Home Bias and Expected Stock Returns: An Equilibrium Analysis

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Abstract

We study the effect of the home bias on international asset pricing by extending the core-satellite approach of active asset allocation to an equilibrium analysis. In this model, investors from different countries combine their home asset with a common core portfolio. In equilibrium, the composition of the core portfolio is informative about expected asset returns: if the home bias is the same in all countries, expected returns are not distorted and the core portfolio equals the market portfolio; if, however, the home bias is particularly pronounced in one country, its share in the core portfolio must be reduced, which implies a lower expected return to discourage foreign investors. We exploit this significance of the core portfolio to estimate the home premium in a new way. An important advantage of this approach is that it does not rely on ex post returns to estimate expected returns. We find that our empirical estimate of the core portfolio is close to the market portfolio. The impact of the existing deviations remains small owing to the high positive correlation of international asset returns. As a consequence, our main empirical result is that the home bias does not substantially affect expected returns.

Keywords: Home bias, Asset pricing, International diversification, Implied expected return, Core-satellite approach, Home preferences, Equilibrium model

JEL: G11, G12, G15, G02, F30

1. Introduction

Most stock market investors strongly overweight their home country compared to a well-diversified international portfolio. This tendency, which is known as home bias, is so strong and widespread that we can expect it to have an impact on international asset pricing. We study this impact theoretically and empirically by addressing the following three research questions: What are the theoretical determinants of the relation between the home bias and expected stock returns in equilibrium? How large is a potential home premium in asset returns? Is the home bias driven by market frictions or behavioral aspects, in particular familiarity?

Answering these question requires an equilibrium analysis. One reason is that the level of home bias in different countries is interwoven. If, for example, the investors in a large country show a particularly strong home preference, they will claim a large share of stocks from their home country for themselves. Therefore, they will outbid other investors who, as a consequence, have to tilt their portfolios away from this country. To capture this interplay, we extend the model of Treynor and Black (1973), which is well known for establishing the theoretical foundation of the core-satellite approach in asset allocation. Treynor and Black (1973) analyze the optimal portfolio decision of an active investor who holds a subjective view of expected abnormal returns (alphas) of a limited number of assets and assumes that the other assets are fairly priced. As a result, the optimal portfolio consists of two parts: a passive portfolio that is optimal for an investor without active views (core portfolio) and an active portfolio that consists of the stocks perceived as mispriced (satellites). The weights of the stocks in the active portfolio are chosen in accordance with the degree of mispricing and the specific risk involved. We apply this framework to our setting by expressing the home preference of investors in terms of a positive alpha for their home asset (see, similarly, Levy and Levy, 2014). Thus, investors will combine the passive (core) portfolio, which is internationally well diversified, with their home asset (satellite). Treynor and Black (1973) do not study the market equilibrium resulting from the investment decisions of different active investors. In our setting, however, this extension is straightforward because each investor holds his or her home asset as the only active component. The market clearing condition then is that for each country, the active holding of home investors and the passive holdings as part of the core portfolio add up to the total asset supply.

In our framework, the deviations of the core portfolio from the market portfolio are informative about the impact of the home bias on expected asset returns. If the core portfolio is equal to the market portfolio, a passive investor chooses the same portfolio as in a world without home bias, which means that the home bias does not distort the structure of expected returns. This situation could be called a symmetrical home bias because the share of assets held actively at home is the same in each country. In this case, the *level* of expected returns can be affected by the lower level of diversification implied in the home bias, but the structure remains the same. If a structural change in expected returns occurs, it will show up in deviations of the core portfolio from the market portfolio. For example, an asset with a reduced weight in the core portfolio has a lower expected return which indicates that the home investors in this country have a particularly strong home preference so that they accept a low expected return in order to crowd out other investors. In this case, the home bias is asymmetrical.

We exploit the crucial role of the structure of the core portfolio for our empirical estimation of expected asset returns. Specifically, we first estimate the composition of the core portfolio and from this infer the structure of expected returns. An important advantage of this approach is that our estimation does not rely on ex post returns. Our test is in the spirit of Cooper and Kaplanis (1994) who "use tests based on predictions about portfolio holdings" (p. 47).

Our main empirical result is that the core portfolio is so close to the market portfolio that the effect of the home bias on expected returns is almost negligible. It is not sufficiently large to be detected in ex post returns. This is true despite the home bias being generally very pronounced, with substantial differences across countries. Nevertheless, the effect on expected returns is small primarily for two reasons. First, even though the weights in the core portfolio differ from the market weights, the overall compositions are very similar in the sense that countries with a large market capitalization maintain a strong weight in the core portfolio and countries with a small market capitalization remain small in the core portfolio. Second, the correlation of international asset returns is high (approximately 0.6), which means that changes in the expected return of one country have a strong impact on its weight compared to other countries. Therefore, small adjustments in expected returns are sufficient to render the core portfolio instead of the market portfolio optimal (see Levy and Levy, 2014).

There exists an extensive literature on the home bias and its determinants, but few articles provide an equilibrium analysis. Our paper is most closely related to the eminent work of Solnik and Zuo (2012), who present a global equilibrium model in which investors maximize expected utility based on a utility function that incorporates foreign aversion. The foreign aversion or, equivalently, the home preference results from regret when investors hold foreign assets that achieve lower returns than the home assets. The model is solved using the two-moment Arrow-Pratt approximation. Solnik and Zuo (2012) derive two major conclusions from their theoretical analysis. The first is that expected returns are affected by *differences* in national home preferences and not the level as such. This means "that traditional asset pricing would hold in a world where investors have similar levels of home preference across the world" (Solnik and Zuo, 2012, p. 290f). The second major conclusion is that the relationship between differences in national home preferences and expected returns is opposite to the one that prevails in a world with segmented financial markets. For example, Lau et al. (2010) assume that a strict regulation forces investors to invest a certain share of their wealth into home assets and the remaining part into the global market portfolio. In this setting, the higher the enforced home investment is, the higher the specific risks investors have to bear. Thus, home assets are valued lower to compensate for the specific risk through a higher expected return. This effect, however, is reversed when markets are integrated as in Solnik and Zuo (2012). In this case, the higher expected returns intended as a compensation for the specific risk borne by home investors would *attract* international investors, while the opposite is needed: to keep other investors at bay, the expected returns must be *lower*. The assets are still attractive for home investors because of their home preference.

The model presented here replicates and supports these findings. Although in this regard not innovative, the framework has some strengths: it is simple and intuitive, extends the well-known core-satellite approach to an equilibrium analysis and is rich in terms of the determinants of the home bias. In particular, the model allows us to study the role of specific risk and of the size of the stock market in relation to the wealth of national investors (Hong et al., 2008). It also highlights the significance of how the passive portfolio is structured in equilibrium. The main contribution of this paper is to use this insight about the difference between the core portfolio and the market portfolio in order to estimate how the home bias affects expected returns. Because this test uses specific information from the model, it is more powerful than the standard tests based on realized stock returns that have been applied in previous studies. Our finding is not consistent with a substantial home bias premium as found in the previous literature.

The remainder of the paper is structured as follows. Section 2 presents the model and Section 3 the estimation method. We describe the data in Section 4 and report the empirical results in Section 5. In the results section, we first show the overall and country-specific level of home bias over time. We then estimate how strongly the home bias distorts the passive portfolio and what this implies for expected returns. Finally, we examine whether the home preferences are better explained by familiarity or market frictions. Section 6 concludes.

2. The model

2.1. Assumptions

We consider a global financial market consisting of countries $l = 1, \dots, n$, each of which is represented by one tradable asset, which we can think of as an index portfolio. We assume that all investors have a unique country of origin and that they are sufficiently small not to have market power. We use the short form "investor l" for an investor from country l.

We assume that home investors receive a surplus α_l to the expected return μ_l of their home asset. This means that investors in our model hold heterogeneous views of expected asset returns. From the perspective of investors from outside country l, asset l provides an expected return of μ_l, while it provides an expected reward of $\mu_l + \alpha_l$ from the perspective of home investors. A first economic rationale for the surplus α_l is that foreign investors bear higher transaction costs of investing in country l than home investors. A second interpretation is that α_l reflects a preference of investors for the assets of their country of origin. Thus, it represents a non-monetary return component that is exogenously determined by investors' preferences, whereas the financial component μ_l is the result of asset pricing in equilibrium. In what follows, we use the term "home reward" for the alpha component in expected returns.

Following standard portfolio theory, we assume that investors have a horizon of one period. They exhibit exponential utility with risk aversion parameter $\gamma > 0$ (Arrow-Pratt coefficient of absolute risk aversion) so that expected utility is a linear function of the portfolio's expected return and volatility.

Finally, following Treynor and Black (1973), we assume that the single-index model of Sharpe (1963) holds approximately. This assumption implies a simplified covariance structure which allows to decompose optimal portfolios into a passive and an active part.[1] The passive component corresponds to the optimal portfolio of an investor without private information, i.e. in our setting without a home reward. In the Treynor and Black (1973) model, the passive portfolio is the market portfolio. In our extended model, however, the passive portfolio will generally deviate from the market portfolio. The reason is that the structure of expected returns is "distorted" by the active asset holdings of home investors. This means that the optimal portfolio of investor l in case of $\alpha_l = 0$, which is the passive portfolio, will not necessarily be equal to the market portfolio. Analogous to Treynor and Black (1973), we assume that the single index in the single-index model is this passive portfolio. As is well known, this index definition is, in a strict sense, inconsistent because it implies some covaria-

[1]In the regret-theoretic model of Solnik and Zuo (2012), the same decomposition arises from the two-moment Arrow-Pratt approximation of expected utility, see equation (6) in their paper.

tion of specific returns. Otherwise, the returns of the assets in the passive portfolio could not exactly add up to the index return. Following Treynor and Black (1973), we assume that the effect of this covariation of specific returns is small so that the single-index model provides a useful approximation.

2.2. Active asset allocation

Let subscript b denote the passive portfolio that is optimal for investors without home preference. By assumption, it corresponds to the index of the single-index model. The optimal stock portfolio of investor l consists of the index portfolio with weight $x_{l,b}$ and the home asset with weight $x_{l,l}$, where $x_{l,b} + x_{l,l} = 1$. The home asset is the only active holding of investor l because, from her perspective, it is the only asset with (possibly) nonnegative alpha. Treynor and Black (1973) show that the optimal weight $x_{l,l}$ is given by:[2]

$$x_{l,l} = \frac{\frac{1}{\lambda}\frac{\alpha_l}{\sigma^2_{\epsilon_l}}}{1 + (1 - \beta_l)\frac{1}{\lambda}\frac{\alpha_l}{\sigma^2_{\epsilon_l}}}, \tag{1}$$

where λ is defined as the market premium per unit of variance risk of the passive portfolio:

$$\lambda := \frac{\mu_b}{\sigma^2_b}. \tag{2}$$

Thus, the optimal weight of the home asset crucially depends on the abnormal return α_l per unit of specific risk $\sigma^2_{\epsilon_l}$ which is known as the Treynor-Black appraisal ratio. The beta adjustment in the denominator of equation (1) arises from the fact that a home asset with high beta provides a strong indirect exposure to the index so that direct index holdings are

[2]See the derivation in the Appendix.

less prevalent. The optimal weight of the home asset in equation (1) does not depend on the degree of risk aversion of the investor because it is the weight within the risky asset portfolio that is then combined with the riskless asset to achieve the desired risk level.

If the active weights of the home assets, $x_{l,l}$, are known, we can compute implied alphas by solving equation (1) for the implied home rewards which gives:

$$\alpha_l = \lambda \sigma_{\epsilon_l}^2 \frac{x_{l,l}}{1 - (1 - \beta_l)\, x_{l,l}}. \tag{3}$$

2.3. Market clearing

Let W denote the world market capitalization. We denote by $h_l > 0$ the world market share of investors from country l, with $\sum_l h_l = 1$. Furthermore, let $w_{m,l}$ denote the weight of asset l in the global market portfolio m and $w_{b,l}$ the weight of asset l in the index portfolio b. The total wealth B invested in the index portfolio is given by the sum of index investments made by investors from all countries l, so that $B := \sum\limits_l x_{l,b} h_l W$, where $h_l W$ is the wealth of investor l. Market clearing requires that for each asset l, the amount that investors from country l invest actively in their home asset and the amount invested in asset l through global holdings of the passive portfolio must add up to asset l's market capitalization:

$$x_{l,l} h_l W + w_{b,l} B = w_{m,l} W. \tag{4}$$

Solving equation (4) for $x_{l,l}$, we obtain:[3]

$$
\begin{aligned}
x_{l,l} &= \left(\frac{w_{m,l}W - w_{b,l}B}{w_{m,l}W}\right)\frac{w_{m,l}}{h_l} \\
&= \left(1 - \frac{w_{b,l}}{w_{m,l}}\frac{B}{W}\right)\frac{w_{m,l}}{h_l}.
\end{aligned} \tag{5}
$$

In equilibrium, equations (1) and (5) hold simultaneously and determine the structure of the core portfolio $w_{b,l}$, the active asset holdings $x_{l,l}$ and the overall passive investment B.

Equation (5) reveals three elements of the home bias measured by $x_{l,l}$. First, the ratio B/W is a measure of the overall impact of the home bias: the smaller the proportion of total wealth that is invested in the index portfolio, the more pronounced is the global home bias. Second, the ratio $w_{b,l}/w_{m,l}$ reflects the country-specific level of the home bias. If the weight of asset l in the passive portfolio b is smaller than its weight in the market portfolio m, home investments in country l are more important than on average in the other countries so that a smaller part of asset l is available for global investors. These two elements are combined in the bracket term in equation (5) which expresses the amount of active home investments in country l as a proportion of the market capitalization of asset l. Since $x_{l,l}$ is the active home investment as a proportion of the wealth of investor l, the ratio $w_{m,l}/h_l$ serves as a scaling factor: the larger the stock market in country l is compared to the wealth of investor l, the more pronounced the home bias of investor l must be to account for a given difference between $w_{b,l}$ and $w_{m,l}$.

To assess the importance of the home bias for expected asset returns, we translate the

[3] After some transformations, we obtain the same equation when solving equation (7) in Solnik and Zuo (2012) for θ_i. We state the following correspondences: $x_{i,i}$ in this paper corresponds to θ_i in Solnik and Zuo (2012); h_i to w_i; $w_{m,i}$ to m_i; w_m to $\boldsymbol{M}$; w_b to $\boldsymbol{M} - \boldsymbol{\Delta}$ and $w_{m,i} - w_{b,i}$ to δ_i.

structures of the passive portfolio and the market portfolio into corresponding vectors of expected returns. Let $w_b = (w_{b,1}, \ldots, w_{b,n})'$ and $w_m = (w_{m,1}, \ldots, w_{m,n})'$ denote the vectors of weights in the passive portfolio and market portfolio, respectively. For a given variance-covariance matrix V of asset returns, the implied expected excess returns are given by:

$$\mu_{imp,b} = \lambda V w_b \quad \text{and} \quad \mu_{imp,m} = \lambda V w_m. \tag{6}$$

2.4. A closer look at the home bias measure

Our home bias measure is $x_{l,l}$, while other studies have used the measure (Kho et al., 2009; Solnik and Zuo, 2012):[4]

$$HB_l = 1 - \frac{f_{l,l}}{f_{m,l}}, \tag{7}$$

where $f_{l,l}$ is the proportion of wealth of investor l invested abroad and $f_{m,l}$ is the share of foreign assets in the market portfolio. Investor l's share of foreign investments corresponds to 1 minus the share of overall home investments, either directly or via the index portfolio. Thus, within our model, HB_l as defined in equation (7) can be written as:

$$HB_l = 1 - \frac{1 - (x_{l,l} + (1 - x_{l,l})\, w_{b,l})}{1 - w_{m,l}}, \tag{8}$$

HB_l is zero if investor l chooses a proportion of her foreign investments that is equal to the share of foreign assets in the global market portfolio. Without any investments abroad, the home bias measure becomes one.

To highlight the difference to our home bias measure $x_{l,l}$, we can rewrite equation (8) as

[4] Solnik and Zuo (2012) refer to measure HB_l in Section 6.2 and use this measure in the empirical analysis, but also refer to the equivalent to $x_{l,l}$ as the "normalized home preference" (p. 279).

follows:

$$HB_l = \frac{w_{b,l} - w_{m,l}}{1 - w_{m,l}} + \frac{1 - w_{b,l}}{1 - w_{m,l}} x_{l,l}. \tag{9}$$

Equation (9) shows that HB_l does not incorporate the effect of home preferences on the composition of the passive portfolio. In case of $x_{l,l} = 0$ (no home bias), HB_l will still be positive if $w_{b,l} > w_{m,l}$. There appears to be a home bias because the higher weight of asset l in the passive portfolio is (mis)interpreted as an active overweighting of the home asset by investor l.[5] For $x_{l,l} = 1$, we obtain $HB_l = x_{l,l}$. The deviation between the two measures becomes smaller the higher the level of home bias is. Notwithstanding the differences, it is important to stress that the measures are very similar (Solnik and Zuo, 2012, p. 281). Even if portfolio b deviates substantially from the market m, the differences between $x_{l,l}$ and HB_l for given l will remain small compared to the cross-sectional differences in the home bias levels ($x_{l,l}$ for $l = 1, \ldots, n$).

3. Estimation method

Our estimation proceeds in four steps. First, we collect country-level data on investor wealth, foreign and home investments and index returns for our sample of $n = 41$ countries. These data allow us to obtain straight-forward estimates of the composition of the market portfolio, w_m, the market share of investors, h_l, and the global investment amount, W, on Dec. 31 of each year of our sample period. We estimate year-end values of betas β_l with

[5] Ultimately, the interpretation depends on how the home bias is defined. In line with measure HB_l, any deviation of the share of home assets in an investor's portfolio from the share of these assets in the market portfolio would indicate a nonzero home bias. In this case "it is sufficient that investors of a single country be foreign averse to induce a home bias in every country" (Solnik and Zuo, 2012, p. 281). However, the home preference of investors in a single country affects the holdings of other investors only by means of a modified composition of the common core portfolio. This is not considered a component of the home bias when its definition requires an active home investment in line with measure $x_{l,l}$.

respect to the market portfolio and the specific index returns $\sigma^2_{\epsilon_l}$ based on monthly returns over the last five years. The variance-covariance matrix V is set up in line with the single-index model. We assume a market risk premium, λ, according to equation (2) of 2.5. Second, we estimate the w_b vector, i.e., the composition of the passive portfolio, and translate these weights into implied expected returns using equation (6). Our asset pricing test is based on these implied returns.[6] Third, we simultaneously estimate the global passive investment amount, B, and the active home investments, $x_{l,l}$ according to equation (5). Fourth, we compute the alphas of the home assets, α_l, from equation (3).

The second and third step need further exploration. In the second step, we obtain an estimate of w_b in the following way. Let $F_{k,x}$ denote the dollar investment of investor k in asset x. In our model, each investor k holds foreign assets i and j with $i \neq j$ and $k \notin \{i, j\}$ only as part of the passive portfolio b so that the ratio $r_{i,j}$ of these asset holdings corresponds to the ratio $w_{b,i}/w_{b,j}$:

$$r_{i,j} := \frac{w_{b,i}}{w_{b,j}} = \frac{\sum_{k \notin \{i,j\}} F_{k,i}}{\sum_{k \notin \{i,j\}} F_{k,j}}. \tag{10}$$

Because we observe the $F_{k,x}$ for all combinations of k and x, we can use equation (10) to estimate $r_{i,j}$ for all i, j. Within our model, it is sufficient to compute $r_{i,i+1}$ for $i = 1, \ldots, n-1$, because the weights $w_{b,m}$ for $2 \leq m \leq n$ are then obtained by $w_{b,m} = w_{b,1} \prod_{i=1}^{m-1} r_{i,i+1}$ with $w_{b,1}$ chosen such that the weights add up to one. Within the model, the resulting w_b vector does not depend on the ordering of assets $i = 1, \ldots, n$. However, if the actual investments do not perfectly correspond to the two-fund structure of home asset and passive portfolio b,

[6] A similar test based on the equilibrium model of Solnik and Zuo (2012) would be to estimate $\boldsymbol{\Delta}$ (see equations (7) and (8) on p. 279) and to compare the expected returns of equation (8) with market implied returns. The optimal portfolio of an investor without home preference in the model of Solnik and Zuo (2012) is $\boldsymbol{M} - \boldsymbol{\Delta}$.

the ordering of assets becomes relevant. Therefore, we compute w_b for 100 random orderings and take the mean value as our final estimate.[7]

Given the estimate of w_b, the only remaining unknown on the right-hand side of equation (5) is the global passive investment amount B. Any level of B is consistent with an equilibrium: for given B and $x_{l,l}$ from condition (5), $x_{l,b} = 1 - x_{l,l}$ ensures the right amount of passive investments, i.e., $B = \sum_l x_{l,b} h_l W$.[8] To find the applicable level of B, we can exploit the aggregate amount of foreign investments because, in our model, foreign investments only occur via the passive portfolio. More specifically, we choose B such that the theoretical amount of foreign investments is equal to the actual aggregate foreign holdings:[9] $\sum_l x_{l,b} (1 - w_{b,l}) h_l W = \sum_l F_l$, where F_l is the actual holding of foreign assets by investor l.

4. Data

Our main data source is the Coordinated Portfolio Investment Survey (CPIS) of the International Monetary Fund. CPIS has been used in different studies on the home bias, e.g., by Fidora et al. (2007), Solnik and Zuo (2012) and Mishra (2015). The participating countries biannually report their foreign portfolio holdings, divided into equity investments and long-term and short-term bonds, of which we only use the equity holding data. CPIS was launched in 1997 with 29 countries. Since 2001, the survey has been updated every year, and since 2013, every six months. In 2014, 70 countries participated, among them all 46 countries classified by MSCI as developed countries or emerging countries with the exception

[7] In repeated tests of 100 simulations we verify that the standard error of the mean is negligible.

[8] Summing up both sides of equation (5) over all l and multiplying with $h_l W$, we obtain: $\sum_l x_{l,l} h_l W = W - B$, which implies the specified expression for B.

[9] The theoretical investment of investor l in foreign markets is equal to the share of her investment in portfolio b times the share of foreign investments within portfolio b times the wealth of investor l.

of China, Taiwan, Qatar, Peru and the United Arab Emirates. India has participated since 2004. In 2014, the participating countries represented approximately 88% of the world market capitalization.

The absence of China in CPIS appears problematic because in 2014, China's stock market had a market capitalization of USD 6 trillion (IMF, 2018) and ranked second in size after the US. For this reason, we add China to the database using additional mutual fund data. It is important to note that China is only absent from CPIS as a participating country; it is, however, included as a destination for investments of CPIS participants. Therefore, we can estimate the amount invested by Chinese investors at home as the difference between China's total market capitalization and the aggregate holdings of CPIS countries in China. What is missing is the corresponding amount of Chinese investments in foreign countries. Here, we assume that the ratio of Chinese foreign investments and home investments is the same as the ratio of foreign assets and home assets in the portfolios of Chinese mutual funds. We extract the fund holding data from the shareholder database of Thomson Reuters Eikon. The same procedure is applied to Taiwan.

The CPIS guidelines state that participating countries should only report the holdings of their own residents (IMF, 2002, p. 5). However, it is particularly difficult to implement this rule in the case of off-shore countries. For example, if a UK investor invests in a mutual fund in Ireland that buys assets in continental Europe, this might falsely be reported as an investment of a UK resident in Ireland instead of continental Europe and an additional investment of Ireland in continental Europe. As a consequence, the importance of off-shore countries as a destination of investment flows and the foreign investments of off-shore countries would be overestimated (Solnik and Zuo, 2012, p. 282). This problem appears to be severe for

Ireland and Hong Kong. According to CPIS reports, the aggregate holdings of foreigners in these two countries exceed their total market capitalization, which clearly indicates that these countries often served as a transit destination and not as the final destination of investment flows. For this reason, we exclude Ireland and Hong Kong from our sample, which results in a final sample of 21 developed countries and 20 emerging countries. In the following, we only consider investment holdings within this sample of 41 countries. Table 1 lists the countries and shows their market capitalization weights ($w_{m,l}$) for the first year of the sample period (2004), the mid-sample year (2009) and the last year (2014). For 2014, we also report the share of wealth of investors from each of the countries (h_l) and the share of investors' foreign and home investments (F_l and H_l, respectively).

5. Empirical results

5.1. Degree of overall and country-specific home bias

Figure 1 shows that the share of the global passive portfolio (B/W) increased from approximately 20% in 2004 to almost 30% in 2014. With the exception of the years of the financial crisis, the ratio B/W increased steadily, indicating a decreasing importance of the overall home bias (Solnik and Zuo, 2012, p. 285). However, the overall home bias is still very substantial at the end of the sample period, with more than 70% of funds invested actively at home.

The degree of the country-specific home bias measured by $x_{l,l}$ becomes apparent from Figure 2. The bars represent year 2014, the blue triangles year 2009 and the black circles year 2004. The bars of emerging markets are grey-shaded. In 2014, 20 of the 41 sample countries exhibit an active home investment of 0.8 or larger. In 2009 and 2004, the $x_{l,l}$ values

Table 1: **Descriptive statistics: global stock markets**

Country	Code	2004	2009	2014			
		$w_{m,l}$ (%)	$w_{m,l}$ (%)	$w_{m,l}$ (%)	h_l (%)	F_l (%)	H_l (%)
Developed markets							
Australia	AUS	2.20	2.89	2.09	2.12	24.75	75.25
Austria	AUT	0.24	0.25	0.15	0.18	52.89	47.11
Belgium	BEL	0.73	0.55	0.57	0.57	34.55	65.45
Canada	CAN	3.36	3.87	3.42	4.00	36.67	63.33
Denmark	DNK	0.42	0.38	0.48	0.55	49.32	50.68
Finland	FIN	0.50	0.40	0.30	0.31	44.94	55.06
France	FRA	4.26	4.26	3.19	2.66	30.77	69.23
Germany	DEU	3.22	2.66	2.57	2.08	34.22	65.78
Israel	ISR	0.26	0.44	0.32	0.29	28.63	71.37
Italy	ITA	2.16	1.36	0.86	0.85	33.31	66.69
Japan	JPN	9.99	7.57	6.99	6.21	16.36	83.64
Netherlands	NLD	1.43	1.22	1.19	1.58	72.10	27.90
New Zealand	NZL	0.12	0.08	0.12	0.11	10.38	89.62
Norway	NOR	0.39	0.48	0.34	1.17	80.60	19.40
Portugal	PRT	0.19	0.11	0.09	0.09	32.60	67.40
Singapore	SGP	0.60	1.08	1.20	1.53	37.56	62.44
Spain	ESP	2.63	3.28	1.58	1.32	10.66	89.34
Sweden	SWE	0.93	0.94	1.00	1.12	40.46	59.54
Switzerland	CHE	2.27	2.36	2.32	1.59	31.23	68.77
United Kingdom	GBR	7.50	5.93	5.11	4.58	47.23	52.77
United States	USA	46.05	34.37	42.28	44.52	18.17	81.83
Emerging markets							
Brazil	BRA	0.92	3.01	1.34	1.06	1.91	98.09
Chile	CHL	0.33	0.54	0.38	0.44	20.21	79.79
China	CHN	1.21	7.91	9.51	8.98	1.36	98.64
Colombia	COL	0.06	0.33	0.24	0.25	9.47	90.53
Czech Republic	CZE	0.07	0.10	0.04	0.05	26.12	73.88
Egypt	EGY	0.07	0.21	0.11	0.10	0.33	99.67
Greece	GRC	0.35	0.26	0.09	0.07	2.84	97.16
Hungary	HUN	0.07	0.06	0.02	0.02	32.65	67.35
India	IND	1.03	2.67	2.38	1.99	0.07	99.93
Indonesia	IDN	0.19	0.46	0.67	0.57	0.30	99.70
Korea, Republic	KOR	1.18	1.89	1.94	1.68	11.64	88.36
Malaysia	MYS	0.51	0.65	0.75	0.72	9.45	90.55
Mexico	MEX	0.48	0.80	0.78	0.61	0.56	99.44
Philippines	PHL	0.08	0.20	0.42	0.37	0.11	99.89
Poland	POL	0.19	0.34	0.27	0.23	3.67	96.33
Russian Federation	RUS	0.54	1.72	0.62	0.49	0.46	99.54
South Africa	ZAF	1.25	1.84	1.52	1.47	10.01	89.99
Taiwan	TWN	1.41	1.62	1.69	2.63	48.16	51.84
Thailand	THA	0.32	0.38	0.69	0.59	1.95	98.05
Turkey	TUR	0.27	0.52	0.35	0.27	0.13	99.87

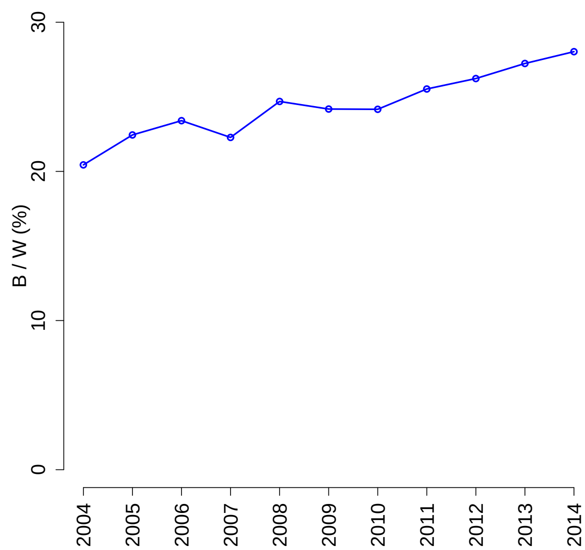

Figure 1: **Estimated percentage of holdings in the passive core portfolio over time**

tend to be even higher, which is in line with the decreasing trend of the overall bias shown before. Only four markets invest less than 50% of their funds at home, namely Norway, the Netherlands, Great Britain and Austria. In general, developed markets tend to have a smaller home bias level than emerging markets (see white vs. grey-shaded bars in Figure 2).

5.2. How strongly does the home bias distort the passive portfolio and expected returns?

Figure 3 illustrates the difference between the market portfolio m and the passive portfolio b for the years 2004 (top panel), 2009 (middle panel) and 2014 (bottom panel). On the x-axis, the countries are sorted in ascending order of their weight in the market portfolio. The cumulative market portfolio weights are shown as circles on the scale of the left-axis. The circles are filled if the corresponding country is an emerging market. The line represents the cumulative weights of the passive portfolio. Initially, the line is located below the circles, which indicates that the largest stock markets are underrepresented in the passive portfolio. This discrepancy is larger in 2004 than in 2014. Overall, however, the cumulative weights

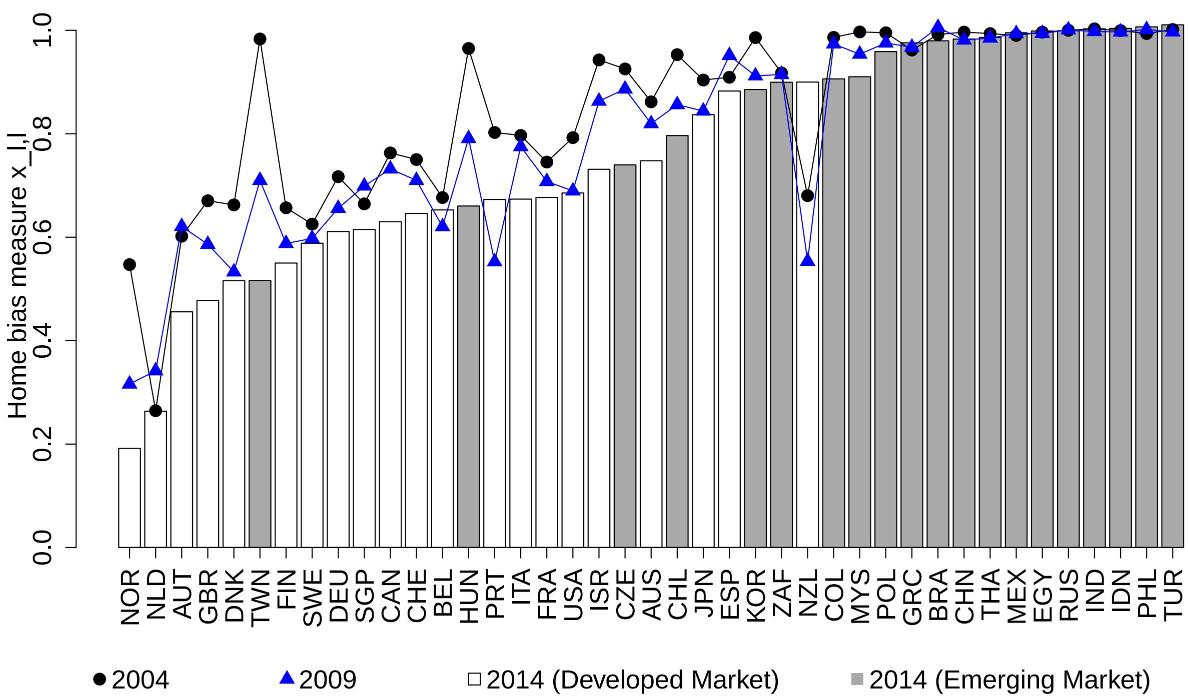

Figure 2: **Active home investments by country in 2004, 2009 and 2014**

suggest that the structure of the passive portfolio is very similar to the structure of the market portfolio.

The reason for the similarity of portfolios m and b is that the ordering of countries is more or less the same: countries with a strong market capitalization are also relatively important in the passive portfolio. However, if we control for country size, the differences between the weights $w_{m,l}$ and $w_{b,l}$ are often substantial, which is apparent for the bars in the same figure. They show the ratio $w_{b,l}/w_{m,l}$ on the scale of the right axis. For several countries, this ratio is above 2 or below 0.5. Thus, while the overall composition of the portfolios is similar, the differences on the country level are considerable. As expected, the ratio $w_{b,l}/w_{m,l}$ is negatively related to the degree of the home bias $x_{l,l}$: if the assets of country l face strong demand of home investors, their share in the global passive portfolio will be smaller than in the market portfolio (see equation 5).

Next, we analyze by how much the expected asset returns have to change so that the tangency portfolio in ($\mu\sigma$)-optimization is portfolio b instead of the market portfolio m. Figure 4 shows the difference $\mu_{imp,b} - \mu_{imp,m}$ of implied expected returns according to equation (6) for all countries and years. The countries on the x-axis are sorted in descending order of the mean difference from 2004 to 2014. The crucial result is that the differences are small. With the exception of China, the absolute deviations are almost always below 0.2 percentage points. For China, the expected return implied in b is up to 0.8 percentage points smaller than the expected return implied in m, which reflects the small weight of China in the passive portfolio. The deviations are so small mainly for two reasons. First, as described before, portfolios b and m are quite similar, and second, the country returns are strongly correlated (mean correlation of 0.607 across all country pairs) so that a shift in the weight of one country can be well compensated by adjusting the weights of other countries.

Although the differences $\Delta\mu_l := \mu_{imp,b,l} - \mu_{imp,m,l}$ are small, they are systematically related to the degree of home bias. To show this, we estimate the pooled regression $\Delta\mu_{l,t} = \alpha + \beta x_{l,l,t} + \epsilon_{l,t}$, where $\Delta\mu_{l,t}$ is $\Delta\mu_l$ as estimated in year t, and $x_{l,l,t}$ is the degree of home bias $x_{l,l}$ in year t (41 countries, years 2004 to 2014). The estimated slope coefficient β of -0.178 is highly significant in a statistical sense (t-value of -8.5; R^2 of 13.7%) but not so in an economic sense because the difference between a complete home bias and no home bias at all corresponds to a difference in expected returns of only 0.178 percentage points per year. Without considering the observations for China, the β estimate is even smaller (-0.127), while the R^2 rises to 28.9%.

Overall, we conclude that our model estimates suggest that the distortions of expected returns caused by differential home bias levels are almost negligible.

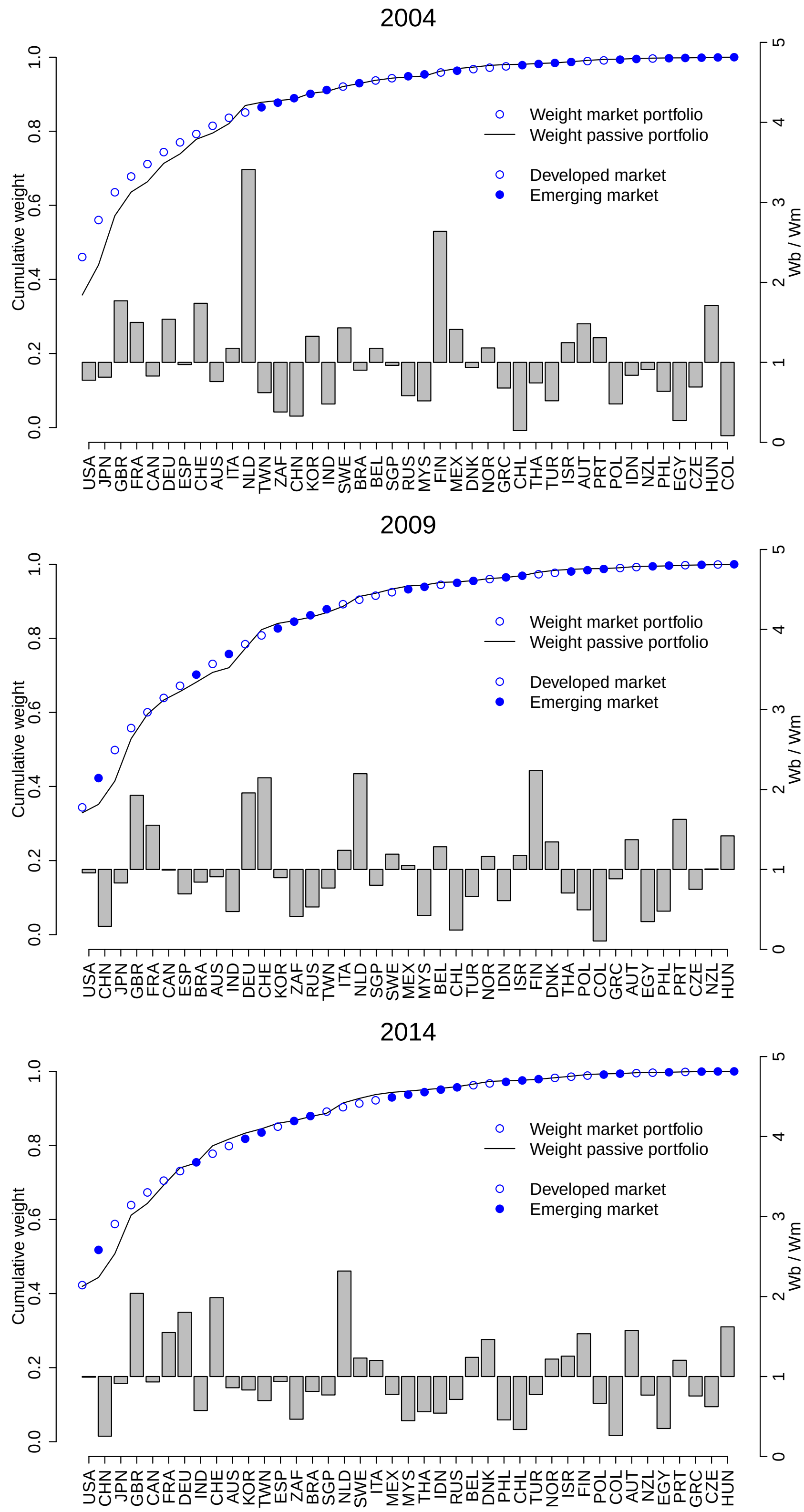

Figure 3: **Comparison of market portfolio and passive core portfolio.** The points and lines show the cumulative weight (left scale). The bars show the ratio of weights in the passive core portfolio and the market portfolio (right scale).

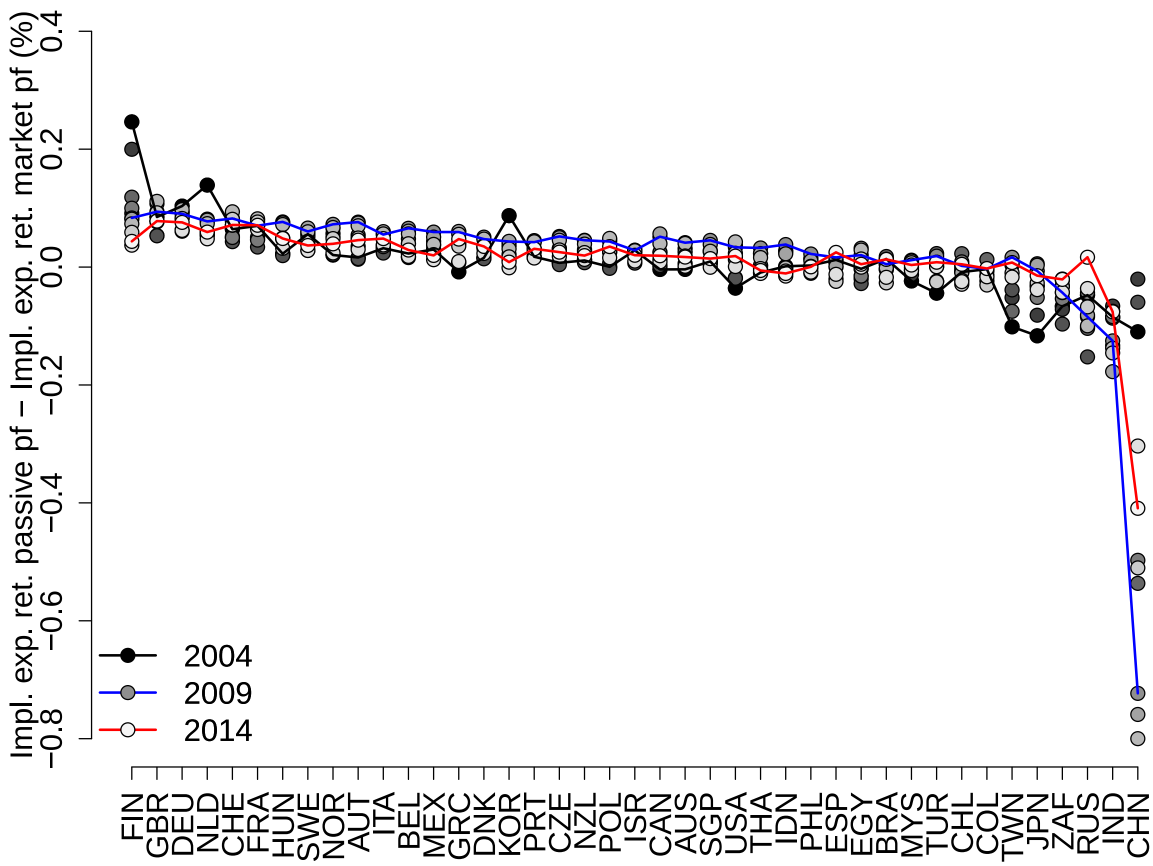

Figure 4: **Difference of expected returns implied in the passive core portfolio and expected returns implied in the market portfolio (in percent per annum).** The graph contains one point per year and country for 41 countries and all years from 2004 to 2014 with lighter grey shades for more recent years. To highlight the observations of the first year, the mid year and the last year of the sample period, these are connected through a line. The countries are sorted in descending order of the mean difference from 2004 to 2014.

5.3. Sources of the home reward: familiarity or market frictions?

Figure 5 shows the estimated implied alphas (α_l) according to equation (3) for our 41 countries and the sample years from 2004 to 2014. The countries are ordered on the horizontal axis in descending order of their mean alpha across the sample years. All alpha estimates are positive, which reflects the universal tendency to overweight home assets. More importantly, the estimated alphas are generally substantial. A considerable part of the estimates lies between 10% and 20%, and the highest observations are near 40%. These values indicate that the observed home bias implies a significant loss in risk diversification that must be compensated by a high alpha reward. The alpha estimates tend to decrease during the sample period, which is consistent with our previous observation of an increasing share of passive investing.

In our model, the exogenous home reward α_l is an important driver of the endogenous home bias level $x_{l,l}$. As equation (3) shows, the positive association between home reward and home bias is moderated by the specific risk of the home assets σ_{ϵ_l}: the higher the specific risk at home is, the smaller the home bias for a given home reward. If the home reward were the same for all countries, we would find an inverse relationship of specific risk and home bias across countries. Empirically, however, $x_{l,l}$ is positively associated with σ_{ϵ_l} (correlation coefficient of 0.54)[10], which means that investors from countries with high specific risk do not compensate for this risk by putting more emphasis on diversifying internationally; on the contrary, they tend to focus more strongly on their risky home market. This is only consistent with rational investor behavior if the home reward is particularly high in countries with pronounced specific risk. Correspondingly, the correlation coefficient between α_j and σ_{ϵ_l}

[10]Pearson correlation coefficient across 41 countries for pooled data from 2004 to 2014 (451 observations).

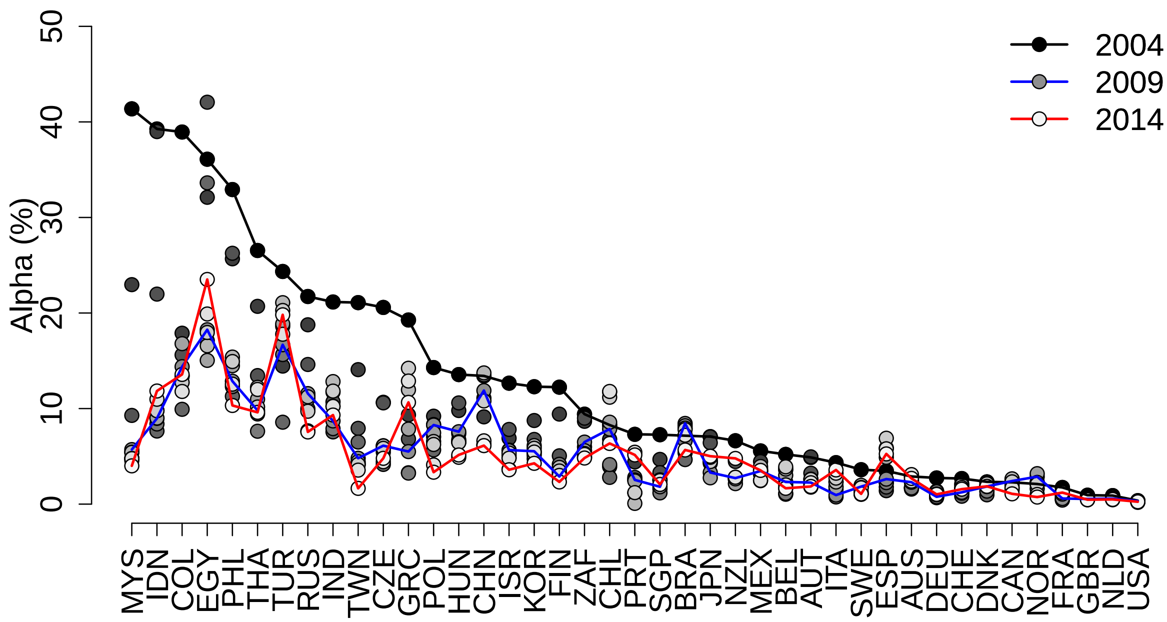

Figure 5: **Alpha estimates by country and year (in percent per annum).** The graph contains one point per year and country for 41 countries and all years from 2004 to 2014, with lighter grey shades for more recent years. To highlight the observations of the first year, the mid year and the last year of the sample period, these are connected through a line. The countries are ordered in descending order of their mean alpha across the sample years.

in our pooled sample is as high as 0.807. In what follows, we carry out a regression analysis to examine the sources of the home reward.

We draw the explanatory variables mainly from previous literature. Similar to Chan et al. (2005), we group the variables into the following categories: (i) economic development; (ii) stock market development; (iii) investor protection; (iv) capital flow frictions; (v) familiarity; and (vi) country classification. In predicting the signs of associations between explanatory variables and alpha, we must stay in line with our theoretical framework. For example, it is true that a large and typically well-developed stock market tends to attract funds from the outside so that the share of assets held by home investors might be relatively small. This link, however, is already considered in our equilibrium model as the large stock market has a corresponding weight in the passive portfolio. In principle, only two explanations for alpha are justified within the model. The first explanation refers to differential transaction costs, meaning that transaction costs of investing at home are smaller than the costs of investing abroad. Thus, investing at home provides a reward in the amount of the transaction costs difference. In the model, this difference is taken as exogenous, but equilibrium pricing then takes these transaction costs into account. The second explanation is familiarity, meaning that investors have a preference for their home assets not because of specific risk-return characteristics but because they feel more confident with more familiar asset holdings.

Against this background, we conjecture that wealthy countries with highly developed stock markets and a high level of investor protection provide investors with a sophisticated financial infrastructure including wealth management solutions and easy access to international financial markets. In this environment, the transaction costs of investing abroad will not be much higher than the transaction costs of investing at home. Thus, we hypothesize that proxy variables for economic development, stock market development and investor protection are negatively related to alpha. Capital flow frictions have the opposite effect because they favor home investments. The proxy variables for familiarity are also expected to be positively associated to alpha.

We use the following proxy variables for economic and stock market development: GDP per capita, GDP growth, foreign trade volume, stock market capitalization and stock market turnover. Our measures of capital flow restrictions are an index of capital control and a trade-weighted index of exchange rate volatility. The latter index is included because exchange rate risk is supposed to be an important impediment to international diversification. Proxies for investor protection are measures of shareholder rights, the level of minority shareholder protection, requirements with respect to corporate transparency and the quality of state governance. Our familiarity measures are designed to capture the geographical and cultural distance to other countries, where a larger distance translates into a larger conjectured alpha at home. Specifically, the proxy variable are the average geographical distance to other sample countries, the proportion of sample countries sharing the same main language, the stock market capitalization of neighboring countries and the share of foreign residents. Our last category consists of two country classifications. The Emerging Market dummy variable might be regarded as summarizing core aspects of the other categories because emerging markets differ from developed markets in terms of their economic development, their stock market development and the degree of investor protection. We also include a Eurozone dummy variable to account for the fact that Eurozone countries are part of a common integrated market. Table 2 defines the proxy variables in more detail and specifies the data sources. Table 3 shows descriptive statistics.

Table 2: **Variables and data sources**

Variable	Description and source
Economic Development	
GDP per Capita	GDP per Capita in US-Dollar. World Development Indicators (WDI, World Bank)
GDP Growth	Yearly growth of GDP. WDI (World Bank)
Foreign Trade Volume	Volume of imports and exports scaled by GDP. WDI (World Bank)
Stock Market Development	
Capitalization	Stock market capitalization as a percentage of GDP. WDI, Thomson Reuters Eikon
Turnover	Ratio of the total value of stocks traded to the market capitalization. WDI, OMX Nordic Exchange, Thomson Reuters Eikon
Investor Protection	
Shareholder Rights	Index to assess shareholder rights on a scale from 0 (poor) to 10.5. Doing Business Database (World Bank)
Minority Protection	Index to assess the protection of minority shareholders on a scale from 0 (poor) to 10. Doing Business Database (World Bank)
Corporate Transparency	Index to assess the transparency of companies on a scale from 0 (poor) to 9. Doing Business Database (World Bank)
State Governance	Governance index constructed using principal component analysis based on six governance indicators. World Governance Indicators (World Bank)
Capital Flow Frictions	
Capital Control	Index to measure imposed restrictions on capital in- and outflows on a scale from 0 (no restrictions) to 10. The Economic Freedom Network
Exchange Rate Volatility	Annualized volatility of monthly changes in a country's real exchange rate index. Bank for International Settlements
Familiarity	
Distance	Average distance between a country's capital and the capitals of all other countries of the sample. CEPII
Common Language	Share of countries with a common official language of a country. CEPII
Capitalization Neighbors	Sum of market capitalization weights of a country's neighboring markets. WDI (World Bank), Thomson Reuters Eikon
Foreign Residents	Share of foreign-born population. WDI (World Bank)

Table 3: **Descriptive statistics: proxy variables for sources of home preference**

		Economic Development			Stock Market Development		Investor Protection				Capital Flow Restrictions		Familiarity			
Country	Code	GDP per Capita ($)	GDP Growth (%)	Foreign Trade Volume (%)	Capi-tali-zation (%)	Turn-over (%)	Share-holder Rights	Min. Pro-tection	Corp. Trans-parency	State Gover-nance	Cap. Cont-rol	Ex-Rate Vol. (%)	Dis-tance (km)	Com. Lan-guage (%)	Capitali-zation Neigh. (%)	Foreign Resi-dents (%)
Developed markets																
Australia	AUS	49’561	2.96	41.10	111.12	79.05	5.00	5.80	8.00	3.98	7.06	8.43	12’774	20.45	0.00	25.09
Austria	AUT	46’267	1.44	98.92	32.96	44.91	8.00	6.50	7.00	3.91	6.57	1.72	5’245	6.82	6.74	14.31
Belgium	BEL	43’618	1.48	152.67	64.98	45.27	4.00	5.80	6.00	3.24	4.90	2.10	5’419	13.64	8.16	8.88
Canada	CAN	44’995	1.97	64.59	117.85	75.84	6.00	7.70	6.00	3.98	2.94	6.10	8’352	27.27	35.51	19.54
Denmark	DNK	56’972	0.69	96.33	66.21	75.47	8.00	7.20	9.00	4.55	2.24	2.36	5’310	0.00	2.88	8.50
Finland	FIN	46’405	1.01	78.23	82.69	111.60	7.00	5.70	6.00	4.62	5.73	2.69	5’409	2.27	2.66	4.01
France	FRA	40’415	1.07	55.59	75.68	81.36	6.00	6.50	8.00	3.04	3.99	2.34	5’504	6.82	9.53	11.16
Germany	DEU	41’813	1.33	78.55	43.57	132.51	8.00	6.00	7.00	3.65	6.01	3.01	5’259	6.82	9.12	13.32
Israel	ISR	28’703	4.21	72.92	80.37	41.72	7.00	7.50	9.00	1.54	2.40	5.18	5’756	20.45	0.21	27.75
Italy	ITA	35’599	−0.25	52.83	33.09	175.91	8.00	6.30	7.00	1.34	2.66	2.34	5’454	2.27	6.35	7.82
Japan	JPN	40’523	0.76	30.37	77.14	123.77	7.00	6.00	5.00	3.04	4.48	8.03	8’685	0.00	0.00	1.60
Netherlands	NLD	49’376	1.14	136.59	82.36	108.61	7.00	5.70	7.00	4.14	0.86	2.87	5’405	2.27	3.46	10.73
New Zealand	NZL	33’758	2.15	58.17	31.69	16.63	8.00	8.30	7.00	4.40	2.71	7.60	14’155	20.45	0.00	20.69
Norway	NOR	86’381	1.63	70.06	57.39	83.62	8.00	7.50	9.00	4.24	4.90	5.38	5’454	0.00	2.60	9.04
Portugal	PRT	21’579	−0.03	69.99	35.70	65.73	4.00	5.70	6.00	2.48	4.55	1.79	6’212	2.27	2.28	7.20
Singapore	SGP	43’102	6.30	390.26	235.39	50.45	8.00	8.30	8.00	3.77	3.43	2.85	9’014	27.27	0.62	39.81
Spain	ESP	30’076	0.77	56.12	84.52	109.11	10.00	6.50	8.00	2.24	6.43	2.60	5’949	9.09	3.99	10.75
Sweden	SWE	52’303	1.97	86.44	99.41	114.69	9.00	7.20	7.00	4.36	6.71	4.89	5’376	2.27	0.85	13.40
Switzerland	CHE	71’485	2.16	113.62	212.61	58.12	8.00	5.00	6.00	4.30	5.87	4.84	5’401	13.64	8.32	25.12
United Kingdom	GBR	42’742	1.39	56.85	118.23	70.66	8.00	7.80	8.00	3.54	2.42	5.34	5’556	20.45	0.22	10.72
United States	USA	48’455	1.72	28.14	122.93	200.53	4.00	6.50	5.40	3.13	5.04	4.42	8’719	20.45	4.14	13.63

Table 3: continued

Country	Code	Economic Development: GDP per Capita ($)	Economic Development: GDP Growth (%)	Economic Development: Foreign Trade Volume (%)	Stock Market Development: Capitalization (%)	Stock Market Development: Turnover (%)	Investor Protection: Shareholder Rights	Investor Protection: Min. Protection	Investor Protection: Corp. Transparency	Investor Protection: State Governance	Capital Flow Restrictions: Cap. Control	Capital Flow Restrictions: Ex-Rate Vol. (%)	Familiarity: Distance (km)	Familiarity: Com. Language (%)	Familiarity: Capitalization Neigh. (%)	Familiarity: Foreign Residents (%)
Emerging markets																
Brazil	BRA	8’971	3.68	25.39	56.64	58.96	7.00	6.50	8.00	−0.04	6.19	11.74	10’639	2.27	0.48	0.33
Chile	CHL	11’639	4.21	70.60	112.55	16.29	10.00	6.50	2.00	2.92	4.62	7.58	12’268	9.09	0.22	1.87
China	CHN	4’242	10.05	53.88	51.77	165.74	1.00	4.50	9.00	−1.25	9.65	4.96	7’765	6.82	7.61	0.06
Colombia	COL	5’673	4.79	36.73	47.91	14.54	6.00	7.30	6.00	−0.89	8.74	8.94	10’638	9.09	1.98	0.26
Czech Republic	CZE	18’336	2.49	132.31	21.40	55.43	8.00	6.00	5.00	2.12	6.22	5.72	5’243	0.00	3.49	3.35
Egypt	EGY	2’283	4.35	53.46	48.22	44.71	2.00	4.30	5.00	−1.51	4.71		5’829	4.55	0.32	0.35
Greece	GRC	25’315	−1.35	56.52	39.75	49.89	8.00	6.30	7.00	1.22	5.80	4.37	5’495	0.00	0.42	10.98
Hungary	HUN	12’995	1.36	153.72	21.56	79.04	8.00	5.50	7.00	1.87	5.73	7.45	5’246	0.00	0.44	3.90
India	IND	1’143	7.62	48.51	79.20	75.21	10.00	7.30	6.00	−0.61	10.00	5.61	6’891	20.45	5.56	0.49
Indonesia	IDN	2’536	5.66	52.95	38.79	34.75	6.00	5.70	5.00	−1.21	8.60	9.23	9’562	0.00	0.64	0.13
Korea, Republic	KOR	22’015	3.79	90.79	83.41	160.61	7.00	7.30	9.00	1.84	4.83	7.24	8’163	0.00	0.00	1.36
Malaysia	MYS	8’394	5.13	171.84	140.11	31.81	8.00	8.00	7.00	0.92	9.30	3.58	8’842	6.82	1.86	7.42
Mexico	MEX	9’000	2.63	59.79	35.06	26.32	8.00	6.00	4.00	−0.33	8.32	7.91	10’480	9.09	35.51	0.71
Philippines	PHL	1’991	5.44	77.23	62.86	16.83	1.00	4.20	7.00	−1.05	9.23	5.03	8’996	20.45	0.00	0.27
Poland	POL	11’663	3.98	81.72	33.96	38.08	8.00	6.30	7.00	1.66	8.18	8.11	5’233	0.00	4.35	1.81
Russian Federation	RUS	10’472	3.81	51.30	48.96	56.99	8.00	6.00	8.00	−1.74	5.15	6.85	5’474	0.00	6.65	7.99
South Africa	ZAF	6’397	3.18	60.14	233.70	27.13	8.00	7.00	4.00	0.74	9.23	12.07	9’160	20.45	0.00	3.05
Taiwan	TWN				190.84	130.94	7.00	7.00	9.00	2.24		4.07	8’508	6.82	0.00	
Thailand	THA	4’564	3.72	132.42	73.77	78.83	4.00	6.70	7.00	−0.52	8.46	4.71	8’284	0.00	0.62	3.87
Turkey	TUR	9’210	4.77	52.47	31.30	149.26	8.00	7.00	7.00	−0.08	7.83	12.28	5’484	0.00	0.41	1.93

We carry out pooled regressions of implied alpha on different sets of explanatory variables. We include time fixed effects to take account of shifts in the overall level of alpha that are not explained by our explanatory variables. Table 4 shows the results for the total sample, Table 5 for the subsample of developed markets and Table 6 for the subsample of emerging markets. The t-values (in brackets) are based on standard errors clustered at the country level.

In the total sample, the proxies for economic development alone explain 53.8% of the cross-sectional variation of alpha (see column 1 in Table 4). GDP per capita is the most important variable, as predicted with a negative coefficient (significant at the 1% level). Among the proxies for the stock market development (column 2), the size of the stock market in relation to GDP is most important, but the adjusted R^2 amounts to only 5%. The only significant proxy variable of investor protection is state governance, but its association with alpha is so strong that the regression for investor protection (column 3) has an R^2 of 50.1%. The two proxies for capital flow frictions are both significant with the predicted sign (R^2 of 32.3%; column 4). Additionally, two proxies for familiarity are significant at the 1% level in the predicted direction, namely the market capitalization of neighboring countries and the share of foreign residents (column 5). The estimated coefficient of the emerging market dummy is highly significantly positive (column 6) while the coefficient of the Eurozone dummy is insignificant. The country classifications alone explain 38.4% of the variation of alpha.

The explanatory variables most closely associated with alpha are economically related. In particular, GDP per capita is related to state governance (correlation coefficient of 0.832), the emerging market dummy (-0.826), foreign residents (0.578) and capital control (-0.516). These results are consistent with the view that wealthy countries with efficient institutions

Table 4: **Determinants of implied alpha: total sample**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(GDP per Capita)	−0.046***						−0.025**
	(−6.752)						(−2.361)
GDP Growth	−0.176						−0.073
	(−1.040)						(−0.524)
Foreign Trade Volume	0.004						0.005
	(0.972)						(0.817)
Capitalization		−0.026**					−0.017**
		(−2.522)					(−2.250)
Turnover		−0.020					0.003
		(−1.454)					(0.461)
Shareholder Rights			−0.003				−0.005*
			(−0.904)				(−1.759)
Minority Protection			0.001				0.008
			(0.211)				(1.343)
Corporate Transparency			−0.004				−0.006*
			−0.956				−1.782
State Governance			−0.022***				−0.008*
			(−8.117)				(−1.755)
Capital Control				0.011***			0.003**
				(5.339)			(2.235)
Exchange Rate Volatility				0.444**			0.214
				(2.374)			(1.248)
ln(Distance)					0.018		−0.024
					(0.717)		(−1.558)
Common Language					0.075		−0.107
					(0.614)		(−1.498)
Capitalization Neighbors					−0.198***		−0.132**
					(−2.882)		(−1.977)
Foreign Residents					−0.354***		0.162**
					(−3.406)		(2.435)
Emerging Markets Dummy						0.085***	0.002
						(7.066)	(0.181)
Eurozone Dummy						0.006	−0.010
						(0.701)	(−1.029)
Observations	440	451	451	429	440	451	429
Adjusted R^2 (within)	0.538	0.050	0.501	0.323	0.234	0.384	0.606

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

exert less capital control and are more open to migrants, which is associated with better integration in international financial markets (lower frictions) and greater openness to foreign investments (smaller familiarity bias). However, column 7 in Table 4 for the comprehensive regression shows that measures of capital control and familiarity contribute explanatory power in addition to GDP per capita. With the inclusion of all explanatory variables, the adjusted R^2 rises to 60.6%.

Within the subsample of developed markets, the explanatory power is much smaller (see Table 5). GDP per capita is again negatively associated with alpha when only economic development proxies are considered. However, even this relation becomes insignificant in the comprehensive regression. The estimated coefficients for the subsample of emerging markets are similar to the coefficients found for the total sample, but the R^2-coefficients are clearly smaller. This is not surprising because the variation of alpha is much larger if developed and emerging markets are both included.

At the beginning of this section, we addressed the puzzling observation that investors from countries with high specific risk, who would benefit most from international diversification, exhibit a particularly pronounced home reward (which then leads to a strong home bias). Our regression results now suggest that two factors behind this observation are frictions of investing abroad and a larger cultural distance to other asset markets. These results are broadly consistent with the proposed theoretical framework.

6. Conclusion

The overall strength of the home bias has decreased over time but is still very substantial. It is present in all 41 countries of our sample, albeit in varying degrees. In equilibrium, it

Table 5: **Determinants of implied alpha: developed markets**

	(1)	(2)	(3)	(4)	(5)	(6)
ln(GDP per Capita)	−0.029**					−0.019
	(−2.447)					(−1.548)
GDP Growth	−0.118					−0.055
	(−0.854)					(−0.498)
Foreign Trade Volume	0.002					0.008**
	(0.607)					(2.310)
Capitalization		−0.009*				−0.003
		(−1.741)				(−0.494)
Turnover		−0.007				−0.008**
		(−1.546)				(−2.524)
Shareholder Rights			0.003*			0.002
			(1.667)			(1.266)
Minority Protection			0.0004			0.001
			(0.111)			(0.334)
Corporate Transparency			−0.004			−0.003*
			(−1.413)			(−1.713)
State Governance			−0.008			−0.006
			(−1.585)			(−1.321)
Capital Control				0.002		0.002*
				(1.496)		(1.903)
Exchange Rate Volatility				0.077		0.328**
				(0.694)		(2.051)
ln(Distance)					0.018**	0.004
					(2.072)	(0.302)
Common Language					−0.097	−0.090*
					(−1.486)	(−1.679)
Capitalization Neighbors					−0.022	0.0003
					(−0.633)	(0.013)
Foreign Residents					0.026	0.011
					(0.566)	(0.156)
Observations	234	234	234	234	234	234
Adjusted R^2 (within)	0.136	0.019	0.123	−0.016	0.043	0.334

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

Table 6: **Determinants of implied alpha: emerging markets**

	(1)	(2)	(3)	(4)	(5)	(6)
ln(GDP per Capita)	−0.042***					0.024*
	(−3.073)					(1.903)
GDP Growth	−0.261					−0.011
	(−1.078)					(−0.082)
Foreign Trade Volume	0.003					0.034*
	(0.189)					(1.682)
Capitalization		−0.023**				−0.045***
		(−2.225)				(−4.598)
Turnover		−0.002				0.024*
		(−0.134)				(1.912)
Shareholder Rights			−0.008**			−0.001
			(−2.075)			(−0.264)
Minority Protection			0.005			0.008
			(0.706)			(0.988)
Corporate Transparency			−0.007			−0.015***
			(−1.409)			(−3.280)
State Governance			−0.017***			−0.037***
			(−4.156)			(−5.268)
Capital Control				0.008***		0.003
				(3.043)		(1.074)
Exchange Rate Volatility				−0.006		−0.070
				(−0.020)		(−0.388)
ln(Distance)					−0.047	−0.001
					(−1.043)	(−0.023)
Common Language					0.069	0.189*
					(0.527)	(1.784)
Capitalization Neighbors					−0.244***	−0.448***
					(−4.270)	(−6.612)
Foreign Residents					−0.380**	−0.067
					(−2.565)	(−0.556)
Observations	206	217	217	195	206	195
Adjusted R^2 (within)	0.196	−0.016	0.268	0.031	0.098	0.434
Note:				*p<0.1; **p<0.05; ***p<0.01		

is precisely these *differences* across countries that determine the impact of the home bias on international asset pricing: the stronger the country-specific home bias is, the lower the expected return of the country asset. The prior literature has focused on testing this directional prediction. In this way, however, more specific information on the magnitude of the effect that can be derived from the underlying equilibrium model is not used. In the equilibrium version of the Treynor and Black (1973) model used here, adjustments in expected returns become apparent from differences between the market portfolio and the optimal portfolio of an investor without home preference (core portfolio). Our empirical analysis of these differences suggests that the overall composition is very similar. It is true that some countries obtain a weight in the core portfolio that is more than twice (or less than half) that in the market portfolio. These countries, however, are relatively small. In addition, the differences in the weighting structures have a limited impact on the portfolio characteristics because international asset returns are highly correlated. Therefore, we find that differences in expected returns implied in the market portfolio are very close to the expected returns implied in the estimated core portfolio. In fact, the differences are so small (mostly below 0.2% p.a.) that it would not be possible to detect them in a test based on ex post returns. If such a test provides a home bias premium of monthly -0.99% as in Solnik and Zuo (2012), this result is not consistent with our equilibrium analysis, even though the estimate has the predicted sign. In this sense, our approach fits well into the discussion on false positives in studies on determinants of expected returns. The remedy applied here is to base the test on specific structural implications of the model rather than the sign of the predicted association alone.

Appendix

We analyze the optimal asset allocation of an investor from country l ($l = 1, \ldots, n$). Her portfolio consists of the index portfolio with weight $x_{l,b}$ and country asset holdings $x_{l,i}$ for $i = 1, \ldots, n$. In what follows, we focus on the structure of the risky part of the portfolios.[11] This part is then combined with the riskless asset according to the investor's risk preferences.

As proposed by Treynor and Black (1973), it is useful to define new assets $i = 1, \ldots, n$ which provide access only to the specific asset returns $\epsilon_i := r_i - \beta_i r_b$, where r_i is defined as asset i's total excess return and β_i as its return exposure with respect to the return of index b. The "specific-return assets", together with index b, allow us to build the same portfolios as are possible with the original assets. To replicate the portfolio $(x_{l,1}, \ldots, x_{l,n}, x_{l,b})$ with a portfolio $(x^*_{l,1}, \ldots, x^*_{l,n}, x^*_{l,b})$ of the new (specific-return) assets plus the unmodified index portfolio b, the weights of assets $i = 1, \ldots, n$ remain unchanged to maintain the same exposure to specific returns.[12] The index holding, however, has to be adjusted to also include the index exposure previously achieved indirectly by investments in assets i. This indirect index investment is now replaced by a direct holding of index b.[13] Therefore, portfolios of the original and newly defined assets are identical if the following conditions hold:

$$x^*_{l,i} = x_{l,i}, \quad i = 1, \ldots, n; \qquad x^*_{l,b} = x_{l,b} + \sum_{i=1}^{n} \beta_i x_{l,i}. \tag{11}$$

For our investor from country l, all specific-return assets have an expected return of zero except for the home asset, which has an expected return of α_l. Because assets i for $i \neq l$

[11] This means that $x_{l,b} + \sum_i x_{l,i} = 1$.

[12] The investments $x_{l,b}$ and $x^*_{l,b}$ provide pure index exposure. By definition, the index return r_b is not affected by abnormal expected returns of home assets. These are included in the specific returns ϵ_l.

[13] Since $x_b + \sum_i x_{l,i} = 1$, this means that the sum of the new weights x^* is generally not equal to one.

would add specific risk to the portfolio without contributing to expected return, these assets are not included in the optimal portfolio. Therefore, only index b and the home asset have to be considered, and the portfolio expected return and variance can be written as:

$$\mu_p = x^*_{l,b}\mu_b + x^*_{l,l}\alpha_l; \qquad \sigma^2_p = x^{*2}_{l,b}\sigma^2_b + x^{*2}_{l,l}\sigma^2_{\epsilon_l}, \tag{12}$$

where $\mu_b = \mathbb{E}[r_b]$ and $\sigma^2_{\epsilon_l} = Var(\epsilon_l)$. Differentiating expected utility $EU = \mu_p - \frac{1}{2}\gamma\sigma^2_p$ with respect to $x^*_{l,b}$ and $x^*_{l,l}$ and setting the result equal to zero, we obtain the following ratio w_0 of optimal asset holdings:[14]

$$w_0 := \frac{x^*_{l,l}}{x^*_{l,b}} = \frac{\alpha_l/\sigma^2_{\epsilon_l}}{\mu_b/\sigma^2_b} = \frac{1}{\lambda}\frac{\alpha_l}{\sigma^2_{\epsilon_l}}, \tag{13}$$

where λ is defined as the market premium per unit of variance risk for the passive portfolio:

$$\lambda := \frac{\mu_b}{\sigma^2_b}. \tag{14}$$

Switching back from equation (13) to the original asset holdings, we can rewrite ratio w_0 using the link between original and new assets provided by equation (11):

$$w_0 = \frac{x^*_{l,l}}{x^*_{l,b}} = \frac{x_{l,l}}{x_{l,b} + \beta_l x_{l,l}}. \tag{15}$$

Since the original asset weights add to one, we can replace $x_{l,b}$ in equation (15) by $x_{l,b} = 1 - x_{l,l}$.

[14] This optimization does not consider the constraint $x_{l,b} + x_{l,l} = 1$, or equivalently, $x^*_{l,b} + (1 - \beta_l)x^*_{l,l} = 1$; see equation (11) with $x_{l,i} = 0$ for $i \neq l$. The constraint does not have an impact on the ratio of optimal weights.

Solving for $x_{l,l}$ and inserting the expression for w_0 from equation (13) then gives:

$$x_{l,l} = \frac{w_0}{1 + (1 - \beta_l)w_0} = \frac{\frac{1}{\lambda}\frac{\alpha_l}{\sigma^2_{\epsilon_l}}}{1 + (1 - \beta_l)\frac{1}{\lambda}\frac{\alpha_l}{\sigma^2_{\epsilon_l}}}. \tag{16}$$

References

Chan, K., Covrig, V., Ng, L., 2005. What determines the domestic bias and foreign bias? evidence from mutual fund equity allocations worldwide. The Journal of Finance 60 (3), 1495–1534.

Cooper, I., Kaplanis, E., 1994. Home bias in equity portfolios, inflation hedging, and international capital market equilibrium. The Review of Financial Studies 7 (1), 45–60.

Fidora, M., Fratzscher, M., Thimann, C., 2007. Home bias in global bond and equity markets: The role of real exchange rate volatility. Journal of International Money and Finance 26, 631–655.

Hong, H., Kubik, J. D., Stein, J. C., 2008. The only game in town: Stock-price consequences of local bias. Journal of Financial Economics 90, 20–37.

IMF, 2002. Coordinated Portfolio Investment Survey Guide. International Monetary Fund, 2nd Edition.

IMF, 2018. Coordinated portfolio investment survey.
URL `http://data.imf.org/?sk=B981B4E3-4E58-467E-9B90-9DE0C3367363`

Kho, B.-C., Stulz, R. M., Warnock, F. E., 2009. Financial globalization, governance, and the evolution of the home bias. Journal of Accounting Research 47 (2), 597–635.

Lau, S. T., Ng, L., Zhang, B., 2010. The world price of home bias. Journal of Financial Economics 97, 191–217.

Levy, H., Levy, M., 2014. The home bias is here to stay. Journal of Banking & Finance 47, 29–40.

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

Sharpe, W. F., 1963. A simplified model for portfolio analysis. Management Science 9, 277–293.

Solnik, B., Zuo, L., 2012. A global equilibrium asset pricing model with home preference. Management Science 58 (2), 273–292.

Treynor, J. L., Black, F., 1973. How to use security analysis to improve portfolio selection. The Journal of Business 46 (1), 66–86.