EUROPEAN CENTRAL BANK

EUROSYSTEM

Working Paper Series

Marco Graziano, Maurizio Michael Habib

Mutual funds and safe government bonds: do returns matter?

No 2931

Abstract

This paper investigates the sensitivity of the demand for *safe* government debt to currency *unhedged* and *hedged* excess returns in a sample of US mutual funds. We find evidence of active rebalancing towards government bonds that offer relatively higher returns on an *unhedged* basis, in particular euro-denominated securities. The size of the effect is large, leading to a change in portfolio share by around one percentage point on average in response to a change by one percentage point in the currency-specific excess return. Interestingly, mutual funds rebalance their portfolio towards currencies, such as the Japanese yen, that display large deviations in the covered interest parity and offer higher returns than US Treasuries on an *hedged* basis. Finally, when global financial risk is on the rise, US mutual fund managers repatriate their investments towards US government debt securities, mainly at the expenses of euro-denominated ones. Our results imply that deviations in pricing conditions like uncovered and covered interest parity for sovereign bonds affect capital flows from the United States towards other major currency areas.

JEL Classification: F3, G11, G12, G15, G23

Keywords: government bonds, safe assets, mutual funds, search for yield, covered interest parity.

Non-technical summary

Since the global financial crisis in 2008, a scarcity of safe assets emerged, leading to a dramatic decline in the yields of government debt issued by major advanced economies with a reserve currency status, and a growing interest in the characteristics of safe assets. Understanding the drivers of demand for safe assets becomes even more important as geopolitical risk is on the rise following the war in Ukraine, sanctions on Russia by advanced economies and tensions in the Middle East, which might cause long-term consequences for the international monetary system. One of the main features of safe assets is the relatively low elasticity of their demand with respect to yields. In this paper, we contribute to the mounting evidence that this is not always the case. We show that cross-currency yield differentials in the sovereign bond market of high-rating issuers can affect the relative appeal of currencies for US mutual funds, an important class of investors, shaping the overall demand for global safe assets.

We find that US-based fund managers actively rebalance towards government bonds offering higher returns than the portfolio-weighted average return on an *unhedged* basis, i.e. without hedging the currency risk. The size of the effect is significant. A change by one percentage point in unhedged excess return leads to a change in portfolio shares by around one percentage point, on average, across several currencies. This portfolio adjustment also has important implications for capital flows. For instance, an increase in the excess return of euro area government debt securities by one percentage point would trigger capital flows from the United States towards the euro area economies issuing highly-rated debt securities in the order of magnitude of \$300 million, amounting to around 2 percent of total quarterly foreign flows into highly-rated euro area government debt securities, according to balance of payments data.

Importantly, there are significant differences in the reaction to excess returns on an unhedged or hedged basis. Currencies such as the Japanese yen, that offer lower returns on an unhedged basis, may still attract US-based institutional investors by offering relatively higher returns on a currency *hedged* basis. These results reveal that US mutual funds do exploit the advantage conferred by their role of liquidity providers in the market for forward dollars, where mismatches in hedging flows combined with balance sheet frictions of intermediaries open up deviations in the covered interest parity condition.

We also provide insights on the role of financial and monetary conditions for the sovereign portfolio shares of US mutual funds and for their sensitivity to excess returns. When global risk is on the rise, US mutual fund managers repatriate their investments towards US government debt securities, mainly at the expenses of euro-denominated ones. On the other hand, when US monetary policy rates are low, US fund managers respond more strongly to the excess returns of euro-denominated securities. This finding extends the evidence of search for yield in a low interest rate environment to the context of safe government bonds.

Overall, our results have significant implications for capital flows from the United States towards other major currency areas, as well as for the impact of the failures of arbitrage conditions on the incentives of institutional investors.

1 Introduction

Since the global financial crisis in 2008, a scarcity of safe assets emerged, leading to a dramatic decline in the yields of government debt issued by major advanced economies with a reserve currency status and a growing interest in the characteristics of safe assets (Caballero et al., 2017). Safe assets command a premium not only for safety but also for liquidity (Krishnamurthy and Vissing-Jorgensen, 2012), are information insensitive (Gorton, 2017) and have a negative market beta, appreciating when global risk aversion is on the rise, i.e they are like a "good friend", valuable and liquid when one needs them (Brunnermeier et al., 2022). Most of the empirical research on this topic focuses on what is considered the world's premier safe asset, US Treasury debt, while there are only few studies that try to offer a global perspective to this debate (Du et al., 2018; Habib and Stracca, 2015; Habib et al., 2020). Understanding the drivers of demand for safe assets becomes even more important as geopolitical risk is on the rise following the war in Ukraine, sanctions on Russia by advanced economies, and tensions in the Middle East, which might have implications for the international monetary system (Brunnermeier et al., 2022). In this paper, we tackle this issue from a specific angle, studying the portfolio of *safe* government debt securities – debt issued by sovereigns with the highest credit rating, double A or higher according to Standard & Poor's – held by US mutual funds, which play a key role in intermediating savings from the world's largest economy to the rest of the world.[1] Specifically, we study whether asset managers of US mutual funds shift the allocation of these portfolios towards currencies that offer higher yields. We also ask whether the demand for high-rated government bonds by mutual funds is affected by global financial conditions, as typical of safe haven assets. By studying the sensitivity of the portfolio shares of safe government securities to returns differentials for a major class of investors such as mutual funds, we help to shed light on the broader nature of demand for safe assets.

To a very large extent, government debt of major advanced economies is issued in domestic currency and therefore the US dollar return of the portfolio of US mutual funds will be influenced by exchange rate movements of these currencies against the US dollar. Portfolio managers may decide to accept the currency risk or hedge it.

[1] Total assets managed by the fund industry in the United States rose from little over USD 5 trillion at the turn of the century to more than USD 16 trillion at the end of 2022 (see Financial Accounts of the United States, Table L.122, Federal Reserve Board), and are a growing source of financing in the sovereign debt markets of advanced economies (Fang et al., 2022).

As a novelty compared to the existing literature, we use a granular fund-level panel dataset to investigate the reaction of the portfolio shares of sovereign safe assets to both currency *unhedged* excess returns – i.e the total return differential between US dollar debt and that issued in another currency – and currency *hedged* excess returns, relevant whenever asset managers use derivatives to neutralise the impact of fluctuations in the exchange rate of the US dollar against other currencies in the portfolio. Indeed, around 90% of US fixed income funds with an international focus use currency forwards to manage their foreign exchange exposure (Sialm and Zhu, 2021). To hedge against this currency risk, managers have to sell the foreign currency in the forward market against the US dollar.

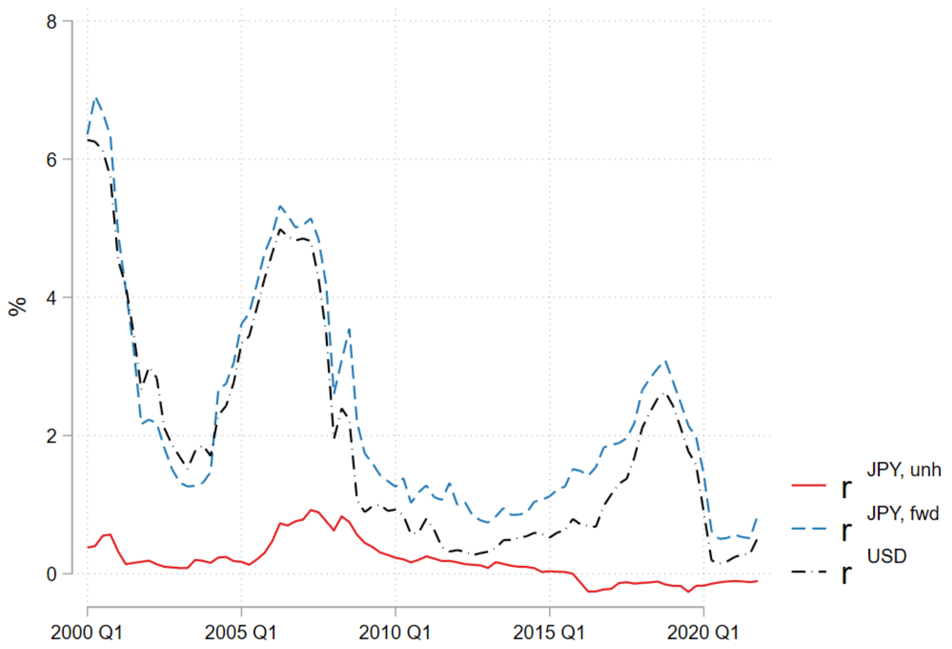
In theory, the Covered Interest Parity (CIP) should ensure that interest rate differentials match the forward premium or discount, i.e the difference between the spot exchange rate and the forward one, which represents the cost of currency hedging operations. This way, the dollar return equals the return from investing in another currency that is hedged into dollars.[2] In practice, there may be large deviations from CIP, which create a wedge between the dollar return and the foreign currency *hedged* return.[3] As a result, the portfolio manager of a US dollar-based fund that invests in government debt securities issued by sovereigns with similar credit risk is confronted with a choice between three potential returns: (i) the return on US dollar debt; (ii) the currency *unhedged* return from investing in debt issued by another country and denominated in a foreign currency, including an exchange rate fluctuation between the current spot rate and future spot rate; (iii) a *hedged* return in US dollar terms from investing in the foreign currency debt and covering the exchange rate risk with derivatives. Figure 1 shows concretely the return opportunities of a US investor that must decide between investing in US (dollar) debt or Japanese (yen) debt securities. On an unhedged basis, US Treasuries (black dashed line) yield higher returns than

[2]For instance, assuming similar credit and liquidity risk and the same maturity between two debt securities issued by the United States and another sovereign, if the interest rate on the foreign currency - say debt issued by Japan in Japanese yen - is lower than the interest rate on US dollar debt, then the US dollar should be priced at a discount against the Japanese yen in the forward market with respect to the spot market.

[3]CIP deviations in government bonds have been attributed to either the unique safety and liquidity of US Treasuries (Krishnamurthy and Vissing-Jorgensen (2012), Du et al. (2018)) or frictions in FX markets (Borio et al. (2016)), and their implications are usually understood in terms of affecting the cost of USD hedging for non-dollar investors. From the perspective of dollar-based US investors, CIP deviations can instead represent an opportunity for higher returns on foreign government bonds on a hedged basis, in line with the speculative motive of hedging described by Anderson and Danthine (1981).

Japanese government bonds (red solid line) so that an investment in Japanese yen offers a lower return unless the investor expects that the yen will appreciate over the investment horizon. The comparison between the return from an investment in US Treasuries (black dashed line) and one in Japanese debt, currency hedged (blue dashed line) is particularly interesting. Under CIP, the black and blue lines should coincide. Indeed, the two lines tend to comove. However, we can observe large deviations in our sample: on average more than 50 basis points and, in some instances, even up to 100 basis points in favour of an investment into Japanese debt, currency hedged. Most importantly, since the global financial crisis in 2008, the sign of this deviation is consistently positive so that this *risk-free* excess return is *predictable*. To our knowledge, so far no one investigated whether US professional investors, such as fund managers, tried to exploit these opportunities to boost the overall return of their dollar portfolios, and how these strategies differ across currencies.

Figure 1. Hedged and unhedged returns from investing in Japanese debt against the return from US Treasuries



Average yields on US Treasuries in dollars, r_t^{US} black line . Average yield of Japanese government bonds in yen, $r_t^{j,unh}$ red line. Average yield of Japanese government bonds hedged into dollars, $r_t^{j,fwd}$ blue line. All yields are averaged over the 3 month, 1 year, 2 year and 5 year maturities. Hedged returns are calculated based on forward contract of the same maturity as the corresponding government bond. Source: Refinitiv Eikon.

To assess the sensitivity of the portfolio of US mutual funds to differentials in currency *unhedged* and *hedged* returns, this study uses panel regressions of the shares of currencies of major advanced economies with an elevated credit rating: the US dollar, the euro [4] the Japanese yen, the pound sterling, the Swiss franc, and the Australian dollar. We estimate a model for each currency, including fund and time fixed-effects to isolate idiosyncratic variation in fund-level, currency-specific excess returns. The objective of our analysis is the behaviour of fund managers and their decision to change the currency allocation of their portfolio in response to returns. Therefore, we net out valuation effects that are driven by changes in bond prices and exchange rates and focus on the active rebalancing of their currency portfolio, which tends to dominate the overall variation in the currency shares.

Our main findings are the following. We find evidence of active rebalancing towards government bonds that offer relatively higher returns on an *unhedged* basis, in particular euro-denominated securities. The size of the effect is large, leading to a change in the portfolio share of the US dollar, the euro, the pound sterling, the Swiss franc or the Australian dollar by around one percentage point in response to a change by one percentage point (one standard deviation approximately) in currency-specific excess returns. The ensuing impact on capital flows is also sizeable. For instance, an increase by one percentage point in the excess return of euro area economies issuing highly-rated debt triggers capital flows from the United States towards these euro area economies in the order of magnitude of \$300 million. This accounts for around 2 percentage points of total foreign flows into highly-rated euro area government debt securities on a quarterly basis, according to the balance of payments. There is also evidence of active rebalancing into the Japanese yen and the Canadian dollar when they offer relatively higher returns on an *hedged* basis. The evidence for the Japanese yen is particularly intriguing, as government debt denominated in this currency typically offers the highest and least volatile hedged excess return among the government debt securities in our portfolio. A one standard deviation change in Japanese yen hedged excess returns is estimated to trigger a reallocation by around 150 basis points in its portfolio share. As regards the other currencies, the lower sensitivity of portfolio shares to hedged returns is consistent with recent findings of relatively exchange-rate inelastic demand for forwards for the investment fund sector as a whole (Wallen (2022), Bräuer and Hau (2022)). Therefore, our results suggest that the sign, magni-

[4] For the euro area, we include only government debt issued by Austria, Belgium, France, Germany and the Netherlands, which maintained a credit rating from S&P of AA or higher throughout our sample period.

tude and persistence of CIP deviations on government bonds do affect the portfolio choice of mutual funds, which in turn drive large capital flows from the United States.

This study offers additional insights that are relevant for the theoretical and empirical literature on the portfolio choice of private institutional investors. First, we find evidence of strong frictions, since the coefficients associated with the lagged currency shares in our regressions are positive and statistically significant. The slow portfolio adjustment is consistent with the results in Bacchetta et al. (2023) for equity funds. Second, there is some tentative evidence of *currency momentum* for debt issued by the euro area and Japan, as the response of currency shares to past currency movements is positive. Third, we ask whether global financial turbulence, proxied by the VIX index measuring investors' risk aversion, is associated with a reallocation within our portfolio of safe assets. We find that when global risk is on the rise, US mutual fund investors repatriate their investments towards US government debt securities, mainly at the expenses of euro-denominated ones. Finally, we study whether the low interest environment of the past decade had an impact in the currency allocation. When the policy rate of the Federal Reserve is low, the sensitivity of the currency share of the euro in the sovereign portfolio of US mutual funds to excess returns is more elevated, suggesting that US professional investors search for yield in the euro area in a low interest rate environment. Interestingly, times of tight monetary policy in the US are instead associated with higher portfolio shares for the yen and the Swiss franc, as well as a lower sensitivity to their excess returns. This finding is consistent with a flight to safety behaviour, but only to the extent that high US policy rates contain information on global financial stress that is distinct from investors' risk aversion as measured by the VIX, as suggested by Habib and Venditti (2019) .

Our paper relates to two main strands of literature. The first one is the analysis of the demand for safe assets. Krishnamurthy and Vissing-Jorgensen (2012) and Jiang et al. (2021) argue that the premium commanded by US Treasuries over other assets with similar credit risk is a reflection of demand by investors that value their safety and liquidity even at the expense of lower returns. Jiang et al. (2023) document low rates of returns on Treasuries for foreign investors in particular. Tabova and Warnock (2022) partly challenge this view by providing evidence of elastic demand for Treasuries from foreign private investors, who actually achieve high returns on their Treasury portfolio. In a similar vein, Fang et al. (2022) and Eren et al. (2023)

find that, on aggregate, mutual funds display a particularly yield-elastic demand for advanced-economy sovereign bonds.[5] We contribute to this debate by studying the demand for safe assets issued by several countries, not only US Treasuries, and from the perspective of US rather than foreign investors. Our analysis highlights a strong reaction of mutual funds' demand to the excess returns of safe government debt securities. This elasticity is different across investment currencies and also appears to depend on the opportunities provided by deviations in the CIP. These deviations allow US-based investors to obtain higher returns on a currency-hedged basis when they invest invest in non-US dollar currencies.

The second strand of related literature examines the role of mutual funds and the search for yield in driving capital flows across countries. Studies of mutual funds include the analysis of both flows in and out of funds, and the portfolio choice of managers. A notable contribution in this area is Raddatz and Schmukler (2012), which finds that both injections into/redemptions from funds and changes in country shares by asset managers respond to country returns. Other papers that zoom in specifically on portfolio choice include Falkenstein (1996) and Camanho et al. (2022), but they focus on US *equity* funds.[6] The latter fits most closely with our analysis in that it studies portfolio rebalancing in response to foreign excess returns, taking exchange rate movements into account. Several papers that use mutual funds data are concerned mainly fund flows and neglect managers' portfolio choice. Some examples are Kroencke et al. (2015), Banegas et al. (2022), Fratzscher et al. (2016), Hau and Lai (2016), Fratzscher et al. (2018), and Bubeck et al. (2018). These studies suggest that overall both conventional and unconventional monetary policies result in substantial mutual fund flows, with a stronger effect for outflows from corporate bond funds and inflows into equity funds. Other papers investigate the search for yield and the resulting capital flows, not necessarily driven by mutual funds. Frankel and Engel (1984) and Bohn and Tesar (1996) are among the first papers to test empirically the asset demand implications of portfolio choice models, uncovering evidence of search for yield behaviour. More recent papers focus on risk-taking, including Ammer et al. (2016) and Ammer et al. (2019). They use confidential data on US bond holdings by

[5] Faia et al. (2022) reports high sensitivity of euro area mutual funds to the returns of corporate bonds as well.

[6] This feature is common to much of the literature, mainly due to better data availability. Papers that do use data on bond funds, such as Raddatz and Schmukler (2012),Raddatz et al. (2017) and Cenedese and Elard (2021), typically rely on rather limited samples.

foreign investors to show that low interest rate in investors' residence countries lead to inflows into US equities and corporate bonds, especially in the high-yield, high-risk segment. Ahmed et al. (2023) considers the relationship between foreign excess returns, currency hedging and search for yield, but focusing instead on the investment of euro area investment funds in US corporate bonds. They find that institutional investors hedge their foreign exchange risk exposure, which compresses their excess returns and leads them to shift their portfolio towards riskier corporate bonds when US monetary policy tightens.

We extend the literature on mutual funds and capital flows across a number of dimensions. First, we provide a systematic analysis of the determinants of US mutual funds' demand for *safe* government bonds, within a large sample in terms of total Assets under Management (AuM) and coverage of the bond fund universe. In particular, we zoom in on a portfolio of safe government debt securities and calculate *fund-specific* excess returns that closely reflect the idiosyncratic incentive for each fund to invest in a given country/currency. Similarly to other studies, we find that currency excess returns are an important driver of active reallocation on the fund managers' part. Our results have also implications for the role of mutual funds in international capital flows, highlighting that the response of managers' portfolio choices to international investment opportunities plays a significant role.

The remainder of the paper is structured as follows. Section 2 provides background and descriptive analysis on the mutual funds portfolio data. We present the results of our econometric models of portfolio shares in Section 3. Finally, Section 4 concludes.

2 Data

2.1 Description of the dataset

We use a commercial dataset, Refinitiv Lipper, which provides detailed information regarding the portfolios of US-domiciled mutual funds. We restrict the scope of the analysis to fixed-income funds and exclude mixed-funds which may have an incentive to substitute equity for bonds in response to common shocks that affect all bond yields. Our initial sample includes 880 funds with an active management style, which we observe quarterly from 2010 Q1 to 2021 Q4.[7] The main target of our investigation is the portfolio share of government debt issued by advanced economies with elevated credit ratings. Specifically, we select countries that maintained an S&P credit rating of AA or above rating throughout our sample period: Australia, Canada, highly-rated euro area countries, Japan, Switzerland, the United Kingdom and the United States.[8] The share $s^j_{i,t}$ of country (currency) j bonds held by fund i in quarter t is calculated as the ratio of the market value of country (currency) j government bonds, summed over all maturities; to the market value of government bonds of all countries of interest, likewise summed over all maturities. In the analysis the terms "country" and "currency" will be used interchangeably as the sovereigns in our portfolio issue government debt almost exclusively denominated in their domestic currency.

The rationale for choosing these countries in particular is twofold. First, we want to study safe assets, looking at a portfolio of major international currencies with a low degree of credit risk. These are also the major currencies that account for the bulk of foreign exchange reserves in the IMF's COFER dataset, which are particularly valued for their safety by official investors with a conservative investment mandate. Second, we include both currencies for which CIP deviations offer on average an extra return from the point of view of a US dollar investor (EUR, JPY), and those for which the CIP deviation is usually negative (AUD). The aim is to investigate whether the reaction to hedged excess returns changes with the sign of the CIP deviations. We remove from the sample all fund-quarter observations for which there are no holdings of sovereign bonds for any of these countries.

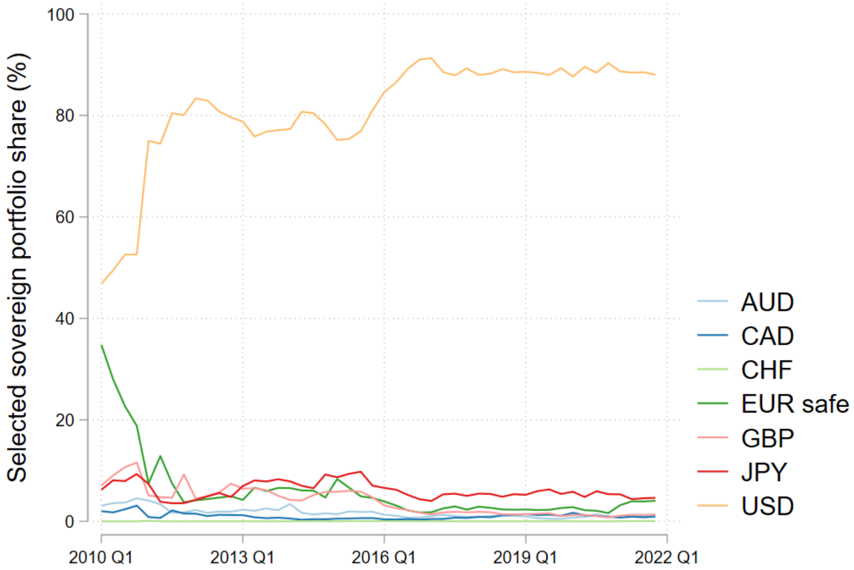
There is a strong *home bias* in the portfolio of US-based funds that must be addressed before starting our empirical analysis, since we are interested in the decisions of fund managers with a diversified international portfolio.[9] Our initial sample includes more than 600 funds that invest only in US Treasuries, with an average AuM of $1.6 billion. As a result, the aggregate portfolio share s^j_t is strongly biased towards US Treasuries,

[7] Our panel is unbalanced, since funds enter and drop out of the sample. In appendix E.4, we perform robustness checks on both descriptive and econometric analysis, to ensure that our results are not affected by the sample composition.

[8] Consistently with our focus on safe government bonds, we include in the euro area share only bonds issued by countries which maintained an S&P credit rating of AA or above throughout our sample period. Namely, they are Austria, Belgium, France, Germany and the Netherlands.

[9] Home bias is a common feature of international portfolios, see for example Hau and Rey (2008), Coeurdacier and Rey (2013), Coeurdacier and Gourinchas (2016)

Figure 2. Aggregate portfolio shares: full sample



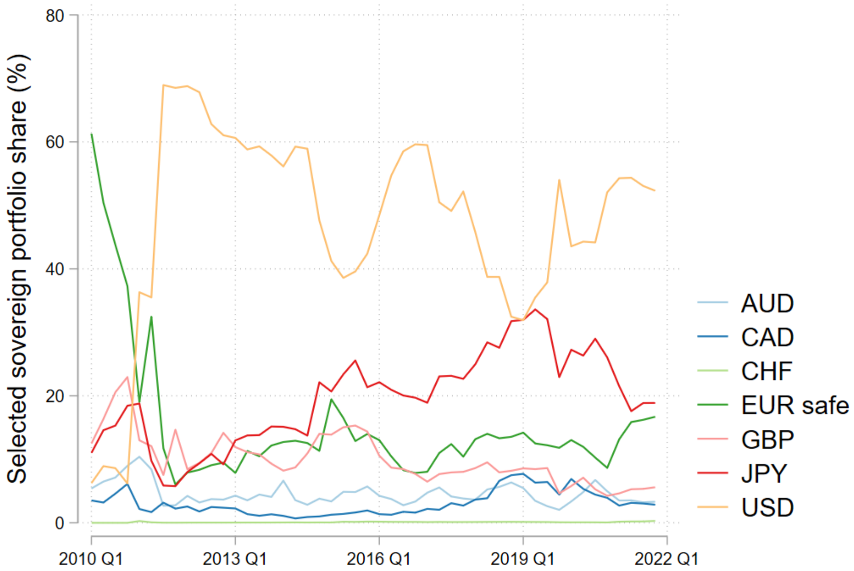
The chart reports the aggregate currency shares in a portfolio of selected sovereign issuers with an elevated rating standard (AA or more). The aggregate share s_t^j of country (currency) j bonds in quarter t is calculated as the ratio of the market value of country (currency) j government bonds, summed over all maturities and all funds; to the market value of government bonds of all countries of interest, summed over all maturities and all funds. Source: Refinitiv Lipper.

accounting for more than 80% of the total portfolio (see Figure 2). The share of debt securities issued by highly-rated euro area economies, Japan and the United Kingdom ranges between 5% and 30%. To account for this home bias, we exclude all funds that have an average portfolio share greater than 95% in any of the countries of interest.[10] The sample thus restricted includes 186 funds. Figure 3 plots aggregate portfolio shares in the restricted sample excluding funds with a country focus. The US share drops to a level much closer to that of other countries, indicating a sub-sample of internationally-oriented funds. As a robustness check, in appendix E.5, we investigate whether the results of the analysis including only funds whose average portfolio is close to an International CAPM benchmark are similar to the results using this portfolio.

Figure 4 shows that the total AuM of funds in our sample excluding funds with a country focus varies over time, ranging from \$100 billion in 2010 Q3, to \$366 billion

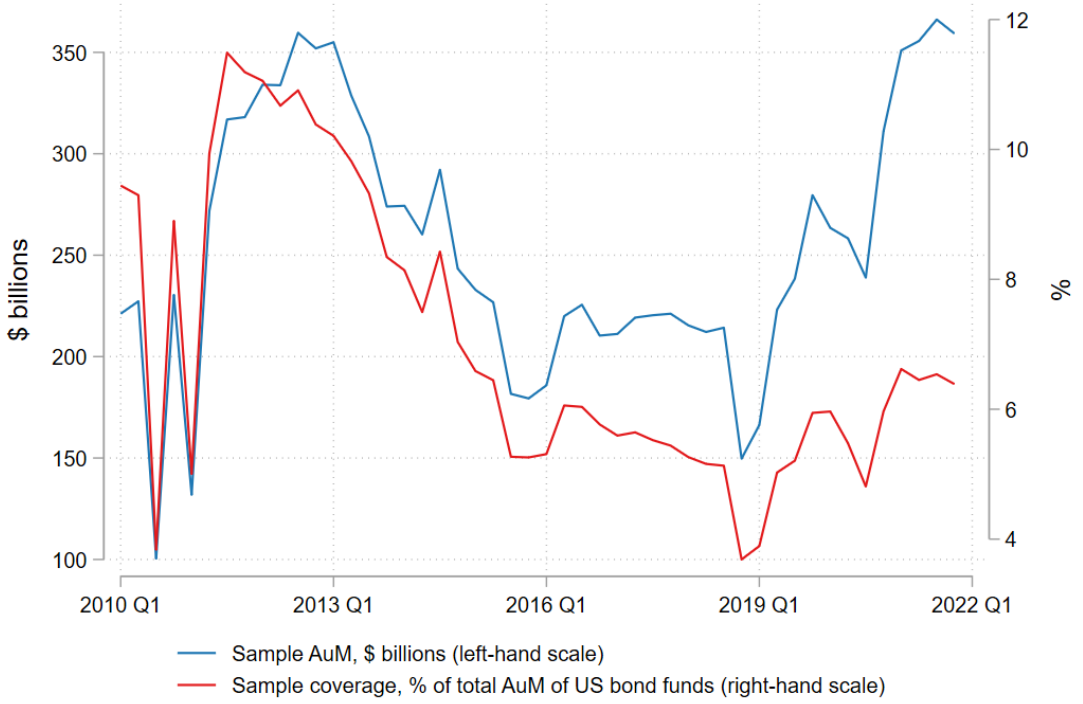
[10] In addition, we also exclude funds that never invest in country j when studying the allocation towards currency j. Flows into funds with a geographical focus on a single country can provide useful information on the choice of retail investors, but this is outside the scope of this study.

Figure 3. Aggreagate portfolio shares: sample excluding funds with a country focus



The chart reports the aggregate currency shares in a portfolio of selected sovereign issuers with an elevated rating standard (AA or more), excluding funds that have an average portfolio share greater than 95% in any of the countries of interest. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. The aggregate share s_t^j of country (currency) j bonds in quarter t is calculated as the ratio of the market value of country (currency) j government bonds, summed over all maturities and all funds; to the market value of government bonds of all countries of interest, summed over all maturities and all funds. Source: Refinitiv Lipper.

Figure 4. Sample excluding funds with a country focus: coverage



Sample coverage calculated as total AuM of all funds in the sample excluding funds that have an average portfolio share greater than 95% in any of the countries of interest, divided by total AuM of all bond mutual funds domiciled in the US. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Source: Refinitiv Lipper and Federal Reserve Finanial Accounts of the United States, Table F.122

in 2021 Q3. This corresponds to a coverage of about 4 to 11% of the AuM held by all US-based mutual funds investing in the fixed-income market. The size and coverage of our sample are larger than those of previous studies using portfolio-level data on fixed-income mutual funds. For example, Cenedese and Elard (2021) use EPFR data covering a maximum of 75 bond funds with aggregate $106 billion AuM, while Raddatz and Schmukler (2012) report total AuM ranging from $10 to $100 billion out of 121 bond funds.

Sovereign bonds constitute a minority of assets in the sample, with the average fund holding $482 million worth of sovereign bonds, which is roughly one fifth of total assets (see Table 1). The remaining assets consist primarily of corporate bonds, cash, and derivatives. The debt issued by the highly-rated countries that constitute our portfolios account for more than a half (approximately 57%) of holdings of sovereign debt of the average fund. Panel B of Table 1 reports portfolio shares in the sample. The US share across time and funds averages around 43%, while highly-rated euro area issuers and Japan have an average share 16%. These currency shares are not very far from a theoretical benchmark from the international-CAPM, where the US debt would represent 50% of the market capitalisation of our portfolio of currencies, the highly-rated euro-denominated debt 13% and Japanese debt 23%. Therefore, our selection procedure results in a subsample of geographically well-diversified funds displaying substantial time-series and cross-sectional variation in country shares, and whose average portfolio broadly reflects relative sizes in the sovereign bond market.

Table 1. Sample excluding funds with a country focus: summary statistics

	N	Mean	SD	Min	P5	P95	Max
A. Fund characteristics							
Assets under management ($Mil.)	4,823	2,544	10,528	0.10	11.20	8,470	179,914
Total sovereign holdings ($Mil.)	4,906	482	1,669	0.03	2.51	2,295	46,539
Selected sovereign holdings ($Mil.)	4,906	277	1,126	0.01	0.77	1,277	29,880
Reporting quarters	4,906	41	11	1	13	48	48
B. Selected sovereign portfolio shares							
United States	4,906	0.43	0.44	0	0	1.00	1
Euro Area safe	4,906	0.16	0.24	0	0	0.69	1
Australia	4,906	0.09	0.22	0	0	0.64	1
Canada	4,906	0.04	0.13	0	0	0.23	1
Japan	4,906	0.16	0.23	0	0	0.61	1
Switzerland	4,906	0.00	0.02	0	0	0.01	0.56
United Kingdom	4,906	0.12	0.20	0	0	0.52	1

Statistics are calculated on the sample that excludes funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Highly-rated sovereign holdings include government bonds of all maturities issued by Australia, Canada, euro area highly-rated issuers (Austria, Belgium, Germany, France, the Netherlands), Japan, Switzerland, United Kingdom and United States. Shares refer to the portfolio that comprises all debt securities issued by the selected highly-rated sovereigns. Source: Refinitiv Lipper.

Comparing the summary statistics for fund characteristics and portfolio shares with those pertaining to the whole sample in Table A2 in Appendix B reveals that the selection procedure did not significantly alter the size and aggregate exposure to sovereign holdings of funds in the sample. At the same time, the portfolio of the average fund matches much more closely that of a global investor.

2.2 Disentangling active and passive reallocation in portfolio shares

The currency portfolio shares, our main variable of interest, is affected not only by the active reallocation by fund managers, but potentially also by valuation effects from exchange rate and bond price movements. It is necessary to disentangle these two components to study whether the active reallocation may be influenced by return differentials. To do that, the change in fund i's currency j portfolio share $\Delta s^j_{i,t}$ can be decomposed as

$$\Delta s^j_{i,t} = \Delta s^{j,A}_{i,t} + \Delta s^{j,P,R}_{i,t} + \Delta s^{j,P,XR}_{i,t}. \tag{1}$$

Here, $\Delta s^{j,P,R}_{i,t}$ is the passive change in portfolio share due to changes in the issue-currency market value of country j bonds; $s^{j,P,XR}_{i,t}$ is the passive change in portfolio share due to the appreciation or depreciation of the issuance currency of country j bonds *vis-à-vis* the US dollar, the reporting currency in the dataset; and $\Delta s^{j,A}_{i,t}$ is the change in portfolio shares due to active rebalancing on the fund manager's part. This decomposition follows closely the method used in Curcuru et al. (2011) and Bubeck et al. (2018), among others.

The passive reallocation due to bond returns in the currency of issuance is

$$\Delta s^{j,P,R}_{i,t} = s^j_{i,t-1}\left(\frac{R^j_t}{\bar{R}_{i,t}} - 1\right), \tag{2}$$

where R^j_t is the growth in the total return index of country j's government bonds between quarters $t-1$ and t, including both changes in prices and the reinvestment of coupon payments and interests, averaged across all maturities; and $\bar{R}_{i,t} = \sum^k s^k_{i,t-1} R^j_t$ is the overall performance of the portfolio, more precisely the weighted average of the performance of the total return indices of government bonds in fund i's portfolio. Intuitively, if the return of securities issued by country j is higher with respect to the rest of the portfolio, the share of country j will automatically increase even if the fund manager did not perform any active portfolio reallocation.
Similarly, the passive reallocation due to exchange rate effects is

$$\Delta s^{j,P,XR}_{i,t} = s^j_{i,t-1}\left(\frac{A^j_t}{\bar{A}_{i,t}} - 1\right), \tag{3}$$

where $A^j_t = \frac{E^{USD/j}_t - E^{USD/j}_{t-1}}{E^{USD/j}_{t-1}}$ is the percentage appreciation of currency j with respect to the dollar between quarters $t-1$ and t, with $E^{USD/j}_t$ denoting the spot exchange rate in terms of dollars per unit of currency j ; and $\bar{A}_{i,t} = \sum^k s^k_{i,t-1} A^j_t$ is the average appreciation of fund i's portfolio with respect to the dollar between quarters $t-1$ and

t [11]. Once again, passive reallocation measures are defined *relative* to other countries in the portfolio. For instance, let us assume that the US dollar depreciates across the board against all the other currencies in the portfolio and this depreciation is not uniform across various currencies. First, as a consequence of the depreciation, the dollar share in the portfolio will decrease. Second, the impact of valuation effects on the other currencies will depend from the extent of their bilateral appreciation against the dollar. For instance, the share of currency j will increase passively if its appreciation with respect to the dollar is stronger than the appreciation of other currencies in the portfolio, whereas the impact of the valuation effect on the share other currencies may be positive or negative, depending on the relative size of their bilateral appreciation against the dollar.

Appendix B.2 shows the decomposition of changes in aggregate portfolio shares into active and passive reallocation components of the changes in currency shares in the aggregate portfolio, indicating that active reallocation dominates for all currencies.

Table 2. Fund-level active reallocation

	N	Mean	SD	Skewness	Kurtosis	Min	P1	P5	P95	P99	Max
$\Delta s_{i,t}^{AUD,ACT}$	3,442	-0.26	11.31	-0.52	32.29	-100	-43.50	-9.87	9.78	37.37	100
$\Delta s_{i,t}^{CAD,ACT}$	3,333	0.04	8.13	1.63	56.97	-99	-26.73	-6.05	5.91	25.63	100
$\Delta s_{i,t}^{CHF,ACT}$	692	0.00	1.00	-5.84	122.49	-16	-2.20	-0.65	0.70	2.90	8
$\Delta s_{i,t}^{EUR_S,ACT}$	3,668	-0.51	15.43	0.06	21.71	-100	-59.59	-17.90	14.16	59.64	100
$\Delta s_{i,t}^{JPY,ACT}$	3,425	0.23	12.43	0.20	26.83	-100	-42.95	-13.05	13.69	42.98	100
$\Delta s_{i,t}^{GBP,ACT}$	3,442	0.17	13.15	0.33	25.24	-100	-46.04	-14.07	15.05	47.71	100
$\Delta s_{i,t}^{USD,ACT}$	4,359	0.29	17.39	0.05	18.60	-100	-71.93	-17.14	20.55	73.59	100

All variables in percentage points. Summary statistics are calculated over the distribution of fund-quarter observations in the sample excluding funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries.

Table 2 reports summary statistics for the active reallocation across currencies at the fund-level. The average quarterly change in the shares is close to zero, ranging between +29 basis points for the US dollar and -51 basis points for the euro, reflecting inertia in the portfolio shares. However, large changes in the portfolio share by more than 10 percentage points are not infrequent for most currencies, on a quarterly basis (see standard deviation). Importantly, we identify the presence of several outliers with

[11] All government bonds in our sample are denominated in the issuer country's currency.

active rebalancing in the portfolio share by 100% in both directions.[12] Most likely, these outliers reflect observations that have been misreported by the fund manager or the data provider (e.g when there are two consecutive large changes with the opposite sign) or, if not a reporting issue, they represent radical changes in the strategy that are most likely unrelated to excess returns. In order to prevent these outliers from affecting our results, we augment our regressions with a dummy that takes a value of 1 for fund-quarters observations in the top or bottom 1% by active rebalancing $\Delta s_{i,t}^{j,A}$.[13]

3 Econometric analysis

3.1 Baseline specification

Our variable of interest is the currency share in the portfolio of highly-rated government debt securities. Rearranging the terms of equation 1, we may see that the currency share at time t, $s_{i,t}^{j}$, is a function of its value in the previous period, the active reallocation by fund managers and the passive reallocation due to price effects and exchange rate effects that have been described in Section 2.2:

$$s_{i,t}^{j} = s_{i,t-1}^{j} + \Delta s_{i,t}^{j,A} + \Delta s_{i,t}^{j,P,R} + \Delta s_{i,t}^{j,P,XR}. \tag{4}$$

Therefore, controlling for the past currency share, $s_{i,t-1}^{j}$, and for the valuation effects, $\Delta s_{i,t}^{j,P,R} + \Delta s_{i,t}^{j,P,XR}$, we can attribute the residual variation in the currency share exclusively to the active reallocation component, $\Delta s_{i,t}^{j,A}$, which, in turn, we aim to explain with the excess currency return, $r_{i,t}^{ex,j}$. Concretely, our empirical approach consists of regressing fund i's portfolio share in currency j on its own lag, fund-level excess returns, and passive reallocation components.[14] We estimate a separate model for each currency j to examine variations in investor behaviour that may arise from factors specific to the destination country, such as its status as a safe haven and the direction of dollar CIP deviations.[15] The baseline regression equation is

[12] Appendix B provides the same set of summary statistics for passive reallocation.

[13] In Appendix E.3, we show that the vast majority of our results survives a more stringent definition of both country-focused funds, selected as $\bar{s}_i^j \geq 0.90$; and outliers, selected as observations in the top or bottom 2.5% by $\Delta s_{i,t}^{j,A}$

[14] Note that the Nickell (1981) bias due to the inclusion of the lagged share is small in our setting because of the relatively large T. It is bounded above at around 4.5% for the average fund run of 41 quarters, while it drops to circa 3.8% if we consider the full 48-quarter run of our sample.

[15] In Appendix H we present results from estimating the currency-specific models jointly by exploiting the restriction $\sum_j s_{i,t}^j = 1$

$$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}, \quad (5)$$

where α^j_i and γ^j_t are fund and quarter fixed effects; $\mathbb{1}^{Out,j}_{i,t}$ is a dummy that takes value 1 if observation i, t is below the 1^{st} percentile or above the 99^{th} percentile of the distribution of the active portfolio reallocation, $\Delta s^{j,A}_{i,t}$, and 0 otherwise; $r^{ex,j}_{i,t} = r^j_t - \sum_{k \neq j} f^k_{i,t-1} r^k_t$ is currency j' s excess return with respect to the fund's sovereign portfolio; $f^k_{i,t-1}$ is the lagged share of currency k in the portfolio that excludes currency j.[16] We construct excess returns on a fund-specific basis, so that we can exploit fund and time fixed effects to single out idiosyncratic variation in the investment opportunity available to funds. In the analysis, we distinguish between unhedged excess returns, denoted as $r^{ex,j,unh}_t$, and currency hedged excess returns, $r^{ex,j,fwd}_t$, of country j's government bonds. The next subsection provides an in-depth analysis of these excess returns. Finally, the terms $\Delta s^{j,P,R}_{i,t}$ and $\Delta s^{j,P,XR}_{i,t}$ denote the passive reallocation components stemming from bond price or from exchange rate effects, respectively, which have been introduced in Section 2.2.

Fund fixed effects control for fund-specific characteristics, such as management style or geographical focus, that might explain a significant portion of the variation in share levels. Time fixed effects control for any global and country j-level variables that might affect both demand for sovereign bonds and their yield across all funds. Shocks to aggregate demand by global investors constitute a prime example, as they have been shown to have an important impact on bond pricing.[17] Importantly, time fixed effects absorb all time-varying factors that affect currency-specific demand for sovereign bonds. For example, changes in investors' risk appetite can result in generalised flight-to-safety behaviour towards US Treasuries, introducing a positive correlation between returns and portfolio shares in our regressions. If we are ready to assume further that fund-specific demand shocks do not affect the price of government bonds or exchange rates, the residual within-fund variation in fund-specific excess returns after controlling for global and currency-specific aggregate demand shocks identifies the average sensitivity of portfolio shares to excess returns.

[16] We use the lagged shares to calculate excess returns, both as a benchmark observable to fund managers at the point of decision, and to allay concerns of multicollinearity with current shares.

[17] See for example Faia et al. (2022) and Schmidt and Yeşin (2022).

It is worth noting that this model allows us to test two additional hypothesis regarding the drivers of the current currency portfolio share: (i) *portfolio frictions* and (ii) *valuation effects*. First, the inclusion of the lagged share, $s^j_{i,t-1}$, allows us to examine the share autocorrelation, which captures delayed portfolio adjustments. In line with Bacchetta et al. (2023), we interpret the parameter β^j_1 as a gauge of *portfolio frictions*. A positive β^j_1 implies a positive correlation between past and current shares, given currency-specific excess returns, indicating slow portfolio adjustment. Such sluggishness can be attributed to several factors such as delayed reaction to new information (highlighted in Bohn and Tesar (1996) and Froot et al. (2001)), transaction costs, or targeted currency-share levels. Second, the coefficients on the passive reallocation components, β^j_3 and β^j_4, offer insights into whether fund managers proactively alter portfolio shares in response to *valuation effects*. If these coefficients are equal to zero, changes in the currency share due to valuation effects are completely offset by an active reallocation of the opposite sign. Intuitively, this corresponds to a portfolio strategy where the fund manager targets a constant currency share over time. Conversely, coefficients between 0 and 1 imply partial offsetting. A coefficient equal to 1 implies full pass-through of valuation effects to share changes, so that the current share is only a function of the past level and valuation effects. Lastly, a coefficient of β_3 or β_4 greater than 1 suggests that the active reallocation goes in the same direction of valuation effects, an indication of a *currency momentum* strategy. For example, if fund managers increase their investments in Japanese bonds after witnessing the relative appreciation of the Japanese yen against the dollar between the previous and current quarters, we would observe $\beta^{JPY}_4 > 1$.

3.2 Unhedged and hedged excess returns

The main explanatory variable of interest is the fund-specific excess return of country j government bonds. It measures the attractiveness of investing in currency j relative to other currencies in the fund's portfolio. As already mentioned, excess returns are calculated on a currency hedged and on an unhedged basis. Our portfolio includes currencies, like the Australian dollar, that play the role of investment currency in a traditional carry trade strategy, as well as currencies, like the Japanese yen, that are used as funding currencies. Furthermore, average country interest rates are negatively correlated with the sign of CIP deviations with respect to the dollar, as shown in Borio et al. (2016). Then, from the perspective of a US investor, the incentives to invest in a given currency might point in opposite directions on an unhedged or hedged basis. We aim to capture these competing forces by analysing responses to unhedged and hedged returns separately.

The unhedged return $r_t^{j,unh}$ is simply the yield of country j's government bond in the domestic currency, averaged over the 3 month, 1 year, 2 year and 5 year maturities. We assume that expectations of the future exchange rate are equal to their current value, as it has been observed since Meese and Rogoff (1983) that exchange rates behave very closely to a random walk, making their current value a reasonably accurate forecast for future rates.[18]

We calculate currency hedged returns as $r_t^{j,fwd} = r_t^{j,unh} \frac{F_t^{USD/j}}{E_t^{USD/j}}$, where $F_t^{USD/j}$ is the forward exchange rate in terms of dollars per unit of currency j averaged over the 3 month, 1 year, 2 year and 5 year maturities. We choose $F_t^{USD/j}$ because forwards are the preferred exchange rate hedging instruments of US mutual funds. The evidence in Sialm and Zhu (2021) shows that 90% of international bond funds use forwards to manage their foreign exchange exposure. Hedged excess returns could be interpreted as a weighted average deviation from CIP for country j's government bonds with respect to other countries in the portfolio. The hypothesis we want to test is whether mutual funds modify their country shares based on the resulting cross-currency differences in hedged returns.[19]

[18]Note that in this paper we adopt the perspective of the fund manager investing at time t. Therefore, we need a proxy for the manager's expectations of exchange rates at $t+1$ to assess the predictability of excess returns, rather than using exchange rates at $t+1$ as in the Fama (1984) regressions used by most of the macro-focused literature. Instead, in keeping with the random walk view of exchange rates, we use the exchange rate at t as the fund manager's forecast for $t+1$. This approach could be refined by using data on exchange rate expectations by market participants.

[19]It is important to point out that we are not suggesting that US mutual funds engage in CIP arbitrage. In an intermediary-based FX pricing framework à la Gabaix and Maggiori (2015), they are best conceptualised as originators of hedging flows from different countries into dollars, who take as given the forward rates offered by international dealer banks. In turn, FX market rates are possibly driven by the banks's leverage constraints and the heterogeneous nature of aggregate demand across currencies. As shown by Rime et al. (2022), CIP arbitrage necessitates short-selling and possibly expanding the balance sheet with leverage. Therefore, "true" CIP deviations that generate arbitrage profits must take into account both the institution-specific funding costs and balance sheet constraints of FX intermediaries, as well as transaction costs. US mutual funds rarely engage in short selling, as shown in An et al. (2021). Furthermore, they face rather stringent leverage regulations, and when leverage does arise it typically does so in the form of index funds synthetically increasing their exposure to the reference index through derivatives, as shown in Boguth and Simutin (2018). Therefore, bond mutual funds are not well-equipped to act as CIP arbitrageurs.

Table 3. Fund-level unhedged and hedged returns

	Summary statistics							Autocorrelations			
	N	Mean	SD	Skewness	Kurtosis	Min	Max	AC(1)	AC(2)	AC(3)	AC(4)
A. Unhedged excess returns (percentage points)											
$r_{i,t}^{ex,AUD,unh}$	4,906	1.47	1.33	0.46	2.68	-0.91	5.13	0.90***	0.84***	0.77***	0.69**
$r_{i,t}^{ex,USD,unh}$	4,906	0.56	1.07	-0.91	6.36	-4.38	3.02	0.92***	0.85***	0.76***	0.67**
$r_{i,t}^{ex,CAD,unh}$	4,906	0.47	0.76	-1.04	7.39	-3.51	2.43	0.48***	0.31	0.20	0.17
$r_{i,t}^{ex,GBP,unh}$	4,906	-0.02	0.77	-1.39	6.24	-4.01	1.31	0.39***	0.24	0.16	0.17
$r_{i,t}^{ex,JPY,unh}$	4,906	-0.68	0.79	-1.71	6.76	-4.92	0.56	0.73***	0.55***	0.34	0.16
$r_{i,t}^{ex,EUR_s,unh}$	4,906	-0.82	0.89	-0.45	3.86	-4.15	1.74	0.79***	0.74***	0.66**	0.70**
$r_{i,t}^{ex,CHF,unh}$	4,906	-1.02	0.82	-1.08	4.33	-4.56	0.79	0.76***	0.69***	0.58**	0.54*
B. Hedged excess returns (percentage points)											
$r_{i,t}^{ex,JPY,fwd}$	4,906	0.56	0.40	3.05	14.93	-0.01	3.15	0.44***	0.29*	0.24	0.17
$r_{i,t}^{ex,CHF,fwd}$	4,906	0.39	0.44	2.38	10.54	-0.32	2.95	0.58***	0.48**	0.40*	0.26
$r_{i,t}^{ex,EUR,fwd}$	4,906	0.22	0.44	2.48	11.32	-0.49	2.79	0.36**	0.22	0.14	0.16
$r_{i,t}^{ex,GBP,fwd}$	4,906	0.02	0.44	2.78	13.78	-1.01	2.68	0.09	0.08	-0.03	0.04
$r_{i,t}^{ex,CAD,fwd}$	4,906	0.01	0.42	3.06	15.59	-0.70	2.66	0.15	0.05	0.01	0.18
$r_{i,t}^{ex,AUD,fwd}$	4,906	-0.17	0.55	1.59	8.14	-1.49	2.66	0.19	0.10	0.20	0.24

Summary statistics are calculated over the distribution of fund-quarter observations in the sample excluding funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Autocorrelations up to 4 quarters, AC(q), are calculated over the sample of cross-sectional average excess returns for each currency $\bar{r}_t^j = \frac{1}{I}\sum_{i=1}^{I} r_{i,t}^{ex,j}$. Standard errors for autocorrelations are calculated using the Bartlett (1946) formula. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Summary statistics for unhedged and hedged returns are displayed in the left-hand side of Table 3, where we have ranked currencies according to their average unhedged (panel A) or hedged (panel B) excess return. There is a clear mapping between interest rates (unhedged excess returns) across currencies and the sign of dollar CIP deviations (hedged excess returns), as noted by Borio et al. (2016). High-interest rate currencies, such as the Australian dollar, offer positive unhedged excess returns, but negative hedged excess returns. On the contrary, low-interest rate currencies, such as the Japanese yen, the euro and the Swiss franc offer negative unhedged excess returns and positive hedged currency returns, which are particularly elevated for the Japanese yen (56 basis points) and the Swiss franc (around 40 basis points). Funds then face markedly different incentives to invest in any given currency on a unhedged or hedged basis. Note also that the negative unhedged and positive hedged excess returns of Switzerland and Japan are consistent with different signs of deviations from UIP and CIP *vis à vis* the dollar for safe haven currencies, documented in Bacchetta et al. (2023).

To assess the predictability of excess returns, the right-hand side of Table 3 displays autocorrelations for cross-sectional average excess returns for each currency $\bar{r}_t^j = \frac{1}{I}\sum_{i=1}^{I} r_{i,t}^{ex,j}$. Unhedged returns display a positive, significant, and large autocorrelation up to four quarters ahead for most currencies. On the other hand, hedged returns display much smaller autocorrelation coefficients, significant only up to a maximum of two quarters, and only for the Japanese yen, Swiss franc and euro. Therefore, current unhedged returns provide a better signal for forward-looking investors than their hedged counterpart, and so we would expect an overall stronger reaction of portfolio rebalancing to excess returns on an unhedged basis. We discuss the predictability of excess returns in more detail in Appendix C.

3.3 Search for yield without hedging currency risk

Table 4 reports the results from the estimation of the baseline model using unhedged excess returns as the explanatory variable for the active reallocation by fund managers. We find that the coefficient associated with the unhedged excess return is positive and statistically significant for several currencies (AUD, CHF, GBP, EUR and USD), indicating a broad-based search for yield behaviour among safe government bonds. The size of the coefficients is also economically relevant. For instance, an increase by one percentage point in the excess return of euro area safe government bonds, slightly more than one standard deviation (see Table 3), leads to an increase by 0.84 percentage points in the portfolio share of the euro for the average fund. Such portfolio adjustment triggers capital flows from the United States towards the euro area economies issuing highly-rated debt securities in the order of magnitude of $300 million, amounting to around 2 percent of total foreign flows into highly-rated euro area government debt securities on a quarterly basis, according to balance of payments data. The size of the impact of excess unhedged returns on the currency share of the US dollar, the Australian dollar, and the pound sterling is of a similar magnitude, even though slightly less significant from a statistical point of view. Funds do not rebalance towards the Japanese yen, in response to unhedged excess returns, and the rebalancing towards the Swiss franc is statistically significant but small. Note that these two currencies offered the highest positive *hedged* excess returns, on average, in our sample period (see Table 3). In the next subsection, we shall investigate whether the portfolio shares of these two currencies are more sensitive to their returns on a hedged rather than on an unhedged basis.

The results in Table 4 show strong evidence of portfolio frictions and a rather limited impact of valuation effects on currency shares. First, the coefficient on the lagged currency share is large, ranging between 0.63 for the euro and 0.77 for the Australian dollar, and always highly statistically significant. This suggests that portfolio frictions are important as funds tend to benchmark portfolio shares and seldom deviate from these benchmarks.[20] Second, the coefficients associated with price valuation effects are not statistically different from zero, suggesting that fund managers tend to offset valuation effects and do not let the currency shares change passively as a result of movements in bond prices and exchange rates. Nevertheless, fluctuations in the exchange rate of the Japanese yen and the euro seem to have an impact. For the Japanese yen, the coefficient associated with the exchange rate valuation effects is close to 1, implying a nearly full pass-through of valuation effects to changes in the share for this currency. For the euro, the coefficient associated with the exchange rate valuation effects is greater than one, suggesting the presence of a currency momentum strategy, whereby fund managers actively increase (or decrease) their exposure to euro-denominated government bonds whenever the euro appreciates (or depreciates) in the previous quarter.

3.4 Search for yield hedging currency risk

Table 5 shows the results of the model where the unhedged excess return has been replaced by the hedged excess return. This model describes the portfolio choice of those fund managers who do not assume the currency risk and are thus confronted with returns from non-US dollar currencies that include the cost of hedging exchange rate fluctuations. In this case, evidently, a model for the currency share of the US dollar cannot be estimated since there is no currency risk to be hedged. The coefficient associated with the hedged excess return is not always statistically significant and not always positive. However, quite interestingly, the regressions for the Canadian dollar and, importantly, for the Japanese yen show that fund managers active rebalance in response to hedged excess returns. The portfolio adjustment is large. A one standard deviation change in Japanese yen excess returns, around 40 basis points, hedged into US dollars, is estimated to trigger a reallocation by around 150 basis points in its portfolio share. Intriguingly, Japan is one of the few countries displaying predictability in hedged returns. At the same time, US dollar CIP deviations *vis-à-vis* the Japanese yen are the largest among currencies in the advanced economy sovereign bond portfolio, as shown in Figure 1 and Table 3. Therefore, there is some suggestive evidence that US mutual funds exploit their favourable po-

[20] In appendix F we show that adding up to four lags to the model does not reveal any evidence of unit root behaviour, confirmed by the results of unit root tests.

Table 4. Baseline unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.77***	0.74***	0.71***	0.70***	0.71***	0.63***	0.74***
	(0.03)	(0.03)	(0.11)	(0.04)	(0.04)	(0.03)	(0.03)
$r^{ex,j,unh}_{i,t}$	1.03*	0.46	0.10*	0.94*	0.46	0.84***	1.86**
	(0.61)	(0.28)	(0.06)	(0.53)	(0.63)	(0.27)	(0.90)
$\Delta s^{j,P,R}_{i,t}$	-0.25	-0.17	0.93	-1.69	0.53	-0.27	-2.81
	(4.38)	(5.61)	(4.20)	(2.77)	(2.22)	(1.75)	(1.77)
$\Delta s^{j,P,XR}_{i,t}$	0.26	0.86	2.76	-0.14	0.89**	1.53***	0.50
	(1.11)	(1.45)	(1.83)	(1.11)	(0.40)	(0.48)	(1.16)
Within R^2	0.68	0.62	0.55	0.53	0.57	0.48	0.61
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668	4,359
N (funds)	129	113	22	122	117	131	177
Avg. nr. quarters	41	42	43	41	42	41	40

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

sition as suppliers of dollars in the USD-JPY hedging market to seek higher returns.[21]

The relatively low sensitivity of portfolio shares to hedged excess returns, compared with unhedged returns, might be attributed to the low predictability of hedged excess returns for most currencies. These results are in line with the findings of low elasticity of hedging demand to exchange rates in Bräuer and Hau (2022). Our approach differs because our measure of hedged returns includes the forward premium, a more precise measure of the price of hedging than spot exchange rates. In addition, we do not observe holdings of FX forward contracts directly. However, hedged returns are relevant for fund managers only to the extent that positions are actually hedged.

[21] The model for the United Kingdom indicates an active *decrease* in portfolio shares in response to hedged excess returns, even though the statistical significance of this result is not very strong. Note also that predictability of excess returns is very poor for the United Kingdom on both an unhedged and a hedged basis, as shown in Figures 3(e) and 4(e). Therefore, current excess returns for this currency do not appear to offer a consistent signal for the future.

Therefore, portfolio shares that are empirically unresponsive to excess hedged returns may be the outcome of a low degree of currency hedging as well as the result of the low sensitivity of hedging demand to forward premia.

Table 5. Baseline hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.79***	0.73***	0.71***	0.71***	0.70***	0.63***
	(0.03)	(0.03)	(0.11)	(0.04)	(0.04)	(0.03)
$r^{ex,j,fwd}_{i,t}$	-1.64	3.58***	-0.42	-3.60*	3.92**	1.94
	(1.98)	(1.00)	(0.38)	(1.95)	(1.73)	(1.58)
$\Delta s^{j,P,R}_{i,t}$	-0.39	0.02	0.89	-1.89	0.45	-0.31
	(4.30)	(5.47)	(4.17)	(2.86)	(2.20)	(1.74)
$\Delta s^{j,P,XR}_{i,t}$	0.33	0.74	2.77	-0.16	0.93**	1.44***
	(1.05)	(1.44)	(1.82)	(1.08)	(0.42)	(0.53)
Within R^2	0.68	0.62	0.56	0.53	0.57	0.48
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	41	42	43	41	42	41

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.5 Search for the safest asset

In this section, we investigate whether US mutual funds increase their exposure to domestic (i.e. US) or foreign safe government bonds in periods of financial stress, searching for the safest among safe assets from the point of view of an investor based in the United States. The previous section demonstrated how US mutual funds actively react to currency-specific opportunities for excess returns. However, we are analysing safe assets that offer desirable properties above and beyond monetary returns, such as the ability to attract investors' demand and maintain their market value and liquidity in times of financial stress (Longstaff (2004), Beber et al. (2009), Habib and Stracca (2015)). One may wonder whether within the segment of high-rated government bonds some might be considered more desirable by investors than other safe government bonds.

We test the flight to safety hypothesis by adding to the baseline model the VIX, which measures the expected volatility in the US stock market and is generally considered a good proxy of global risk aversion. In this model, flight to safety toward country j would be captured by a positive correlation between the VIX and active reallocation into country/currency j. This specification does not allow us to use time fixed effects, as they would absorb the level of the VIX. Therefore, we replace them with a set of destination-country-specific macroeconomic variables to control for factors that affect demand for government bonds in each currency j. We estimate the following model for both hedged and unhedged returns:

$$s_{i,t}^j = \alpha_i^j + \eta^j \mathbb{1}_{i,t}^{Out,j} + \beta_1^j s_{i,t-1}^j + \beta_2^j r_{i,t}^{ex,j} + \beta_3^j VIX_t + \beta_4^j \Delta s_{i,t}^{j,P,R} + \beta_5^j \Delta s_{i,t}^{j,P,XR} + \boldsymbol{\beta_6^j W_t^j} + \varepsilon_{i,t}^j, \tag{6}$$

where VIX_t is the average value of the VIX index in quarter t in standard deviation units, and $\boldsymbol{W_t^j}$ is a vector of country-level controls that includes inflation, which affects the real payoff of country j's government bonds; and the Citigroup Economic Surprise Index, which accounts for macroeconomic shocks that may influence the incentives to invest in country/currency j across all funds. We then interpret $\beta_3^j > 0$ as an indication that the debt issued by country j behaves as a safe haven. A positive value of this coefficient indicates that fund managers reallocate their portfolio towards the government debt of country j when global risk aversion is rising.

Table 6 reports the results including unhedged returns in the regressions.[22] Across most currencies, high risk aversion in financial markets shows no correlation with portfolio shares, even for safe-haven currencies like the Swiss franc and the Japanese yen. In a nutshell, investors might move money in and out of safe government debt (which we do not control here), but it does not seem that they alter their portfolio of safe securities. However, there is some tentative evidence that US fund managers actively

[22]For the sake of brevity, we report results for hedged returns in Appendix I.2. They confirm the message that the VIX is not a significant driver of active portfolio reallocation for US fund managers.

reallocate towards domestic government bonds, at the expense of euro area sovereign debt, when global financial risk is on the rise. A one standard deviation increase in the VIX index is associated with an active reallocation of 59 basis points towards US bonds, and of 69 basis points away from euro area bonds. The retrenchment towards domestic government securities is consistent with a flight-to-safety argument, as US Treasuries are the global safe asset *par excellence*, as well as with heightened home bias in uncertain times (Forbes and Warnock, 2012).

Table 6. Search for safety unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.78***	0.74***	0.71***	0.71***	0.73***	0.64***	0.75***
	(0.03)	(0.03)	(0.10)	(0.04)	(0.04)	(0.03)	(0.03)
$r^{ex,j,unh}_{i,t}$	0.72***	0.48	0.00	0.81	-0.06	1.01***	0.71
	(0.26)	(0.29)	(0.04)	(0.54)	(0.44)	(0.25)	(0.49)
VIX_t	23.12	10.83	-3.03	-10.28	-38.62	-69.17*	59.27*
	(22.77)	(18.51)	(2.57)	(27.21)	(37.03)	(36.21)	(33.02)
$\Delta s^{j,P,R}_{i,t}$	0.67	-1.06	1.03	0.46	-0.09	0.20	-1.48
	(4.47)	(5.46)	(3.76)	(2.45)	(1.61)	(1.54)	(1.70)
$\Delta s^{j,P,XR}_{i,t}$	0.13	0.99	2.66	-0.19	0.82**	0.86*	0.55
	(1.04)	(1.29)	(1.64)	(0.86)	(0.35)	(0.50)	(1.22)
Within R^2	0.68	0.61	0.53	0.51	0.56	0.47	0.59
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668	4,359
N (funds)	129	113	22	122	117	131	177
Avg. nr. quarters	32	33	32	33	33	33	32

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 VIX_t + \beta^j_4 \Delta s^{j,P,R}_{i,t} + \beta^j_5 \Delta s^{j,P,XR}_{i,t} + \boldsymbol{\beta^j_6 W^j_t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. $\boldsymbol{W_t}$ includes year-on-year inflation for country j in quarter t in percentage points, the Citi Economics Surprise Index for country j in quarter t in standard deviation units, and the VIX in quarter t in standard deviation units. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.6 The role of central bank policy rates

Much of the literature on search for yield frames this behaviour in the low-interest-rate environment prevailing in the aftermath of the 2007 global financial crisis. As central bankers pushed the policy rate toward zero and engaged in unconventional monetary policy measures, such as asset purchases, investors looked for higher returns abroad or in riskier assets. This line of argument has been applied to mutual funds too. Cenedese and Elard (2021) show that unconventional monetary policy operations by the ECB, BoE, BoJ and Fed triggered reallocation of mutual fund portfolio shares away from countries conducting Unconventional Monetary Policies (UMP) towards other advanced economies. Similarly, Kaufmann (2020) documents that accommodative monetary policy shocks by the Fed result in flows into euro area corporate bond funds.

It is then natural to ask whether the search for yield behaviour detected in the safe government bond portfolio of US mutual funds is stronger when the domestic policy rate is low. We test this hypothesis by augmenting our baseline regression model with the US policy rate and its interaction with excess returns. Much like the regressions in Section 3.5, we cannot use time fixed effects as they would absorb the level of the US policy rate. Therefore, we estimate fund fixed effects model augmented with country-specific macroeconomic variables and the VIX as a factor that accounts for the global financial cycle, with the aim of controlling for demand shocks. In Appendix I.1 we present the results of models containing only the interaction between the policy rate and excess returns. They allow the use of times and funds fixed effects with the same identification strategy as the main models in Section 3. We estimate the following model for both hedged and unhedged returns:

$$s_{i,t}^{j} = \alpha_i^j + \eta^j \mathbb{1}_{i,t}^{Out,j} + \beta_1^j s_{i,t-1}^j + \beta_2^j r_{i,t}^{ex,j} + \beta_3^j cb_t^{US} + \beta_4^j cb_t^{US} \times r_{i,t}^{ex,j} + \beta_5^j \Delta s_{i,t}^{j,P,R} + \beta_6^j \Delta s_{i,t}^{j,P,XR} + \boldsymbol{\beta_7^j W_t} + \varepsilon_{i,t}^j, \quad (7)$$

where cb_t^{US} is the average mid-point for the Federal Reserve target rate in quarter t, and $\boldsymbol{W_t}$ is a vector of country-level and global controls. The country-level controls are inflation and the Citigroup Economic Surprise Index. As in Section 3.5, we use the VIX as a global factor to capture swings in risk appetite that drive co-movement in global bond prices. We then interpret $\beta_4 < 0$ as evidence of stronger rebalancing into currency j in response to excess returns when the Fed policy rate is low.

Table 7. Policy rate unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.78***	0.74***	0.71***	0.71***	0.72***	0.64***
	(0.03)	(0.03)	(0.11)	(0.04)	(0.04)	(0.03)
$r^{ex,j,unh}_{i,t}$	0.57*	0.50	-0.14**	1.33*	0.31	1.37***
	(0.33)	(0.44)	(0.07)	(0.78)	(0.50)	(0.37)
cb^{US}_t	-0.42	0.28	0.13*	-0.40	2.41***	-1.22**
	(0.40)	(0.25)	(0.08)	(0.36)	(0.80)	(0.52)
$cb^{US}_t \times r^{ex,j,unh}_{i,t}$	0.00	-0.00	0.00***	-0.01	0.01*	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$\Delta s^{j,P,R}_{i,t}$	0.67	-1.08	1.09	0.82	0.51	0.20
	(4.43)	(5.46)	(3.79)	(2.57)	(1.66)	(1.52)
$\Delta s^{j,P,XR}_{i,t}$	0.12	1.03	2.66	-0.24	0.60*	0.82
	(1.02)	(1.31)	(1.64)	(0.84)	(0.33)	(0.50)
Within R^2	0.68	0.61	0.53	0.51	0.56	0.47
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	41	42	43	41	42	41

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 cb^{US}_t + \beta^j_4 cb^{US}_t \times r^{ex,j,unh}_{i,t} + \beta^j_5 \Delta s^{j,P,R}_{i,t} + \beta^j_6 \Delta s^{j,P,XR}_{i,t} + \boldsymbol{\beta^j_7 W_t} + \varepsilon^j_{i,t}$.
Each column reports results for a different currency j. $\boldsymbol{W_t}$ includes year-on-year inflation for country j in quarter t in percentage points, the Citi Economics Surprise Index for country j in quarter t in standard deviation units, and the VIX in quarter t in standard deviation units. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7 displays the results for the unhedged returns models. There is some evidence of higher responsiveness to excess returns for euro area government bonds at times of low US interest rates, albeit the size of the effect is small. A one percentage point decrease in the Federal Funds target rate is associated with a one basis point higher reallocation into the euro area for a given increase in euro area excess returns.[23] This

[23]Note that we are interested in the *level* of the interest rate as an indicator of the overall policy

result extends the findings in Kaufmann (2020), which studies investment fund flows into equity and corporate debt, to government bonds as well. Furthermore, low US interest rates are associated with a higher euro area portfolio share conditional on excess returns, which is also consistent with searching for yield abroad.

Strikingly, the results are reversed for the Japanese yen and Swiss franc, the two foreign safe haven currencies in the portfolio. A contractionary Fed policy rate is correlated with a *high* portfolio share, and the interaction coefficient is positive, albeit again very small. High US policy rates lead to a worsening of global financial conditions accompanied by a drop in risk appetite, as argued in Miranda-Agrippino and Rey (2020). In turn, the swings in the global financial cycle caused by both monetary policy and risk aversion shocks are an important driver of international portfolio flows. The fact that US mutual funds actively *increase* their exposure to Swiss and Japanese government bonds when US monetary policy is contractionary, combined with the relative insensitivity to excess returns for these two currencies, suggests flight to safety towards sovereign bonds denominated in these two currencies.

4 Conclusions

One of the main features of safe assets, such as the government debt securities issued by economies with elevated credit ratings, is the relatively low elasticity of their demand with respect to yields. In this paper, we contribute to the mounting evidence that this is not always the case. Cross-currency yield differentials in the sovereign bond market of high-rating issuers can affect the relative appeal of currencies for an important class of investors such as US mutual funds, shaping the overall demand for global safe assets.

Specifically, US-based fund managers actively rebalance towards government bonds offering higher returns than the portfolio-weighted average return on an *unhedged* basis, i.e. without hedging the currency risk. The size of the effect is significant. A change by one percentage point in their unhedged excess return, approximately one

stance of the Federal Reserve, rather than monetary policy shocks. Therefore, we do not instrument cb_t^{US}. As a result, we do not interpret coefficients β_3 and β_4 causally. Although monetary policy decisions are plausibly exogenous to mutual funds portfolio choice, the domestic macroeconomic conditions that drive the former might not be.

standard deviation, leads to a change in their portfolio shares by around 100 basis points, on average, across several currencies. This portfolio adjustment has also important implications for capital flows. For instance, an increase in the excess return of euro area government debt securities by one percentage point would trigger capital flows from the United States towards the euro area economies issuing highly-rated debt securities in the order of magnitude of $300 million, amounting to around 2 percent of total foreign flows into highly-rated euro area government debt securities on a quarterly basis, according to balance of payments data. Importantly, there are significant differences in the reaction to excess returns on an unhedged or a hedged basis. Currencies such as the Japanese yen, that offer lower returns on an unhedged basis, seem capable of increasing their pull for US-based institutions by offering relatively higher returns on a currency hedged basis. These results reveal that US mutual funds do exploit the advantage conferred by their role of liquidity providers in the market for forward dollars, where mismatches in hedging flows combined with balance sheet frictions of intermediaries open up CIP deviations. In this respect, the different sensitivity of currency shares to unhedged and hedged returns appear important and merit further research.

There are additional results that are important for portfolio choice theory and the demand for safe assets. We find evidence of strong frictions in portfolio adjustment, with lagged shares displaying positive and significant coefficients in the portfolio regressions, probably due to fund-specific targets and benchmarking. With a few exceptions, valuation effects do not seem to influence the currency shares, as fund managers offset through active rebalancing the impact of changes in bond prices and exchange rates on the various currency shares. When global financial risk is on the rise, there is evidence that US mutual fund investors repatriate their investments towards US government debt securities, mainly at the expenses of euro-denominated ones. Finally, in periods of low US policy rates, the sensitivity of sovereign portfolio shares to excess returns is more elevated than in other periods, indicating that the mechanism of searching for yield abroad in a low-interest-rate environment highlighted in previous studies is not unique to corporate bonds and equities. However, when US policy rates are high, they increase their exposure to safe-haven currencies like the Japanese yen and the Swiss franc. Overall, our results have significant implications for capital flows from the United States towards other major currency areas, as well as for the impact of the failures of arbitrage conditions, such as the CIP, on the incentives of institutional investors.

References

Ahmed, A., B. Hofmann, and M. Schmitz (2023, December). Foreign Institutional Investors, Monetary Policy, and Reaching for Yield. *BIS Working Papers* (1153).

Ammer, J., S. Claessens, A. Tabova, and C. Wroblewski (2019, July). Home country interest rates and international investment in U.S. bonds. *Journal of International Money and Finance 95*, 212–227.

Ammer, J., A. Tabova, and C. Wroblewski (2016, December). "Low-For-Long" Interest Rates and Portfolio Shifts in Advanced Foreign Economies. *IFDP Notes 2016*(27).

An, L., S. Huang, D. Lou, and J. Shi (2021, January). Why Don't Most Mutual Funds Short Sell? *Financial Markets Groups Discussion Papers 838*.

Anderson, R. W. and J.-P. Danthine (1981, December). Cross hedging. *Journal of Political Economy 89*(6), 1182–96.

Bacchetta, P., K. Benhima, and B. Berthold (2023, September). Foreign Exchange Intervention with UIP and CIP Deviations: The Case of Small Safe Haven Economies. *Swiss Finance Institute Research Paper 23*(71).

Bacchetta, P., S. Tièche, and E. van Wincoop (2023, October). International Portfolio Choice with Frictions: Evidence from Mutual Funds. *Review of Financial Studies 36*(10), 4233–4270.

Banegas, A., G. Montes-Rojas, and L. Siga (2022, May). The effects of U.S. monetary policy shocks on mutual fund investing. *Journal of International Money and Finance 123*(C).

Bartlett, M. S. (1946). On the Theoretical Specification and Sampling Properties of Autocorrelated Time-Series. *Supplement to the Journal of the Royal Statistical Society 8*(1), 27.

Beber, A., M. W. Brandt, and K. A. Kavajecz (2009, February). Flight-to-quality or flight-to-liquidity? evidence from the euro-area bond market. *The Review of Financial Studies 22*(3), 925–957.

Bogdanova, B., T. Chan, and K. Micic (2021, June). Enhancing the BIS government bond statistics. *BIS Quarterly Review*, 15–24.

Boguth, O. and M. Simutin (2018, February). Leverage constraints and asset prices: Insights from mutual fund risk taking. *Journal of Financial Economics 127*(2), 325–341.

Bohn, H. and L. L. Tesar (1996, May). U.S. Equity Investment in Foreign Markets: Portfolio Rebalancing or Return Chasing? *The American Economic Review 86*(2), 77–81.

Borio, C., R. McCauley, P. McGuire, and V. Sushko (2016, September). Covered interest parity lost: Understanding the cross-currency basis. *BIS Quarterly Review*, 45–64.

Bräuer, L. and H. Hau (2022, October). Can Time-Varying Currency Risk Hedging Explain Exchange Rates? *Swiss Finance Institute Research Paper 22*(27).

Brunnermeier, M. K., H. James, and J.-P. Landau (2022). Sanctions and the international monetary system. *VoxEU. org 5*.

Brunnermeier, M. K., S. Merkel, and Y. Sannikov (2022, January). Debt as safe asset. *NBER Working Papers 29626*.

Bubeck, J., M. M. Habib, and S. Manganelli (2018, December). The portfolio of euro area fund investors and ECB monetary policy announcements. *Journal of International Money and Finance 89*, 103–126.

Caballero, R. J., E. Farhi, and P.-O. Gourinchas (2017, Summer). The Safe Assets Shortage Conundrum. *Journal of Economic Perspectives 31*(3), 29–46.

Camanho, N., H. Hau, and H. Rey (2022, October). Global Portfolio Rebalancing and Exchange Rates. *The Review of Financial Studies 35*(11), 5228–5274.

Cenedese, G. and I. Elard (2021, July). Unconventional monetary policy and the portfolio choice of international mutual funds. *Journal of International Money and Finance 115*, 102357.

Choi, I. (2001, April). Unit root tests for panel data. *Journal of International Money and Finance 20*(2), 249–272.

Coeurdacier, N. and P.-O. Gourinchas (2016, September). When bonds matter: Home bias in goods and assets. *Journal of Monetary Economics 82*, 119–137.

Coeurdacier, N. and H. Rey (2013, March). Home Bias in Open Economy Financial Macroeconomics. *Journal of Economic Literature 51*(1), 63–115.

Curcuru, S. E., C. P. Thomas, F. E. Warnock, and J. Wongswan (2011, December). US International Equity Investment and Past and Prospective Returns. *American Economic Review 101*(7), 3440–3455.

Dickey, D. A. and W. A. Fuller (1979, June). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association 74*(366), 427–431.

Driscoll, J. C. and A. C. Kraay (1998, November). Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data. *Review of Economics and Statistics 80*(4), 549–560.

Du, W., A. Tepper, and A. Verdelhan (2018, June). Deviations from Covered Interest Rate Parity. *The Journal of Finance 73*(3), 915–957.

Elton, E. J., M. J. Gruber, and C. R. Blake (1996, October). Survivor Bias and Mutual Fund Performance. *Review of Financial Studies 9*(4), 1097–1120.

Eren, E., A. Schrimpf, and D. Xia (2023, June). The demand for government debt. *BIS Working Papers 1105.*

Faia, E., J. Salomao, and A. V. Veghazy (2022, December). Granular Investors and International Bond Prices: Scarcity-Induced Safety. *CEPR Discussion Papers 17454.*

Falkenstein, E. G. (1996, March). Preferences for Stock Characteristics As Revealed by Mutual Fund Portfolio Holdings. *The Journal of Finance 51*(1), 111–135.

Fama, E. F. (1984, November). Forward and spot exchange rates. *Journal of Monetary Economics 14*(3), 319–338.

Fang, X., B. Hardy, and K. Lewis (2022, May). Who Holds Sovereign Debt and Why It Matters. *CEPR Discussion Papers 30087.*

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

Frankel, J. and C. M. Engel (1984, November). Do asset-demand functions optimize over the mean and variance of real returns? A six-currency test. *Journal of International Economics 17*(3-4), 309–323.

Fratzscher, M., M. Lo Duca, and R. Straub (2016, May). ECB Unconventional Monetary Policy: Market Impact and International Spillovers. *IMF Economic Review 64*(1), 36–74.

Fratzscher, M., M. Lo Duca, and R. Straub (2018, February). On the International Spillovers of US Quantitative Easing. *The Economic Journal 128*(608), 330–377.

Froot, K. A., P. G. O'Connell, and M. S. Seasholes (2001, February). The portfolio flows of international investors. *Journal of Financial Economics 59*(2), 151–193.

Gabaix, X. and M. Maggiori (2015, August). International Liquidity and Exchange Rate Dynamics*. *The Quarterly Journal of Economics 130*(3), 1369–1420.

Gorton, G. (2017, August). The history and economics of safe assets. *Annual Review of Economics 9*(1), 547–586.

Habib, M. M. and L. Stracca (2015, December). Is there a global safe haven? *International Finance 18*(3), 281–298.

Habib, M. M., L. Stracca, and F. Venditti (2020). The fundamentals of safe assets. *Journal of International Money and Finance 102*, 102119. Global Safe Assets, International Reserves, and Capital Flow.

Habib, M. M. and F. Venditti (2019, May). The Global Capital Flows Cycle: Structural Drivers and Transmission Channels. *ECB Working Papers 2280*.

Hau, H. and S. Lai (2016, May). Asset allocation and monetary policy: Evidence from the eurozone. *Journal of Financial Economics 120*(2), 309–329.

Hau, H. and H. Rey (2008, April). Home Bias at the Fund Level. *American Economic Review 98*(2), 333–338.

Hausman, J. (1978, November). Specification tests in econometrics. *Econometrica 46*(6), 1251–71.

Jiang, Z., A. Krishnamurthy, and H. Lustig (2021, June). Foreign Safe Asset Demand and the Dollar Exchange Rate. *The Journal of Finance 76*(3), 1049–1089.

Jiang, Z., A. Krishnamurthy, and H. Lustig (2023, August). The Rest of the World's Dollar-Weighted Return on U.S. Treasurys. *NBER Working Papers 30089*.

Kaufmann, C. (2020, November). Investment Funds, Monetary Policy, and the Global Financial Cycle. *European Central Bank Working Papers 2489*.

Krishnamurthy, A. and A. Vissing-Jorgensen (2012, April). The Aggregate Demand for Treasury Debt. *Journal of Political Economy 120*(2), 233–267.

Kroencke, T., M. Schmeling, and A. Schrimpf (2015, March). Global Asset Allocation Shifts. *BIS Working Papers 497*.

Longstaff, F. A. (2004, July). The Flight-to-Liquidity Premium in U.S. Treasury Bond Prices. *The Journal of Business 77*(3), 511–526.

Lustig, H. and A. Verdelhan (2007, February). The Cross Section of Foreign Currency Risk Premia and Consumption Growth Risk. *American Economic Review 97*(1), 89–117.

Meese, R. A. and K. Rogoff (1983, February). Empirical exchange rate models of the seventies. *Journal of International Economics 14*(1-2), 3–24.

Miranda-Agrippino, S. and H. Rey (2020, November). U.S. Monetary Policy and the Global Financial Cycle. *The Review of Economic Studies 87*(6), 2754–2776.

Nickell, S. (1981, November). Biases in Dynamic Models with Fixed Effects. *Econometrica 49*(6), 1417–1426.

Raddatz, C. and S. L. Schmukler (2012, November). On the international transmission of shocks: Micro-evidence from mutual fund portfolios. *Journal of International Economics 88*(2), 357–374.

Raddatz, C., S. L. Schmukler, and T. Williams (2017, September). International asset allocations and capital flows: The benchmark effect. *Journal of International Economics 108*, 413–430.

Rime, D., A. Schrimpf, and O. Syrstad (2022, October). Covered Interest Parity Arbitrage. *The Review of Financial Studies 35*(11), 5185–5227.

Schmidt, R. and P. Yeşin (2022, December). The Growing Importance of Investment Funds in Capital Flows. *Swiss National Bank Working Papers 13*(22).

Sialm, C. and Q. Zhu (2021, July). Currency management by international fixed income mutual funds. *NBER Working Papers 29082*.

Solnik, B. H. (1974, August). An equilibrium model of the international capital market. *Journal of Economic Theory 8*(4), 500–524.

Tabova, A. and F. Warnock (2022, December). Preferred Habitats and Timing in the World's Safe Asset. *NBER Working Papers 30722*.

Wallen, J. (2022, March). Markups to financial intermediation in foreign exchange markets. *Harvard Business School Working Papers*.

A Data sources

Appendix Table A1. Data sources

Data	Source
Assets under management, US mutual fund industry	Federal Reserve Financial Accounts of the United States
Fund-level data on US fixed income funds	Refinitiv Lipper for Invsetment Managament and Lipper Global Data feed
Government bond yields	Refinitiv Eikon
Government bond indices	Refinitiv Eikon
Spot and forward exchange rates	Refinitiv Eikon
Amount of government debt outstanding	Bank for International Settlements
CPI inflation	Federal Reserve Economic Data (FRED)
Citigroup Economic Surprise Index	Haver Analytics
Federal Reserve policy rate	Bank for International Settlements

B Further descriptive statistics

B.1 Whole sample

Appendix Table A2. Whole sample summary statistics

	N	Mean	SD	Min	P5	P95	Max
A. Fund characteristics							
Assets under management ($Mil.)	15,438	2,382	8,656	0.08	12.84	8,977	179,914
Total sovereign holdings ($Mil.)	15,700	422	1,754	0.00	1.03	1,822	46,539
Selected sovereign holdings ($Mil.)	15,700	318	1,499	0.00	0.62	1,273	43,175
Reporting quarters	15,700	34	14	1	8	48	48
B. Selected sovereign portfolio shares							
United States	15,700	0.82	0.37	0	0	1.00	1
Euro Area safe	15,700	0.05	0.16	0	0	0.37	1
Australia	15,700	0.03	0.13	0	0	0.12	1
Canada	15,700	0.01	0.08	0	0	0.07	1
Japan	15,700	0.05	0.15	0	0	0.44	1
Switzerland	15,700	0.00	0.01	0	0	0.00	0.56
United Kingdom	15,700	0.04	0.12	0	0	0.24	1

Statistics are calculated on the whole sample of funds. Highly-rated sovereign holdings include government bonds of all maturities issued by Australia, Canada, euro area highly-rated issuers (Austria, Belgium, Germany, France, the Netherlands), Japan, Switzerland, United Kingdom and United States. Shares refer to the portfolio that comprises all debt securities issue by the selected highly-rated sovereigns. Source: Refinitiv Lipper.

B.2 Decomposition of changes in portfolio share

B.3 Passive reallocation

Appendix Table A3. Fund-level price passive reallocation

	N	Mean	SD	Min	P5	P25	P50	P75	P95	Max
$\Delta s_{i,t}^{AUD,P,R}$	3,442	-0.00	0.12	-2.01	-0.11	0.00	0.00	0.00	0.13	1.08
$\Delta s_{i,t}^{CAD,P,R}$	3,333	0.00	0.10	-2.27	-0.08	-0.00	0.00	0.00	0.10	0.84
$\Delta s_{i,t}^{CHF,P,R}$	692	-0.00	0.04	-0.71	-0.03	-0.00	0.00	0.00	0.01	0.15
$\Delta s_{i,t}^{EUR_S,P,R}$	3,668	-0.02	0.17	-2.06	-0.29	-0.04	0.00	0.01	0.22	0.89
$\Delta s_{i,t}^{JPY,P,R}$	3,425	-0.00	0.21	-1.87	-0.36	-0.02	0.00	0.05	0.34	1.12
$\Delta s_{i,t}^{GBP,P,R}$	3,442	0.01	0.18	-1.03	-0.28	-0.05	0.00	0.03	0.32	1.17
$\Delta s_{i,t}^{USD,P,R}$	4,359	0.02	0.25	-1.17	-0.31	-0.00	0.00	0.00	0.41	2.27

Fund-level passive reallocation due to issue-currency bond returns. All variables in percentage points. Summary statistics are calculated over the distribution of fund-quarter observations in the sample excluding funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries.

Appendix Table A4. Fund-level exchange rate passive reallocation

	N	Mean	SD	Min	P5	P25	P50	P75	P95	Max
$\Delta s_{i,t}^{AUD,P,XR}$	3,442	-0.01	0.37	-3.21	-0.43	0.00	0.00	0.00	0.42	2.93
$\Delta s_{i,t}^{CAD,P,XR}$	3,333	0.00	0.23	-2.79	-0.26	0.00	0.00	0.01	0.29	2.36
$\Delta s_{i,t}^{CHF,P,XR}$	692	0.01	0.13	-0.67	-0.05	0.00	0.00	0.00	0.08	2.79
$\Delta s_{i,t}^{EUR_S,P,XR}$	3,668	-0.01	0.52	-3.82	-0.78	-0.08	0.00	0.07	0.84	3.23
$\Delta s_{i,t}^{JPY,P,XR}$	3,425	-0.04	0.76	-3.23	-1.34	-0.16	0.00	0.02	1.20	3.82
$\Delta s_{i,t}^{GBP,P,XR}$	3,442	0.02	0.45	-2.86	-0.69	-0.04	0.00	0.12	0.81	2.07
$\Delta s_{i,t}^{USD,P,XR}$	4,359	0.02	0.36	-2.73	-0.44	0.00	0.00	0.00	0.54	3.13

Fund-level passive reallocation due to exchange rate effects. All variables in percentage points. Summary statistics are calculated over the distribution of fund-quarter observations in the sample excluding funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries.

C Predictability of excess returns

Current excess returns provide insights on the relative yield that an investor can expect from government bonds in the same quarter. However, if mutual fund managers are forward-looking, current excess returns are more informative for their portfolio choice to the extent that they can forecast *future* excess returns. To test for predictability, we compute autocorrelations of cross-sectional average excess returns for each currency $\bar{r}_t^j = \frac{1}{I}\sum_{i=1}^{I} r_{i,t}^{ex,j}$. Unhedged returns, pictured in Figure A2 display a positive and high autocorrelation, significant at the 95% level for up to four quarters for all currencies. Therefore, a fund that observes a positive excess return from currency j in quarter t can expect a positive extra return for up to one year thereafter, a useful signal for rebalancing toward that currency. This is in line with a long-standing literature documenting the predictability in currency excess returns (e.g. Fama (1984)) and the profitability of carry trade strategies that go long high-interest rate currencies (e.g. Lustig and Verdelhan (2007)). In addition, our findings show forecastability of excess returns not only with respect to individual currencies, but even when weighted by fund-specific portfolio shares, so that individual investors do have incentives to exploit this margin for higher returns.

The picture is strikingly different for hedged returns, shown in Figure A3. Autocorrelations are only significantly different from zero at a one-quarter horizon for the euro and yen, and at a two-quarter horizon for Swiss franc. Even when autocorrelations are significant, they are much lower than for unhedged returns, never exceeding 0.6.

Overall, wedges for the UIP condition are larger than for CIP, as already evident in Table 3.[24] The marked difference in predictability between these deviations suggests that funds can glean more information from contemporaneous unhedged returns, and so possibly have more incentives to respond to them compared to hedged returns.

D Fixed versus random effects

The baseline model in Section 3 uses fund fixed effects, but a random effects estimator would be more efficent if fund-specific unobservables α_i were uncorrelated with the vector of explanatory variables $\boldsymbol{X}_{i,t}$. In this appendix, we test the null hypothesis $Cov[\alpha_i, \boldsymbol{X}_{i,t}] = 0$ via a Hausman (1978) test.

Table A5 reports the p-values of the test for the baseline unhedged and hedged returns models for each currency. The null hypothesis is rejected at the 1% significance level for all currencies and both models, suggesting that fund-specific unobservables are indeed correlated with explanatory variables. Therefore, the choice of a fixed-effects estimator in the baseline model is appropriate.

[24] This is a robust result in the literature. In a recent example, Bacchetta et al. (2023) report dollar CIP deviations with respect to the Japanese yen and the Swiss franc of less than 1%, while UIP deviations reach up to 10%.

Appendix Table A5. Hausman (1978) test for random vs. fixed effects

	AUD	CAD	CHF	GBP	JPY	EUR	USD
P-value unhedged returns	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P-value hedged returns	0.00	0.00	0.00	0.00	0.00	0.00	

P-values of Hausman (1978) test, obtained from comparing estimates from the fixed effects and random effects estimation of the baseline model $s^j_{i,t} = \alpha_i + \gamma_t + \beta_1 s^j_{i,t-1} + \beta_2 r^{ex,j}_{i,t} + \beta_3 \Delta s^{j,P,R}_{i,t} + \beta_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon_{i,t}$, with $r^{ex,j}_{i,t} = r^{j,unh}_{i,t}$ or $r^{j,fwd}_{i,t}$.

E Robustness checks

E.1 Pooled OLS

In this appendix, we present results from running the baseline regressions of Section 3 with Pooled Ordinary Least Squares. Formally, the estimating equation is

$$s^j_{i,t} = \alpha + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}. \tag{8}$$

These models serve as a benchmark for our identification strategy. By comparing the results in Tables A6 and A7 with the time and fund fixed effects models in Section 3, we can observe that the coefficients on excess returns for some currency, like the US dollar in the unhedged return model, are attenuated towards zero and/or lose significance. This is consistent with fixed effects removing the bias towards zero due to demand shocks.

E.2 Whole sample

In this sub-section, we present results for the baseline unhedged and hedged returns regressions estimated for the whole sample, without applying the selection procedure outlined in Section 2.1.

The complete sample consists of all 880 funds, including all currency-specific funds whose portfolio shares change barely or not at all over time. While the presence of such funds is liable to bias the analysis substantially , the results presented here are nonetheless useful as a benchmark for the effects of our sample selection strategy.

Table A8 reports results for unhedged returns, and Table A9 for hedged returns. In

Appendix Table A6. Pooled OLS unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.86***	0.81***	0.93***	0.80***	0.87***	0.76***	0.92***
	(0.02)	(0.02)	(0.05)	(0.03)	(0.03)	(0.02)	(0.01)
$r^{ex,j,unh}_{i,t}$	-0.01	0.40***	-0.03	0.87***	0.54	1.25***	-0.45
	(0.26)	(0.14)	(0.05)	(0.25)	(0.34)	(0.34)	(0.44)
$\Delta s^{j,P,R}_{i,t}$	0.05	-0.63	0.28	0.05	1.55	1.11	-1.13
	(5.67)	(5.41)	(3.69)	(2.43)	(1.72)	(1.55)	(1.56)
$\Delta s^{j,P,XR}_{i,t}$	0.62	0.72	2.76	-0.33	0.99**	1.25**	1.10
	(1.20)	(1.40)	(1.74)	(0.82)	(0.44)	(0.61)	(1.35)
R^2	0.78	0.70	0.97	0.66	0.76	0.64	0.85
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668	4,359
N (funds)	129	113	22	122	117	131	177
Avg. nr. quarters	41	42	43	41	42	41	40

Coefficients from regression model $s^j_{i,t} = \alpha + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

both cases, the magnitude and significance of coefficients is rather different from the findings of the models estimated on the restricted sample that excludes funds with a country focus and presented in Section 3. The smaller and less significant coefficients on unhedged excess returns for most currencies in the whole sample regressions suggest that the presence of funds focused on single countries does introduce some bias towards zero. On the other hand, results from hedged return models are broadly consistent with the baseline. One exception is the coefficient for the euro, which turns weakly significant in the whole sample.

E.3 Alternative sample and outlier selection

Our baseline sample excludes funds with a country focus, defined as having an average portfolio share of at least 95% for any currency. Furthermore, we define as outliers fund-quarter observations in the top and bottom 1% by active portfolio share reallocation. We include a dummy for these observations to absorb their impact on

Appendix Table A7. Pooled OLS hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.85***	0.80***	0.93***	0.81***	0.87***	0.78***
	(0.02)	(0.02)	(0.05)	(0.03)	(0.03)	(0.02)
$r^{ex,j,fwd}_{i,t}$	0.49	3.28***	0.05	-3.69***	-1.29	-2.23
	(0.70)	(0.92)	(0.18)	(1.25)	(1.40)	(1.75)
$\Delta s^{j,P,R}_{i,t}$	0.04	-0.03	0.27	-0.29	1.41	1.14
	(5.60)	(5.13)	(3.68)	(2.52)	(1.81)	(1.53)
$\Delta s^{j,P,XR}_{i,t}$	0.57	0.60	2.76	-0.33	1.00**	1.24**
	(1.16)	(1.39)	(1.74)	(0.81)	(0.45)	(0.57)
R^2	0.78	0.70	0.97	0.66	0.76	0.63
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	41	42	43	41	42	41

Coefficients from regression model $s^j_{i,t} = \alpha + \beta^j_1 s^j_{i,t-1} + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_2 r^{ex,j,fwd}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

our estimates.

While we believe these thresholds capture country-focused funds and outliers satisfactorily, they are inevitably discretionary. Therefore, in this section we test the sensitivity of our results to more stringent crieria for both thresholds. We now define country-focused funds as having an average portfolio share of 90% or higher for any currency. We also tag as outliers fund-quarter observations in the top and bottom 2.5% by active portfolio share reallocation.

Tables A10 and A11 display the results of unhedged and hedged return models using this alternative selection procedure. The estimates are almost identical in terms of both size and statistical significance. One exception is the elasticity to US dollar excess returns, which loses significance with respect to the baseline model. We are

Appendix Table A8. Whole sample unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.78***	0.73***	0.65***	0.70***	0.71***	0.63***	0.73***
	(0.03)	(0.03)	(0.13)	(0.04)	(0.05)	(0.03)	(0.03)
$r^{ex,j,unh}_{i,t}$	0.07	0.30*	-0.00	0.33	1.02**	0.24	1.71*
	(0.25)	(0.15)	(0.00)	(0.27)	(0.42)	(0.20)	(0.94)
$\Delta s^{j,P,R}_{i,t}$	-0.52	-0.54	1.23	-0.73	2.11	1.36	-1.14
	(4.32)	(4.68)	(3.95)	(2.44)	(1.35)	(1.69)	(1.41)
$\Delta s^{j,P,XR}_{i,t}$	0.20	0.64	2.65	-0.24	0.95**	1.14***	0.85
	(1.00)	(1.14)	(1.61)	(0.87)	(0.38)	(0.38)	(1.12)
Within R^2	0.67	0.59	0.54	0.51	0.55	0.46	0.58
N (fund-quarter)	13,611	13,611	13,611	13,611	13,611	13,611	13,611
N (funds)	880	880	880	880	880	880	880
Avg. nr. quarters	34	34	34	34	34	34	34

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

then reassured that our results do not depend on the exact thresholds for sample and outlier selection, and can survive more exacting criteria for both.

E.4 Correcting for survivorship bias

Our dataset comprises funds that drop out of the sample due to liquidation or merging.At the same time, new funds enter the sample during the period we analyse, either because they are newly created or because they start reporting to Lipper. Furthermore, some funds abandon the sample temporarily. For example, the fund "John Hancock Government Income Fund" first joins in the sample in 2012 Q1, and it is observed until 2013 Q4, when it drops out to re-appear in 2016 Q1. The consequences are twofold: the panel is unbalanced, and the sample only includes funds that are active at any given quarter, potentially leading to survivorship bias.

Survivorship bias affects preeminently models of the performance of funds (Elton et al. (1996)), so in principle it should not be particularly severe for our study given

Appendix Table A9. Whole sample hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.79***	0.72***	0.65***	0.71***	0.71***	0.63***
	(0.03)	(0.03)	(0.13)	(0.04)	(0.04)	(0.03)
$r^{ex,j,fwd}_{i,t}$	-1.06	2.97***	0.01	-3.36**	3.19**	2.16*
	(1.34)	(0.77)	(0.02)	(1.54)	(1.29)	(1.16)
$\Delta s^{j,P,R}_{i,t}$	-0.49	-0.44	1.23	-0.96	1.95	1.30
	(4.32)	(4.55)	(3.95)	(2.50)	(1.36)	(1.70)
$\Delta s^{j,P,XR}_{i,t}$	0.22	0.47	2.65	-0.15	1.04**	1.08***
	(0.98)	(1.10)	(1.61)	(0.84)	(0.42)	(0.38)
Within R^2	0.67	0.59	0.54	0.52	0.55	0.46
N (fund-quarter)	13,611	13,611	13,611	13,611	13,611	13,611
N (funds)	880	880	880	880	880	880
Avg. nr. quarters	34	34	34	34	34	34

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \eta^j \mathbb{1}^{Out,j}_{i,t} + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,fwd}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

that we examine only portfolio shares.

Nevertheless, to alleviate any concerns of results being affected by changes in sample composition over time, we repeat our descriptive and econometric analysis using only funds in the restricted sample, excluding funds with a country focus, that are present in the sample for at least five consecutive years. There are 112 funds that meet this condition out of 186 in this sample that we use in the baseline models. Ideally, we would only include funds that are present throughout the sample period, but only 32 funds would meet such a strict requirement, preventing us from relying on large-sample asymptotics in our panel regressions.

We first compare the size and portfolio shares of the sample excluding funds with a country focus with long-permanence funds to ascertain whether the latter differ in

Appendix Table A10. Alternative sample selection unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.77***	0.75***	0.68***	0.69***	0.72***	0.63***	0.74***
	(0.03)	(0.03)	(0.13)	(0.04)	(0.04)	(0.03)	(0.03)
$r^{ex,j,unh}_{i,t}$	1.20*	0.44	0.09	1.01*	0.30	1.07***	1.55
	(0.65)	(0.29)	(0.05)	(0.56)	(0.67)	(0.29)	(0.95)
$\Delta s^{j,P,R}_{i,t}$	0.15	-0.89	1.01	-1.93	0.02	-0.74	-3.16
	(4.79)	(5.67)	(4.29)	(2.76)	(2.40)	(1.77)	(2.22)
$\Delta s^{j,P,XR}_{i,t}$	0.10	0.44	2.73	0.07	0.87**	1.34***	0.03
	(1.09)	(1.27)	(1.80)	(1.13)	(0.39)	(0.46)	(1.26)
Within R^2	0.68	0.62	0.56	0.54	0.59	0.48	0.62
N (fund-quarter)	3,264	3,112	692	3,329	3,202	3,448	3,996
N (funds)	168	168	168	168	168	168	168
Avg. nr. quarters	40	40	40	40	40	40	40

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.90$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries.Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

any meaningful way. Table A12 shows that the funds in the long-permanence sample are broadly similar to those in the baseline sample, in terms of both size and sovereign portfolio shares. As expected, the only large difference is the higher average of 44 reporting quarters, edging closer to the maximum of 48. These descriptive statistics already suggest that survivorship bias is unlikely to skew our results, but we seek to confirm it by running the baseline models on the long-permanence sample.

Tables A13 and A14 report results for the baseline regressions run on the sample of long-permanence funds. Overall, the results are similar, with the exception of the loss of significance in the excess return coefficient for JPY in the hedged return model, and the presence of very high coefficients on valuation effects for Switzerland, probably due to the drastic reduction in the number of funds which makes large-I asymptotics unreliable.

Appendix Table A11. Alternative sample selection hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.79***	0.74***	0.68***	0.70***	0.71***	0.63***
	(0.03)	(0.03)	(0.12)	(0.04)	(0.04)	(0.03)
$r^{ex,j,fwd}_{i,t}$	-1.25	3.74***	-0.29	-3.19	3.66**	1.80
	(1.99)	(1.06)	(0.41)	(1.93)	(1.70)	(1.66)
$\Delta s^{j,P,R}_{i,t}$	-0.03	-0.74	0.97	-2.10	-0.05	-0.77
	(4.72)	(5.51)	(4.27)	(2.87)	(2.37)	(1.77)
$\Delta s^{j,P,XR}_{i,t}$	0.17	0.30	2.74	0.04	0.90**	1.25**
	(1.05)	(1.25)	(1.79)	(1.10)	(0.41)	(0.50)
Within R^2	0.68	0.63	0.56	0.54	0.59	0.48
N (fund-quarter)	3,264	3,112	692	3,329	3,202	3,448
N (funds)	168	168	168	168	168	168
Avg. nr. quarters	40	40	40	40	40	40

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,fwd}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

E.5 Global funds

The sample selection strategy used in the main body of the paper aims at isolating funds with an international investment horizon, and it produces aggregate portfolio shares that are consistent with this goal. However, it is based on the arbitrary threshold of a 95% average portfolio share. To test whether our core results survive a more systematic sample selection strategy, in this appendix we offer an alternative procedure that identifies global funds based on the distance from an International Capital Asset Pricing Model (ICAPM henceforth) benchmark.

The canonical ICAPM model predicts that a mean-variance investor would choose shares in a portfolio of non currency-hedged international bonds equal to the relative market capitalization of each asset (Solnik (1974)). We calculate the ICAPM portfolio

Appendix Table A12. Long-permanence sample summary statistics

	N	Mean	SD	Min	P5	P95	Max
A. Fund characteristics							
Assets under management ($Mil.)	3,826	2,905	11,670	0.10	14.40	11,937	179,914
Total sovereign holdings ($Mil.)	3,888	523	1,345	0.10	3.38	2,458	22,698
Selected sovereign holdings ($Mil.)	3,888	300	952	0.02	0.89	1,406	21,116
Reporting quarters	3,888	44	6	21	29	48	48
B. Selected sovereign portfolio shares							
United States	3,888	0.43	0.44	0	0	1.00	1
Euro Area safe	3,888	0.15	0.22	0	0	0.61	1
Australia	3,888	0.08	0.21	0	0	0.60	1
Canada	3,888	0.05	0.13	0	0	0.24	1
Japan	3,888	0.16	0.23	0	0	0.61	1
Switzerland	3,888	0.00	0.01	0	0	0.01	0.08
United Kingdom	3,888	0.12	0.20	0	0	0.54	1

Highly-rated sovereign holdings include government bonds of all maturities issued by Australia, Canada, euro area highly-rated issuers (Austria, Belgium, Germany, France, the Netherlands), Japan, Switzerland, United Kingdom and United States. Shares refer to the portfolio that comprises all debt securities issue by the selected highly-rated sovereigns. The sample includes only funds that are observed for at least five consecutive years and excludes all funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Source: Refinitiv Lipper.

weights as the relative market capitalization of each country in the selected sovereign portfolio. Formally,

$$w_t^{j,CAPM} = \frac{B_t^j}{\sum_k B_t^k} \tag{9}$$

Where B_t^j is the amount of country j's central government debt outstanding in quarter t.

For each fund, we then calculate the Euclidean distance $d_{i,t}$ between the vector of average portfolio shares and the vector of relative market capitalizations as

$$d_{i,t} = \sqrt{\sum_j \left(s_{i,t}^j - w_t^{j,CAPM}\right)^2} \tag{10}$$

For our empirical analysis, we keep the funds that are in the bottom 50% in the distribution of time-series average Euclidean distance $\bar{d}_i$. This criterion is meant to capture the set of funds that are closest to the theoretical benchmark of a fully-diversified ICAPM portfolio.

Figure A4 compares the theoretical ICAPM wieghts, on the left-hand side, with the

Appendix Table A13. Long permanence funds unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.79***	0.78***	0.56***	0.72***	0.75***	0.62***	0.75***
	(0.03)	(0.04)	(0.15)	(0.04)	(0.04)	(0.03)	(0.02)
$r^{ex,j,unh}_{i,t}$	0.58	0.58**	0.14**	1.14**	0.11	0.81**	1.68
	(0.58)	(0.24)	(0.06)	(0.53)	(0.52)	(0.31)	(1.03)
$\Delta s^{j,P,R}_{i,t}$	-0.71	-0.39	-6.89	-1.03	0.12	-1.21	-3.28
	(5.16)	(6.74)	(9.46)	(2.99)	(1.81)	(2.01)	(2.03)
$\Delta s^{j,P,XR}_{i,t}$	0.11	1.05	0.59	0.73	0.64	1.79***	0.37
	(0.99)	(1.57)	(2.30)	(0.93)	(0.43)	(0.47)	(1.10)
Within R^2	0.70	0.67	0.51	0.57	0.62	0.48	0.62
N (fund-quarter)	2,852	2,870	561	2,890	2,931	3,098	3,583
N (funds)	84	79	13	80	82	87	111
Avg. nr. quarters	44	45	46	44	44	45	44

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j, as well as funds that have less than five consecutive years of observations. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

aggregate portfolio shares in the low $\bar{d}_i$ sub-sample, on the right-hand side. The aggregate shares are volatile but close to the ICAPM benchmark, save for a home bias, especially in the latest parts of the sample. Overall, we are satisfied that this procedure yields a sub-sample of funds with a global investment horizon.

Tables A15 and A16 present the results of running the baseline time and fund fixed effects models on the sub-sample of global funds identified through ICAPM distance. Interestingly, the results for are rather different from the baseline. Only the Swiss franc and Japanese yen display a positive and significant coefficient in the unhedged returns model, with Japan the only currency with a positive reaction to excess returns on both an unhedged and a hedged basis.

Appendix Table A14. Long permanence funds hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.80***	0.77***	0.56***	0.74***	0.75***	0.63***
	(0.03)	(0.04)	(0.15)	(0.04)	(0.04)	(0.03)
$r^{ex,j,fwd}_{i,t}$	-0.39	3.02***	-0.37	-1.92	1.45	-0.80
	(1.73)	(0.99)	(0.37)	(2.35)	(2.50)	(1.80)
$\Delta s^{j,P,R}_{i,t}$	-0.75	-0.27	-7.07	-1.05	0.10	-1.30
	(5.14)	(6.60)	(9.46)	(2.99)	(1.80)	(2.00)
$\Delta s^{j,P,XR}_{i,t}$	0.14	0.93	0.61	0.68	0.65	1.82***
	(0.97)	(1.54)	(2.29)	(0.90)	(0.43)	(0.48)
Within R^2	0.70	0.67	0.51	0.57	0.62	0.48
N (fund-quarter)	2,852	2,870	561	2,890	2,931	3,098
N (funds)	84	79	13	80	82	87
Avg. nr. quarters	44	45	46	44	44	45

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,fwd}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j, as well as funds that have less than five consecutive years of observations. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

F Autocorrelation of portfolio shares

The autocorrelation of portfolio shares is a strikingly robust result of our analysis, with displaying highly significant coefficients on $s^j_{i,t-1}$ across all currencies and specifications. While the estimated coefficients are always below one, it is important to investigate the possibility of unit roots in portfolio shares that would jeopardise inference in our models. In this appendix, we perform unit root tests and augment our baseline models with longer lags of $s^j_{i,t}$ to explore the higher-order autocorrelation of portfolio shares.

We perform a Fisher-type panel unit root test that allows for unbalanced panels with gaps. The test is based on performing Dickey and Fuller (1979) unit-root tests on each panel and combining the resulting p-values to test the null hypothesis that all

Appendix Table A15. Global funds unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.67***	0.58***	0.66***	0.69***	0.72***	0.60***	0.68***
	(0.05)	(0.06)	(0.08)	(0.05)	(0.05)	(0.04)	(0.04)
$r^{ex,j,unh}_{i,t}$	-0.34	0.20	0.02***	-0.75**	1.75***	-0.07	0.64
	(0.32)	(0.24)	(0.01)	(0.37)	(0.43)	(0.34)	(0.88)
$\Delta s^{j,P,R}_{i,t}$	3.99	-1.71	-0.85	-1.86	2.98	-2.55	-1.62
	(4.14)	(4.43)	(2.70)	(1.64)	(1.94)	(1.96)	(1.36)
$\Delta s^{j,P,XR}_{i,t}$	-1.16	0.49	-0.18	-0.33	1.03**	1.49***	1.06
	(1.20)	(1.32)	(1.11)	(0.69)	(0.39)	(0.42)	(0.91)
Within R^2	0.58	0.44	0.58	0.56	0.60	0.48	0.51
N (fund-quarter)	4,985	4,985	4,985	4,985	4,985	4,985	4,985
N (funds)	443	443	443	443	443	443	443
Avg. nr. quarters	32	32	32	32	32	32	32

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model only includes funds in the bottom 50% of the average ICAPM Euclidean distance $\bar{d}_i$ distribution. Each model excludes funds for which the average portfolio share of currency j is equal to 0. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

panels exhibit a unit root.

Table A17 reports the p-values for the Fisher test performed on each currency's portfolio share, showing that we can reject at the 1% level of significance the null hypothesis that all panels display a unit root.

We then augment the baseline regressions for unhedged and hedged returns with four lags of the portfolio share, allowing us to investigate autocorrelation up to one year ahead. Tables A18 and A19 present the results of these regressions, broadly confirming the results of the baseline models for what concerns excess returns and valuation effects for hedged returns. The addition of further portfolio share lags does not affect the size or significance of the coefficient on $s^j_{i,t-1}$, and none of the further lag coeffficients are statistically significant, save for weak significance on for the Japanese Yen and the Euro. On the other hand, they seem to add noise to the model, turning

Appendix Table A16. Global funds hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.70***	0.58***	0.66***	0.69***	0.72***	0.60***
	(0.05)	(0.06)	(0.08)	(0.05)	(0.05)	(0.05)
$r^{ex,j,fwd}_{i,t}$	-7.54**	0.28	0.03	-0.98	4.38**	-1.59
	(3.56)	(0.85)	(0.05)	(1.58)	(1.76)	(1.67)
$\Delta s^{j,P,R}_{i,t}$	3.86	-1.72	-0.86	-2.07	2.65	-2.54
	(4.14)	(4.43)	(2.72)	(1.56)	(1.86)	(1.95)
$\Delta s^{j,P,XR}_{i,t}$	-0.93	0.48	-0.18	-0.23	1.16***	1.54***
	(1.12)	(1.34)	(1.12)	(0.72)	(0.43)	(0.43)
Within R^2	0.59	0.44	0.58	0.56	0.60	0.48
N (fund-quarter)	4,985	4,985	4,985	4,985	4,985	4,985
N (funds)	443	443	443	443	443	443
Avg. nr. quarters	32	32	32	32	32	32

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,fwd}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model only includes funds in the bottom 50% of the average ICAPM Euclidean distance $\bar{d}_i$ distribution. Each model excludes funds for which the average portfolio share of currency j is equal to 0. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

most coefficients on excess returns statistically insignificant. Overall, these results point at a very weak autocorrelation beyond the first quarter, implying that portfolio stickiness is short-lived and portfolio shares are rather flexible.

G Lagged excess returns

Figures A2 shows evidence of autocorrelation of fund-specific unhedged excess returns for all currencies for up to two quarters, and A3 displays predictability at a one-quarter horizon for the Euro, the Japanese Yen and the Swiss Franc. Therefore, it is natural to ask whether funds use lagged values as a predictor of future excess returns that drives active portfolio reallocation.

To answer this question, we run the baseline models augmening the unhedged and

Appendix Table A17. Portfolio shares unit root tests

	AUD	CAD	CHF	GBP	JPY	EUR	USD
P-value Choi (2001) statistic	0.00	0.00	0.00	0.00	0.00	0.00	0.00

P-values from Fisher-type test using the Choi (2001) modified inverse χ^2 transformation that is consistent for $I \to \infty$. The individual Dickey and Fuller (1979) regressions for each panel i are $\Delta\tilde{s}^j_{i,t} = \alpha^j + \beta^j \tilde{s}^j_{i,t-1} + \xi^j \delta\tilde{s}^j_{i,t-1} + \varepsilon^j_{i,t}$, where $\tilde{s}^j_{i,t} = s^j_{i,t} - \bar{s}^j_t$

hedged excess returns models with their first lag $r^{ex,j}_{i,t-1}$. Formally, the estimating equation is

$$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j}_{i,t} + \beta^j_3 r^{ex,j}_{i,t-1} + \beta^j_4 \Delta s^{j,P,R}_{i,t} + \beta^j_5 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}, \tag{11}$$

Tables A20 and A21 report the results, showing that lagged excess returns are not associated with active reallocation on an unhedged or hedged basis for any currency. These results are consistent with the weaker predictability of excess returns at longer horizons.

H Joint estimation

The dependent variables in our econometric analysis are the shares in a portfolio of sovereign bonds, $s^j_{i,t}$. In the main body of the paper, we run portfolio regressions separately on each individual currency share, but the shares sum up to 1 across currencies by construction. In this appendix, we exploit the cross-equation restriction $\sum_j s^j_{i,t} = 1$ to discipline the fitted values. We implement the summing-up constraint by estimating the equations jointly, following Bubeck et al. (2018).

H.1 Methodology

Let $\boldsymbol{X}^j_{i,t} = (\alpha_i, \gamma_t, \mathbb{1}^{Out,j}_{i,t}, s^j_{i,t-1}, r^{ex,j}_{i,t}, \Delta s^{j,P,R}_{i,t}, \Delta s^{j,P,XR}_{i,t})$ the $K = 7$-dimensional vector fund- and time-specific intercepts and explanatory variables in the baseline regression. We can rewrite the model for each currency j compactly by stacking the observations over the T quarters and I funds:

$$\boldsymbol{s}_j = \boldsymbol{\beta}'_j \boldsymbol{X}_j + \boldsymbol{\varepsilon}_j \tag{12}$$

Where $\boldsymbol{s}_j = (s^j_{1,1}, \dots s^j_{I,T})$ is the vector of currency j portfolio shares, $\boldsymbol{\beta}^j = (1, 1, \eta^j_1, \beta^j_1, \beta^j_2, \beta^j_3, \beta^j_4)$ is the vector of coefficients and constants, $\boldsymbol{X}_j = (\boldsymbol{X}^j_{1,1}, \dots \boldsymbol{X}^j_{I,T})$ is the vector of explanatory variables in the baseline portfolio regression, and $\boldsymbol{\varepsilon}_j = (\varepsilon^j_{1,1}, \dots \varepsilon^j_{I,T})$ is the vector of residuals, all stacked over the time and fund dimensions.

The $J = 6$ portfolio regressions can be estimated jointly as $\boldsymbol{s} = \boldsymbol{X\beta} + \boldsymbol{\varepsilon}$, without a summing-up constraint, by stacking them using a block diagonal matrix $\boldsymbol{X}$ of dimension $JL \times LK$, where L is the number of fund-quarter observations. [25]

$$\begin{bmatrix} \boldsymbol{s}_1 \\ \boldsymbol{s}_2 \\ \vdots \\ \boldsymbol{s}_J \end{bmatrix} = \begin{bmatrix} \boldsymbol{X}_1 & \boldsymbol{0}_L & \dots & \boldsymbol{0}_L \\ \boldsymbol{0}_L & \boldsymbol{X}_2 & \dots & \boldsymbol{0}_L \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{0}_L & \boldsymbol{0}_L & \dots & \boldsymbol{X}_J \end{bmatrix} = \begin{bmatrix} \boldsymbol{\beta}_1 \\ \boldsymbol{\beta}_2 \\ \vdots \\ \boldsymbol{\beta}_J \end{bmatrix} + \begin{bmatrix} \boldsymbol{\varepsilon}_1 \\ \boldsymbol{\varepsilon}_2 \\ \vdots \\ \boldsymbol{\varepsilon}_J \end{bmatrix} \tag{13}$$

To introduce the summing-up restriction $\sum_j s^j_{i,t} = 1$, we start by rewriting fund i's portfolio share of currency j in quarter t as

$$s^j_{i,t} = 1 - \sum_{m \neq j} s^m_{i,t} = \boldsymbol{\iota}'_{j,i,t}\boldsymbol{s}, \tag{14}$$

where $\boldsymbol{\iota}_{j,i,t}$ is a JL-sized vector containing $(L-1)J + J$ zeros and $J-1$ ones, which extracts the entries of $\boldsymbol{s}$ corresponding to the i,t-th observation for currency j.

We can then re-write the vector s_j of all observations for currency j:

$$\boldsymbol{s}_j = \boldsymbol{1} - \boldsymbol{\iota}'_j\boldsymbol{s} = \boldsymbol{1} - \boldsymbol{\iota}'_j(\boldsymbol{X\beta}) + \boldsymbol{\varepsilon}, \tag{15}$$

where $\boldsymbol{\iota}'_j$ is a $L \times JL$ matrix that stacks vectors $\boldsymbol{\iota}'_{j,i,t}$ across the fund and time dimensions. We then substitute $\boldsymbol{s} = \boldsymbol{X\beta} + \boldsymbol{\varepsilon}$ from the joint estimation system in the second step.

The resulting equation is used as constraint by appending it to the joint estimation system:

$$\begin{bmatrix} \boldsymbol{s} \\ \boldsymbol{s}_j \end{bmatrix} = \begin{bmatrix} \boldsymbol{X\beta} + \boldsymbol{\varepsilon} \\ 1 - \boldsymbol{\iota}'_j(\boldsymbol{X\beta} + \boldsymbol{\varepsilon}) \end{bmatrix}. \tag{16}$$

[25] Note that $L \neq IT$ because the panel is unbalanced.

By rearranging the system, we can write it as

$$\underbrace{\begin{bmatrix} \boldsymbol{s} \\ \boldsymbol{s}_j - \mathbf{1}_{L\times 1} \end{bmatrix}}_{\equiv \tilde{\boldsymbol{s}}} = \underbrace{\begin{bmatrix} \boldsymbol{I}_{JL} \\ -\boldsymbol{\iota}_j^{'} \end{bmatrix} \boldsymbol{X}}_{\equiv \tilde{\boldsymbol{X}}} \boldsymbol{\beta} + \underbrace{\begin{bmatrix} \varepsilon \\ -\boldsymbol{\iota}_j^{'} \varepsilon \end{bmatrix}}_{\equiv \tilde{\boldsymbol{\varepsilon}}}. \tag{17}$$

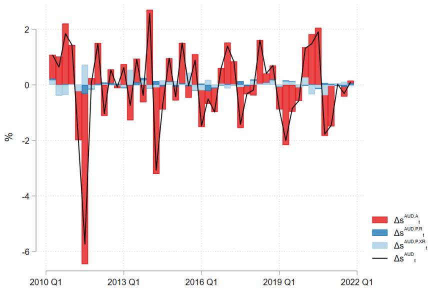
The coefficients $\boldsymbol{\beta}$ can then be estimated simply by running an OLS regression with the same standard errors as the baseline model on the transformed system $\tilde{\boldsymbol{s}} = \tilde{\boldsymbol{X}}\tilde{\boldsymbol{\beta}} + \tilde{\boldsymbol{\varepsilon}}$. Therefore, the summing-up restriction is imposed by adding a $(L+1)$-th group of observations that contains transformed values of the dependent variables for one currency j, which are excluded from the other rows. [26]

H.2 Results

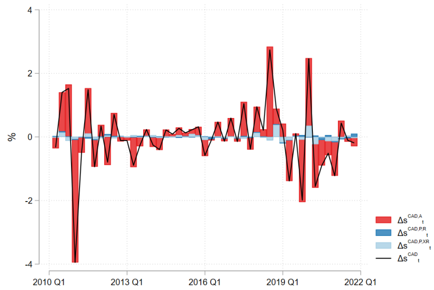
Tables A22 and A23 display the results of the joint estimation of the baseline model, run separately for unhedged and hedged returns. Unhedged returns results are broadly comparable with those of the baseline model, with higher elasticities for the euro and US dollar. The hedged return models show instead highly significant and economically large coefficients on $r_{i,t}^{ex,j,unh}$ for the Australian dollar, the Canadian dollar and the euro.

[26] The estimation procedure is invariant to which currency j is "excluded".

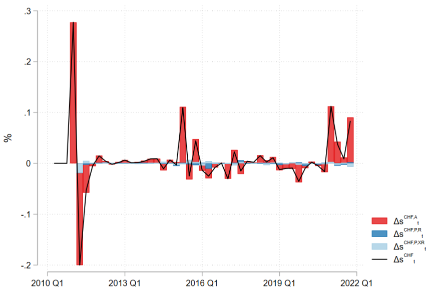
Appendix Figure A1. Decomposition of aggregate active and passive reallocation



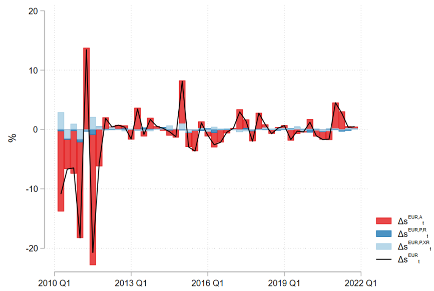
(a) Australia



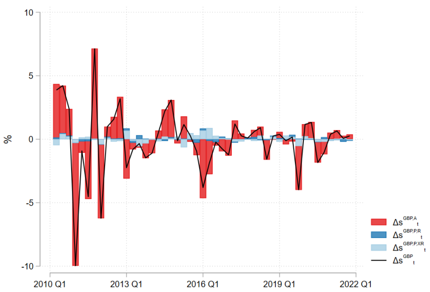
(b) Canada



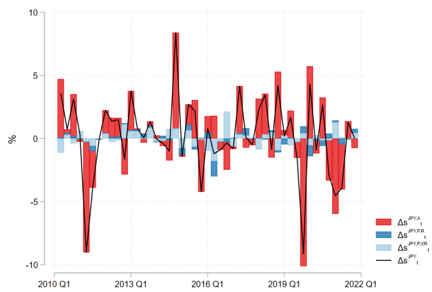
(c) Switzerland



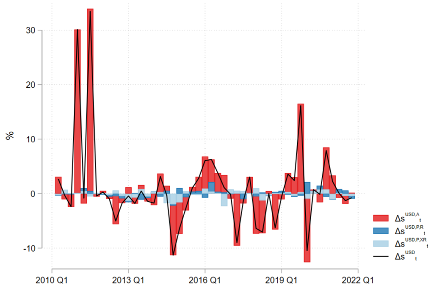
(d) Euro area



(e) United Kingdom



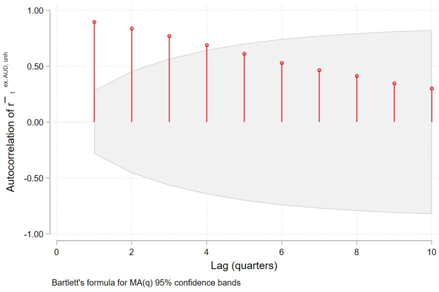
(f) Japan



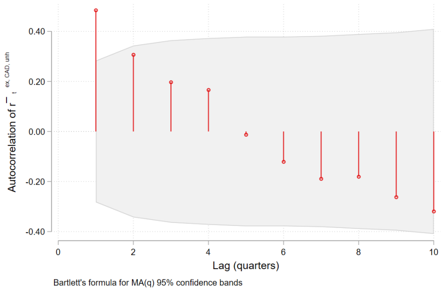
(g) United States

Portfolio shares are calculated on the basis of aggregate amounts held by all funds in the sample excluding funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Δs_t is the change in aggregate country j portfolio share; $\Delta s_t^{P,R} = s_{t-1}^j \left(\frac{A_t^j}{A_t} - 1 \right)$ is the passive reallocation due to bond returns in the currency of issuance ; $\Delta s_t^{P,XR} = s_{t-1}^j \left(\frac{A_t^j}{A_t} - 1 \right)$ is the passive reallocation due to exchange rate effects; $\Delta s_t^A = \Delta s_t - \Delta s_t^{P,R} - \Delta s_t^{P,XR}$ is the active reallocation.

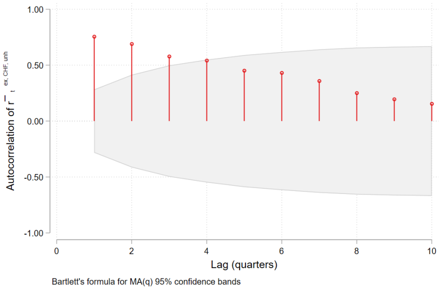
Appendix Figure A2. Autocorrelation of fund-level unhedged excess returns $r_{i,t}^{ex,j,uhn}$.



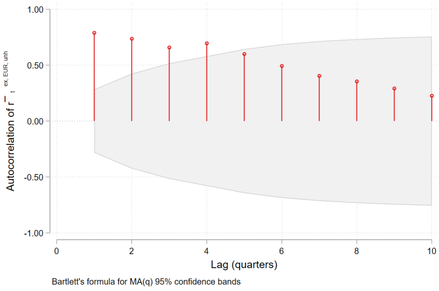
(a) AUD



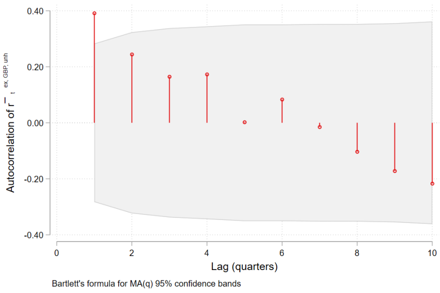
(b) CAD



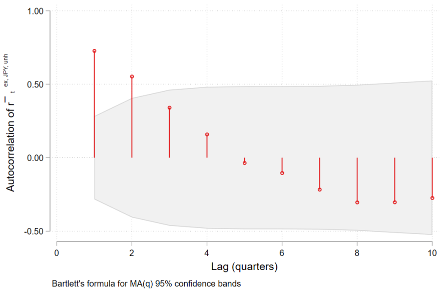
(c) CHF



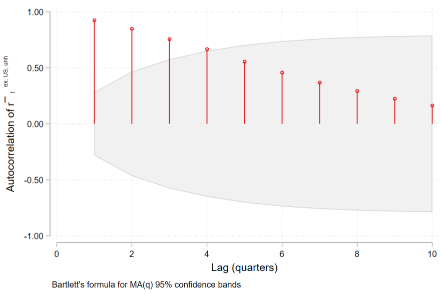
(d) EUR



(e) GBP



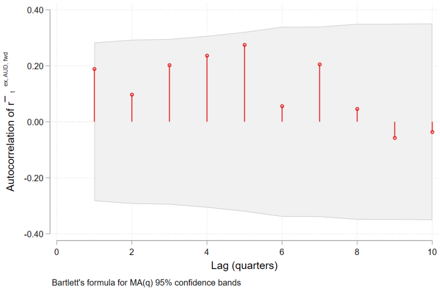
(f) JPY



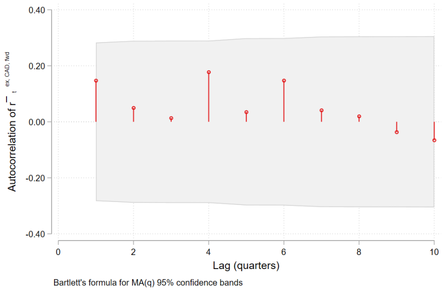
(g) USD

Quarterly autocorrelations calculated on the basis of average fund-level excess returns in the sample that excludes funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Confidence bands are calculated at the 95% level using Bartlett (1946)'s formula.

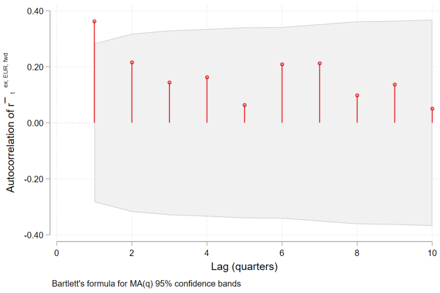
Appendix Figure A3. Autocorrelation of fund-level hedged excess returns $r_{i,t}^{ex,j,fwd}$.



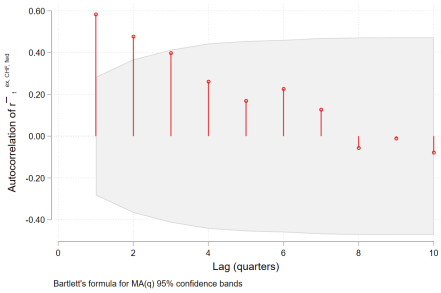
(a) AUD



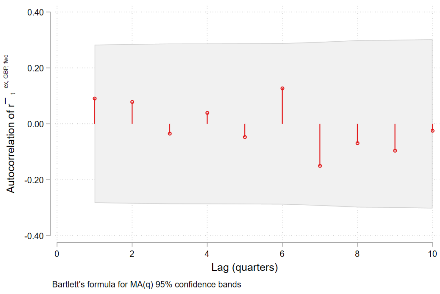
(b) CAD



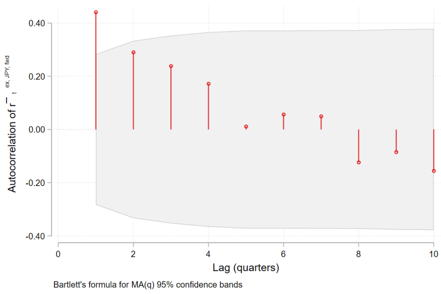
(c) EUR



(d) CHF



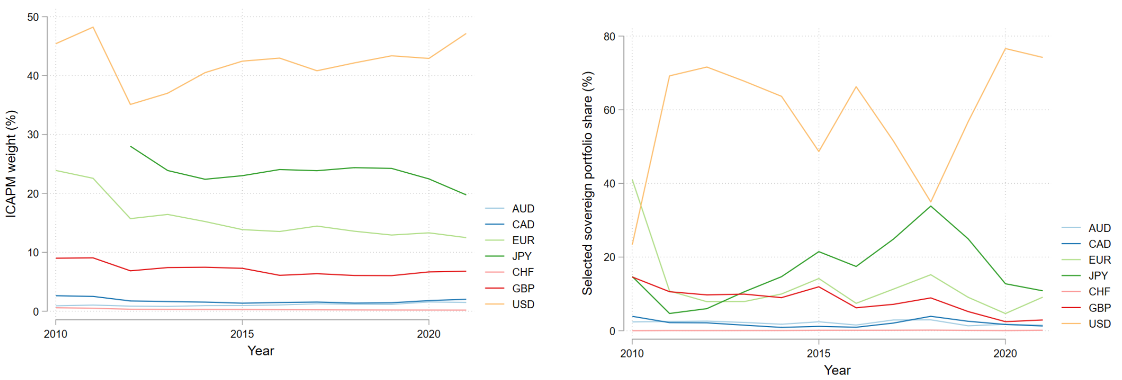
(e) GBP



(f) JPY

Quarterly autocorrelations calculated on the basis of average fund-level excess returns in the sample that excludes funds with $\bar{s}_i^j \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Confidence bands are calculated at the 95% level using Bartlett (1946)'s formula.

Appendix Figure A4. ICAPM and global fund sample share comparison



The left-hand side chart shows ICAPM weights for selected sovereigns, calculated as the relative market capitalization of outstanding central government debt. The right-hand side chart shows aggregate shares in the portfolio of selected sovereigns for funds in the bottom 50% of the the $\bar{d}_i$ distribution. Source: BIS government bond statistics (Bogdanova et al. (2021)) and Refinitiv Lipper.

Appendix Table A18. Lagged portfolio share unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.62***	0.71***	0.73***	0.67***	0.60***	0.56***	0.66***
	(0.05)	(0.07)	(0.19)	(0.05)	(0.08)	(0.05)	(0.05)
$s^j_{i,t-2}$	0.06	0.02	0.01	0.04	0.12*	0.09	-0.01
	(0.06)	(0.05)	(0.12)	(0.06)	(0.06)	(0.06)	(0.05)
$s^j_{i,t-3}$	-0.01	-0.01	0.01	-0.00	-0.01	-0.01	0.06
	(0.07)	(0.07)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)
$s^j_{i,t-4}$	0.02	0.01	-0.08	0.04	0.01	-0.04	0.01
	(0.04)	(0.05)	(0.10)	(0.04)	(0.04)	(0.03)	(0.02)
$r^{ex,j,unh}_{i,t}$	0.68	0.18	0.17***	0.61	0.53	0.24	0.96
	(0.63)	(0.23)	(0.04)	(0.50)	(0.64)	(0.44)	(0.90)
$\Delta s^{j,P,R}_{i,t}$	0.19	1.87	-3.45	-1.18	0.44	0.34	-1.55
	(3.54)	(4.82)	(3.26)	(3.10)	(1.95)	(1.91)	(1.94)
$\Delta s^{j,P,XR}_{i,t}$	-0.47	0.60	7.07**	-0.37	0.71	1.27**	-0.20
	(1.09)	(1.74)	(3.18)	(0.95)	(0.43)	(0.57)	(1.24)
Within R^2	0.57	0.58	0.57	0.54	0.57	0.43	0.53
N (fund-quarter)	2,651	2,654	564	2,717	2,744	2,882	3,296
N (funds)	129	113	22	122	117	131	177
Avg. nr. quarters	41	42	43	41	42	41	40

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \sum_{p=1}^4 \beta^j_1 s^j_{i,t-p} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table A19. Lagged portfolio share hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.64***	0.70***	0.74***	0.68***	0.60***	0.57***
	(0.05)	(0.06)	(0.19)	(0.05)	(0.07)	(0.05)
$s^j_{i,t-2}$	0.06	0.02	0.01	0.04	0.11*	0.09*
	(0.06)	(0.05)	(0.12)	(0.06)	(0.06)	(0.06)
$s^j_{i,t-3}$	-0.01	-0.02	0.01	-0.00	-0.02	-0.01
	(0.07)	(0.07)	(0.06)	(0.05)	(0.05)	(0.04)
$s^j_{i,t-4}$	0.02	0.01	-0.08	0.04	0.02	-0.04
	(0.04)	(0.04)	(0.10)	(0.04)	(0.04)	(0.03)
$r^{ex,j,fwd}_{i,t}$	-3.54	3.50**	-0.23	-0.59	5.70***	-2.43
	(2.61)	(1.32)	(0.48)	(2.38)	(1.51)	(2.05)
$\Delta s^{j,P,R}_{i,t}$	0.15	2.00	-3.49	-1.21	0.28	0.24
	(3.47)	(4.69)	(3.26)	(3.15)	(1.92)	(1.89)
$\Delta s^{j,P,XR}_{i,t}$	-0.40	0.49	7.07**	-0.41	0.76*	1.32**
	(1.02)	(1.73)	(3.19)	(0.93)	(0.45)	(0.58)
Within R^2	0.57	0.58	0.57	0.54	0.57	0.43
N (fund-quarter)	2,651	2,654	564	2,717	2,744	2,882
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	41	42	43	41	42	41

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \sum_{p=1}^{4} \beta^j_1 s^j_{i,t-p} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 \Delta s^{j,P,R}_{i,t} + \beta^j_4 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table A20. Lagged unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.77***	0.75***	0.71***	0.70***	0.71***	0.63***	0.74***
	(0.03)	(0.03)	(0.12)	(0.04)	(0.04)	(0.03)	(0.03)
$r^{ex,j,unh}_{i,t}$	1.22	0.79	-0.03	1.08	0.91	1.11*	2.01*
	(0.95)	(0.83)	(0.12)	(0.67)	(1.04)	(0.61)	(1.17)
$r^{ex,j,unh}_{i,t-1}$	-0.24	-0.45	0.20	-0.19	-0.60	-0.36	-0.22
	(0.87)	(0.89)	(0.13)	(0.60)	(0.70)	(0.62)	(0.80)
$\Delta s^{j,P,R}_{i,t}$	-0.23	-0.06	0.88	-1.67	0.55	-0.28	-2.84
	(4.36)	(5.66)	(4.17)	(2.78)	(2.19)	(1.75)	(1.80)
$\Delta s^{j,P,XR}_{i,t}$	0.26	0.89	2.83	-0.15	0.89**	1.53***	0.48
	(1.11)	(1.43)	(1.84)	(1.11)	(0.40)	(0.48)	(1.14)
Within R^2	0.68	0.62	0.56	0.53	0.57	0.48	0.61
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668	4,359
N (funds)	129	113	22	122	117	131	177
Avg. nr. quarters	41	42	43	41	42	41	40

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 r^{ex,j,unh}_{i,t-1} + \beta^j_4 \Delta s^{j,P,R}_{i,t} + \beta^j_5 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table A21. Lagged hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^{j}_{i,t-1}$	0.79***	0.73***	0.71***	0.71***	0.70***	0.63***
	(0.03)	(0.03)	(0.11)	(0.04)	(0.04)	(0.03)
$r^{ex,j,fwd}_{i,t}$	-1.03	3.85***	-0.44	-3.70*	4.17**	1.73
	(2.08)	(1.06)	(0.39)	(2.07)	(1.88)	(1.52)
$r^{ex,j,fwd}_{i,t-1}$	-0.84	-0.45	0.03	0.19	-0.55	0.42
	(0.87)	(0.42)	(0.10)	(0.67)	(0.59)	(1.20)
$\Delta s^{j,P,R}_{i,t}$	-0.35	-0.00	0.89	-1.90	0.48	-0.27
	(4.31)	(5.45)	(4.17)	(2.86)	(2.18)	(1.75)
$\Delta s^{j,P,XR}_{i,t}$	0.36	0.73	2.78	-0.17	0.94**	1.46***
	(1.06)	(1.45)	(1.82)	(1.08)	(0.42)	(0.53)
Within R^2	0.68	0.62	0.56	0.53	0.57	0.48
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	41	42	43	41	42	41

Coefficients from regression model
$s^j_{i,t} = \alpha^j_i + \gamma^j_t + \eta^j \mathbb{1}^{Out,j}_{i,t} + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 r^{ex,j,unh}_{i,t-1} + \beta^j_4 \Delta s^{j,P,R}_{i,t} + \beta^j_5 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table A22. Unhedged returns joint estimation

	AUD	CAD	CHF	GBP	JPY	EUR	USD
$s^j_{i,t-1}$	0.62***	0.58***	0.85***	0.59***	0.57***	0.51***	0.47***
	(0.03)	(0.02)	(0.18)	(0.03)	(0.04)	(0.03)	(0.02)
$r^{ex,j,unh}_{i,t}$	-0.03	0.84*	-2.27**	0.72	0.50	1.29***	2.47**
	(0.25)	(0.48)	(1.05)	(0.64)	(0.62)	(0.46)	(1.04)
$\Delta s^{j,P,R}_{i,t}$	-2.58	-1.60	-2.40	-1.64	1.11	0.18	-0.06
	(3.86)	(3.48)	(5.40)	(2.42)	(1.76)	(1.44)	(1.67)
$\Delta s^{j,P,XR}_{i,t}$	-0.21	0.52	2.70	-0.00	0.83*	0.76	0.20
	(0.90)	(1.10)	(1.92)	(0.56)	(0.43)	(0.49)	(0.79)
Within R^2	0.52	0.52	0.52	0.52	0.52	0.52	0.52
N (fund-quarter)	3,778	3,606	739	3,744	3,700	3,999	4,830
N (funds)	129	113	22	122	117	131	177
Avg. nr. quarters	41	41	41	41	41	41	41
N (joint estimation) 26720							

Coefficients from joint regression model $\tilde{\boldsymbol{s}} = \tilde{\boldsymbol{X}}\tilde{\boldsymbol{\beta}} + \tilde{\boldsymbol{\varepsilon}}$ using unhedged returns $r^{ex,j,unh}_{i,t}$. Each column reports results for a different currency j, but all coefficients are estimated jointly. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table A23. Hedged returns joint estimation

	AUD	CAD	CHF	GBP	JPY	EUR
$s^{j}_{i,t-1}$	0.58***	0.58***	0.96***	0.61***	0.60***	0.51***
	(0.02)	(0.02)	(0.22)	(0.03)	(0.05)	(0.02)
$r^{ex,j,fwd}_{i,t}$	1.79***	4.02***	2.91	-0.14	-0.93	2.63**
	(0.60)	(1.23)	(2.02)	(1.29)	(1.51)	(1.23)
$\Delta s^{j,P,R}_{i,t}$	-1.89	-1.66	-3.30	-1.55	1.31	0.39
	(3.98)	(2.66)	(5.86)	(2.34)	(1.78)	(1.48)
$\Delta s^{j,P,XR}_{i,t}$	-0.44	0.38	2.93	0.08	0.91*	0.75
	(0.88)	(0.98)	(1.92)	(0.53)	(0.46)	(0.51)
Within R^2	0.52	0.52	0.52	0.52	0.52	0.52
N (fund-quarter)	3,778	3,606	739	3,744	3,700	3,999
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	33	33	33	33	33	33
N (joint estimation) 26720						

Coefficients from joint regression model $\tilde{\boldsymbol{s}} = \tilde{\boldsymbol{X}}\tilde{\boldsymbol{\beta}} + \tilde{\boldsymbol{\varepsilon}}$ using hedged returns $r^{ex,j,fwd}_{i,t}$. Each column reports results for a different currency j, but all coefficients are estimated jointly. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^{j}_{i} \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

I Further results

I.1 Policy rates models with time and fund fixed effects

Appendix Table A24. Policy rate time and fund FE unhedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.77***	0.75***	0.71***	0.70***	0.71***	0.63***
	(0.03)	(0.03)	(0.12)	(0.04)	(0.04)	(0.03)
$r^{ex,j,unh}_{i,t}$	0.89	0.59	-0.08	1.71**	-0.16	1.23***
	(1.82)	(0.39)	(0.14)	(0.75)	(0.58)	(0.35)
$cb^{US}_t \times r^{ex,j,unh}_{i,t}$	0.00	-0.00	0.00*	-0.01**	0.01*	-0.01*
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$\Delta s^{j,P,R}_{i,t}$	-0.26	-0.18	0.91	-1.59	0.64	-0.22
	(4.35)	(5.62)	(4.20)	(2.81)	(2.22)	(1.74)
$\Delta s^{j,P,XR}_{i,t}$	0.27	0.85	2.78	-0.16	0.86**	1.50***
	(1.13)	(1.46)	(1.82)	(1.10)	(0.41)	(0.49)
Within R^2	0.68	0.62	0.56	0.53	0.57	0.48
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	41	42	43	41	42	41

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \gamma^j_t + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,unh}_{i,t} + \beta^j_3 cb^{US}_t * r^{ex,j,unh}_{i,t} + \beta^j_4 \Delta s^{j,P,R}_{i,t} + \beta^j_5 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

I.2 Search for safety hedged returns

Appendix Table A25. Policy rate time and fund FE hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.79***	0.73***	0.69***	0.71***	0.70***	0.63***
	(0.03)	(0.03)	(0.12)	(0.04)	(0.04)	(0.03)
$r^{ex,j,fwd}_{i,t}$	-0.88	2.57**	0.19	-5.89***	1.11	-1.80
	(2.98)	(1.12)	(0.41)	(1.90)	(3.49)	(1.70)
$cb^{US}_t \times r^{ex,j,fwd}_{i,t}$	-0.00	0.01	-0.01***	0.02	0.02	0.03**
	(0.01)	(0.01)	(0.00)	(0.02)	(0.03)	(0.01)
$\Delta s^{j,P,R}_{i,t}$	-0.37	-0.05	0.86	-2.02	0.43	-0.31
	(4.30)	(5.53)	(4.22)	(2.93)	(2.21)	(1.73)
$\Delta s^{j,P,XR}_{i,t}$	0.33	0.74	2.77	-0.18	0.90**	1.54***
	(1.06)	(1.44)	(1.81)	(1.07)	(0.41)	(0.51)
Within R^2	0.68	0.62	0.56	0.53	0.57	0.48
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	41	42	43	41	42	41

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \gamma^j_t + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,fwd}_{i,t} + \beta^j_3 cb^{US}_t * r^{ex,j,unh}_{i,t} + \beta^j_4 \Delta s^{j,P,R}_{i,t} + \beta^j_5 \Delta s^{j,P,XR}_{i,t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table A26. Search for safety hedged returns regressions

	AUD	CAD	CHF	GBP	JPY	EUR
$s^j_{i,t-1}$	0.79***	0.73***	0.71***	0.72***	0.73***	0.64***
	(0.03)	(0.03)	(0.11)	(0.04)	(0.04)	(0.03)
$r^{ex,j,fwd}_{i,t}$	-0.16	3.88***	-0.16	-3.26*	2.21*	1.87
	(0.74)	(0.88)	(0.16)	(1.69)	(1.25)	(1.30)
VIX_t	24.48	6.10	-2.81	-13.58	-44.02	-52.02
	(21.23)	(14.81)	(2.92)	(28.42)	(39.11)	(34.85)
$\Delta s^{j,P,R}_{i,t}$	0.55	-0.58	1.03	0.12	-0.09	0.31
	(4.34)	(5.20)	(3.75)	(2.47)	(1.57)	(1.52)
$\Delta s^{j,P,XR}_{i,t}$	0.34	0.82	2.66	-0.20	0.77**	0.93*
	(1.02)	(1.29)	(1.63)	(0.86)	(0.32)	(0.50)
Within R^2	0.67	0.61	0.53	0.51	0.56	0.47
N (fund-quarter)	3,442	3,333	692	3,442	3,425	3,668
N (funds)	129	113	22	122	117	131
Avg. nr. quarters	32	33	32	33	33	33

Coefficients from regression model $s^j_{i,t} = \alpha^j_i + \beta^j_1 s^j_{i,t-1} + \beta^j_2 r^{ex,j,fwd}_{i,t} + \beta^j_3 VIX_t + \beta^j_4 \Delta s^{j,P,R}_{i,t} + \beta^j_5 \Delta s^{j,P,XR}_{i,t} + \boldsymbol{\beta^j_6 W^j_t} + \varepsilon^j_{i,t}$. Each column reports results for a different currency j. $\boldsymbol{W_t}$ includes year-on-year inflation for country j in quarter t in percentage points, the Citi Economics Surprise Index for country j in quarter t in standard deviation units, and the VIX in quarter t in standard deviation units. Each model excludes funds for which the average portfolio share of currency j is equal to 0 and funds with $\bar{s}^j_i \geq 0.95$ for any j. The sample also excludes fund-quarter observations with no holdings of sovereign debt issued by the selected countries. Driscoll and Kraay (1998) standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Acknowledgements

We thank Tamar den Besten for excellent research assistance, Pablo Anaya Longaric for help with the data, and Johannes Bubeck for sharing his code and for helpful discussion. We are grateful to Philippe Bacchetta, Michele Ca'Zorzi, Ester Faia, Georgios Georgiadis, Massimo Ferrari Minesso and seminar participants at the European Central Bank and at the University of Lausanne for useful feedback. The views expressed in this paper belong to the authors and are not necessarily shared by the European Central Bank.

Marco Graziano
University of Lausanne, Lausanne, Switzerland; email: marco.graziano@unil.ch

Maurizio Michael Habib
European Central Bank, Frankfurt am Main, Germany; email: maurizio.habib@ecb.europa.eu

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.ecb.europa.eu

PDF ISBN 978-92-899-6679-5 ISSN 1725-2806 doi:10.2866/200497 QB-AR-24-048-EN-N