of bonds are coupon bonds, which pay one unit of the good of the country where they originate at every future date. Let $a_{ii,t}$ be the holdings of domestic bonds that pay one unit of good i as a coupon and $a_{ji,t}$ be the holdings of foreign bonds that pay one unit of good j as a coupon. Therefore, the extended budget constraint of household i is

$$\begin{aligned} P_{i,t}C_{i,t} + \sum_{k=i,j}\left[V_{s_k,t}s_{ki,t} + \frac{p_{k,t}}{1+r_{k,t}}b_{ki,t} + p_{a_k,t}a_{ki,t}\right] \quad = \quad & W_{i,t}N_{i,t} + T_{i,t} + \sum_{k=i,j}\left[\left(V_{s_k,t} + D_{k,t}\right)s_{ki,t-1}\right. \\ & \left. + p_{k,t}b_{ki,t-1} + \left(p_{a_k,t} + p_{k,t}\right)a_{ki,t-1}\right]. \end{aligned} \quad (31)$$

where $p_{a_i,t}$ is the price of country i's coupon bond, and T_i is still given by eq. (15) since, as in the case of equities, households start off by holding the entire stock of domestic bonds.

The justification for coupon bonds is twofold. First, corporate bonds in our model are short-term securities and, therefore, households cannot use them to hedge against the long-run component of the terms of trade risk. Just equities would capture the latter if short-term bonds were the only other tradable assets (Benigno and Nisticò, 2012). Second, coupon bonds make our model comparable with the extensive body of studies that allow the complete markets equilibrium to be replicated. Indeed, by introducing coupon bonds, we assume that there are as many assets for risk sharing as aggregate shocks. In turn, this ensures that agents' portfolio choice remains symmetric and is, importantly, independent of the size of the shocks (i.e., their covariance matrix).[23] However, there is still a source of market incompleteness, and it is the endogenous one: the borrowing constraints faced by firms, which limit the availability of corporate bonds for smoothing consumption and leisure under certain contingencies.

Given the introduction of trade in bonds, there are another two market clearing conditions,

$$\sum_{k=i,j} b_{ik,t} = B_{i,t} \qquad \sum_{k=i,j} a_{ik,t} = 0, \quad (32)$$

[23]Symmetry in financial risk sharing does not depend on market completeness if there are only two tradable assets, but it does when more assets can be traded. In particular, some deviations from symmetry might arise when there are more than two tradable assets but still less than needed to complete the markets. This is, for example, the robustness case analyzed in Appendix D, where we restrict risk sharing to only four assets, leaving all the rest the same. However, we have checked that such deviations are so tiny in our model that all our numerical findings always reflect the choice of both Home and Foreign households.

and the Home NFAs are:

$$nfa_{H,t} = nx_{H,t} + \frac{P_{H,t-1}}{P_{H,t}} \left(\boldsymbol{R}'_{\mathcal{R},t} \boldsymbol{\omega}_{t-1} + \widetilde{R}_{b_F,t} nfa_{H,t-1} \right), \tag{33}$$

where $\boldsymbol{\omega}_t = (\omega_{1,t} \;\; \omega_{2,t} \;\; \omega_{3,t} \;\; \omega_{4,t} \;\; \omega_{5,t})'$ is the vector capturing the Home portfolio positions, $\boldsymbol{R}_{\mathcal{R},t}$ is the vector of the corresponding five excess returns (taking the foreign corporate bond as the reference asset) and $nfa_{H,t} := \omega_{1,t} + \omega_{2,t} + \omega_{3,t} + \omega_{4,t} + \omega_{5,t} + RER_t p_{F,t} b_{FH,t} / \left[(1 + r_{F,t}) P_{F,t} \right]$. Given symmetry, $\omega_{2,t} = -\omega_{1,t}$ and $\omega_{4,t} = -\omega_{3,t}$, which allows us to restrict our attention to the Home country's holdings of domestic equities, domestic corporate bonds and domestic coupon bonds in the numerical analysis that follows. The analytic development of the portfolio choice problem is analogous to that in Section 3.4.1 and is described in Appendix C.5.

6.2 Quantitative Analysis

We are now ready to analyze the predictions of the extended model. We will show that it confirms that corporate leverage has a negative impact on the appetite for domestic equities, adding predictions for risk sharing through bonds and capturing the desired positive relationship between the elasticity of substitution θ and the domestic bias in assets. We will refer to the appendix for several complementary results, including the one showing how this extended model can be compared with an MM benchmark framework.

To calibrate the extended model, we continue using our baseline calibration strategy from Section 4 but adapt it to the new features of the model as follows. We choose ϕ_1 such that capacity utilization equals 1 in the steady state, while the elasticity of capital depreciation to u_K is from Smets and Wouters (2007): $\phi_2 = 1.54$. Since this extended model overcomes some of the previous weaknesses and macro elasticities are often above 1 in the data (Feenstra et al., 2018), we use the value of standard 1.5 (Backus et al., 1995) as new baseline θ. As for TFP and IST shocks, the persistence of financial shocks is 0.9 and their volatility and correlation are $\sigma_\xi = 1\%$ and $corr(\xi_H, \xi_F) = 0.2$, respectively, as in the estimates of Jermann and Quadrini (2012) and Rouillard (2018). Finally, $\psi = 1.342$ to keep the relative volatility of investment at 3.

6.2.1 Results

Table D.1 reports the portfolio positions associated with the calibration just described. We find that investors have a little appetite for domestic equities: s_{HH} is 54.89%, which is empirically consistent with the cross-sectional average EHB index for the years after 2010 in our sample (Fig. 1). This is smaller than the share s_{HH} found for the baseline model analyzed earlier (Table 3). The reason is that now any country's households can insure against idiosyncratic shocks by taking positions not only in the market for equities, but also in the bond markets. The returns on bonds are noncontingent in the currency of denomination, so the cross-border bond return differentials track the terms of trade. Put differently, bonds are particularly effective in hedging against the terms of trade risk, which reduces the portion of such risk captured by equities (Engel and Matsumoto, 2009; Coeurdacier and Gourinchas, 2016). We find that the total holdings of domestic bonds in a country's portfolio ($pb_{HH}/(1+r) + p_a a_{HH}$) equal 0.99 units of output (Y), and the majority of these holdings is made of domestic corporate bonds ($pb_{HH}/[(1+r)Y] = 0.85$). Comparing the latter to the total supply of corporate bonds, we have $b_{HH}/B = 110.01\%$. Overall, these results suggest that there is a considerable preference for domestic bonds.

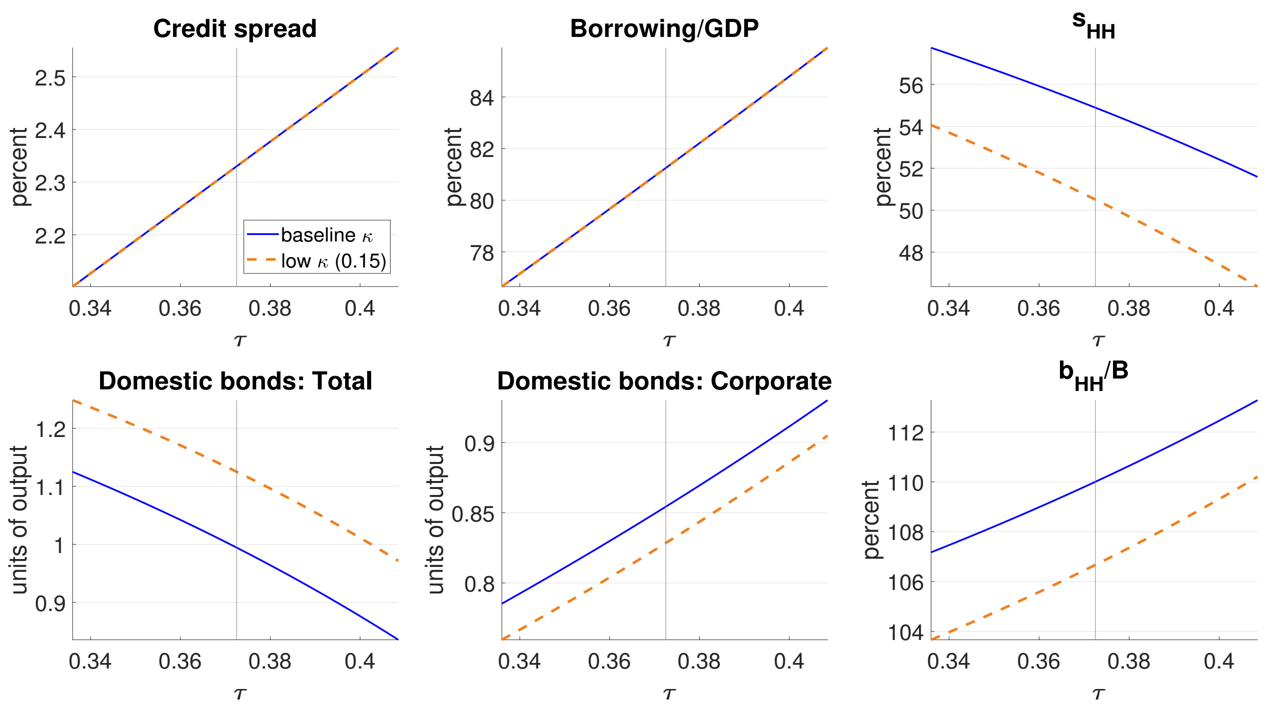


Figure 6: Sensitivity of the country portfolios, steady-state credit spread and steady-state borrowing/GDP ratio to τ in the extended model.

While all these portfolio positions refer to the baseline tax advantage of debt ($\tau = 0.3725$) and substitutability between debt and equity financing ($\kappa = 0.285$), Fig. 6 portrays what happens when both of these parameters change. This is the same sensitivity analysis that we carried out for Table 3: τ increases for the symmetric steady state of the model to match the increase in the credit spread and credit-to-output ratio found in the data for the second subsample (2000-18) as opposed to the first subsample period (1980-99). All the other parameters are kept fixed at their baseline values, besides when we repeat the same exercise for a lower κ (0.15).

Let us start from the results under the baseline κ: the increase in τ leads not only to a fall in the portfolio share of domestic equities, but also to a fall in the total holdings of domestic bonds. In this regard, although the bond portfolios of nations are not a specific scope of our analysis, and we cannot address many of the recent developments that characterized the bond markets either, our model offers an interpretation for the facts highlighted by Coeurdacier and Rey (2013). These authors show that the *bond home bias* of nations tends to exceed their equity home bias, and advanced economies' bond home bias declined over time. By construction, in our model the preference for domestic bonds stems largely from a preference for domestic goods, consistently with the empirical work linking bond home bias to currency home bias (Burger et al., 2018; Maggiori et al., 2020).[24] See Lane and Shambaugh (2010a,b) for earlier, related evidence.

However, Fig. 6 shows also that the decline in investors' total holdings of domestic bonds masks a reallocation between different types of bonds. In particular, investors increase their positions in domestic corporate bonds modestly, implying that the exposure to domestic coupon bonds declines by more in absolute value and determines the pattern observed for the overall bond portfolio. Therefore, as the increase in the tax advantage of debt allows firms to borrow more, the increase in the supply of corporate bonds reduces households' willingness to share risk through other types of bonds. This is consistent with a related argument made by Coeurdacier et al. (2010), with the difference that they assume that the MM theorem applies and all bonds pay a coupon.[25] In our case, this theorem does not apply, so the supply of corporate bonds is connected to the pledgeable capital of firms through the borrowing constraints; moreover, the maturity of each asset class plays a role of its own. While equities and coupon bonds are both long-term assets, corporate bonds are short-term assets. So the latter bonds are the safe assets in our model, being completely riskless when denominated in the domestic currency

[24]More accurately, our model shares the same perspective as the one in the empirical work of Burger et al. (2018), while in Maggiori et al. (2020) the perspective is different. Burger et al. (2018) focus on investors, whereas Maggiori et al. (2020) present micro-level evidence that is more specific to the borrowers. According to this evidence, there is domestic bias in bonds because advanced economies' firms tend to borrow in domestic currency even from international lenders, with the possible exception of U.S. companies. In our model, the currency composition of portfolios is chosen by the investors, with firms issuing domestic currency assets.

[25]Note that the latter assumption implies collinearity between the returns on different types of traded assets in Coeurdacier et al. (2010), and the same would happen in our model. This is another reason for considering bonds that have different maturities, in addition to the fact that firms face borrowing constraints in our model.

of the households. In this sense, so far as firms borrow up to their limit in both countries, the symmetric increase in equilibrium credit spreads compensates for any potential additional risks posed by more leveraged businesses, and the symmetric increase in the equilibrium credit-to-output ratios translates into a greater supply of safe assets for each country's households. This also means that the increase in b_{HH}/B should not be taken simply as compensating the decline in s_{HH} in households' exposure to domestic firms; corporate bonds and equities are distinct assets. Furthermore, the increase in b_{HH}/B (5.7%) is smaller than the decline in s_{HH} (-10.66%). See Table E.2 too.

Finally, let us turn to the sensitivity of agents' portfolio decisions to τ when κ is lower than in the baseline (dashed lines in Fig. 6). We see that households' reaction to an increase in corporate leverage does not differ from the one we have described so far. What differs is that, as in Table 3, households are less willing to hold domestic equities than for the baseline κ. Now, this reduction in the exposure to domestic equities is associated to an increase in the purchase of domestic coupon bonds, as the total holdings of domestic bonds increase, even though the portion of these holdings that is made of corporate bonds is slightly lower. The reason is that coupon bonds and equity shares are both useful to hedge against the long-run effects of terms of trade changes, so coupon bonds substitute for equities in this regard as κ falls. In turn, this triggers another portfolio rebalancing, which takes place within the overall bond portfolio.

6.2.2 Deconstructing the Main Mechanisms

At this point, we can deconstruct the key mechanisms that characterize the extended model. To this end, we examine both factors that were important already in the simpler model of the previous sections (TFP shocks, IST shocks and the elasticity of substitution between goods) and new factors (financial shocks). We do so not only for the complete extended model just analyzed, but also for a version of it in which agents can trade only four assets, namely home and foreign equities and home and foreign corporate bonds. The justification for this robustness is twofold. On one side, the 4-asset extended model allows us to illustrate the contribution of financial shocks more in detail, given that changing, for instance, σ_{ξ} in the complete extended model does not affect the optimal portfolios. On the other side, focusing on the 4-asset extended model allows for a comparison with an MM benchmark framework (Appendix D). Differently from before, such a comparison is now subtle and approximate because the MM theorem corresponds to the limit case $\tau, \kappa \to 0$. In this case, $\mu \to 0$ and, therefore, there cannot be uncertainty about

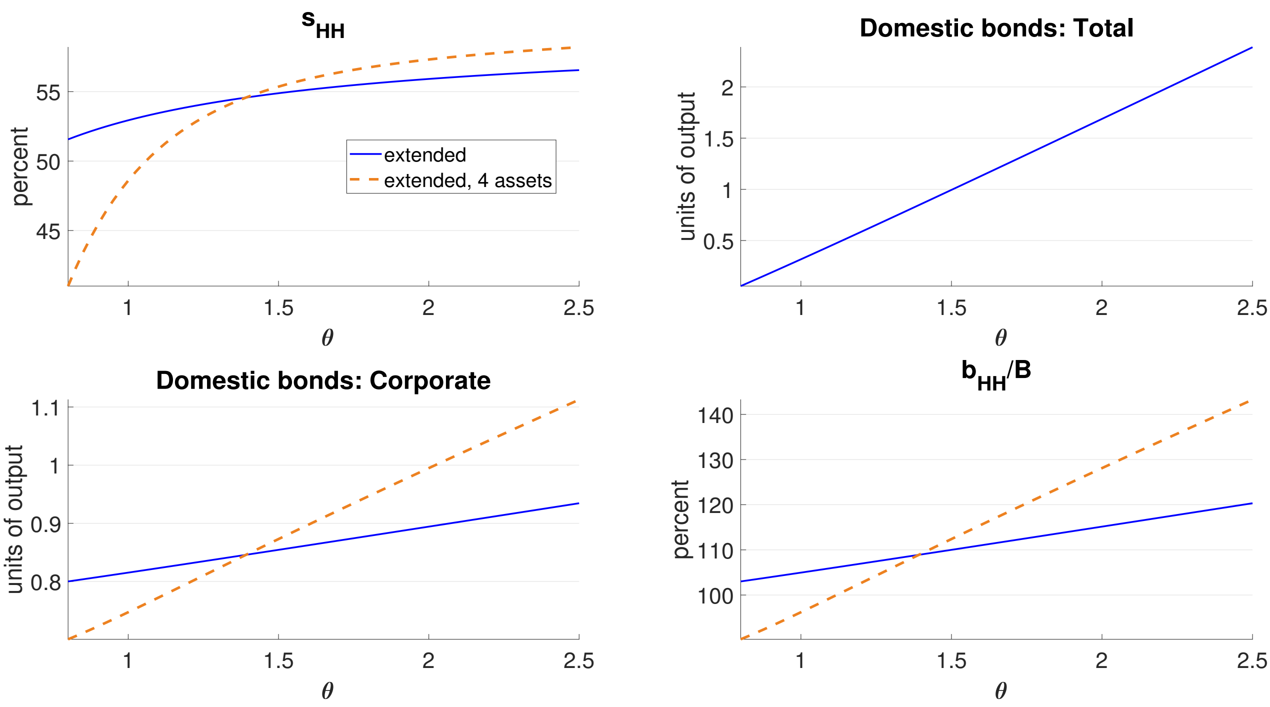


Figure 7: Sensitivity of country portfolios to the elasticity of substitution between goods (θ) in the extended model with and without coupon bonds (4 assets).

the liquidation value of collateral and related shocks. In turn, this means that the portfolio choice problem has a solution only if it does not involve more than four assets.

Elasticity of Substitution Between Goods. Fig. 7 captures the sensitivity of all components of households' portfolios to increasing values of θ. When this parameter is low and the terms of trade responds strongly to shocks, households opt for a relatively moderate exposure to domestic bonds. This helps containing the decline in the Home-Foreign relative returns on bonds caused by terms of trade depreciations. On the other hand, the latter become less severe for $\theta \to 2.5$, and, hence, the domestic bias in bonds tends to increase.

By comparing the continuous lines (referring to the complete extended model) in the two diagrams at the top of Fig. 7, we see that s_{HH} is considerably less sensitive to θ than the bond portfolio. This is consistent with the emphasis placed by the literature on the usefulness of bonds to hedge against the terms of trade risk. Nevertheless, s_{HH} displays a slight increase for higher values of θ, reflecting the fact that equities are useful to hedge against the long-run component of $\eta_{ToT,t+1}$, along with coupon bonds. In fact, if these bonds were not tradable, as in the 4-asset version of our extended model (dashed lines in Fig. 7), the sensitivity of s_{HH} to θ would be larger than in our complete model (continuous lines). In particular, there would be less appetite for domestic stocks in the 4-asset extended model than in the complete extended one for θ smaller than about 1.4, and conversely more appetite for $\theta > 1.4$. In any case, the negative effect of corporate leverage on s_{HH} stemming from the tax advantage τ of debt is robust to the value assumed by θ (see Tables D.2 and E.2).

Furthermore, in Appendix D, we show that the degree of home bias increases with θ even under the MM theorem, but the effects are quantitatively much larger than in our model. Once again, this is because the latter generates a smaller preference for domestic assets than a framework satisfying the MM theorem.

TFP and IST Shocks. The propagation of an increase in Home TFP or IST is analogous to the one found in Section 5, regardless of whether the menu of tradable assets include the coupon bonds (not reported for brevity) or is limited to four assets (Fig. D.3-D.4). The only difference with the results in Section 5 is a quantitative one, and it originates from the standard amplification mechanism provided by the endogenous capital utilization. To better understand its role, we analyze the sensitivity of the model to alternative values of the parameter ϕ_2. We consider a low value of 1.3, which is in line with Schmitt-Grohé and Uribe (2012) and Kamber et al. (2015), and a high value of 1.82, which is in line with Jermann and Quadrini (2012).

As usual, the propagation of shocks is stronger, the lower ϕ_2 is, as changing capital utilization becomes less costly and, therefore, firms can hire more labor and produce more (Fig. E.3). In turn, the greater responsiveness of labor (or the real wage) implies that low values of ϕ_2 strengthen the negative effects of corporate leverage on s_{HH}. However, the results are qualitatively the same as those obtained under the baseline ϕ_2 in Fig. 6 (see Tables D.2 and E.2), and, as in Section 5, leverage mitigates the effects that the technology shocks would have under the MM theorem. This mitigation calls for a relatively smaller s_{HH} (see Figures D.3 and D.4 and Table E.1).

Financial Shocks. Fig. D.5 (complete extended model) and E.4 (4-asset extended model) show that a positive Home financial shock reduces the debt-equity multiplier, making it easier for Home firms to obtain external credit for the accumulation of capital and the hiring of workers. The ensuing increase in output makes Foreign goods relatively more expensive, but the transmission of the shock to the Foreign country is altogether positive.

In other words, the real effects of a positive Home financial shock are generally similar to those of Home positive TFP and IST shocks put together, except for the debt-equity multiplier. This difference implies that the influence of financial shocks on households' portfolio choice can also be different from that of the other two shocks, especially the IST shocks. Indeed, IST shocks have been used to capture financial market disturbances in models without financial frictions since Justiniano et al. (2011). We know from Section 5 that—as opposed to TFP shocks—IST shocks magnify (reduce) the preference for domestic stocks when θ is large (small), and we have verified that this is still the case for the extended model. Fig. D.7 shows that financial shocks have the opposite effect instead. By focusing on the 4-asset version of our model, we let σ_{ξ} increase from almost 0% to the 1% set by calibration—for the baseline $corr(\xi_H, \xi_F)$ and a higher value of it. As a result, the preference for domestic stocks increases (decreases) with the size of the financial shocks for small (large) values of θ. This suggests that, not only trade in bonds, but also financial shocks matter for the predictions of the extended model.

7 Conclusions

We have advanced a revisitation of the question of whether equity home bias is the consequence of investors seeking insurance against idiosyncratic labor income shocks in light of the effect of corporate leverage on labor market outcomes. In the data, the change in the EHB of the advanced economies over the period 1980-2018 is negatively correlated with that of their NFCC, a correlation that we have found to be robust along several dimensions. Next, we have introduced corporate leverage in the two-country international portfolio model with differentiated products used in the literature by departing from the MM theorem. In the model, leverage is increasing in the tax advantage of corporate debt, and it has real effects on the labor market and households' risk sharing motives through the credit spread. Driven by two types of technology shocks and financial shocks, this model can account for the relatively low average EHBs of around 56-66% observed in the last two decades.

This result suggests that, absent other distortions and provided that countries do not comove too tightly, a financial imperfection can actually encourage the international diversification of risk. Future work could corroborate this conclusion and clarify its welfare implications. Also, we have left the emerging countries out of our analysis for a mix of limited data availability and, importantly, the well-known difference between emerging countries and advanced ones when it comes to borrowing in domestic vs. foreign currency. It would be interesting to look into the potential effect of corporate leverage on emerging countries' EHB. Traditionally, the latter is greater and more stable than the advanced economies' EHB (Coeurdacier and Rey, 2013), but recently the EHB of some emerging countries experienced a decline (Hnatkovska, 2019).

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Online Appendix (Not for Publication)

A Data

A.1 Countries

List of countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong, Israel, Italy, Korea, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, and United States.
Financial centers: Belgium, Hong Kong, Netherlands, Singapore, Switzerland, and United Kingdom.

A.2 Variables

- *Equity home bias*: estimated using the approach of Warnock (2002) and subsequent literature. It involves data for the portfolio equity assets and liabilities of nations, the nations' stock market capitalization and the world stock market capitalization. The portfolio equity assets and liabilities are from the database of Lane and Milesi-Ferretti (2017) for the period up to 2015 and the International Financial Statistics (IFS) for 2016-2018, while the stock market capitalization is from the World Development Indicators (WDI) and the World Federation of Exchanges (WFE). All these data are in current US\$.[26] As indicated by Coeurdacier and Rey (2013), the Equity Home Bias Index (EHB) can be expressed as follows:

$$EHB_i = 1 - \frac{\text{share of foreign equities in country } i\text{'s portfolio}}{\text{share of foreign equities in the world market portfolio}}$$

- *Stock market capitalization-to-GDP*: stock market capitalization in current US\$ (from WDI and WFE) divided by GDP in current US\$ from the WDI. In particular, the WFE database has been used only for Italy and United Kingdom as the quality of the data is better than that of the WDI regarding this variable. Moreover, we have manually filled the 1998 data points for both Austria and Italy using the data from Catini et al. (2010)'s dataset to eliminate a gap or clear misreporting of the data. This has been possible because all three

[26] The extension of the series for portfolio equity is done if and only if the two datasets used are similar (i.e., when the differences do not exceed $\pm 10\%$) across years 2005-2015. Note that this means excluding very few countries, most of which are financial centers (Belgium, Netherlands, Portugal, Singapore and United Kingdom).

datasets (WDI, WFE and Catini et al. (2010)) are consistently similar across the time span.

- *Corporate debt-to-output ratio*: break-adjusted level of total credit to non-financial corporations as a percentage of GDP from the Bank for International Settlements (BIS).

- *GDP per capita*: proxy for economic development, obtained as the ratio of GDP in 2015 $ (PPP) from the National Accounts Statistics of the Organization for Economic Cooperation and Development (OECD) to population from the WDI.

- *Trade share*: proxy for trade openness proposed by Heathcote and Perri (2013) and obtained as the average of the exports- and imports-to-GDP ratios, using data for trade in goods and services and GDP from the WDI.

- *Real exchange rate*: US-based real exchange rates estimated using the consumer price indexes (CPIs) and the nominal exchange rates from the IFS, except for the exchange rates euro to dollar. These are from the BIS.

- *GDP correlation*: correlation of the quarterly GDP of each country with the aggregate quarterly GDP of the remaining countries. We have used real PPP-valued OECD data for all the countries except two. The two exceptions are Hong Kong and Singapore, for which OECD data are unavailable at the quarterly frequency. We have thus obtained an approximately equivalent measure using GDP data (in national currency and at current prices) from Datastream, the US CPI from the OECD and the PPP converter for 2011 $ from the WDI. For consistency with this converter, the GDP data for all the other countries are expressed in 2010 $ (see the archive of the OECD National Accounts).

- *Capital account openness*: the normalized Chinn-Ito index (Chinn and Ito, 2006), namely *"ka_open"*. The values that this variable takes range from zero to one, where the latter indicates the highest degree of openness.

- *Population*: total population from the WDI.

B Further Empirical Results

Table B.1: EHB and its subcomponents for 2018 (sample FS)

	(1) Domestic market in % of world market capitalization	(2) Foreign equity in domestic portfolio (share)	(3) Foreign equity in world market portfolio (share)	(4) EHB
Australia	1.84	0.36	0.98	0.63
Austria	0.17	0.70	1.00	0.29
Belgium	0.67	0.50	0.99	0.50
Canada	2.82	0.45	0.97	0.54
Czech Republic*	0.13	0.24	1.00	0.76
Denmark*	0.41	0.38	1.00	0.62
Finland*	0.50	0.40	0.99	0.60
France	3.45	0.36	0.97	0.63
Germany	2.56	0.52	0.97	0.47
Greece	0.06	0.27	1.00	0.73
Hong Kong	5.56	0.23	0.94	0.76
Israel	0.27	0.40	1.00	0.59
Italy*	0.93	0.66	0.99	0.33
Japan	7.72	0.31	0.92	0.67
Korea	2.06	0.21	0.98	0.78
Netherlands*	1.18	0.82	0.99	0.17
New Zealand	0.13	0.55	1.00	0.45
Norway	0.39	0.82	1.00	0.18
Portugal	0.10	0.59	1.00	0.41
Singapore	1.03	0.49	0.99	0.50
Spain	1.05	0.45	0.99	0.55
Sweden*	0.93	0.42	0.99	0.58
Switzerland	2.10	0.59	0.98	0.40
United Kingdom*	5.68	0.49	0.94	0.48
United States	44.33	0.26	0.56	0.54

*Observation year for: CZE is 2008; DNK and FIN is 2004; GBR and ITA is 2014; NLD is 2015; SWE is 2003.

Table B.2: Summary statistics of the 5-year differenced data for the MAIN sample of countries: mean, median and standard deviation.

VARIABLES	(1) mean	(2) median	(3) sd
EHB	-5.697	-4.907	11.991
NFCC	5.200	4.212	14.237
Log GDP per capita	0.094	0.088	0.084
Market Cap./GDP	7.859	6.369	29.918
GDP correlation	0.009	-0.001	0.762
Chinn-Ito	0.061	0.000	0.155
Trade share	1.712	1.524	4.016
Log population	0.034	0.026	0.031
Log RER	0.206	0.048	0.912

Table B.3: Summary statistics of the 5-year differenced data for the MAIN sample of countries: correlation matrix.

	EHB	NFCC	Trade share	Chinn-Ito	Market cap./GDP	Log population	GDP correlation	Log GDP per capita	Log RER
EHB	1.000								
NFCC	-0.302	1.000							
Trade share	-0.048	0.026	1.000						
Chinn-Ito	0.114	-0.064	0.085	1.000					
Market cap./GDP	0.160	-0.112	0.165	0.090	1.000				
Log population	-0.045	0.134	-0.264	-0.083	-0.003	1.000			
GDP correlation	0.135	-0.304	0.093	0.102	0.256	-0.001	1.000		
Log GDP per capita	0.146	-0.094	0.058	0.131	0.307	0.029	0.061	1.000	
Log RER	0.132	-0.066	0.148	0.178	0.097	-0.059	0.130	-0.013	1.000

Table B.4: Regressions with controls, using 5-year differenced data, for the full sample (FS) of countries.

VARIABLES	(1) EHB	(2) EHB	(3) EHB	(4) EHB	(5) EHB	(6) EHB	(7) EHB	(8) EHB
NFCC	-0.183***	-0.196***	-0.174**	-0.192***	-0.176***	-0.179***	-0.171***	-0.152**
	(-2.964)	(-3.184)	(-2.731)	(-2.902)	(-2.857)	(-3.042)	(-3.064)	(-2.579)
Trade share	0.053							-0.080
	(1.120)							(-1.469)
Chinn-Ito		0.465						-1.409
		(0.154)						(-0.469)
Market cap./GDP			0.020*					0.018
			(1.818)					(1.537)
Log population				18.753				18.357
				(0.449)				(0.463)
GDP correlation					0.837			0.991
					(0.928)			(1.203)
Log GDP per capita						12.366		20.094*
						(1.263)		(1.963)
Log RER							14.964***	16.130***
							(3.117)	(3.063)
Constant	2.551***	5.049***	5.096***	2.209*	2.154**	1.467	-8.128**	4.974*
	(4.961)	(12.513)	(8.553)	(1.944)	(2.629)	(1.563)	(-2.418)	(1.981)
Observations	601	586	599	601	601	600	601	584
R-squared	0.227	0.231	0.234	0.226	0.228	0.228	0.270	0.291
SAMPLE	FS	FS	FS	FS	FS	FS	FS	FS

*** $p<0.01$, ** $p<0.05$, * $p<0.1$; t-statistics in parentheses; country fixed effects and time effects as well as standard errors clustered by both country and time in all the regressions.

Table B.5: Regressions with controls, using 5-year differenced data, for the balanced sample (BS) of countries.

VARIABLES	(1) EHB	(2) EHB	(3) EHB	(4) EHB	(5) EHB	(6) EHB	(7) EHB	(8) EHB
NFCC	-0.297***	-0.317***	-0.314***	-0.364***	-0.301***	-0.291***	-0.252**	-0.323***
	(-3.211)	(-3.454)	(-3.303)	(-3.365)	(-3.302)	(-3.232)	(-2.831)	(-3.643)
Trade share	0.069							-0.307
	(0.401)							(-1.370)
Chinn-Ito		-4.755						-9.293**
		(-1.289)						(-2.302)
Market cap./GDP			0.102***					0.082***
			(4.344)					(3.403)
Log population				140.538**				133.869**
				(2.388)				(2.429)
GDP correlation					-0.160			0.312
					(-0.143)			(0.295)
Log GDP per capita						41.416**		59.309***
						(2.337)		(3.439)
Log RER							14.613**	17.590**
							(2.609)	(2.701)
Constant	-5.148***	-5.094***	-8.530***	-8.587***	-5.184***	-8.048***	-9.456***	-7.878**
	(-5.912)	(-7.288)	(-8.830)	(-6.824)	(-3.550)	(-6.635)	(-5.480)	(-2.989)
Observations	393	385	392	393	393	393	393	384
R-squared	0.289	0.303	0.322	0.308	0.288	0.307	0.340	0.438
SAMPLE	BS	BS	BS	BS	BS	BS	BS	BS

*** $p<0.01$, ** $p<0.05$, * $p<0.1$; t-statistics in parentheses; country fixed effects and time effects as well as standard errors clustered by both country and time in all the regressions.

Table B.6: Regressions with controls, using 3-year differenced data, for the MAIN sample of countries.

VARIABLES	(1) EHB	(2) EHB	(3) EHB	(4) EHB	(5) EHB	(6) EHB	(7) EHB	(8) EHB
NFCC	-0.281**	-0.281**	-0.274**	-0.325**	-0.270**	-0.288**	-0.285**	-0.345***
	(-2.643)	(-2.574)	(-2.536)	(-2.790)	(-2.542)	(-2.765)	(-2.662)	(-2.883)
Trade share	0.155							0.028
	(1.190)							(0.144)
Chinn-Ito		2.332						0.685
		(0.508)						(0.133)
Market cap./GDP			0.095***					0.094***
			(6.743)					(6.462)
Log population				149.990**				161.243**
				(2.110)				(2.425)
GDP correlation					0.537			0.179
					(0.834)			(0.255)
Log GDP per capita						-10.167		-13.202
						(-0.932)		(-1.381)
Log RER							4.472	3.465
							(1.050)	(0.651)
Constant	-2.375***	-0.767	-2.296***	-5.091***	-2.588***	-1.959***	-4.586**	3.661*
	(-3.960)	(-1.328)	(-3.516)	(-3.839)	(-3.738)	(-2.954)	(-2.319)	(2.090)
Observations	506	493	504	506	506	506	506	491
R-squared	0.246	0.247	0.293	0.260	0.245	0.245	0.248	0.320
SAMPLE	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN

*** $p<0.01$, ** $p<0.05$, * $p<0.1$; t-statistics in parentheses; country fixed effects and time effects as well as standard errors clustered by both country and time in all the regressions.

Table B.7: Regressions with controls, using 7-year differenced data, for the MAIN sample of countries.

VARIABLES	(1) EHB	(2) EHB	(3) EHB	(4) EHB	(5) EHB	(6) EHB	(7) EHB	(8) EHB
NFCC	-0.273***	-0.292***	-0.276***	-0.333***	-0.274***	-0.262***	-0.208***	-0.247***
	(-4.199)	(-4.583)	(-4.098)	(-4.418)	(-4.200)	(-4.161)	(-3.667)	(-4.392)
Trade share	0.175							-0.207
	(1.299)							(-1.269)
Chinn-Ito		0.422						-3.271
		(0.161)						(-1.411)
Market cap./GDP			0.072**					0.074**
			(2.474)					(2.730)
Log population				121.627**				107.953**
				(2.766)				(2.646)
GDP correlation					-0.017			0.301
					(-0.013)			(0.247)
Log GDP per capita						19.744*		25.906**
						(1.900)		(2.313)
Log RER							18.953***	22.085***
							(7.998)	(6.749)
Constant	6.947***	6.836***	6.273***	2.303	2.634	3.122	7.002***	-4.116*
	(16.690)	(12.836)	(7.575)	(1.500)	(1.544)	(1.730)	(8.671)	(-1.777)
Observations	430	417	428	430	430	430	430	415
R-squared	0.317	0.330	0.334	0.332	0.315	0.322	0.390	0.451
SAMPLE	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN

*** p<0.01, ** p<0.05, * p<0.1; t-statistics in parentheses; country fixed effects and time effects as well as standard errors clustered by both country and time in all the regressions.

C Analytical Results

C.1 Proofs

C.1.1 Proof of Proposition 1

Proof. We proceed in two steps. In the first step, we obtain the optimal portfolio as a function of the "hedge ratios", which capture the comovement between the excess return on Home vs. Foreign equities and the variables that agents are concerned for. In the second step, we use the properties of GHH preferences to rewrite and simplify the solution for the optimal portfolio.

First step. Taking a second order approximation of condition (19) for investment in Home vs. Foreign equities for each country i (with $i = H, F$), we obtain the following Home-Foreign relative arbitrage condition:

$$\begin{aligned} 0 &= \mathbb{E}_t \left(\hat{R}_{s_H,t} - \hat{R}_{s_F,t}\right) \left(\widehat{MUC}_{H,t+1} - \widehat{MUC}_{F,t+1}\right) + O\left(h^3\right) \\ &= \mathbb{E}_t \, \hat{R}_{s_{\mathcal{R}},t} \left(\widehat{MUC}_{H,t+1} - \widehat{MUC}_{F,t+1}\right) + O\left(h^3\right), \end{aligned} \tag{34}$$

where a *hat* denotes percent deviations from the fully symmetric steady state, $\hat{R}_{s_{\mathcal{R}},t}$ is the excess return on Home vs. Foreign equities, $O\left(h^3\right)$ captures terms of third or higher orders, with h being the distance from the steady state, and $\widehat{MUC}_{i,t+1}$ denotes country i's marginal utility of consumption at time $t+1$ for $i = H, F$. Formally, this is

$$\widehat{MUC}_{i,t+1} = -\sigma\left(v_C \hat{C}_{i,t+1} - v_N \hat{N}_{i,t+1}\right) + \widehat{RER}_{t+1} + O\left(h^2\right), \tag{35}$$

where $v_C := C\left[C - \chi N^{1+\nu}/\left(1+\nu\right)\right]^{-1}$ and $v_N := \chi N^{1+\nu}\left[C - \chi N^{1+\nu}/\left(1+\nu\right)\right]^{-1}$. Let us denote the Home-Foreign relative value of the marginal utility of consumption by $\widehat{MUC}_{\mathcal{R},t+1} := \widehat{MUC}_{H,t+1} - \widehat{MUC}_{F,t+1}$ and use an analogous notation for other relative variables.

The behavior of $\widehat{MUC}_{\mathcal{R},t+1}$ depends upon the dynamics of the net foreign assets (NFA) of the two countries. According to eq. (21), the dynamics of the Home NFA around the steady state are, up to first order accuracy,

$$\widehat{nfa}_{H,t} = \widehat{nx}_{H,t} + \widetilde{\omega}\hat{R}_{s_{\mathcal{R}},t} + \frac{1}{\beta}\widehat{nfa}_{H,t-1} + O\left(h^2\right), \tag{36}$$

where $\widehat{nfa}_{H,t} := nfa_{H,t}/Y$, $\widehat{nx}_{H,t} := nx_{H,t}/Y$ and $\widetilde{\omega} := \omega/\left(\beta Y\right)$, with ω being the steady-state portolio. The dynamics of the Home trade balance component of this law of motion for $\widehat{nfa}_{H,t}$

are given by

$$\widehat{nx}_{H,t} = \hat{p}_{H,t} + \hat{Y}_{H,t} - \hat{P}_{H,t} - \left[(1-\varsigma_X)\hat{C}_{H,t} + \varsigma_X \hat{X}_{H,t}\right], \tag{37}$$

where $\varsigma_X := X/Y$. Therefore, subtracting to eq. (36) an analogous expression for the Foreign NFA under the global equilibrium condition $\widehat{nfa}_{H,t} + \widehat{nfa}_{F,t} = 0$ and computing a forward-looking solution, we get:

$$\begin{aligned}
\frac{1}{\beta}\widehat{nfa}_{H,t} \quad = \quad & \frac{1-\varsigma_X}{2}\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\hat{C}_{\mathcal{R},t+k} - \widetilde{\omega}\hat{R}_{s_{\mathcal{R}},t} \\
& -\frac{\varsigma_{WN}}{2}\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\left(\hat{W}_{\mathcal{R},t+k} + \hat{N}_{\mathcal{R},t+k}\right) \\
& -\frac{\varsigma_{\Pi}}{2}\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\hat{\Pi}_{\mathcal{R},t+k} - \frac{1-\varsigma_X}{2}\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\widehat{RER}_{t+k} + O\left(h^2\right),
\end{aligned} \tag{38}$$

where $\varsigma_{\Pi} := \Pi/Y$, $\varsigma_{WN} := WN/Y$ and we have used the following two results. First, up to the first order, $\mathbb{E}_{t+1}\hat{R}_{s_{\mathcal{R}},t+k} = 0 \;\; \forall k > 1$. Second, eq. (22), an analogous equation for the Foreign country and eq. (2) imply

$$\varsigma_{WN}\left(\hat{W}_{\mathcal{R},t} + \hat{N}_{\mathcal{R},t}\right) + \varsigma_{\Pi}\hat{\Pi}_{\mathcal{R},t} = \hat{Y}_{\mathcal{R},t} - \widehat{ToT}_t - \varsigma_X\left(\hat{X}_{\mathcal{R},t} - \widehat{RER}_t\right) + O\left(h^2\right). \tag{39}$$

Approximating the Euler equation for the reference asset ($1 = \mathbb{E}_t m_{i,t+1}\tilde{R}_{s_F,t+1}$) for $i = H, F$ and solving forward, we find that

$$\begin{aligned}
\widehat{MUC}_{\mathcal{R},t+1} \quad = \quad & -\left[\sigma v_C - \beta\left(\sigma v_C - \varphi v_{\beta,C}\right)\right]\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\hat{C}_{\mathcal{R},t+k} \\
& +\left[\sigma v_N - \beta\left(\sigma v_N - \varphi v_{\beta,N}\right)\right]\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\hat{N}_{\mathcal{R},t+k} \\
& +(1-\beta)\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\widehat{RER}_{t+k} + O\left(h^2\right),
\end{aligned} \tag{40}$$

where $v_{\beta,C} := C\left[1 + C - \chi N^{1+\nu}/\left(1+\nu\right)\right]^{-1}$ and $v_{\beta,N} := \chi N^{1+\nu}\left[1 + C - \chi N^{1+\nu}/\left(1+\nu\right)\right]^{-1}$.

Next, we combine eq. (38) and eq. (40) to eliminate $\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\hat{C}_{\mathcal{R},t+k}$ and further use $\widehat{RER}_t = (2\gamma - 1)\,\widehat{ToT}_t \;\; \forall t$, obtaining an equation for the dynamics of $\widehat{MUC}_{\mathcal{R},t+1}$. The latter dynamics are then used in conjunction with eq. (34) to find the optimal portfolio:

$$\begin{aligned}
\widetilde{\omega} \quad = \quad & \frac{1-\varsigma_X}{2\left[\sigma v_C - \beta\left(\sigma v_C - \varphi v_{\beta,C}\right)\right]}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{L,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})} - \frac{\varsigma_{WN}}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{WN,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})} \\
& -\frac{\varsigma_{\Pi}}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{\Pi,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})} - \frac{\Gamma}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{ToT,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})},
\end{aligned} \tag{41}$$

where $\Gamma := (2\gamma - 1)(1 - \varsigma_X)\left[1 - \frac{1-\beta}{\sigma v_C - \beta(\sigma v_C - \varphi v_{\beta,C})}\right]$ and the following definitions express the *risk* factors behind portfolio choice:

$$\begin{aligned}
\eta_{L,t+1} &:= \left[\sigma v_N - \beta\left(\sigma v_N - \varphi v_{\beta,N}\right)\right] \sum_{k=1}^{\infty} \beta^{k-1}\mathbb{E}_{t+1}\hat{N}_{\mathcal{R},t+k} && (42)\\
\eta_{WN,t+1} &:= \sum_{k=1}^{\infty} \beta^{k-1}\mathbb{E}_{t+1}\left(\hat{W}_{\mathcal{R},t+k} + \hat{N}_{\mathcal{R},t+k}\right) && (43)\\
\eta_{\Pi,t+1} &:= \sum_{k=1}^{\infty} \beta^{k-1}\mathbb{E}_{t+1}\hat{\Pi}_{\mathcal{R},t+k} && (44)\\
\eta_{ToT,t+1} &:= \sum_{k=1}^{\infty} \beta^{k-1}\mathbb{E}_{t+1}\widehat{ToT}_{t+k}. && (45)
\end{aligned}$$

These four determinants are the changes in leisure, the labor income risk, the dividend income risk and the terms of trade risk, respectively.

Second step. Households' optimal labor effort satisfies eq. (23), so the approximated Home-Foreign relative labor supply is

$$\hat{N}_{\mathcal{R},t} = \frac{1}{\nu}\left[\hat{W}_{\mathcal{R},t} + (2\gamma - 1)\,\widehat{ToT}_t\right]. \tag{46}$$

Using this result to eliminate $\hat{N}_{\mathcal{R},t+k}$ from both $\eta_{L,t+1}$ and $\eta_{WN,t+1}$ and simplifying, eq. (41) becomes

$$\begin{aligned}
\widetilde{\omega} &= -\frac{\Gamma}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_\mathcal{R},t+1}\eta_{ToT,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_\mathcal{R},t+1})} - \frac{\varsigma_\Pi}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_\mathcal{R},t+1}\eta_{\Pi,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_\mathcal{R},t+1})}\\
&\quad + \frac{\mathbb{E}_t\hat{R}_{s_\mathcal{R},t+1}}{\mathrm{Var}(\hat{R}_{s_\mathcal{R},t+1})}\cdot\left[\begin{array}{c}\left(\frac{1-\varsigma_X}{2}\right)\frac{\sigma v_N - \beta(\sigma v_N - \varphi v_{\beta,N})}{\sigma v_C - \beta(\sigma v_C - \varphi v_{\beta,C})}\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\hat{N}_{\mathcal{R},t+k}\\ -\frac{\varsigma_{WN}}{2}\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\left(\hat{W}_{\mathcal{R},t+k} + \hat{N}_{\mathcal{R},t+k}\right)\end{array}\right]\\
&= -\frac{\Gamma}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_\mathcal{R},t+1}\eta_{ToT,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_\mathcal{R},t+1})} - \frac{\varsigma_\Pi}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_\mathcal{R},t+1}\eta_{\Pi,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_\mathcal{R},t+1})}\\
&\quad - \frac{\mathbb{E}_t\hat{R}_{s_\mathcal{R},t+1}}{\mathrm{Var}(\hat{R}_{s_\mathcal{R},t+1})}\cdot\left[\frac{1}{2}\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\left(A_W\hat{W}_{\mathcal{R},t+k} + A_{ToT}\widehat{ToT}_{t+k}\right)\right],
\end{aligned} \tag{47}$$

where the coefficients a_W and a_{ToT} are

$$\begin{aligned}
A_W &:= \frac{1}{\nu}\left[\varsigma_{WN}(1+\nu) - (1-\varsigma_X)\frac{\sigma v_N(1-\beta) + \beta\varphi v_{\beta,N}}{\sigma v_C(1-\beta) + \beta\varphi v_{\beta,C}}\right] && (48)\\
A_{ToT} &:= \frac{2\gamma - 1}{\nu}\left[\varsigma_{WN} - (1-\varsigma_X)\frac{\sigma v_N(1-\beta) + \beta\varphi v_{\beta,N}}{\sigma v_C(1-\beta) + \beta\varphi v_{\beta,C}}\right], && (49)
\end{aligned}$$

respectively.

Note that $1-\varsigma_X$ is the proportion of total output that is consumed and ς_{WN} is the labor income share. Hence, given v_C, v_N, $v_{\beta,C}$ and $v_{\beta,N}$, we have that

$$(1-\varsigma_X)\,\frac{\sigma v_N\,(1-\beta)+\beta\varphi v_{\beta,N}}{\sigma v_C\,(1-\beta)+\beta\varphi v_{\beta,C}}=\frac{\chi N^{1+\nu}}{Y}=\varsigma_{WN},\tag{50}$$

where the second equality is ensured by the households' optimal condition for labor. As a result, $A_W=\varsigma_{WN}$, $A_{ToT}=0$ and eq. (41) can ultimately be written as follows:

$$\begin{aligned}\widetilde{\omega} \;&=\; -\frac{\Gamma}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{ToT,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}\\ &\quad-\frac{\varsigma_{WN}}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{W,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}-\frac{\varsigma_{\Pi}}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{\Pi,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})},\end{aligned}\tag{51}$$

where $\eta_{W,t+1}:=\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\hat{W}_{\mathcal{R},t+k}$ is the wage risk stemming from the combination of $\eta_{L,t+1}$ and $\eta_{WN,t+1}$. Knowing that $\widetilde{\omega}=(s_{HH}-1)V/(\beta Y)$ and $\mathbb{E}_t\hat{R}_{s_{\mathcal{R}},t+1}=0$ up to the first order, it is straightforward to obtain eq. (24) from eq. (51). □

C.1.2 Proof of Proposition 2

Proof. The dynamics of the Home-Foreign relative dividend income are given by

$$\hat{\Pi}_{\mathcal{R},t}=\frac{(2\gamma-1)\varsigma_X-1}{\varsigma_{\Pi}}\widehat{ToT}_t+\frac{\hat{Y}_{\mathcal{R},t}}{\varsigma_{\Pi}}-\frac{\varsigma_{WN}}{\varsigma_{\Pi}}\left(\hat{W}_{\mathcal{R},t}+\hat{N}_{\mathcal{R},t}\right)-\frac{\varsigma_X}{\varsigma_{\Pi}}\hat{X}_{\mathcal{R},t}.\tag{52}$$

Therefore, we can combine the risk factors $\eta_{W,t+1}$ and $\eta_{\Pi,t+1}$ to eliminate the dynamics of the relative nominal wage. As a result, the optimal portfolio (24) becomes

$$\begin{aligned}\widetilde{\omega} \;&=\; -\frac{1}{2}\left[\Gamma+(2\gamma-1)\varsigma_X-1\right]\frac{\mathbb{E}_t\hat{R}_{s_{\mathcal{R}},t+1}}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}\cdot\left(\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\widehat{ToT}_{t+k}\right)\\ &\quad-\frac{1}{2}\cdot\frac{\mathbb{E}_t\hat{R}_{s_{\mathcal{R}},t+1}}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}\cdot\left\{\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\left[\hat{Y}_{\mathcal{R},t+k}-\varsigma_{WN}\hat{N}_{\mathcal{R},t+k}-\varsigma_X\hat{X}_{\mathcal{R},t+k}\right]\right\}.\end{aligned}\tag{53}$$

Let us now consider the labor market. We already know from eq. (46) that the Home-Foreign relative supplied labor is $\hat{N}_{\mathcal{R},t}=\nu^{-1}\left[\hat{W}_{\mathcal{R},t}+(2\gamma-1)\,\widehat{ToT}_t\right]$. In turn, the optimal demand for labor (8), approximated to the first order, suggests that the dynamics of the nominal wage are

$$\hat{W}_{i,t}=\hat{p}_{i,t}+\hat{Y}_{i,t}-\frac{\mu}{1+\mu}\left(\hat{\mu}_{i,t}-\hat{\lambda}_{i,t}\right)-\hat{N}_{i,t},\quad\text{for } i=H,F.\tag{54}$$

Therefore, the Home-Foreign relative equilibrium employment is

$$\hat{N}_{\mathcal{R},t} = \frac{1}{1+\nu}\left[\hat{Y}_{\mathcal{R},t} - 2(1-\gamma)\widehat{ToT}_t - \frac{\mu}{1+\mu}\left(\hat{\mu}_{\mathcal{R},t} - \hat{\lambda}_{\mathcal{R},t}\right)\right], \tag{55}$$

with $\hat{\lambda}_{\mathcal{R},t} = -\kappa D\hat{D}_{\mathcal{R},t}$.

In light of eq. (55), the solution for the optimal portfolio in eq. (53) implies

$$\begin{aligned}
\widetilde{\omega} &= -\frac{\widetilde{\Gamma}}{2}\cdot\frac{\mathbb{E}_t\hat{R}_{s_{\mathcal{R}},t+1}}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}\cdot\left(\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\widehat{ToT}_{t+k}\right) \\
&\quad -\frac{1}{2}\cdot\frac{\mathbb{E}_t\hat{R}_{s_{\mathcal{R}},t+1}}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}\cdot\left\{\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\left[\begin{array}{c}\left(1-\frac{\varsigma_{WN}}{1+\nu}\right)\hat{Y}_{\mathcal{R},t+k} - \varsigma_X\hat{X}_{\mathcal{R},t+k} \\ +\frac{\varsigma_{WN}\mu}{(1+\nu)(1+\mu)}\left(\hat{\mu}_{\mathcal{R},t+k} - \hat{\lambda}_{\mathcal{R},t+k}\right)\end{array}\right]\right\} \\
&= -\frac{\widetilde{\Gamma}}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{ToT,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})} - \frac{1}{2}\cdot\frac{\mathbb{E}_t\left(\hat{R}_{s_{\mathcal{R}},t+1}\eta_{y,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}.
\end{aligned} \tag{56}$$

where $\eta_{y,t+1}$ denotes the overall income risk and

$$\begin{aligned}
\widetilde{\Gamma} &= \Gamma + (2\gamma-1)\varsigma_X - 1 + 2\frac{\varsigma_{WN}}{1+\nu}(1-\gamma) \\
&= -2\left(1-\frac{\varsigma_{WN}}{1+\nu}\right)(1-\gamma) - \frac{(2\gamma-1)(1-\varsigma_X)(1-\beta)}{\sigma\upsilon_C - \beta(\sigma\upsilon_C - \varphi\upsilon_{\beta,C})}.
\end{aligned}$$

Finally, knowing that $\widetilde{\omega} = (s_{HH}-1)V/(\beta Y)$ and $\mathbb{E}_t\hat{R}_{s_{\mathcal{R}},t+1} = 0$ up to the first order, it is straightforward to obtain eq. (26) from eq. (56).

Moreover, it is easy to see that $\widetilde{\Gamma} < 0$, given that $\nu > 0$, $\gamma \in (0.5, 1]$ and $\beta, \varsigma_X \in (0,1)$. Furthermore, $\eta_{y,t+1}$ is independent of the debt-equity multiplier only if $\mu \to 0$. □

C.2 Solving for portfolios numerically

Following Devereux and Sutherland (2010, 2011), the model in Section 3 can be solved by adding a financial wealth shock, $\epsilon_t^{(\omega)}$, to the vector of innovations that are proper of the model, $\boldsymbol{\varepsilon_t}$.[27] Then, given the state-space solution of the model, the solution for $\widetilde{\omega}$ is as follows:

$$\hat{R}_{s_{\mathcal{R}},t+1} = \mathbf{J}\boldsymbol{\varepsilon}_{t+1} \tag{57}$$

$$\widehat{MUC}_{H,t+1} - \widehat{MUC}_{F,t+1} = \mathbf{L_e}\boldsymbol{\varepsilon}_{t+1} + \mathbf{L}_{\mathcal{S}}\begin{pmatrix}\hat{\boldsymbol{e}}_t \\ \hat{\boldsymbol{\mathcal{S}}}_{t+1}\end{pmatrix}, \tag{58}$$

[27] See also Trani (2015) for a more comprehensive discussion and a generalization.

where $\boldsymbol{\varepsilon_{t+1}} = (\varepsilon_{Z_H,t+1}, \varepsilon_{\zeta_H,t+1}, \varepsilon_{Z_F,t+1}, \varepsilon_{\zeta_F,t+1})'$, $\hat{\boldsymbol{e}}_{\boldsymbol{t}}$ is the vector of exogenous states, $\hat{\boldsymbol{\mathcal{S}}}_{\boldsymbol{t+1}}$ is the vector of endogenous states, and $\mathbf{J}$, $\mathbf{L_e}$, $\mathbf{L}_{\mathcal{S}}$ contain coefficients describing the solution. Therefore, since

$$\epsilon^{(\omega)}_{t+1} = \mathbf{H}\boldsymbol{\varepsilon_{t+1}}, \tag{59}$$

and $\mathbf{J}$ and $\mathbf{L_e}$ are linear combinations of $\mathbf{H}$ ($\mathbf{J}$=$\mathbf{J_1 H} + \mathbf{J_2}$ and $\mathbf{L_e}$=$\mathbf{L_{e,1} H} + \mathbf{L_{e,2}}$), we get

$$\widetilde{\omega} = (\mathbf{J_2 \Sigma_\varepsilon L'_{e,2} J'_1} - \mathbf{L_{e,1} J_2 \Sigma_\varepsilon J'_2})^{-1} \mathbf{J_2 \Sigma_\varepsilon L'_{e,2}}, \tag{60}$$

where $\mathbf{\Sigma}_\varepsilon$ is the covariance matrix of the shocks.

C.3 Optimal Porfolio and the Elasticity of Substitution between Goods

The analysis conducted in this section is for an elasticity of substitution between goods, θ, that can be either equal to 1 or different from 1.

The relative demand for consumption and investment goods can be written as follows:

$$\frac{c_{HH,t} + c_{HF,t}}{c_{FH,t} + c_{FF,t}} = ToT_t^\theta \Lambda_\gamma \left(RER_t^\theta \frac{C_{F,t}}{C_{H,t}} \right) \tag{61}$$

$$\frac{x_{HH,t} + x_{HF,t}}{x_{FH,t} + x_{FF,t}} = ToT_t^\theta \Lambda_\gamma \left(RER_t^\theta \frac{X_{F,t}}{X_{H,t}} \right), \tag{62}$$

where $\Lambda_\gamma(z) = \frac{1+\frac{1-\gamma}{\gamma}z}{\frac{1-\gamma}{\gamma}+z}$. Therefore, taking a first-order approximation, the Home-Foreign relative output implied by the goods market clearing condition (17) is

$$\hat{Y}_{\mathcal{R},t} = \theta \left[1 - (2\gamma - 1)^2\right] \widehat{ToT}_t + (2\gamma - 1) \left[(1 - \varsigma_X)\hat{C}_{\mathcal{R},t} + \varsigma_X \hat{X}_{\mathcal{R},t}\right]. \tag{63}$$

We can use this result to eliminate $\hat{Y}_{\mathcal{R},t+k}$ from the optimal portfolio (26), obtaining:

$$s_{HH} = 1 - \frac{\widetilde{\Gamma}_\theta}{2(V/Y)} \frac{\text{Cov}\left(\hat{R}_{s_\mathcal{R},t+1}, \eta_{ToT,t+1}\right)}{\text{Var}(\hat{R}_{s_\mathcal{R},t+1})} - \frac{1}{2(V/Y)} \cdot \frac{\text{Cov}\left(\hat{R}_{s_\mathcal{R},t+1}, \widetilde{\eta}_{y,t+1}\right)}{\text{Var}(\hat{R}_{s_\mathcal{R},t+1})}, \tag{64}$$

where

$$
\begin{aligned}
\widetilde{\eta}_{y,t+1} \quad &:= \quad \sum_{k=1}^{\infty} \beta^{k-1} \mathbb{E}_{t+1} \left\{ \left(1 - \frac{\varsigma_{WN}}{1+\nu}\right) (2\gamma - 1)(1 - \varsigma_X) \hat{C}_{\mathcal{R},t+k} \right. \\
&\quad \left. - \left[2(1-\gamma) + \frac{\varsigma_{WN}(2\gamma-1)}{1+\nu}\right] \varsigma_X \hat{X}_{\mathcal{R},t+k} + \frac{\varsigma_{WN}\mu}{(1+\nu)(1+\mu)} \left(\hat{\mu}_{\mathcal{R},t+k} - \hat{\lambda}_{\mathcal{R},t+k}\right) \right\} \quad (65) \\
\widetilde{\Gamma}_\theta \quad &:= \quad \widetilde{\Gamma} + \left(1 - \frac{\varsigma_{WN}}{1+\nu}\right) \theta \left[1 - (2\gamma-1)^2\right] \\
&= \quad - \left(1 - \frac{\varsigma_{WN}}{1+\nu}\right) \left\{2(1-\gamma) - \theta\left[1 - (2\gamma-1)^2\right]\right\} - \frac{(2\gamma-1)(1-\varsigma_X)(1-\beta)}{\sigma v_C - \beta(\sigma v_C - \varphi v_{\beta,C})}. \quad (66)
\end{aligned}
$$

Note also that

$$
\widetilde{\Gamma}_\theta \Big|_{\theta=1} = 2\left(1 - \frac{\varsigma_{WN}}{1+\nu}\right)(2\gamma-1)(1-\gamma) - \frac{(2\gamma-1)(1-\varsigma_X)(1-\beta)}{\sigma v_C - \beta(\sigma v_C - \varphi v_{\beta,C})},
$$

which would of course equal zero if there were no domestic bias in tastes (i.e., $\gamma = 0.5$).

More generally, so long as $0.5 < \gamma < 1$, $\widetilde{\Gamma}_\theta > \widetilde{\Gamma}$—with $\widetilde{\Gamma} < 0$—and this is more so, the greater θ is. Theoretically, $\widetilde{\Gamma}_\theta \geq 0$ if

$$
\theta \geq \frac{1}{1 - (2\gamma-1)^2} \left\{ 2(1-\gamma) + \frac{(2\gamma-1)(1-\varsigma_X)(1+\nu)(1-\beta)}{(1+\nu-\varsigma_{WN})[\sigma v_C(1-\beta) + \varphi\beta v_{\beta,C}]} \right\}.
$$

It is well known that there is an ample range of estimates for θ. Most micro estimates suggest values widely above 2, but macro estimates are generally below 2. It is only for $\gamma = 1$ that $\widetilde{\Gamma}_\theta = \widetilde{\Gamma}$, and they are both unambiguously negative.

Comparing eq. (64) with eq. (26), we can easily see that the former does not help in either further simplifying or further clarifying the latter. The reason for this is that, in our model, portfolio choice is influenced by financial market imperfections and the nonseparability of agents' preferences between consumption and leisure. In the absence of both these characteristics, Coeurdacier et al. (2010) and Heathcote and Perri (2013), among others, take advantage of complete risk sharing to express $\hat{C}_{\mathcal{R},t}$ solely as a function of $\widehat{ToT}_t$. Moreover, the cost of corporate borrowing vs. equity financing affects $\widetilde{\omega}$ in the same way in eq. (64) as in eq. (26).

C.4 Portfolio Choice under Separable Preferences

Let us make the more frequent assumption in the literature on equity home bias that agents display separable rather than GHH preferences:

$$u(C_{i,t}, N_{i,t}) = \frac{C_{i,t}^{1-\sigma}}{1-\sigma} - \chi^{(sp)} \frac{N_{i,t}^{1+\nu}}{1+\nu}. \tag{67}$$

Coherently, the endogenous discount factor depends solely on consumption:

$$\beta_{i,t} = \beta(C_{i,t}) = (1 + C_{i,t})^{-\varphi_i^{(sp)}}. \tag{68}$$

To find the equation for the equilibrium portfolio share, we can go through the same steps indicated in Section C.1. In other words, it is necessary to combine a second order approximation of the portfolio Euler equation with an approximation of the Home country's NFA. The second-order approximation of the portfolio Euler equation is again given by eq. (34), and the approximation of the NFA is also equal to the one used under GHH preferences (eq. (38)). However, the dynamics of the Home-Foreign relative marginal utility of consumption are different; that is,

$$\widehat{MUC}_{\mathcal{R},t+1} = -\sigma \hat{C}_{\mathcal{R},t+1} + \widehat{RER}_{\mathcal{R},t+1}, \tag{69}$$

implying that

$$\begin{aligned}
\sum_{k=1}^{\infty} \beta^{k-1} \mathbb{E}_{t+1} \hat{C}_{\mathcal{R},t+k} &= \frac{\sigma}{\sigma - \beta(\sigma - \varphi v_{\beta,C}^{(sp)})} \hat{C}_{\mathcal{R},t+1} \\
&\quad - \frac{1}{\sigma - \beta(\sigma - \varphi v_{\beta,C}^{(sp)})} \left[\widehat{RER}_{t+1} - (1-\beta) \sum_{k=1}^{\infty} \beta^{k-1} \mathbb{E}_{t+1} \widehat{RER}_{t+k} \right],
\end{aligned} \tag{70}$$

where $v_{\beta,C}^{(sp)} := C/(1+C)$.

Using the latter to eliminate $\sum_{k=1}^{\infty} \beta^{k-1} \mathbb{E}_{t+1} \hat{C}_{\mathcal{R},t+k}$ from the dynamics of the NFA in eq. (38) and, then, combining the ensuing equation with the second-order accurate portfolio Euler equation in eq. (34), we get

$$\begin{aligned}
\widetilde{\omega}^{(sp)} &= -\frac{\varsigma_{WN}}{2} \cdot \frac{\mathbb{E}_t \left(\hat{R}_{s_{\mathcal{R}},t+1} \eta_{WN,t+1} \right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})} \\
&\quad - \frac{\varsigma_{\Pi}}{2} \cdot \frac{\mathbb{E}_t \left(\hat{R}_{s_{\mathcal{R}},t+1} \eta_{\Pi,t+1} \right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})} - \frac{\Gamma^{(sp)}}{2} \cdot \frac{\mathbb{E}_t \left(\hat{R}_{s_{\mathcal{R}},t+1} \eta_{ToT,t+1} \right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})},
\end{aligned} \tag{71}$$

where $\Gamma^{(sp)} := (2\gamma - 1)\,(1 - \varsigma_X)\left[1 - \frac{1-\beta}{\sigma - \beta\left(\sigma - \varphi v_{\beta,C}^{(sp)}\right)}\right]$. The difference between this result and that in eq. (41) is that here agents do not account for the value of leisure in making their financial decisions. As a result, these decisions are motivated by hedging against the whole labor income risk, $\eta_{WN,t+1}$, rather than just the wage risk, $\eta_{W,t+1}$.

Next, combining the risk factors $\eta_{WN,t+1}$ and $\eta_{\Pi,t+1}$, the solution for $\widetilde{\omega}$ becomes

$$\begin{aligned}\widetilde{\omega} \;\; = \;\; & -\frac{1}{2}\left[\Gamma^{(sp)} + (2\gamma-1)\varsigma_X - 1\right]\frac{\mathbb{E}_t\hat{R}_{s_{\mathcal{R}},t+1}}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}\cdot\left(\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\widehat{ToT}_{t+k}\right) \\ & -\frac{1}{2}\cdot\frac{\mathbb{E}_t\hat{R}_{s_{\mathcal{R}},t+1}}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}\cdot\left[\sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\left(\hat{Y}_{\mathcal{R},t+k} - \varsigma_X\hat{X}_{\mathcal{R},t+k}\right)\right]. \end{aligned} \tag{72}$$

It follows that

$$s_{HH}^{(sp)} = 1 - \frac{\widetilde{\Gamma}^{(sp)}}{2(V/Y)}\cdot\frac{\mathrm{Cov}\left(\hat{R}_{s_{\mathcal{R}},t+1}, \eta_{ToT,t+1}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})} - \frac{1}{2(V/Y)}\cdot\frac{\mathrm{Cov}\left(\hat{R}_{s_{\mathcal{R}},t+1}, \eta_{y,t+1}^{(sp)}\right)}{\mathrm{Var}(\hat{R}_{s_{\mathcal{R}},t+1})}, \tag{73}$$

where

$$\eta_{y,t+1}^{(sp)} \;\; := \;\; \sum_{k=1}^{\infty}\beta^{k-1}\mathbb{E}_{t+1}\left(\hat{Y}_{\mathcal{R},t+k} - \varsigma_X\hat{X}_{\mathcal{R},t+k}\right) \tag{74}$$

$$\widetilde{\Gamma}^{(sp)} \;\; := \;\; -2(1-\gamma) - \frac{(2\gamma-1)(1-\varsigma_X)(1-\beta)}{\sigma - \beta(\sigma - \varphi v_{\beta,C}^{(sp)})}, \tag{75}$$

with $\widetilde{\Gamma}^{(sp)} < 0$.

Given that here preferences are separable, one could furthermore follow the steps outlined in Section C.3 to write eq. (72) as a function of only two determinants of portfolio choice, that is, investment and the terms of trade.

C.5 Extended Model: Equilibrium Conditions and Portfolios

New first order conditions. The new first order conditions for the optimization problem of the firm in country i (with $i, j = H, F$ and $i \neq j$) are:

$$
\begin{aligned}
D_{i,t} &= p_{i,t}Y_{i,t} - W_{i,t}N_{i,t} - P_{i,t}X_{i,t} + \frac{p_{i,t}}{1 + r_{i,t}(1-\tau_i)}B_{i,t} - p_{i,t}B_{i,t-1} && (76)\\
Y_{i,t} &= f\left(Z_{i,t}, \mathcal{KS}_{i,t}, N_{i,t}\right) - \varkappa\left(D_{i,t}\right) && (77)\\
W_{i,t}N_{i,t} &= \xi_{i,t}\left(P_{i,t}K_{i,t} - \frac{p_{i,t}}{1 + r_{i,t}}B_{i,t}\right) && (78)\\
\lambda_{i,t} &= \frac{1}{1 + p_{i,t}\varkappa'\left(D_{i,t}\right)} && (79)\\
1 &= \mathbb{E}_t m_{i,t+1}\frac{\lambda_{i,t+1}}{\lambda_{i,t}}R_{b_i,t+1} + \frac{\mu_{i,t}}{\lambda_{i,t}}\xi_{i,t}\left[\frac{1 + r_{i,t}(1-\tau_i)}{1 + r_{i,t}}\right] && (80)\\
W_{i,t}\left(1 + \frac{\mu_{i,t}}{\lambda_{i,t}}\right) &= p_{i,t}f_N\left(Z_{i,t}, \mathcal{KS}_{i,t}, N_{i,t}\right) && (81)\\
q_{i,t} - \frac{\mu_{i,t}}{\lambda_{i,t}}\xi_{i,t} &= \mathbb{E}_t m_{i,t+1}\frac{\lambda_{i,t+1}P_{i,t+1}}{\lambda_{i,t}P_{i,t}} \\
&\quad \cdot\left[\frac{p_{i,t+1}}{P_{i,t+1}}f_{\mathcal{KS}}\left(Z_{i,t+1}, \mathcal{KS}_{i,t+1}, N_{i,t+1}\right)u_{K_{i,t+1}} + (1 - \delta(u_{K_{i,t+1}}))q_{i,t+1}\right] && (82)\\
q_{i,t}\delta'(u_{K_{i,t}}) &= \frac{p_{i,t}}{P_{i,t}}\lambda_{i,t}\frac{\alpha f(Z_{i,t}, \mathcal{KS}_{i,t}, N_{i,t})}{\mathcal{KS}_{i,t}} && (83)\\
\lambda_{i,t} &= q_{i,t}e^{\zeta_{i,t}}\left[1 - \Psi\left(\frac{X_{i,t}}{X_{i,t-1}}\right) - \Psi'\left(\frac{X_{i,t}}{X_{i,t-1}}\right)\frac{X_{i,t}}{X_{i,t-1}}\right] \\
&\quad + \mathbb{E}_t m_{i,t+1}\frac{P_{i,t+1}}{P_{i,t}}q_{i,t+1}e^{\zeta_{i,t+1}}\Psi'\left(\frac{X_{i,t+1}}{X_{i,t}}\right)\left(\frac{X_{i,t+1}}{X_{i,t}}\right)^2 && (84)\\
x_{ii,t} &= \gamma\left(\frac{p_{i,t}}{P_{i,t}}\right)^{-\theta}X_{i,t} && (85)\\
x_{ji,t} &= (1-\gamma)\left(\frac{p_{j,t}}{P_{i,t}}\right)^{-\theta}X_{i,t}. && (86)
\end{aligned}
$$

As far as the household is concerned, the Euler equations are

$$
1 = \mathbb{E}_t\widetilde{R}_{b_k,t+1}m_{i,t+1} = \mathbb{E}_t R_{s_k,t+1}m_{i,t+1} = \mathbb{E}_t R_{a_k,t+1}m_{i,t+1}, \quad \text{for } k = i, j, \qquad (87)
$$

with

$$
\begin{aligned}
m_{i,t+1} &:= \beta_{i,t}\frac{u_C\left(C_{i,t+1}, N_{i,t+1}\right)P_{i,t}}{u_C\left(C_{i,t}, N_{i,t}\right)P_{i,t+1}} && (88)\\
R_{s_i,t} &:= \left(V_{i,t} + D_{i,t}\right)/V_{i,t-1} && (89)\\
\widetilde{R}_{b_i,t} &:= \frac{R_{b_i,t} - p_{i,t}\tau_i/p_{i,t-1}}{1-\tau_i} && (90)\\
R_{a_i,t} &:= \left(p_{a_i,t} + p_{i,t}\right)/p_{a_i,t-1}, && (91)
\end{aligned}
$$

because she can take positions in six internationally traded assets, while the rest of the equilibrium conditions is as in Section 3.

Portfolio choice. Letting the Foreign corporate bond be the reference asset, household i's first order conditions for traded assets (87) imply the following portfolio Euler equations:

$$
\begin{aligned}
0 &= \mathbb{E}_t \left(R_{s_H,t+1} - \tilde{R}_{b_F,t+1}\right) m_{i,t+1} && (92)\\
0 &= \mathbb{E}_t \left(R_{s_F,t+1} - \tilde{R}_{b_F,t+1}\right) m_{i,t+1} && (93)\\
0 &= \mathbb{E}_t \left(R_{a_H,t+1} - \tilde{R}_{b_F,t+1}\right) m_{i,t+1} && (94)\\
0 &= \mathbb{E}_t \left(R_{a_F,t+1} - \tilde{R}_{b_F,t+1}\right) m_{i,t+1} && (95)\\
0 &= \mathbb{E}_t \left(\tilde{R}_{b_H,t+1} - \tilde{R}_{b_F,t+1}\right) m_{i,t+1}, && (96)
\end{aligned}
$$

which can be written more compactly as

$$0 = \mathbb{E}_t \boldsymbol{R}_{\mathcal{R},t+1} m_{i,t+1}, \tag{97}$$

where $\boldsymbol{R}_{\mathcal{R},t} = \left(R_{s_H,t} - \widetilde{R}_{b_F,t} \;\; R_{s_F,t} - \widetilde{R}_{b_F,t} \;\; R_{a_H,t} - \widetilde{R}_{b_F,t} \;\; R_{a_F,t} - \widetilde{R}_{b_F,t} \;\; \widetilde{R}_{b_H,t} - \widetilde{R}_{b_F,t}\right)'$ is the vector of the excess returns.

From the the budget constraint (31) and $T_{H,t}$, we find that the Home country's NFA (in units of the final good) are given by

$$nfa_{H,t} = nx_{H,t} + \frac{P_{H,t-1}}{P_{H,t}} \left(\boldsymbol{R}'_{\mathcal{R},t} \boldsymbol{\omega}_{t-1} + \widetilde{R}_{b_F,t} nfa_{H,t-1}\right), \tag{98}$$

where $\boldsymbol{\omega}_t = (\omega_{1,t} \;\; \omega_{2,t} \;\; \omega_{3,t} \;\; \omega_{4,t} \;\; \omega_{5,t})'$ is the country portfolio, and $nfa_{H,t} = \omega_{1,t} + \omega_{2,t} + \omega_{3,t} + \omega_{4,t} + \omega_{5,t} + RER_t p_{F,t} b_{FH,t} / \left[(1 + r_{F,t}) P_{F,t}\right]$. The portfolio shares $\omega_{1,t}$ and $\omega_{2,t}$ capture the equity portfolio—referring to Home and Foreign stocks, respectively. Formally, they are: $\omega_{1,t} := (s_{HH,t} - 1) V_{H,t} / P_{H,t}$; $\omega_{2,t} := s_{FH,t} RER_t V_{F,t} / P_{F,t}$. The remaining shares, $\omega_{3,t}$, $\omega_{4,t}$, $\omega_{5,t}$, capture the bond portfolio. Specifically, the first two shares capture the holdings of coupon bonds, and are defined as follows: $\omega_{3,t} := p_{a_H,t} a_{HH,t} / P_{H,t}$; $\omega_{4,t} := p_{a_F,t} RER_t a_{FH,t} / P_{F,t}$. In turn, $\omega_{5,t} := p_{H,t} \left(b_{HH,t} - B_{H,t}\right) / \left[(1 + r_{H,t}) P_{H,t}\right]$ captures the holdings of corporate bonds. Given symmetry, we must have $\omega_{2,t} = -\omega_{1,t}$ and $\omega_{4,t} = -\omega_{3,t}$, which is ultimately ensured by the menu of traded assets under assumption.

Computing a second-order approximation of eq. (97) for $i = H, F$, we get the following relative arbitrage condition:

$$\mathbf{0} = \mathbb{E}_t \hat{\boldsymbol{R}}_{\mathcal{R},t+1} \left(\widehat{MUC}_{H,t+1} - \widehat{MUC}_{F,t+1} \right) + \boldsymbol{O}\left(\boldsymbol{h}^3\right), \tag{99}$$

where $\boldsymbol{O}\left(\boldsymbol{h}^3\right)$ captures terms of third or higher orders, with $\boldsymbol{h}$ being the vector of distances from the steady state. In turn, the approximation of the Home NFA (98) is

$$\widehat{nfa}_{H,t} = \widehat{nx}_{H,t} + \hat{\boldsymbol{R}}'_{\mathcal{R},t} \widetilde{\boldsymbol{\omega}} + \frac{1}{\beta} \widehat{nfa}_{H,t-1} + \boldsymbol{O}\left(\boldsymbol{h}^2\right), \tag{100}$$

where $\widetilde{\boldsymbol{\omega}} := \boldsymbol{\omega} / \left(\beta Y\right)$. Therefore, we can follow the same steps outlined in Appendix C.1, finding

$$\begin{aligned} \widetilde{\boldsymbol{\omega}} \quad &= \quad -\frac{\Gamma}{2} \boldsymbol{\Sigma}_{\hat{\boldsymbol{R}}}^{-1} \left[\mathbb{E}_t \left(\hat{\boldsymbol{R}}_{\mathcal{R},t+1} \eta_{ToT,t+1} \right) \right] \\ &\quad\; -\frac{\varsigma_{WN}}{2} \boldsymbol{\Sigma}_{\hat{\boldsymbol{R}}}^{-1} \left[\mathbb{E}_t \left(\hat{\boldsymbol{R}}_{\mathcal{R},t+1} \eta_{W,t+1} \right) \right] - \frac{\varsigma_{\Pi}}{2} \boldsymbol{\Sigma}_{\hat{\boldsymbol{R}}}^{-1} \left[\mathbb{E}_t \left(\hat{\boldsymbol{R}}_{\mathcal{R},t+1} \eta_{\Pi,t+1} \right) \right] \end{aligned} \tag{101}$$

where $\boldsymbol{\Sigma}_{\hat{\boldsymbol{R}}}^{-1} := \mathbb{E}_t \hat{\boldsymbol{R}}_{\mathcal{R},t+1} \hat{\boldsymbol{R}}'_{\mathcal{R},t+1}$ is the covariance matrix of the excess returns, and, then,

$$\widetilde{\boldsymbol{\omega}} = -\frac{\widetilde{\Gamma}}{2} \boldsymbol{\Sigma}_{\hat{\boldsymbol{R}}}^{-1} \left[\mathbb{E}_t \left(\hat{\boldsymbol{R}}_{\mathcal{R},t+1} \eta_{ToT,t+1} \right) \right] - \frac{1}{2} \boldsymbol{\Sigma}_{\hat{\boldsymbol{R}}}^{-1} \left[\mathbb{E}_t \left(\hat{\boldsymbol{R}}_{\mathcal{R},t+1} \eta_{y,t+1} \right) \right]. \tag{102}$$

Note that $\boldsymbol{\Sigma}_{\hat{\boldsymbol{R}}}^{-1} := \mathbb{E}_t \hat{\boldsymbol{R}}_{\mathcal{R},t+1} \hat{\boldsymbol{R}}'_{\mathcal{R},t+1}$ is independent of the covariance matrix of the shocks ($\boldsymbol{\Sigma}_{\varepsilon}$) because Home and Foreign households can trade six assets to hedge against the six sources of aggregate uncertainty (*spanning condition*). For the same reason, the optimal $\widetilde{\boldsymbol{\omega}}$ displays symmetry in asset holdings, even though markets are endogenously incomplete in our model.

To obtain an expression for the Home agents' holdings of each type of traded asset from , we can use that $\widetilde{\boldsymbol{\omega}} := \boldsymbol{\omega} / \left(\beta Y\right)$, the definition of each component of $\boldsymbol{\omega}$ and $\mathbb{E}_t \hat{\boldsymbol{R}}_{\mathcal{R},t+1} = \mathbf{0}$ up to the first order. As a result, the share of the portfolio invested in domestic equities is

$$\begin{aligned} s_{HH} \quad &= \quad 1 - \frac{\widetilde{\Gamma}}{2(V/Y)} \beta \frac{\operatorname{Cov}\left(\hat{R}_{s_H,t+1} - \widehat{\tilde{R}_{b_F,t+1}}, \eta_{ToT,t+1} | \hat{\boldsymbol{r}}_{\mathcal{R}}^{(1)} \right)}{\operatorname{Var}\left(\hat{R}_{s_H,t+1} - \widehat{\tilde{R}_{b_F,t+1}} | \hat{\boldsymbol{r}}_{\mathcal{R}}^{(1)} \right)} \\ &\quad\; - \frac{1}{2(V/Y)} \beta \frac{\operatorname{Cov}\left(\hat{R}_{s_H,t+1} - \widehat{\tilde{R}_{b_F,t+1}}, \eta_{y,t+1} | \hat{\boldsymbol{r}}_{\mathcal{R}}^{(1)} \right)}{\operatorname{Var}\left(\hat{R}_{s_H,t+1} - \widehat{\tilde{R}_{b_F,t+1}} | \hat{\boldsymbol{r}}_{\mathcal{R}}^{(1)} \right)}, \end{aligned} \tag{103}$$

where $\hat{\boldsymbol{r}}_{\mathcal{R}}^{(1)}$ is a 4×1 vector formed by the elements 2-5 of $\hat{\boldsymbol{R}}_{\mathcal{R},t+1}$ and associated to $\widetilde{\omega}_1$. Given symmetry, $\widetilde{\omega}_1 = -\widetilde{\omega}_2$ and, hence, it is easy to determine the portfolio share of Foreign equities (s_{FH}).

In turn, the share of the portfolio invested in domestic coupon bonds is

$$
\begin{aligned}
a_{HH} \quad = \quad & -\frac{\widetilde{\Gamma}}{2(p_a/Y)}\beta\frac{\text{Cov}\left(\hat{R}_{a_H,t+1} - \widehat{\tilde{R}_{b_F,t+1}}, \eta_{ToT,t+1}|\hat{\boldsymbol{r}}_{\mathcal{R}}^{(3)}\right)}{\text{Var}\left(\hat{R}_{a_H,t+1} - \widehat{\tilde{R}_{b_F,t+1}}|\hat{\boldsymbol{r}}_{\mathcal{R}}^{(3)}\right)} \\
& -\frac{1}{2(p_a/Y)}\beta\frac{\text{Cov}\left(\hat{R}_{a_H,t+1} - \widehat{\tilde{R}_{b_F,t+1}}, \eta_{y,t+1}|\hat{\boldsymbol{r}}_{\mathcal{R}}^{(3)}\right)}{\text{Var}\left(\hat{R}_{a_H,t+1} - \widehat{\tilde{R}_{b_F,t+1}}|\hat{\boldsymbol{r}}_{\mathcal{R}}^{(3)}\right)},
\end{aligned} \tag{104}
$$

where $\hat{\boldsymbol{r}}_{\mathcal{R}}^{(3)}$ is a 4×1 vector formed by the elements 1-2 and 4-5 of $\hat{\boldsymbol{R}}_{\mathcal{R},t+1}$ and associated to $\widetilde{\omega}_3$. Again, given symmetry, $\widetilde{\omega}_3 = -\widetilde{\omega}_4$ and, hence, it is easy to determine the portfolio share of Foreign coupon bonds (a_{FH}). Finally, the share of the portfolio invested in domestic corporate bonds is

$$
\begin{aligned}
b_{HH} \quad = \quad & B - \frac{\widetilde{\Gamma}}{2(1/Y)} \cdot \frac{\text{Cov}\left(\widehat{\tilde{R}_{b_H,t+1}} - \widehat{\tilde{R}_{b_F,t+1}}, \eta_{ToT,t+1}|\hat{\boldsymbol{r}}_{\mathcal{R}}^{(5)}\right)}{\text{Var}\left(\widehat{\tilde{R}_{b_H,t+1}} - \widehat{\tilde{R}_{b_F,t+1}}|\hat{\boldsymbol{r}}_{\mathcal{R}}^{(5)}\right)} \\
& -\frac{1}{2(1/Y)} \cdot \frac{\text{Cov}\left(\widehat{\tilde{R}_{b_H,t+1}} - \widehat{\tilde{R}_{b_F,t+1}}, \eta_{y,t+1}|\hat{\boldsymbol{r}}_{\mathcal{R}}^{(5)}\right)}{\text{Var}\left(\widehat{\tilde{R}_{b_H,t+1}} - \widehat{\tilde{R}_{b_F,t+1}}|\hat{\boldsymbol{r}}_{\mathcal{R}}^{(5)}\right)},
\end{aligned} \tag{105}
$$

where $\hat{\boldsymbol{r}}_{\mathcal{R}}^{(5)}$ is a 4×1 vector formed by the elements 1-4 of $\hat{\boldsymbol{R}}_{\mathcal{R},t+1}$ and associated to $\widetilde{\omega}_5$. Under symmetry, the portfolio share of Foreign corporate bonds (b_{FH}) follows from the market clearing condition in eq. (32).

Numerical solution for portfolios. The solution procedure is analogous to the one described in Section C.2. The difference is that now the vector of shocks is 6×1— $\boldsymbol{\varepsilon_{t+1}} = (\varepsilon_{Z_H,t+1}, \varepsilon_{\zeta_H,t+1}, \varepsilon_{\xi_H,t+1}, \varepsilon_{Z_F,t+1}, \varepsilon_{\zeta_F,t+1}, \varepsilon_{\xi_F,t+1})'$—and, given the perfect spanning that characterizes the extended model, the equation for the optimal portfolio positions (eq. (60)) effectively simplifies to:

$$
\widetilde{\omega} = (\mathbf{J_2 L'_{e,2} J'_1} - \mathbf{L_{e,1} J_2 J'_2})^{-1}\mathbf{J_2 L'_{e,2}}. \tag{106}
$$

D Extended Model without Trade in Coupon Bonds

The 4-asset version of our extended model is such that agents can trade home and foreign equities as well as home and foreign corporate bonds but not home and foreign coupon bonds. Consequently, the spanning condition is not (strictly) satisfied, but the model can still be calibrated as described in Section 6.2.

We compare the predictions of our 4-asset extended model with an MM benchmark model, which corresponds to the case $\tau, \kappa \to 0$. This implies that $\mu \to 0$, ruling out both the borrowing limits posed by imperfect contract enforcement under uncertainty and the financial shocks that originate from it. Each country continues to be subject to TFP and IST shocks instead, and, hence, the MM benchmark for our 4-asset model is, by construction, a framework where agents cannot trade more than four assets. Only if this is the case a solution to the portfolio choice problem exists, because the *rank condition* is satisfied and, hence, the covariance matrix of the excess returns on assets is invertible.

As in Section 5, this MM benchmark is calibrated imposing the same targets that characterize the calibration strategy of our model. Therefore, the equilibrium interest rate of the MM benchmark model equals the rate $\widetilde{R}_b$ of our model. Additionally, $\alpha = 0.36$, so in the MM benchmark model, corporate bonds finance a fraction $l = 0.3669$ of the capital stock, and the parameters χ and φ are 3.7813 and 0.0461, respectively. Moreover, we set $\psi = 0.773$.

As shown in Table D.1, our model predicts that $s_{HH} = 55.36\%$ and domestic (corporate) bond holdings are 0.87 units of output, whereas the home bias in both equities and bonds is considerably larger in the MM benchmark model. Additionally, the table points out that the predictions of our 4-asset extended model are close to those of the complete model. We already know from Section 6 that the similarity between the endogenous portfolios of the two versions of our extended model is due to θ being 1.5. In particular, s_{HH} would be notably smaller in the 4-asset version of the model than in the complete one for smaller values of θ (Fig. 7), given that in the former version of the model equities are the only assets that can provide hedging against the long-term component of $\eta_{ToT,t+1}$.

Fig. D.3-D.5 show the effect of positive Home TFP, IST and financial shocks for the portfolios in Table D.1. These effects are discussed in Section 6. In turn, in Fig. D.1, we show how the households' portfolios change with an increase in τ, leaving all the remaining parameters unchanged. This is the same sensitivity exercise conducted for Table 3 and Fig. 6, whereby increasing values of τ allow the steady state of the model to capture the higher average credit spreads and corporate borrowing-to-GDP ratios found in our data for the second subsample relative to the first one. Inserting the same change in corporate borrowing-to-GDP in the MM benchmark model, which lacks an endogenous capital structure and leverage-related risks, we obtain the results in Fig. D.2. Overall, we find that households invest progressively less in domestic stocks in the context of our model, whereas s_{HH} is fully independent of corporate borrowing in the MM benchmark model.

As far as the bond portfolio is concerned, Fig. D.1-D.2 show that agents' holdings of domestic corporate bonds increase along with an increase in their supply, but the degree of home bias falls in both our model and the MM benchmark. On one side, this lends support to the idea that the negative effect of corporate leverage on home bias in assets concerns more equities than bonds and rests crucially on the endogeneity of the credit spread as its transmission mechanism. Our model and the MM benchmark have similar predictions for the bond portfolio, despite the fact that borrowing does not generate any additional risk and does not bring any advantage to the firms relative to equity financing under the MM theorem. On the other side, the decline in corporate bond home bias is consistent with the decline in the holdings of corporate plus coupon bonds predicted by the complete extended model (Fig. 6). However, this similarity rests on θ being sufficiently large (Table D.2).[28] Once again, this effect of θ stems from the fact that equities compete with coupon bonds in hedging against the long-run component of $\eta_{ToT,t+1}$, and, therefore, s_{HH} is less stable with respect to θ when households cannot trade coupon bonds than when they do it.

Notwithstanding this, the effect of θ on households' preference for domestic vs. foreign equities is not specific to our model; it is present also in the context of the MM benchmark model, and actually forcefully so. We show this in Fig. D.6, which is obtained by letting θ increase from 0.8 to 2.5 and keeping all the other parameters—including τ—fixed at their baseline values. We see that the difference between models grows larger, the greater θ is.

Finally, Fig. D.7 shows the sensitivity of households' portfolios to the size of idiosyncratic financial shocks (σ_ξ) and their cross-border correlation ($corr(\xi_H, \xi_F)$). The domestic bias increases (decreases), for all the traded assets, with the importance of financial shocks when θ is small (large). As stressed in Section 6, this effect of financial shocks on home bias contrasts that produced by IST shocks and, hence, complete the mechanism through which leverage abates the demand of a country's households for domestic assets, especially domestic equities.

[28] Instead, the elasticity ϕ_2 of depreciation to capital utilization has a quantitative effect analogous to that found within the complete extended model. See Table E.2 for a comparison.

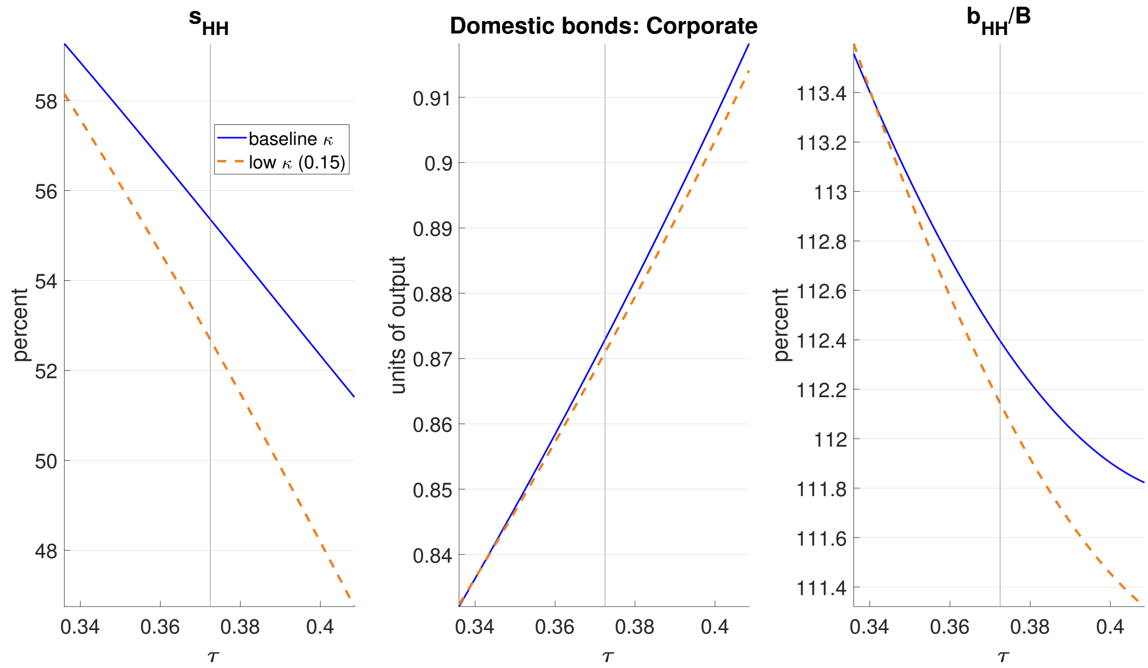

Figure D.1: Sensitivity of country portfolios to τ in the extended model without coupon bonds (4 assets).

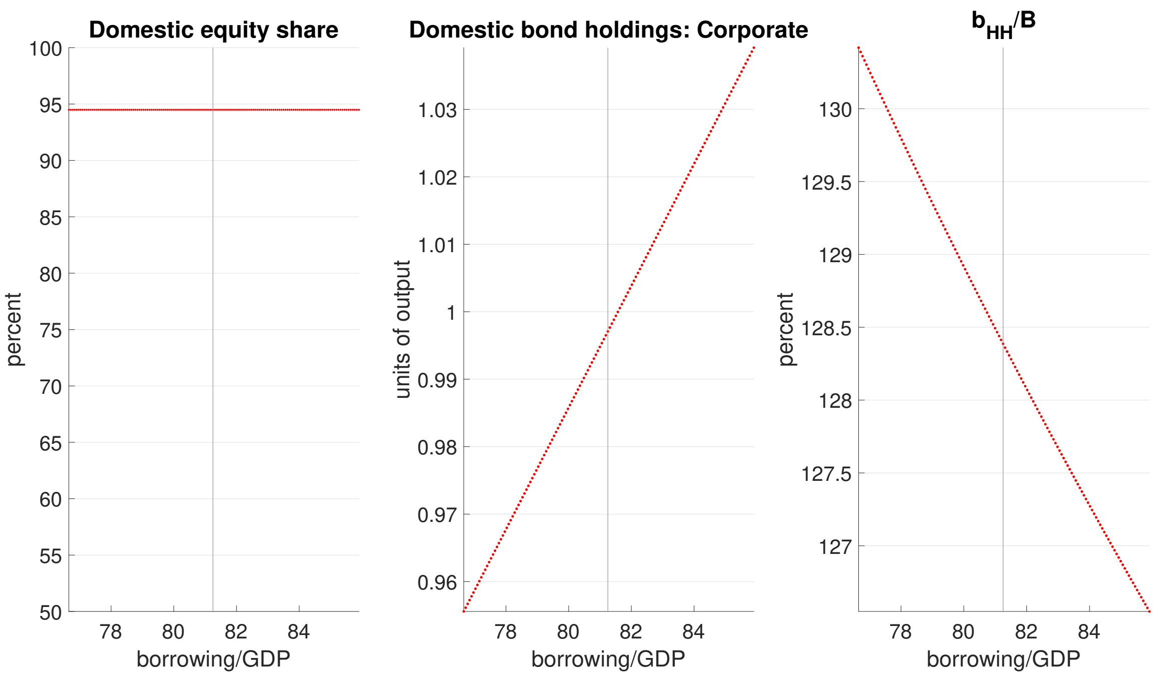

Figure D.2: Sensitivity of country portfolios to borrowing/GDP ($B/[(1+r)Y]$) in the MM benchmark for the extended model without coupon bonds (4 assets).

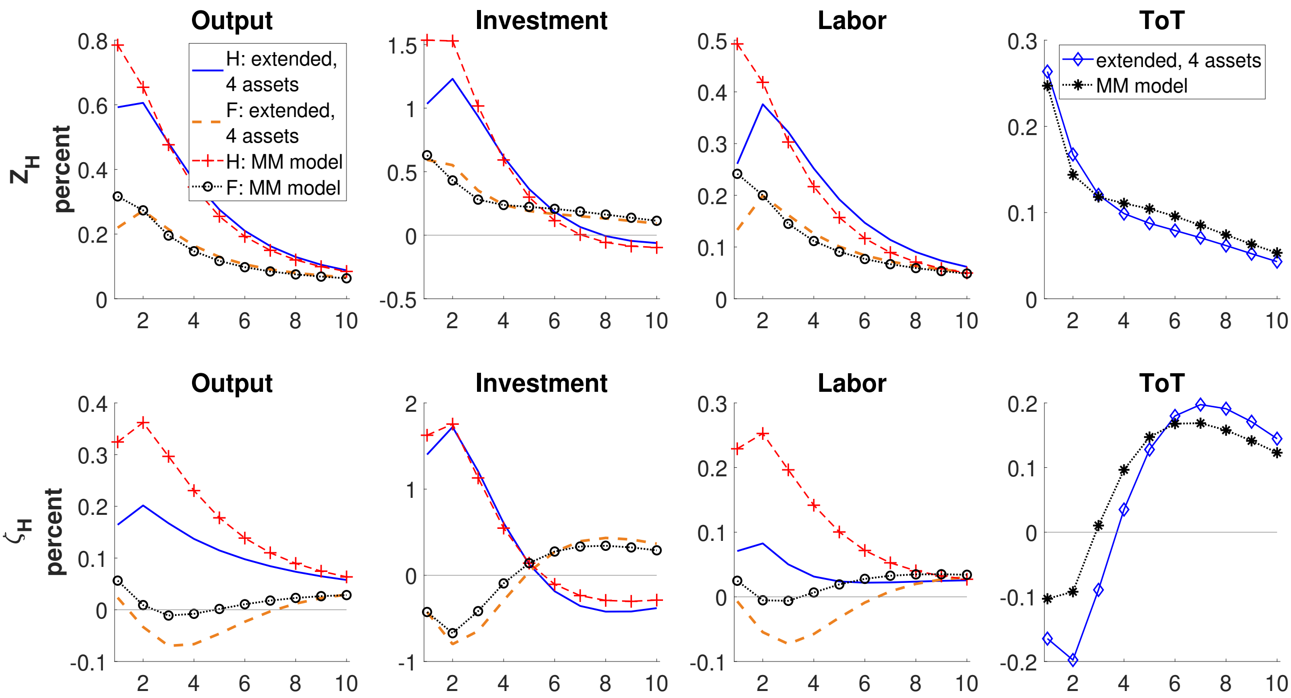

Figure D.3: Responses of output, investment, labor and the terms of trade to a positive Home TFP shock (above) or IST shock (below) in the extended model without coupon bonds (4 assets).

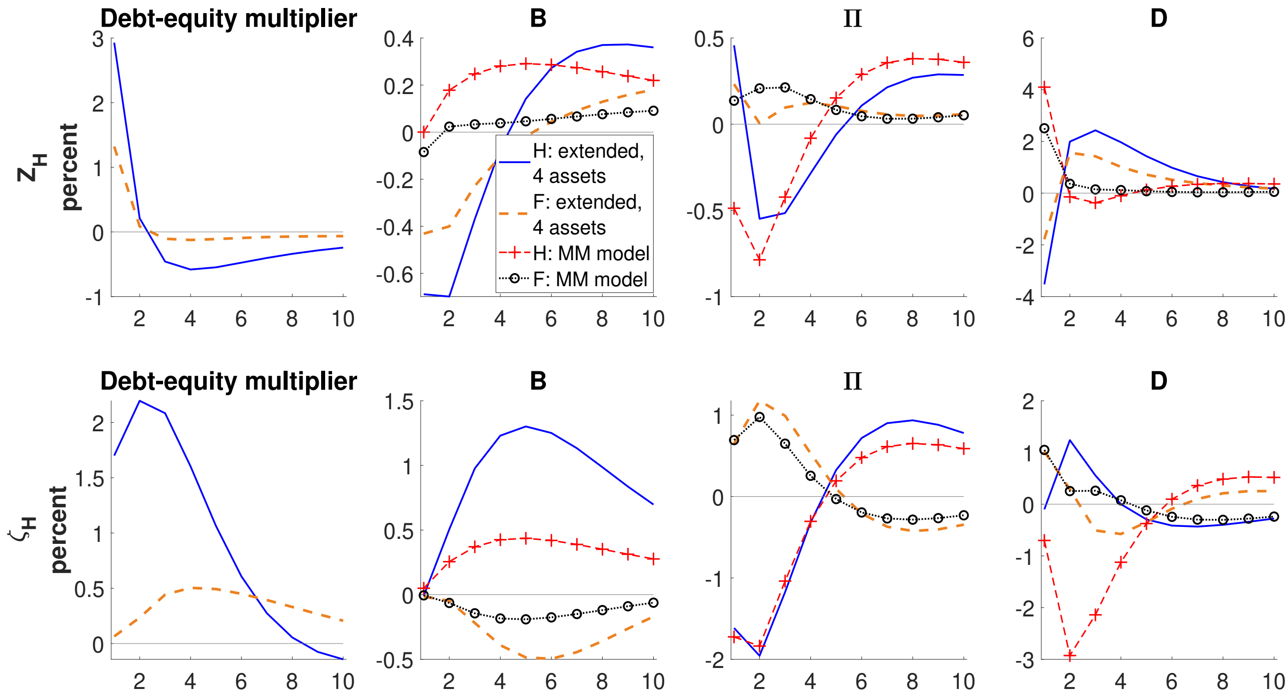

Figure D.4: Responses of corporate debt, dividend income and dividend payout to a positive Home TFP shock (above) or IST shock (below) in the extended model without coupon bonds (4 assets).

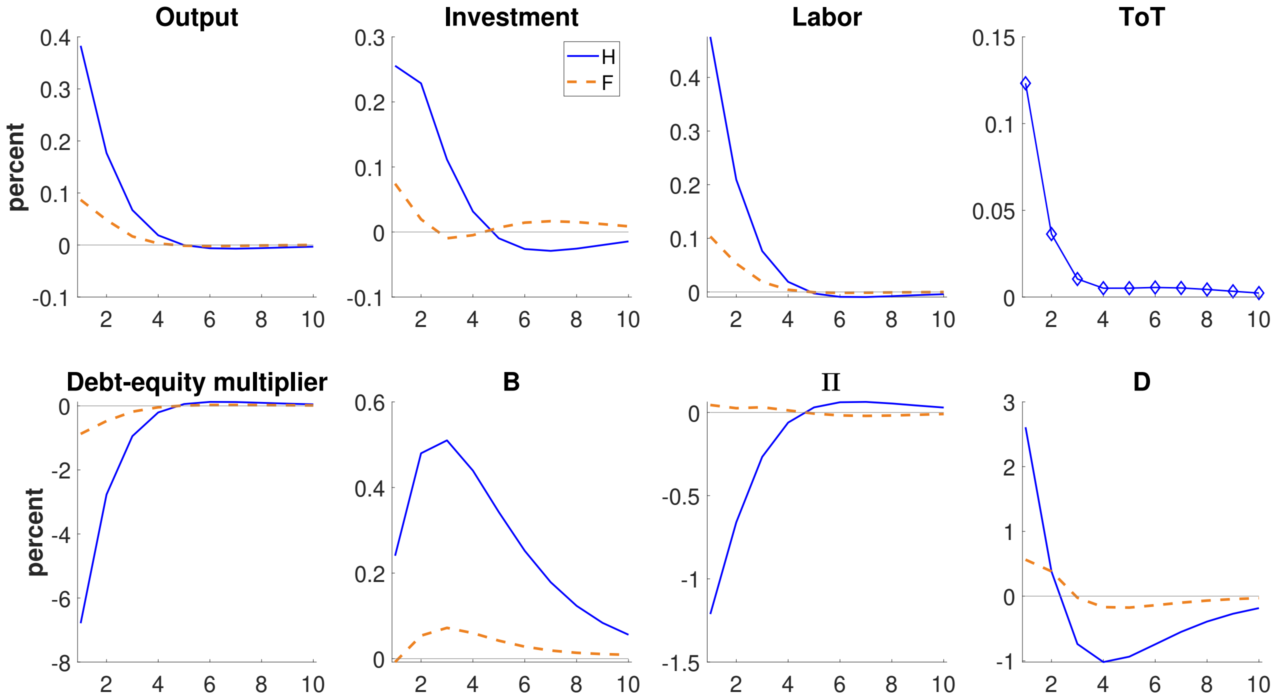

Figure D.5: Impulse responses to a positive Home financial shock in the extended model without coupon bonds (4 assets).

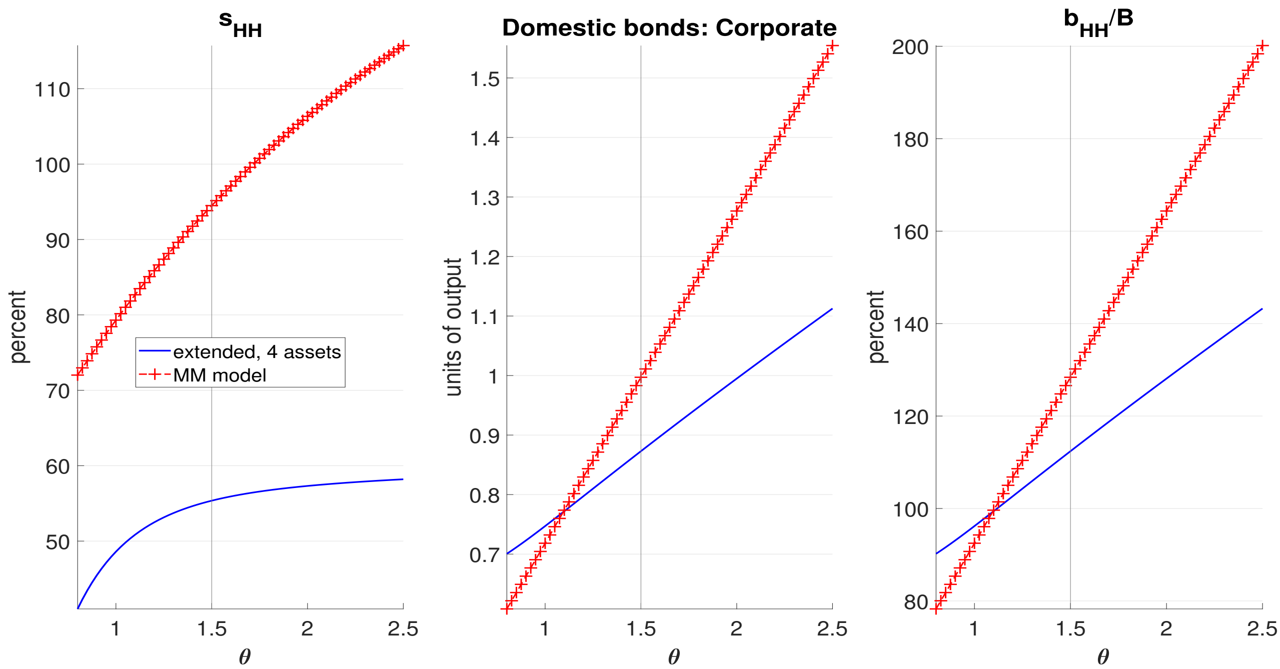

Figure D.6: Sensitivity of country portfolios to the elasticity of substitution between goods (θ) in models with trade in equities and corporate bonds, but not in coupon bonds.

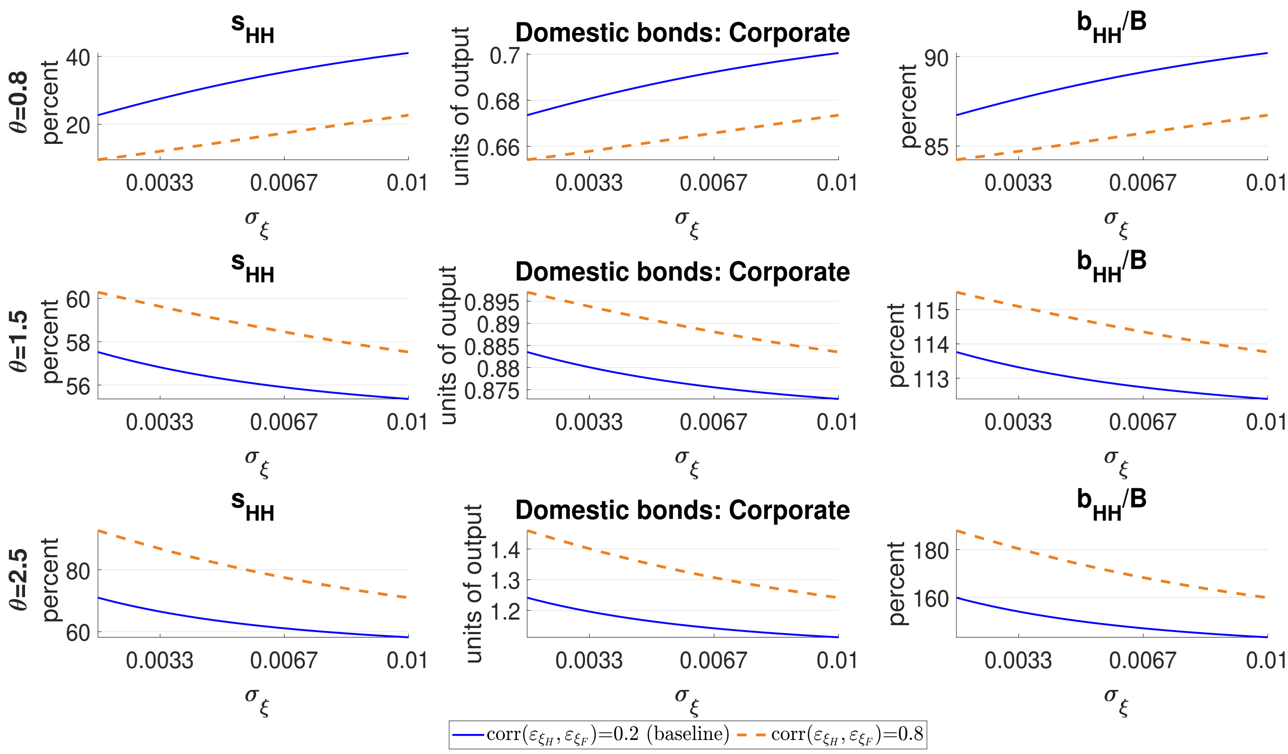

Figure D.7: Sensitivity of country portfolios to the standard deviation of the financial shocks in the extended model without coupon bonds (4 assets).

Table D.1: Country portfolios in the extended model without coupon bonds (4 assets) and in its MM benchmark for the baseline calibration.

	s_{HH} (percent)	Domestic bonds: Total (units of output)	Domestic bonds: Corporate (units of output)	b_{HH}/B (percent)
Complete extended model	54.89	0.99	0.85	110.01
Models with 4 assets				
Extended, 4 assets	55.36	N/A	0.87	112.4
MM benchmark	94.50	N/A	1.00	128.39

Domestic bonds: Total and *Domestic bonds: Corporate* are expressed in units of output as follows: $[pb_{HH}/(1+r)+p_a a_{HH}]/(pY)$ and $b_{HH}/[(1+r)Y]$, respectively. The tax advantage, τ, goes from 0.336 to 0.4085.

Table D.2: Sensitivity of country portfolios to τ for alternative elasticities of capital depreciation to utilization (ϕ_2) and elasticities of substitution between goods (θ) in the extended model without coupon bonds (4 assets).

ϕ_2	s_{HH} (growth)	Domestic bonds: Corporate (change)	b_{HH}/B (growth)
		Low θ (0.8)	
Low (1.30)	-7.615%	0.112	4.665%
1.54	-22.283%	0.109	4.224%
High (1.82)	-19.649%	0.106	3.710%
		$\theta = 1.5$	
Low (1.30)	-12.843%	0.099	-0.008%
1.54	-13.261%	0.086	-1.527%
High (1.82)	-11.461%	0.082	-2.148%
		High θ (2.5)	
Low (1.30)	-13.966%	0.082	-3.791%
1.54	-11.651%	0.066	-5.360%
High (1.82)	-9.923%	0.059	-5.982%

Domestic bonds: Corporate are expressed in units of output as follows; that is, $b_{HH}/[(1+r)Y]$. The tax advantage, τ, goes from 0.336 to 0.4085.

E Further Numerical Results

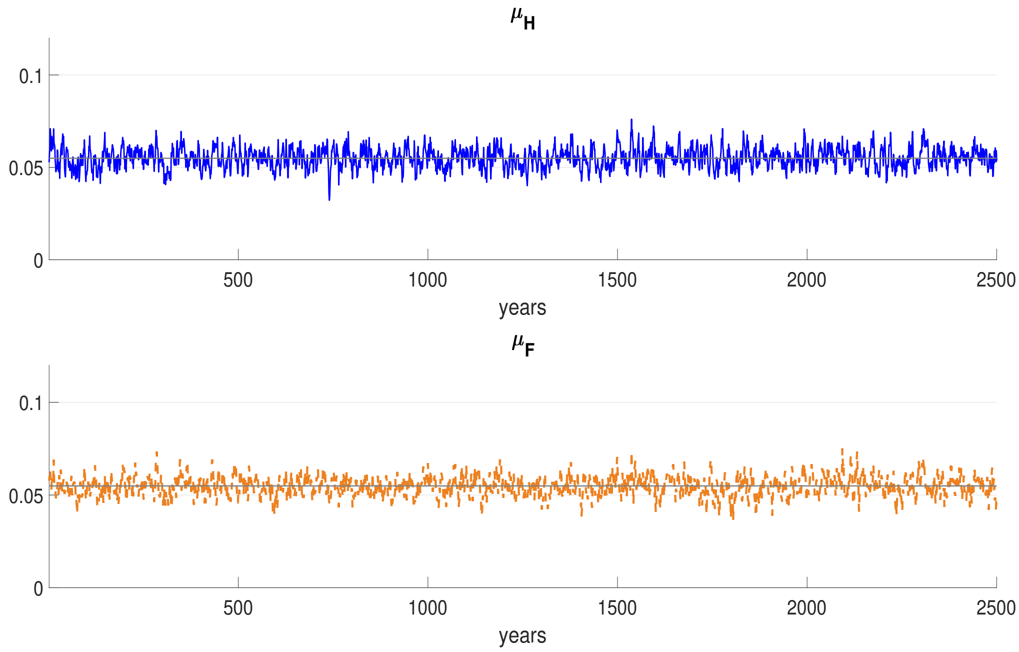

Figure E.1: Simulation of the multipliers in the model.

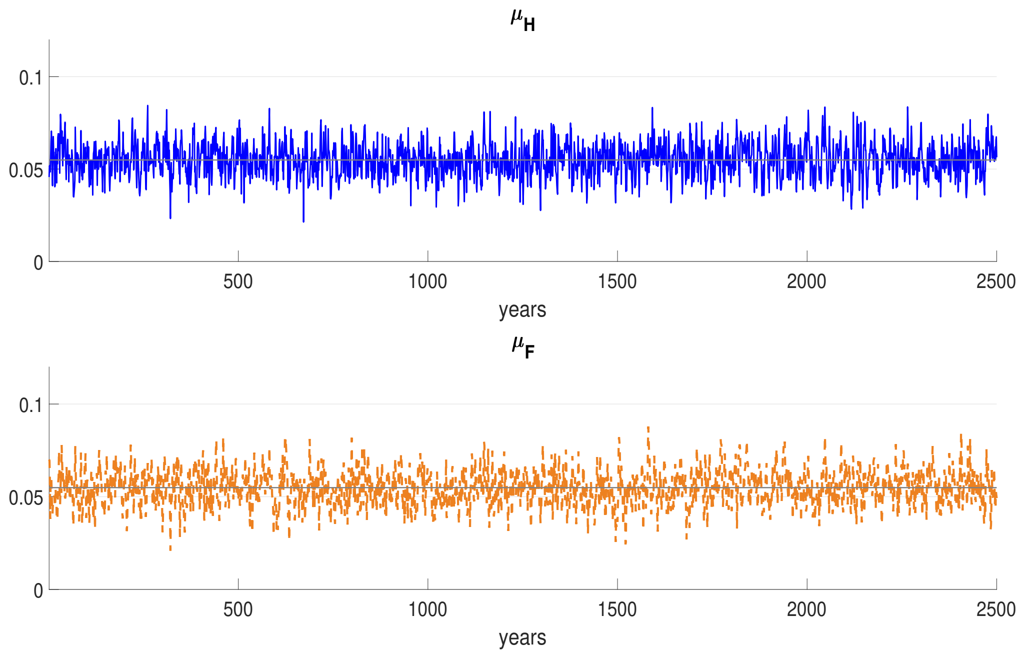

Figure E.2: Simulation of the multipliers in the (complete) extended model.

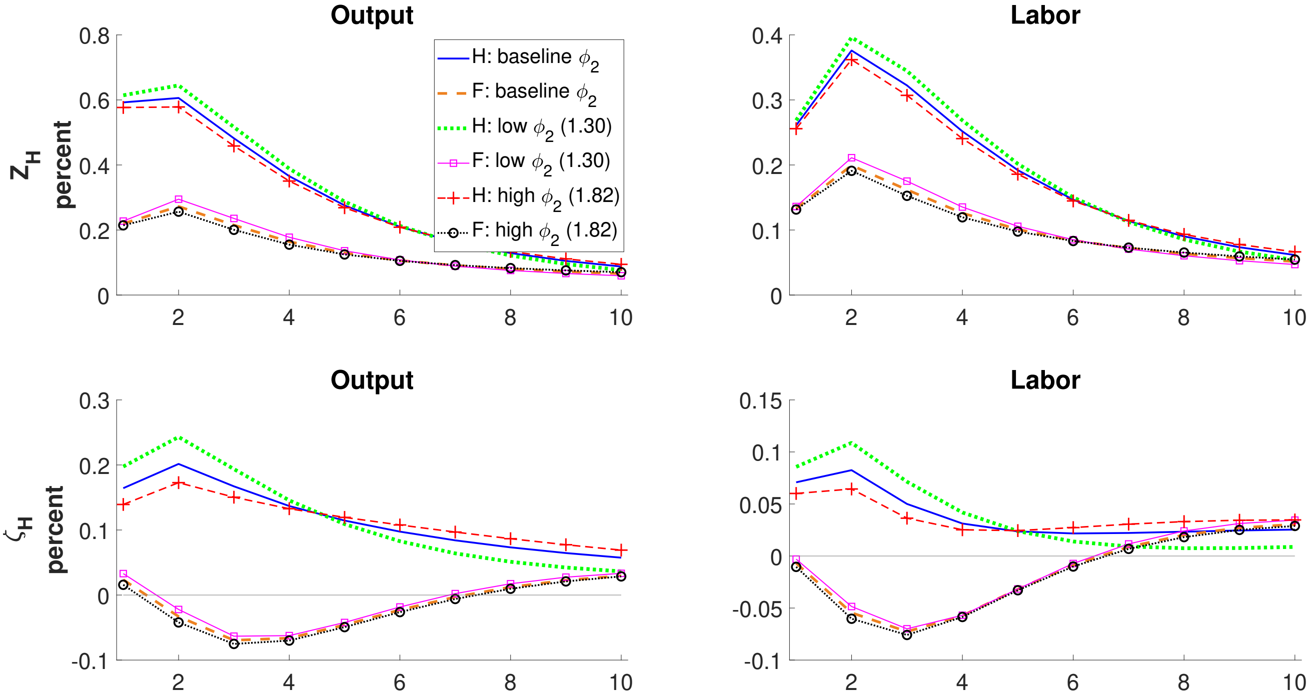

Figure E.3: Responses of output and labor to a positive Home TFP shock (above) or IST shock (below) in the (complete) extended model for alternative values of ϕ_2.

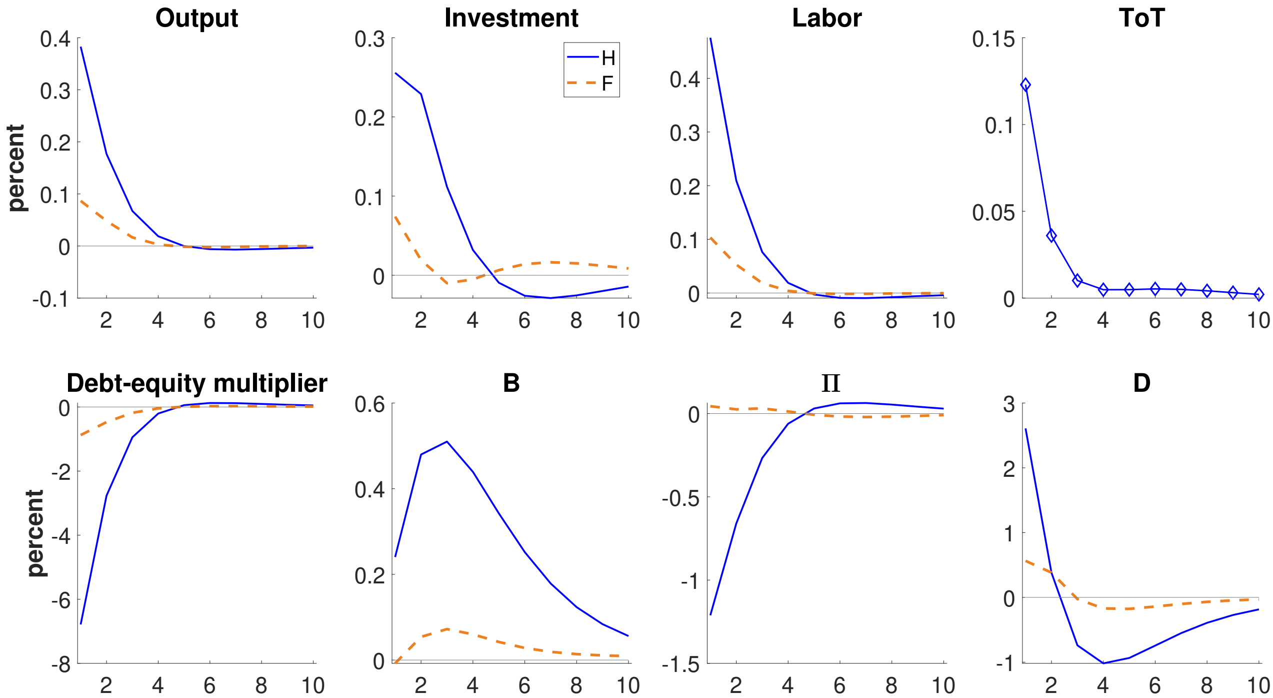

Figure E.4: Impulse responses to a positive Home financial shock in the (complete) extended model.

Table E.1: Cumulative (percent) responses to an increase in $\zeta_{H,t}$.

	Baseline τ	High τ (0.4085)	MM benchmark
Model			
Labor (H-F relative)	0.313	0.283	0.633
Debt-equity multiplier (H-F relative)	5.193	5.417	N/A
Extended model, 4 assets			
Labor (H-F relative)	0.524	0.487	0.941
Debt-equity multiplier (H-F relative)	5.981	6.111	N/A
Complete extended model			
Labor (H-F relative)	0.521	0.490	N/A
Debt-equity multiplier (H-F relative)	5.968	6.120	N/A

Table E.2: Sensitivity of country portfolios to τ for alternative elasticities of capital depreciation to utilization (ϕ_2) and elasticities of substitution between goods (θ) in the (complete) extended model.

ϕ_2	s_{HH} (growth)	Domestic bonds: Total (change)	Domestic bonds: Corporate (change)	b_{HH}/B (growth)
		Low θ (0.8)		
Low (1.30)	-33.431%	-0.394	0.187	10.779%
1.54	-16.326%	-0.162	0.143	6.666%
High (1.82)	-11.571%	-0.091	0.129	5.315%
		$\theta = 1.5$		
Low (1.30)	-19.215%	-0.531	0.182	8.665%
1.54	-10.661%	-0.289	0.145	5.698%
High (1.82)	-7.960%	-0.206	0.132	4.591%
		High θ (2.5)		
Low (1.30)	-14.032%	-0.730	0.192	7.856%
1.54	-8.346%	-0.450	0.154	5.217%
High (1.82)	-6.426%	-0.347	0.140	4.131%

Domestic bonds: Total and *Domestic bonds: Corporate* are expressed in units of output as follows: $[pb_{HH}/(1+r) + p_a a_{HH}]/(pY)$ and $b_{HH}/[(1+r)Y]$, respectively. The tax advantage, τ, goes from 0.336 to 0.4085.