Investor Experiences and International Capital Flows*

Ulrike Malmendier†
UC Berkeley, NBER, and CEPR

Demian Pouzo‡
UC Berkeley

Victoria Vanasco§
CREI and BGSE

June 17, 2019

Abstract

We propose a novel explanation for several classic international macro puzzles regarding capital flows and portfolio investment, which incorporates the recent macro-finance evidence on belief formation. We argue that experience-based learning (EBL) can explain the tendency of investors to hold an overproportional fraction of their equity wealth in domestic stocks (home bias), to withdraw capital from foreign equity markets in periods of foreign crises (fickleness), and to also withdraw from foreign equity markets in periods of domestic crises (retrenchment). The EBL framework generates additional implications regarding the strength of these puzzles in times of high and low economic activities, and depending on the demographics composition of market participants. We test and confirm these predictions in the data.

*We thank Vladimir Asriyan, Fernando Broner, Nicolas Courdacier, and Jaume Ventura for their comments and suggestions, and Clint Thomas Hamilton for his outstanding research assistance.

†Department of Economics and Haas School of Business, University of California, 501 Evans Hall, Berkeley, CA 94720-3880, ulrike@berkeley.edu

‡Department of Economics, University of California, 501 Evans Hall, Berkeley, CA 94720-3880, dpouzo@berkeley.edu

§CREI, and BGSE, Ramon Trias Fargas 25-27, Barcelona, 08005, Spain, vvanasco@crei.cat

1 Introduction

At least since Obstfeld and Rogoff (2000), researchers have tried to find a unifying explanation for the major puzzles in international macroeconomics that is empirically more convincing. The traditional emphasis on the dichotomy of traded versus non-traded goods had often seemed too rigid, and the assumed size of trade costs and other frictions can be unrealistic in terms of the magnitudes. In this paper, we aim to make progress on a different aspect of modeling realism: the implied psychological realism. Specifically, we argue that the belief formation process underlying international capital flows and portfolio investments should reflect the evidence and new approaches in the recent wave of macro-finance models of risk-taking.

The research on belief formation in macro-finance has been stimulated by investor behavior during the recent crises in the stock and housing markets and the long-lasting ramifications of those crises. The new generation of models of investor expectations aims to account both for classic asset-pricing puzzles such as return predictability (Campbell and Shiller (1988), Fama and French (1988)) and excess volatility (LeRoy and Porter (1981), Shiller (1981), LeRoy (2005)), and for micro-level stylized facts such as investors chasing past performances and the long-lasting effects of crises experiences. As argued by Woodford (2013), the empirical evidence suggests a need for dynamic models that go beyond the rational-expectations hypothesis.

One key element that all models in this new wave of macro-finance research aim to capture is investors' apparent overweighing of recent realizations of relevant economic variables when forming beliefs. Models of natural expectation formation (Fuster, Hebert, and Laibson (2011); Fuster, Laibson, and Mendel (2010)) and over-extrapolation (Barberis, Greenwood, Jin, and Shleifer (2015); Barberis, Greenwood, Jin, and Shleifer (2016)) deliver this feature of investor behavior, in addition to the puzzles mentioned above.

A second key element is the longer-lasting effect of crisis experiences and its systematic cross-sectional differences. As conveyed by the notion of "depression babies" or the "deep scars" of the 2008 financial crisis (Blanchard (2012), Malmendier and Shen (2017)), macro-economic shocks alter investment and consumption behavior for decades to come, and (then) younger cohorts tend to react significantly more strongly than (then) older cohorts. This is where models of experience-based learning (EBL) come in, which naturally generate both the overweighing of recent experiences and the long-lasting effects of lifetime experiences, in addition to the classical asset-pricing puzzles.

This literature on *experience effects* builds on the seminal work by Kahneman and Tversky on availability bias. Tversky and Kahneman (1974) show that, when individuals form beliefs about future realizations of stochastic variables, they tend to assign extra weight to information that is particularly easily "available" to them. Such information tends to be personally experienced outcomes, and in particular recent realizations. Building on this insight, Weber et al. (1993)) provide extensive evidence that "learning from experience" is significantly more powerfull than "learning from description."[1]

On the empirical side, the research on experience effects shows that individuals assign extra weight to realizations of macro-financial variables that they have personally experienced when they form beliefs about future outcomes of the same variables. For example, investors who have lived through periods of financial crisis tend to shy away from stock-market investment for decades to come and have particularly pessimistic beliefs about future stock market returns (Malmendier and Nagel (2011)).[2] Investors who have experienced periods of high inflation tend to overestimate future inflation, invest more in housing (as an inflation hedge), and finance their housing with fixed-rate mortgages, as they overestimate future inflation and interest rates (cf. Malmendier and Nagel (2016),

[1] Cf. also Hertwig, Barron, Weber, and Erev (2004) and Simonsohn, Karlsson, Loewenstein, and Ariely (2008).

[2] The same holds for IPO experiences and future IPO investment (Kaustia and Knüpfer (2008); Chiang, Hirshleifer, Qian, and Sherman (2011)).

Botsch and Malmendier (2018), and Malmendier and Steiny (2018)).[3] Consumers who have experienced periods of economic downturn and high unemployment rates are more careful in their spending and progress less in their careers than their education, income, and wealth would predict (cf. Oreopoulos, von Wachter, and Heisz (2012); Malmendier and Shen (2017).)

A recent string of theory papers in finance have proposed conceptual frameworks to capture these stylized facts, e. g., Schraeder (2015), Collin-Dufresne, Johannes, and Lochstoer (2016), Ehling, Graniero, and Heyerdahl-Larsen (2017), Malmendier, Pouzo, and Vanasco (2018). These papers explore the role of experience-based learning (EBL) in OLG economies where agents make portfolio decisions between a risky and a safe asset. Agents in these models learn about the return of the risky asset from past asset returns, and in doing so, they overweight observations that they have personally lived through. The advantage of introducing EBL to otherwise standard models is that it provides a micro-foundation for belief heterogeneity which tightly links the distribution of beliefs in an economy to demographics and history. Since different cohorts, e.g., younger vs. older cohorts, have different experiences, EBL naturally generates belief heterogeneity, which has important implications for price volatility, trade volume, and other market outcomes.

These insights have direct implications for international macro models. Recency bias would naturally affect the reaction to both domestic and foreign crises, and long-lasting "scars" from crises experiences should apply to foreign events and foreign investment as well. Moreover, if agents learn more from personal experiences, then past events not only affect future beliefs of foreign and domestic agents, they also generate belief heterogeneity across these different types of agents (domestic vs. foreign), and differently so for younger versus older cohorts. As a result, different demographic compositions across countries have predictive power for economic outcomes.

[3] Malmendier, Nagel, and Yan (2018) show that even FOMC members' stated inflation beliefs are strongly affected by their personal lifetime experiences.

Nevertheless, most of the international macro models to date are formulated under the "rational expectation paradigm." By and large, they work under the assumption that economic agents have the correct beliefs about the laws of complex economic processes.[4]

In this paper, our goal is to introduce experience-based learning into the international macro context and show its potential to explain some of the long-standing puzzles on capital flows and portfolio investment. We focus on home bias, fickleness, and retrenchment. The home-bias portfolio puzzle was first discussed by French and Poterba (1991), who calculated that, at the time, both Americans and Japanese hold more than 90% of their equity wealth in respective home countries' stocks. While the extent of home bias is smaller in smaller countries and has declines relative to its high in the late 1990s, the bias remains strong across countries (Cooper, Sercu, and Vanpée 2013). Fickleness is the pattern of foreign capital exiting in periods of domestic crises ((Caballero and Simsek 2018)). And retrenchment describes the pattern of domestic investors reducing their foreign investment during periods of crisis (Forbes and Warnock 2012; Broner, Didier, Erce, and Schmukler 2013). As Caballero and Simsek (2018) point out the latter pattern is less researched but empirically as prevalent as fickleness.

We propose that *experience-based learning* offers a unifying explanation for all three puzzles, home bias, fickleness, and retrenchment, and allows to generate further testable predictions that account for the demographic composition of different countries. Our model set-up extends the OLG framework of Malmendier, Pouzo, and Vanasco (2018) to a two-country setting, the home country H and the foreign country F. Agents can invest in the home and the foreign risky asset, both in unit net supply, and each being a claim to a stream of future risky outputs of the respective country. They can also invest in a riskfree asset, which is in completely elastic supply. We assume that all agents know the shape of the distributions of outputs for both countries, including their variance, but

[4] Some exceptions include Gourinchas and Tornell (2004), Van Nieuwerburgh and Veldkamp (2009), Chousakos, Gorton, and Ordonez (2016).

that they are uncertain about the output means.

In this framework, experienced-based learning (EBL) means that agents over-weigh realizations observed during their lifetimes when forecasting output, and that they tilt the excess weights towards the most recent observations. That is, even though all agents observe the entire history of output realizations in both countries, they choose to weigh observations more if they have personally *experienced* them and more so if these experienced events are recent. As information is available to all agents, prices do not add new information. We derive posterior beliefs and show that their variance decreases in age and in the precision of prior, and increases in the variance of output.

Turning to the equilibrium analysis, we first show that, in the benchmark case of known output means, all generations in all countries hold the same portfolios. We then derive equilibrium demand for the risky and the risk-free assets when agents face uncertainty about the true mean of the output distribution, separately for each generation in each country. We show that, if agents are born with the same priors about domestic and foreign output, experience-based learning does not imply home bias. However, if agents have more precise priors about domestic output, experience-based learning implies home bias. Moreover, the EBL framework implies that home bias decreases in global output and that we will observed fickleness (outflow of foreign funds) and retrenchment (inflow of domestic funds) after recessions. The opposite is the case after booms.

Finally, we turn to the role of market composition. A key feature of experience-based learning models is that they capture the systematic cross-sectional differences in updating behavior. We extend this insight to capture differences in the differences between the older and younger generations of investors across countries. For simplicity we return to the setting of equal priors Specifically, we show that, if the H country has a larger fraction of young generations who are participating in the market, then home biases increases current excess output, relative to the other country, but decreases in last period's excess output. We also predict outflows of domestic funds and and inflows of foreign funds after recessions in country H. For both statements, the opposite holds if H has fewer young investors than F.

We analyze home bias, fickleness, and retrenchment in the data. We use data from the IMF and the World Federation of Exchanges. We translate our theoretical comparison between countries H and F into an empirical comparison of the US and the rest of the world (ROW). First we confirm positive US home bias in every period of our 1980-2017 sample. We then provide evidence that, as output increases in both the US and the ROW, domestic funds leave the US, i. e., home bias decreases. This is consistent with our predictions. We also observe fickleness (outflow of foreign funds) and retrenchment (inflow of domestic funds) after recessions, and that both phenomena are exacerbated when there are more young agents in the ROW relative to the US (using U.N. population data).

Overall our findings suggest that international macro analyses might benefit from incorporating more modern approaches to belief formation and, in particular, acknowledge the longlasting effects of prior experiences in domestic and foreign markets on investors willingness to invest in the respective markets.

Related Literature. We have already referenced much of the literature on experience effects and its theoretical underpinning, models of experience-based learning. A discussion of the broader literature on learning in explaining asset pricing puzzles, extrapolation, departures from the rational beliefs in asset pricing, and learning in OLG models can be found in Malmendier, Pouzo, and Vanasco (2018).

Our paper connects to a large literature on equity home bias, which originated with French and Poterba (1991) and Tesar and Werner (1995). Cooper, Sercu, and Vanpée (2013) provide a survey of this literature and summarize the leading explanations, which include theories that rely on hedging motives, barriers to entering foreign stock markets, and information asymmetries, among other approaches. The literature relying on informational asymmetries documents the roles of distance, language, and culture in generating home (Grinblatt and Keloharju 2001), but also points to home bias even at the local level, for example towards local companies (Coval and Moskowitz 2001).[5] Bae, Stulz, and Tan (2008) find that US investors underweight foreign countries more when local analysts in a country have a greater advantage. This evidence is consistent with informational asymmetries explaining US underinvestment in foreign countries due to asymmetric information. Similar to Guidolin (2005), we model asymmetric information by allowing for agents to have a more precise prior about their domestic output. Our model resembles Guidolin (2005) and others in its OLG set-up (see also Carmichæl and Coën (2003)) and use of learning dynamics (see also Balduzzi and Liu (2001)), but differs in that we introduce experienced-based learning which allows for additional demographic heterogeneity to be exploited.

Our paper also connects to the growing literature surrounding fickleness and retrenchment. We aim to explain two of the stylized facts presented in Broner, Didier, Erce, and Schmukler (2013), specifically that inflows and outflows are pro-cyclical and that retrenchments, and ergo fickleness, occurs during both domestic and global crises. Further, we also explain some of the results of Forbes and Warnock (2012) who note a strong correlation between periods of retrenchment and fickleness.[6] Our paper relates to Caballero and Simsek (2018) who explain these capital flow patterns in a model which assumes fickleness. Our model explains the empirical facts with investors' belief formation process, and our empirical results extend those of Caballero and Simsek (2018), who also

[5] Relatedly, Malloy (2005) document that geographically proximate analysts are more accurate and influential. The literature is mixed on the return implications of home bias (Ardalan 2019).

[6] Forbes and Warnock (2012) use a narrower definition of fickleness and retrenchment. They consider "gross capital flows" by type of investor (domestic versus foreign) rather than differentiating between net inflows and outflows. In their paper, retrenchment refers to a period with strongly negative outflows, i. e., domestic investors reducing their investments abroad, and and a stop refers to a period with strongly negative gross inflows, i. e., foreigners reducing their domestic investment and thus generating outflows.

document a positive correlation between inflows and outflows. Our estimations highlight periods in which the correlation between inflows and outflows is stronger, and the role of countries' demographic composition. Finally, our paper relates to research using asymmetric information to explain global capital flows include Tille and Van Wincoop (2008) and Dvořák (2003).

The remainder of the paper is organized as follows. First, we present the model setup, the notion of experience-based learning, and the equilibrium concept in Section 2. Section 3 characterizes equilibrium demand and prices, and extends the model to allow for heterogeneity in prior beliefs about foreign and domestic assets. Section 4 introduces heterogeniety in market participations, i.e., the demographic structures in markets, across countries. In Section 5 we test the predictions of the model. Section 6 concludes. All proofs are relegated to the Appendix.

2 Model Setup

Our model describes the decisions of different generations of domestic and foreign investors to invest in domestic and foreign assets. We will generally use superindices for the investor's country of origin i and generation n, and subindices for country j in whose asset the investor is investing, and for the current time t. In a few instances we will simplify to distinguish between "the young" and "the old" with subindices 0 and 1 (more generally age), and a star to indicate foreign country. These are instances when the context does not require keeping track of all the information in the indices, and when it is useful to highlight cross-country symmetries.

2.1 The Maximization Problem

Consider two countries H and F, each populated with overlapping generations of a continuum of risk-averse agents. Time is infinite and indexed by t. At each point in time $t \in \mathbb{Z}$, a new generation is born in each country and lives for two periods. Hence, there are three generations alive at any t: the young, the adult, and the old. The generation born at $t = n$ is called the generation n, and each generation has a mass of $\frac{1}{4}$ identical agents.

Preferences. All agents have CARA preferences with risk aversion γ, and they maximize per-period utility, i. e., are myopic.[7] Generation n in country $i \in \{H, F\}$ is born with an endowment of $\mathcal{W}^{i,n}$ consumption goods, and can transfer resources across time by investing in financial markets. Trading takes place at the beginning of each period. At the end of the last period of their lives, old agents consume the wealth they have accumulated. Figure 1 illustrates the time line of this economy.

Financial Markets. All agents have access to a storage technology, which has a gross return of R, and there is a risk-free asset that all agents can trade. There are also two risky assets in unit net supply, each being a claim to a stream of future risky outputs of country i, $\{y_{i,t}\}$. That is, the dividend paid on country i's risky asset corresponds to country i's output. We assume outputs to be independent across countries and time and identically distributed, $y_{i,t} \sim N\left(\theta_i, \sigma_i^2\right)$ at time t for $i \in \{H, F\}$. To keep the model tractable, we assume that agents' endowments are sufficiently large so that the risk-free asset pays a return of R every period in equilibrium.[8]

Agents from generation $n \in \mathbb{Z}$ in country i that participate in financial markets have

[7] This assumption simplifies the maximization problem considerably and highlights the main determinants of portfolio choice generated by experience-based learning. For the same reason it is commonly used in finance (see Vives 2010). We show that our results do not depend on the myopic assumption in Appendix B.

[8] One way to ensure this would be to set $\mathcal{W}_t^i = \mathcal{W} + \upsilon y_{i,t}$ where υ is chosen to ensure, that for all $y_{i,t}$, endowments are greater than the aggregate demand for the risky asset of country i.

the following budget constraint at any time $t \in \{n, n+1\}$

$$\mathcal{W}_t^{i,n} = x_{H,t}^{i,n} \cdot p_{H,t} + x_{F,t}^{i,n} \cdot p_{F,t} + a_t^{i,n}, \tag{1}$$

where $\mathcal{W}_t^{i,n}$ denotes the wealth of generation n of country i at time t, $x_{j,t}^{i,n}$ and $a_t^{i,n}$ are the investments of generation n of country i in the risky asset of country $j \in \{H, F\}$ and in the risk-free asset, respectively, and $p_{j,t}$ is the price of one unit of the risky asset of country j at time t. As a result, wealth next period is

$$\begin{aligned}\mathcal{W}_{t+1}^{i,n} &= x_{H,t}^{i,n} \cdot (p_{H,t+1} + y_{H,t+1}) + x_{F,t}^{i,n} \cdot (p_{F,t+1} + y_{F,t+1}) + a_t^{i,n} R &(2)\\ &= \sum_{j\in\{H,F\}} x_{j,t}^{i,n}(p_{j,t+1} + y_{j,t+1} - p_{j,t}R) + \mathcal{W}_t^{i,n} R. &(3)\end{aligned}$$

We denote the excess payoff received in $t+1$ from investing at time t in one unit of the risky asset of country j, relative to the risk-free asset, as $s_{j,t+1} \equiv p_{j,t+1} + y_{j,t+1} - p_{j,t}R$. In our framework with CARA preferences, this is analogous to the equity premium. Using this notation, $\mathcal{W}_{t+1}^{i,n} = \sum_{j\in\{H,F\}} x_{i,t}^{j,n} s_{j,t+1} + \mathcal{W}_t^{i,n} R$.

To model uncertainty about fundamentals, we assume that agents do not know the mean of output processes, θ_H and θ_F, but that they can use past output realizations to learn about them. To keep the model tractable, we assume that the variance of output is σ^2 for both countries, and that it is known by all agents at all times.

For a given wealth level $\mathcal{W}_t^{i,n}$, the problem of a generation n at each time $t \in \{n, n+1\}$ is to choose $\{x_{j,t}^{i,n}\}_{j\in\{H,F\}}$ to maximize $E_t^{i,n}[-\exp(-\gamma \mathcal{W}_{t+1}^{i,n})]$, i. e.,

$$\max_{\{x_H, x_F\}\in\mathbb{R}^2} E_t^{i,n}\left[-\exp(-\gamma(x_H s_{H,t+1} + x_F s_{F,t+1}))\right], \tag{4}$$

where $E_t^{i,n}[\cdot]$ is the (subjective) expectation with respect to a joint Gaussian distribution that we will define below. Note that, when $x_{j,t}^{i,n}$ is negative, generation n of country i is

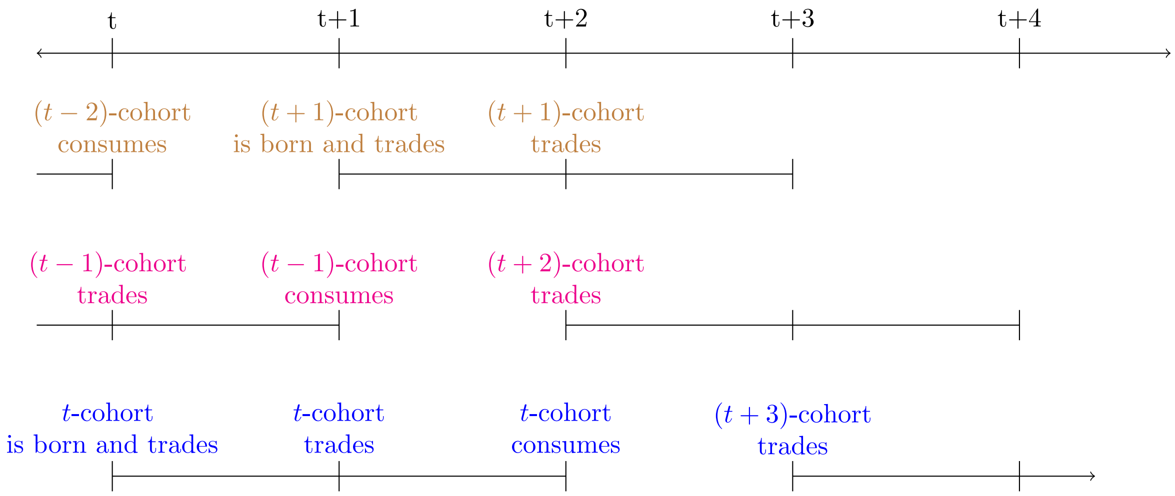

Figure 1: Timeline.

short-selling the risky asset of country j at time t.

2.2 Agents' Belief Formation

In this framework, experienced-based learning (EBL) means that agents over-weigh realizations observed during their lifetimes when forecasting dividends, i. e., output, and that they tilt the excess weights towards the most recent observations, as in Malmendier, Pouzo, and Vanasco (2018). For simplicity, we assume that agents *only* use observations realized during their lifetimes.[9] That is, even though all agents observe the entire history of output realizations in both countries, they choose to disregard observations they have not *experienced*. Finally, as in our setting information is available to all agents, prices do not add new information, which greatly simplifies the analysis.

We assume that all agents know the shape of the distribution of outputs for both countries, including their variance, but are uncertain about output means θ_H and θ_F. Let m_j^i denote the prior belief about the mean of output in country j that agents in country i are born with, where we restrict m_j^i to be Gaussian with mean θ_j. With this,

[9] We only need agents to discount pre-lifetime relative to lifetime observations for our results to hold.

we construct the subjective mean of dividends of generation n at time t following the empirical evidence on Malmendier and Nagel (2011) as follows

$$\theta_{j,t}^{i,n} \equiv (1-\omega_{j,age}^{i}) \cdot m_{j}^{i} + \omega_{j,age}^{i} \cdot \sum_{k=0}^{age} w(k,\lambda,age) y_{j,t-k}, \tag{5}$$

where $age = t - n$, and where, for all $k \leq age$,

$$w(k,\lambda,age) = \frac{(age+1-k)^{\lambda}}{\sum_{k'=0}^{age}(age+1-k')^{\lambda}} \tag{6}$$

denotes the weight an agent aged age assigns to the output on country j observed k periods earlier, and $w(k,\lambda,age) \equiv 0$ for all $k > age$. The denominator in (6) is a normalizing constant that depends only on age and on the parameter that regulates the recency bias, λ. For $\lambda > 0$, more recent observations receive relatively more weight, whereas for $\lambda < 0$ the opposite holds. Finally, $\omega_{j,age}^{i} \equiv \frac{age+1}{\tau_{j}^{i}+age+1}$ denotes the weight that agents assign to their experience beliefs (with $1-\omega_{j,age}^{i}$ being the weight they assign to their prior belief m_{j}^{i}), which increases with age and decreases with the relative importance agents assign to their prior beliefs, regulated by parameter $\tau_{j}^{i} \in [0,\infty)$. Thus, after observing history of output realizations $\{y_{H,0},...y_{H,t},y_{F,0},...,y_{F,t}\}$, the posterior belief of generation $n \in \{t-1,t\}$ in country $i \in \{H,F\}$ at time t are

$$y_{H,t} \sim N(\theta_{H,t}^{i,n},(\sigma_{H,t}^{i,n})^{2}) \tag{7}$$

$$y_{F,t} \sim N(\theta_{F,t}^{i,n},(\sigma_{F,t}^{i,n})^{2}) \tag{8}$$

where $\theta_{j,t}^{i,n}$ is given by (5) and $\sigma_{j,t}^{i,n}$ by

$$\sigma_{j,t}^{i,n} \equiv \left((1-\omega_{j,age}^{i})^{2}(\tau_{j}^{i})^{-1} + (\omega_{j,age}^{i})^{2}\sum_{k=0}^{age} w(k,\lambda,age)^{2}\right)\sigma^{2}, \tag{9}$$

We make two observations about the variance of posterior beliefs. First, the posterior variance decreases with age, as agents incorporate more observations into their belief formation process. Thus, old agents in country i have more precise posteriors than younger agents in the same country. Second, the posterior variance decreases in the precision of prior beliefs and increases in the variance of output.

2.3 Equilibrium Definition

We now proceed to define the equilibrium of the economy with EBL agents.

Definition 2.1 (Equilibrium). *An equilibrium is a demand profile for the risky assets $\{x_{j,t}^{i,n}\}$, a demand profile for the risk-free asset $\{a_t^{i,n}\}$, and price schedules $\{p_{j,t}\}$ such that:*

1. *Given the price schedule, $\{(a_t^{i,n}, x_{H,t}^{i,n}, x_{F,t}^{i,n}) : t \in \{n, n+1\}\}$ solve the maximization problem (4) of generation n in country $i \in \{H, F\}$.*

2. *Markets clear in all $t \in \mathbb{Z}$:*

$$1 = \frac{1}{4}\left(x_{H,t}^{H,t} + x_{H,t}^{H,t-1} + x_{H,t}^{F,t} + x_{H,t}^{F,t-1}\right), \tag{10}$$

$$1 = \frac{1}{4}\left(x_{F,t}^{H,t} + x_{F,t}^{H,t-1} + x_{F,t}^{F,t} + x_{F,t}^{F,t-1}\right). \tag{11}$$

We focus the analysis on the class of linear equilibria, i. e., equilibria with affine prices:

Definition 2.2 (Linear Equilibrium). *A linear equilibrium is an equilibrium wherein prices are an affine function of output realizations. That is, there exists a $K \in \mathbb{N}$, $\alpha_j \in \mathbb{R}$, and $\beta_{j,k} \in \mathbb{R}$ for all $k \in \{0, ..., K\}$ such that*

$$p_{j,t} = \alpha_j + \sum_{k=0}^{K} \beta_{j,k} \cdot y_{j,t-k}. \tag{12}$$

3 Equilibrium Characterization

3.1 Benchmark

Before we analyze the equilibrium portfolio choices under learning, we derive the demand for risky assets in the benchmark case of known mean output θ_H and θ_F. Consider an economy where the mean of outputs are known by all agents, i. e., $E^{i,n}_{j,t}[y_{j,t}] = \theta_j \; \forall \, n, t$. In this scenario, there are no disagreements across cohorts nor across countries, and the demands of any cohort trading at time t is

$$x^{i,n}_{j,t} \in \arg\max_{x \in \mathbb{R}} E\left[-\exp(-\gamma x s_{j,t+1})\right]. \tag{13}$$

The solution to this problem is standard and given by

$$x^{i,n}_{j,t} = \frac{E\left[s_{t+1}\right]}{\gamma V[s_{t+1}]} \tag{14}$$

for all $n \in \{t-1, t\}$, and zero otherwise. Since there is no heterogeneity in cohorts' demands and there is a unit supply of each risky asset, in any equilibrium, $x^{i,n}_{j,t} = 1$ for all $n \in \{t-1, t\}$, and zero otherwise. Furthermore, there exists a unique equilibrium with prices $p_j = P_j = \frac{\theta_j - \gamma\sigma^2}{R-1}$ for all t.[10]

3.2 Equilibrium Demand Under EBL

We begin by analyzing the demands of generation n in country $i \in \{H, F\}$ at time t, given prices $p_{j,t}$, by solving problem (4).

Proposition 3.1. *The demand of generation $n \in \{t, t-1\}$ in country $i \in \{H, F\}$ for*

[10] Our analysis focuses on Fundamental Equilibria, as we rule out the presence of price bubbles.

the risky asset of country $j \in \{H, F\}$ at time t is

$$x_{j,t}^{i,n} = \frac{E_t^{i,n}\left[y_{j,t+1} + p_{j,t+1}\right] - Rp_{j,t}}{\gamma V_{j,t}^{i,n}\left[y_{j,t+1} + p_{j,t+1}\right]}, \tag{15}$$

and the demand for the risk-free asset of cohort n in country i at time t is

$$a_t^{i,n} = w_t^{i,n} - x_{H,t}^{i,n} p_{H,t} - x_{F,t}^{i,n} p_{F,t}. \tag{16}$$

With these demands, we can impose market clearing to solve for market prices. We make the following guess for prices of the risky-free asset in country j at time t

$$p_{j,t} = \alpha_j + \beta_{j,0} y_{j,t} + \beta_{j,1} y_{j,t-1}, \tag{17}$$

and use the method of undetermined coefficients to verify our guess and obtain price coefficients $\{\alpha_j, \beta_{j,0}, \beta_{j,1}\}$,

$$\sum_{n \in \{t,t-1\}} \left(\frac{1}{4} \frac{E_t^{H,n}\left[y_{j,t+1} + p_{j,t+1}\right] - Rp_{j,t}}{\gamma V_{j,t}^{H,n}\left[y_{j,t+1} + p_{j,t+1}\right]} + \frac{1}{4} \frac{E_t^{F,n}\left[y_{j,t+1} + p_{j,t+1}\right] - Rp_{j,t}}{\gamma V_{j,t}^{F,n}\left[y_{j,t+1} + p_{j,t+1}\right]} \right) = 1 \tag{18}$$

As we have assumed that countries are symmetric and that the variance of output is known by all agents, it suffices to keep track of the posterior belief volatilities of the young ($age = 0$) and the adult ($age = 1$) generations at time t:

$$\sigma_{age}^2 = V_{i,t}^{i,n}\left[y_{i,t}\right], \quad i \in \{H, F\} \tag{19}$$

$$\sigma_{age}^{*2} = V_{j,t}^{i,n}\left[y_{j,t}\right], \quad j \in \{H, F\}, j \neq i. \tag{20}$$

for domestic and foreign output, respectively, and where $age = t - n$. In addition, posterior means can be stated as follows

$$E_t^{i,t}\left[y_{i,t+1}\right] = \left(1 - w_0\right) m + w_0 y_{i,t} \tag{21}$$

$$E_t^{i,t-1}\left[y_{i,t+1}\right] = \left(1 - w_1\right) m + w_1 \left[\omega y_{i,t} + \left(1 - \omega\right) y_{i,t-1}\right], \tag{22}$$

$$E_t^{i,t}\left[y_{j,t+1}\right] = \left(1 - w_0^*\right) m + w_0^* y_{j,t} \tag{23}$$

$$E_t^{i,t-1}\left[y_{j,t+1}\right] = \left(1 - w_1^*\right) m + w_1^* \left[\omega y_{j,t} + \left(1 - \omega\right) y_{j,t-1}\right]. \tag{24}$$

for $i, j \in \{H, F\}$ and $j \neq i$. In our model, agents' posterior beliefs may differ for two reasons. First, older agents have more "experience" that younger agents, and thus have a more precise posterior belief for a given country's output: $\sigma_0 > \sigma_1$ and $\sigma_0^* > \sigma_1^*$. Second, when agents have more precise prior beliefs about their own country's output than about the foreign country's output, as typically assumed in the literature, the same will hold for their posterior beliefs. Thus, for a given cohort, posterior volatilities for the foreign country's output will be higher than for domestic output: $\sigma_{age} < \sigma_{age}^*$ for $age \in \{0, 1\}$. As a result, the weight that an agent assigns to the output realization $y_{j,t}$ for $j \in \{H, F\}$ when forming her beliefs varies with the agents' age, $age \in \{0, 1\}$ and her country of origin, $i \in \{H, F\}$.

we will suppose that agents have more precise prior beliefs about their own country's output.

By using our linear guess for prices, plugging in the posterior means and variances into equation (18), and using the method of undetermined coefficients we obtain the following expressions that fully characterize prices for the asset of country $i \in \{H, F\}$,

$$\begin{aligned}
\beta_{i,0} &= \frac{\Sigma R}{\Sigma R - \frac{1}{4}\left\{\frac{w_0}{\sigma_0^2} + \frac{w_1\omega}{\sigma_1^2} + \frac{w_0^*}{\sigma_0^{*2}} + \frac{w_1^*\omega}{\sigma_1^{*2}} + \frac{1}{R}\left(\frac{w_1(1-\omega)}{\sigma_1^2} + \frac{w_1^*(1-\omega)}{\sigma_1^{*2}}\right)\right\}} - 1 \\
\beta_{i,1} &= \frac{(1+\beta_{i,0})(1-\omega)}{4\Sigma R}\left\{\frac{w_1}{\sigma_1^2} + \frac{w_1^*}{\sigma_1^{*2}}\right\} \\
\alpha_i &= \frac{(1+\beta_0^i)}{\Sigma(R-1)}\left(\frac{1-w_0}{\sigma_0^2} + \frac{1-w_1}{\sigma_1^2} + \frac{1-w_0^*}{\sigma_0^{*2}} + \frac{1-w_1^*}{\sigma_1^{*2}}\right)m - \frac{\gamma(1+\beta_0^i)^2}{\Sigma(R-1)}
\end{aligned} \tag{25}$$

where $\Sigma \equiv \frac{1}{4}\left(\frac{1}{\sigma_0^2} + \frac{1}{\sigma_1^2} + \frac{1}{\sigma_0^{*2}} + \frac{1}{\sigma_1^{*2}}\right)$. With this, we can compute the holdings of both risky assets for each cohort in each country as a function of past output realizations, and analyze the effect of output shocks on cross-country flows. At time t, the holdings of cohort $n \in \{t, t-1\}$ in country i of assets from country i and $j \neq i$ are

$$\begin{aligned}
x_{i,t}^{i,t} &= \frac{\tilde{\alpha}_i + (1+\beta_{0,i})(1-w_0)m}{\gamma(1+\beta_{0,i})^2\sigma_0^2} + \frac{w_0(1+\beta_{0,i}) + \beta_{1,i} - R\beta_{0,i}}{\gamma(1+\beta_{0,i})^2\sigma_0^2}y_{i,t} - \frac{R\beta_{1,i}}{\gamma(1+\beta_{0,i})^2\sigma_0^2}y_{i,t-1} \\
x_{i,t}^{i,t-1} &= \frac{\tilde{\alpha}_i + (1+\beta_{0,i})(1-w_1)m}{\gamma(1+\beta_{0,i})^2\sigma_1^2} + \frac{w_1(1+\beta_{0,i})\omega + \beta_{1,i} - R\beta_{0,i}}{\gamma(1+\beta_{0,i})^2\sigma_1^2}y_{i,t} + \frac{w_1(1+\beta_{0,i})(1-\omega) - R\beta_{1,i}}{\gamma(1+\beta_{0,i})^2\sigma_1^2}y_{i,t-1} \\
x_{j,t}^{i,t} &= \frac{\tilde{\alpha}_j + (1+\beta_{0,j})(1-w_0^*)m}{\gamma(1+\beta_{0,j})^2\sigma_0^{*2}} + \frac{w_0^*(1+\beta_{0,j}) + \beta_{1,j} - R\beta_{0,j}}{\gamma(1+\beta_{0,j})^2\sigma_0^{*2}}y_{j,t} - \frac{R\beta_{1,j}}{\gamma(1+\beta_{0,j})^2\sigma_0^{*2}}y_{j,t-1} \\
x_{j,t}^{i,t-1} &= \frac{\tilde{\alpha}_j + (1+\beta_{0,j})(1-w_1^*)m}{\gamma(1+\beta_{0,j})^2\sigma_1^{*2}} + \frac{w_1^*(1+\beta_{0,j})\omega + \beta_{1,j} - R\beta_{0,j}}{\gamma(1+\beta_{0,j})^2\sigma_1^{*2}}y_{j,t} + \frac{w_1^*(1+\beta_{0,j})(1-\omega) - R\beta_{1,j}}{\gamma(1+\beta_{0,j})^2\sigma_1^{*2}}y_{j,t-1}
\end{aligned}$$

where $\tilde{\alpha}_i = \alpha_i(1-R)$. The following definitions will be useful for our analysis. First, let $X_{j,t}^i \equiv \frac{1}{4}\left(x_{j,t}^{i,t} + x_{j,t}^{i,t-1}\right)$ denote the aggregate demand in country i of the asset of country j; and let $\bar{X}_t^i \equiv \{X_{H,t}^i, X_{F,t}^i\}$ denote the portfolio of risky assets of country i at time t. With this, we introduce the notion of home bias in portfolio holdings for our two-country economy.

Definition 3.1 (Home Bias)**.** *We say that there is home bias in portfolio holdings at time t when*

$$HB_t \equiv X_{H,t}^H - X_{F,t}^H > 0.$$

Due to the symmetry across countries embedded in the model, it is sufficient to compare a country's holdings of domestic vs. foreign assets to assess the presence of home bias in portfolio holdings. As the world portfolio is given by one unit of the domestic asset and one unit of the foreign asset, no home bias in portfolio holdings would imply that $X^H_{H,t} = X^H_{F,t} = X^F_{H,t} = X^F_{F,t}$; that is, all countries hold the same fraction of assets of the H and F country, and thus $HB_t = 0$. Finally, due to market clearing, $HB_t > 0$ implies that $X^F_{F,t} - X^F_{H,t} > 0$ as well, so it is WLOG to focus on the holdings of the H country.

Finally, it is useful to define booms and recessions of individual countries as periods in which positive or negative macro-shocks follow a period of output stability in both countries.

Definition 3.2 (Booms and Recessions)**.** *We say there is a* recession *in country i at time t when $y_{i,t-1} = y_{j,t} = y_{j,t-1} = \bar{y}$ and $y_{i,t} < \bar{y}$. Analogously, we say there is a* boom *in country i at time t when $y_{i,t-1} = y_{j,t} = y_{j,t-1} = \bar{y}$ and $y_{i,t} > \bar{y}$.*

We begin by characterizing the portfolio choice of each country in an economy with no heterogeneity across countries.

Lemma 3.1. *If all agents are born with the same prior belief about domestic and foreign output, then all countries hold the same fraction of the world portfolio. As a result, aggregate holdings of domestic and foreign assets are*

$$X^H_{H,t} = X^F_{H,t} = X^H_{F,t} = X^F_{F,t} = 1,$$

and thus do not vary during domestic or foreign booms or recessions.

When countries share prior beliefs, $\tau = \tau^*$, the efficient portfolio theory holds, as both countries hold a fraction of the world portfolio, which implies there is no home bias in portfolio holdings. This is true even though agents form beliefs by using their lifetime experiences. It is important to highlight, however, that within a country individual cohorts need not be holding the world portfolio. In particular, deviations in the portfolio holdings of young agents from the world portfolio are off-set by deviations in the portfolio holdings of adult agents in that same country, so that in aggregate the efficient portfolio result holds. The results in Lemma 3.1 have important implications for international flows, as they suggest that domestic, foreign, or local booms or recessions should have no impact on a country's aggregate portfolio holdings, and thus international flows.

In what follows, we show how these predictions change when we allow for different prior beliefs or degrees of market participation across countries. In particular, we will show heterogeneity across countries can generate deviations from the efficient portfolio benchmark which are consistent with the data, such as home bias, and capital fickleness and retrenchment during domestic and global crisis.

3.3 Heterogeneity in Prior Beliefs

We suppose that agents have more precise prior distributions about their own country's output than the foreigner's; that is, $\tau > \tau^*$. There are many reasons why agents may have more precise prior beliefs about their own country's output, such as early lifetime experiences that foreigners have not had, or inter-generational information transmission. Even though we do not model this explicitly, we believe that a more precise prior distribution is a good way to capture the notion that agents are more confident about their knowledge of their own country than foreigners.

Proposition 3.2. *If agents have more precise prior beliefs about domestic than foreign output, $\tau > \tau^*$, then we should expect home bias in portfolio holdings:*

$$\mathbb{E}\left[X^H_{H,t} - X^H_{F,t}\right] > 0,$$

where $\mathbb{E}[\cdot]$ is the unconditional expectations operator over the true distribution of outputs.

Furthermore, home bias at time t decreases in global output, $Y_t \equiv y_{H,t} + y_{F,t}$.

The assumption that domestic agents have a more precise prior belief about their own country's output has important implications for portfolio holdings and countries' reactions to macro-shocks. First, a more precise domestic prior belief implies that domestic agents perceive less risk when investing in the domestic asset than in the foreign asset: $\sigma^2_{age} < \sigma^{*2}_{age}$, where $age \in \{0, 1\}$. As a result, all else equal, they are more willing than foreigners to hold the domestic asset than the foreign asset, driving home bias in portfolio holdings. Second, a more precise domestic prior belief implies that domestic agents put more weight on their prior belief about domestic output than foreign agents do when computing their posterior mean, i.e., $1 - w_{age} > 1 - w^*_{age}$. From inspection of posterior means (21)-(24), it follows that domestic agents underreact to domestic shocks relative to foreign agents, $w_{age} < w^*_{age}$, when forming their beliefs. As a result, as global output increases, domestic agents under-react to the boom in domestic output (or equivalently, they over-react to the boom in foreign output), and an outflow of domestic funds from the domestic country occurs, decreasing home bias in portfolio holdings.

Corollary 3.1. *If agents have more precise prior beliefs about domestic than foreign output, $\tau > \tau^*$, after a* recession *in country i there is an outflow of foreign funds (fickleness) and an inflow of domestic funds (retrenchment). The opposite flow pattern follows a* boom *in country i.*

The results in Corollary 3.1 suggest that the model can rationalize two patterns of international flows that have been identified in the literature and that are hard to explain with standard models that rationalize home bias (Forbes and Warnock 2012). First, that during domestic crisis, there is an inflow of domestic funds – a behavior usually referred to as *retrenchment*. Second, that during domestic crisis there is an outflow of foreign funds – a pattern usually referred to as *fickleness*.

4 Heterogeneity in Market Participation

We now suppose that agents have the same prior beliefs, but differ in the demographics of market participation. To be able to do so in our OLG setting, we assume that a fraction of agents in country i participate in this market; in particular, we denote by $\phi^{i,age} \in (0,1)$ the mass of agents with $age \in 0,1$ of country i that participate in the market for risky assets, where $\phi^{i,0} + \phi^{i,1} = \Phi^i$ is assumed to be constant over time.[11] This allows us to study the effect of heterogeneous market demographics across countries, which could be due to cultural differences or constraints that affect the age at which agents enter or exit financial markets, and that are outside the scope of this paper. Agents that do not participate in the market for risky claims invest all of their wealth in the risk-free asset.

Our equilibrium definition needs to be adjusted, as the new market clearing condition states that in all $t \in \mathbb{Z}$:

$$1 = \phi^{H,0} x_{H,t}^{H,t} + \phi^{H,1} x_{H,t}^{H,t-1} + \phi^{F,0} x_{H,t}^{F,t} + \phi^{F,1} x_{H,t}^{F,t-1}, \tag{26}$$

$$1 = \phi^{H,0} x_{F,t}^{H,t} + \phi^{H,1} x_{F,t}^{H,t-1} + \phi^{F,0} x_{F,t}^{F,t} + \phi^{F,1} x_{F,t}^{F,t-1}. \tag{27}$$

By using our linear guess for prices, plugging in the posterior means and variances into equation (18), and using the method of undetermined coefficients we obtain the following adjusted expressions that fully characterize prices for the asset of country $i \in \{H, F\}$

[11] The assumption that the total fraction of agents that participate in the market is constant over time is done to reduce notation and simplify exposition, but varying the mass of market participants can be simply incorporated into our framework.

when market participations differ across countries,

$$\beta_{i,0} = \frac{\Sigma R}{\Sigma R - \left\{\frac{\phi^{i,t}}{\sigma_0^2} w_0 + \frac{\phi^{i,t-1}}{\sigma_1^2} w_1 \omega + \frac{\phi^{j,t}}{\sigma_0^{*2}} w_0^* + \frac{\phi^{j,t-1}}{\sigma_1^{*2}} w_1^* \omega + \frac{(1-\omega)}{R}\left(\frac{\phi^{i,t-1}}{\sigma_1^2} w_1 + \frac{\phi^{j,t-1}}{\sigma_1^{*2}} w_1^*\right)\right\}} - 1$$

$$\beta_{i,1} = \frac{(1+\beta_{i,0})(1-\omega)}{\Sigma R}\left\{\frac{\phi^{i,t-1}}{\sigma_1^2} w_1 + \frac{\phi^{j,t-1}}{\sigma_1^{*2}} w_1^*\right\} \tag{28}$$

$$\alpha_i = \frac{\left(1+\beta_0^i\right)}{\Sigma(R-1)}\left(\frac{\phi^{i,t}}{\sigma_0^2}(1-w_0) + \frac{\phi^{i,t-1}}{\sigma_1^2}(1-w_1) + \frac{\phi^{j,t}}{\sigma_0^{*2}}(1-w_0^*) + \frac{\phi^{j,t-1}}{\sigma_1^{*2}}(1-w_1^*)\right) m - \frac{\gamma\left(1+\beta_0^i\right)^2}{\Sigma(R-1)}$$

where $\Sigma \equiv \frac{\phi^{i,t}}{\sigma_0^2} + \frac{\phi^{i,t-1}}{\sigma_1^2} + \frac{\phi^{j,t}}{\sigma_0^{*2}} + \frac{\phi^{j,t-1}}{\sigma_1^{*2}}$.

Without loss of generality, we analyze the case in which $\phi_{H,t} > \phi_{F,t}$, that is, there is a relatively larger mass of young market participants in the H country. There are many reasons why different countries may have different demographics of market participation. First, the difference could be simply driven by differences in the country's overall demographics due to different natality and mortality rates (which in our model are constant over time). Second, differences could be driven by cultural reasons or market frictions that induce different generations to participate or exit the market at a different points in their life. Our simple model is not able to capture all the exogenous and endogenous reasons why a country's market demographics may differ, but we believe that our reduced-form approach captures some of the forces at play when demographics do differ across countries.

Proposition 4.1. *If both countries have the same prior belief, home bias at time t increases in $y_{H,t} - y_{F,t}$ and decreases in $y_{H,t-1} - y_{F,t-1}$ if and only if country H has a larger fraction of young market participants, $\phi_{H,t} > \phi_{F,t}$.*

Corollary 4.1. *If both countries have the same prior belief, after a recession in country H, there is an outflow of domestic funds and an inflow of foreign funds from country H if and only if country H has a larger fraction of young market participants, $\phi_{H,t} > \phi_{F,t}$.*

5 Empirical Implications

In this section, we analyze the 5 empirical implications of our model. If countries have similar demographics then our model predicts: (1) home bias on average, (2) a decrease in home bias during booms, (3) fickleness and retrenchment, and (4) fickleness and retrenchment are exacerbated by recessions. If countries have different demographics: (5) fickleness and retrenchment results are exacerbated when the foreign country has a relatively larger fraction of young agents in the market. First, we turn to one of the most persistent macro-financial puzzles: home bias. We document the persistence of home bias which, consistent with the prediction (1). We also document results on home bias consistent with prediction (2). Second, we follow the approach of Caballero and Simsek (2018) to document retrenchment and fickleness and extend their results to US equity data. We examine fickleness and retrenchment both in a general context, as in Caballero and Simsek (2018), and then the additional context of recessions. We then test the additional, novel prediction generated by our model that demographic composition affects the intensity of our fickleness and retrenchment.

5.1 Home Bias

5.1.1 Data

To measure equity home bias we use data from the IMF and the World Federation of Exchanges. Our measurement of home bias roughly follows a basic implementation using the procedures of Mishra (2015) and Cooper, Sercu, and Vanpée (2013) in data and/or process. Summary statistics and more details on the construction of our home bias measure can be found in Appendix B.

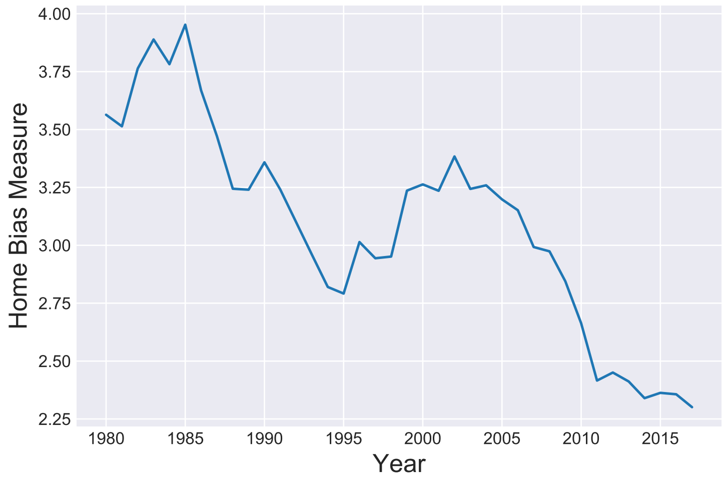

Figure 2: US Home Bias by Year

Notes. This figure plots equity home bias estimated as the approximate percentage of US listed equity allocated domestically minus the approximate percentage of the world's foreign invested, listed equity allocated to the US.

5.1.2 Persistence

We find positive US home bias in every period with average home bias of 55%, meaning that the US invested on average 55% more of its total assets in the US than our unbiased benchmark. Our home bias measure ranges from about 30% to 70%. Taking into account the longer time frame and differences in calculation, these results are roughly consistent with Mishra (2015) who estimates average US home bias of around 60% to 75% and Cooper, Sercu, and Vanpée (2013) who estimate similar measures of home bias around 45% and 78%.

5.1.3 Decrease During Booms

We next shift to our second prediction, a decrease in home bias during booms. More precisely as output increases in both the US and the rest of the world (ROW), there is an outflow of domestic funds in the US. We construct 2 measures, one to capture domestic investment of US citizens and the other to capture home bias. The measure of domestic investment is the log of US domestic investment divided by US foreign investment. The home bias measure is equal to the measure of domestic investment subtracting the log of foreign investment in the US divided by foreign investment in foreign countries.[12] As dependent variables we construct a relative output measure. The log of US GDP divided by ROW GDP. As a measure of foreign output we use the log of ROW GDP. GDP data is provided by the World Bank. Summary statistics and more thorough details on variable construction are included in Appendix B.

Table 1 presents the results from regressing our home bias measure and our home investment measure on the relative output measure, five lags of the relative output measure, the foreign output measure, and five lags of the foreign output measure. We then generate the F-statistic testing whether the coefficient on the foreign output measure and all 5 of its lags are the same. We find that for home bias measure the F-statistic is marginally insignificant at the 10% level. In contrast, for the home investment measure we find that the F-statistic is significant at the 0.01% level. This suggests that a shock to foreign output in a given period and the past five values are not all providing similar information. Given the statistical significance of only the contemporaneous value, this suggests that current ROW output shocks are more important for home investment than past values. In column 2 of Table 1, we also find evidence at the 5% level that as us output contemporaneously increases, relative to the ROW, US domestic investment decreases relative to investment in the ROW.

5.2 Fickleness & Retrenchment

We now shift to testing our model predictions about the behavior of fickleness and retrenchment. In our benchmark model with same prior beliefs and demographics, any change in US or ROW output should have no impact in the investment decisions of both

[12] These are the two values used to calculate the unbiased benchmark used in the calculation of percent home bias.

Table 1: Home Bias

Variable descriptions can be found in Appendix-Section B. Newey-West robust standard errors with a maximum of 3 lags are used to calculate the t statistics. The F-statistic test if the coefficient on Foreign Output Measure is equal to that of all 5 of its lags.

	(1) Home Bias Measure	(2) Home Investement Measure
Relative Output Measure in t	-0.354	-4.472**
	(-0.31)	(-2.15)
Relative Output Measure in t-1	0.677	0.729
	(0.59)	(0.49)
Relative Output Measure in t-2	2.514*	1.680
	(1.98)	(0.71)
Relative Output Measure in t-3	-1.302	1.213
	(-0.70)	(0.93)
Relative Output Measure in t-4	0.216	-1.705
	(0.12)	(-0.78)
Relative Output Measure in t-5	0.200	0.918
	(0.18)	(0.67)
Foreign Output Measure in t	-1.844	-6.325**
	(-1.64)	(-2.67)
Foreign Output Measure in t-1	0.575	1.146
	(0.51)	(0.69)
Foreign Output Measure in t-2	2.382*	1.568
	(2.00)	(0.62)
Foreign Output Measure in t-3	-2.038	0.848
	(-1.14)	(0.64)
Foreign Output Measure in t-4	1.182	-1.410
	(0.65)	(-0.72)
Foreign Output Measure in t-5	-0.780	1.075
	(-0.76)	(0.94)
Constant	20.38***	96.55***
	(6.42)	(15.06)
F-statistic	2.042	3.943
P-value of F-statistic	0.1071	0.0090
R^2	0.9470	0.9810
N	38	38

Newey-West robust t statistics using 3 lags in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

the US and the ROW, as prices would do the entire adjustment (see Lemma 3.1). When we consider the case of more precise prior beliefs about domestic output, however, we would expect to see opposite patterns of investment by the US and the ROW in response to changes in output (see Proposition 3.2). In particular, there should be an inflow of domestic funds (retrenchement) and an outflow of foreign funds (fickleness) after a negative domestic or global shock.

Consistent with our model, Forbes and Warnock (2012) find evidence of fickleness and retrenchment increasing during global recessions, and after domestic negative GDP growth news. For our empirical strategy, we follow Caballero and Simsek (2018), who demonstrate that capital inflows are strongly correlated with capital outflows, as predicted by our model. They find that such correlations are especially strong for OECD countries, which includes the US. To map our model onto data we use equity data and define the two countries as the US and the ROW. In this subsection, using the approach of Caballero and Simsek (2018), we extend their results to US equity data, examine the importance of recessions for these results, and then examine the importance of demographics.

To examine inflows and outflows with a focus on equity, we use IMF data on the flows of equity portfolio investment. The equity component of portfolio investment is often used as a measure of listed stock ownership as in Mishra (2015) and Cooper, Sercu, and Vanpée (2013). Our data diverges from Caballero and Simsek (2018) in two ways, we use only US data and we focus exclusively on equity portfolio investment.[13] We use the term outflows to refer to changes in US foreign investment and inflows to refer to changes in foreign investment in the US.[14] To ensure our results our robust we use jackknife SEs.[15]

[13] Caballero and Simsek (2018) consider total direct investment, portfolio investment, other investments, and, in the case of outflows, also reserve assets. This, for example, also includes the debt component of portfolio investment.

[14] This terminology follows Caballero and Simsek (2018).

[15] We use jackknife SEs because analytically calculated heteroskedasticity robust SEs appear to be biased by finite sample bias. We use jackknife SEs as opposed to bootstrap SEs due to the very tiny (i.e. 13) sample sizes. Further, jackknife SEs cannot be biased by sample size or repetition choices.

The empirical specification of Caballero and Simsek (2018), regressing inflows on outflows, is ideal for showing retrenchement for two reasons: it highlights the key divergence from traditional capital flow models and since the effects of retrenchment and fickleness should be roughly proportional we do not need a large battery of control variables. In column 1 of Table 2, we replicate the result of Caballero and Simsek (2018) with our data and find that US inflows and outflows are correlated at the 10% level.[16] This provides evidence for the fickleness and retrenchment. In our benchmark model, the response to any news would be symmetric and therefore the correlation would be negative. In example, during a recession outflows should be positive as US citizens withdraw money and negative inflows as foreigners also withdraw money. These results, however, are consistent prediction 3 based on our model in which agents' priors are less precise about foreign countries.

One potential concern with this regression, although at odds with the literature, is that we observe the opposite of retrenchement and fickleness in the data. For example, during a US recession, US investors invest less in the US and foreigners invests more. To address this concern, in column 2 of Table 2, we do a direct test for retrenchment during recessions and find a strong correlation, statistically significant at the 5% level, between US disinvesting from foreign countries and recessions.[17] This result serves to provide further evidence of how outflows and recessions are correlated.

Our model suggests that fickleness and retrenchment occur after periods of stability, thus are findings for fickleness and retrenchment should be exacerbated by macro-shocks like recessions. Unfortunately, neither the above results nor our model provide insight

[16] Caballero and Simsek (2018) divide flows by GDP smoothed by the HP filter. Given that, in contrast to Caballero and Simsek (2018), we focus only on one country, we don't adjust our data in this manner; however, we obtain similar results in terms of both signs and statistical significance if we make this adjustment.

[17] We don't find statistically significant evidence for or against fickleness using this simple regression approach. We suggest that these results are likely more muted for fickleness than retrenchment, possibly because of the US' strong economic reputation although that is normally applies to primarily to US treasuries. Given our other results and the broader literature, such as Obstfeld (2012) who, as noted by Caballero and Simsek (2018), documents fickleness and retrenchment during the 2008-2009 financial crisis, we suggest that US fickleness still deserves strong consideration.

about the time horizon in which retrenchment occurs. Given our results, one reasonable hypothesis is that inflows and outflows are generally uncorrelated except during recessions when both values suddenly increase. Under this hypothesis, outflows and inflows would be correlated over the full sample; however, if we were to separate the years in which recessions occurred and the years in which recessions did not occur then there would be no significance in the no-recession years.[18] If we saw a positive sign in the recession years then it would suggests that fickleness and retrenchement occur with similar paths on a yearly basis during recessions. This would suggest that the severity of macro-shocks that occur within recessions also induce proportional retrenchment and fickleness on an approximately yearly basis. We can test this second hypothesis, that retrenchement and fickleness occur on a yearly basis, empirically as laid out above. If fickleness and retrenchement occur on a yearly basis, then our model suggests our results should be stronger during macro-shocks while expectations are changing. Conveniently, if we see a positive correlation for outflows during recessions years that is at least as strong as the non-recession years then this would also confirm prediction 4 that fickleness and retrenchment are exacerbated during macro-shocks.

Recessions (and booms) are difficult to define and so, rather than using an ad hoc definition, we rely on the recessions as defined by NBER. We then split the data into years where the US was and wasn't in a recession. We find that if we look at the 13 years where the US was in a recession, the coefficient on outflows increases, the statistical significance raises to the 5% level, and the R^2 increases about 5 fold. In contrast, in the sample of years where the US was not in a recession the results are not statistically significant even at the 10% level despite having more than double the sample size.[19] These results are consistent with the results of our model which suggest that fickleness

[18] Here we deal with primarily with recessions since they are defined, documented above, and largely what the intuition of retrenchement and fickleness are built on. It would also be reasonable to expect a positive coefficient, caused by booms having the opposite effect of recessions, in the non-recession years.

[19] These results may suggest that recessions induce larger fickleness and retrenchment effects.

and retrenchment occur strongly during macro-shocks and not during periods of stability. Further, these results allow us to suggest that the timing of retrenchment and fickleness can occur on a yearly basis.

Table 2: Recessions and Capital Flows

Outflows correspond to changes US portfolio investment in foreign countries. Inflows correspond to changes in foreign portfolio investment in the US. Recession years are when the US was in a recession for at least one quarter. US recessions correspond to the proportion of the year (in quarters) when the US was defined to be in a recession by NBER. Constants included but not tabulated.

	(1) Outflows	(2) Outflows	(3) Outflows	(4) Outflows
Inflows	0.30*		0.28	0.42**
	(1.69)		(1.16)	(2.75)
US Recession		-7.17e10**		
		(-2.17)		
R^2	0.098	0.069	0.072	0.539
N	48	48	35	13
Sample	Full	Full	Non-Recession	Recession

Jackknife robust t statistics in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Next, we test the fifth prediction from our model: when there are more young agents in the ROW, fickleness and retrenchment are exacerbated. To examine this we use population data from the UN. We define a variable which measures the percentage of the population that is young outside the US.[20] We then split this variable into terciles and define the years in the top tercile as the years with more young.[21] Terciles are used to best parallel the recession years sample size. In column 2 of Table 3, we find that in the

[20] Our model highlights the relative difference in young population between the two countries. In practice, the US always has a lower fraction of young people than the ROW in this time period. Further, in contrast to the model the size of the US population is dwarfed by the ROW population. Thus we zoom in on the ROW demographics which carry the most weight.

[21] Our results are also robust to using the above median sample or the top quartile as the subsample with more young.

years with a higher percentage of young agents' outside the US the correlation between outflows and inflows is statistically significant at the 5% level. In the sample with a lower percentage of young agents' we find the same coefficient to be statistically insignificant despite having double the sample size.

The next step is to examine whether or not the years with more young people outside the US happen to coincide with the years of recessions in the US whether by reason or by chance. We find, however, that this is not the case: of the 13 recession years and 15 years with more young only 3 years overlap. As a logical next step and to ensure the relationships aren't mutually exclusive somehow, we define two more samples, one for recession years or years with more young and the converse. This splits the sample approximately in half. In column 4 of Table 3, we find that in the sample of recession years or years with more young the correlation is statistically significant at the 0.01% level despite having only 25 observations! This suggests the results from our model, even though they relied on different assumptions, can be combined to deliver stronger, more robust insights on the presence of fickleness and retrenchment.

6 Conclusion

To be completed.

Table 3: Recessions and Capital Flows

Outflows correspond to changes US portfolio investment in foreign countries. Inflows correspond to changes in foreign portfolio investment in the US. US recessions correspond to the percent of the year (in quarters) when the US was defined to be in a recession by NBER. Constants included but not tabulated. Recession years are when the US was in a recession for at least one quarter. More young years infer the percent of young in the ROW population was in the top tercile. Fewer young is the converse.

	(1) Outflows	(2) Outflows	(3) Outflows	(4) Outflows
Inflows	0.240	0.455**	0.210	0.389****
	(0.92)	(2.80)	(0.51)	(4.01)
R^2	0.0509	0.476	0.0278	0.349
N	31	15	21	25
Sample	More Young	Fewer Young	Fewer Young and Non-Recession	More Young or Recession

Jackknife robust t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

References

Ardalan, K. (2019). EQUITY HOME BIAS: A REVIEW ESSAY. *Journal of Economic Surveys 33*(3), 949–967.

Bae, K.-H., R. M. Stulz, and H. Tan (2008). Do local analysts know more? A cross-country study of the performance of local analysts and foreign analysts. *Journal of Financial Economics 88*(3), 581–606.

Balduzzi, P. and L. Liu (2001). Parameter uncertainty and international investment in a multi-period setting.

Barberis, N., R. Greenwood, L. Jin, and A. Shleifer (2015). X-CAPM: An extrapolative capital asset pricing model. *Journal of Financial Economics 115*(1), 1–24.

Barberis, N., R. Greenwood, L. Jin, and A. Shleifer (2016). Extrapolation and bubbles. Working Paper, National Bureau of Economic Research.

Blanchard, O. (2012). Sustaining a Global Recovery. *Finance and Development 46*(3), 9–12.

Botsch, M. and U. Malmendier (2018). Inflation Experiences and Contract Choice – Evidence from Residential Mortgages. Working paper, UC-Berkeley.

Broner, F., T. Didier, A. Erce, and S. L. Schmukler (2013). Gross capital flows: Dynamics and crises. *Journal of Monetary Economics 60*(1), 113–133.

Caballero, R. J. and A. Simsek (2018). A model of fickle capital flows and retrenchment. Working Paper, National Bureau of Economic Research.

Campbell, J. Y. and R. J. Shiller (1988). Stock Prices, Earnings, and Expected Dividends. *Journal of Finance 43*(3), 661–676.

Carmichæl, B. and A. Coën (2003). International portfolio choice in an overlapping generations model with transaction costs. *Economics Letters 80*(2), 269–275.

Chiang, Y.-M., D. Hirshleifer, Y. Qian, and A. E. Sherman (2011). Do Investors Learn from Experience? Evidence from Frequent IPO Investors. *Review of Financial Studies 24*, 1560–1589.

Chousakos, K., G. Gorton, and G. Ordonez (2016). Aggregate Information Dynamics.

Collin-Dufresne, P., M. Johannes, and L. A. Lochstoer (2016). Asset pricing when 'this time is different'. *The Review of Financial Studies 30*(2), 505–535.

Cooper, I., P. Sercu, and R. Vanpée (2013). The equity home bias puzzle: A survey. *Foundations and Trends in Finance 7*(4), 289–416.

Coval, J. D. and T. J. Moskowitz (2001). The geography of investment: Informed trading and asset prices. *Journal of political Economy 109*(4), 811–841.

Dvořák, T. (2003). Gross capital flows and asymmetric information. *Journal of International Money and Finance 22*(6), 835–864.

Ehling, P., A. Graniero, and C. Heyerdahl-Larsen (2017). Asset prices and portfolio choice with learning from experience. *The Review of Economic Studies 85*(3), 1752–1780.

Fama, E. F. and K. R. French (1988). Dividend yields and expected stock returns. *Journal of financial economics 22*(1), 3–25.

Forbes, K. J. and F. E. Warnock (2012). Capital flow waves: Surges, stops, flight, and retrenchment. *Journal of International Economics 88*(2), 235–251.

French, K. R. and J. M. Poterba (1991, January). Investor Diversification and International Equity Markets. Working Paper 3609, National Bureau of Economic Research.

Fuster, A., B. Hebert, and D. Laibson (2011). Natural Expectations, Macroeconomic Dynamics and Asset Pricing. In D. Acemoglu and M. Woodford (Eds.), *NBER Macroeconomics Annual 2011*. Chicago, IL: University of Chicago Press.

Fuster, A., D. Laibson, and B. Mendel (2010). Natural Expectations and Macroeconomic Fluctuations. *Journal of Economic Perspectives 24*, 67–84.

Gourinchas, P.-O. and A. Tornell (2004). Exchange rate puzzles and distorted beliefs. *Journal of International Economics 64*(2), 303–333.

Grinblatt, M. and M. Keloharju (2001). How distance, language, and culture influence stockholdings and trades. *The Journal of Finance 56*(3), 1053–1073.

Guidolin, M. (2005). Home Bias and High Turnover in an Overlapping-generations Model with Learning. *Review of International Economics 13*(4), 725–756.

Hertwig, R., G. Barron, E. U. Weber, and I. Erev (2004). Decisions from Experience and the Effect of Rare Events in Risky Choice. *Psychological Science 15*, 534 C539.

Kaustia, M. and S. Knüpfer (2008). Do Investors Overweight Personal Experience? Evidence from IPO Subscriptions. *Journal of Finance 63*, 2679–2702.

LeRoy, S. F. (2005). Excess Volatility. *working paper*.

LeRoy, S. F. and R. D. Porter (1981). The present value relation: Tests based on implied variance bounds. *Econometrica 49*, 555–574.

Malloy, C. J. (2005). The geography of equity analysis. *The Journal of Finance 60*(2), 719–755.

Malmendier, U. and S. Nagel (2011). Depression Babies: Do Macroeconomic Experiences Affect Risk-Taking? *Quarterly Journal of Economics 126*, 373–416.

Malmendier, U. and S. Nagel (2016). Learning from Inflation Experiences. *Quarterly Journal of Economics 131*, 53–87.

Malmendier, U., S. Nagel, and Z. Yan (2018). The Making of Hawks and Doves. Working paper, UC-Berkeley.

Malmendier, U., D. Pouzo, and V. Vanasco (2018). Investor Experiences and Financial Market Dynamics.

Malmendier, U. and L. S. Shen (2017). Scarred Consumption. Working paper, UC-Berkeley.

Malmendier, U. and A. Steiny (2018). Rent or Buy? The Role of Lifetime Experiences of Macroeconomic Shocks within and across Countries. Working paper, UC-Berkeley.

Mishra, A. V. (2015). Measures of equity home bias puzzle. *Journal of Empirical Finance 34*, 293–312.

Obstfeld, M. (2012). Does the current account still matter? *American Economic Review 102*(3), 1–23.

Obstfeld, M. and K. Rogoff (2000). The six major puzzles in international macroeconomics: is there a common cause? *NBER macroeconomics annual 15*, 339–390.

Oreopoulos, P., T. von Wachter, and A. Heisz (2012). The Short- and Long-Term Career Effects of Graduating in a Recession: Hysteresis and Heterogeneity in the Market for College Graduates. *American Economic Journal: Applied Economics* (4), 1–29.

Schraeder, S. (2015). Information Processing and Non-Bayesian Learning in Financial Markets. *Review of Finance*, 1–31.

Shiller, R. J. (1981). Do stock prices move too much to be justified by subsequent changes in dividends? *American Economic Review 71*, 421–436.

Simonsohn, U., N. Karlsson, G. Loewenstein, and D. Ariely (2008). The tree of experience in the forest of information: Overweighing experienced relative to observed information. *Games and Economic Behavior 62*(1), 263–286.

Tesar, L. L. and I. M. Werner (1995). Home bias and high turnover. *Journal of international Money and Finance 14*(4), 467–492.

Tille, C. and E. Van Wincoop (2008). International capital flows under dispersed information: Theory and evidence. Working Paper, National Bureau of Economic Research.

Tversky, A. and D. Kahneman (1974). Judgment under uncertainty: Heuristics and biases. *Science 4157*, 1124–1131.

Van Nieuwerburgh, S. and L. Veldkamp (2009). Information immobility and the home bias puzzle. *The Journal of Finance 64*(3), 1187–1215.

Vives, X. (2010). *Information and Learning in Markets: The Impact of Market Microstructure*. Princeton University Press.

Weber, E. U., U. Böckenholt, D. J. Hilton, and B. Wallace (1993). Determinants of diagnostic hypothesis generation: effects of information, base rates, and experience. *Journal of Experimental Psychology: Learning, Memory, and Cognition 19*(5), 1151.

Woodford, M. (2013). Macroeconomic Analysis without the Rational Expectations Hypothesis. *Annual Review of Economics 5*(1), forthcoming.

****** WORK IN PROGRESS ******

Appendix A Proofs for Results

Proof of Lemma 3.1. As $\tau_j^i = \tau_i^i$, we have that $w_{t-n} = w_{t-n}^*$ and that $\sigma_{t-n}^2 = \sigma_{t-n}^{*2}$, same demographics implies that $\phi^{i,n} = \phi^{j,n}$ and that overall market participation is the same across countries $\phi^i = \phi^j = \phi$. With this, the aggregate demand of the Home country for the Foreign country's asset is given by

$$X_{F,t}^H = \phi^{H,0}\frac{\mathbb{E}_t^{H,t}[s_{F,t}]}{\mathbb{V}_t^{H,t}[s_{F,t}]} + \phi^{H,1}\frac{\mathbb{E}_t^{H,t-1}[s_{F,t}]}{\mathbb{V}_t^{H,t-1}[s_{F,t}]} \tag{29}$$

while the aggregate demand of the Foreign country for the Foreign country's asset is

$$X_{H,t}^F = \phi^{F,0}\frac{\mathbb{E}_t^{F,t}[s_{F,t}]}{\mathbb{V}_t^{F,t}[s_{F,t}]} + \phi^{F,1}\frac{\mathbb{E}_t^{F,t-1}[s_{F,t}]}{\mathbb{V}_t^{F,t-1}[s_{F,t}]} \tag{30}$$

As both country's have the same prior beliefs about output in country F and all agents in a given cohort observe the same output realizations, it follows that agents in both countries in a given cohort have the same posterior beliefs. Additionally, as both countries have the same market demographics, it follows that $X_{F,t}^H = X_{F,t}^F$. Market clearing implies that

$$X_{F,t}^H X_{F,t}^H + \phi^F X_{F,t}^F = 1.$$

It follows that $X_{F,t}^H = X_{F,t}^F = \frac{1}{2\phi}$. The proof for $X_{H,t}^H = X_{H,t}^F = \frac{1}{2\phi}$ is isomorphic. □

Proof of Proposition 3.2. To show that a decrease in the prior precision about a foreign country induces a home bias in the domestic country, it suffices to show that $\frac{\partial \mathbb{E}[HB_{H,t}]}{\partial \tau^*}|_{\tau^*=\tau} < 0$, which would imply that $HB_{H,t} > 0$ if $\tau^* < \tau$. As τ^* decreases, everything else equal, the aggregate demand in country H of domestic assets, $X_{H,t}^H$, remains unchanged. Thus, we focus on the effect of a decrease in the prior precision about the foreign asset on the demand of the domestic country for the foreign asset. We thus highlight the terms in the demand that are directly affected by the prior precision τ^*:

$$X_{F,t}^H = \phi^t\left[\frac{\tilde{\alpha} + (1+\beta_{F,0})(1-w_0^*)m}{\gamma(1+\beta_{F,0})^2\sigma_0^{*2}} + \frac{w_0^*(1+\beta_{F,0}) + \beta_{F,1} - R\beta_{F,0}}{\gamma(1+\beta_{F,0})^2\sigma_0^{*2}}y_{F,t} - \frac{R\beta_{F,1}}{\gamma(1+\beta_{F,0})^2\sigma_0^{*2}}y_{F,t-1}\right] + ...$$
$$\phi^{t-1}\left[\frac{\tilde{\alpha} + (1+\beta_{F,0})(1-w_1^*)m}{\gamma(1+\beta_{F,0})^2\sigma_1^{*2}} + \frac{w_1^*(1+\beta_{F,0})\omega + \beta_{F,1} - R\beta_{F,0}}{\gamma(1+\beta_{F,0})^2\sigma_1^{*2}}y_{F,t} + \frac{w_1^*(1+\beta_{F,0})(1-\omega) - R\beta_{F,1}}{\gamma(1+\beta_{F,0})^2\sigma_1^{*2}}y_{F,t-1}\right].$$

where the terms indexed by $*$ are a function of τ^*. We can then compute $\frac{\partial X_{F,t}^H(\tau^*)}{\partial \tau^*}$ as follows

$$= \phi^{t}\frac{\left(y_{F,t}-m\right)\frac{\partial w_{0}^{*}}{\partial\tau^{*}}}{\gamma\left(1+\beta_{F,0}\right)\sigma_{0}^{*2}}+\phi^{t-1}\frac{\left(\omega y_{F,t}+\left(1-\omega\right)y_{F,t-1}-m\right)\frac{\partial w_{1}^{*}}{\partial\tau^{*}}}{\gamma\left(1+\beta_{F,0}\right)\sigma_{1}^{*2}}+\phi^{t}\frac{\partial x_{F,t}^{t,H}}{\partial\sigma_{0}^{*2}}\frac{\partial\sigma_{0}^{2*}}{\partial\tau^{*}}+\phi^{t-1}\frac{\partial x_{F,t}^{t-1,H}}{\partial\sigma_{1}^{*2}}\frac{\partial\sigma_{1}^{*2}}{\partial\tau^{*}}$$

As $\mathbb{E}[y_{F,t}] = m$ for all t, it follows that

$$\mathbb{E}\left[\frac{\partial X_{F,t}^{H}\left(\tau^{*}\right)}{\partial\tau^{*}}\right]=\phi^{t}\frac{\partial x_{F,t}^{t,H}}{\partial\sigma_{0}^{*2}}\frac{\partial\sigma_{0}^{2*}}{\partial\tau^{*}}+\phi^{t-1}\frac{\partial x_{F,t}^{t-1,H}}{\partial\sigma_{1}^{*2}}\frac{\partial\sigma_{1}^{*2}}{\partial\tau^{*}}<0$$

□

Proof of Proposition 4.1. Let $\tau + \tau^*$, all agents share the same prior belief. Then, we have that $\sigma_a^2 = \sigma_a^{*2}$ and thus $w_a = w_a^*$ for $a \in \{0, 1\}$, which implies that $\beta_{0,F} = \beta_{0,H} = \beta_0$ due to symmetry. Thus, we have that

$$1+HB_{t}\propto\frac{1}{\sigma_{0}^{2}\sigma_{1}^{2}}\left[\left(\phi^{F,1}\phi^{H,0}-\phi^{F,0}\phi^{H,1}\right)w_{0}+\left(\phi^{F,0}\phi^{H,1}-\phi^{H,0}\phi^{F,1}\right)\omega w_{1}\right]y_{H,t} \tag{31}$$

$$+\left[\phi^{F,0}\phi^{H,1}-\phi^{H,0}\phi^{F,1}\right]w_{1}\Sigma\left(1-\omega\right)y_{H,t-1} \tag{32}$$

$$+\left[\left(\phi^{H,1}\phi^{F,0}-\phi^{F,1}\phi^{H,0}\right)w_{0}+\left(\phi^{H,0}\phi^{F,1}-\phi^{F,0}\phi^{H,1}\right)\omega w_{1}\right]y_{F,t} \tag{33}$$

$$+\left[\phi^{H,0}\phi^{F,1}-\phi^{F,0}\phi^{H,1}\right]w_{1}\Sigma\left(1-\omega\right)y_{F,t-1} \tag{34}$$

$$1+HB_{t}\propto\frac{\left(\phi^{H,0}\phi^{F,1}-\phi^{H,1}\phi^{F,0}\right)}{\sigma_{0}^{2}\sigma_{1}^{2}}\left(\left(w_{0}-\omega w_{1}\right)\left(y_{H,t}-y_{F,t}\right)-w_{1}\Sigma\left(1-\omega\right)\left(y_{H,t-1}-y_{F,t-1}\right)\right) \tag{35}$$

Thus, a country's HB is a function of the differential output realizations in the domestic relative to the foreign country. The intuition is as follows: as young agents (in both countries), overreact to more recent observations relative to older cohorts, then the HB depends on the current realizations in each country and the number of young relative to old in each country:

$$\frac{\partial HB_{t}}{y_{H,t}-y_{F,t}}=\frac{\left(1+\beta_{0}\right)}{\sigma_{0}^{2}\sigma_{1}^{2}}\left(\phi^{H,0}\phi^{F,1}-\phi^{H,1}\phi^{F,0}\right)\left(w_{0}-\omega w_{1}\right) \tag{36}$$

$$\frac{\partial HB_{t}}{y_{H,t-1}-y_{F,t-1}}=-\frac{\left(1+\beta_{0}\right)}{\sigma_{0}^{2}\sigma_{1}^{2}}\left(\phi^{H,0}\phi^{F,1}-\phi^{H,1}\phi^{F,0}\right)w_{1}\Sigma\left(1-\omega\right) \tag{37}$$

Thus, HB increases in $y_{H,t} - y_{F,t}$ and decreases in $y_{H,t-1} - y_{F,t-1}$ if and only if

$$\phi^{H,0}\phi^{F,1}-\phi^{H,1}\phi^{F,0}>0$$

$$\frac{\phi^{H,0}}{\phi^{H,1}}>\frac{\phi^{F,0}}{\phi^{F,1}}$$

.
As we have assume the total mass of market participants is the same, we have that

$$\frac{\phi^{H,0}}{\phi^{H,1}} > \frac{\phi^{F,0}}{\phi^{F,1}} \iff \frac{\phi^{H,0}}{\Phi - \phi^{H,0}} > \frac{\phi^{F,0}}{\Phi - \phi^{F,0}} \iff \boxed{\phi^{H,0} > \phi^{F,0}}.$$

□

Appendix B Data

All monetary data are in US$ and inflation adjusted using the GDP deflator. Our sample for the home bias data is the 38 years that run from 1980-2017 due to availability of US market cap data. Our inflows and outflows sample runs from 1970-2017 for Table 1 due to the availability of the BOP series we use; however, the the UN population data ends in 2015 so the sample for table 2 runs from 1970-2015. Summary statistics are presented in Table 4.

B.1 Summary Statistics

Table 4: Summary Statistics

Home Bias, Home Bias Measure, and Home Investment Measure are based on data from 1980-2017. Relative Output Measure, Foreign Output Measure, Outflows, Inflows, and US Recessions use data from 1970-2017. ROW Percent Young uses data from 1970-2015.

Variable	N	Mean	SD	Min	Max
Home Bias Measure	38	3.09	0.45	2.30	3.95
Home Investment Measure	38	2.20	1.09	0.96	4.36
Relative Output Measure	48	-0.58	0.18	-0.88	-0.13
Foreign Output Measure	48	30.54	0.54	29.39	31.29
Outflows	48	6.86e10	9.02e10	-4.17e10	4.24e11
Inflows	48	5.29e10	9.47e10	-1.82e11	3.04e11
US Recessions	48	0.17	0.33	0	1
ROW Percent Young	46	0.65	0.02	0.60	0.68

B.2 Home Bias

In general, the data construction we use to calculate our home bias measure is constructed following on Mishra 2015 and Cooper, Sercu, and Vanpée 2013. Places where our calculations diverge from both are noted.

We focus primarily on home bias in listed equities. There is no publicly available data on total domestic equity holdings of the US; however, we can approximate this amount by subtracting the total portfolio investment in the US from the total listed market cap of the US. We use total listed market cap data from the World Federation of Exchanges downloaded from World Bank. One difference in calculation from referenced papers is that we use the IMF's International Investment Positions (IIP) data to source US equity liabilities as opposed to Current Portfolio Investement Survey(CPIS). This is because IIP data offers a longer time series. We did not make any adjustments to the IIP. To determine total US listed equity investment, we sum US investment in domestic equity as well as US investment in foreign equity, as measured by the equity portfolio investment assets of the US in the IIP data.

We use GDP data provided by the World Bank from 1970-2017.

The measures used in Table 1 are defined in Table 5 Rest of world (ROW) is defined using the same countries/regions listed below. X-Y Inv is meant to mean the amount X has invested in Y. These measures as above apply to publicly listed stocks/portfolio investment.

Table 5: Variable Definitions

Variable Name	Formula
Output Measure	log(US GDP) - log(ROW GDP)
Foreign Output Measure	log(ROW GDP)
Home Bias Measure	[log(US-US Inv) - log(US-ROW Inv)] - [log(ROW-US Inv) - log(ROW-ROW Inv)]
Home Investment Measure	log(US-US Inv) - log(US-ROW Inv)

B.3 Fickleness and Retrenchment

Outflows are the raw changes from the IMF Balance of Payments data for the for US portfolio investment in foreign countries (Variable Code: `BFPAE_BP6_USD`). Inflows are the raw changes from the IMF Balance of Payments data for the for foreign portfolio investment in the US (Variable Code: `BFPLE_BP6_USD`).

US recession data comes from NBER's Business Cycle Dating Committee. The recession sample are years where for at least one quarter the US is in a recession. The US Recession variable is the proportion of the year, in quarters, where the US is in a recession. For example, if the US is in a recession one quarter in a given year the variable will have the value .25 in that year.

World population data comes from the UN. Following Malmendier, Pouzo, and Vanasco 2018, we limit the population to people from 25 and 75 and define young people as those below 50. For computational simplicity we limit our definition of the rest of world (ROW) population to the combine population of a panel of 20 countries/regions (based on UN names and divisions). These countries/regions are Canada, Mexico, Brazil, Chile, Argentina, Peru, United Kingdom, France, Germany, Spain, Italy, Switzerland, Luxembourg, China (Mainland), Hong Kong, Japan, Singapore, Republic of Korea, Australia, and New Zealand.

To define the more young panel, we calculate the ROW percentage young and take the top tercile of observations. The fewer young panel is the converse.

The more recession years are 1970, 1973, 1974, 1975, 1980, 1981, 1982, 1990,1991, 2001, 2007, 2008, and 2009.

The more young years are 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, and 2002.