Beyond Home Bias: Portfolio Holdings and Information Heterogeneity

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Abstract

We investigate whether information frictions are important determinants of banks' sovereign debt portfolios. Going beyond the classic home versus foreign distinction in holdings, we study the heterogeneity within the foreign sovereign portfolio. First, we propose a modified version of the Van Nieuwerburgh and Veldkamp (2009) model with a two-tiered information structure that links portfolio holdings and information acquisition. Second, we find strong support for the key predictions of the model in the data: if a bank makes a forecast for a given country, it is more likely to hold debt of that country. Moreover, more optimistic and more precise forecasts predict larger portfolio holdings.

JEL classification: G11, G21, F30.

Keywords: Home bias, Information frictions, Portfolio choice, Banks.

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1 Introduction

The portfolio home bias puzzle is a well documented empirical phenomenon in international finance. It has given rise to a large and active literature that has analyzed a number of potential explanations.[1] Largely due to the lack of appropriate data, the primary focus of prior work has been on understanding the basic dichotomy between home and foreign assets at the aggregate level, while the heterogeneity among individual foreign holdings has received less attention. Recent work by Hau and Rey (2008), Coeurdacier and Rey (2013), however, has highlighted the potentially important role such heterogeneity can play in discriminating between different theories of the home bias.

In this study, we go beyond the classic home versus foreign distinction in holdings, and study both theoretically and empirically how information frictions affect the entire portfolio allocation, including across individual foreign assets. We focus in particular on models of portfolio choice with information frictions because of two reasons. First, they have proven quite successful in explaining the puzzle and as a result have become a common benchmark in the literature (Van Nieuwerburgh and Veldkamp (2009), Coeurdacier and Rey (2013)). Second, our dataset allows us to construct proxies for the information of each individual economic agent (in our case a bank) and link them to their holdings of individual foreign assets, making it a natural laboratory for testing the implications of information models.

In order to analyze the link between information frictions and portfolio holdings empirically, we take advantage of a unique dataset that matches European banks' sovereign debt holdings and credit amounts from the European Banking Authority (EBA) with banks' forecasts on the same countries' 10-year sovereign debt yields, obtained from Consensus Economics. This dataset allows us to analyze not only the relative relationship t only the22 11.1379(

intensive margin, in terms of a cost of increasing the precision of beliefs about the actual future return realization. As a result, in the allocation problem. First, we show that indeed banks have an information advantage on their home country relative to foreign ones, in the sense of producing more accurate forecasts about their domestic country, than foreign banks do.[4] This justifies the basic economic intuition of our model that portfolio bias is due to information differences across potential investments. Second, we show that producing a forecast about a country strongly predicts the likelihood of investing in that country; in other words, information acquisition seems to determine portfolio sparseness, just as it does in the model. These facts support the link between information frictions and the *extensive margin* of portfolio choice.

We then turn our attention to the link between the intensive margin of information and the intensive margin of portfolio bias. We show that, conditional on producing forecasts on a set of countries, the precision and relative optimism of these forecasts have statistically dummies have explanatory power over and above what can be attributed to any home advantage in information. Thus, we conclude that information frictions play an important role in determining the heterogeneity in banks' portfolio holdings, but they are not quite enough by themselves to explain the full extent of the classic home bias puzzle.

This paper contributes to the large literature on home bias in asset holdings. The basic observation has been extensively documented for both equities (French and Poterba (1991), Tesar and Werner (1998), Ahearne et al. (2004)) and bonds (Burger and Warnock (2003), Fidora et al. (2007), Coeurdacier and Rey (2013)), and is a robust feature of both the aggregate data and the micro, individual investor data (Huberman (2001), Ivković and Weisbenner (2005), Massa and Simonov (2006), Goetzmann and Kumar (2008)). Recently, the European debt crisis has specifically emphasized the role of home bias in European banks' frictions. These results add to the literature that attempts to test and quantify the predictions of information-based models.[5] To the best of our knowledge, we are the first to directly link investors' information sets with their portfolio holdings; in other words, we are able to match individual bank holdings of country's sovereign debt with the same bank forecast about the country's 10-year sovereign debt yield. Previous empirical studies on information frictions, even those at the investor level, cannot match each asset in the investor's portfolio with his or her expectation (and its accuracy) about the performance of the asset. Therefore, we are able to provide direct evidence in favor of the main implications of portfolio choice models with information frictions. Also, many of the aforementioned studies focus on individual household investors that may not be very sophisticated. Our work suggests that information frictions are pervasive even among large European banks.

On the theoretical side, we add an extensive margin of information acquisition and power utility preferences that generate wealth effects to a standard portfolio choice model with information frictions *a' la* Van Nieuwerburgh and Veldkamp (2009). Our augmented model is able to rationalize the newly available evidence on the link between the extensive margin of information acquisition and the extensive margin (sparseness) of portfolio holdings. Moreover, its more detailed implications are also well supported by our empirical tests.

The paper is organized as follows. Section 2 describes the data and presents stylized facts. Section 3 presents the model and Section 4 the empirical tests the implications from the model. Section 5 concludes.

[5] Guiso and Jappelli (2006) estimate a negative correlation at the investor level between the portfolio Sharpe ratio and time spent acquiring financial information, consistent with overconfident investors. Guiso and Jappelli (2008) trace portfolio under-diversification to the lack of financial literacy. Ahearne et al. (2004) document that countries with a larger share of companies publicly listed in the U.S. attract larger weights in the U.S. equity portfolio. Massa and Simonov (2006) show that Swedish investors do not hedge risk but invest in stocks they are more familiar with, and earn higher returns. Grinblatt and Keloharju (2001) provide evidence that cultural and geographical proximity determines trading patterns among Finnish investors.

2 Data and Stylized Facts

2.1 Data

For our purposes, it is key to have data on portfolios and expectations on sovereign debt returns at the investor level. To this end, we merge information on European banks' sovereign portfolios from the EBA to banks' forecasts from Consensus Economics.

The EBA data, collected for the bank stress tests, is a semi-annual dataset of credit and sovereign exposures at the bank level for 28 countries belonging to the European Economic Area (EEA) from 2010Q1 to 2013Q4.[6] The EBA sample covers the largest banking groups in Europe (61-123 banks) and contains data at the consolidated level, not the subsidiary. For example, we know the amount of French sovereign bonds held by HSBC Holdings plc at a specific point in time, but not those of HSBC France. In order to keep our assets under study relatively homogeneous in characteristics other than the expectation over economic fundamentals, we focus on the holdings of EBA sovereigns. Those assets as homogeneous, with very similar liquidity characteristics and virtually identical regulatory treatment. They are also highly relevant asset class, as they form a significant proportion of the total security portfolio of the typical bank.

We then hand-match the banks in the EBA sample to Consensus Economics, a survey of professional forecasters which includes many of the banks in our sample as participants. At the beginning of each month, Consensus surveys analysts working for banks, consulting firns, non-financial corporations, rating agencies, universities and other research institutions (see

[6] The stress tests were held at irregular intervals, thus we have the following exposure dates available:

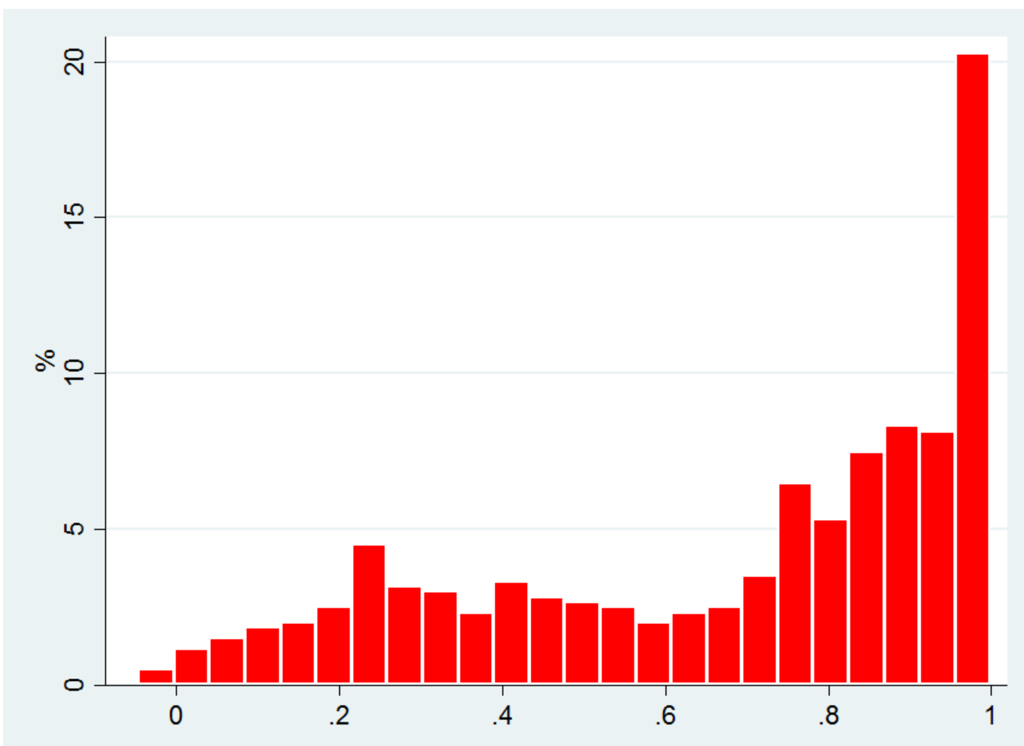
Table 9 in the Appendix for a detailed list of forecasters). These analysts provide forecasts for a set of key macroeconomic and financial variables for all major industrialized countries and some emerging markets. The forecasters include both domestic and foreign institutions. We match by name the banks in Consensus Economics to those in the EBA dataset. In case these appear through their international subsidiaries, we match the subsidiary's forecast to the portfolio share of the banking group it belongs to (*i.e.* HSBC France forecasts for the French economy is matched with HSBC Holdings plc portfolio share).

In the empirical analysis we use the 10–year sovereign yields as the forecasting variable, because it is most relevant in determining expected returns of sovereign debt, while at the same time guaranteeing good coverage by analysts.[7] It is highly relevant, since expecting a higher future yield on a debt instrument (which provides a fixed stream of payments) countries between 2006 to 2014. The average squared forecast error is 0.36, which translates into a 0.6 percentage points standard deviation error. The time-averaged squared forecast error per forecaster is a bit higher on average (0.46), but has smaller standard deviation (0.56 vs 0.60).

where x_H is the portfolio share of a bank's holdings of domestic sovereign debt and x_H is the share of home country's debt as a fraction of total world debt (the CAPM portfolio). The HB index takes the value of 0 when the investor holds domestic assets in the same proportion as the benchmark CAPM portfolio ($x_H = x_H$), is positive when domestic assets are over-weighted, with a limiting value of 1 when the whole portfolio is composed exclusively of domestic assets ($x_H = 1$). It can be negative if domestic assets are under–weighted compared to the CAPM portfolio ($x_H < x_H$) . The histogram of HB values for the different banks in our dataset pooling across all dates (2010Q1-2013Q4) is presented in Figure 1.

Figure 1: Home Bias Index Histogram

This figure plots the distribution for the home bias index, $HB = 1 - (1 - x_H)/(1 - x_H)$, for all EBA banks in 2010Q1-2013Q4.



Virtually all banks display at least some home bias (except for one bank, BNP Paribas, that has a slight negative HB index) and the median (mean) at 0.85 (0.72) is quite high. This is the basic observation of the home bias that has also been documented extensively in many previous studies. Size is a big driver of the overall level of home bias, but cannot alone

Figure 2: Home Bias Index: Small vs. Large Banks

This figure plots the distribution for the home bias index, HB = 1 − (1 −

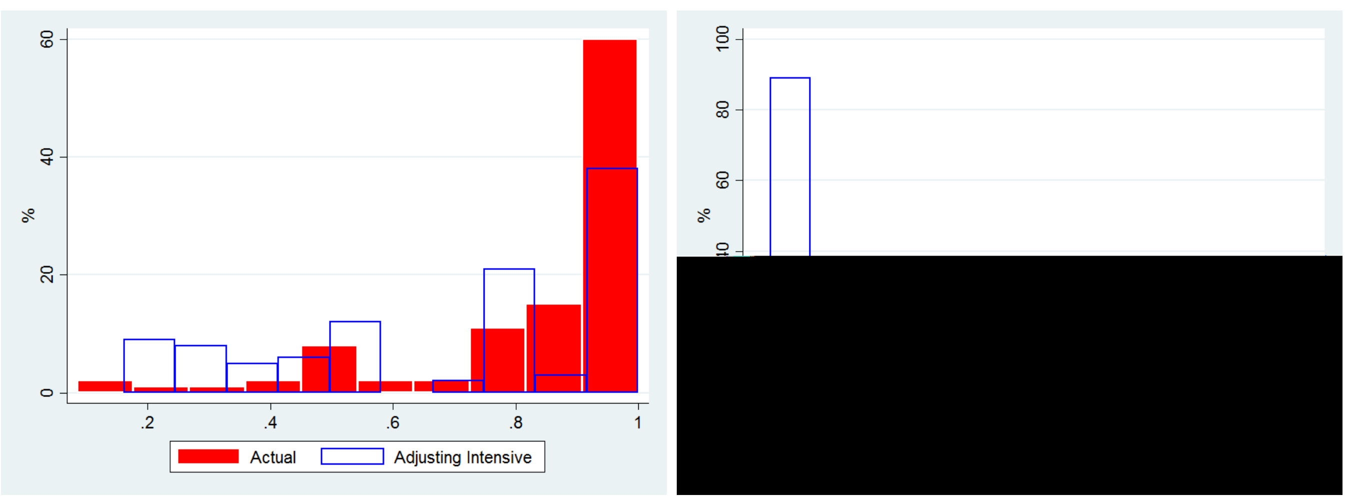
extensive margin of the home bias, for each bank we construct a counter-factual home bias index by setting the portfolio share of foreign sovereigns held in non-zero quantities equal to their world market share. Thus, the counter-factual portfolio deviates from the market portfolio in terms of foreign investments only through its 0s, i.e. its sparseness. The results are presented in Figure 3 below, with panel (a) and (b) showing the results for small and large banks respectively. We see that the extensive margin is indeed a major driver of the home

Intensive Margin: To measure the extent to which the home bias is driven by the *intensive margin* of portfolio adjustment, we construct a di erent counter-factual home bias index, where we set the portfolio share of all non-zero foreign investments equal to their respective market share, while leaving any zeros unchanged. We plot the results in panels (a) and (b) of Figure 4. It is striking to see how in this case the home bias for large banks is almost entirely eliminated, while it is still significant for small banks. This is the flip side of the adjustment on the extensive margin we saw previously. Taking both results together, we can conclude that while small banks do underweight the foreign investment they hold in positive quantities, most of the home bias is explained by the fact that they do not invest at all in many countries (the 'extensive margin' is most important). Large banks, on the other hand, tend to invest in all countries, but significantly underweight their foreign investments compared to holdings of domestic assets.

Figure 4: Home Bias Index: Adjusting the Intensive Margin, Small and Large Banks

This figure plots the distribution for a counterfactual home bias index replacing all non-zero exposures with the optimal portfolio shares ($x_j = x_j$ if $x_j > 0$). Panel (a) plots the distribution for banks in the bottom quintile of total assets in 2010 (<e38 billion), while Panel (b) for banks in the top quintile of total assets in 2010 (>e550 billion).

(a) Small (b) Large



Biases among Foreign Holdings: The results so far indicate that there is significant heterogeneity among individual foreign assets. In particular, we have seen that foreign holdings are sparse, hence some foreign investments are held in positive quantities, while many are not held at all. Next, we focus on the heterogeneity among the individual foreign assets that are held in non-zero quantities.

We would like to know if there are any biases in the relative portfolio weights of the foreign investments the banks do hold. Essentially, we ask the question if there is differential portfolio.

Figure 5: Foreign Bias

This figure plots the distribution of the foreign bias index, $1-(1-\tilde{x}_j)/(1-\tilde{x}_j)$, for non-domestic exposures

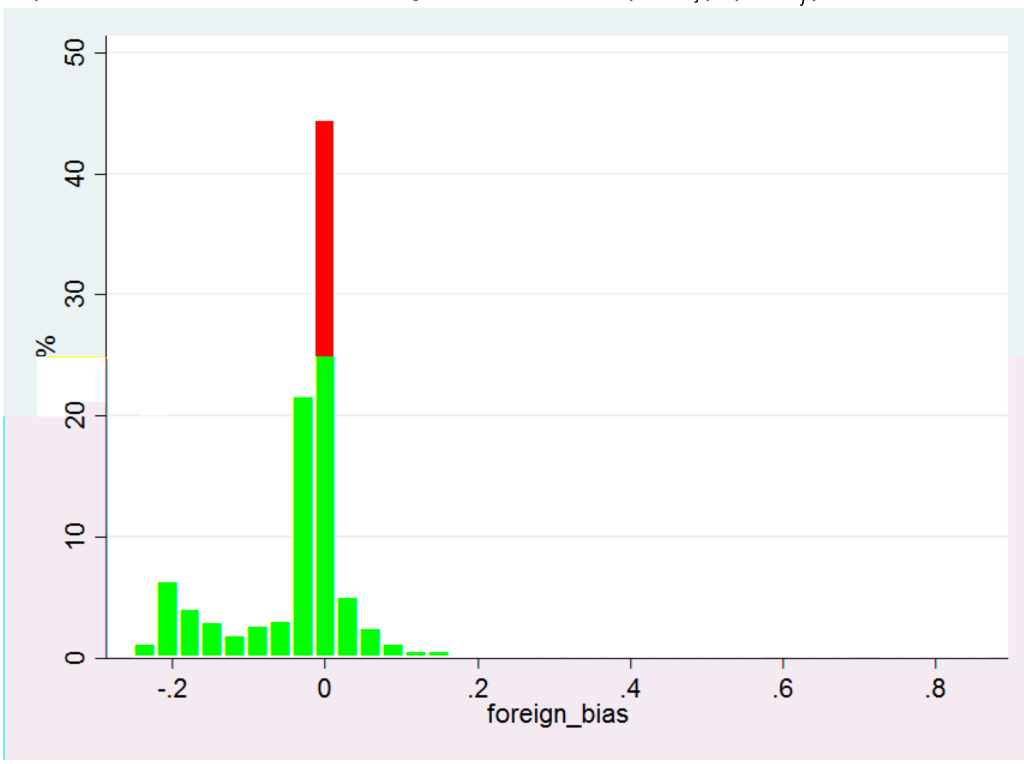


Figure 5 presents the histogram of $Bias_j$ pooling across banks. Notice that the median (average) bias towards an individual foreign asset is practically zero, −0.008 (−0.03), and the entire distribution is squeezed tightly around zero, with a standard deviation of just 0.09. There are a few outliers (maximum of 0.78 and minimum of −0.25), but by and large the mass of portfolio bias among foreign holdings is concentrated right around zero. This suggests

country fixed effects. In particular, forecaster fixed effects allow us to estimate, within each payoffs, but those can be viewed as long-term bonds which have uncertain payoffs due to uncertainty in their future price.

We first describe the asset market structure and then explain the information choice of the agents. There are N different countries of equal size, with a continuum of agents of mass $\frac{1}{N}$ living in each. There are N risky assets, one associated with each country, and a risk-free savings technology with an exogenous rate of return R^f. Thus, in period 1 agent i in country j faces the budget constraint

$$W_{1j}^{(i)} = \sum_{k=1}^{N} P_k x_{jk}^{(i)}$$

one another. This assumption has no effect on the qualitative results of the model, and could purchase unbiased signals about the actual realization of any d_k:

$$\eta_{jk}^{(i)} = d_{jk} + u_{jk}^{(i)},$$

where $u_{jk}^{(i)} \quad iidN(0, \sigma_{u_{jk}}^{(i)2})$. The precision of these signals is not exogenously given, but the agents choose it optimally, subject to an increasing and convex cost $C(\kappa)$ of the total amount of information, κ, encoded in their chosen signals. Information, κ, is measured in terms of entropy units (Shannon (1948)). This is the standard measure of information flow in information theory and is also widely used by the economics and finance literature on optimal information acquisition (e.g. Sims (2003), Van Nieuwerburgh and Veldkamp (2010)). It is defined as the reduction in uncertainty, measured by the entropy of the unknown asset payo s vector $\mathbf{d}$, that occurs after observing the vector of noisy signals $\eta_j^{(i)} = [\eta_{j1}, \ldots, \eta_{jN}]$:

$$\kappa = H(\mathbf{d}|I_j^{(i)}) - H(\mathbf{d}|I_j^{(i)}, \eta_j^{(i)}).$$

$H(X)$ denotes the entropy of random variable X and $H(X|Y)$ is the entropy of X conditional on knowing Y.[10] Moreover, $I_j^{(i)}$ is the prior information set of agent i, which contains both the subset of priors on $\mathbf{d}$ which he has purchased and the public information that is observed for free by all agents (such as the equilibrium prices). Thus, κ measures the total amount of information about the vector of asset returns $\mathbf{d}$

those beliefs, agents pick the portfolio composition that maximizes their expected utility:

$$\max_{\alpha_j^{(i)}} E\left[\frac{(W_{2j}^{(i)})1-\gamma}{1-\gamma} | I_j^{(i)}, \eta_j^{(i)}\right]$$

s.t.

$W^{(i}$

conditions, and solving for the portfolio shares α yields:

$$\alpha = \frac{1}{\gamma}\hat{\Sigma}_j^{-1}(E(\mathrm{r}_{t+1}|I_j^{(i)}, \eta_j^{(i)}) - r^f + \frac{1}{2}diag(\hat{\Sigma}_j))$$

to the extent to which those extra reasons for holdings bonds are unrelated to the financial payoffs of the bonds, they are modeled by z_k.

We guess and verify that the equilibrium price is linear in the states and of the form

$$p_k = \bar{\lambda}_k + \lambda_{dk} d_k + \lambda_{zk} z_k.$$

Thus, the price itself contains useful information about the unknown d_k, and the agents can extract the following informative signal from it,

$$\tilde{p}_k = d_k + \frac{\lambda_{zk}}{\lambda_{dk}}(z_k - \mu_z).$$

The agents combine this signal together with their private signals η and the priors, and use Bayes' rule to form posterior beliefs, leading to the following expressions for the conditional expectation and variance:

$$E(d_k | I_j^{(i)}, \eta_j^{(i)}) = \left[\frac{1}{\sigma_{dk}^2} + (\frac{\lambda_{dk}}{\lambda_{zk}}\sigma_{zk})^2 + \frac{1}{\sigma_{\eta jk}^2} \right]^{-1} \left[\frac{\mu_{dk}}{\sigma_{dk}^2} + (\frac{\lambda_{dk}}{\lambda_{zk}\sigma_{zk}})^2 \tilde{p}_k + \frac{1}{\sigma_{\eta jk}^2}\eta_{jk}^{(i)} \right]$$

$$\hat{\sigma}_{jk}^2 = \left[\frac{1}{\sigma_{dk}^2} + (\frac{\lambda_{dk}}{\lambda_{zk}}\sigma_{zk})^2 + \frac{1}{\sigma_{\eta jk}^2} \right]^{-1}$$

Note that we drop the i index on all variance terms because all agents within the same country face identical problems and hence choose the same information acquisition strategy. We can then substitute back everything into the market clearing conditions and solve for the equilibrium asset price's coefficients. The details are given in the appendix, and here we just highlight the resulting coefficients λ_{dk} and λ_{zk} which determine the informativeness of the prices. The resulting coefficients are:

$$\lambda_{zk} = -\gamma \bar{\sigma}_k^2 \left[1 + \frac{\bar{\varphi}_k \bar{q}_k}{\gamma^2 \sigma_z^2} \right]$$

$$\lambda_{dk} = \bar{\sigma}_k^2 \bar{q}_k \left(1 + \bar{\varphi}_k \bar{q}_k \right.$$

same information costs.

We solve the information choice problem in three steps. First, we solve for the optimal allocation of intensive information, given a choice of total intensive information acquired K and the set of countries that the agent has chosen to learn about H, by solving:

$$\max_{\hat{\sigma}^2_{jk}} \sum_{k \in H} \frac{1}{2} \ln\left(1 + (\gamma - 1)\frac{\sigma_k^2}{\hat{\sigma}^2_{jk}}\right) + \frac{\gamma - 1}{2} \sum_{k \in H} \frac{m_k^2}{\hat{\sigma}^2_{jk} + (\gamma - 1)\sigma_k^2} \quad (9)$$

s.t.

$$\sum_{k \in H} \kappa_k \leq K$$

The details are given in the appendix, but the main result is that the agents find it optimal to allocate all intensive information to the payoff of the domestic asset so that for agents in country j, $\kappa_j = K$ and $\kappa_i = 0$ for all $i \neq j$. Intuitively, the result is due to the fact that the objective function is convex in the information allocated to any given country κ_k. Thus, agents find it optimal to specialize in acquiring intensive information about only one country. Given our assumption that the agents also get one free signal on the payoff of the domestic assets, this tips the scale towards home information, and thus agents choose to specialize in home information.

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purchase information on the unconditional distribution of asset payo□s, i.e. the extensive margin information choice. The cost of adding an asset to the learning (and hence investment portfolio) is a fixed amount c that agents need to pay for the due diligence study. The gain is derived from expecting to earn positive excess returns on the asset (on average). The detailed characterization of this choice is presented in the Appendix, but the key intuition for why it is uniquely determined is the fact that the marginal cost of adding an additional asset to the learning portfolio is increasing.

This happens for two reasons. First, marginal utility of investable wealth W_{1j} is declining, and the more resources an agent spends on due diligence studies (Ψ_j) the fewer are left for portfolio investment. As a result, even though all due diligence studies cost the same fixed amount c in terms of wealth, each additional study has an increasing utility cost because it decreases investable wealth further and further. Second, lower investable wealth also translates to a lower optimal choice of K and therefore lower utility from the home asset holdings (the ones you purchase extra intensive information about). Thus, increasing the breadth of the portfolio carries increasing costs but a fixed benefit – the expected gain of adding one more asset to your portfolio. As a result, unless the fixed cost of acquiring priors is very small relative to the agent's initial wealth, it is unlikely that the agent will learn about all available assets. This generates sparse foreign portfolios, with the level of sparseness varying with the wealth level of the agent.

3.4 Model Implications

The model is able to match the stylized portfolio facts that we documented earlier, and Proposition 1 formalizes these implications.

Proposition 1. *In a symmetric world where all countries are ex-ante identical, the equilibrium portfolio holdings of an agent in country j, $\alpha_j = [\alpha_{j1}, \ldots, \alpha_{jN}]$, display the following features:*

1. *Sparseness: Agents do not necessarily invest in all available foreign assets, i.e. $\alpha_{jk} = 0$ for some k.*

2. ***Sparseness decreases with wealth:*** *The number of countries k for which $\alpha_{jk} = 0$ is decreasing with $W_{1j}^{(i)}$, i.e. the size of the agent's investment portfolio*

3. ***Foreign bias concentrated around zero:*** *All foreign assets that the agent invests a positive quantity in are held in the same proportions relative to one another, as their market weights. Formally, if k, k H, then*

$$\alpha_{jk} = \alpha_{jk}$$

and hence the expected Foreign Bias index for those holdings is zero:

$$E(Bias_j) = 1 = \frac{1 - \frac{1}{N}}{1 - \frac{1}{N}} = 0$$

where $\tilde{N} = |H|$ is the cardinality of the set of foreign countries that the agent learns about and thus has a positive exposure to.

Proof. Intuition sketched in the text, details in the Appendix. □

The first result, sparseness, is a direct consequence of the two-tiered information structure of the model. Since agents need to first acquire a basic understanding of a given market before they enter it (i.e. learn the unconditional mean of the asset payoff), they do not necessarily enter all markets and as a result portfolios tend to be sparse and feature cases of $\alpha_{jk} = 0$. The agent will add new assets to their portfolio up to the point at which the cost of doing a new initial country study exceeds the gain of doing so. The gain is pretty straightforward – the agent likes to add new assets to his portfolio because they offer (1) positive excess returns and (2) diversification benefits.

The cost is simply c in financial terms, and its effect on utility works directly through reducing the portfolio wealth of the individual – the $\ln(W_{1j})$ term in equation (8). Since the log is a concave function, the cost of learning about more countries (i.e. the reduction in $\ln(W_{1j})$ caused by spending c on a new due diligence study) is increasing in the number of countries one has already learned about. In the symmetric equilibrium of Proposition 1, the gain of learning about an additional country is constant, hence there is an optimal number of foreign countries that the agent will learn about. This could be zero (i.e. only invest in the home country) if the agent's wealth is sufficiently low. But at higher levels of wealth, the utility cost of adding new countries is lower, hence richer agents would learn about at least some of the foreign countries, and possibly all foreign countries given enough wealth. This last observation is also behind the second result that the sparseness of the portfolio is decreasing in the agent's wealth.

Lastly, consider the positive foreign holdings of the agent and how they relate to one another. Recall that the agent finds it optimal to specialize in acquiring additional intensive information only about the home asset. Thus, for all foreign assets he relies only on publicly available information and his priors. In a symmetric world where all countries are ex-ante identical, the relative informativeness of the equilibrium prices of the different assets will be the same as well. Therefore, the posterior variance of foreign assets payoffs, which only relies on priors and the information contained in prices, is the same. Thus, the expected optimal portfolio weight of a foreign asset k is:

$$E(\alpha_{jk}) = \frac{m - r^f + \frac{1}{2}\tilde{\sigma}^2}{\gamma\tilde{\sigma}^2}$$

where $m = m_k$ for all k is the expected excess return on the risky assets. As a result, the foreign bias of any foreign holding is the same, and is in fact zero.[11]

[11] For now we have only proved this last result on zero foreign bias in the symmetric world case. However, we conjecture that the bias would be heavily concentrated around zero in an asymmetric world as well, because of the same intuition that agents would rely only on public information about all foreign assets. They will not specifically generate any excess information asymmetry through their private learning.

4 Empirical Tests

As we have seen, this model with two-tiered information cost structure can rationalize the stylized portfolio facts documented in Section 2.2, but is this mechanism empirically relevant? To examine this question, we directly test the model's key implications in the data. We derive two sets of implications that are crucial to the inner-workings of the mechanism, and examine each of them in the following sections. First we test whether portfolio sparseness follows sparseness in information (extensive margin). Second, we test whether optimism and foreign country, it has a sovereign exposure to that country about two standard deviations higher. We progressively saturate the model with fixed effects in order to make sure that unobserved heterogeneity does not affect the main result. We start with no fixed effects in column (1), we then add time (column (2)), bank (column (3)), destination country (column (4)) and finally bank–time (column (5)) and country–time (column (6)) fixed effects. Basically, in the last specification we are only using variation across foreign holdings for the same bank

4.2 Intensive Margin of Information and Portfolios

Lastly, we look at the specific relationship between the precision of beliefs and portfolio shares in the data. In the model, the optimal portfolio share for an asset k for which an agent pays the fixed information cost c is:

$$\alpha_k = \frac{E(r_k | I_j^{(i)}, \eta_{jk}^{(i)}) - r^f}{\gamma \hat{\sigma}_k^2} + \frac{1}{2\gamma} \tag{11}$$

This puts specific restrictions on the relationship between portfolio shares, expected returns and the precision of those expectations as summarized in Proposition 2 below.

Proposition 2. *(Comparative Statics) The optimal portfolio share of asset k in the portfolio of agent i in country j is*

1. *Increasing in the conditional expected return* $E(r_k | I_j^{(i)}, \eta_{jk}^{(i)}$ (5439

(*i*

sensitivity to beliefs ($\frac{\partial \alpha}{\partial E(r)}$) increases with the precision of beliefs – i.e. when a bank becomes optimistic about a country, it reallocates more of its portfolio towards that country the more precise its beliefs about that country are ($\frac{\partial^2 \alpha}{\partial E(r) \partial \sigma^2} < 0$).

would further add to this negative effect, we therefore expect that β_3 is positive. To sum up, the model predicts that $\beta_1 < 0$, $\beta_2 < 0$, and $\beta_3 > 0$.

The intensive margin results are displayed in Tables 6 and 7. The two tables differ as to their treatment of domestic exposures, and we split the analysis in two like this because of the large home bias in the data. Table 6 sidesteps the home bias issue and tests the model's implications outlined above using only foreign holdings (thus it does not ask the model to fully explain the large amount of home bias we observe in the data). On the other hand, Table 7 uses the full sovereign portfolio and controls for any potentially unexplained home bias by including two additional dummy variables: $Home$ for domestic exposures and $Home \times GIIPS$ for domestic exposures of banks located in peripheral countries. Indeed, the European sovereign debt crisis highlighted how sovereign distress feeds back into distress of the domestic banking sector; this is primarily due to the considerable home bias of banks located in the periphery (DeMarco and Macchiavelli (2015), Ongena et al. (2016)). The sample is restricted to be the same in both tables, so that these are banks that have at least one foreign exposure in addition to the domestic one.

Consistent with the predictions of our model, more precise information impacts portfolio holdings both directly and indirectly: more accuracy (lower SFE) not only leads to higher holdings (direct effect), but it also amplifies the effect of expectations on holdings, making portfolio shares more sensitive to changes in forecasts (indirect/amplification effect). Regardless of how we deal with home bias, the intensive margin results are unaffected and strongly support the model's predictions. More importantly, no matter how much we saturate the model with fixed effects, results are robust. Except for β_2 which loses significance in the last column when we include both country-time and bank-time fixed-effects, all coefficients remain statistically significant and with the correct sign as predicted by the model.

The estimated coefficients are also economically significant; let us consider the last column of Table 6 which uses foreign holdings only and includes both bank-time and destination country-time fixed effects. The effect of uncertainty is large: a one standard deviation decrease in $\overline{SFE}$ (0.32) at the average 10-year yield forecast (3.75%) is associated with a 1.2 percentage points increase in sovereign debt holdings, which is about one tenth of a standard deviation increase in portfolio holdings.[13] The economic significance of the amplification effect of information precision (β_3) is also sizable. To illustrate return to the previous example of a one standard deviation decrease in $\overline{SFE}$ – had the point forecast of the 10–year yield been one standard deviation (2%) below the mean (so that expected returns would have been one standard deviations above their mean), holdings would have further increased by an additional 2.77%, more than doubling the original effect of 1.2%.

Finally, Table 7 shows that the results are robust to using the full sovereign debt portfolio of banks, including their heavily overweighted home investments. Moreover, those results also suggest that while relevant, information frictions alone cannot explain the full extent of the home bias we observe in the data. We can see that from the fact that the extra home dummies are highly significant and positive, especially for the peripheral banks, meaning that home exposures are larger than what can be attributed to the greater precision and possibly greater optimism of the domestic forecasts relative to the foreign ones. Thus, we can conclude that information frictions matter particularly strongly for understanding the composition of foreign holdings, but are only part of the story of the apparent heavy preference for home assets.

5 Conclusion

In this paper we study whether information frictions can explain the heterogeneity in banks' sovereign debt holdings. We go beyond the standard home versus foreign divide, and analyze the entire portfolio allocation. In order to empirically connect information frictions with portfolio holdings, we take advantage of banks' sovereign exposure data from EBA, matched with banks' forecasts from Consensus Economics. The empirical findings suggest

[13] The relevant summary statistics for the sample on the intensive margin are found in Table 2, Panel C, third to last row.

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Table 1: Variable Definition

Table 2: Summary Statistics

This table provides summary statistics for all variables used in the empirical analyses.

Variable	Mean	Std. Dev.	25th pct.	50th pct.	75th pct.	90th pct.	99th pct.	[redacted]
Panel A. Consensus Economics (all forecasters)								[redacted]
$Y10_{b,c,t}$	3.44	1.52	2.2	3.5	4.35	5.2	7.88	[redacted]
$SFE(Y10_{b,c,t})$	0.36	0.60	.02	0.12	0.41	1	3.45	[redacted]
$\overline{SFE}(Y10_{b,c})$	0.46	0.56	0.17	0.32	0.48	0.88	3.19	[redacted]
Home	0.60	0.48	0	1	1	1	1	[redacted]
Panel B. EBA–Consensus Economics (extensive margin - including the 0s)								[redacted]
$ShareSovEEA_{b,c,t}$	4.53	14.32	0	0.11	1.62	9.35	88.77	[redacted]
$1(ShareSovEEA_{b,c,t})$	0.613	0.487	0	1	1	1	1	[redacted]
$ShareSovEEA_{b,c,t}$|Home=0	2.08 $_{b,c,t}$Y22051	6.28	0	0.08	1.22	4.89F33	9.|Hoeo57.|H	[redacted]

Table 3: Are Home Forecasters Better?

This table provides estimates for equation (1). The dependent variable is the average squared forecast error of bank *b* regarding the 3-month ahead forecast on country *c*'s 10–year yield ($\overline{SFE}$(Y10)). Home is a dummy equal to one if the forecaster is domestic, zero otherwise. EBA_bank is a dummy equal to one if the forecaster is an EBA bank. Standard errors are clustered at the forecaster level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Home	-0.241	-0.436	-0.294	-0.295	-0.515	-0.441
	(0.068)	(0.133)	(0.123)	(0.091)	(0.192)	(0.199)
EBA_bank				-0.132		
				(0.124)		
Home × EBA_bank				0.171	0.218	0.364
				(0.133)	(0.238)	(0.227)
Observations	335	197	197	335	197	197
N of Forecasters	182	44	44	182	44	44
Forecaster FE	no	yes	yes	no	yes	yes
Destination Country FE	no	no	yes	no	no	yes

Table 4: Extensive Margin: Foreign Sovereign Exposures and Foreign Forecast

This table provides the estimates for equation (10). The dependent variable is the share of EEA country *c* in bank *b* sovereign portfolio in Panel A and a dummy equal to one if bank *b* holds a positive amount of sovereign bonds of EEA country *c* in Panel B. The sample is restricted to foreign countries only. $\text{ForeignFcst}_{b,c,t}$ is a dummy equal to one if bank *b* makes a 10–year yield forecast for country *c* in year *t* and zero otherwise. Standard errors are two–way clustered at the bank and country level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Panel A: Dependent variable $ShareSovEEA_{b,c,t}$ for non–domestic exposures

	(1)	(2)	(3)	(4)	(5)	(6)
ForeignFcst	13.64	13.64	13.56	12.47	12.52	12.70
	(4.879)	(4.888)	(5.271)	(5.170)	(5.207)	(5.270)
Observations	5566	5566	5566	5566	5566	5566
Adj. R^2	0.121	0.120	0.147	0.258	0.243	0.216
N of Banks	35	35	35	35	35	35
N of Countries	23	23	23	23	23	23

Panel B: Dependent variable $\mathbf{1}(ShareSovEEA_{b,c,t})$ for non–domestic exposures

	(1)	(2)	(3)	(4)	(5)	(6)
ForeignFcst	0.457	0.459	0.322	0.219	0.220	0.219
	(0.060)	(0.061)	(0.076)	(0.117)	(0.117)	(0.119)
Observations	5566	5566	5566	5566	5566	5566
Adj. R^2	0.0219	0.0269	0.224	0.385	0.386	0.379
N of Banks	35	35	35	35	35	35
N of Countries	23	23	23	23	23	23
Time FE	no	yes	yes	yes	yes	yes
Bank FE	no	no	yes	yes	no	yes
Destination country FE	no	no	no	yes	yes	yes
Country–Time FE	no	no	no	no	yes	yes
Bank–Time FE	no	no	no	no	no	yes

Table 5: Robustness: Extensive Margin: Foreign Credit Exposures and Foreign Forecast

This table provides the estimates for equation (10). The dependent variable is the share of credit to EEA country c in bank b lending portfolio in Panel A and a dummy equal to one if bank b lends a positive amount to EEA country c in Panel B. The sample is restricted to foreign countries only. $\text{ForeignFcst}_{b,c,t}$ is a dummy equal to one if bank b makes a 10–year yield forecast for country c in year t and zero otherwise. Standard errors are two–way clustered at the bank and country level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

Panel A: Dependent variable $ShareCredEEA_{b,c,t}$ for non–domestic exposures

	(1)	(2)	(3)	(4)	(5)	(6)
ForeignFcst	0.122	0.122	0.127	0.119	0.119	0.122
	(0.051)	(0.051)	(0.056)	(0.057)	(0.057)	(0.057)
Observations	4114	4114	4114	4114	4114	4114
Adj. R^2	0.138	0.138	0.170	0.213	0.192	0.165
Time FE	no	yes	yes	yes	no	no
Bank FE	no	no	yes	yes	no	no
Destination country FE	no	no	no	yes	no	no
Country–Time FE	no	no	no	no	yes	yes
Bank–Time FE	no	no	no	no	no	yes

Panel B: Dependent variable $\mathbf{1}(ShareCredEEA_{b,c,t})$ for non–domestic exposures

	(1)	(2)	(3)	(4)	(5)	(6)
ForeignFcst	0.380	0.382	0.471	0.316	0.323	0.351
	(0.102)	(0.105)	(0.081)	(0.108)	(0.106)	(0.109)
Observations	4114	4114	4114	4114	4114	4114
Adj. R^2	0.0181	0.104	0.222	0.352	0.369	0.443
N of Banks	36	36	36	36	36	36
N of Countries	26	26	26	26	26	26
Time FE	no	yes	yes	yes	no	no
Bank FE	no	no	yes	yes	no	no
Destination country FE	no	no	no	yes	no	no
Country–Time FE	no	no	no	no	yes	yes
Bank–Time FE	no	no	no	no	no	yes

Table 6: Intensive Margin – Foreign Exposures Only

This table provides the estimates for equation (12). The dependent variable is the share of EEA country *c* sovereign bonds in bank *b* sovereign portfolio. The independent variables are defined in Table 1. Standard errors are two–way clustered at the bank and country level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)
$\overline{SFE}(Y10)$	-35.47	-13.02	-17.67	-22.48	-22.68
	(15.367)	(6.707)	(8.173)	(6.618)	(6.426)
Y10	-3.867	-1.705	-2.030	-2.745	-2.369
	(2.000)	(0.612)	(0.520)	(1.341)	(1.222)
$\overline{SFE}(Y10) \times Y10$	5.946	2.589	3.606	4.438	4.799
	(2.456)	(0.822)	(1.107)	(1.017)	(0.788)
Observations	206	206	148	192	125
Adj. R^2	0.797	0.853	0.739	0.852	0.580
N of Banks	17	17	7	17	7
N of Destination Countries	11	11	11	9	8
Time FE	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes
Destination Country FE	no	yes	yes	yes	yes
Bank–Time FE	no	no	yes	no	yes
Destination Country–Time FE	no	no	no	yes	yes

Appendix

A Solving the Model

In period 2, the agents face the problem

$$\max_{\alpha_j^{(i)}} E \left[(W_{2j}^{(i)} \right.$$

where we have used $\hat{\Sigma}_j = \text{Var}(\mathbf{r}|I_j^{(i)}, \eta_j^{(i)})$ to denote the posterior variance of the risky asset payo□s, and have dropped the subscript i since second moments are the same for all agents within a country (information sets di□er only in he iid noise in the η signals). For future reference, note also that since $\mathbf{r} = \mathbf{d} - \mathbf{p}$ and $\mathbf{p}$ is in the information set of the agent, it follows that $\hat{\Sigma}_j = \text{Var}(\mathbf{d}|I_j^{(i)}, \eta_j^{(i)})$.

Lastly, plugging (14) into the objective function (13) and taking expectations over the resulting log-normal variable yields the following objective function:

$$\frac{(W_{1j})^{1-\gamma}}{1-\gamma} \exp \left[(1-\gamma) \left(r^f + \alpha' \left(E_{1j}(\mathbf{r}) - r^f + \frac{1}{2} diag(\hat{\Sigma}_j) \right) - \frac{1}{2} \alpha' \hat{\Sigma}_j \alpha \right) + \frac{(1-\gamma)^2}{2} \alpha' \hat{\Sigma}_j \alpha \right]$$

where with a slight abuse of notation we have dropped the i subscript for convenience, and use the notation E_{1j}

A.2 Information Choice

In period 0 agents solve for the optimal information strategy, given their knowledge of optimal portfolios as a function of information (the solution to period 1 problem discussed above). First, we compute the time 1 expected utility conditional on an information choice. Using the optimal portfolio shares computed before, and evaluating the expected utility, conditional on the agent's full information set gives

$$E_{1j}\left[\frac{W_{1j}^{1-\gamma}}{1-\gamma}\exp\left((1-\gamma)r_j^p\right)\right] = \frac{W_{1j}^{1-\gamma}}{1-\gamma}\exp\left((1-\gamma)r^f + \frac{1-\gamma}{2\gamma}\hat{\mu}_j\hat{\Sigma}_j^{-1}\hat{\mu}_j\right) \tag{15}$$

where $\hat{\mu}_j = E_{1j}(\mathrm{r}) - r^f + \frac{1}{2}diag(\hat{\Sigma}_j)$. Conditional on just the priors of agents in country j (i.e. ex-ante), this is a Normal random variable, with the distribution $\hat{\mu}_j \sim N(\mathrm{m}_j, \Sigma - \hat{\Sigma}_j)$ where m_j is a Nx1 vectors with the following elements:

$$m_k = \bar{\sigma}_k^2\left(\gamma\mu_{zk} - \frac{1}{2}\bar{\varphi}_k\right) + \frac{1}{2}\hat{\sigma}_{jk}^2$$

Thus, ex-ante excess return is increasing in the effective supply of the asset μ_{zk} and decreasing in the average invested wealth $\bar{\varphi}_k$. Moreover, the variance of $\hat{\mu}_j$ is a diagonal matrix with the following diagonal elements

$$(\Sigma - \hat{\Sigma}_j)_{kk} = \underbrace{\bar{\sigma}_k^2(\bar{\varphi}_k + (\gamma^2\sigma_z^2 + \bar{\varphi}_k\bar{q}_k)\bar{\sigma}_k^2)}_{\sigma_k^2} - \hat{\sigma}_{jk}^2$$

To get better intuition, note that $\sigma_k^2 = \mathrm{Var}(d_k - p_k)$; thus σ_k^2 is the unconditional volatility of the excess return. Lastly, the above expected utility (15) was *conditional* on a choice of $\hat{\Sigma}_j$ and particular realizations of the informative signals. To compute the optimal information choice, we need to take its ex-ante expectation (meaning expectation over the actual realizations of signals and resulting asset prices). Doing so gives us

$$
\begin{aligned}
E_{0j}\left[\frac{W_{1j}^{1-\gamma}}{1-\gamma}\exp\left((1-\gamma)r_j^p\right)\right] &= \frac{W_{1j}^{1-\gamma}}{1-\gamma}E_{0j}\left[E_{1j}[\exp((1-\gamma)r_j^p)]\right] \\
&= \frac{W_{1j}^{1-\gamma}}{1-\gamma}\exp((1-\gamma)r^f)E_0\left[\exp\left(\frac{1-\gamma}{2\gamma}\hat{\mu}_j\hat{\Sigma}_j^{-1}\hat{\mu}_j\right)\right] \\
&= \frac{W_{1j}^{1-\gamma}}{1-\gamma}\exp((1-\gamma)r^f))|\frac{1}{\gamma}I - \frac{1-\gamma}{\gamma}\Sigma
\end{aligned}
$$

information, κ_k, that he acquires.

We solve the information choice problem in three steps – a choice of allocation of intensive information, a choice of the total amount of intensive information acquired, and a choice of extensive information. First, note that given choices of the extensive information H and total intensive information K, agents solve the problem

$$\max_{\kappa_k} \sum_{k \in H} \frac{1}{2} \ln \left(1 + (\gamma - 1) \frac{\sigma_k^2}{\exp(-\kappa_k)\tilde{\sigma}_k^2} \right) + \frac{\gamma - 1}{2} \sum_{k \in H} \frac{m_k^2}{\exp(-\kappa_k)\tilde{\sigma}_k^2 + (\gamma - 1)\sigma_k^2} \tag{17}$$

s.t.

$$\sum_{k \in H} \kappa_k \leq K$$

A.2.1 Step 1: Choice of κ_k

The partial derivative of the objective function, $\frac{\partial U_0}{\partial \kappa_k}$, is

$$\frac{(\gamma - 1)\left[4\hat{\sigma}_k^2(m_k^2 + \sigma_k^2 - (\gamma - 1)m_k\sigma_k^2) + 4(\gamma - 1)\sigma_k^4 - \hat{\sigma}_k^6 - 2(\gamma - 1)\sigma_k^2\hat{\sigma}_k^4\right]}{8(\hat{\sigma}_k^2 + (\gamma - 1)\sigma_k^2)^2}$$

and the second derivative, $\frac{\partial^2 U_0}{(\partial \kappa_k)^2}$, is

$$\frac{(\gamma - 1)\left[\hat{\sigma}_k^6 + 3(\gamma - 1)\hat{\sigma}_k^4\sigma_k^2 + 4(\gamma - 1)\sigma_k^2(\sigma_k^2 + (\gamma - 1)m_k\sigma_k^2 - m_k^2) + 4\hat{\sigma}_k^2(m_k^2 + \sigma_k^2(1 + (\gamma - 1)^2\sigma_k^2) - (\gamma - 1)m_k)\right]}{8(\hat{\sigma}_k^2 + (\gamma - 1)\sigma_k^2)^3}$$

Notice that the unconditional Sharpe Ratio (SR) being less than 1 ($\frac{\bar{m}}{\sigma_k} < 0$), which is true in the data, is a sufficient condition for $\frac{\partial^2 U_0}{(\partial \kappa_k)^2} > 0$. Thus, assuming the SR is less than one implies that information choice is a convex problem. Moreover, if $4 > \gamma\tilde{\sigma}_k^2$, which is also true under realistic parameters, we can show that the partial derivative with respect to information about asset k is positive when the agent's posterior variance equals the unconditional variance of the asset k:

$$\left.\frac{\partial U_0}{\partial \kappa_k}\right|_{\hat{\sigma}_k^2=\sigma_k^2} > 0$$

acquiring priors on asset k and adding it to your portfolio is given by the term

$$\ln\left(1 + (\gamma - 1)\frac{\sigma_k^2}{\tilde{\sigma}_k^2}\right) + \frac{\gamma - 1}{2}\frac{\sigma_k^2 + m_k^2}{\tilde{\sigma}_k^2 + (\gamma - 1)\sigma_k^2} \tag{18}$$

The first term captures the expected benefit of holding an additional asset with positive expected returns, and the second captures the diversification benefit of adding a new, independent asset to the portfolio. To arrive at that take the agent's ex-ante beliefs that $m_k \sim N(m_k, \sigma_k^2)$ and take expectations over the terms specific to asset k in U_0.

The marginal cost of purchasing priors is increasing in the amount of assets you already learn about. This works through two different effects. First, note that

$$\frac{\partial^2 \ln(W_{1j})}{(\partial \Psi_j)^2} = -\frac{1}{W_{1j}^2}$$

which comes from the fact that marginal utility of investible wealth is declining, and further prior information acquisition, and thus incurring an additional fixed cost c, is becoming increasingly costlier in utility terms. Second, increases in Ψ_j leads to lower investible wealth, and hence a lower optimal intensive information choice K^* and therefore lower utility from trading home assets (the ones you are informed about). Both of those effects combine to lead to the conclusion that there are increasing costs to increasing the breadth of information, and hence the portfolio. As a result, unless the fixed cost of acquiring priors is very small relative to the bank's wealth, it is unlikely that the bank will learn about all available assets. This generates sparse foreign portfolios, with the level of sparseness varying with the wealth level of the bank.

B Proof of Proposition 1

1. In a symmetric world where all fundamental terms have the same variance $\sigma_k^2 = \sigma^2$ for all k and the ex-ante expected return on all assets is the same, $m_k = m$ for all k, all

asset prices are symmetric in the sense that they are the same linear function of their respective state variables. Thus, all price coe□cients are the same, $\lambda_{dk} = \lambda_d$, $\lambda_{zk} = \lambda_z$, and $\bar{\lambda}_k = \bar{\lambda}$ for all k

intensive information $K(|H|)$ is: :

$$\ln(W - C(K(|H|)) - \Psi) - \ln(W - C(K(|H|+1)) - \Psi - c) = \ln(\quad W - C(K(|H|))$$

hence the sparseness of portfolios will decrease.

3. Because the agent optimally chooses to not acquire any extra intensive information about his foreign portfolio holdings, his optimal portfolio is purely driven by the unconditional expectation and variance of returns. Since agents are rational, as long as they did the due diligence, they all see the true unconditional expectation, hence share the same beliefs over the foreign countries. Then, the optimal portfolio holdings of all foreign countries that the agent chooses to learn and invest in are the same:

$$\alpha_k = \alpha = \frac{E(r|p) - r^f}{\gamma\tilde{\sigma}^2} + \frac{1}{2\gamma}$$

Hence, since all foreign holdings are the same as a share of the total portfolio of the agent, as a share of just the *foreign* portion of the portfolio they are all equal to $\frac{1}{N}$:

$$x^{-H}$$

their beliefs more than the average belief are the ones who will increase their portfolios. Substituting in the expression for the equilibrium price, p_k, in the optimal holdings expression, we can show that the equilibrium portfolio holdings of asset k of bank j are given by

$$\alpha_{jk} = \frac{E_{1j}(d_k)) - \bar{E}_1(d_k)}{\gamma \hat{\sigma}^2_{jk}} + \frac{1}{2\gamma}\left(1 - \frac{\bar{\sigma}^2_k}{\hat{\sigma}^2_{jk}}\bar{\varphi}_k\right) + \gamma z_k \frac{\bar{\sigma}^2_k}{\hat{\sigma}^2_{jk}} \tag{19}$$

where we define the average market expectation (wealth-weighted) $\bar{E}_1(d_k)$ as

$$\bar{E}_1(d_k) = \bar{\sigma}^2_k \left(\sum_{j \in B_k} \frac{W_{1j}}{N_k} \frac{\int E^{(i)}_{1j}(d_k)di}{\hat{\sigma}^2_{jk}} \right)$$

As we can see, the basic results of the partial equilibrium comparative statics still remain true as long as you control for the average market beliefs. Agents will hold more of a given asset the more optimistic they are about its return *relative* to the average market belief, the higher the precision of their beliefs *relative* to the average market precision, and their portfolio holdings will be more responsive to their relative optimism, the greater is the precision of their beliefs. In our empirical tests we control for all of this market effects by including the appropriate fixed effects.

D Additional Tables

Table 8: Number of forecasters per country

This table contains the number of forecasters for each country in Consensus Economics. Observations refers to the number of forecasters × number of months in the sample.

Country	Obs.	min	p25	p50	p75	max
France	1645	2	14	15	16	18

Table 9: Forecasters

ABI	DIW - Berlin	ISAE	OFCE
ABN AMRO	DIW Berlin	ITEM Club	OTP Bank
AFI	DNB	ITOCHU Institute	Oddo Securities
AXA Investment Managers	DTZ Research	IW - Cologne Institute	Oxford - LBS
Action Economics	DZ Bank	IfW - Kiel Institute	Oxford Economics
Allianz	Daiwa Institute of Research	Inforum - Univ of Maryland	PAIR Conseil
American Int'l Group	Danske Bank	Inst Estud Economicos	PKO Bank
BAK Basel	DekaBank	Inst L R Klein (Gauss)	PNC Financial Services
BBVA	Deutsche Bank	Institut Crea	Pictet & Cie
BHF-Bank	Dresdner Bank	Institute EIPF	Prometeia
BIPE	DuPont	Instituto de Credito Oficial	RBS
BNP Paribas	EFG Eurobank	Intesa Sanpaolo	RDQ Economics
BPCE	ENI	JP Morgan	REF Ricerche
BPH	Eaton Corporation	Japan Ctr for Econ Research	RWI Essen
Banca Com Romana	Econ Institute SAV	Japan Tech Info Services Corp	Rabobank
Banca IMI	Econ Intelligence Unit	KOF Swiss Econ Inst	Rai□eisen
Banesto	Econ Policy Institute	KUKE	Rexecode
Bank America Corp	Economic Perspectives	Kempen & Co.	Roubini Global Econ
Bank Julius Baer	Erik Penser Bank	Kiel Economics	SBAB Bank
Bank Vontobel	Erste Bank	Kopint-Tarki	SEB
Bank Zachodni	Est Inst of Econ Rsrch	La Caixa	Sal Oppenheim
Bank of America	Euler Hermes	Landesbank Berlin	Santander
Bank of Tokyo-Mits. UFJ	Euromonitor	Lehman Brothers	Schroders
Bankia	Exane	Liverpool Macro Research	Skandiabanken
Barclays	Experian	Lloyds TSB Financial Markets	Slovenska Sporitelna
BayernLB	FERI	Lodz Institute - LIFEA	Societe Generale
Beacon Econ Forecasting	FUNCAS	Lombard Street Research	Standard & Poor's
Bear Stearns	Fannie Mae	MESA 10	Statistics Norway
CASE	Feri EuroRating	MM Warburg	Svenska Handelsbanken
CEOE	First Securities	Macroeconomic Advisers	Swedbank
CEPREDE	First Trust Advisors	Merrill Lynch	Swiss Life
CIB Budapest	Fitch Ratings	Millennium Bank	Swiss Re
CSOB	Ford Motor Company	Mitsubishi Research Institute	Takarek Bank
Caja Madrid	Fortis	Mitsubishi UFJ Research	Tatra Banka
Cambridge Econometrics	GAMA	Mizuho Research Institute	The Conference Board
Capital Economics	GKI Econ Research	Mizuho Securities	Theodoor Gilissen
Capitalia	Gdansk University	Moody's Analytics	Total
Centre Prev l'Expansion	General Motors	Morgan Stanley	Toyota Motor Corporation
Centro Europa Ricerche	Georgia State University	NHO Conf Nor Enterprise	UBS
Chamber of Commerce	Global Insight	NHO Confed Nor Enterprise	UniCredit
Chrysler	Goldman Sachs	NIBC	United Bulgarian Bank
Citigroup	HBOS	NIESR	United States Trust
Coe-Rexecode	HQ Bank	NLI Research Institute	Univ of Michigan - RSQE
Commerzbank	HSBC	NYKredit	Vienna Institute - WIIW
Concorde Securities	HSH Nordbank	Nat Assn of Home Builders	WGZ Bank
Confed of British Industry	HWWI	National Institute - NIER	Wachovia Corp
Confed of Swed Enterprise	Helaba Frankfurt	Natixis	Wells Capital
Confindustria	Hypo Alpe Adria	Nippon Steel	Wells Fargo
Credit Agricole	IFL-Univers Carlos III	Nomura	WestLB
Credit Suisse	IFO - Munich Institute	Nordea	ZÃijrcher Kantonalbank
D&B	ING	Northern Trust	Öhman

Type	%	Type	%
Bank	51.50	University	2.88
Consulting Firm	21.15	Business Association	2.59
Research Institute	11.25	Corporation	2.02
Financial Services	8.32	Total	100

Table 10: Intensive Margin – Foreign Exposures Only, Robustness

This table provides the estimates for equation (12). The dependent variable is the share of EEA country *c* sovereign bonds in bank *b* sovereign portfolio. The independent variables are defined in Table 1. Standard errors are three–way clustered at the bank, country and year level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)

Table 11: Intensive Margin – Domestic and Foreign Exposures, Robustness

This table provides the estimates for equation (12). The dependent variable is the share of EEA country *c* sovereign bonds in bank *b* sovereign portfolio.The three main independent variables are defined in Table 1; Home equals one for domestic forecasts only; GIIPS equals one only for banks located in either Greece, Ireland, Italy, Portugal or Spain. Standard errors are three–way clustered at the bank, country and year level. ***,**,* indicate statistical significance at 1%, 5%, and 10%, respectively.

$\overline{SFE}(Y10)$	-35.06	-41.80	-54.47	-51.98	-54.68
	(21.357)	(18.534)	(22.300)	(23.406)	(23.920)
Y10	-4.461	-3.657	-4.055	-4.050	1.528
	(1.765)	(1.197)	(1.562)	(1.947)	(3.328)
$\overline{SFE}(Y10) \times Y10^1$	5.604	6.499	9.057	8.255	9.070
	(2.963)	(2.215)	(2.800)	(3.185)	(3.243)
Home	17.57	12.93	13.41	12.45	14.43
	(6.483)	(6.582)	(6.870)	(7.018)	(6.866)
Home × GIIPS	59.58	64.03	65.67	66.75	65.25
	(16.532)	(15.016)	(17.179)	(16.600)	(16.517)
Observations	408	408	247	407	226
Adj. R^2	0.870	0.913	0.665	0.907	0.500
N of Banks	34	34	15	34	15
N of Destination Countries	11	11	11	11	10
N of Time Periods	8	8	8	8	8
Time FE	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes
Destination Country FE	no	yes	yes	yes	yes
Bank-Time FE	no	no	yes	no	yes
Destination Country-Time FE	no	no	no	yes	yes