MANAGEMENT SCIENCE
Vol. 58, No. 2, February 2012, pp. 273–292
ISSN 0025-1909 (print) | ISSN 1526-5501 (online)
http://dx.doi.org/10.1287/mnsc.1110.1361

A Global Equilibrium Asset Pricing Model with Home Preference

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We develop a global equilibrium asset pricing model assuming that investors suffer from foreign aversion, a preference for home assets based on familiarity. Using a utility formulation inspired by regret theory, we derive closed-form solutions. When the degree of foreign aversion is high in a given country, investors place a high valuation on domestic equity, which results in a low expected return. Thus, the model generates the simple prediction that a country's degree of home bias and the expected return of its domestic assets should be inversely related. Our predicted relation between the degree of home bias and a country's expected return has the opposite sign predicted by models that assume some form of market segmentation. Using International Monetary Fund portfolio data, we find that expected returns are negatively related to home bias.

Key words: international asset pricing; home bias; familiarity; regret
History: Received July 14, 2010; accepted March 14, 2011, by Brad Barber, Teck Ho, and Terrance Odean, special issue editors. Published online in *Articles in Advance* June 24, 2011.

1. Introduction

Although there are many intuitive explanations for the observed equity home bias, a major question is what equilibrium asset pricing would be consistent with such explanations. In this paper, we provide a global capital asset pricing model (CAPM) that assumes a behavioral preference for home assets. Our model relies on two building blocks: familiarity and regret. Investors' preference for home assets is supported by the concept of familiarity (see Huberman 2001). In the model, we assume that investors exhibit both traditional risk aversion and a preference for home assets (foreign aversion) using a formulation of their utility function inspired by regret theory (Loomes and Sugden 1982, Bell 1982). Under some assumptions, we are able to derive closed-form solutions for the global asset allocation decision in an N-country setting. Foreign aversion captures investors' preferences toward home assets and leads investors to underinvest in foreign stocks in order to reduce the potential for regret, thereby creating a home bias. This result is no surprise and is not the paper's contribution. To draw a parallel, traditional risk aversion implies that investors require a higher expected return on risky assets than they do on risk-free assets. But the contribution of the traditional CAPM is to derive equilibrium risk premiums and portfolio holdings. Analogously, we derive market equilibrium results by assuming that investors of all countries exhibit both traditional risk aversion and (possibly different or null) foreign aversion, and we discuss how foreign aversion influences equilibrium expected returns and holdings.

A main contribution of our paper is a discussion of the equilibrium relationship between the magnitude of home bias in each country and global asset pricing. Two conclusions of our equilibrium asset pricing model are worth stressing:

(1) When foreign aversion is high in some countries (i.e., a strong home bias) and low in others (i.e., a low home bias), there are pricing implications. A country with high foreign aversion will have a higher demand for its local equity, resulting in a lower expected return. Thus, the expected return on a country's equity should be inversely related to the extent of home bias in that country. In other words, countries with (relatively) high home bias should exhibit (relatively) low equilibrium expected returns.

(2) If all investors have a similar level of foreign aversion worldwide, assets would be priced according to the traditional CAPM (in which only traditional risk is priced), even though the home bias in holdings is significant. So foreign aversion can introduce large home biases without any asset pricing differential.

A key assumption in our model is the concavity of the foreign-aversion function (i.e., regret aversion). Familiarity could also lead to several other behavioral biases, including relative optimism, perceived competence, and "keeping up with the Joneses." All these behavioral biases would induce some bias in equity holdings. However, in many such behavioral models, home bias in holdings is derived from market imperfections or some differing views on return distributions. In contrast, our model assumes that markets are frictionless and that return expectations are homogeneous. This behavioral trait (i.e., regret) is also different from the psychological force in Cao et al. (2011), where investors pessimistically evaluate portfolio choice alternatives that deviate from the domestic portfolio. Both approaches rely on the familiarity concept. However, in their model, home bias derives from investors' pessimistic beliefs about foreign assets (some form of model uncertainty) rather than the shape of the utility function, as in our setting. In addition, they only model a simple two-country case. Our utility formulation provides a distinct way of modeling home bias that is parsimonious and tractable.

The asset pricing model offers interesting empirical insights. Even if only a few investors exhibit foreign aversion, they will affect equilibrium, as their bias cannot be "arbitraged away" by other investors. Actually, it is sufficient that investors from a single country be foreign averse to induce a home bias in every country. Because foreign aversion is likely to evolve slowly, it is not surprising to find a slow evolution of home bias despite the rapid market liberalization of recent years. Gordon Brown, global chief investment officer of Fidelity International, even believes that the recent financial crisis will lead to an increase in home preference: "First, [I] expect the financial world to become more local. Investors will favor local, home-country stocks over international investments as emotion overrides reason. Home is where the heart is and we should expect investors to feel safer in their own backyards for a while. They will feel most confident holding domestic stocks where their governments will protect both them and their institutions" (De Ramos 2008).

An alternative explanation to the observed equity home bias is the existence of international investment barriers and institutional controls that lead to national market segmentation. Segmented CAPMs also postulate, by construction, a home bias, but their rational pricing implications are quite different from ours. As discussed below, they predict a positive relation between the extent of home bias and country expected returns. In the empirical section of this paper, we oppose the two major explanations of home bias and their pricing implications: one based on investor behavior (which affects their utility function) and one based on market imperfections (segmentation). But both factors (foreign aversion and investment barriers) can be at play simultaneously.

Our model's implications are tested using detailed information on actual global portfolio holdings reported by the International Monetary Fund (IMF) and segmentation ratings. The home bias ratio (see the definition below and in Kho et al. 2009) appears to be extensive and varies widely among countries. In a traditional CAPM, the home bias ratio should be 0%; in a fully segmented world with no foreign holdings, it should be 100%. Among developed countries, the average ratio is around 70%; it ranges from 37% for the Netherlands to 93% for Greece. The home bias ratio for the United States is close to the average. Home bias is much higher among emerging markets.

We try to test whether a preference-based or segmentation-based approach provides a better explanation of international asset pricing based on observed home biases. We conduct both a simple cross-sectional test and some dynamic difference-in-differences tests. In the cross-sectional test, we use the long-run mean return as a proxy for the expected return and find that expected returns and home bias are negatively correlated, after controlling for world beta and market segmentation. In the difference-in-differences tests, we examine how changes in a country's home bias lead to changes in its expected returns relative to the world return. We find that an annual decrease in home bias is associated with a lower realized return in that year, after controlling for changes in segmentation and changes in expected cash flows (proxied by changes in dividend yields). This finding suggests that if a country's home bias decreases in a given year, its expected return will increase, which is achieved by a decrease in its local stock price. Moreover, we find similar results after taking into account the asset pricing implications of home bias changes in other countries. Overall, the empirical tests seem to provide support for our model's predictions.

2. Related Literature

Traditional international CAPMs have fairly straightforward conclusions (see Solnik 1974, Adler and Dumas 1983). In frictionless markets where agents have traditional utility functions, every investor should hold a combination of their risk-free asset and the world market portfolio even in the presence of currency risk. Every portfolio should include domestic and foreign equity in proportion to their market capitalization. Pricing is such that the risk premium on assets hedged against currency risk is proportional to their covariances with the world market portfolio; hence the diversification benefits of international assets are valued.

Contrary to the predictions of international CAPMs, it has been repeatedly claimed that investors do not hold the world market portfolio and have a bias toward home equity. Numerous tentative explanations have been provided for the observed equity home bias (see reviews in Strong and Xu 2003, Karolyi and Stulz 2003, Bekaert and Wang 2009), with the two major justifications being institutional and behavioral. The institutional explanation relies on explicit barriers to international investments (regulations, investment constraints, transaction costs, differential taxes). The behavioral explanation depends on investors' preference for home assets based on some behavioral traits (familiarity, relative optimism, perceived competence, "keeping up with the Joneses"). Other explanations have also been provided: asymmetry of information (where local investors have better information on their home markets than foreign investors do); private benefits for domestic insiders; and hedging motives (inflation, currency, and human capital risks). Actually, numerous authors have questioned whether nonbehavioral explanations could justify the extent of the observed home bias. French and Poterba (1991) suggest that explanations for the home bias puzzle must be behavioral, not institutional. For example, globalization has removed many barriers to international investments, at least in developed markets. Information is now widely and rapidly disseminated, at least for large firms that make up the bulk of world market capitalization. Currency risk can be easily hedged.

Although there are intuitive explanations for the observed home bias, a major question is what equilibrium asset pricing would be consistent with such explanations. CAPMs have been developed to model some common forms of barriers to international investment. These international CAPMs assume partial or full international market segmentation (e.g., Stulz 1981, Errunza and Losq 1985, Chaieb and Errunza 2007), and they imply, by construction, home bias. But the interesting contribution of segmented CAPMs is to develop the pricing implications. Errunza and Losq (1985) focus on the impact of barriers to free cross-border portfolio flows and develop an international asset pricing model. They state that "the securities inaccessible to a subset of investors command a super risk premium" (Errunza and Losq 1985, p. 105). Their conclusion, that the expected return should be higher in countries with high investment barriers (and hence a high home bias) is the opposite of ours. The intuition of the segmented CAPMs is quite straightforward; consider, for example, Germany, where foreign investment in many major German corporations (so-called national champions) is restricted by various regulations and rules. Shares in these national champions must be held by local investors, even if they do not willingly wish to do so. In equilibrium, this can only be induced by a higher expected return (lower price) relative to traditional CAPM pricing. Foreigners would like to invest in those attractive (cheap) national champions, but are restricted from doing so. Naturally, the fact that national champions must be held by nationals also creates a local home bias. Hence, there is a positive relation between the expected return on a country and its home bias ratio. Most tests of segmentation have focused on the type of segmentation with restriction on investment by foreigners, typically in emerging markets,[1] and the general finding has been a positive premium for such segmented markets (see references in Chaieb and Errunza 2007).

The segmentation envisioned above is one in which foreigners are restricted from investing in the home security. But the segmentation feature could be the opposite, namely that home investors are legally forced to invest at home, while foreigners can invest anywhere. Were home investors, for segmentation reasons, forced to stay home, home securities could also carry a higher expected return. This may happen because domestic investors cannot diversify away the specific country risk in the same way that foreign investors can, and thus require a higher rate of return on domestic securities than foreign investors do. Lau et al. (2010) detail this risk diversification argument and state that "both Models (8) and (11) imply that investors with concentrated domestic asset holdings would need to be compensated with higher returns, as there is less global risk sharing between domestic and foreign investors. Therefore, a larger degree of home bias would lead to a higher cost of capital" (p. 194).

Rather than relying on some institutional market imperfections, we model investors' preferences toward home assets and propose a global equilibrium asset pricing model that is inspired by regret theory. Regret theory has been applied extensively within the decision sciences field, but it has been more sparingly employed in the area of finance. For example, Braun and Muermann (2004) apply regret theory to demand for insurance, Muermann et al. (2006) to asset allocation in defined contribution pension schemes, Michenaud and Solnik (2008) to currency hedging, and Engelbrecht-Wiggans and Katok (2008) to auctions. Reviews of experimental work on regret can be found in Michenaud and Solnik (2008) and Bleichrodt et al. (2010). We assume that investors treat domestic and foreign assets differently and experience regret when their foreign investment position underperforms domestic assets (foreign aversion). Kahneman and Lovallo (1993) suggest that decision makers are excessively prone to treat problems as unique. Rather than looking at the whole portfolio as prescribed by traditional utility theory, investors tend

[1] Even in developed countries, the typical restriction protects strategic industries from foreign ownership; it does not limit foreign capital flows.

to put different types of investments in different mental compartments, *layers* (see Statman 1999), or *narrow frames* (see Barberis and Huang 2009). Investors have a core portfolio made of domestic stocks. Foreign stocks are assigned to an unfamiliar asset class separate from domestic stocks; investors care about not only their absolute return and risk characteristics, but also their performance relative to that of the core domestic asset class. When foreign stocks underperform domestic stocks, investors feel the pain of regret of having invested abroad.

Investors' tendency to prefer home assets is inspired by the well-known concept of familiarity (see Huberman 2001). Ackert et al. (2005) find experimental evidence that investors perceive themselves as more familiar with local securities and invest more in them. International evidence suggests that investors tilt their portfolios toward those stocks that are most closely related to them (see Grinblatt and Keloharju 2001, Massa and Simonov 2006). The fact that investors tend to prefer local stocks is also true within a country where distance seems to matter, as shown by Coval and Moskowitz (1999), and Ivkovic and Weisbenner (2005).[2] But the lack of familiarity is likely to be more pronounced for stocks from a remote foreign country, which may have a different language and different reporting methods.

Familiarity could also lead to other cognitive biases that result in home bias, including relative optimism, perceived competence, and "keeping up with the Joneses." However, all these models rely on heterogeneous beliefs or market frictions that we do not impose. Strong and Xu (2003) use survey data of fund managers' views on prospects for international equity markets and find that fund managers show significant relative optimism toward their home equity market. The influence of perceived competence on international investing is evidenced in Kilka and Weber (2000) and Graham et al. (2009): investors believe that they are more competent in investing domestically than abroad and therefore treat foreign assets differently for fear of showing incompetence. External habit formation models ("keeping up with the Joneses") assume a behavioral bias and some market imperfection that leads to a home bias. In their approach, agents have exogenous preferences to mimic the consumption of people in their community (e.g., country) and therefore agents tend to mimic the portfolio choices of those living in their country. As stressed by Gollier (2004), relative consumption preferences are not sufficient to induce home bias. Generally, the resulting equilibrium will imply that everyone holds the world market portfolio; agents do mimic the portfolio held by other nationals, but that portfolio is the world market portfolio. To induce home bias, some exogenously specified financial market imperfection must be introduced. This approach requires the ad hoc feature of exogenously specifying some arbitrary level of home bias (or market imperfection) for a category of investors, which we do not have to do. Regret theory offers a general formulation of the utility function that leads to market equilibrium under frictionless financial markets. We are able to characterize the properties of the equilibrium solely as a function of the levels of risk and foreign aversions, and market observables.

A paper related to ours is Cao et al. (2011). They use Gilboa-Schmeidler preferences and model familiarity bias in which individuals pessimistically evaluate choice alternatives against the status quo (i.e., the focal choice option). In the context of international finance, they argue that because domestic assets start out by being domestically held, domestic investors view them as the status quo and are reluctant to shift away from this initial position. This argument, that domestic investors perceive the domestic portfolio as focal and use it as the benchmark, lends support to the benchmark choice in our paper (i.e., the domestic portfolio). The intuition is similar: the fear of the unfamiliar makes investors reluctant to deviate from domestic assets. Cao et al. (2011) also conclude that equilibrium stock prices reflect an unfamiliarity premium. However, there are two important differences between their approach and ours. First, the key assumption in their model is investors' pessimistic beliefs (some form of model uncertainty) rather than the shape of the utility function, as in our setting. In our model, we assume that investors have perfect knowledge about all moments of stock returns, and foreign aversion does not come from any uncertainty about parameters. Second and importantly, whereas Cao et al. (2011) model a two-country case, our utility formulation is able to derive closed-form solutions for an N-country case with a risk-free asset. This provides us with the opportunity to derive the asset pricing implications by taking into account the cross-country effect of changes in home biases. Regret theory is a parsimonious reduced form with attractive properties, as outlined below.

Although some might disagree that investors have a preference for home assets, it would be sufficient that some, but not all, investors exhibit home preference to make our extended global CAPM interesting. The tests conducted in the later part of this article provide some empirical support for the main implications of our model.

[2] Seasholes and Zhu (2010) find that the preference for local stocks cannot be explained by an informational advantage.

3. A behavioral Model of Global Asset Allocation Choices

We propose an extended-utility approach, in which we incorporate home preference using a formulation derived from regret theory. Following Loomes and Sugden (1982) and Bell (1982), we assume that investors reach an optimal asset allocation by maximizing expected utility. But their expected utility takes into account their foreign aversion, in addition to traditional risk aversion. Loomes and Sugden (1982) and Bell (1982) derive an extended utility function of final wealth x resulting from a given investment choice, knowing that a different investment choice would have led to a final wealth y:

$$U(x, y) = v(x) + f(v(x) - v(y)), \tag{1}$$

where $U(x, y)$ is the extended utility of achieving x, knowing that y could have been achieved, and $v(x)$ is the traditional von Neumann–Morgenstern utility function, also called *value function* or choiceless utility. This traditional value function is assumed to be monotonically increasing and concave (risk aversion), and its expected value reflects the return and risk of the overall portfolio. The difference $v(x) - v(y)$ is the value loss/gain of having chosen an investment that yields x rather than a forgone choice that yields y. The regret function $f(\cdot)$ is monotonically increasing and concave, with $f(0) = 0$. Note that the argument of $f(\cdot)$ can be positive if the chosen investment has a better outcome than the alternative. Rejoicing, as named by Loomes and Sugden (1982), is the additional pleasure of knowing, ex post, that the best decision has been selected. Concavity of the regret function, $f'' < 0$, implies regret aversion (here foreign aversion). Investors are regret sensitive (foreign averse) only if the function is concave, just like they are risk averse if the value function $v(\cdot)$ is concave. This extended utility is defined over the ex post (final) outcomes of investment choices; and rational investors would make choices ex ante by maximizing their expected utility:

$$EU(x, y) = Ev(x) + Ef(v(x) - v(y)). \tag{2}$$

Loomes and Sugden (1982) and Bell (1982, 1983) conclude that this is a well-behaved parsimonious functional form that is consistent with empirically observed deviations from traditional expected utility theory (e.g., violations of transitivity). It is a simple functional form based on two functions: a traditional utility plus a function that captures regret. Our model of home preference is a rather simple application of regret theory formulation. Although the mathematical formulation of regret theory inspired our modeling of home preference, we do not claim to provide a full-fledged regret-theoretic model. We adopt this formulation because it is well adapted for modeling home preference and has attractive properties. We incorporate a foreign-aversion function that compares the return on the chosen global asset allocation to the return that would have been achieved with a portfolio fully invested in domestic assets. In Equation (2), x is the outcome of the chosen global allocation and y is the outcome of a purely domestic allocation. Investors are assumed to treat foreign assets as a separate asset class and our model restricts regret to be felt only on the return achieved on this foreign asset class relative to the core, or domestic, portfolio. Using familiarity parlance, our regret function simply states that investors are reluctant to deviate from familiar domestic assets for fear of the unfamiliar. Remember that all choices are done *ex ante*, not after observing the ex post outcome. Here, we assume that investors decide ex ante on their optimal asset allocation (with outcome x) taking into account potential deviations from a purely domestic choice (with outcome y). If investors had no foreign aversion, this additional utility term would not be present. Obviously, such a specification will necessarily lead to home bias, but the paper's contribution is to derive the equilibrium asset pricing implications and the relation between the extent of home bias and asset pricing.

In the model, we have N countries and one asset per country (the country's market portfolio). In addition, we have a common risk-free asset with return R_0. This means that there is no foreign exchange risk in our model. Although not having stochastic exchange rates is an apparent limitation of the model, traditional CAPMs with currency risks conclude that currency risks do not affect optimal equity holdings because of the availability of currency hedging (e.g., Solnik 1974, Adler and Dumas 1983). That is, with complete tradability of currency risk, all investors will hold the world market portfolio (hedged against currency risk) and there is no home bias. Hence, currency risk cannot explain the home bias in traditional CAPMs.[3] We assume that markets are frictionless and that return expectations are homogeneous. This is in contrast with other explanations of home bias that rely on some market frictions, such as restrictions on foreign ownership or differential taxes, or on some differing views on return distribution, such as relative optimism or information asymmetries.

[3] The assumption of the complete tradability of currency risk is not fully verified in the real world. Some currencies, mostly in smaller emerging countries, lack easily available forward currency contracts, so there could be some home bias due to currency risk. This is a potential limitation of both the traditional CAPM and our model.

This is a two-period model. In each country, 1 to N, there is a representative/aggregate investor. Investors located in the country called "country i" allocate their wealth to equity assets, with realized return $\mathbf{R}$ and to the risk-free asset with a return R_0. Investors from country i have a wealth W_i and allocate $\boldsymbol{\alpha}_i^T\mathbf{1}W_i$ to equity assets, and $(1-\boldsymbol{\alpha}_i^T\mathbf{1})W_i$ to the risk-free asset. Final wealth W_i^1 is given by

$$\begin{aligned} W_i^1 &= W_i[1+(1-\boldsymbol{\alpha}_i^T\mathbf{1})R_0+\boldsymbol{\alpha}_i^T\mathbf{R}] \\ &= W_i + W_i[R_0+\boldsymbol{\alpha}_i^T(\mathbf{R}-\mathbf{1}R_0)] \\ &= W_i(1+R_0)+W_i\boldsymbol{\alpha}_i^T\mathbf{r}, \end{aligned} \tag{3}$$

where all vectors in bold are $N\times 1$ column vectors: $\boldsymbol{\alpha}_i$ is a column vector of investment weights in equity, $\mathbf{1}$ is a column vector of ones, $\mathbf{R}$ is a column vector of realized return on equity, and $\mathbf{r}$ is a column vector of excess return on equity $(\mathbf{R}-\mathbf{1}R_0)$.

The value (traditional utility) of final wealth, can be written explicitly as a function of $\boldsymbol{\alpha}_i$, the vector of decision variables, and of the vector of stochastic variables $\mathbf{r}$: $v_i(W_i\boldsymbol{\alpha}_i^T\mathbf{r})$. The extended utility function reflecting the foreign aversion of investors from country i is written as

$$U_i(W_i^1) = v_i(W_i\boldsymbol{\alpha}_i^T\mathbf{r}) + f_i\big(v_i(W_i\boldsymbol{\alpha}_i^T\mathbf{r}) - v_i(W_i\mathbf{d}_i^T\mathbf{r})\big), \tag{4}$$

where $\mathbf{d}_i$ is a column vector with zeros everywhere except 1 in the ith location. The extended utility function incorporates a foreign-aversion function that compares the return on the chosen global asset allocation to the return that would have been achieved with a portfolio fully invested in domestic assets. Risk considerations are taken into account in the value function, but in addition, investors may experience regret from their decision to invest abroad. Concavity in the regret function assures foreign aversion. Here we assume that fully foreign-averse investors would choose ex ante the domestic market portfolio. One could argue that fully foreign-averse investors would choose a combination of the domestic market portfolio and the risk-free asset. Because we have one representative investor per country, the choice of the domestic market portfolio seems natural and allows us to derive the intuition of the influence of home preference in a simpler manner. One could argue that the theory is "cheap" in the sense that it directly postulates home preference. But the derivations are very complex and the major attraction is to obtain equilibrium holdings and pricing results that are testable and opposed to conclusions of other rational models of home bias. Actually, the same criticism could be leveled at the traditional CAPM, which simply postulates risk aversion; but the attraction of the CAPM lies in the conclusions on equilibrium holdings and pricing.

4. Optimal Portfolio Allocation with Home Preference

Investors maximize their expected utility:

$$\begin{aligned} EU_i(W_i^1) &= Ev_i(W_i\boldsymbol{\alpha}_i^T\mathbf{r}) \\ &\quad + Ef_i\big(v_i(W_i\boldsymbol{\alpha}_i^T\mathbf{r}) - v_i(W_i\mathbf{d}_i^T\mathbf{r})\big). \end{aligned} \tag{5}$$

This is a well-behaved optimization problem, because $EU_i(\cdot)$ is concave with respect to $\boldsymbol{\alpha}_i$.[4] To derive analytical allocation rules, we need to make specific assumptions about the functions $v_i(\cdot)$ and $f_i(\cdot)$, as well as the distribution of $\mathbf{r}$. If $f_i(\cdot)$ is linear, then the problem is reduced to a traditional expected utility maximization, as the maximization with respect to $\boldsymbol{\alpha}_i$ of the expected utility given in (5) reduces to the maximization of $Ev_i(W_i\boldsymbol{\alpha}_i^T\mathbf{r})$. In general $f_i(\cdot)$ is assumed to be concave (foreign aversion). Except for very particular and simplistic functions $v_i(\cdot)$ and $f_i(\cdot)$, we cannot derive explicit allocation rules and would have to resort to numerical solutions with little generality. The problem already arises in the traditional maximization of expected utility in portfolio theory, but there are some interesting cases where explicit rules can be worked out.[5] In our model, the problem is compounded by the presence of a concave foreign-aversion function defined over a value function. An ad hoc assumption that would make the model a bit more tractable could be to model the foreign-aversion term as defined over payoffs, not the valuation of payoffs. But this simplification would not be consistent with regret theory and would cost us the theoretical and empirical appeal of this approach.

An interesting alternative is to use the two-moment approximation proposed by Pratt (1964). We use a Taylor expansion of (4) and take its expected value, ignoring moments higher than two. We then maximize with respect to $\boldsymbol{\alpha}_i$ and are able to derive explicit asset allocation rules with interesting economic interpretations. This two-moment Arrow–Pratt approximation is very similar in spirit and results to the multivariate normality assumption for return distributions introduced in the finance literature (or lognormality in the case of continuous-time models). In both cases, we end up with models that rely solely on the first two moments of return distributions. In our model, the extended utility function is complex with two attributes, risk and foreign aversions. The Arrow–Pratt approach allows us to derive explicit

[4] Various derivations are provided in the online appendix to this paper. The online appendix is available at http://papers.ssrn .com/abstract=1778662.

[5] When the utility function belongs to the HARA (hyperbolic absolute risk aversion) class and asset returns are multivariate normally distributed, there is a linear relation between optimal portfolio weights and wealth level.

equilibrium results that lend themselves to economic interpretations.[6]

For a given allocation $\boldsymbol{\alpha}_i$, we develop the Taylor expansion around zero for small price movements. We expand the value function $v_i(\cdot)$ around zero and the regret function $f_i(\cdot)$ around zero. So the implicit arguments are zero for all derivatives of $v_i(\cdot)$ and $f_i(\cdot)$. Let $\bar{\mathbf{r}} = E(\mathbf{r})$ and $\boldsymbol{\Omega} = E(\mathbf{r}\mathbf{r}^T)$. The optimal equity allocation by investors of country i is given by

$$\boldsymbol{\alpha}_i^* = \boldsymbol{\Omega}^{-1}\frac{\bar{\mathbf{r}}}{\lambda_i} \times (1-\theta_i) + \theta_i \mathbf{d}_i, \tag{6}$$

where $\lambda_i = -W_i v_i''/v_i'$ is the traditional measure of relative risk aversion, and the parameter θ_i can be regarded as the normalized home preference. Following Bell (1983), we define $\gamma_i = -W_i v_i' f_i''/(1+f_i')$ as the foreign-aversion parameter and $\theta_i = (\gamma_i/\lambda_i)/(1+\gamma_i/\lambda_i)$ as the measure of home preference. It should be remembered that the home preference parameter is solely influenced by the ratio of foreign aversion to risk aversion, not by foreign aversion per se. The home preference parameter θ_i has a value of zero in the absence of foreign aversion; the value ranges up to one when foreign aversion dominates risk aversion. In the traditional case where there is no foreign aversion, $f_i(\cdot) = 0$ (or f_i is linear), the optimal allocation to stocks by a regret-free investor reduces to $\boldsymbol{\Omega}^{-1}(\bar{\mathbf{r}}/\lambda_i)$. This is the standard result under the assumption of multivariate normality (mean-variance result). On the other hand, if foreign aversion is extremely large relative to risk aversion $(\gamma_i/\lambda_i = \infty)$, home investors will hold no foreign assets $(\theta_i = 1$, full home bias).

5. Global Market Equilibrium

We now aggregate asset demands and equate them to supplies (market capitalization). We assume that all risk parameters are exogenous and study the expected excess return $\bar{\mathbf{r}}$ resulting from market equilibrium. Because the focus of our analysis is on the role of foreign aversion, we make the simplifying assumption that investors from the N countries have the same traditional risk aversion $\lambda_i \equiv \lambda$,[7] but different foreign-aversion parameters γ_i, and hence different home preference parameters θ_i.

[6] Strictly speaking, the Arrow–Pratt approximation is valid for small risks. The quality of the two-moment approximation depends on the actual return distributions and the shape of the utility function. This has been extensively discussed in the literature, see Samuelson (1970), and Levy and Markowitz (1979). We thank Christian Gollier for his assistance in giving us a clearer view of this approach.

[7] Without that assumption, the asset pricing relation would be based on some weighted-average risk aversion, as is the case in the traditional CAPM, which would complicate the notations without bringing any original insight.

5.1. Asset Pricing Relation

We define

$$W = \sum_{i=1}^{N} W_i \quad \text{and} \quad M = \sum_{i=1}^{N} M_i,$$

where W is total wealth, M is total market capitalization, and W_i and M_i are the wealth and market capitalization of each country; in equilibrium $M = W$. The vector $\mathbf{M}$ is the column vector of market capitalization weights with the ith element $m_i = M_i/M = M_i/W$. We also denote relative wealth as $w_i = W_i/W$. We define the world-average home preference:

$$\theta_W = \frac{1}{W}\sum_{i=1}^{N} W_i\theta_i = \sum_{i=1}^{N} w_i\theta_i.$$

This is the world average of home preferences weighted by the wealth of investors. We also wish to measure how the home preference of investors of country i differs from the world average. We define relative home preference δ_i as

$$\delta_i = \frac{1}{1-\theta_W}(w_i\theta_i - m_i\theta_W). \tag{7}$$

Note that the δ_is are weighted by the size of the country and that they sum to zero. The relative home preference of country i is equal to the sum of all foreign δ_js with a minus sign: $\delta_i = -\sum_{j\neq i}\delta_j$. In the case of zero net foreign investment, we have $\delta_i = m_i(\theta_i - \theta_W)/(1-\theta_W)$. We define $\boldsymbol{\Delta}$ as the column vector with δ_i as the ith element. The global asset pricing relation is

$$\bar{\mathbf{r}} = \lambda\boldsymbol{\Omega}(\mathbf{M} - \boldsymbol{\Delta}), \tag{8}$$

where $\boldsymbol{\Delta}$, the column vector of δ_is, can be considered as a pure arbitrage portfolio because the δ_is sum to zero and the weights of the market portfolio sum to one.

Let $R_W = \sum_{i=1}^{N} m_i R_i$ and $R_\delta = \sum_{i=1}^{N}\delta_i R_i$. For country i, we have

$$E(R_i) - R_0 = \lambda\,\mathrm{cov}(R_i, R_W) - \lambda\,\mathrm{cov}(R_i, R_\delta). \tag{9}$$

This is the main asset pricing relation of our CAPM with home preference. *In the absence of foreign aversion* $(\theta_i = \delta_i = 0)$, the asset pricing relation (9) yields a familiar result:[8]

$$E(R_i) - R_0 = \lambda\,\mathrm{cov}(R_i, R_W). \tag{10}$$

All assets are priced according to their covariances with the world market portfolio. Risk diversification benefits are priced. The traditional result suggests that, ceteris paribus, the lower the covariance

[8] Note that $\mathbf{M}^T\bar{\mathbf{r}} = \bar{r}_W = \lambda(\mathbf{M}^T\boldsymbol{\Omega}\mathbf{M} - \mathbf{M}^T\boldsymbol{\Omega}\boldsymbol{\Delta}) = \lambda[\sigma_W^2 - \mathrm{cov}(R_W, R_\delta)]$. In the absence of foreign aversion $(\boldsymbol{\Delta} = \mathbf{0})$, we obtain the usual CAPM pricing relation: $E(R_i) - R_0 = [E(R_W) - R_0][\mathrm{cov}(R_i, R_W)/\sigma_W^2]$.

of foreign assets with the world market portfolio, the lower the expected return. Foreign assets that offer good diversification benefits for home investors justify a lower expected return. But *foreign aversion* can affect expected returns. The first term of Equation (9) is the traditional asset pricing relation and the second term can be viewed as a home preference premium or home bias premium. Assume, for the time being, that investors in all countries have zero net foreign investments (their wealth equals the market value of their domestic assets, $W_i = M_i$), as doing so simplifies the intuition.

First, assume that all investors exhibit the *same* level of home preference. Therefore, investors can be foreign averse ($\theta_i \neq 0$) but with similar home preference across the world ($\delta_i = 0$). In this case, asset pricing relation is *identical* to that found in the traditional case (no home bias premium). The conclusion is that foreign aversion does not affect asset pricing, although it does affect asset holdings (see further discussion below). This is an important result. Asset pricing is not affected by the home bias per se; it is only affected by differences in home preference across countries. When investors from different countries have the same level of home preference, no pricing adjustment is needed. Relative to the traditional CAPM, the underinvestment in foreign assets by domestic investors is matched by the home preference of foreign investors for their local assets. So foreign aversion can introduce large home biases without any asset pricing differential. Only when home preference *differs* across countries does a home bias premium enter international asset pricing. This insight is quite different from CAPMs derived with some form of segmentation, where investment barriers and home bias necessarily lead to pricing biases. For example, asset pricing models developed under the assumption of total or partial segmentation conclude that restricted securities should have a higher expected return in equilibrium than nonrestricted securities.

Detailing the second term of (9), we get

$$\operatorname{cov}(R_i, R_\delta) = \sum_{j=1}^{N} \operatorname{cov}(R_i, \delta_j R_j)$$
$$= \delta_i \operatorname{cov}(R_i, R_i) + \sum_{j\neq i} \delta_j \operatorname{cov}(R_j, R_i). \quad (11)$$

Note that $\operatorname{cov}(R_i, R_\delta)$ in (11) is an increasing function of δ_i, so the home bias premium of a country is a decreasing function of its δ_i. If investors from the country i have a higher home preference than average ($\delta_i > 0$), the expected return on that country's equity is generally going to be lower than in the traditional case (negative home bias premium or home bias discount). Ceteris paribus, investors from a more foreign-averse country have a stronger demand for domestic equity and are therefore willing to accept a lower expected return. Of course, this lower expected return will make their equity market less attractive to investors from the other countries; hence foreign investors (foreign to country i) will have a lower demand for equity i and will exhibit some home bias that accommodates the home bias of country i in equilibrium.

The absolute magnitude of the home bias premium also depends on the diversification benefits provided to home investors by the foreign assets. The lower the covariance of foreign assets with home assets, the higher is the absolute value of the home bias premium. Underinvesting in foreign assets that offer good diversification benefits must be compensated by a larger home bias premium/discount. Hence, it is more costly to underinvest in assets that provide attractive diversification benefits. But the sign (direction) of the home bias premium is determined by relative home preference, as discussed above.

This can be illustrated in the simple case where all markets have the same variance of returns σ^2 and similar cross-country correlation ρ. Remembering that the sum of national relative preferences must be zero ($\sum_j \delta_j = 0$), the home bias premium for stocks of country i is given by

$$-\lambda \operatorname{cov}(R_i, R_\delta) = -\lambda\delta_i \operatorname{cov}(R_i, R_i) + \lambda \sum_{j\neq i} \delta_j \operatorname{cov}(R_j, R_i)$$
$$= -\lambda\delta_i\sigma^2 + \lambda\rho\sigma^2 \sum_{j\neq i}\delta_j = -\lambda\delta_i\sigma^2(1-\rho).$$

The premium will be negative for a country with a higher home preference, and its absolute value depends on the differential in home preference and the correlation between markets. If the correlation is low, the benefits of international diversification are large and a higher home bias premium/discount is required in equilibrium to compensate the loss of risk diversification.

Hence, the stylized prediction is that countries with lower expected returns are those with a higher home preference and lower covariances with other countries. Looking at Equation (8) also reveals that the international asset pricing implications of relative home preference are equivalent to a correction of the market capitalization of each country by the vector $\mathbf{\Delta}$ of relative home preferences. This is a strikingly simple and intuitive result that shows how the "relevant" (or corrected) global market capitalization has to be adjusted for asymmetries in home preference. The correction is theoretically given by the relative foreign aversion and empirically by the relative home bias.[9]

[9] Because relative home preference "effectively" withdraws some domestic market capitalization from the global equity market, its

5.2. Equilibrium Holdings and Home Bias

In equilibrium, the asset allocation to equity for investors of country i is given by

$$\boldsymbol{\alpha}_i^* = \boldsymbol{\Omega}^{-1}\frac{\bar{\mathbf{r}}}{\lambda_i} \times (1-\theta_i) + \theta_i \mathbf{d}_i = (\mathbf{M}-\boldsymbol{\Delta}) \times (1-\theta_i) + \theta_i \mathbf{d}_i.$$

For the home allocation of country i residents, denoted by αh_i, we get

$$\alpha h_i = (m_i - \delta_i) \times (1-\theta_i) + \theta_i. \tag{12}$$

The usual measure of home bias is the "home bias ratio" (*HB*), which is calculated as one minus the ratio of the weights of foreign stocks in the investors' portfolio and in the world market portfolio (see Kho et al. 2009). This ratio would be zero in the absence of home bias and one if no foreign assets were held (full home bias). Some statistics about national home bias ratios are given in the empirical section (see Table 1). In the notations above, the home bias ratio for country i would be equal to

$$HB_i = 1 - \frac{1-\alpha h_i}{1-m_i} = \frac{\alpha h_i - m_i}{1-m_i}.$$

In equilibrium, the home bias ratio is equal to

$$HB_i = \theta_i - \frac{\delta_i(1-\theta_i)}{1-m_i} = \theta_W + (\theta_i - \theta_W) - \frac{\delta_i(1-\theta_i)}{1-m_i}. \tag{13}$$

We first assume that home preference is *identical* worldwide ($\delta_i = 0,\ \forall i$). Then, the home bias is identical in every country and equals the universal measure of home preference θ_W. Note that all investors have a home bias, with a similar *HB* equal to $\theta_W (HB_i = HB_W = \theta_W)$, but that asset pricing follows the traditional CAPM formula (10). This is a striking conclusion of this work: home bias is consistent with assets being priced solely for their risk diversification properties. However, *differential* home preferences affect both asset pricing, as shown above, and equilibrium holdings. The second term of (13) is $(\theta_i - \theta_W)$: investors will have a higher home bias ratio than the world average if their home preference is higher than the world average. This is a natural result: the higher the home preference, the higher the home bias.

The last term of (13) is $-\delta_i(1-\theta_i)/(1-m_i)$ and can be regarded as a pricing adjustment. A country with a high home preference ($\theta_i > \theta_W$) will have a high demand for local equity; but that demand must be accommodated by foreign investors. In equilibrium, this will lead to a lower expected return (relative to traditional CAPM pricing) for local equity. This lower expected return induces foreign investors to underinvest in that particular local market and accommodate the lower demand for foreign assets from local investors. It will also make foreign assets more attractive in terms of expected returns for local investors and reduce local home bias ratio ("pricing adjustment"). In equilibrium, the home bias of local investors has to be accommodated by an offsetting home bias in the holdings of *all* the other investors, but that accommodation is spread across all the other countries. An interesting implication is that it is sufficient that investors of a single country be foreign averse to induce a home bias in every country. Given that one country has a small market capitalization relative to the rest of the world, the pricing adjustment term should generally be small compared to $(\theta_i - \theta_W)$. This pricing adjustment term can be written (assuming for simplicity that $m_i = w_i$) as $-[m_i/(1-m_i)] \times [(1-\theta_i)/(1-\theta_W)] \times (\theta_i - \theta_W)$. All countries have a smaller market capitalization than the rest of the world. For example, Germany's weight in world market capitalization is approximately 3.3%; hence the ratio $m_i/(1-m_i)$ is around 0.034.

It might be useful to go back to the relative roles of risk aversion and foreign aversion. In the traditional CAPM, national risk aversion would not affect the composition of the equity portfolios held by nationals. Assume that the Japanese are more risk averse than the Americans. Nevertheless, the Japanese will still hold the world market portfolio as their portfolio of risky assets. The proportion of Japanese equity in the equity portfolio is the same for the Japanese or the Americans. Nor would the fact that the Japanese have higher risk aversion induce a higher expected return on Japanese stocks. The only issue that matters is the covariance of Japanese stocks with the world market portfolio. This conclusion is quite different for foreign aversion, as outlined above. It could be that for cultural reasons, the Japanese also exhibit high foreign aversion (risk and foreign aversion could be correlated), but what is important is the ratio of foreign aversion to risk aversion.

To summarize, a higher local home preference will generally simultaneously induce a lower expected return on the local market and a higher local home bias ratio. There should be a negative relation between the expected return on a country and its home bias ratio. This result is the opposite of that under segmented CAPMs, where there is generally a positive relation between the expected return on a country and its home bias ratio.

global asset pricing implications are related to those of large global index revisions that also modify the amount of freely traded global equity contributed by each country; see Hau (2010). The fact that other cross-sectional studies on large-scale asset supply shocks find strong evidence in favor of the CAPM model lends some support to our paper.

6. Data Description

6.1. Data

Data on global portfolio holdings, used to compute home bias ratios, is scarce and patchy. The U.S. Treasury has published statistics on the foreign holdings of U.S. investors since 1994, but similar data for most other countries is lacking. Fortunately, the IMF has started to publish an annual *Coordinated Portfolio Investment Survey* (CPIS) in recent years. The first CPIS, conducted in 1997, had only 29 member countries participating. Since 2001, the CPIS has been undertaken on an annual basis and covers most IMF member countries. The CPIS calls for data on holdings of securities at year-end, and provides detailed statistics on the geographical breakdown of foreign equity holdings per country of origin and per country of investment. The CPIS data used here were made available in July 2010 and cover nine years (the year 1997 and the 2001–2008 period). We restrict ourselves to countries for which we have CPIS data, even if the data may be incomplete for some years.

Similar to any survey data, the CPIS data have built-in limitations: in terms of comprehensiveness, some countries, notably China, are not (yet) reporting; India did not report until 2004. In addition, the CPIS's annual frequency is considered to be too low in real-world applications and financial research that uses daily or monthly price data. Its late availability, with a generally 18-month publication lag, also limits its interest for many studies. And, as with most global data, there are some oddities. Within the European Union (EU), Luxembourg is an attractive place to base mutual funds that can be subscribed to by EU residents. However, as stressed by Kho et al. (2009), Luxembourg is simply a conduit to invest in other countries, not a final investment destination. Thus, we should interpret the CPIS data for such offshore countries with caution. Because we lump together all foreign investments from (to) a country irrespective of destination (origin), this indirect method of investing abroad through an offshore center poses fewer problems to our study. We use CPIS data in our study because it is the most detailed data source for analyzing equity home bias in a global context.[10]

We use total-return stock market indices from Morgan Stanley Capital International (MSCI) and its classification of developed and emerging markets as of 2008. MSCI calculates country indices since December 1969 for developed markets and since December 1987 for emerging markets. As of 2008, MSCI covers 23 developed markets and 25 emerging markets. Although CPIS covers all 23 of these developed markets, we exclude Ireland and Hong Kong. Similar to Luxembourg, they are offshore countries that are the listing bases for numerous foreign funds or securities that are reported as domestic assets. The number of emerging countries that we can use in this empirical analysis is limited by data availability; CPIS has no data on China, Jordan, Morocco, Peru, and Taiwan. We end up with 21 developed markets and 20 emerging markets, listed in Table 1. The panel of developed markets represents around 96% of the total market capitalization of all developed markets. The percentage is smaller for emerging markets because of the exclusion of China.

A typical segmented CAPM suggests that countries with high levels of segmentation should have higher expected returns (lower stock prices). If the home bias is caused by investment constraints rather than preferences, then the result would be the opposite of what we claimed earlier. Therefore, we wish to add a segmentation variable to control for segmentation. Consistent measures of investment constraints do not abound across all countries. We use the extent of national capital controls as a proxy for relative segmentation. Each year, the IMF reports on up to 13 different types of international capital controls in its *Annual Report on Exchange Arrangements and Exchange Restrictions*. These controls include restrictions with respect to both inward and outward capital flows or the holding of assets at home by nonresidents and abroad by residents. For each type of capital control, the IMF reports whether or not it is levied. The 0–10 rating used in this paper (i.e., *Seg*) is the percentage of capital controls levied as a share of the total number of capital controls listed multiplied by 10. This approach is used by the Economic Freedom Network.[11]

Two data limitations need to be addressed: First, despite the fact that these 13 capital controls include both forms of restrictions, namely, barriers "to" (i.e., preventing foreigners from coming in) and barriers "from" (i.e., preventing domestic investment from flowing abroad), we are not able to separate them. For example, when assessing "controls on direct investment," the IMF refers to "investment for the purpose of establishing lasting economic relations both abroad

[10] One possible alternative is to use information on mutual fund holdings available from Thomson-Reuters (e.g., Lau et al. 2010). However, measures based on such data also suffer from problems: (1) portfolio holdings of other domestic investors (i.e., individual and other institutional investors) are omitted; and (2) some foreign investors also hold domestic mutual funds.

[11] The Economic Freedom Network (http://www.freetheworld.com) constructs a similar rating, where the 0–10 rating is the percentage of capital controls *not* levied as a share of the total number of capital controls listed multiplied by 10. Hence, their rating is simply equal to 10 minus our rating. Our segmentation rating increases with the level of segmentation; theirs decreases. We are grateful to Robert A. Lawson of the Economic Freedom Network for helping us get this data.

Table 1 Country-Level Statistics for Developed Markets and Emerging Markets

Developed markets			Emerging markets		
Country	Market cap	*HB* (%)	Country	Market cap	*HB* (%)
Australia	749,947	81.41	Argentina	40,159	79.72
Austria	105,156	51.28	Brazil	501,394	98.79
Belgium	247,353	47.45	Chile	120,775	84.82
Canada	1,206,351	71.36	Colombia	44,843	97.08
Denmark	159,223	59.55	Czech Republic	48,000	86.68
Finland	220,515	64.14	Egypt	64,287	98.50
France	1,676,673	70.02	Hungary	26,212	87.41
Germany	1,263,225	56.32	India	844,916	99.94
Greece	135,468	92.54	Indonesia	88,968	99.77
Italy	728,518	56.98	Israel	110,642	91.80
Japan	3,434,787	87.11	Malaysia	189,387	97.89
Netherlands	588,375	37.20	Mexico	252,288	98.46
New Zealand	34,167	60.16	Pakistan	34,655	99.53
Norway	168,152	48.86	Philippines	44,196	99.53
Portugal	73,815	62.55	Poland	88,975	97.42
Singapore	253,849	69.25	Russia	388,736	99.73
Spain	951,124	86.93	South Africa	434,449	85.43
Sweden	381,281	58.41	South Korea	530,516	95.20
Switzerland	878,151	59.13	Thailand	110,008	98.85
United Kingdom	2,739,821	62.20	Turkey	122,110	99.90
United States	15,498,837	71.69			
Mean (equally weighted)		64.50			94.82
Mean (market-cap-weighted)		70.57			96.18
SD		14.03			6.37

Notes. This table reports the average country-level statistics for the 21 developed markets and the 20 emerging markets over the 2001–2008 period. The market capitalization data are in millions of U.S. dollars, as reported by the World Federation of Exchanges.

by residents and in the country by nonresidents" (as in the *Compilation Guide* of the IMF annual reports). Thus, if either restriction is levied by one country, the IMF will report the existence of this type of control in that country. As a result, the segmentation rating constructed in this paper measures the joint effect of both forms of restrictions. Second, this rating may not fully capture the extent of market segmentation as it is solely based on the 13 capital transactions investigated by the IMF. However imperfect such a rating may be, we expect it to be positively correlated with other forms of market segmentation that it does not directly measure, and thus we use it as a control variable in our empirical tests. To the extent that our segmentation control is imperfect, it will make testing implications of our preference-based model more difficult as the two concepts, segmentation and preferences, lead to opposite signs in the pricing relation. If home bias only captures the effect of investment constraints (rather than home preference), we would expect the data to reject the implications of our model. Most developed countries have relaxed or eliminated restrictions on foreign investments by its residents. However, such restrictions are still prevalent in emerging countries. Therefore, being an emerging market is in itself an indicator of segmentation. We will focus on the panel of developed markets to minimize the potential segmentation effects, while also reporting results for the panel of emerging markets and the joint panel.

6.2. Home Bias Ratio

We use the extent of national home bias as a proxy for relative foreign aversion. As mentioned previously, the usual measure of home bias is the home bias ratio calculated as one minus the ratio of the weights of foreign stocks in the investors' portfolio and in the world market portfolio (see Kho et al. 2009). It is also the natural ratio to use given our theoretical results. This ratio would be zero in the absence of home bias and one if no foreign assets were held (i.e., total home bias).

We compute the home bias ratio using CPIS portfolio holdings data as well as data on stock market capitalization from the World Federation of Exchanges (WFE), Euronext, the OMX Nordic Exchange, and the S&P Emerging Markets Database. All data are in U.S. dollars and at year-end. CPIS provides detailed statistics on the total foreign investment *from* country i (F_i) and the amount of foreign investment *to* country i from investors of all other countries (EF_i). We do not have a direct measure of the total (domestic plus foreign) portfolio holdings of investors of country i, but we can infer it by taking the national market cap (M_i), adding foreign investments from country i (F_i) and subtracting foreign investments to country i (EF_i): $W_i = M_i + F_i - EF_i$. We can now compute the home bias ratio (HB) as

$$HB = 1 - \frac{\text{\% foreign portfolio investment}}{\text{\% foreign market cap}} = 1 - \frac{F_i/W_i}{(W - M_i)/W}.$$

There are two related measures of home bias developed in the literature.[12] The first one ($HB1$) is used in Fontaine et al. (2010) and Morse and Shive (2011). It is computed as $HB1 = (M_i - EF_i)/W_i - M_i/W = (W - M_i)/W - F_i/W_i$.

Our home bias ratio can be viewed as a normalized version of this $HB1$:

$$HB = 1 - \frac{F_i/W_i}{(W - M_i)/W} = \frac{(W - M_i)/W - F_i/W_i}{(W - M_i)/W} = \frac{HB1}{(W - M_i)/W} = \frac{HB1}{1 - m_i}.$$

We think that this normalization makes sense because it takes into account the scale of the market under consideration. For the same HB, large countries have a lower $HB1$ than small countries. In our data, the United States has a $HB1$ of 41%, which is lower than most developed markets simply because of its size, although few would argue that U.S. investors have a much smaller home bias than others. In any case, the two measures are closely related and highly correlated in our sample ($\rho = 0.97$).

The second measure ($HB2$) is used in Lau et al. (2010). It is calculated based on domestic holdings:

$$HB2 = \frac{(M_i - EF_i)/W_i}{M_i/W} = \frac{(W_i - F_i)/W_i}{M_i/W} = 1 - HB + \frac{HB}{m_i}.$$

According to this measure, size (per m_i) will strongly affect the measured home bias. For example, assume countries where nationals hold no foreign assets. These countries have a full home bias, and HB will be 100%. However, in such cases, $HB2$ is totally driven by market size. For a large country with a market cap $m_i = 40\%$, we get $HB2 = 2.5$; but for a small country with $m_i = 0.05\%$ we get $HB2 = 2{,}000$, even though neither country holds any foreign assets and both can be regarded as fully home biased. Similar strange conclusions would arise with a home bias of 50%. A big country would look much less home biased than a small one. A log transformation, as performed in Lau et al. (2010), does not change the size bias; it simply reduces the scaling a bit. Therefore, the effect picked up by $HB2$ is mainly a country-size effect and not home bias per se. For example, based on our ratio HB, Switzerland has less home bias than the United States; whereas based on the other ratio, the United States is the least biased country in the world, with $\log HB2$ equal to 0.7, compared to 3.3 for Switzerland. This seems implausible. $\log HB2$ has a weak correlation with HB ($\rho = 0.44$) and a strong negative correlation with market cap ($\rho = -0.61$).

For our panel of the 21 developed markets, we have home bias ratios for all years from 2001 to 2008, but are missing 1997 data for Germany, Greece, and Switzerland. Among our panel of the 20 emerging markets, only seven countries reported in 1997. Although most countries started to report in 2001, Pakistan waited until 2002, Mexico until 2003, and India until 2004.

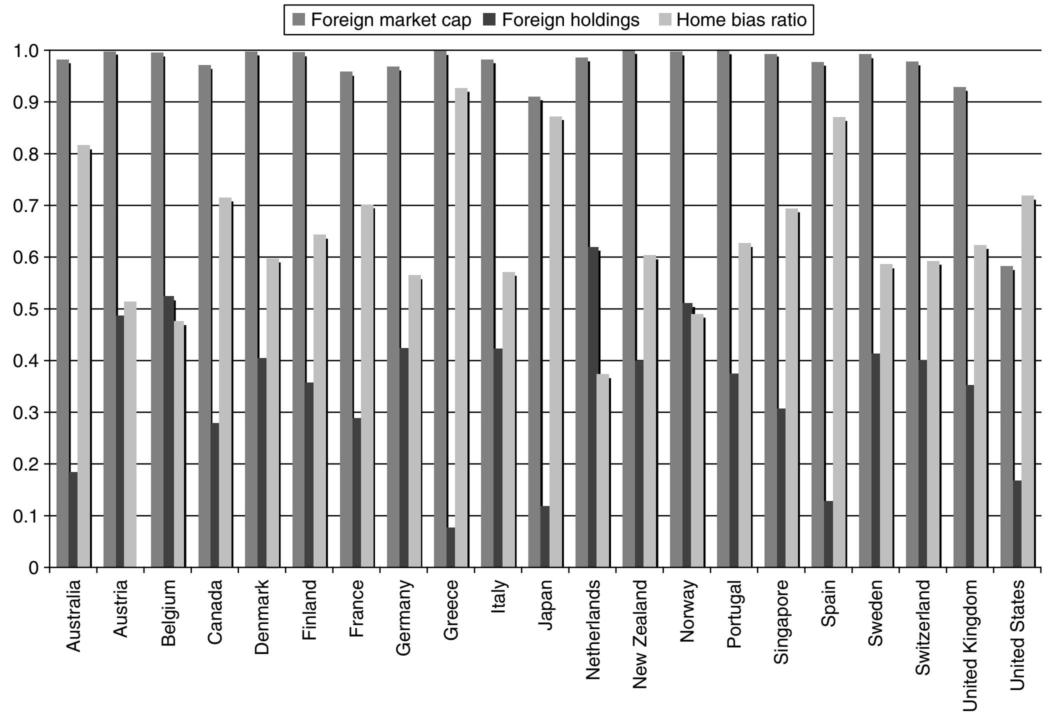
As an illustration, Figure 1 plots the average foreign market capitalization, foreign holdings, and home bias ratios for the 21 developed markets over the 2001–2008 period. The first bar gives estimates of the ratio of foreign to investors' total equity holdings. "Foreign holdings" in Figure 1 are not limited to those in the other 20 countries, but include all foreign equity investments. The second bar indicates the ratio of foreign to world market capitalization for all countries. For example, non-U.S. equity markets represent some 58% of world market capitalization, but U.S. investors only hold an average of some 16% in foreign stocks in their equity portfolios. The home bias ratio (HB) is the third piece of information reported in Figure 1. The HB for U.S. investors over this period is $1 - 16/58 = 72\%$.

Equity home bias is not only prevalent in the United States; investors from all countries exhibit a large home bias. It is often argued in the media that U.S. investors exhibit a very large home bias, implying that home bias is smaller for other countries. In fact, the share of foreign stocks held by non-U.S. investors in their equity portfolio tends to be larger than it is for U.S. investors, but their domestic equity market is much smaller, so the capitalization weight of foreign stocks from their local perspective is much higher. For example, British investors hold 35% of their equity portfolio in foreign stocks, whereas the capitalization weight of foreign stocks from a British perspective is 93%. The HB for British investors is 62%. It ranges from 37% for Dutch investors to 93% for Greek investors.

Table 1 reports the average HB by country over the 2001–2008 period. For developed markets, the mean HB is 65% with equal weighting and 71% with market-cap weighting; its standard deviation is 14%. The United States has a HB close to the average. The home bias is much larger for emerging markets than it is for developed markets. Emerging markets have a

[12] An earlier discussion of various measures and the importance of size bias can be found in Bekaert and Wang (2009).

Figure 1 **Ratio of Foreign Equity Holdings to Total Equity Holdings per Nationality of Investor**

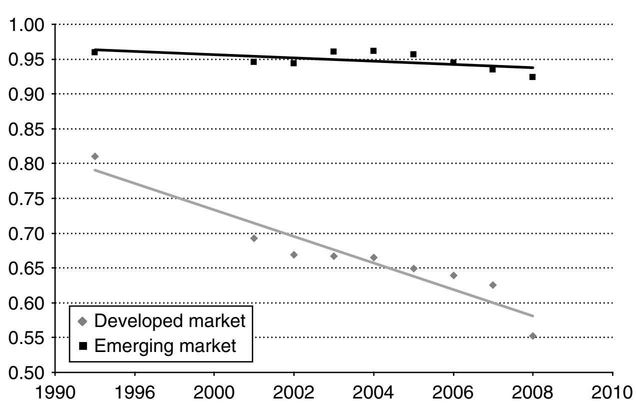


Notes. This figure plots the average foreign market capitalization, foreign holdings, and home bias ratios for the 21 developed markets over the 2001–2008 period. For investors from each country, the first bar gives the ratio of foreign to world market capitalization as reported by the World Federation of Exchanges. The second bar gives the ratio of foreign to total equity holdings of national investors calculated using the data reported by the IMF in their CPIS database for the same period. The third bar gives the home bias ratio (which would be zero if foreign holdings were in proportion to world market capitalization).

mean *HB* of 95% with equal weighting and 96% with market-cap weighting; its standard deviation is 6%. There is little doubt that investment restrictions play a significant role among most emerging markets.

It would be expected that *HB* gets reduced over time. We plot the (simple) mean home bias ratios over time from 1997 to 2008 in Figure 2. We compute the average *HB* separately for developed markets and emerging markets. As we can see in the figure, the home bias ratio tends to decrease over time, especially for the 21 developed markets. For these markets, the (simple) average *HB* decreases from 81% in 1997 to 55% in 2008. For emerging markets, the reduction in *HB* over time is small; the average *HB* decreases from 96% in 1997 to 92% in 2008.

Figure 2 **Home Bias Trend**



Note. This figure plots the (simple) mean home bias ratios over time from 1997 to 2008, both for developed markets (denoted by diamonds) and for emerging markets (denoted by squares).

Table 2 reports the summary statistics on the *HB* changes (ΔHB). First, we can see that most of the reduction in home bias comes between 1997 and 2001 (−12.80% for developed markets, and −0.57% for emerging markets). In 2001, all developed countries exhibit a decrease in home bias from 1997, ranging from −34.45% for Austria to −2.57% for the United States. We also find that the mean and median of ΔHB are almost always negative, suggesting a general trend of decreasing home bias. There is also heterogeneity across countries within a given year: within each year from 2002 to 2008, there are always countries whose home bias decreases and countries whose home bias increases simultaneously, though the magnitudes of home bias increases are generally relatively small.

7. Tests

Our first test is a crude cross-sectional regression between a proxy for expected return and home bias

Table 2 Summary Statistics on Changes in Home Bias (Δ *HB*)

Year	Obs.	Mean	Median	SD	Min	Max
Panel A: Summary statistics on changes in home bias for developed markets						
2001	18	−12.80	−11.28	8.86	−34.45	−2.57
2002	21	−2.37	−1.91	4.46	−10.22	8.81
2003	21	−0.21	0.64	2.98	−9.35	3.19
2004	21	−0.24	−0.45	3.22	−5.15	7.62
2005	21	−1.58	−1.43	3.93	−12.24	6.37
2006	21	−0.93	−0.88	2.81	−7.34	3.77
2007	21	−1.46	−2.10	3.78	−7.96	9.63
2008	21	−7.28	−5.79	8.73	−37.69	1.87
Panel B: Summary statistics on changes in home bias for emerging markets						
2001	7	−0.57	0.50	2.80	−6.37	1.75
2002	17	−0.53	−0.24	3.63	−12.66	6.53
2003	18	1.50	0.05	3.94	−2.54	12.35
2004	19	−0.08	−0.05	1.66	−3.75	4.32
2005	20	−0.56	−0.05	1.28	−2.95	0.91
2006	20	−1.18	−0.29	2.40	−8.76	1.82
2007	20	−0.96	−0.11	1.78	−5.37	0.91
2008	20	−1.12	−0.18	3.49	−11.66	4.82

Notes. This table reports the summary statistics on *HB* changes (Δ *HB*) over the years from 1997 to 2008, both for developed markets (in panel A) and for emerging markets (in panel B). Note that for 2001, the number represents the change from 1997 to 2001. For subsequent years, the numbers are annual changes. The home bias ratio (*HB*) is in percents.

ratio, using world beta and segmentation rating as control variables. With limited time-series data available on home bias and a small number of countries, we cannot perform sophisticated conditional tests. For the home bias ratio, we only have eight annual observations from 2001 to 2008, and one additional observation for 1997 with some missing countries. Hence, we cannot perform a Fama–McBeth methodology or other conditional tests. We are well aware of the limitations of unconditional tests where we use simple proxies for expected returns and risk variables, but cannot find alternatives. Despite its limitations, this test is presented for illustrative purposes and for comparison with past research. In our second test, we use a difference-in-differences approach and examine how changes in home bias of a country lead to changes in its expected returns relative to the world return.

7.1. Cross-Sectional Tests

We estimate the cross-sectional regression:

$$MeanRet_{it} = a + b \times Beta_{it} + c \times HB_{it} + d \times Seg_{it} + \varepsilon_{it}. \quad (14)$$

In our unconditional test, a natural proxy for expected return is the mean return over a very long time period. As Lundblad (2007, p. 146) suggests, "a large data span is required to reliably detect the risk return tradeoff." Thus, we cannot use our full country panel because MSCI only starts to cover some markets in the mid-1990s. MSCI's starting date for emerging markets is 1987, and so we focus on the 17 classical developed markets[13] and 11 emerging markets[14] for which we have MSCI stock index data from that date. We will use our full panel for the difference-in-differences tests that do not require a proxy for expected returns. We compute the average return in dollars over the whole period (from December 1987 to December 2008) for all markets as well as their world beta. We have data on portfolio holdings for nine years and hence the *HB* data from various years.

One option could be to simply use the home bias ratio estimated for one single year (e.g., the last year, 2008). But estimates for any single year are subject to specific events taking place in that market, as well as sampling errors. To minimize this problem, we use a panel econometric method that includes all years. Table 3 reports estimates of Equation (14) using year fixed effects and robust standard errors. It is a crude and dirty test but one that allows the estimation of the magnitude of the effect and comparison with traditional CAPM tests.

We control for segmentation as it can partly explain the observed home bias. Within developed markets, the correlation between *HB* and *Seg* using all yearly observations is 0.20. Within emerging markets, the correlation between *HB* and *Seg* is higher and equal to 0.54. If we pool developed markets and emerging markets together, the correlation increases to 0.70. This can be explained by the very different characteristics of developed markets and emerging markets as shown in Table 1: developed markets tend to have a much lower home bias than emerging markets, so we are pooling together two different types of countries. The crude correlation estimates suggest that segmentation partly explains the observed home bias. However, the correlation is still low, especially among developed markets, and there can be other explanations for the observed home bias, such as investors' preferences, as described in our model. It is also possible that *Seg* is a noisy and imperfect measure of segmentation and *HB* may pick up the true segmentation. However, in that case, we would expect a positive relation between *HB* and *MeanRet*, which is the opposite of our prediction.

[13] The 17 developed markets have been covered by MSCI since its inception in 1969. They represent about 95% of the total market capitalization of all developed markets. The four developed markets not covered are Finland, Greece, New Zealand, and Portugal.

[14] The 11 emerging markets are Argentina, Brazil, Chile, India, Indonesia, Malaysia, Mexico, the Philippines, South Korea, Thailand, and Turkey. For India, we only have MSCI index data since 1992. Nevertheless, we keep India because it has been considered a classical emerging market and has been covered by the S&P Emerging Market Indices since their inception in 1975. For India, we chain link the MSCI index data from 1992 with S&P/IFCG (Global) index data from 1987 to 1992.

Table 3 Cross-Sectional Relation of Mean Country Returns and Home Bias

	(1)	(2)	(3)
Beta	0.0013	0.0099***	0.0012
	(1.34)	(4.00)	(1.23)
HB	−0.0099***	−0.0429***	−0.0088***
	(−5.03)	(−3.64)	(−4.33)
Seg	0.0005***	−0.0003	0.0004***
	(4.73)	(−0.57)	(3.20)
EM			0.0369***
			(4.33)
EM × *Beta*			0.0087***
			(3.32)
EM × *HB*			−0.0337***
			(−2.92)
EM × *Seg*			−0.0007
			(−1.52)
Constant	0.0146***	0.0512***	0.0142***
	(8.81)	(5.88)	(8.55)
Obs.	151	89	240
Adjusted R^2 (%)	20.9	18.8	52.0

Notes. This table reports the results for the regression (14). Column (1) presents the results for the 17 developed markets, column (2) presents the results for the 11 emerging markets, and column (3) presents the results for the joint panel. We use the average monthly return over the period from December 1987 to December 2008 as a proxy for expected return (*MeanRet*), and compute their world beta (*Beta*) over that period. *HB* is the home bias ratio and *Seg* is the segmentation rating. *EM* is a dummy variable that equals one for emerging markets. All tests are unconditional using year fixed effects and robust standard errors. The *t*-statistics are reported in parentheses below the coefficients.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

We use the three distinct panels described above: the 17 developed markets, the 11 emerging markets, and the joint panel of developed markets and emerging markets. Column (1) of Table 3 gives the results for developed markets where the assumption of frictionless markets is more likely to be valid. All coefficients have the expected sign. World beta and segmentation are positively linked to expected return (as expected in segmented CAPM) and *HB* is negatively linked to expected return (as expected in our preference-based CAPM). The constant is a monthly expected return of 1.46%. The estimated world market risk premium equals 0.13% per month (approximately 2% per year), but the *t*-statistic is low, which is not surprising given the results of past unconditional tests of global CAPM. The home bias premium is a monthly −0.99%. It is negative, as implied by our model, and statistically significant at the 1% level. The coefficient on segmentation ratings (*Seg*) is 0.05% and significant at the 1% level. Despite the positive correlation between the segmentation variable and the *HB* reported above, the two variables enter with opposite signs in the regression, suggesting that the *HB* captures more than segmentation effects. In untabulated results, when we include either *HB* or *Seg* separately in the regression, each of them has the expected sign: the coefficient for *HB* is −0.79% and significant at the 1% level; and the coefficient for *Seg* is 0.02% and significant at the 5% level.

The next column reports the results for emerging markets. Our model fares quite well and the extent of home bias still has a negative influence on mean return (−4.29%, significant at 1%). However, the segmentation variable shows up with a slightly negative but statistically insignificant coefficient (−0.03%, with *t*-statistic −0.57). This is a bit surprising. The third column reports the results when we include both developed and emerging markets. Because of the very different nature of the two types of market, we add a dummy variable for emerging markets (*EM*), and its interaction with *Beta*, *HB*, and *Seg*. In essence, these coefficients test the differences in coefficients between columns (1) and (2). The emerging markets dummy has a positive coefficient of 3.69%; hence (segmented) emerging markets have higher returns than developed markets. It could be that our proxy variable for segmentation is imperfect and that other forms of segmentations are picked up by the emerging markets dummy. As mentioned above, it could mean that being classified as an emerging market is by itself a good indicator of high investment constraints and hence segmentation (not picked up by our IMF rating). Other omitted variables (e.g., economic growth and improved political climate) could also explain the importance of this emerging markets dummy. The interaction term of *EM* with *HB* is negative and significant (−3.37%, significant at 1%), lending some support to our preference-based implication, even for emerging markets. As expected, the *HB* still has a negative coefficient (−0.88%, significant at 1%): the higher the home bias, the lower the expected return.

In a robustness check, we conduct tests based only on past available information for each observation period. Although it is arbitrary, we assume that expected returns are measured using all past available information and that world betas are measured using the past 10 years of data (120 monthly observations). For example, we use the 2001 *HB*, the mean return over 1987–2001, and the world beta computed over 1992–2001. Results (untabulated) are fairly similar and lend support to the predictions of our model.

7.2. Difference-in-Differences Tests

Because we have consecutive annual observations for the *HB* from 2001 to 2008, we can design dynamic difference-in-differences tests where we examine how changes in a country's *HB* lead to changes in its expected returns relative to the world return. One appealing econometric advantage of this difference-in-differences approach is that we can eliminate all country-level fixed effects, which should substantially reduce the omitted-variable problem. Furthermore, we do not have to rely on a crude proxy for expected return. We first present a difference-in-differences test in which only changes in home bias of the home country are considered, and then a more sophisticated test in which both own-country and cross-country effects are considered.

Because of the discontinuity of the *HB* data, we exclude the 1997 observation.[15] We end up with, at most, seven annual observations for the change in *HB*. With only seven annual returns, we cannot develop a full-fledged asset pricing methodology à la Fama–French. Nevertheless we can conduct some difference-in-differences tests. If the *HB* of a country decreases in a given year, our asset pricing model suggests that its expected return should increase. Ceteris paribus, this would be achieved by a decrease in the local stock price. Of course, everything is relative to the world return. So an annual decrease in *HB* should be associated with a negative relative return in that year. Because the annual excess return of a country also captures its cash-flow news, we should either control for expected cash flow changes directly, or decompose stock returns into a cash-flow component and an expected-return component and look at the latter. In our regression, we control for expected cash-flow changes by using the dividend yield change (relative to that in the world index) as a proxy. The dividend yield data are deduced directly from the cum and ex dividend MSCI indices. We could implement a vector autoregressive system to do the return decomposition. However, with a few annual stock returns, the estimated parameters are quite noisy. Nevertheless, with monthly data, previous research finds that expected-return news causes much more variation in stock returns than does cash-flow news (e.g., Campbell 1991). Thus, if we find an association between the annual excess return of a country and the change in its *HB*, it is likely to be caused by expected-return innovations, instead of cash-flow innovations.

7.2.1. Test I. The first series of tests is conducted by simply extending the previous econometric methodology to a dynamic setting. We regress the annual excess return of a country over the world index (denoted by *ExRet*) on the change in the country's *HB* (denoted by ΔHB), controlling for the change in *Seg* (denoted by ΔSeg) and the change in dividend yields (denoted by $\Delta Dividend$):

$$ExRet_{it} = a + b \times \Delta HB_{it} + c \times \Delta Seg_{it} + d \times \Delta Dividend_{it} + \varepsilon_{it}. \qquad (15)$$

[15] When we include the data of 1997 and define the change in *HB* in 2001 as the difference between *HB* in 2001 and *HB* in 1997, we find similar results (untabulated).

We use year fixed effects and Rogers standard errors with country clustering. The use of year fixed effects and country clustering is logically dictated by our data set. Results are reported in columns (1)–(3) in Table 4. Recall that our major panel is the 21 developed markets where the assumption of frictionless markets is more likely to be valid. Column (1) of Table 4 reports the results for the developed markets. We find a strong positive association between annual relative return and the change in *HB*. The regression coefficient equals 1.22 and is statistically significant at the 1% level. This suggests that a 1% change in the home bias ratio is associated with approximately a 1.22% annual relative return in that country. We also find a negative association between annual relative return and the change in *Seg* (−0.015, with *t*-statistic −1.42), which is consistent with the explanation that a lower price is needed to induce local investors to hold stocks in a country that imposes more capital controls. The opposite signs of the coefficients on ΔHB and ΔSeg suggest that *HB* captures more than segmentation effects. Consistent with the existing literature, the coefficient on $\Delta Dividend$ is positive (8.69) and significant at the 1% level.

The next column reports the results for the 20 emerging markets. Again, we find a relatively strong positive association between annual relative return and the change in *HB* (1.48, significant at 10%). However, the R^2 (4.1%) is much lower compared with that associated with developed markets (28.5%). We find similar results in the joint panel where we include both developed markets and emerging markets. In particular, we find a positive coefficient for ΔHB (1.46, significant at 1%), a negative coefficient for ΔSeg (−0.034, significant at 5%), and a positive coefficient for $\Delta Dividend$ (2.99, significant at 10%).

A potential concern with this simple difference-in-differences test is that an excess realized return caused by some omitted factor could lead to a mechanical adjustment to *HB* ("own-price pressure effect") if investors do not rebalance their portfolio accordingly, for example, because of investment constraints or other factors/motivations. Changes in dividend yield partly controls for other factors and will pick up some mechanic effect of price adjustment (short-term changes in dividend yield is strongly influenced by price movements as dividends are fairly stable).[16]

[16] In addition, we include some technical control variables and find similar results (untabulated). We define $Outflows_i = F_i/EF_i$. Consider an exogenous shock (not endogenous as in our model) in the form of a drop of domestic stock prices relative to other markets. Without a voluntary rebalancing of portfolio holdings, *Outflows* should increase. That is because foreign holdings by domestic residents are not affected by this domestic market drop, whereas foreign holdings of domestic securities are affected. This price adjustment is purely technical and changes in *Outflows* can be used to control for such mechanical price pressure effect. Our results are robust after controlling for changes in *outflows*.

Table 4 Cross-Sectional Relation of Annual Country Excess Returns and Changes in Home Bias

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ *HB*	1.2152***	1.4757*	1.4637***				
	(5.05)	(1.77)	(5.49)				
Δ *OwnHB*				0.4428***	0.3630***	0.4451***	0.4621***
				(4.58)	(9.38)	(9.02)	(8.16)
Δ *OtherHB*				0.2705*	0.1387**	0.2346***	0.2485***
				(2.07)	(2.27)	(3.17)	(3.23)
Δ *Seg*	−0.0154	0.0029	−0.0343**	−0.0003	−0.0109	−0.0312**	
	(−1.42)	(0.10)	(−2.15)	(−0.03)	(−0.44)	(−2.07)	
Δ *Dividend*	8.6885***	2.4409*	2.9884*	8.8870***	2.4091*	2.8516*	
	(4.21)	(1.78)	(1.79)	(4.67)	(1.81)	(1.80)	
Constant	0.0962***	0.2434***	0.1703***	0.1457***	0.2383***	0.1951***	0.1882***
	(7.51)	(8.60)	(8.93)	(3.98)	(7.50)	(7.54)	(7.20)
Obs.	147	134	281	147	134	281	281
Adjusted R^2 (%)	28.5	4.1	9.5	30.6	14.2	22.8	18.1

Notes. This table reports the cross-sectional relation of annual country excess returns and changes in home bias. The period is from December 2001 to December 2008. Columns (1)–(3) report the results for the regression (15) where we regress the annual excess return of a country over the world index (*ExRet*) on the change in the country *HB* (Δ *HB*), controlling for the change in *Seg* (denoted by Δ *Seg*) and the change in dividend yields (Δ *Dividend*). Columns (4)–(7) report the results for the regression (17) where we regress *ExRet* on Δ *OwnHB* and Δ *OtherHB*, controlling for Δ *Seg* and Δ *Dividend*. Both Δ *OwnHB* and Δ *OtherHB* are multiplied by 10,000. Columns (1) and (4) present the results for developed markets, columns (2) and (5) present the results for emerging markets, and columns (3), (6), and (7) present the results for the joint panel. We use year fixed effects and Rogers standard errors with country clustering. The t-statistics are reported in parentheses below the coefficients.

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Next, we expand the model to take into account the effects of changes in the home bias of other countries, where a potential "own-price pressure effect" does not apply.

7.2.2. Test II. So far, we only tested the influence of a change of foreign aversion in the home country. Another econometric improvement comes from a tighter testing of the theory itself by introducing the cross-country effect of changes in national home biases. We recall our main pricing equation (8):

$$\bar{\mathbf{r}} = \lambda\boldsymbol{\Omega}(\mathbf{M} - \boldsymbol{\Delta}).$$

It can be written (in time differences) as

$$\begin{aligned}\Delta\bar{\mathbf{r}}_t &= \lambda\boldsymbol{\Omega}(\mathbf{M}_t - \mathbf{M}_{t-1}) - \lambda\boldsymbol{\Omega}(\boldsymbol{\Delta}_t - \boldsymbol{\Delta}_{t-1})\\ &= \lambda\boldsymbol{\Omega}(\mathbf{M}_t - \mathbf{M}_{t-1}) - \lambda\boldsymbol{\Gamma}(\boldsymbol{\Delta}_t - \boldsymbol{\Delta}_{t-1})\\ &\quad - \lambda(\boldsymbol{\Omega} - \boldsymbol{\Gamma})(\boldsymbol{\Delta}_t - \boldsymbol{\Delta}_{t-1}),\end{aligned}$$

where the matrix $\boldsymbol{\Gamma}$ is a diagonal matrix with the diagonal elements of the covariance matrix $\boldsymbol{\Omega}$.

We now wish to introduce the home bias ratio (*HB*) as a proxy for relative home preference (δ), but they are not related in a simple manner. In the previous section, we used the property that home bias increases with relative home preference to conduct a linear test between the domestic market return and the domestic (own) *HB*. With some simplifying assumptions we can try to get a tighter testing of the pricing relation.

According to (7), in the case of no net foreign investment (i.e., $m_i = w_i$), we have

$$\delta_i = \frac{m_i}{1-\theta_W}(\theta_i - \theta_W).$$

As discussed in §5, the pricing adjustment in (13) is small for markets with moderate market capitalization compared to world market capitalization (as is the case for all markets except the United States). Under that assumption, we have $HB_i \approx \theta_W + (\theta_i - \theta_W)$. Thus, δ_i can be expressed as

$$\delta_i = \frac{m_i}{1-\theta_W}(\theta_i - \theta_W) \approx \frac{m_i}{1-\theta_W}(HB_i - \theta_W) \approx k(m_i \times HB_i) + c_i,$$

where $k = 1/(1-\theta_W)$ and $c_i = -\theta_W/(1-\theta_W) \times m_i$. Replacing the vector of relative foreign aversion by the *HB* proxy, we get

$$\begin{aligned}\Delta\bar{\mathbf{r}}_t &= \lambda\boldsymbol{\Omega}(\mathbf{M}_t - \mathbf{M}_{t-1}) - \lambda k\boldsymbol{\Gamma}(\mathbf{HB}_t - \mathbf{HB}_{t-1})\\ &\quad - \lambda k(\boldsymbol{\Omega} - \boldsymbol{\Gamma})(\mathbf{HB}_t - \mathbf{HB}_{t-1}),\end{aligned} \qquad (16)$$

where $\mathbf{HB}_t$ is a column vector with $HB_{it} \times m_{it}$ as the ith element. Note that a difference-in-differences approach could estimate not only the price effect of the second term $\lambda k\boldsymbol{\Gamma}(\mathbf{HB}_t - \mathbf{HB}_{t-1})$, but also the price effect of home bias changes across countries given by the third term $\lambda k(\boldsymbol{\Omega} - \boldsymbol{\Gamma})(\mathbf{HB}_t - \mathbf{HB}_{t-1})$. In Test I, we only estimated the own-country effect given by the constant diagonal terms in $\boldsymbol{\Gamma}$. The advantage of this third term is also that it is induced by changes in foreign aversion in other countries and therefore is different from the diagonal terms that could induce spurious "own-price pressure effect" from reallocation toward or away from home equity. A drawback of this more general panel specification is that it requires estimating the covariance matrix and we can only infer some simple proxy of this covariance matrix. We estimate the covariance matrix based on the monthly index returns data from 1997 to 2008. Despite all these simplifying assumptions, showing that the cross-country effect also has the right sign would be additional evidence for our model. The first term of (16) is the traditional effect of the change in beta; we do not include it in our tests as we have no direct and reliable way to measure it.

We estimate the following regression:

$$ExRet_{it} = a + b \times \Delta\, OwnHB_{it} + c \times \Delta\, OtherHB_{it} + d \times \Delta\, Seg_{it} + e \times \Delta\, Dividend_{it} + \varepsilon_{it}. \quad (17)$$

The variables in the equation are defined as follows:

- $\Delta\, OwnHB_{it} = VAR_i \times (HB_{it} \times m_{it} - HB_{it-1} \times m_{it-1})$, where VAR_i is the variance of country i's stock market returns;
- $\Delta\, OtherHB_{it} = \sum_{j \neq i} COV_{ji} \times (HB_{jt} \times m_{jt} - HB_{jt-1} \times m_{jt-1})$, where COV_{ji} is the covariance of country j's stock market returns with country i's stock market returns.

From our theoretical derivations, we expect the coefficients for both $\Delta\, OwnHB$ and $\Delta\, OtherHB$ to be positive.[17] The results are reported in columns (4)–(7) in Table 4. Column (4) reports the results for developed markets. We find positive and significant coefficients for both $\Delta\, OwnHB$ (0.44, significant at 1%) and $\Delta\, OtherHB$ (0.27, significant at 10%). The coefficient on $\Delta\, Seg$ has the expected sign (−0.0003) but is insignificant (with t-statistic −0.03). We still find a significantly positive coefficient for $\Delta\, Dividend$ (8.89, significant at 1%). For emerging markets (reported in column (5)), we find positive and significant coefficients for both $\Delta\, OwnHB$ (0.36, significant at 1%) and $\Delta\, OtherHB$ (0.14, significant at 5%). Compared with the adjusted R^2 reported in column (2) (4.1%), the R^2 in column (5) increases substantially for emerging markets (14.2%). This increase in R^2 suggests that changes in the home bias of other countries provide explanatory power to the asset returns of the home country. This is an important result of our model where the global asset pricing implications of cross-country effect is modeled. The results for the joint panel are reported in column (6). All the coefficients have the expected signs and are significant: the coefficients of $\Delta\, OwnHB$ and $\Delta\, OtherHB$ are both positive (0.45 and 0.23, respectively) and significant at the 1% level; the coefficient on $\Delta\, Seg$ is negative (−0.031) and significant at the 5% level; the coefficient on $\Delta\, Dividend$ is positive (2.85) and significant at the 10% level. In addition, the R^2 of the joint panel also improves substantially from column (3) (22.8% versus 9.5%). To assess how much variation of country excess returns is linked solely to home bias changes, we report in column (7) with only $\Delta\, OwnHB$, $\Delta\, OtherHB$ and a constant as regressors for the joint panel. We find that home bias changes can explain 18.1% of country excess-return variation, providing additional support for the predictions of our model.

[17] One must recall that the theoretical and empirical analysis is done in relative terms. Ceteris paribus, an increase in relative home preference in one country will technically lead to a decrease in all other countries. The same holds for relative expected returns. The intuition has been discussed in §5.

To investigate the overall effect of home bias changes of all countries, we define $\Delta\, TotalHB = \Delta\, OwnHB + \Delta\, OtherHB$ and estimate the following regression:

$$ExRet_{it} = a + b \times \Delta\, TotalHB_{it} + c \times \Delta\, Seg_{it} + d \times \Delta\, Dividend_{it} + \varepsilon_{it}. \quad (18)$$

In untabulated results, we find a positive and significant coefficient on $\Delta\, TotalHB$ for all three panels: 0.38 for developed markets, 0.30 for emerging markets, and 0.37 for the joint panel, all of which are significant at the 1% level. This is unsurprising, given our results in Table 4.

Overall, we gain some support for the implications of our preference-based approach of home bias. We do not mean to say that segmentation is not present, but rather that it can only partly explain the observed home bias.

8. Conclusions

We model home preference, a preference for home assets based on familiarity, using a foreign-aversion formulation inspired by regret theory. In our paper, home bias derives from the concavity of the foreign-aversion function. We assume frictionless markets and homogeneous expectations on returns. These characteristics differentiate our paper from other behavioral approaches that rely on model uncertainty, heterogeneous beliefs, or market frictions. Our purpose is to find how home bias could affect asset pricing in an equilibrium where investors can have different levels of home preference.

Two major conclusions arise from our theoretical work. First, differences in national home preferences would impact expected returns in a direction that is opposite to the conclusion of segmented CAPMs. We find a negative home bias premium for countries with a high home preference. In other words, the higher the local home bias ratio, the lower the expected return on local equity, ceteris paribus. Intuitively, the stronger home preference of local investors will generate higher demand for local equity. In equilibrium, local investors are willing to accept higher prices and lower expected stock returns. A second conclusion is that traditional asset pricing would hold in a world where investors have similar levels of home preference across the world. This striking conclusion means that a large home bias in every country could be consistent with the traditional result that assets are priced solely according to their covariances with the world market portfolio. Segmented CAPMs lead to the opposite conclusion that the expected return should be higher in countries with high investment barriers (and consequently a high home bias). Hence, asset pricing implications are quite different depending on whether the observed home bias is explained by investors' preferences or by market segmentation.

We conduct an empirical investigation with IMF portfolio data. Home bias is extensive everywhere but varies greatly between countries. To test the predictions of our model, we perform both a simple cross-sectional test and some dynamic difference-in-differences tests. In the cross-sectional tests, we find that long-run returns have a negative association with the extent of home bias. This is true for the panel of developed markets and the panel of emerging markets. Even though emerging markets have characteristics that strongly differ from those of developed markets, we also find a negative relation between expected return and home bias in the joint panel once controlling for segmentation. Our stronger results come from dynamic tests linking changes in home bias to changes in equity prices (realized returns). Our theory suggests that a reduction in domestic home bias should lead to an increase in domestic expected return and hence a negative realized return. We find empirical support for this prediction in all three market panels. This conclusion holds when we refine the tests to include the influence of home bias changes in foreign countries on domestic equity returns. In sum, the analyses provide support for the implications of our behavioral model. It does not mean that the institutional approach (segmentation) is rejected by the data, and both effects seem to be at play simultaneously. But the asset pricing results are broadly consistent with the predictions of our preference-based CAPM.

Acknowledgments

The authors thank Brad Barber (special issue coeditor), Ines Chaieb, Harald Hau, Mark Seasholes, and two anonymous reviewers for their excellent suggestions. The authors are also grateful for comments on a related paper from Michael Adler, Ines Chaieb, Ian Cooper, Vihang Errunza, Thierry Foucault, Christian Gollier, Campbell Harvey, Sébastien Michenaud, Meir Statman, René Stulz, Axel Waldecker, and seminar participants at Imperial College. Financial support from Fondation HEC and the Institut Europlace de Finance is gratefully acknowledged.

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