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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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Foreign bias in equity portfolios: Informational advantage or familiarity bias?

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Abstract

We use the European Central Bank's new and detailed database of European equity holdings by households to test two competing theories of international biases in equity portfolios, *viz.* that they reflect either informational advantages or familiarity bias. The database allows look-through handling of investments via mutual funds and the like, and reveals that home bias is smaller than usually believed. We find that both home bias and foreign bias are positively associated with the Cremers and Petajisto (2009) ActiveShare measure and negatively with the fraction of the country sub-portfolio invested via mutual funds, both of which are consistent with information effects rather than familiarity bias. Again consistent with the information hypothesis, we further find a positive relationship between excess returns and ActiveShare, as well as higher expected returns when foreign bias is positive rather than negative. Given the investor's place of residence, nationality has no impact, so portfolios per nationality group within a country provide additional test material.

Key words: International portfolio choice; home bias; foreign bias; informational advantage; familiarity; behavioral economics; active share.

JEL codes: G15, G18, G30, G38, F3

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1 Introduction

We use the European Central Bank (ECB)-coordinated Securities Holdings Statistics (SHS) database of European equity holdings to test two competing theories of international biases in equity portfolios. The first hypothesis posits that the biases reflect informational advantages, which we define as superior knowledge or insight about a specific company or industry that motivates return-motivated underdiversification ('speculation', in Black (1995)'s terminology). This hypothesis predicts that active portfolio holdings within a foreign country sub-portfolio are positively related to overweight investment in that country, because active portfolio holdings are necessary to take advantage of information (Treynor and Black, 1973). The second hypothesis says that international equity investment biases reflect a behavioral preference for shares of countries that are 'more familiar' to the investor. Familiarity, in this context, means some combination of geography, language, and culture. The behavioral bias could be based on overoptimism regarding the equity returns from more familiar countries, or on 'keeping up with the Joneses', or on over-reliance on local index benchmarks. A key feature of all these behavioral explanations is that they do not require active positions in individual shares to implement them. They can be most cheaply and easily achieved by holding country index funds. Therefore, the relationship between active equity holdings in a country and the degree of over-weighting of that country in the investor's portfolio provides a first test of whether the motivation for the over-weighting seems to be informational advantage or behavioral. As a complement to the tests on portfolio weights, we also use returns on investors' portfolios to test for the presence of a genuine informational advantage, namely by checking whether subportfolios with more active management do provide higher returns.

We use a comprehensive panel of European household holdings of international equities, both individual stocks and funds. This database enables us to examine, for the first time, the relationship between active positions, country over-weighting, and excess returns. All financial institutions in the Eurozone contribute to the data, rather than one major bank or a single class of institutions such as mutual funds, and the aggregates for each reporting country are broken down to an unusual extent. The richness of the data enables us to investigate the relationship between active positions, country weights, and excess returns using the entire cross-section of holdings in foreign countries (the foreign bias), rather than just the home country holdings (the home bias). This gives the test much higher power than is possible

using the home bias alone: if there are R reporting 'home' countries and D destinations, then we can work with $R(D-1)$ foreign subportfolios against just R subportfolios of domestic investments.

We implement the tests using holdings of equity investors from every European country investing in every international equity market. This is a relatively new database, and even its descriptives already provide relevant new insights. First, we have separate data on investors' holdings of mutual funds and of individual shares. This allows us to look through households' indirect holdings of equities via funds; and this exercise tells us that home bias is substantially lower than previously measured, because households tend to own funds that are highly international. While those fund holdings are still tilted towards more similar foreign countries, the direct investments do represent active positions, so this is by no means a strategy of global indexing. In the ECB data we can also test whether, in this context, 'home' means nationality or place of residence. To that end we investigate the behavior of two types of investors where nationality and place of residence do not coincide: 'emigrants', who live outside the country of which they are nationals, and 'immigrants', who do not have the nationality of the country they live in. We find that the behavior of non-natives is much more similar to that of the natives of the country in which they are immigrants than it is to the country from which they are emigrants. This suggests that if information is causing the foreign bias, it must be more closely related to the country of residence than it is to the country of origin. The fact that we have data on subsets of residents of a given country then also allows us to use even more data for testing: beside the $R(D-1)$ foreign portfolios held by natives, we observe a multiple of that number of portfolios held by immigrants into that country.

The findings from the main tests are as follows. Consistent with the information hypothesis, we find that higher over-weighting of a foreign country in an equity portfolio is associated with active positions held in that foreign equity sub-portfolio. The magnitude of the effect is consistent with the perceived excess return from the active positions being sufficient to offset the incremental risk from reduced international diversification. We further find a positive relationship between excess returns and ActiveShare, consistent with the information hypothesis. We also find that positive foreign bias implies higher expected returns than negative foreign bias, again consistent with the information hypothesis. There may be a missing factor, though: given a negative foreign bias, the relationship between excess returns and foreign bias is negative, which is inconsistent with either hypothesis and

may indicate some measurement problem within that group. We further investigate whether over-weighting is associated with direct investment in individual equities or with indirect investment via funds. We find, both for home bias and for foreign bias, that over-weighting is negatively associated with investment via funds and positively associated with direct investment in individual equities. Behavioral strategies that favour more familiar countries as a whole rather than individual stocks could be more cheaply implemented using country index funds, so this evidence is also consistent with an informational motivation for the biases rather than a behavioral one.

2 Literature review and hypotheses development

The two biases we investigate are the home bias, whereby equity investors overweight their home countries, and the foreign bias, whereby they overweight countries that are more 'familiar'. In this context 'familiar' means some combination of geographical closeness, cultural similarity, ease of communication, or correlatedness of equity markets. Our formal tests are based on the foreign bias because of the much greater degrees of freedom. In this Section we describe our hypotheses and discuss related literature.

2.1 The information hypothesis

One hypothesis is that foreign equity investment biases are caused by relative informational advantages pertaining to an individual stock or industry. In the information hypothesis the reason for overinvesting in more similar countries is that the investor has a relative informational advantage in these countries; for more 'distant' countries, a comparative advantage is less likely. Three key insights regarding the information explanation are that (i) even an initially tiny informational advantage may lead domestic investors to overinvest heavily in their home market (Coval and Moskowitz, 1999, 2001; VanNieuwerburgh and Veldkamp, 2009; Dziuda and Mondria, 2012); (ii) to exploit an informational advantage the investor must take active positions (Treynor and Black, 1973; Schumacher, 2018); and (iii) in equilibrium those active positions must result in an expected excess return that is sufficient to offset the foregone benefit of international diversification.

In the case of home bias the informational advantage regarding home equities generates an expectation, true or imaginary, of expected excess returns for home equities and results

in home bias. A similar idea can be used to explain foreign bias. Foreign bias concerns the level of investment in various foreign markets, given the overall holdings of foreign equities. Even though an investor may have an information *dis*advantage in all foreign markets relative to the domestic investor in those markets, the VanNieuwerburgh and Veldkamp (2009) argument applies to their relative incentive to invest in information acquisition in different foreign markets. Thus, if they are endowed with a smaller information disadvantage (relative to local investors) in destination country j that is close to them compared to a more distant country k, they will have an incentive to invest more in information about, and assets from, destination country j relative to remote country k. This will result in a smaller informational disadvantage and a greater relative incentive to take active positions in destination country j relative to country k.

From an empirical point of view we test whether the structure of portfolios is consistent with an equilibrium that has been generated by the information explanation. We perform the test using the foreign bias rather than the home bias because this generates far more degrees of freedom, as we saw. Specifically, we test:

H1A: (Information) *The level of the active share-holding in a foreign country is positively related to a higher over-weighting of that country in the foreign part of the investor's portfolio, and the relationship between active positions and over-weighting is consistent with an equilibrium where the expected excess return from the information generating the active positions offsets the cost of foregone diversification.*

The measure of active trading we use is the ActiveShare measure of Cremers and Petajisto (2009), the summed absolute deviations between actual weights and market value weights, which they have shown in other contexts to be correlated with excess returns. We measure this for each individual foreign-country sub-portfolio of the investor's international portfolio.

We also hypothesize that it is unlikely that investors will exploit their relative informational advantage by investing primarily in common investment funds. For example, an investor cannot hold active positions relative to the index in a foreign country by holding the index fund of that country. Nor can she do so by holding an international fund where the sub-portfolio for that country tracks its index. Even if the fund is not an index fund, this way of investing still precludes the individual investors from acting on their own information. Therefore, we also test the hypothesis:

H1B: (Information) *The proportion of investment in a foreign country via funds rather*

than via individual shares is negatively related to over-weighting of that country in the foreign part of an investor's portfolio.

An informational advantage may very well be related to company size. For example, it could be that foreign investors, facing a menu of foreign stocks, mostly buy the bigger ones because they feel at a lesser information disadvantage regarding these relative to small stocks. There is an issue, however, if size bias is caused by other motives, like a preference for liquid stocks. While a degree of liquidity-based bias is quite plausible for institutional investor, it is less of a consideration to individual households, which is the data we study. In addition, liquidity *preference* is not very country-related and is therefore less likely to be correlated with foreign bias. That said, if our measure of underdiversification would contain a liquidity-based component, this would act as a measurement error in the regressor, a problem usually associated with a bias towards zero in the variable's regression coefficient. As we do find significant coefficients, the conclusion is conservative.

If the link between foreign bias and active share is rational, both active share and over-weighting should be positively related to excess returns on the portfolios held by the investor(s). A higher excess return on investments in foreign country j relative to country k indicates less of an information disadvantage in country j. Hence, all other things being equal, the investor should be willing to hold more in country j than country k and the foreign bias should be greater. This should generate a positive relationship between realised excess portfolio returns and foreign bias. Under the information hypothesis the mechanism that generates excess returns is a higher active share, so we also hypothesize a positive relationship between active share and excess returns. That is, the testable hypotheses is

H1C: (Information) *The excess return on the sub-portfolio held in a foreign country is positively related to the active share of that sub-portfolio, and also positively related to over-weighting of that country in the foreign part of an investor's portfolio.*

In the next subsection we contrast the implications of the familiarity hypothesis with the above three implications of the information hypothesis.

2.2 The familiarity hypothesis

Despite some theoretical and empirical support for the informational explanation of international equity portfolio biases, which we summarize below, the evidence remains incomplete

for at least two major reasons. First, there is another hypothesis which can explain many of the same facts as the information hypothesis: familiarity bias. Second, there are empirically unproven links in the theoretical chain of reasoning that goes from relative informational advantage via portfolio holdings to excess returns sufficient to justify giving up significant diversification gains. Specifically, to date neither the detailed structure of portfolios nor the level of excess returns generated by the biases have been shown convincingly to be those that are predicted by the information explanation.

As an alternative explanation for international equity biases, the familiarity hypothesis says that investors invest in more 'familiar' countries for reasons unrelated to better information about specific stocks or industries; what defines familiarity, in our definition, is that it relates to a country as a whole, not to selected firms or sectors. This behavioral explanation comes in several forms, including overoptimism regarding the equity returns from more familiar countries, or 'keeping up with the Joneses' (Lauterbach and Reisman, 2004), or over-reliance on local index benchmarks (Basak et al., 2006; Solnik and Zuo, 2012). All these say that investors will overweight countries that are more 'familiar', where familiar means some combination of geographic proximity, cultural and language similarity, or correlatedness of markets, depending on the specific hypothesis. The key feature of these hypotheses is that they do not require that the investor holds an active country sub-portfolio in order to implement their preference, and they do not require higher excess returns to reward higher investment in a particular foreign country. The generalized nature of the preference means that it can primarily be implemented by holding funds that are diversified at least at the country level.

For example, if the motivation is to track the local index benchmark because this corresponds to the idea of 'keeping up with the Joneses', then investors in their home market will prefer to hold a fully diversified portfolio. For many households this is likely to take place indirectly through funds because of the cost of forming a diversified portfolio from direct investment in shares. For the more familiar countries the portfolio will similarly be diversified within those countries, and most easily implemented via funds. Thus we formulate our alternative hypotheses:

H2A: (Familiarity) *The level of the active share-holding in a foreign country is unrelated to a higher over-weighting of that country in the foreign part of the investor's portfolio.*

H2B: (Familiarity) *The proportion of investment in a foreign country via funds rather*

than via individual shares is positively related to over-weighting of that country in the foreign part of an investor's portfolio.

H2C: (Familiarity) *The excess return on the sub-portfolio held in a foreign country is unrelated to the active share of that sub-portfolio, and also unrelated to over-weighting of that country in the foreign part of an investor's portfolio.*

So the perceived informational advantage, in our terminology, is manifested by the active positions in different stocks or industries, as opposed to a general attitude towards a country as a whole—'(un)familiarity'. This dichotomy leaves out a third hypothesis, market timing. Market timing would be based on superior information, or a perception thereof, but is not stock- or industry-specific. While market timing behavior may exist, the idea that this would explain portfolio biases is inconsistent with the observed intertemporal stability of home bias and foreign bias. It is true that short-lived portfolio shifts could still have occurred within the quarters, but then the puzzle would be why this is never visible on the reporting dates. Even so, the relation of any such short-term shifts with the three-month total return is not likely to be strong. In addition, if the investors' information were about market timing, the biases would have to change significantly over time to take advantage of that information, and that is not what we observe in the data.

2.3 Testing for informational versus familiarity effects

Recall that, to test for familiarity effects versus information effects, we rely on three portfolio measures. The first is Cremers and Petajisto (2009)'s 'active share' (AS) measure of the sub-portfolio invested by investor i into country j, *i.e.* the summed absolute deviations between actual weights of country-j shares in i's subportfolio and their local market value weights —see Section 3.5. Our second proxy is 'funds weight' (FW), the weight of investments via funds within investor i's country-j subportfolio (Section 3.6). Investments via funds are, by nature, not based on company-specific information, and industry-specific funds are quite rare. So if we would find that foreign bias is negatively related to FW within the foreign subportfolio, this would indicate active positions rather than passive diversification. Our third measure is the excess return on the foreign sub-portfolio measured relative to a standard three-factor model. Under the informational advantage hypothesis, a higher foreign bias and a higher active share within a foreign country sub-portfolio should be positively related to the excess return. As the alternative hypothesis we use the familiarity hypothesis,

whereby neither active share nor excess return should be related to foreign bias, and funds' weight should be positively rather than negatively related to foreign bias..

Our first test uses a regression of the over- or underweighting of foreign countries (foreign bias, *FB*), with *AS* and *FW* as key regressors:[1]

$$FB_{i,j,t} = \alpha_1 + \beta_1\, x_{i,j,t} + \delta_1\, AS_{i,j,t} + \eta_1\, FW_{i,j,t} + [\text{Fixed Effects}] + e_{i,j,t}. \tag{1}$$

The information hypothesis says that δ_1 is positive, η_1 is negative, and the size of δ_1 is large enough to be consistent with expected excess returns equivalent to the foregone diversification. The familiarity hypothesis says that δ_1 is zero, and η_1 is positive.

The '$\beta_2\, x_{i,j,t}$' part in the above equation indicates that we do not use the *AS* and *FW* as alternatives to the covariates traditionally used in the gravity-type research strand; rather, *AS* and *FW* act as complements, or competitors if you wish, alongside the standard regressors. In summary, informational explanations imply that, if a resident from home country i over-weights destination country j within the international part of her portfolio, this should show up as an active country-j subportfolio to take advantage of information, rather than as a well-diversified, passive position in j's market.

Our second test uses a regression of the excess return from a foreign country subportfolio (excess return, *ER*) on ActiveShare, foreign bias, and/or *FW*. The nesting version is

$$ER_{i,j,t} = \alpha_2 + \beta_2\, x_{i,j,t} + \delta_2\, AS_{i,j,t} + \eta_2\, FW_{i,j,t} + \theta_2 FB_{i,j,t} + [\text{Fixed Effects}] + e_{i,j,t}. \tag{2}$$

The information hypothesis says that η_2 is negative while δ_2 and θ_3 are positive, and the size of θ_2 is large enough to be consistent with expected excess returns equivalent to the foregone diversification. The familiarity hypothesis says that δ_2, η_2 and θ_2 are zero.

All regressions rely on a 3D panel based on aggregated subportfolios of individual stock holdings, either direct or with indirect look-through positions. Aggregation is across all investors of residence/nationality i. For instance, we have 13 'native' groups i (one per reporting home country), and we observe their portfolios for 59 separate destination countries over 19 quarters.

2.4 Other related work

[1]The fixed effects are for t and i, j, t in regressions with *FB* on the left, and for i, j in regressions with excess returns on the left, where the FF factors replace the time fixed effect.

Our work is related to a large body of literature. To save space we discuss only the work that is most closely related to this study; for an overview of the wider literature, we refer readers to the survey by Cooper et al. (2013). Specifically, first we briefly discuss the evidence regarding home bias; then we summarize the studies that examine the foreign bias; finally we discuss the ActiveShare measure.

Home bias is not the primary focus of this study, but the home bias and foreign bias are closely related (Cooper et al., 2018). In particular, the informational and behavioral explanations for home bias mirror those for foreign bias, so the evidence regarding these explanations for the home bias is a useful context for the evidence regarding the foreign bias.

A number of studies find that home bias is associated with superior investment performance, as the information hypothesis implies (Hau, 2001; Coval and Moskowitz, 1999; Dvorzak, 2005; Massa and Simonov, 2006; Kalev et al., 2008; Baik et al., 2010). However, several studies find no such association and suggest that the explanation is more likely to be behavioral (Grinblatt and Keloharju, 2000; Huberman, 2015; Cohen, 2008; Seasholes and Zhu, 2010; Pool et al., 2012; Levy, 2017). Thus the link between home bias, portfolio choice, and excess returns is not yet conclusively empirically verified.

One specific behavioral explanation for home bias is the idea that investors are relatively more optimistic than foreigners regarding their home equity market. Evidence consistent with this has been found by French and Poterba (1991), Pastor (2000), Strong and Xu (2003), Li (2004), and Solnik and Zuo (2016). Evidence against it for emerging markets is presented in Lai and Teo (2008). Other behavioral explanations for the international investment biases, such as keeping up with the Joneses and benchmarking bias, are hard to test on the home bias because of the limited degrees of freedom. We discuss these explanations in the context of the foreign bias below.

Regarding the foreign bias, one body of work examines the determinants of foreign portfolio holdings using country level data (Portes and Rey, 2005; Lane and Milesi-Ferretti, 2008; Okawa and Van Wincoop, 2012; Coeurdacier and Rey, 2013). In these standard 'gravity' models, bilateral distance or other variables measuring actual or potential information flows are used as proxies for informational advantages. Positive portfolio biases are generally found to be strongly related to these measures of 'closeness', most of which could measure either informational advantage or familiarity. These studies do not examine the detailed structure of portfolios beyond their country weightings.

Regarding specific tests of information or familiarity bias as explanations of the foreign bias, Portes and Rey (2005) find an association between overweighting of foreign countries and variables proxying information flows. Schumacher (2018) studies the foreign portfolio allocations of mutual funds and finds that they exploit an informational advantage by taking active positions abroad in industries that are important in the home market. This strategy generates positive risk-adjusted alpha's. Jagannathan et al. (2019) also examine portfolio holdings, those by international funds with 'local' managers. They find that such funds attract higher flows than funds without local managers, and outperform funds with non-local managers. Fedenia et al. (2013) analyse foreign portfolio holdings and performance for U.S. investments to study the informational advantage hypothesis both at the stock and industry level to explain over- and under-diversification. They show that overweighted industry-portfolios outperform well-diversified portfolio, which is consistent with the hypothesis of an informational advantage behind portfolio choice and, thus, behind foreign bias. Thapa et al. (2013) provide evidence on the role of information on portfolio choice. In contrast, Tesar and Werner (1995) and Chan et al (2005) find overweighting of countries whose equity markets are highly correlated with the home market, a result consistent with a benchmark bias. None of these studies examines household portfolio holdings in detail, like direct holdings versus positions via funds.

A limited number of studies has exploited household data on stock level portfolio holdings.[2] These studies generally highlight the importance of both informational advantages and familiarity biases to explain household international portfolio allocations (Bekaert et al., 2017). Other closely related recent papers in the home-bias literature include Dziuda and Mondria (2012); Fedenia et al. (2013). Lindblom et al. (2018) examines the 'birthplace bias' of investors and finds this is not explained by either information or familiarity.

Overall, the empirical literature on the home bias and foreign bias has not yet conclusively shown whether these arise primarily from informational advantage or are behavioral. For example, Bekaert et al. (2017) summarize their findings as evidence consistent with 'familiarity bias and information barriers'. In this study we hope to contribute to the understanding of the relative importance of these competing explanations by examining more closely one aspect of the chain that links investor portfolio choice to portfolio performance

[2]For early work on household portfolios, see Ivković and Weisbenner (2005); Polkovnichenko (2005); Goetzmann and Kumar (2008); Calvet et al. (2009); Giofré (2013)

if the information hypothesis is correct: the taking of active positions to exploit the relative informational advantage. Cremers and Petajisto (2009) introduce the ActiveShare measure and apply it to a sample of U.S. equity funds. They find that small funds have in general more aggressive active bets than large funds and ActiveShare is strongly positively correlated with performance, both before and after costs. Petajisto (2013) confirms these findings in a similar study, but Frazzini et al. (2016) find no link between ActiveShare and fund outperformance using the same sample of funds. Similarly Choi et al. (2017) find that portfolio concentrations at certain country and industry levels are associated with excess returns for investors, and they explain this in terms of informational advantages. See also Ivkovic et al. (2008) for households, who earn higher excess returns for local stocks not in the U.S. benchmark index.

The richness of the data also enables us to test the effect of a previously unexplored dimension of these biases: residence in a country that is not the 'passport' home country of the investor. The data report, for every nationality i, holdings by households who are residents in r but are not nationals. For home bias we identify two types of investors in a country other than those who are both native and resident: 'emigrants', who are native but no longer live there, and 'immigrants', who are not native but do live there. Their behavior has been explored also by Foad (2011) or Lindblom et al. (2018). We find that the choices by immigrants are much closer to those of natives than are those by emigrants. As such, they can be used as a set of additional data next to the natives' data.

3 Data and research design

3.1 Data structure

The Securities Holdings Statistics - Sectoral (SHS-S) database from the ECB covers quarterly portfolio holdings data from Q4, 2013 until Q2, 2018 (19 quarters). This highly confidential granular dataset contains the portfolio holdings positions at market value of euro area households in individual stocks and mutual funds that have an International Securities Identification Number (ISIN code). We focus on household data. The positions held are reported for about 51,284 companies and 26,214 equity funds, representing 59 host countries. There

are 13 reporting countries,[3] and each of these provides equity holdings for up to 59 nationality groups of investors residing in the reporting country. After grouping by destination country, the 0.8 billion data points are condensed into about 180,000 portfolio-bias numbers, of which 15,000 are for 'natives' and 165,000 for migrants. The data set of direct equity holdings is significantly smaller than the indirect holdings through funds. This is because there are many small or exotic stocks that are not directly held (for example Slovenian households do not directly invest in a small company in Vietnam). For many stocks, holdings by foreigners are via funds only.

3.2 Portfolio holdings: direct and indirect

We use the quarterly portfolio holdings data from SHS-S. The ECB receives data from each reporting country's custodians and aggregates them to the national level per investor category, like all households. That is, we observe the total household holdings for a given home country i in a given stock issued in destination country j. A very interesting feature of the dataset is that the entries to the underlying database are recorded per custodian regardless of what the investor's nationality is. This means that we also have information about the portfolio holdings by households with a nationality from country i, residing in country r. These immigrant holdings, as we call them, are not restricted to euro area nationalities. For example we know the equity portfolio holdings of U.S. households living in Germany. This means that our data has three cross-sectional dimensions (households with nationality i, residence country r, and stocks from destination country j) and one time dimension (quarterly observations). We split the data in two sets, portfolio holdings by native households (nationality i = residence country r), and by migrants (residents of r with nationality $i \neq r$). In the latter set we report data with 'home' defined as either the residence country ('immigrants') or the passport country ('emigrants').

We collect portfolio holdings data on individual stocks and equity funds. Specifically, for more than 51,000 stocks of companies from all over the world and for each of 26,000 equity mutual funds, we know how many shares are held in custody by investors in each Eurozone home country i. Within each reporting home country i, the positions in each company and

[3]Austria (AT), Belgium (BE), Cyprus (CY), Germany (DE), Finland (FI), Greece (GR), Ireland (IE), Italy (IT), Latvia (LV), the Netherlands (NL), Portugal (PT), Slovenia (SI) and Spain (ES).

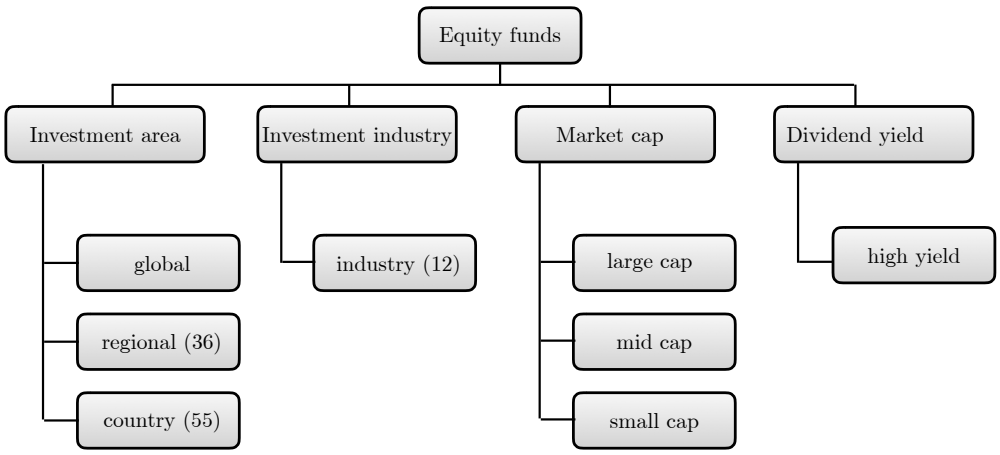


Figure 1: Breaking up equity funds into underlying stock holdings

fund are further broken down by investor category; and households, the objects of our study, are further subdivided by nationality of the investors that are filing equity holdings in that reporting country. For the equity funds we can also break down the investment style by geography, industry, size class and yield.

With these data we are able to complement, for every country of destination, direct holdings of households in individual shares with look-through equity holdings (via household holdings of funds, that is). We reconstruct the total equity portfolios of households by summing the individual equity holdings with the stock holdings of the equity funds. The steps followed to clean the data and obtain the "fund look-through" are described in Appendices A.1 and A.2. Most of the funds are specialised by area (the leftmost branch in Figure 1); industry funds, and cap- or yield-focused funds, are minor by numbers or invested amounts.

The look-through procedure for the equity funds means that we end up with three data sets of portfolio holdings. The first set contains the direct holdings in individual stocks, the second data set consists of the indirect holdings from the fund positions and the third dataset is the sum of the first two. Our baseline analysis is performed on the direct equity holdings, but we also run some regressions on the direct and indirect equity portfolios.

3.3 Benchmark portfolios

The actual portfolios are compared to no-bias benchmark portfolios. The latter are created based on a list of all shares; that is, they are created by merging the shares that are included the SHS holdings data and the equity list from Thomson Reuters Refinitiv. For each

stock we download its quarterly free-float market capitalisation (in millions of EUR). So the benchmarks are created based on free floated market values of stocks. Apart from market value, we also collect industry classification and dividend yield.

We construct country benchmarks for the calculation of AS and home and foreign bias. For the decomposition of equity funds we also create regional, industry, size and dividend yield benchmarks. All benchmarks are value weighted. The global benchmark includes all 51,284 stocks, covering 59 countries.

3.4 Home and foreign bias

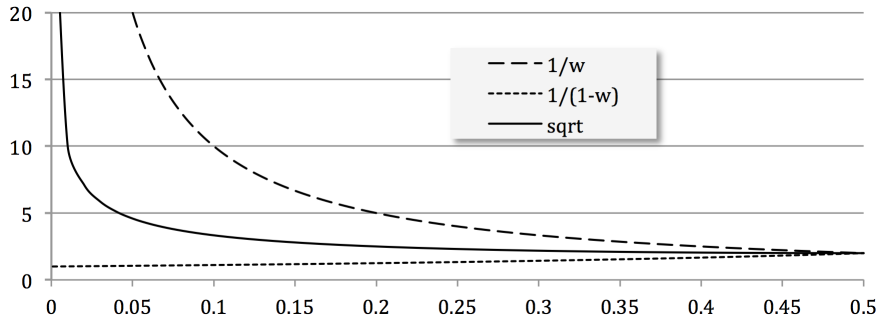
Let $y_{i,j}$ denote the weight assigned by the (aggregate) household investor from country i to shares from country j. The raw home bias of a home country i is calculated as the difference between the weight $y_{i,i}$ of domestic shares in i's total portfolio and the market-cap weight w_i of the home country in the global benchmark:

$$HB_i^{raw} := y_{i,i} - w_i. \tag{3}$$

The raw home bias creates some challenges. First, the economic meaning of a given amount of bias depends crucially on the size of the market, *i.e.* the benchmark weight w_i: a two-percent bias is small if the benchmark has $w = 0.30$, but may be more meaningful for a small country with $w = 0.005$. For this reason, many studies use a scaled version of the raw measure—sometimes w_i, sometimes $1 - w_i$. Cooper et al. (2013) critically review the scaling methods and propose to divide the raw home bias by $\sqrt{w_i(1 - w_i)}$. One motivation for the square-root weight is that it corrects for random deviations in a logical way. Specifically, if an investor picks stocks blindly in the sense that the chance of picking a home stock is w_i, then the expected home bias is zero and its standard deviation $\sqrt{w_i(1 - w_i)}$. Cooper et al. (2013) also rate the three competing scalers on the basis of a priori desiderata, and conclude the square-root rule does best. The three alternative weighting rules are plotted in Figure 2: (i) $1/w_i$, which applies huge multipliers to raw bias numbers for tiny markets; (ii) $1/(1 - w_i)$, which weighs most raw numbers rather equally; and (iii) the geometric average of those, whose multipliers are still large for tiny countries but fall much more rapidly in w_i. So in what follows, when we refer to home bias we have in mind the scaled version,

$$HB_i := \frac{y_{i,i} - w_i}{\sqrt{w_i(1 - w_i)}}, \tag{4}$$

Figure 2: **Scaling factors assigned to raw home- of foreign-bias figures: three alternatives**



Note For value weights between 0 and 0.5, the figure illustrates three weighting schemes for raw portfolio-bias. Raw bias equals $y_i - w_i$ with y_i an observed portfolio weight and w_i a market-cap weight. Most w_i numbers are below 0.1; the U.S. is the sole outlier. The competing weight schemes are (i) $1/w_i$, which assigns huge weights to raw bias numbers for tiny markets; (ii) $1/(1-w_i)$, which weighs raw numbers rather equally; and (iii) the geometric average of those, where weights are still huge for tiny countries but fall much more rapidly.

Following the same logic, the raw foreign bias is often defined as the difference of the weight of destination country j in home country i's total portfolio and the weight of destination country j in the benchmark,

$$FB^{raw}_{i,j} := y_{i,j} - w_j. \tag{5}$$

The same scaling issues arise as with home bias. An additional problem uncovered by Cooper et al. (2018), is that the raw foreign bias measures are highly correlated across different home countries. The reason is that actual foreign holdings y_j are small relative to w_j, meaning that the measure is dominated by the benchmark part w_i rather than the home countries' portfolio choices y_i. This commonality problem is much lower when the portfolio bias is scaled by $\sqrt{w_j(1-w_j)}$. For comparison, the average pairwise correlation between the raw foreign bias measures across home countries is equal to 0.81, while for the scaled $FB^{\dagger}$ this is only 0.44. A third issue is that aggregate raw foreign bias mirrors home bias; thus, the issue of why investors over-weight their home assets gets mixed up with the issue of which foreign countries receive more attention relative to others. For that reason, our raw foreign bias uses actual and benchmark weights that refer just to the foreign subportfolio:

$$y^{\dagger}_{i,j} := \frac{y_{i,j}}{\sum_{\forall k \neq i} y_{i,k}} = \frac{y_{i,j}}{1 - y_{i,i}}, \tag{6}$$

$$w^{\dagger}_{i,j} := \frac{w_j}{\sum_{\forall k \neq i} w_k} = \frac{w_j}{1 - w_i}. \tag{7}$$

This way we factor out the home bias effect from the foreign bias measures. For any given home country i both the $y^\dagger$-s and $w^\dagger$-s now sum to unity. Since the $y^\dagger$-s and $w^\dagger$ have comparable sizes, the benchmark parts can no longer dominate the series. Aggregate bias is zero per home country, and overweighting becomes roughly as frequent as under-weighting.

Like for home bias, when we refer to foreign bias we actually have in mind the scaled version, unless 'raw' is explicitly added as a subscript:

$$FB^{\dagger,raw}_{i,j} := y^\dagger_{i,j} - w^\dagger_{i,j}, \tag{8}$$

$$FB^{\dagger}_{i,j} := \frac{y^\dagger_{i,j} - w^\dagger_{i,j}}{\sqrt{w^\dagger_{i,j}(1 - w^\dagger_{i,j})}}. \tag{9}$$

Our main research question is whether any such over-weighting reflects familiarity or, instead, information-based selective investing. Active share, as defined below, is our first covariate related to underdiversification.

3.5 Active share (AS)

Following Cremers and Petajisto (2009), for each home country i, the active share of households from home country i in destination country j is equal to:

$$AS_{i,j} = 0.5 * \sum_{k(j)} |x_{i,k(j)} - w_{j,k(j)}|, \tag{10}$$

where $x_{i,k(j)}$ is equal to the proportion of investor i's portfolio invested in shares of the k-th company headquartered in destination country j, and $w_{j,k(j)}$ is the weight of stock $k(j)$ in the stock market of destination country j. If all holdings are concentrated in one or a few small stocks, AS approaches unity; it equals zero if the actual portfolio mimics the value-weighted local index. A portfolio specialising in the smallest size quartile has a higher AS than one focusing on the biggest size quartile. Thus if an investor holds a market-weighted country fund because of the familiarity of that country, they will have zero active share for that country. If in their direct holdings they deviate from the market portfolio within the country they will have positive active share. Both these measures will be measured independently of the amount invested in the country, since they depend only on the portfolio weights in the sub-portfolio for that country.

AS can be calculated from $x_{i,k(j)}$ interpreted as total holdings, but also as one of the two components of total holdings, *i.e.* either direct holdings or indirect holdings as imputed

from fund positions. Each resulting AS number can point to underdiversified subportfolios: even investments via a fund can be concentrated in, say, North-American small-cap stocks with high yields, which would leave the investor with positions in only a small intersection of the region's universe of shares. Yet the interpretation differs: AS^{dir} unambiguously reflects decisions about individual stocks, while AS^{ind} is based on style preferences or expectations about factor returns, possibly based on the history of what used to be called anomalies but not on information, perceived or true, about individual companies. So we define

$$AS^{dir}_{i,j} = 0.5 * \sum_{k(j)} |x^{dir}_{i,k(j)} - w_{j,k(j)}|, \tag{11}$$

$$AS^{ind}_{i,j} = 0.5 * \sum_{k(j)} |x^{ind}_{i,k(j)} - w_{j,k(j)}|, \tag{12}$$

with $x^{dir}_{i,k(j)}$ scaled such that $\sum_{k(j)} x^{dir}_{i,k(j)} = 1$ and likewise for $x^{ind}_{i,k(j)}$. The direct measure is the superior proxy for information-based trading in the stock-picking sense.

3.6 Funds' Weight as a measure of of non-selective investments

To test the hypothesis that the biases are driven by familiarity, we also use the proportion invested via funds rather than individual shares. There are essentially two ways for an investor to purchase foreign shares: directly, by picking out certain stocks, or indirectly by buying shares of a mutual fund. When investors buy funds, we suppose they do so because they seek exposure to a specific market at minimal transaction costs, not because they have an informational advantage about a specific company or industry. Therefore, we proxy index benchmarking by Funds' Weight (FW), the degree to which i's total investments into country-j equities is made via funds:[4]

$$FW_{i,j} = \frac{V^{Ind}_{i,j}}{(V^{dir}_{i,j} + V^{Ind}_{i,j})}. \tag{13}$$

where $V^{dir}_{i,j}$ is the total value of destination country j's shares held by investors from home country i through direct equity holdings and $V^{Ind}_{i,j}$ is the total value of destination country j's shares held by investors from home country i through mutual fund holdings.

[4]This treats all investments via funds as passive, which ignores the fact that some positions in industry funds may have been taken on the basis of superior insights or information. We could accordingly have treated all industry-fund holdings as active, information-based investments, but that procedure is likely to overshoot in the other direction. Given the small weight of industry funds in the total, their treatment is not likely to be material, all the more since the current (conservative) procedure already provides evidence in favor of information-based positions.

Table 1: **Control regressors: description and source**

Variable	Description	Source
lnGDP home	logarithm of the home country's GDP	World Bank
findev	financial development indicator	Global Competitiveness Index
colony	dummy equal to 1 for colonial linkage between home and host	CEPII database
comlang ethno	dummy equal to 1 common language spoken by min 9% of the population	CEPII database
ln distance	log of distance between home and host calculated following the great circle formula using latitudes and longitudes of the most important cities (in terms of population) or their official capitals	CEPII database
contiguous	dummy equal to 1 if home and host are contiguous	CEPII database
landlocked	dummy equal to 1 if home is landlocked	CEPII database
equity restrict	index of capital inflow restrictions in the destination country	Schindler (2009) and Fernandez et al. (2015)
tax burden	withholding tax on dividends in destination country times the country's average dividend yield	OECD and Thomson Reuters Eikon
political quality	political risk indicator	ICRG PRS Group
euro area	dummy if destination country is within the euro area	
equity restric	index of equity inflow restrictions in the destination country	Schindler (2009) and Fernandez et al. (2015)
bilat trade	Trade separateness between home and host	IMF and World Bank, following Cooper et al. (2018)

3.7 Foreign bias regressions

The regular gravity-type regression for foreign bias uses regressors Xs that refer to the home economy i, to the foreign economy j, or to both (*i.e.* bilateral things, like bilateral trade or common language). The set of controls used in this paper is described in Table 1. To this set of 'control' regressors we add, for every home country i and destination country j pair, AS and FW , as well as a time fixed effect.

For reasons discussed in Section 4.2 we anticipate asymmetries between over- and underweight positions in foreign bias. If, in implementing Equation (1) we segregate the data by sign of the regressee, that creates bias in OLS estimates of the coefficients, which we

mitigate by including an Inverse Mills Ratio (IMR) regressor, the normality-based expected value of the error terms that are cut off because of the sorting on sign.[5] Thus, we generate an overweight indicator, $\mathbf{1}^{+}_{i,j,t} = 1$ if $FB^{\dagger}_{i,j,t} > 0$ and 0 otherwise, and an underweight indicator, $\mathbf{1}^{-}_{i,j,t} := 1 - \mathbf{1}^{+}_{i,j,t}$. The $FB^{\dagger}$ regression then is the following specification of the basic Equation (1):

$$\begin{aligned} FB^{\dagger,scaled}_{i,j,t} &= \alpha_i + \alpha^{+}_i \cdot \mathbf{1}^{+}_{i,j,t} + \sum_{\forall k} \left\{ \beta^{+}_k \cdot [X_{k,i,j,t} \mathbf{1}^{+}_{i,j,t}] + \beta^{-}_k \cdot [X_{k,i,j,t} \mathbf{1}^{-}_{i,j,t}] \right\} \\ &\quad + \delta^{+} \cdot [\mathbf{1}^{+}_{i,j,t} AS_{i,j,t}] + \delta^{-} \cdot [\mathbf{1}^{-}_{i,j,t} AS_{i,j,t}] + \eta^{+} \cdot [\mathbf{1}^{+}_{i,j,t} FW_{i,j,t}] + \eta^{-} \cdot [\mathbf{1}^{-}_{i,j,t} FW_{i,j,t}] \\ &\quad + \gamma^{+} \cdot [IMR^{+}_{i,j,t} \mathbf{1}^{+}_{i,j,t}] + \gamma^{-} \cdot [IMR^{-}_{i,j,t} \mathbf{1}^{-}_{i,j,t}] + \zeta_t + e_{i,j,t}. \end{aligned} \tag{14}$$

The information hypothesis says that δ is positive and η is negative, while the familiarity hypothesis predicts a zero δ and a positive η. The relevant AS measure is the one for the subportfolio of direct holdings, this being the direct reflection of the investors' own choices. The indirect AS is not expected to matter under the information hypothesis: in our logic, investments via funds are not related to the investor's superior knowledge or insights about individual stocks or selected industries. At best, a low indirect AS would be an argument for an index tracker to invest more. The total AS , computed for the entire portfolio, is not helpful as a regressor: it is a non-linear combination of both component AS -s, whose weight $FW/(1 - FW)$ differs across observations. Taking into account also the fact that FW acts as a regressor of its own, the interpretation of the total AS would be quite unclear.

To test the hypotheses concerning excess returns we run regressions with the same basic set-up. Here, the unit of observation is an investor-foreign country pair (i, j) in quarter t. The dependent variable is the return on portfolio (i, j) in quarter t, a 3D panel; the controls are the same as those for FB regressions, except for the omission of the IMRs and the addition of FF world factors. Implicitly, then, the dependent variable is abnormal excess return measured relative to the Fama-French 3-factor model. The key independent variables are ActiveShare, FW, or Foreign Bias. We introduce them in two ways: first in their regular form like in Equation (2), and then with FW, AS and FB split into two series, conditioned on the sign of FB, like in Equation (14).

[5] Familiarly, this hinges on normality; but the results of the regressions without IMRs hardly differ from those with IMRs, even though the IMRs are significant.

4 Results

4.1 Home bias

Before running the regression test using foreign bias, in this section we discuss the home bias statistics, which are quite informative in themselves. Households, notably, are much less home biased than previously measured because the mutual funds they hold tend to be highly international, a feature ignored by most alternative measures.[6] This echoes results in Carvalho (2022) who studies look-through effects in the same data base.

Table 2 shows summary statistics for home bias for domestic investors. Panel A provides data on home bias for the overwhelmingly largest subset of investors, the 'natives'. For them, nationality and residence coincide so that there is no ambiguity about what 'home' means. We see that almost all domestic shares are held directly rather than through funds (FW is less than 15% for 95 percent of countries). Once we include indirect holdings, the median level of percentage home bias HB^{raw}_{dir} falls from 70.44% for direct holdings to $HB^{raw} = 45.05\%$ for aggregate positions including the 'look-through' holdings via funds. That is because the funds in which households invest have a median level of home bias HB^{raw}_{ind} of just 4.10%; thus, they are not typically home country funds. In short, the home bias measured without incorporating indirect holdings significantly overstates the level. The statistics for emigrants and immigrants, also shown in the table, are discussed below.

A second finding is that the AS measure is much higher for direct holdings than for indirect holdings through funds. By comparison with the level of AS reported in other studies, which usually refer to a few individual funds, the 45 percent level of AS in the (native) households' direct positions is rather high, especially when bearing mind that this bears on the aggregate of many households within a country rather than individual portfolios. For comparison, Boermans and Galema (2019) report that the average AS of Dutch pension funds is equal to 35 percent, and Cremers et al. (2016) report average AS numbers ranging from 69 percent for active funds and 16 percent for passive funds. Thus, even after aggregation across many entities, households are generating home bias by taking relatively active

[6] In the IMF portfolio survey, for instance, French investments in a Paris-run equities fund are classified as domestic investments, regardless of the fund's portfolio, etc. This no-look-through problem w.r.t. funds explains why *e.g.* IMF-reported German equity investments into Luxembourg amount to several times the market capitalisation of all Luxembourg stocks.

Table 2: **Home bias, active share and index benchmarking for the total, direct and indirect equity holdings, in percent**

	AS	AS_{dir}	AS_{ind}	HB^{raw}	HB^{raw}_{dir}	HB^{raw}_{ind}	FW
Panel A: Natives - Domestic portfolio							
Median	32.55	36.97	2.99	45.05	70.44	4.10	5.26
Average	41.57	44.76	6.32	44.61	62.63	6.97	6.59
Stdev	20.70	21.89	10.76	24.36	28.08	7.03	12.94
5 %ile	17.28	17.32	0.14	4.07	6.30	0.03	0.03
95 %ile	84.74	85.79	25.03	86.46	95.43	21.82	14.91
Panel B: Emigrants - Domestic portfolio (home = nationality)							
Median	34.74	64.74	4.94	0.01	-0.05	0.13	100.00
Average	41.42	65.27	10.72	1.45	2.56	0.18	71.37
Stdev	27.17	25.84	16.97	11.83	15.98	6.58	38.87
5 %ile	3.42	17.15	0.00	-2.09	-2.88	-1.37	2.28
95 %ile	93.60	99.95	37.24	15.69	24.64	5.34	100.00
Panel C: Immigrants - Domestic portfolio (home = residence)							
Median	52.95	62.70	2.33	17.83	74.35	5.53	8.56
Average	56.72	65.68	5.31	28.48	68.45	11.12	13.94
Stdev	20.41	18.48	10.62	28.44	26.97	15.24	18.85
5 %ile	29.30	38.62	0.00	0.00	15.76	0.00	0.16
95 %ile	91.58	95.41	22.48	89.15	99.79	40.76	51.66

Note The table provides descriptives for three types of domestic portfolios: (A) assets held by residents who are also nationals of the country ('natives'); (B) assets held by nationals who are not residents of their country of citizenship ('emigrants'); and (C) assets held by residents who are nationals of another country ('immigrants'). That is, in (B) and (C) we define a migrant's home by, respectively, residence and citizenship. Migrants' portfolios are much closer to the portfolios held by natives of their country of residence than to the one held by natives of their country of nationality. AS (active share—shown in percent, here) is one-half of the sum of absolute deviations between observed weights of home assets and their free-float market cap, and varies between zero (very passive) and almost unity (all money is in the smallest-cap stock). AS is also computed separately for the subportfolio of direct holdings (assets bought individually by the investor) and for the subportfolio of indirect holdings (assets held via mutual funds). Home bias (HB) is the deviation between the portfolio weight of all home assets held and the (free-float) market-cap weights of home assets, and Funds'Weight (FW) is the indirect holdings of home assets as a fraction of all home assets. HB and FW are in percent, like AS .

positions in home country stocks held directly rather than indirectly through funds. Consistent with the idea that aggregation lowers the calculated AS levels, we note that numbers for smaller investor sets, like the e- or immigrant groups, are much higher, at 65-66 percent on average, in line with the active funds of Cremers et al. (2016).

Overall, for natives home bias is driven by direct holdings of shares and these positions are very active. Indirect holdings of domestic stocks are relatively small, because the funds that are held have very little home bias. This is consistent with the information hypothesis and inconsistent with the familiarity explanation. For example, if the version of the familiarity hypothesis is overoptimism, we would expect to see large holdings of the domestic benchmark which could be held via a domestic index fund. A similar portfolio would satisfy the goal

Table 3: **Overweight of domestic holdings per reporting country by 'natives', in percent: total, direct, and indirect**

Country	HB	HB^{dir}	HB^{ind}	HB^{scaled}	HB^{scaled}_{dir}	HB^{scaled}_{ind}
CY	5.57	9.15	0.03	7.79	12.64	0.03
LV	17.35	36.63	0.12	117.07	249.91	0.73
NL	23.81	47.24	4.02	2.34	4.59	0.40
BE	26.56	51.83	3.06	3.05	5.89	0.35
AT	28.19	42.77	4.23	9.99	15.13	1.50
IE	34.14	38.54	2.14	3.79	4.27	0.24
IT	45.47	75.44	7.50	5.68	9.41	0.94
DE	51.17	69.37	19.35	3.33	4.51	1.26
PT	54.60	77.51	10.20	26.70	38.04	4.92
GR	57.65	87.63	10.16	32.23	48.57	5.76
SI	60.35	91.43	0.05	84.76	128.40	0.06
ES	81.15	95.46	4.47	9.57	11.27	0.53
FI	86.76	92.85	22.07	15.58	16.67	3.96

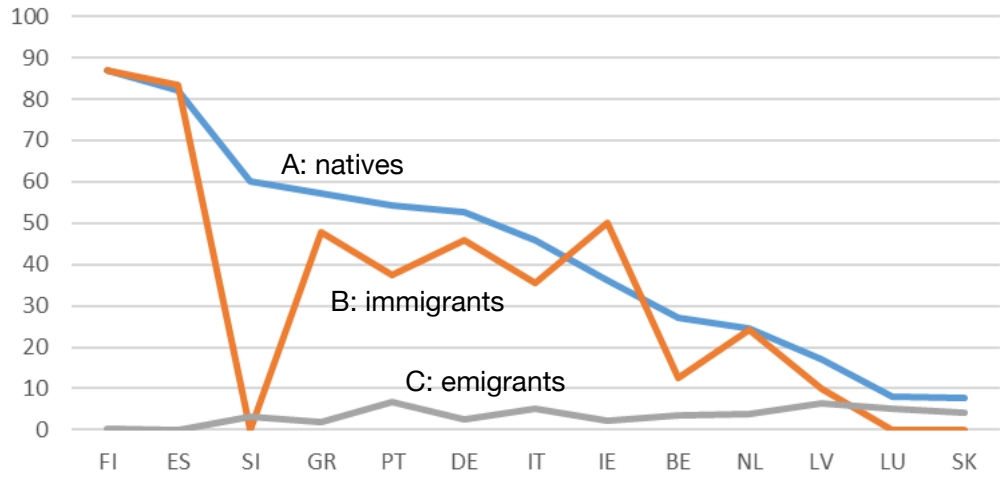
Note The table provides descriptives, by country, for domestic portfolios held by residents who are also nationals of the country ('natives'). Home bias (HB) is the deviation between the portfolio weight of all home assets held and the country's (free-float) market-cap weight, both measured in percent. The scaled version divides the raw weight gap by $\sqrt{w_i\,(1-w_i)}$, w_i being i's weight in the world market. Home bias is also computed separately for the subportfolio of direct holdings (assets bought individually by the investor) and for the subportfolio of indirect holdings (assets held via mutual funds). See footnote 3 for ISO country codes.

of keeping up with the Joneses, and also would be the most desirable if the behavioral explanation for home bias is a domestic benchmark bias.

Table 3 shows the raw and scaled home bias measures by home country, to verify to what extent the overall findings are valid for each country. In every single country, the 'look-through' measure of home bias is lower than the direct measure. For some countries, such as Italy, the difference is very substantial, indicating that the funds held are very international. Even though the direct holdings are highly home-biased and the amount held in funds is relatively small, in every single country the addition of the (very international) funds' holdings decreases the overall home bias substantially.

We now turn to the portfolios of immigrants and emigrants, where the definition of 'home' is not *a priori* clear, and we compare the HB summary statistics depending on whether we define home by place of residence ('immigrants') versus by nationality ('emigrants'). Figure 3 compares, for various reporting countries, the levels of domestic holdings for the three groups. It shows that the emigrants group exhibit very little bias towards their country of citizenship, whereas the immigrants exhibit a level of bias towards the country of residence that is almost as large as the natives', on average. Thus the typical immigrant group behaves

Figure 3: **Time-averaged weight of domestic holdings per reporting country by 'natives', 'emigrants', and 'immigrants' by reporting country**



Note The figure provides descriptives for the weights given to 'home' assets by three types of investors: (A) residents who are also nationals of the country ('natives'); (B) residents who are nationals of another country ('immigrants'); and (C) nationals who are not residents of their country of citizenship ('emigrants'). That is, in (B) and (C) we define a migrant's home by, respectively, residence and citizenship. Migrants' portfolios are much closer to the portfolios held by natives of their country of residence than to the one held by natives of their country of nationality. LV: Latvia; SI: Slovenia; SK: Slovakia.

far more like a set of natives than does the typical emigrants group.[7]

Panels B and C in Table 2 show more detailed summary statistics for home bias for the three groups, not broken down by country. The average level of home bias of domestic, emigrants, and immigrants in a country are 44.61, 1.45, 28.48 respectively, and the medians are even more different, at 45.05, 0.01, and 17.83 percent. The average proportions of funds are 6.59, 71.37, and 13.94 respectively, and the medians are again even more different, at 5.26, 100, and 8.56 percent. Thus, again, immigrants are much more like native investors than are emigrants, both in their level of home bias and in their level of fundholdings. Both domestic investors and immigrants hold largely direct portfolios with a high degree of home bias. Consistent with this result, emigrants treat their country of origin largely like other foreign countries, with a high degree of indirect investment and a low degree of portfolio bias toward their passport home country.

This observation has implications for the test design. First, for the purpose of evaluating

[7]A marked exception is Slovenia (SI), which has just a few dozen smallish home stocks. Austrians and Croats living in Ljubljana apparently do not think of this as their natural home market.

Table 4: **Foreign bias, active share and fundholdings for the total, direct and indirect equity holdings of foreign portfolios by 'natives'**

	AS	AS^{dir}	AS^{ind}	FB	FB^{dir}	FB^{ind}	FW
Panel A. Foreign portfolio overweights							
Median	14.54	59.14	7.26	0.07	0.83	0.12	99.23
Average	18.50	61.99	12.18	0.89	4.26	0.62	86.18
Stdev	16.36	19.38	12.34	2.61	8.27	1.21	22.36
5%ile	1.33	33.73	1.15	0.00	0.01	0.00	31.32
95%ile	52.35	95.78	38.96	4.48	22.05	3.13	100.00
Panel B. Foreign portfolio underweights (ABS)							
Median	12.47	83.04	9.98	0.10	0.11	0.15	99.75
Average	16.83	78.40	12.03	1.74	1.03	2.89	89.92
Stdev	14.64	18.40	8.53	5.88	4.29	7.66	18.37
5%ile	2.10	43.82	2.50	0.00	0.00	0.00	43.19
95%ile	48.44	99.54	29.42	8.09	3.24	25.17	100.00

Note The table provides descriptives for the foreign positions held by investors with clear nationality (residents who are also nationals — 'natives'). Positions in each destination country are treated as a full subportfolio with weights summing to unity. AS (active share) is one-half of the sum of absolute deviations between observed weights of home assets and their free-float market cap, and varies between zero (very passive) and almost unity (all money is in the smallest-cap stock). AS is also computed separately for the subportfolio of direct holdings (assets bought individually by the investor) and for the subportfolio of indirect holdings (assets held via mutual funds). Foreign bias (FB) for home i and host j is the deviation between (i) the value of all foreign assets from country-j held, expressed as a fraction of the value of all foreign assets held, and (ii) the (free-float) market-cap weights of the foreign country's assets in the universe of all non-i assets. Funds'Weight (FW) is the indirect holdings of country-j assets as a fraction of all country-j assets. All numbers are averaged across home countries i and host countries j.

the competing home bias theories, the portfolios held by immigrants can provide additional degrees of freedom to add to natives. For natives of country i alone there is only one observed portfolio per host country j, whereas for immigrants we have data for dozens of portfolios held within a given country of residence i, one for every country the investors immigrated from. In addition, the numbers of investors in a particular immigrants sample tend to be much smaller than that for the natives' sample, so that any possible aggregation effect in AS is much subdued. A second implication is that, in regressions of non-natives' foreign bias, the regressors that are linked to access to information about foreign markets (like language or distance) should refer to the country of residence not of nationality.

4.2 Foreign bias: descriptives and test design

In this Section we discuss the results regarding foreign bias. Recall that, in the foreign-bias calculations following Equations (8) and (9), the home-bias effect is taken out and the

resulting foreign bias numbers are standardised via the squareroot scaler. A first observation is that, in contrast to domestic holdings, foreign holdings are almost entirely through funds; it is highly unusual to hold large amounts of direct holdings of foreign stocks, and one plausible reason is higher transaction costs. Second, these funds are still well-diversified, but less so than the indirect positions held in the home market: AS numbers are 12–18, which is still 2–3 times the home level. Third, the direct holdings, small though they are in size, are quite active, at 60–80% rather than 45% in the domestic positions. On balance, though, the typical total level of active share in foreign holdings remains much lower than for domestic holdings, which is consistent with the main informational advantage being related to domestic stocks. [Ps:] OK?

We allow for the possibility that the coefficients for countries that are overweight are different to those for countries that are underweight. It is easier to overweight the aggregate holding in a foreign country by a large amount than to underweight it by an equivalent amount. In the data, positions in individual shares are no lower than zero, possibly reflecting shortselling costs, and this places a natural limit on the degree of underweighting of the portfolio held by investors from country i in foreign country j. Consistent with this view that shortselling issues do truncate weights at zero, we see that in absolute terms the overweight $FB^{\dagger}$ observations are larger than the negative ones. The presence of many zero weights in underweight portfolios produces a larger AS, which is what we do see when AS^{dir} and AS^{ind} are compared separately between over- and underweight positions.[8] But if part of the zero weights do reflect shortselling problems, then this high AS is still underestimating the information the investor has, because the first-best negative weights would have been even further from the benchmark weights than the zeroes we observe. All these considerations motivate us to let the regression coefficients differ across over- and underweight portfolios.

Given this estimation approach, the descriptives for $FB^{\dagger}$ shown in Table 4 bear on (natives') $FB^{\dagger}$ numbers sorted by sign, with Panel A for overweights and B for underweights. The table illustrates the claims we just advanced to motivate the split-$FB^{\dagger}$ approach. First, within the set of foreign investments, underweight foreign portfolios have a higher AS values

[8]The overall AS is somewhat smaller for underweight positions. This does not contradict the observation on the component AS numbers: (i) the weights of direct versus indirect investments differ across countries, and (ii) because of the absolute value operations, the total AS is not a linear combination of the component AS-s.

Table 5: **Summary statistics for covariates — natives.**

variable	Nobs	Mean	StDev	Min	Max
Main test equation					
FB scaled	14.426	0.045	0.220	−0.794	3.625
AS foreign	14.426	18.196	15.809	0.031	95.357
lnGDP home	14.426	26.740	1.492	23.041	30.626
findev	14.426	4.406	0.747	2.494	6.015
colony	14.426	0.032	0.177	0.000	1.000
comlang ethno	14.426	0.068	0.252	0.000	1.000
ln distance	14.426	8.127	1.030	5.153	9.883
contiguous	14.426	0.047	0.212	0.000	1.000
landlocked	14.426	0.101	0.301	0.000	1.000
tax burden	14.426	0.536	0.808	0.000	8.971
'Exclusion' variables used in Inverse Mills regressor					
euro area	14.426	0.249	0.433	0.000	1.000
political quality	14.426	71.983	11.096	42.500	89.000
equity restric	14.426	0.287	0.379	0.000	1.000
bilat trade	14.091	6.775	2.426	0.000	12.551

Note Foreign bias, as defined in the preceding table, is rescaled by $\sqrt{w_j(1-w_j)}$, dichotomised as overweight or underweight, and submitted to a Heckman selection-model procedure. The table describes the left- and right-hand-side variables in the main equations for over- or underweight $FB^{\dagger}$s and in the probit equations. The variables are as defined in Table 1.

both in direct and indirect holdings. Second, overweights are typically larger indeed than the underweights, in absolute value, whether one looks at the average, the percentiles, or the standard deviation. The regressors for the Probit and the main equation, lastly, are those listed and defined in Table 1. Table 5 provides summary statistics for these covariates.

4.3 Foreign bias: results

Table 6 presents the regression results. All standard errors (shown in parentheses) are robust. In all columns, the regressee is total foreign bias standardised with the squareroot scaler, see Equation (9), but the results are robust to omitting this standardisation, as reported in Section 5.1. In each of the four column groups—(a) to (d)—we see separate coefficients for the positive and negative $FB^{\dagger}$ observations; the column groups differ in terms of the AS proxy/proxies used on the right-hand side. Panel A2 shows the coefficients of AS and FW weighted by the standard deviation of the regressor, so as to provide a scale-free impression of the economic relevance of the regressor.

To test the information hypothesis, direct AS for overweight countries is the most valid

Table 6: **Foreign bias (total, natives): role of active share and fund weights**

	(a)		(b)		(c)	
	overw	underw	overw	underw	overw	underw
A1. Main regressors						
AS^{dir}	0.001***	0.000***	0.001***	0.000***		
	(0.000)	(0.000)	(0.000)	(0.000)		
AS^{ind}			−0.000	−0.000**	0.001***	−0.000
			(0.000)	(0.000)	(0.000)	(0.000)
FW	−0.006***	−0.001***	−0.006***	−0.001***	−0.005***	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
A2. id., standardised						
AS^{dir}	0.102***	0.0624***	0.103***	0.066***		
AS^{ind}		0	−0.004	−0.013**	0.032***	−0.008
FW	−0.904***	−0.118***	−0.904***	−0.124***	−1.066***	−0.020
B. Control regressors						
ln GDP home	0.013***	−0.081***	0.013***	−0.082***	0.012***	−0.063***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
findev	0.006	−0.077***	0.006	−0.077***	0.001	−0.044***
	(0.005)	(0.004)	(0.005)	(0.004)	(0.004)	(0.002)
colony	0.227***	−0.106***	0.227***	−0.109***	0.212***	−0.056***
	(0.037)	(0.021)	(0.037)	(0.021)	(0.035)	(0.012)
comlang ethno	−0.036	−0.009	−0.036	−0.007	−0.034	−0.002
	(0.026)	(0.009)	(0.026)	(0.009)	(0.024)	(0.005)
ln distance	−0.026***	0.026***	−0.026***	0.026***	−0.016***	0.011***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
contiguous	0.136***		0.135***		0.140***	
	(0.018)		(0.018)		(0.018)	
landlocked	−0.083***	−0.012	−0.083***	−0.011	−0.055***	−0.016**
	(0.006)	(0.016)	(0.006)	(0.016)	(0.004)	(0.008)
equity restrict	0.031**	0.024**	0.031**	0.022**	0.036***	0.022***
	(0.013)	(0.011)	(0.013)	(0.011)	(0.005)	(0.005)
tax burden	−0.006**	−0.010*	−0.006**	−0.009*	−0.007***	−0.009***
	(0.003)	(0.005)	(0.003)	(0.005)	(0.001)	(0.003)
inverseMills	−0.000***	0.000*	−0.000***	0.000*	−0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.304***		2.318***		1.756***	
	(0.071)		(0.071)		(0.055)	
fb overw dummy		−2.005***		−2.008***		−1.453***
		(0.087)		(0.095)		(0.072)
Observations (,000)	9.300		9.300		14.091	
R^2 (Adj)	0.517		0.517		0.503	

Note Foreign bias, as defined in the preceding tables, is rescaled by $\sqrt{w_j(1-w_j)}$, dichotomised as overweight or underweight, and submitted to a Heckit procedure. Here, $FB^{\dagger}$ is for the totality of all foreign assets from country j held. The regressors of interest are AS and FW. AS is one-half of the sum of absolute deviations between observed weights of home assets and their free-float market cap, and varies between zero (very passive) and almost unity (all money is in the smallest-cap stock). AS is also computed separately for the subportfolio of direct and indirect holdings. FW is the indirect holdings of country-j assets as a fraction of all country-j assets. For AS , 'direct' refers to the portfolio of assets bought as individual country-j shares, and 'indirect' to the country-j shares held via funds. All portfolios are those held by natives, *i.e.* investors who live in their country of nationality. The standardised coefficients in Panel A2 are defined as the coefficients multiplied by the standard deviation of the regressor, and provide an impression of the economic relevance of the regressors. The control variables are as defined in Table 1. Robust standard errors in parenthesis. *, ** and ** denote significance at the 10, 5, and 1 percent level, respectively.

version, as this reflects the investor's active choices unconstrained by short-selling costs and restrictions. Recall that, under the information hypothesis, we expect a positive coefficient for direct AS and a negative one for FW, and have no priors about the coefficient of indirect AS. In regression version (a), where the direct version of AS is the regressor, the coefficient is positive and significant whether one considers over- or underweight portfolios. In addition, the coefficient for FW is significant and negative, in both under- and over-weighted positions. All this is consistent with the information-based choice model. We initially leave aside the size of the coefficients and the question whether the size of the AS coefficient is consistent with an equilibrium where the expected return from active trading could be sufficient to offset the foregone benefit of international diversification.

Regression (b) shows the effect of adding AS for indirect holdings along with that for direct, and regression (c) shows the result for indirect only. Recall that we do not expect the indirect AS to matter, under the information hypothesis. We see that the coefficients of direct AS are unaffected by the addition of indirect AS . The coefficient for the indirect AS itself, in contrast, seems unstable: in regression (b) it is negative for underweight $FB^{\dagger}$-s and zero for overweight observations while in regression (c) it is positive for the overweight AS and zero for the underweight ones. Besides being unstable, the coefficients are much less impactful than those of the direct AS (see part A2).[9] In all three regressions, lastly, FW comes up with a negative weight that is not just significant but also economically much larger than the direct AS effects, let alone the indirect AS effect. Overall, then, these results are consistent with the information hypothesis, but a version of it where information is used primarily to take overweight positions rather than actively reacting to negative news by underweighting or even short-selling. Also the results for FW are consistent with the information motivation. More overweighting is associated with less investment via funds, *i.e.* with more via direct holdings of shares. This is true for all specifications, and for both overweight and underweight positions. The coefficient is significant in six of the eight columns. The fact that the two exceptions are underweight columns again suggests that there is less ability to implement informational motives for portfolio holdings by underweighting.

The difference between the coefficients in the overweight and underweight regressions confirms the importance of splitting the sample in this way. Interestingly, the coefficients

[9]Recall that this panel reports results for regressors multiplied by the regressor's standard deviation so as to show the relative effect of what are known to be important covariate associated with foreign bias.

of some of the important control variables (such as distance) also flip between the two regressions. Given the importance of some of these variables in the standard gravity model of international investment, this result suggests that regressions that fail to distinguish between overweight and underweight positions may be generally mis-specified, not only for tests of the type we do here.

4.4 Excess returns

In this section we present the results regarding excess returns. The structure of these regressions is similar to those regarding foreign bias, with a three-dimensional panel of 19 quarters, 13 reporting home countries, and 59 destination countries. The dependent variable now is the quarterly excess return on the country-i 'native' investor's holdings of country-j shares, implicitly measured relative to the Fama-French three-factor model as the FF factors are added as regressors. Quarterly returns, in EUR, are measured in excess of the short-end Bund rate and regressed on covariates describing foreign bias ($FB^{\dagger}$), Active Share (AS), and Funds' Weight (FW). In regressions (2) and (4)-(7) we let the $FB^{\dagger}$, AS and/or FW coefficient vary depending on $FB^{\dagger}$'s sign. The dummy for positive $FB^{\dagger}$ is added not just to accommodate sign-dependent slopes but also for its interpretation as the excess return given being over-weight *per se*, *i.e.* regardless of by how much. The control regressors include the standard ones in gravitation models. The Fama-French world factors are compounded from daily numbers available on K. French's website. The mean quarterly excess return on the average portfolio is 2.04 percent, which drops to an average alpha of 0.34 after controlling for the FF factors.

Table 7 summarizes our regression output. Overall, the results are consistent with the information hypothesis. The relationship between AS and excess returns is significantly positive in all specifications. The relationship with FW is either insignificant or weakly significant and positive. The $FB^{\dagger} > 0$ Indicator variable is strongly positively related to excess returns, as the information hypothesis predicts.

Given that foreign bias is positive, the size of the overweight does not seem to matter much, which is mildy puzzling but could just reflect a power issue. More puzzlingly, though, when there is an underweight, its size does matter and is negatively related to expected return, which is predicted by neither the information nor the familiarity hypotheses. It may be the result of the difficulty of measuring foreign bias within this group because of

Table 7: **Excess returns on investors' foreign-shares subportiolio: relation to bias, active share, fund weights and gravity covariates**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Main regressors							
A.1 Foreign Bias (FB^{dir})							
FB^{dir} (scaled)	-0.407^{*}		-0.389^{*}				
	(0.234)		(0.234)				
indicator $FB^{dir} \geq 0$		0.759^{*}		1.202^{***}	1.322^{***}	1.310^{***}	1.199^{***}
		(0.403)		(0.430)	(0.439)	(0.431)	(0.448)
$FB^{dir}\|FB^{dir} \geq 0$ (scaled)		-0.231		-0.251	-0.146	0.025	-0.069
		(0.252)		(0.253)	(0.260)	(0.290)	(0.301)
$FB^{dir}\|FB^{dir} \leq 0$ (scaled)		-4.469^{***}		-4.288^{***}	-3.801^{***}	-3.557^{***}	-3.577^{***}
		(1.218)		(1.214)	(1.299)	(1.310)	(1.311)
A.2 Active Share (AS)							
AS (foreign, direct)			0.032^{***}	0.037^{***}		0.033^{***}	
			(0.009)	(0.009)		(0.009)	
$AS\|FB^{dir} \geq 0$					0.030^{***}		0.043^{***}
					(0.011)		(0.013)
$AS\|FB^{dir} \leq 0$					0.038^{***}		0.028^{**}
					(0.009)		(0.011)
A.3 Funds' Weight (FW)							
$FW\|FB^{dir} \geq 0$						0.011	0.008
						(0.012)	(0.012)
$FW\|FB^{dir} \leq 0$						0.017^{*}	0.025^{**}
						(0.009)	(0.011)
B. Control regressors							
ln GDP	0.133	-0.003	0.162	0.057	0.083	0.131	0.151
	(0.114)	(0.144)	(0.114)	(0.143)	(0.148)	(0.154)	(0.155)
findev	0.155	0.173	0.139	0.204	0.226	0.313	0.343
	(0.215)	(0.218)	(0.216)	(0.219)	(0.222)	(0.235)	(0.235)
colony	0.760	0.612	0.944	0.832	0.854	0.811	0.766
	(0.793)	(0.802)	(0.800)	(0.810)	(0.811)	(0.810)	(0.813)
comlang ethno	-0.643	-0.637	-0.728	-0.706	-0.702	-0.516	-0.443
	(0.470)	(0.473)	(0.475)	(0.477)	(0.477)	(0.483)	(0.488)
ln distance (in km)	-0.000	0.076	-0.125	0.045	0.017	-0.049	-0.092
	(0.156)	(0.191)	(0.161)	(0.191)	(0.194)	(0.200)	(0.201)
landlocked	0.997^{**}	0.976^{**}	1.270^{***}	1.297^{***}	1.320^{***}	1.304^{***}	1.291^{***}
	(0.399)	(0.400)	(0.404)	(0.408)	(0.409)	(0.409)	(0.409)
equity restrict	-1.941^{***}	-2.005^{***}	-2.998^{***}	-3.422^{***}	-3.552^{***}	-3.689^{***}	-3.632^{***}
	(0.708)	(0.720)	(0.783)	(0.823)	(0.828)	(0.824)	(0.829)
tax burden	-0.111	-0.122	-0.012	-0.003	0.009	0.029	0.038
	(0.284)	(0.284)	(0.284)	(0.284)	(0.284)	(0.285)	(0.285)
Market return FF factor	1.058^{***}	1.058^{***}	1.061^{***}	1.062^{***}	1.062^{***}	1.063^{***}	1.063^{***}
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Small minus Big FF factor	-0.336^{***}	-0.336^{***}	-0.340^{***}	-0.338^{***}	-0.338^{***}	-0.339^{***}	-0.339^{***}
	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)
High minus Low FF factor	0.174^{***}	0.175^{***}	0.173^{***}	0.174^{***}	0.174^{***}	0.174^{***}	0.174^{***}
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Constant	-3.493	-1.194	-5.029	-5.061	-5.601	-7.813	-8.460^{*}
	(3.539)	(4.585)	(3.492)	(4.559)	(4.647)	(4.963)	(4.992)

Note We consider, for every country, the foreign portfolios held by investors whose nationality and residence coincide ('natives'). Quarterly returns, in EUR, are measured in excess of the short-end Bund rate and regressed on covariates measuring, or related to, foreign bias (FB), Active Share (AS), and Funds'Weight (FW). $FB^{\dagger}$ is measured relative to the direct non-domestic part of the portfolio, and standardised using the sqrt measure, see equation (9). Active share and FW are defined in Equations (13), (11) and (12). In regressions (2) and (4)-(7) we let the coefficient vary depending on FB's sign. The control regressors include the standard ones in gravitation models as defined in Table 1, and the FF world factor returns. Robust standard errors in parenthesis. *, ** and ** denote significance at the 10, 5, and 1 percent level, respectively.

the truncation at zero holdings caused by the absence of short-selling. This unexpected relation is so pronounced that it dominates the marginal slope, not conditioned on over- and underweight (see regressions (1) and (3)), which becomes borderline negative.

The foreign portfolios are slightly levered w.r.t. the market, and tilted towards both large stocks and away from 'value' firms. A very interesting feature of the results is that two variables that are commonly highly significant in foreign bias regressions, GDP and distance, are insignificant in all specifications of the regression of excess returns on $FB^{\dagger}$ and AS . Although these variables are related to foreign bias, they are not related to excess returns in any way other than through their relationship with foreign bias. Thus they cannot be proxies for information that is not captured in the level of foreign bias.

4.5 How large is the 'information' effect, and is it rational?

Overall, the results for both home bias and foreign bias are consistent with the information hypothesis and inconsistent with the familiarity hypothesis. In this section we discuss whether the amount of active position-taking and excess returns are sufficient to offset the foregone diversification benefits. The economic size of the information effect on portfolio composition is shown in Panel A2 inserted after the coefficients for AS and FW in Table 6. The single most important regressor, in terms of stdev-corrected coefficient, is FW. AS looks less decisive, but its standardized coefficient still amounts to almost half of that of GDP (not shown in its standardised version), which is known to be a very important indicator of foreign bias. This is true even though the regression includes other variables that are commonly taken as proxies for information, such as distance, as well as AS . One interpretation of the distance variable is that it is a proxy for information, so it could be absorbing a large part of the coefficient of AS. Thus the relationship between AS and foreign bias is quite significant economically, and could be larger than we measure if other variables are absorbing part of the effect.

The rationality of the AS choice depends on whether it leads to excess returns that are sufficient to offset the foregone diversification benefits. For foreign bias we measure a difference in excess returns between the overweight and underweight foreign countries of 0.8%-1.3% per quarter. Estimates of the foregone diversification resulting from the foreign bias can be converted into equivalent expected return measures. For developed markets like those in our sample, such estimates are of the order of a few percent at most. Hence

our results are consistent with the informational advantage from 'close' countries resulting in overweighting that is rational, given the trade-off between extra return and foregone diversification.

For home bias we do not estimate the excess return on the overweight holdings, because of the limited degrees of freedom. However, we note that Cremers and Petajisto (2009) report, for US large all-equity mutual funds, active share amounts to between 20 and 100 percent. The average AS of the home portfolios in our sample is 41.57 percent, similar to the low-medium end of the range for the US mutual funds. This is a high level of active share, given that we are looking at the aggregate portfolio of all households in a country rather than individual funds. For the funds with highest AS in their sample, Cremers and Petajisto (2009) report an alpha of 1.51% (page 3351). As with foreign bias, estimates of the foregone diversification resulting from the home bias can be converted into equivalent expected return measures. Such estimates range from 1.5% upwards (Cooper et al., 2013), given standard measures of home bias. Given that our look-through of funds results in a lower level of home bias, the level of active share is consistent with a rational belief in the value of information about the home market if it results in a level of excess return similar to that for the high AS funds in the Cremers and Petajisto (2009) sample. Thus it is plausible that the level of AS is a rational reflection of the trade-off between superior information about home assets and foregone diversification.

5 Additional tests and discussion

5.1 Using an unscaled measure of foreign bias

In one robustness test we repeat the regression of foreign bias on AS and FW using the raw measure of foreign bias, (8), rather than the scaled measure, (9). As we have discussed above, we strongly prefer the scaled measure but some literature uses the raw measure so we repeat the tests here using that. Table 8 presents our results. The coefficients of AS remain significantly positive and those on FW significantly negative, confirming the robustness to the raw measure.

5.2 Tests on Immigrants' foreign bias data

Table 8: **Robustness check: the unscaled Foreign Bias measure as dependent variable.**

	(1)	(2)	(3)
A. Main regressors			
$AS^{dir}\|FB > 0$	0.006***	0.003	
	(0.002)	(0.002)	
$AS^{dir}\|FB < 0$	0.011***	0.009***	
	(0.002)	(0.002)	
$AS^{ind}\|FB > 0$		0.030***	0.025***
		(0.003)	(0.002)
$AS^{ind}\|FB < 0$		0.037***	0.032***
		(0.006)	(0.004)
benchmark$\|FB > 0$	−0.076***	−0.076***	−0.065***
	(0.004)	(0.004)	(0.003)
benchmark$\|FB < 0$	−0.046***	−0.044***	−0.033***
	(0.004)	(0.004)	(0.003)
$FB > 0$ indicator	3.332***	3.557***	3.603***
	(0.543)	(0.535)	(0.425)
A. Control regressors			
gdp d ln	0.820***	0.911***	0.707***
	(0.021)	(0.024)	(0.017)
findev	0.570***	0.640***	0.473***
	(0.041)	(0.044)	(0.030)
nshares	−0.002***	−0.002***	−0.002***
	(0.000)	(0.000)	(0.000)
colony	1.767***	1.803***	1.097***
	(0.406)	(0.404)	(0.331)
comlang ethno	0.581***	0.460**	0.398***
	(0.194)	(0.199)	(0.150)
ln distance	−0.214***	−0.205***	−0.168***
	(0.035)	(0.036)	(0.027)
landlocked	−1.016***	−0.960***	−0.675***
	(0.081)	(0.081)	(0.052)
equity restrict	−0.067	0.066	0.462***
	(0.108)	(0.109)	(0.051)
tax burden	−0.065*	−0.099***	−0.084***
	(0.034)	(0.037)	(0.020)
inverseMills direct	0.000	0.000	0.000**
	(0.000)	(0.000)	(0.000)
Constant	−18.674***	−21.703***	−16.198***
	(0.711)	(0.827)	(0.604)
Observations	9,300	9,300	14,091
R-squared	0.741	0.743	0.725
Adj-r2	0.740	0.742	0.724

Note In this table, the dependent variable is still foreign bias, but unscaled; that is, we use (8) rather than (9). Otherwise the regressions follow those reported in Table 6. Robust standard errors in parenthesis. *, ** and ** denote significance at the 10, 5, and 1 percent level, respectively.

As a further robustness test we apply the foreign bias regression to the data for immigrants and emigrants, treating them as if their home country is that of residence (emigrants) for reasons explained above. Table 9 shows the results of a three-dimensional panel test (time,

residence, nationality). There are far more portfolios available for analysis, this way, but this comes at a double cost. First, the numbers of investors per cell are very much lower, which brings more noise. Second, there may be more heterogeneity in the immigrants data set than in the natives': although the average immigrant behaves more or less like a native, immigrants may still exhibit different international investing preferences along with the effect we are studying.

Unsurprisingly, then, the R^2 drops from about 0.50 (natives) to about 0.10 (immigrants),[10] consistent with the there being more noise and/or more heterogeneity. However, the main result, that the direct measure of AS has a positive slope in overweight countries, remains valid for the immigrant data. The indirect AS measure exhibits a negative association, but recall that this measures is hard to interpret. FW has a significantly negative coefficient for all overweight regressions, consistent with the information explanation. Equally on the positive side, the coefficients for direct AS and FW are algebraically larger than those we saw in the natives' sample, which may be consistent with the idea that in the natives' sample AS is at a greater level of aggregation and that may reduce the size of the information effect. We discuss aggregation further below.

5.3 Aggregation: a discussion

Our tests use of aggregate household data, and one might argue that this could mask some information effects if they are hidden by the aggregation of individual portfolio choices. We argue, however, that the relevant test is the one conducted on aggregate data, for both theoretical and empirical reasons.

Theoretically, home bias and foreign bias are aggregate phenomena. The fact that portfolios are home biased is interesting mainly because this is true in aggregate, and not just for some individuals. In order for an explanation to be plausible it must, therefore, operate at an aggregate level. If, for example, investors could generate excess returns on their home market by holding active positions then that would have to be true for the average investor and, therefore, also for the aggregate investor. The simple algebra of excess returns forces this to be the case. To put it the other way, if the active shares of individual investors disappear when they are aggregated it would mean that in aggregate they hold the index

[10] And about 0.03 for the emigrants.

Table 9: **Foreign bias (total; immigrants and emigrants): role of active share and fund weights**

	Immigrants' portfolios (home = residence)						Emigrants' portfolios (home = nationality)					
	(a)		(b)		(c)		(a)		(b)		(c)	
	overw	underw	overw	underw	overw	underw	overw	underw	overw	underw	overw	underw
AS^{dir}	0.007***	−0.000	0.007***	0.000			−0.021***	0.001**	−0.022***	0.001**		
	(0.001)	(0.000)	(0.001)	(0.000)			(0.006)	(0.001)	(0.006)	(0.001)		
AS^{ind}			−0.003***	−0.000***	0.000	−0.000***			0.012	0.000	0.007	0.000
			(0.001)	(0.000)	(0.000)	(0.000)			(0.010)	(0.001)	(0.006)	(0.001)
FW	−0.017***	0.000***	−0.017***	0.000***	−0.016***	0.001***	−0.062***	0.001***	−0.062***	0.001***	−0.060***	0.002***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.006)	(0.000)	(0.006)	(0.000)	(0.006)	(0.000)
ln GDP	0.073***	−0.025***	0.065***	−0.025***	0.061***	−0.020***	−0.643***	−0.043***	−0.608***	−0.043***	−0.437***	−0.040***
	(0.004)	(0.001)	(0.006)	(0.001)	(0.005)	(0.001)	(0.116)	(0.003)	(0.117)	(0.003)	(0.080)	(0.002)
findev	0.011	−0.018***	0.004	−0.018***	0.007	−0.010***	−0.338***	−0.030***	−0.305***	−0.031***	−0.273***	−0.031***
	(0.011)	(0.002)	(0.013)	(0.002)	(0.010)	(0.001)	(0.039)	(0.005)	(0.043)	(0.005)	(0.033)	(0.003)
colony	0.192***	0.013*	0.191***	0.014*	0.176***	0.004	0.292***	−0.042	0.295***	−0.053**	0.299***	−0.008
	(0.038)	(0.008)	(0.038)	(0.008)	(0.033)	(0.005)	(0.093)	(0.027)	(0.095)	(0.021)	(0.067)	(0.019)
comlang ethno	0.010	0.001	0.017	0.001	−0.004	−0.006	−0.386***	0.072***	−0.422***	0.085***	−0.463***	0.074***
	(0.026)	(0.009)	(0.025)	(0.008)	(0.020)	(0.005)	(0.060)	(0.024)	(0.077)	(0.023)	(0.062)	(0.020)
ln distance	−0.030***	0.031***	−0.033***	0.030***	−0.013**	0.021***	−0.021	−0.027***	−0.009	−0.025***	−0.028	−0.001
	(0.006)	(0.004)	(0.006)	(0.004)	(0.005)	(0.002)	(0.089)	(0.006)	(0.098)	(0.005)	(0.069)	(0.003)
contiguous	−0.149***	0.071***	−0.158***	0.070***	−0.219***	0.066***	−0.908***	−0.086**	−0.870***	−0.089**	−0.660***	−0.099**
	(0.020)	(0.009)	(0.020)	(0.009)	(0.024)	(0.007)	(0.217)	(0.036)	(0.227)	(0.036)	(0.162)	(0.038)
landlocked	−0.147***	0.004	−0.152***	0.003	−0.139***	0.008***	−0.864***	0.025**	−0.843***	0.026**	−0.521***	0.016***
	(0.013)	(0.004)	(0.014)	(0.004)	(0.012)	(0.002)	(0.141)	(0.011)	(0.142)	(0.012)	(0.073)	(0.006)
equity restrict	−0.066	0.010	−0.071	0.006	0.061***	−0.010***	1.692***	0.014	1.723***	0.024	0.874***	0.067***
	(0.044)	(0.007)	(0.046)	(0.007)	(0.015)	(0.003)	(0.277)	(0.029)	(0.268)	(0.023)	(0.130)	(0.009)
tax burden	−0.050***	−0.011***	−0.048***	−0.010***	−0.041***	−0.016***	0.161***	−0.014*	0.153***	−0.015**	0.097***	−0.013***
	(0.006)	(0.002)	(0.006)	(0.002)	(0.004)	(0.002)	(0.043)	(0.007)	(0.040)	(0.007)	(0.026)	(0.004)
inverseMills	0.000***	−0.000***	0.000***	−0.000***	0.000***	−0.000***	0.000*	−0.000***	0.000	−0.000***	0.000	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
fb dum	−0.778***		−0.524*		−0.100		24.524***		23.240***		17.507***	
	(0.194)		(0.282)		(0.265)		(4.177)		(4.329)		(2.992)	
Constant	0.451***		0.471***		0.307***		1.271***		1.302***		1.066***	
	(0.047)		(0.047)		(0.031)		(0.215)		(0.201)		(0.120)	
Nobs (000)	65.278		65.278		94.38		89.105		89.105		127.285	
R-squared	0.107		0.107		0.101		0.030		0.030		0.025	
Adj-r2	0.106		0.106		0.101		0.029		0.029		0.025	

Note Foreign bias, as defined in the preceding tables, is rescaled by $\sqrt{w_j(1-w_j)}$, dichotomised as overweight or underweight, and submitted to a Heckit procedure. Here, $FB^{\dagger}$ is for the totality of all foreign assets held from country j . The regressors of interest are AS and FW. AS is one-half of the sum of absolute deviations between observed weights of home assets and their free-float market cap, and varies between zero (very passive) and almost unity (all money is in the smallest-cap stock). AS is also computed separately for the subportfolio of direct and indirect holdings. FW is the indirect holdings of country-j assets as a fraction of all country-j assets. For AS , 'direct' refers to the portfolio of assets bought as individual country-j shares, and 'indirect' to the country-j shares held via funds. The control variables are as defined in Table 1.

and, therefore, in aggregate they could not generate excess returns. Therefore, their active trading could not be a rational explanation for the aggregate home bias.

The empirical reason to prefer to base the test on aggregate data is that the cross-sectional regressions we run include holdings in various countries, of various sizes, with various characteristics. If we ran the test using data on portfolios of individuals, their idiosyncratic choices would show up as extreme values of many of the variables and it is unlikely that the regressions would be even vaguely well specified. Using aggregate data gives a much better empirical specification. The fact that we get similar results for our main test when we use the native data and the immigrant data suggests that this is so.

6 Conclusions

We test two competing theories of international equity portfolio biases: informational advantage versus the behavioral hypothesis that familiarity generates a preference via one of several mechanisms. The biases are the home bias, a preference for home country stocks, and the foreign bias, a preference for stocks of countries that are 'closer' by a variety of measures that could be correlated with either information or familiarity.

We study ECB data on residents' asset holdings in 13 euro-area countries, and focus on households. The data are new, and some of the descriptives are interesting in themselves. Invested amounts are reported, per group of households, in each of over 50,000 companies and each of over 25,000 mutual funds from all over the world. For instance, we can consider both direct shareholdings and positions held via common investment funds. The data also allow us to study portfolios for nationality-based subgroups within each of the 13 reporting countries. For non-natives, the portfolio closely resembles that of locals from the country of residence rather than from the country of nationality. This means that while we only see 13 domestic portfolios, we can work with thousands of foreign portfolios—many 'immigrant' nationality groups for each of the 13 reporting country, and 58 foreign countries. This is why we study foreign bias.[11]

[11]Most funds are regionally or internationally diversified; country funds are rare. Home bias is achieved by active direct investments in stocks, not via country funds, which is inconsistent with the familiarity explanation for home bias. However, the lack of degrees of freedom means that we cannot test this further using home bias.

Our measures of active management are (i) ActiveShare (AS), the mean absolute deviation between a subportfolio's asset weights and the destination country's 'market' portfolio, and (ii) Funds' Weight (FW), the fraction invested via funds rather than directly as direct holdings of individual shares. We study the foreign bias (FB, defined as the standardised overweight within the non-domestic part of the investor's portfolio) and the returns on each subportfolio, and especially how these are related to AS and FW. We find that overweights are associated with high ActiveShare numbers, which is consistent with the hypothesis that informational advantages explain at least part of portfolio bias. Similarly, a large fraction invested via funds (*i.e.* a small fraction managed by the household itself) tends to come with lower foreign bias, which again is consistent with information-based positions. We further find higher average excess returns when AS is higher and when foreign bias is positive, both of which are consistent with the information hypothesis.

Foreign positions, in contrast, are largely held indirectly via funds. The average level of AS in foreign holdings is much lower than for domestic holdings, consistent with the main informational advantage being related to domestic stocks. Those countries with a high foreign bias have a higher proportion of direct positions, though, and the overall portfolio is more active than for countries with a low foreign bias. Thus the results for the foreign bias are also consistent with the information hypothesis and not with familiarity.

Evidence from regression tests, whether using portfolios held by 'natives' or 'immigrants', points towards a positive relationship between both home and foreign bias and AS, and a negative one with FW. The size of the FW effect is quite pronounced, and also active share is economically significant. All this is inconsistent with the familiarity explanation for international equity biases. Regression tests of the relationship between foreign bias and excess returns find that when investments into a foreign host country exceed the neutral benchmark weight, those foreign-stock subportfolios provide higher excess returns than those that are underweight. However, the relationship between excess returns and foreign bias is not sufficiently well explained by just familiarity and information: within the group of countries that have a negative foreign bias there is a negative relationship between excess returns and foreign bias, which is inconsistent with either theory and may indicate some measurement problem within that group. Pending an explanation and a new model that captures the phenomenon, the methodological implication is that regressions which pool overweight and underweight holdings of foreign countries are likely to be biased tests of the information explanation of foreign bias.

Our regressions contain the standard familiarity proxies as controls. Therefore, what our tests are measuring via AS, FW and excess returns, is not whether information matters *instead of* familiarity, but rather whether information matters over and above the commonly accepted familiarity effects. That said, our results are consistent, overall, with the hypothesis that international equity investment biases reflect a belief on the part of investors that they have informational advantages in closer and more familiar countries. This belief is justified, in the sense that, on average, it leads to excess returns sufficient to compensate for the foregone diversification when we compare foreign countries that are overweight with those that are underweight.

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Appendix

A.1 Data cleaning

We use the securities holdings of households over the period 2013Q4-2018Q2. After applying the below cleaning steps the dataset contains 3,831,514 observations of listed shares and 4,814,193 of mutual fund holdings. Many of these fund holdings are not allocated towards equity funds. For example, at the end of 2018Q2, the total fund holdings were 1.5 trillion euros, whereas of those in funds that specialize in stocks amounted 424 billion euros (28 percent of total).

Filters applied:

- only active securities with an ISIN code.
- only portfolio holdings (so no direct participation or large shareholdings).
- no short positions at holder country level.
- positions per holder country (and ref area) only in stocks with a market value of at least 10 mln euros aggregated over the full sample period (21 quarters).
- For a given destination country, the total household holdings should be at least 1 million euro for a given period and 10 million euro aggregated over the sample period,

otherwise the destination country is excluded. Similarly, the destination country should have at least 10 stocks for a given period and 30 stocks aggregated over the sample period.

- *only a relevant assumption for the "immigrant" data*: For each household from a given country, the stock holdings should contain at least ten stocks for a given period and 30 stocks in aggregated over the sample period, otherwise the holder country is dropped (only a relevant assumption for the "immigrant" data).

- *only a relevant assumption for the "immigrant" data*: For each household from a given country, the total stock holdings market value should be at least 1 million euro for a given period and 10 million euro in aggregate over the sample period, otherwise the holder country is dropped.

A.2 Lookthrough allocation of investments via funds.

In our sample period, the SHS database reports holdings for 69,396 funds, of which 26,270 funds can be classified as equity funds, the others being bond funds, money market funds, hedge funds or commodity funds. For 56 equity funds, we find no information regarding investment style. This results in a final sample of 26,214 equity funds.

We allocate each fund to a fund category based on the Lipper investment style area. More specifically, we determine the investment focus of each fund with respect to geographical area, industry, stock market capitalisation (firm size) and dividend yield as is represented in Figure (1). We identify 36 different regions, 55 countries and 12 industries.[12]

The fund's size and yield orientation are translated into stock holdings using the following rules. Every quarter, a stock is classified as a large-, medium- or small-capitalisation one, respectively, if its total market cap exceeds EUR 250 million (roughly the top 35 percent of the companies, by number), is between EUR 25 and EUR 250 million (the middle 30 percent), or is below EUR 25 million (the bottom 35 percent). Size-based funds can invest in each of the categories exclusively or combine for example small and mid-cap stocks. A stock is considered having a high dividend yield if, in a given quarter, the stock's dividend

[12]The 55 countries refers to 55 countries for which the database contains at least one country fund. The number of destination countries equals 59.

yield (*i.e.* the latest dividend divided by the price) falls in the top quartile of stocks with positive dividend yields.

Based on the allocation of funds into fund categories, we construct the set of individual stock holdings for each fund. Note that fund categories can be any combination from the four fund characteristics in Figure 1. We end up with 256 unique fund categories (hence 256 corresponding benchmarks). For example, the fund KBC Equity Fund Strategic Finance invests in European large capitalisation stocks in the industry Banks & Financial. We calculate the market value weights of all the shares that qualify to be in that benchmark. We then calculate household indirect equity holdings through equity funds are by multiplying the amount held in the fund by the weights of each stock in the fund category's benchmark.

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