

On the Use of Currency Forwards: Evidence from International Equity Mutual Funds*

Wei Opie[†]

Steven J. Riddiough[‡]

November 14, 2025

Abstract

Using a novel, hand-collected, data set of currency forward contracts, we study currency management at US international equity mutual funds. Despite prior evidence indicating funds can enhance their investment performance when using currency forwards, most funds are non-users, which we attribute to higher liquidity risk facing those funds. Among user funds, most construct separate long-short “shadow” currency portfolios that generate small average returns, resulting in almost identical investment performance between user and non-user funds. However, further gains from alternative approaches are limited by costly margin requirements which would significantly increase tracking error and result in underperformance relative to the benchmark.

Keywords: currency hedging, currency derivatives, equity mutual funds

JEL Classification: F31, G11, G15, G23

*We are grateful for comments and suggestions to Vikas Agarwal, Tarun Chordia, Jonathan Dark, Ruchith Dissanayake, Richard Evans, Saurin Patel, Sergei Sarkissian, Elvira Sojli, Andrea Vedolin, Russ Wermers, Min Zhu, Eric Tan, Edward Podolski, conference participants at the 2024 Northern Finance Association Annual Meeting, the 6th Conference on “Recent Advances in Mutual Fund and Hedge Fund Research”, the Monash Winter Finance Conference 2024, The FIRN 2024 Annual Conference, 2024 Northeastern Finance Conference, 2023 FIRN Asset Management Meeting, 2023 Deakin Finance Department Research Day, the 10th Annual Melbourne Asset Pricing Meeting, and seminar participants at the University of St. Gallen, the University of Guelph, the University of Toronto, Temple University, RMIT University, and Laval University. The paper was the winner of the 2023 Hillsdale Investment Management - CFA Society Toronto Research Award and the Best Paper Award at the 2023 FIRN Asset Management Meeting. Wei Opie gratefully acknowledges research funding from the Faculty of Business and Law, Deakin University. Steven Riddiough gratefully acknowledges financial support from the University of Toronto Scarborough Research Competitiveness Fund. We thank Yudong Zheng for outstanding research assistance. All errors are ours.

[†]Deakin University. Email: wei.opie@deakin.edu.au.

[‡]University of Toronto. Email: steven.riddiough@rotman.utoronto.ca.

Investing in international equity markets has grown substantially in the past 30 years, driven by diversification gains and lower transaction costs (Solnik, 1974; Eun et al., 2008; Du and Huber, 2024). A primary way investors gain exposure to foreign equity is by investing in international equity mutual funds. Indeed, total net assets (TNA) in US-based international equity mutual funds have grown significantly, rising from around \$100 billion in 1990 to nearly \$3 trillion today, accounting for 25% of the industry’s TNA (see Figure 1).

Returns on international equities are typically driven, in part, by foreign exchange (FX) movements. It follows that portfolio managers at these funds must answer a critical question: What role should currency play in the portfolio? One option is to simply ignore the risk, leaving the FX exposure unhedged. However, research has shown that optimal currency management can offer a substantial gain in investment performance (Glen and Jorion, 1993; Campbell et al., 2010; Opie and Riddiough, 2020). Given the potential gains that arise from effective currency management, it is critical to understand how portfolio managers approach their currency exposure in practice.

This paper seeks to provide the first comprehensive analysis of currency management by international equity funds. We undertake the task by constructing a novel, hand-collected data set spanning over 55,000 net currency forward positions, covering a 15-year period, from the investment reports of 1,279 US international equity mutual funds. Our study provides the first evidence that, despite the apparent gains from optimal currency management, most funds do *not* use currency forward contracts—or any other derivative contract—to manage their currency exposure. While this could indicate sub-optimal behavior, we find evidence that non-users would be subject to higher liquidity costs and margin requirements if using currency forward contracts. These funds have less liquid underlying portfolios, are subject to higher volatility in investor flows, and would need to enter contracts on less liquid currencies when hedging—disincentivizing the use of currency forwards. Active currency forward users, on the other hand, are less subject to these higher costs, allowing them to more cheaply exploit the potential benefits of currency forwards for investment performance. Surprisingly, however, we show that the investment performance of user funds is indistinguishable from non-user funds.

We find that most active users construct separate long-short currency portfolios, frequently involving currencies not part of the underlying equity portfolio and consistent with their investment objective of targeting higher returns or maximizing capital appreciation. We find these separate currency portfolios are typically small and earn approximately zero Sharpe ratios, on average, helping to explain the lack of investment performance differential between users and

	International Equities		International Bonds	
	Unhedged	Hedged	Unhedged	Hedged
<i>Avg return (%)</i>	6.51	6.48	4.06	4.66
<i>Std (%)</i>	15.2	13.7	5.50	2.70
<i>Sharpe ratio</i>	0.43	0.47	0.73	1.73

Exhibit 1: Hedging Currency Risk in International Equity and Bond Portfolios. The table presents the average annualized monthly returns, standard deviations, and Sharpe ratios of international equity and bond portfolios that are fully hedged or unhedged against currency movements. The equity portfolio is the MSCI All Country World Index. The bond portfolio is the Bloomberg Global Aggregate Index. The sample is from January 1999 to December 2019.

non-users. Yet, consistent with the normative literature on currency management, we show that had funds adopted a simple alternative strategy—such as a naïve currency carry trade—they would have earned significantly higher Sharpe ratios. While this could point towards sub-optimal behavior, we show that it would have also required the funds to hold a costly margin position that would have substantially reduced returns and increased their tracking error. Hence, fund managers are likely restricted in their ability to effectively manage currency exposure, capping the potential gains that are available in practice.

It should be noted that optimal currency management is not well established for international equity funds, unlike for international *fixed-income* funds. The ambiguity is driven by the similarity in performance between fully-hedged and unhedged portfolios. Exhibit 1 illustrates this similarity across hedged and unhedged versions of the MSCI All Country World Equity Index, which generate almost identical Sharpe ratios.¹ For international fixed-income managers, however, the recommendation is simple: Since fixed-income volatility is typically low, currency risk tends to increase total volatility and should be entirely eliminated to enhance investment performance.² Indeed, the Sharpe ratio on the Bloomberg Global Aggregate Bond Index more than doubles when fully hedged against currency risk. Despite the ambiguity for equity funds, the academic literature has identified two general approaches to effectively manage their currency exposure.

¹The average returns of fully hedged and unhedged portfolios are similar when the base currency earns a low absolute average excess return. Indeed, the “dollar” portfolio is known to earn an average return that is not statistically different from zero (Lustig et al., 2011). Volatility in hedged and unhedged equity portfolios is often similar because currency hedging can increase volatility when a hedged currency negatively correlates with the equity market. Currencies that exhibit this property are often referred to as “safe haven” currencies (see, e.g. Ranaldo and Söderlind, 2010).

²For example, Eun and Resnick (2018) state that “*empirical evidence regarding bond markets suggests that it is essential to control exchange rate risk to enhance the efficiency of international bond portfolios.*” Campbell et al. (2010) also show that an almost complete hedge is optimal for risk minimizing bond investors, while Sialm and Zhu (2024) find that 90% of fixed-income mutual funds hedge using currency forwards, which tends to enhance funds’ investment performance.

The first involves dynamically adjusting hedge ratios across currencies or over time, often using mean-variance optimization (see, e.g., Glen and Jorion, 1993; Campbell et al., 2010; Opie and Riddiough, 2020). The second requires constructing a separate currency portfolio, often using well-established strategies such as the currency carry trade, which is subsequently combined with the equity portfolio (Kroencke et al., 2014). Both methods seek to exploit the conditional distributions of currency excess returns and have been found to improve investment performance through a mix of higher returns and lower volatility.

We begin our study of funds’ actual behavior by categorizing the equity mutual funds into two distinct groups: Users and non-users. A *user* fund held an outstanding currency forward contract in at least one quarter during the sample. We identify 471 user funds, and hence more than 60% of funds, despite the apparent gains from active currency management, endogenously choose to leave their currency exposure unhedged. Comparing users and non-users, we observe clear differences in their fund-level characteristics that point towards higher costs that non-users face when entering currency forwards. The initial margin requirements to enter a currency forward contract can be substantial and large losses on the contracts can generate a sudden need for liquidity.³ We find evidence that non-users tend to have less liquid underlying portfolios that cannot be quickly converted to cash, and are subject to more volatile investor flows, which losses on currency forwards could exacerbate. Furthermore, non-user funds hold a higher fraction of low liquidity currencies, which are subject to the highest initial margin requirements when hedged—reducing cash available for core-equity investments.

User funds, subject to less costly liquidity constraints, thus have a greater chance of exploiting the documented benefits from currency management. Surprisingly, however, and in contrast to related work by Sialm and Zhu (2024), who study international fixed-income funds, we find that the investment performance of users and non-users is remarkably similar. Net returns, benchmark-adjusted returns, and gross returns are all indistinguishable, while Sharpe ratios are slightly weaker due to surprisingly *higher* portfolio volatility among users.

A natural and justified concern is that user funds enter currency forward contracts for a variety of reasons—not necessarily to enhance investment performance. We address this concern in three ways. First, we only select funds *without* a hedged benchmark, to ensure funds are not using currency forwards for simple benchmark tracking. Second, we turn to the

³The initial margin generally ranges between 5% and 15% of forward notional amounts (Barroso et al., 2022) and a margin of 6% is the minimum standard under international guidelines (BIS, 2020). In addition, derivative users are required to post daily variation margins which reflect changes in market value of their derivative positions (Czech et al., 2025).

prospectuses of each fund to obtain their investment objective. We find that in almost every case the objective is to earn higher compounded investment returns, suggesting that the use of currency forwards should be to further this objective.⁴ Third, we select funds based on their use of currency forwards by stripping out funds that engage infrequently with forward contracts or that enter small notional positions. While these funds may aim to enhance their investment performance by hedging the FX risk of an upcoming dividend payment, or to reduce the cost of an upcoming international equity purchase, the small positions could artificially reduce the perceived performance difference between users and non-users. After this selection process, we identify 268 *active* currency forward users. However, even relative to this group of users, we continue to find essentially no difference in investment performance relative to non-users.

A fund that fully hedges its currency exposure would have an average “hedge ratio” of 100%. Indeed, as noted earlier, the typical recommendation for fixed-income funds *is* to adopt a full hedge. But among the active users we study, the average hedge ratio is very close to zero. While this may appear to suggest the funds enter small or infrequent positions, the funds are instead entering a mix of long and short contracts across currencies, and thus while the average hedge ratio is small, the average non-signed (or absolute) position is frequently large—reaching as high as 60% of a fund’s total net assets (TNA).

These baskets of currency forwards are thus effectively “shadow” currency portfolios—embedded within and leveraging the equity portfolio—but not reported within the funds’ TNA. Because the average hedge ratio is close to zero, they can be viewed as approximately dollar neutral positions. Around three-quarters of the active users we identify fit into this category, which we label as *portfolio builders*. The approach is consistent with the recommendation in the literature to construct a separate currency portfolio that is then added to the underlying equity portfolio (Kroencke et al., 2014), and we find evidence that the positions entered are partially related to common sources of currency excess returns, particularly carry and momentum. However, among portfolio builders, their currency portfolios earn only around 1% per year on average, with an associated Sharpe ratio of 0.08, and while a small group of funds earns a more significant return, we find little evidence of persistence in the performance.

The other active users tend to adopt the second major approach to effective currency management by limiting currency exposure via short forward positions. These funds, which we label as *exposure managers*, selectively reduce currency exposure and thus maintain non-trivial

⁴Table A.1 in the Online Appendix presents a selection of funds’ stated investment objectives across fund types and families. Examples include the Vanguard Global Equity Fund, which “*seeks to provide long-term capital appreciation*” and Fidelity Advisor Latin American Fund, which “*seeks long-term growth of capital.*”

hedge ratios, typically exceeding 25%. As with portfolio builders, carry and momentum are both important in driving hedge ratios and, intuitively, we find FX volatility plays a major role in determining these positions. Once again, however, the impact on investment performance is small, although generally positive: Overall portfolio volatility is reduced enough to *marginally* increase the fund's Sharpe ratio, but not sufficiently to create a statistically significant difference in investment performance relative to non-users.

A tension arises, therefore, between the earlier academic literature indicating significant benefits from active currency management and the apparent lack of gains actually obtained by the industry. We directly address this tension by considering how each fund may have performed had it chosen to adopt a simple alternative currency investment strategy, such as a full hedge, minimum-variance hedge, or currency carry trade. For example, we consider a naïve version of the currency carry trade, in which we add the strategy to the equity portfolio of portfolio builders or adjust the hedge ratios accordingly for exposure managers. We account for practical considerations relating to margin requirements and transaction costs.

The findings from this analysis are revealing. On a risk-adjusted basis, the performance of the funds *does* significantly improve. Each simple alternative we consider would have enhanced the Sharpe ratio, primarily due to its ability to reduce total volatility. However, the portfolio returns typically drop markedly as well, since the required margin position results in a large proportion of the fund's TNA being held in cash. Funds have benchmarks, and a higher risk-adjusted return would remain unattractive if it also means under-performing the benchmark and exhibiting significant tracking error. The smaller currency portfolios typically adopted by the industry, and the use of less identifiable currency strategies, may therefore be rationalized as a natural effort to exploit the benefits of currency forwards, while also limiting the costs associated with effective currency management.

In sum, the paper is the first to comprehensively study currency management at international equity mutual funds. Margin constraints and liquidity risk limit the use of currency forwards while, among active users, funds generate statistically significant but small gains from currency management—and thus do not outperform non-users. We find evidence that this apparent inconsistency with the earlier literature can be rationalized by funds adhering to their investment mandate which generates implications for future studies on currency management. Failing to account for tracking error caused by the margin requirements and liquidity risk could result in recommendations for the industry that are not available to the funds in practice.

Related literature. The paper is related to the growing literature on the use of currency derivative contracts. Sialm and Zhu (2024) provide an important complementary study on the use of currency derivatives in fixed income funds. Although bond funds benefit from fully hedging foreign exchange risk, equity funds do not experience the same straightforward performance gains. Reflecting this, almost all fixed income funds use currency forwards, although the authors document the puzzling result that average hedge ratios are low, at only 18%, despite them apparently standing to benefit significantly from full hedging. We show that a lack of forward usage could, in part, be explained by the desire to avoid substantial tracking error due to margin requirements and precautionary cash holdings.⁵

Unlike fixed-income funds, equity portfolios also tend to exhibit high volatility, and certain currencies provide natural hedges for equity risk, making effective currency management more complex. In addition, Goldstein et al. (2017) find that fixed income and equity mutual funds exhibit different flow-to-performance relationships. Bond funds display a concave flow-performance relation, in which investor flows are more responsive to poor past performance, potentially incentivizing these funds' to lower volatility through hedging. In contrast, equity fund flows display a convex shape—being less sensitive to poor performance but highly responsive to strong performance—creating distinct incentives for equity funds. We also observe the convex relationship for non-user funds but *not* for users, suggesting another reason for using forwards. Moreover, portfolio building, the dominant currency management strategy among international equity mutual funds, is largely absent among international fixed income funds.

Derivatives are known to provide various benefits to mutual funds, including improved information efficiency, risk management, and reduced transaction costs.⁶ Koski and Pontiff (1999) analyze their use among equity mutual funds, finding 21% of funds use derivatives but that risk exposure and return performance are similar across users and non-users. More recently, Kaniel and Wang (2025) examine derivative use within mutual funds during and after the COVID-19 pandemic, finding that while some users outperformed non-users, those which sought to amplify equity returns using derivatives did not outperform non-users, either during

⁵Dupuy et al. (2024) provide survey evidence consistent with this result, showing that risk managers are especially averse to negative cash flow implications associated with currency forward contracts. In other studies, Bräuer and Hau (2024) investigate European investment funds and find their currency forward positions deviate from those implied by theoretical mean-variance hedge ratios, implying sub-optimal behavior on the part of these managers. Cheema-Fox and Greenwood (2024) document that fixed income investors do indeed hedge more than equity investors, typically towards a target hedge ratio, and that hedging has increased following the global financial crisis, while Chen and Zhou (2025) find that fixed-income funds focusing on emerging markets often amplify their currency exposure using forward contracts.

⁶See, for example, Deli and Varma (2002) and Almazan et al. (2004).

or after the pandemic.⁷ The granular data set we construct allows us to shed light on why users fail to outperform non-users despite the apparent gains demonstrated by the academic literature. The inclusion of margin constraints and associated cash holdings that arise from these strategies significantly reduces funds' expected returns and significantly increases tracking error—despite effective derivative use likely improving funds' overall Sharpe ratios.

Deviations from covered interest rate parity (CIP) also create opportunities and constraints for currency hedging, influencing the cost and availability of forward contracts. Kubitza et al. (2024) find that CIP deviations are a key determinant of currency hedging over time, while Du and Huber (2024) document a decrease in demand for currency hedges when the cost of hedging increases in the cross-section of currencies due to CIP deviations. Similarly, we find that CIP deviations influence hedging activity of funds inside the US, particularly among exposure managers, who hedge less of those currencies associated with higher hedging costs.⁸

Finally, the paper contributes to the broader literature on how exchange rates influence mutual fund decision making. Massa et al. (2016) find that funds under-weighting risky currencies in their equity portfolios tend to underperform, while Camanho et al. (2022) show that foreign exchange returns shape portfolio rebalancing decisions. Burger et al. (2018) and Maggiori, Neiman, and Schreger (2020) further highlight that the international investment choices of mutual funds are heavily influenced by their currency of denomination. Our paper extends this literature by providing the first detailed study of how equity funds use currency derivatives to manage FX exposure and the resulting impact it has on overall investment performance.

The remainder of the paper is structured as follows. Section 1 describes the data and presents industry-wide evidence on the use of currency forwards. Section 2 explores the characteristics and investment performance of user and non-user funds. Section 3 outlines our methodology for categorizing user funds based on their approach to currency management. Section 4 presents results on the determination of currency forward positions and the impact of those positions on investment performance. Section 5 explores alternative approaches to managing currency exposure. Section 6 concludes. Additional results and details on the data set construction are provided in the Online Appendix.

⁷In contrast, in the hedge fund literature, Aragon and Martin (2012) find that hedge funds using option contracts delivered higher benchmark-adjusted portfolio returns and lower risk than non-users.

⁸See Du et al. (2018) and Cenedese et al. (2016) for empirical evidence on CIP deviations. Hedging could also *cause* CIP deviations. Bräuer and Hau (2023) find that institutional currency hedging can explain up to 30% of monthly exchange rate variation, while Aldunate et al. (2025) find that institutional hedging led to larger CIP deviations in the Chilean peso. De Leo et al. (2025) show that currency speculation via currency forwards leads to CIP deviations in emerging market currencies.

1 Data and Industry-Wide Evidence

In this section, we describe our sample of international equity mutual funds and the construction of the data set on currency forwards. We begin by describing data sources, merging procedures, and sample filters, before exploring trends in currency forward use across time.

1.1 International Equity Mutual Funds

We construct our sample of US international equity mutual funds by merging data from *CRSP* and *Morningstar*. The initial data set includes all international equity mutual funds at the intersection of the two data sources. We primarily merge data sets to improve classification accuracy, as *CRSP* and *Morningstar* define international equity funds in slightly different ways; thus, there are occasional inconsistencies in fund classification. To ensure accuracy, we therefore retain only funds classified as international by both *CRSP* and *Morningstar*. The funds include both active managers as well as index funds, across a range of potential investment universes.⁹

Among international funds, *Morningstar* further classifies funds into 17 categories which we group into four main types. Some funds invest across a largely unbounded set of countries with little US asset exposure (“Foreign Funds”), others invest broadly but continue to hold a sizeable share of US exposure (“World Funds”), while a smaller group of funds are more limited in their investment opportunity set, being limited either to emerging markets (“Emerging Market Funds”) or select regions (“Regional Funds”). Furthermore, *Morningstar* provides several important fund-level characteristics that are not available in *CRSP*. The most notable include funds’ benchmark indices, which allow us to verify whether a fund targets a currency-hedged index, and funds’ portfolio weights by currency, which we use to construct currency-level hedge ratios at the fund-quarter level.

1.2 Currency Forward Contracts, Filters, and Other Data

Data on fund-level portfolio holdings are available from *CRSP* starting in 2003. Information on currency derivatives, however, only become available in 2010, and exhibit significant discrepancies relative to funds’ SEC filings.¹⁰ To ensure data accuracy, we therefore hand collect data on

⁹The merging process also enables intermediate consistency checks, following a procedure similar to Berk and van Binsbergen (2015) and Pástor et al. (2015). Detailed classifications can be found in Table A.2 of the Online Appendix and a complete description of our data construction procedure is described in Section C of the Online Appendix.

¹⁰For example, we identify numerous cases where currency forward positions in *CRSP* are not observed in SEC filings, and vice versa. In several instances, we contacted mutual funds directly to query the discrepancy. The funds we contacted always confirmed that the *CRSP* reported positions are erroneous.

funds' open currency forward positions from their quarterly SEC filings, obtained through the EDGAR database. Our sample begins in 2004, the year the SEC mandated quarterly reporting via forms N-Q and N-CSR, and ends in the second quarter of 2019, just before the introduction of monthly filings using form N-Port.¹¹

Figure 2 presents an example of the data that we collect. It shows an extract from the N-CSR filing of AB International Value Fund, for the period ending 31 May 2019. Each row corresponds to a distinct currency forward contract outstanding on that date. Although there is no standardized format for disclosing open forward contracts, funds typically report the notional contract size in both foreign currency and US dollars (USD), the settlement date, the counterparty, and any unrealized gain or loss on the contract. The notional value is necessary for calculating hedge ratios and currency portfolio weights. For cross-currency forward contracts, which do not involve the USD, we convert each leg into a position against the USD. We aggregate long and short positions in the same currency for each period to compute funds' *net* currency forward positions at the currency-quarter level. We merge the currency forward data with monthly fund-level characteristics from *CRSP* and *Morningstar*. The merged sample includes 157,117 fund-month observations across 1,620 funds, of which 519 reported open currency forward positions during the sample and are therefore classified as "user" funds.

We refine our sample by applying several filters. First, we drop fund-month observations where (i) the sum of country weights (including the US) exceeds 101% or falls below 0%; (ii) the sum of foreign (non-US) country weights is below 25%; or (iii) total net assets are less than \$15 million in 2019 dollars.¹² We further restrict the sample to only include funds with at least four quarters of available data, and exclude funds that either track a currency-hedged benchmark or use a benchmark denominated in a foreign currency. We also examine the prospectus of each fund (form N-1A) for language related to currency derivatives. We find that 97% of the funds explicitly state that they may use currency forwards for hedging and, in some cases, speculative purposes. The remaining funds simply make no mention of currency forwards, rather than prohibiting their use. Furthermore, we also verify that no funds offer a currency-hedged equivalent portfolio. Hence, none of the funds in the sample is prevented from using currency forward contracts or mechanically required to maintain a set hedge ratio, meaning the

¹¹Although we occasionally find funds use other currency derivatives, such as futures or options, there are only a small handful of instances, and thus our focus on currency forward contracts is consistent with studying the industry's principal practice around the management of currency exposure.

¹²These filters address: (i) likely data errors in aggregate country weights; (ii) *CRSP*'s requirement that global funds allocate at least 25% to non-US securities; and (iii) the tendency of very small funds to produce extreme, uninformative outcomes (see, e.g., Pástor et al., 2015).

use of currency forward contracts is at each funds' discretion.

Following these additional filters, our sample of currency forwards includes 55,615 net open contracts across 1,279 funds. Of these funds, 596 are foreign funds, 308 are world funds, 276 are emerging market funds, and 99 are regional funds. Moreover, 109 are index funds. Across the sample, 471 funds report using currency forwards during the sample. The average net forward position is short \$13.2 million in foreign currency, i.e., a reduction in foreign currency exposure. We further complement this data set with (i) daily data on spot and forward exchange rates from *WM/Reuters*, (ii) Eurocurrency deposit rates from the *Financial Times*, and (iii) returns on country equity indices from *MSCI*.

1.3 The Evolution of Currency Forwards Usage

The top panel of Figure 3 presents a bar plot of the total number of mutual funds in the sample each year, split by users and non-users. The percentage of user funds for that year is displayed above each bar. The total number of mutual funds increases during the sample, rising from 491 in 2004 to 892 in 2019, reflecting the growing importance of international investing within the US mutual fund industry. We also observe a time-varying demand for currency forwards. At the start of the sample, only 12.8% of funds entered currency forwards, but this share increased to over 31% in and around the global financial crisis (GFC), before declining to less than 20% in 2019. The variation in demand hints towards possible hedging motives during a period of stress and also to more speculative motives in the period prior to the GFC, when currency strategies, including the currency carry trade, delivered especially strong returns. After the GFC, global interest rates trended towards zero and the profitability of many strategies declined, potentially contributing to the decline in demand for currency forwards. The industry-wide variation also coincides with broader US dollar patterns. Between 2004 and 2011, apart from a sharp rise during the GFC, the US dollar weakened against a basket of currencies, before rebounding over the latter part of the sample. During a period in which the US dollar is weakening, mutual funds have an added incentive to contract at favorable rates prior to a foreign asset purchase or to hedge against a potential reversal.

The lower panel of Figure 3 presents the time-series of net and absolute notional values for the outstanding currency forward contracts. Net sales are calculated as the difference between the short and long notional values of contracts, scaled by TNA. A positive value therefore indicates an industry-wide reduction in foreign currency exposure. The absolute position captures, instead, the *sum* of the long and short positions, scaled by TNA. Net sales

are typically modest—less than 4% of TNA—indicating that the funds do not, on average, reduce a substantial amount of their total foreign currency exposure. Absolute positions are significantly larger, especially in the years preceding and around the GFC. Of course, this difference can be viewed as mechanical—the absolute value *must* be at least as large as the net amount. However, if funds did not typically increase currency exposure through the use of long forward contracts and mainly sought to reduce exposure, then the difference would be small. Instead, the sizeable gap indicates that funds entered a substantial number of long currency forward contracts, consistent with pursuing more speculative strategies.

In the following sections, we explore these broad industry themes in more depth. We first turn to the distinction between users and non-users to better understand why a fund may choose not to use currency forwards. We then investigate the determination of currency forward use at a granular fund-currency-quarter level, before analyzing the impact that those currency forwards have on funds’ overall investment performance.

2 The Differences Between Users and Non-Users

In this section, we investigate differences between users and non-users. In doing so, our aim is to first shed light on why funds may choose not to use currency forwards, despite the benefits documented in the academic literature. We then investigate whether users generate any investment outperformance relative to non-users.

2.1 Fund-Level Characteristics

Our primary evidence is presented in Table 1. The table reports the mean and standard deviation of fund characteristics (Panel A) and investment performance metrics (Panel B). The column labeled “Obs” presents the number of fund-quarter observations. The final two columns in Panel A present the difference in means between users and non-users, and the coefficients from a logit regression, in which the binary dependent variable equals one for users and zero for non-users.¹³ Unlike the difference in means test, the logit regression takes account of cross-correlations in determining whether a fund becomes a user of currency forwards.

¹³For the difference in means test, we denote the statistical significance of the difference using asterisk. Three asterisks represent statistic significance at the 1% significance level. We obtain p -values using permutation tests on average fund characteristics with 1,000 resamples. Specifically, for each variable, we randomly assign funds into two groups, which have the same size as the original sample (i.e., the same number of users and non-users), and recalculate the difference in means. Each fund appears once in each resample. The null hypothesis is that there is no difference in means between users and non-users. The p -value represents the proportion of simulated test statistics that exceed the observed test statistic.

The variables are grouped primarily into two themes: (i) those related to the costs of trading currency forwards, as the cost of trading has a large fund-specific component, and (ii) those related to the style of the fund, which may have implications for how currency forwards can be used. We begin by discussing the variables related to the costs of trading. When a fund enters a currency forward contract, it typically needs to put aside an initial margin as collateral against potential losses from future adverse moves in the currency or in the event of default. The exact amount required is likely to vary between funds and according to their relationship with the FX dealer. Typical estimates place the initial margin around 5% to 15% of the notional value, with higher amounts required for the least liquid currencies. Moreover, the margin may require a top-up as currencies fluctuate and a daily variation margin is exchanged by marking the contract to market, which may necessitate a partial liquidation of their underlying holdings. A fund’s underlying portfolio thus has implications for these costs since it is more costly to hedge, for example, a larger and less liquid portfolio.

Comparing between users and non-users, we do not observe a material difference in some broader fund-level characteristics. The holdings of foreign assets in general, or in safe haven currencies specifically, are similar. Users and non-users hold just over 80% of their entire equity portfolios in foreign equity, and around 15%, on average, in safe haven currencies that offer a natural hedge against adverse fluctuations in equity markets.¹⁴ Moreover, while users tend to invest in more countries, economically the difference is minor—16.8 versus 16.0, with large variation within both groups.

We do, however, observe far more substantial differences in other cost-related variables. Non-users tend to hold a larger fraction of higher margin, less liquid, non-G3 currencies and invest in a portfolio of less liquid equities defined, following Chen et al. (2010), as small-cap, mid-cap, or single-country equities excluding the UK, Japan, and Canada.¹⁵ To support this finding, in Figure A.1 in the Online Appendix, we present the proportion of users across each of *Morningstar’s* 17 fund categories and find that the four “large” market capitalization categories are also the four main users of currency forwards. Furthermore, we find non-users experience more volatility in their investor flows, which creates a source of liquidity risk for funds that they may choose to avoid amplifying through the introduction of currency forwards.¹⁶ A larger fund

¹⁴Campbell et al. (2010) argue that equity fund managers should typically leave this form of foreign exchange exposure unhedged. We define the Japanese yen and the Swiss franc as safe haven currencies.

¹⁵We refer to the euro, Japanese yen, and British pound as the G3 currencies.

¹⁶We define flow volatility as the standard deviation of estimated quarterly fund flow over the full sample. Jiang et al. (2021) show that mutual funds with more volatile flows are more likely to hold credit default swaps, using them as liquid substitutes for less-liquid bond exposures with similar return/credit profiles for liquidity

may also benefit from economies of scale if, for example, a centralized currency manager can manage currency exposure across multiple funds simultaneously. However, we find that users are more likely to reside in smaller fund families, potentially driven by larger families adopting blanket policies against the use of currency forwards across all of their funds.

Another potential source of cost reduction stems from managers' experience, or expertise, in currency management. Since currency is not the primary investment vehicle of the fund, managers may need to acquire information about currency markets for themselves or hire a costly external currency manager. We proxy for experience in currency management using the fund's size and age. Interestingly, we find non-users *are* typically smaller funds, with around half the assets under management of user funds, and are also slightly younger, on average, pointing towards experience playing a potential role in the decision to use currency forwards. Consistent with currency forwards creating an additional cost, we find users typically have higher expense ratios, although do not hold more cash, suggesting that the notional size of their forward contracts are not typically large.

The style of the fund may also impact their use of currency forwards. Given that the literature has typically highlighted the need to dynamically manage currency exposure, funds that are more active in trading their underlying equity portfolio may also be more likely to enter currency forwards. Indeed, comparing funds' turnover ratios (of the underlying equity portfolio), we do find a significantly higher level of turnover among the user group—over 15% higher on average—supporting a relationship with forward use. Furthermore, we find that users tend to distribute a higher share of their assets as income each year. This indicates that users generate higher dividend inflows and capital gains that are often required to be converted to US dollars and passed on to investors, which a fund may decide to hedge to reduce investors' short-term currency exposure.

Next, we turn to the prospectuses of funds to check how they describe their potential use of currency forward contracts. Figure A.2 in the Online Appendix presents extracts from funds' prospectuses to illustrate some of the alternative ways in which funds describe their potential use of currency forwards. Many of the funds include a statement in their prospectus to the effect that they may use currency forwards for both "*hedging and non-hedging*" purposes, such as to "*profit from anticipated movements in currency rates,*" rather than just to hedge FX exposure. We denote these funds as being more receptive to currency speculation as a means

management. By contrast, currency forwards cannot replicate equity exposure and they are typically used to hedge the currency component of foreign equities. Hence, greater use of forwards tends to add to liquidity demands (e.g., margin and settlement) rather than reduce them.

to further enhance the investment performance of the fund and find users are more likely to contain this form of statement in their prospectus.

We also consider a potential clientele effect. Institutional investors, who may be capable of directly managing currency exposure, may reduce a fund manager’s need to do so. However, while our univariate analysis suggests that funds using forwards tend to have a lower proportion of institutional share ownership, the difference is not statistically significant in the logit regression. Interestingly, we also find no reduction in the share of index funds using currency forwards. Although we ensure that none of the funds in the sample track a currency-hedged index, around 10% of users *are* index funds—similar to the fraction of non-user index funds.

To expand on this analysis, in Table 2, we present results from a fixed-effect panel regression in which we regress investor quarterly flows on funds’ benchmark-adjusted returns,

$$\text{flow}_{i,t} = \beta^- R_{t-1}^- + \beta^+ R_{t-1}^+ + \mathbf{b}'\mathbf{x}_{i,t-1} + \delta_t + \gamma_i + \varepsilon_{i,t}, \quad (1)$$

where $\text{flow}_{i,t}$ is the flow into fund i in quarter t .¹⁷ The main independent variables are the negative benchmark-adjusted return (R_{t-1}^-) and the positive benchmark-adjusted return (R_{t-1}^+). The negative benchmark-adjusted return equals the minimum of the benchmark-adjusted return and zero, whereas the positive benchmark-adjusted return equals the maximum of the benchmark-adjusted return and zero. In each case, the benchmark-adjusted return is the fund’s return minus the return on the benchmark index specified in the fund’s prospectus. We also control for a set of lagged fund-level characteristics and include fund and time fixed effects. We cluster standard errors by fund and quarter.

Fixed income mutual funds typically experience a negative reaction in flows to weaker investment performance. Indeed, Sialm and Zhu (2024) document this pattern for the fixed income funds they study, helping to explain the funds’ use of currency forward contracts to reduce return volatility and limit large negative returns. In contrast, equity mutual funds tend to exhibit a more pronounced positive reaction to higher returns, which may limit the need to hold currency forwards for hedging purposes. Interestingly, when we assess the response of flows to past benchmark adjusted returns, we find that non users only exhibit a response to positive returns, consistent with the earlier findings on equity mutual funds. Instead, for user funds, investor flows respond to *both* negative and positive benchmark-adjusted returns, and thus currency forwards may be used to protect against losses driving investor flows away from

¹⁷The quarterly fund flow is defined as $[AUM_t - AUM_{t-1} \times (1 + \text{GrossReturn}_t)] / AUM_{t-1}$, where *Gross Return* is the quarterly net return plus 1/4 of the annual expense ratio.

the fund. To confirm this possibility, in the final specification in Table 2, we replace fund flows with hedge ratios. We observe that a more negative benchmark adjusted return results in a larger hedge ratio for users, consistent with reducing currency risk to limit investor outflows.

In sum, non-users tend to face higher costs if they entered forward contracts. For these funds, margin requirements would be larger, and converting assets to cash to cover forward losses would be more expensive. Evidence is also consistent with managers at these funds having less currency market expertise and being less receptive to forward contracts, either due to their less dynamic style of investment management, or by failing to mention currency speculation as a means to enhance investment performance. Naturally, if costs outweigh the benefits, it is rational to avoid currency forwards. Yet, for users, the reverse holds true—currency forwards can aid in meeting their investment mandate of delivering capital appreciation to their investors.

2.2 Investment Performance

In Panel B of Table 1, we investigate the investment performance of user and non-user funds. Consistent with previous studies on the general use of derivative contracts by mutual funds, we do not detect statistically significant differences in performance across a range of investment performance metrics, including net returns, benchmark-adjusted returns, and tracking error. Across each metric, the average value is almost indistinguishable between the two groups. The finding is not driven by higher fees among users: Gross returns and management fees are also not different, on average. Moreover, we puzzlingly observe that users generated *lower* Sharpe ratios, on average, due to *higher* overall portfolio volatility.

This final result is particularly surprising given the large body of evidence indicating that currency forwards should help lower volatility and enhance risk-adjusted performance. This raises the natural question: Why has the use of currency forwards *not* led to relatively stronger investment performance? To begin to answer this question, we first aim to understand why currency forwards have typically been adopted in practice, before turning to study the resulting impact on funds' investment performance at the style level that we introduce next.

3 Currency Management Styles

In this section, we investigate *how* the mutual funds in our sample use currency forwards. We classify funds into distinct styles of currency management based on two key metrics: The hedge ratio, which captures the extent to which funds reduce or amplify currency exposure, and the

absolute notional size of forward positions, which helps to capture funds entering a mix of long and short positions. This classification enables us to distinguish between funds that build separate currency portfolios from those that principally reduce existing currency exposure.

3.1 The Hedge Ratio

To measure how much funds reduce or amplify currency exposure, we examine the distribution of fund-level hedge ratios. The hedge ratio captures the proportion of foreign exchange exposure offset through forward currency contracts. Specifically, for fund i in quarter t , we define the hedge ratio as

$$\text{hr}_{i,t} = \frac{\sum_j \tilde{f}_{i,j,t}}{\sum_j w_{i,j,t}}, \quad (2)$$

where $\tilde{f}_{i,j,t} = f_{i,j,t}/TNA_{i,t}$, is the US dollar value of the net notional forward position in currency j , i.e., the difference between the notional values of the short- and long-forward contracts in currency j , scaled by TNA. The denominator, $w_{i,j,t}$, is fund i 's portfolio weight in foreign currency j in quarter t . Thus, a positive value reflects a net short-term position that reduces foreign currency exposure, whereas a negative value indicates that the fund has increased its currency exposure through its currency forwards. Figure 4(a) displays a histogram of hedge ratios at the fund-level. Three patterns emerge: (i) the hedge ratios tend to cluster around zero, with a mean of just 2.4%; (ii) more than 100 funds *increased* their exposure to foreign currency; and (iii) only 21 funds hedged, on average, more than 20% of their exposure.

These initial results indicate that funds are not primarily aiming to eliminate currency risk. When a fund uses currency forwards, but the average hedge ratio is close to zero, it could indicate that the fund is entering contracts infrequently or in small notional size. Alternatively, the fund could be entering much larger contracts, but taking both long and short positions that net to around zero. For example, a fund with \$100 million under management, invested equally in Japan and Australia, could enter a \$25 million short forward position in yen and a \$25 million long forward position in AUD. Although the average hedge ratio is zero, the economic magnitude of the gross positions is a material fraction of the fund's TNA.

The first possibility is more reflective of short-term hedging demand, such as hedging the foreign exchange rate exposure in an upcoming dividend payment or equity purchase. The latter possibility would be more indicative of a speculative motive designed to help maximize the fund's investment objective. To better understand which possibility is driving the result, we analyze the absolute notional position of each fund's currency forward contracts.

3.2 The Absolute Notional Position

We measure a fund’s absolute forward position, as the sum of its absolute net notional forward positions across currencies scaled by TNA:

$$\text{afp}_{i,t} = \sum_j |\tilde{f}_{i,j,t}|. \quad (3)$$

A natural question is: Why not simply measure the absolute *hedge ratio*? The reason is that the absolute notional position offers an advantage over the absolute hedge ratio when funds enter forward contracts on currencies *not* contained in the underlying equity portfolio. In these situations, the hedge ratio is undefined. Indeed, in later analysis, we present evidence that a large number of positions are entered on currencies that are not part of the equity portfolio, consistent with funds seeking to build a speculative currency portfolio.

Figure 4(b) presents a scatter plot of funds’ average hedge ratios against their average absolute notional positions. The plot reveals a striking pattern: while hedge ratios are often close to zero, many funds enter large average absolute notional positions on their currency forwards, exceeding 50% of TNA for some funds. These funds are effectively constructing a large “shadow” currency portfolio—a source of leverage reported in the notes to the investment statement. We highlight in red (+ markers) all funds whose average absolute notional position is above 2% of the fund’s TNA. However, not all funds construct a shadow portfolio. We also observed that many funds adopted both a low average hedge ratio and a low absolute notional position (denoted by blue \diamond markers in the scatter plot), consistent with short-term hedging, tactical speculation, or liquidity management.

The preceding analysis suggests, therefore, that there is a range of styles in the use of currency forward contracts. A large group of funds, though identified as users, have relatively little interest in holding large currency forward positions on a regular basis. For these funds, both the hedge ratio and the absolute notional position are close to zero. In contrast, many other funds enter contracts in a way that is more consistent with building a currency portfolio. For these funds, the hedge ratio is close to zero, but the absolute notional position is a material fraction of the fund’s TNA. Finally, a smaller group of funds typically removes a material fraction of their currency exposure. For these funds, the hedge ratio is clearly positive.

Given the range of styles we observe, we choose to classify each fund into a style category. In doing so, we can assess the drivers of currency forward usage and the implications for investment performance at the style level. Moreover, we can address whether the inability of

users to outperform non-users is an artifact of “occasional” forward users, whose positions are either too small or too infrequent to materially impact a fund’s average return.

3.3 Currency Management Styles

We assign funds to style categories using three indicators: (i) the proportion of quarters that a fund uses currency forwards, (ii) the average hedge ratio during those quarters, and (iii) the average absolute notional position during those quarters. The first indicator allows us to identify infrequent users. The second indicator allows us to identify funds seeking to significantly reduce currency exposure. The third indicator allows us to separate funds that build currency portfolios from those that use currency forwards occasionally or in small quantities. We define a fund as a currency “portfolio builder” if it has outstanding forward contracts in at least 10% of quarters, maintains an average absolute notional position exceeding 2% of TNA, but a hedge ratio below 10%. In contrast, an “exposure manager” has outstanding forward contracts in at least 10% of quarters and maintains an average hedge ratio equal to or exceeding 10%. All remaining funds are considered occasional users. After assigning funds, we label 202 as portfolio builders, 66 as exposure managers, and 203 as occasional users.¹⁸

To illustrate the classification scheme, Figure 5 presents examples of each currency management style. Figure 5(a) presents a portfolio builder, *J.P. Morgan International Value Fund*. The fund maintained an average hedge ratio close to zero, but entered large long and short notional positions in currency forwards. The fund therefore maintained a dollar neutral currency portfolio that grew to \$786 million in absolute notional, or around 20% of the fund’s TNA, at its peak in 2014. Figure 5(b) presents an exposure manager, *Evermore Global Value Fund*, which maintained a hedge ratio close to 100% and never entered long forward contracts. The *Evermore* fund is extreme in fully hedging all currency exposure. Other exposure managers reduce a smaller fraction of exposure and some choose to vary their hedge ratio over time. Finally, Figure 5(c) presents an occasional user, *Threadneedle International Opportunity Fund*, which sporadically entered currency forward contracts with small notional positions. These contracts had almost no impact on the fund’s currency exposure or investment performance.

To further validate these classifications, Figure 6 presents funds’ average weight in foreign assets (horizontal axis) against their average exposure to foreign currency after accounting for

¹⁸We keep our classification system purposely simple, designed to transparently reflect the diversity of currency management behaviors observed in the data. In robustness tests, we apply alternative classification systems, including a machine learning approach, and find that our core results are robust to these alternative approaches. See Section B in the Online Appendix for further details.

their currency forward positions (vertical axis). A fully hedged fund would lie on the horizontal axis, while a fund that neither reduces nor increases its currency exposure would lie on the 45-degree line. In support of the classification, exposure managers show the largest reduction in currency exposure, as evidenced by their location below the 45-degree line. Instead, portfolio builders and occasional users are clustered along the 45-degree line, confirming that their use of currency forwards does not substantially affect their net currency exposure.

In Figures A.3 and A.4 in the Online Appendix, we present a further breakdown of funds. Figure A.3 presents the split between active funds and index funds. The two groups are similar, although we find that index funds are slightly more likely to be occasional users, consistent with these funds avoiding tracking error. In Figure A.4, we show the split according to fund types based on *Morningstar* classifications. *Foreign Funds* are more likely to be portfolio builders, while *World Funds* are more likely to be exposure managers.¹⁹ This distinction can be rationalized from a cost perspective. Hedging a substantial amount of underlying currency exposure is, as noted previously, costly. By maintaining a significant amount of US dollar assets, *World Funds* have lower costs associated with becoming an exposure manager relative to the other types of fund. *Foreign Funds*, on the other hand, have the broadest underlying exposure and experience across countries and currencies, reducing the cost of acquiring relevant information that can be actively deployed through a currency portfolio.

3.4 Currency Forwards Across Currency Management Styles

In Table 3, we present statistics on currency forward usage among portfolio builders, exposure managers, and occasional users. Portfolio builders and exposure managers tend to have outstanding forward positions in at least 60% of quarters, in contrast to occasional users, who do so only around one-third of the time. Portfolio builders also tend to hold forward contracts across a range of currencies, around 6.6 on average, which amounts to more than 12% of the fund's TNA. These positions are typically dollar neutral, which is implied by the average hedge ratio of 0.1%. In contrast, exposure managers tend to hedge fewer currencies, around 4.8 on average, but adopt a far higher average hedge ratio of 27.7%. Naturally, occasional users, as sporadic users of currency forward contracts, tend to hold contracts on fewer currencies (2.9 on average), with smaller notional size (absolute notional of just 1.5% of the fund's TNA), and with little impact on a fund's total currency exposure (-0.1% average hedge ratio).

In the lower panel of Table 3, we present the breakdown of currency forward positions by

¹⁹In Figure A.5 of the Online Appendix, we show that *World Funds* reduce currency exposure the most.

currency management style. We order the currencies on the basis of their total number of net forward positions. The ranking is aligned with measures of currency turnover, in which the euro, Japanese yen, British pound, and other major developed market currencies dominate (see, e.g., BIS, 2025). Portfolio builders entered the majority of contracts, holding 68% (37,564) of the outstanding net forward contracts in the sample. Of this figure, 11% (4,274) related to currencies for which there was no underlying position (NUP) in their primary equity portfolio. In fact, almost all forward positions entered without an underlying equity portfolio are held by portfolio builders (around 90%), consistent with these funds using currency forwards as an independent source of investment performance. Indeed, many of these positions are entered in emerging market currencies that typically carry a higher interest rate, including the South African rand, Brazilian real, and Mexican peso, while 45% of the positions held by portfolio builders in the New Zealand dollar, a high-yielding developed-market currency, are entered without an investment in New Zealand equities, indicating a possible carry trade motive. Furthermore, a little over 50% (19,730) of the positions entered by portfolio builders were in long forward contracts that *increased* their foreign currency exposure whereas, in contrast, 85% of exposure managers' net positions reduced currency exposure.

We extend the analysis in Figure 7, presenting the average G9 currency positions of portfolio builders and exposure managers over time.²⁰ For portfolio builders, we present the currency portfolio weight of each G9 currency. For exposure managers, we present the “abnormal” hedge ratios, defined as the deviation from the fund-level hedge ratio. The size of each square represents the relative frequency with which currency forwards are entered. We make two observations. First, there is persistence in the forward positions. The Australian dollar, for example, is typically in the long leg of portfolio builders' currency portfolio. Indeed, we observe more persistent evidence of carry trade activity, with long positions repeatedly entered in the Australian dollar, the New Zealand dollar, and the Canadian dollar. Instead, the euro and the Japanese yen are typical funding currencies. For exposure managers, the euro is consistently the currency with the largest abnormal hedge ratio.

Second, we note differences between the two styles of currency management. Portfolio builders were more active between 2006 and 2014, a period in which active currency investing was particularly profitable. In fact, since the GFC many well-known currency strategies have experienced weaker performance, which may partly explain the subsequently reduced size of

²⁰We define the “G9” as the G10 currencies excluding the US dollar: euro (EUR), Japanese yen (JPY), British pound (GBP), Swiss franc (CHF), Australian dollar (AUD), Canadian dollar (CAD), New Zealand dollar (NZD), Swedish krona (SEK), and Norwegian krone (NOK).

portfolio builders' currency portfolios (see, e.g., Ranaldo and Somogyi, 2021). In contrast, exposure managers entered relatively few positions before the GFC, but increased their usage after 2011, a period in which US dollar returns on foreign assets have been negatively affected by the strong appreciation of the US dollar.

In sum, international equity mutual funds show a range of styles in their approach to currency management. Among funds more active in their use of currency forwards, the majority are portfolio builders, constructing a separate currency portfolio which, at the aggregate level, displays some clear hallmarks of carry trade activity. A high number of funds enter forward contracts infrequently or in a small notional size, leading to a relatively minor impact on their overall investment performance. It is important to ask, therefore, whether the lack of investment performance difference between users and non-users is due to the inclusion of these occasional users. We turn to this question at the outset of the next section.

4 Portfolio Builders and Exposure Managers

In this section, we begin by assessing the investment performance of portfolio builders and exposure managers relative to that of non users. For each currency management style, we then investigate the determinants of currency forward use and assess how the forward positions impact funds' overall investment performance.

4.1 Investment Performance Revisited

In Section 2.2, we compared the investment performance of users and non-users and found essentially no difference between the two groups across a range of investment performance metrics. We revisit this analysis, armed with the insights of the previous section, to remove occasional users from the broader group of users. Since the overall investment performance of these funds is unlikely affected by the small size and infrequent nature of the currency forward contracts they enter, it is possible that users will display different performance to non-users once only the most active forms of currency management are considered.

In Table 4, we present the equivalent statistics to those initially displayed in Panel B of Table 1, except we limit the user group to only include portfolio builders and exposure managers. In the last three columns, we present the difference in investment performance between active users, portfolio builders, and exposure managers, relative to that of non-users.²¹

²¹A full breakdown of the investment performance of portfolio builders and exposure managers is presented in Table A.3 of the Online Appendix.

When comparing active users with non-users we find almost identical results to those observed in Table 1. All performance metrics are statistically indistinguishable apart from the Sharpe ratio, which is marginally statistically higher for *non-users*. We observe more differences when splitting up the active users between portfolio builders and exposure managers. The lower Sharpe ratio is driven by portfolio builders. For exposure managers, the Sharpe ratio is, in fact, slightly higher albeit not to a statistically significant level. Unsurprisingly, since the benchmark index is unhedged, exposure managers tend to increase the tracking error of their portfolio by reducing currency exposure. Exposure managers benefit, however, from reduced portfolio volatility, which is statistically significantly lower relative to non-users, although they charge a management fee around 8 bps per annum higher than non-users. In contrast, portfolio builders tend to exhibit higher portfolio volatility than non-users but display slightly lower tracking error, and thus a possible additional motive for their behavior is to better align their currency weights with those in the benchmark index.

In sum, the surprising results presented in Panel B of Table 1 are observed again when only considering the most active forward users. While exposure managers appear to offer some minor incremental benefits relative to non-users, principally through reducing portfolio volatility, portfolio builders generate weaker risk-adjusted performance although exhibit slightly lower tracking error. Since funds' investment performance continues to appear weaker than may be anticipated given the earlier literature on currency management, further scrutiny is warranted to understand *how* individual currency forward positions are determined.

4.2 The Determinants of Currency Forward Positions

We examine how portfolio builders and exposure managers determine their use of currency forward contracts using fixed-effects panel regressions. Given the difference in styles, we investigate different dependent variables for each group. For portfolio builders, we explore the determinants of a currency's weight in their currency portfolio. For exposure managers, we explore the determinants of a currency's hedge ratio.

Specifically, we estimate the model

$$y_{i,j,t} = \mathbf{b}'\mathbf{x}_{j,t-1} + \delta_{em} + \gamma_{i,t} + \varepsilon_{i,j,t}, \quad (4)$$

where the dependent variable $y_{i,j,t}$ is either the currency portfolio weight, $cw_{i,j,t}$, i.e., the weight allocated by fund i to currency j in quarter t , or the hedge ratio, $hr_{i,j,t} = \tilde{f}_{i,j,t}/w_{i,j,t}$, that fund i

enters in quarter t on currency j .²² The vector $\mathbf{x}_{j,t-1}$ contains a set of lagged currency-specific explanatory variables and \mathbf{b} are the associated coefficients. Explanatory variables include the country weight in the underlying equity portfolio; three factors associated with higher currency excess returns: carry, momentum, and value;²³ the bid-ask spread, a liquidity metric relating to the cost of entering currency forward contracts; and an emerging market dummy variable to account for other unobservable differences between developed and emerging market currencies (δ_{em}). For exposure managers, we also include exchange rate volatility, which funds may seek to reduce through hedging; and equity market returns that may result in portfolio rebalancing (see, e.g., Ben Zeev and Nathan, 2024).

To isolate cross-currency variation within funds, we also include fund-by-quarter fixed effects ($\gamma_{i,t}$), allowing us to study why a fund chooses a higher currency portfolio weight or hedge ratio for one currency relative to another. Moreover, in further testing, we also include fund-by-currency fixed effects to explore whether currency weights and hedge ratios are related to a variable through persistence, e.g., consistently entering long positions in high interest-rate currencies, or due to timing, e.g., entering contracts after a change in interest rates. Standard errors are clustered at the fund-by-currency level.

Table 5 presents coefficient estimates and standard errors. Columns (1) and (3) report the results for the two styles of currency management with only the inclusion of fund-by-quarter fixed effects, allowing us to assess the cross-sectional determinants of currency portfolio weights and hedge ratios. Considering these two sets of results, we find that country weights in the equity portfolio are negatively associated with portfolio builders' currency portfolio weights and positively associated with exposure managers' hedge ratios. A ten percent increase in the equity portfolio weight is associated with a five percent reduction in a portfolio builder's currency portfolio weight, and a seven percent increase in an exposure manager's hedge ratio.

Funds across both styles of currency management, therefore, tend to reduce exposure to

²²To calculate the currency portfolio weight, we first normalize the forward position of each currency by the total gross notional exposure of the fund. Specifically, we calculate the absolute notional values of the fund's long and short forward positions, and divide each forward position by the largest of the two values. This approach preserves directional exposure while ensuring that all weights are defined on a consistent scale between funds. We treat the US dollar as the balancing currency so that the currency portfolio weights, including the US dollar, sum to zero. We winsorize hedge ratios at the 1st and 99th percentiles to mitigate against outliers.

²³Lustig et al. (2011) show that high interest rate currencies earn higher excess returns. Menkhoff et al. (2012) find that short-term momentum (one- to three-month exchange rate returns) generates substantial cross-sectional spreads, particularly among emerging market currencies. Asness et al. (2013) and Menkhoff et al. (2017) document that undervalued currencies tend to outperform. We measure exchange rate momentum as the rate of return in the exchange rate over the past quarter, the forward discount is measured as the log difference between the three-month forward and spot rates, while we measure currency value following the procedure of Asness et al. (2013).

their largest currency positions. For exposure managers this is intuitive, as it is consistent with hedging currencies that increase portfolio volatility by the most. There are at least two potential motivations for this pattern among portfolio builders. First, funds may hedge currency exposures derived from their equity holdings to reduce return volatility before adding currency exposure with more attractive risk-return properties. This practice aligns with the recommendation to separate hedging from alpha-seeking currency trades (Pojarliev and Levich, 2014; Kroencke et al., 2014). Second, the highest equity exposures are often in larger developed markets, which are more central to the global trade network and typically offer lower yields on short-dated securities, such as in the eurozone or Japan. Because these countries are associated with lower currency excess returns, they are typically held as funding currencies in an unconditional currency carry trade (see, e.g., Hassan, 2013; Richmond, 2019).

Prior studies have identified signals that help to predict the cross-section of currency excess returns. The most prominent of these signals include carry, momentum, and value. Given these findings, forward users may seek exposure to these sources of return when entering currency forwards. Indeed, portfolio builders and exposure managers both exhibit behavior that is consistent with loading on carry and momentum factors. For portfolio builders, a one percent higher interest rate is associated with a 0.36 percent higher portfolio weight, while a one percent higher exchange rate return during the quarter is associated with a 0.27 percent increase in the next quarter currency portfolio weight.²⁴ Exposure managers also typically reduce the size of their currency hedges on currencies offering higher yields or that have recently appreciated. In each case, the associated coefficient is highly statistically significant, suggesting that currency exposure is changed in ways consistent with targeting higher expected returns. In contrast, currency value has no discernible influence on either currency portfolio weights or hedge ratios.

We also observe a minor impact from liquidity, as measured by the bid-ask spread. However, the main difference in liquidity is likely captured by the emerging market dummy variable. Indeed, for both types of currency management we find the coefficient on the dummy variable is negative and highly statistically significant, implying less reduction of currency exposure among exposure managers and consistent with smaller currency weights among portfolio builders—offsetting the higher weight assigned due to the high yield.²⁵

²⁴Practitioners often consider risk-adjusted carry by investing in a carry trade in which interest rates are scaled by the volatility of the exchange rate (e.g., Dupuy, 2021; Maurer et al., 2023). In column (1) of Table A.4 of the Online Appendix, we explore this alternative measure of carry and find an even stronger effect.

²⁵Another cost associated with currency hedging stems from covered interest rate parity violations, i.e., the cross-currency basis (Du et al., 2018). We calculate the cross-currency basis using eurocurrency rates. Since these rates are not widely available across emerging markets, we choose to evaluate the impact of the cross-

Exchange rate fluctuations typically increase the volatility of an international portfolio. Hedging currencies exhibiting high volatility can therefore aid in minimizing a portfolio’s total risk (Campbell et al., 2010).²⁶ Consistent with this motivation, we find a positive relationship between hedge ratios and FX volatility. A one percentage point increase in annualized volatility is associated with a 0.47 percentage point increase in the hedge ratio. We do not observe a relationship, however, between the hedge ratio and local equity-market returns. The finding is consistent with Camanho et al. (2022), who find that international funds rebalance their equity portfolios at quarter-end, limiting the need for contemporaneous hedging adjustments.

In columns (2) and (4) we add fund-by-currency fixed effects. If a variable becomes insignificant in this alternative specification, it indicates that the fund has *persistence* in its behavior in relation to that variable. We observe this for carry. Both portfolio builders and exposure managers tend to allow more exposure to high yielding currencies on a consistent basis, and thus changes in interest rates are not driving the result. In contrast, momentum is intuitively related to timing—funds increase their exposure to currencies because they recently appreciated and not because they appreciate on average. In general, we find that the variables are not typically related to timing. The only other variable that displays this tendency is the country weight in the funds’ equity portfolio, which is consistent with funds actively adapting their currency portfolio to changes in their underlying portfolio.

Overall, while users do not generate stronger investment performance than non-users, we do observe behavior that is clearly consistent with anticipated determinants of forward use. Funds respond to their underlying equity portfolio and tend to load on two of the most documented drivers of currency excess returns: Carry and momentum. Cost and volatility also play a role, as would be expected by firms seeking to maximize total returns. The findings are also strikingly similar for portfolio builders and exposure managers, suggesting similar motivations driving their use of currency forwards.²⁷ Given these observations, it is pertinent to understand why there is no difference in investment performance between users and non-users. We attempt to

currency basis separately for developed market currencies and report our findings in the last two columns of Table A.4 of the Online Appendix. We find that a higher cross-currency basis, indicative of higher hedging costs for US investors, is associated with significantly lower hedging demand, consistent with hedging demand being sensitive to cost. However, find no association with currency portfolio weights.

²⁶The volatility of an international portfolio increases with exchange rate volatility, but this can be offset if the covariance between the exchange rate and the foreign asset is negative, i.e., if the asset provides a “natural hedge” against foreign exchange fluctuations. However, we find that this covariance effect is not a significant driver of forward positions. The result is available upon request.

²⁷Fund managers may simply respond to the same information and have similar backgrounds and experience. Alternatively, funds may outsource their currency decisions to specialized currency managers leading to similar choices. Indeed, because we do not know who is ultimately responsible for entering currency forwards, we cannot directly study the characteristics of managers.

shed light on the issue by investigating the investment performance of portfolio builders and exposure managers at a granular level.²⁸

4.3 The Impact of Forward Positions on Fund Performance

In Table 6, we present a breakdown of the impact that currency forward positions have on fund performance. In Panel A, we present statistics for portfolio builders. Across all portfolio builders, the average Sharpe ratio of the *currency* portfolio is only 0.08. Given the strong performance of currency portfolios reported in academic studies, especially when combining various currency investment strategies, the performance is surprisingly weak.²⁹ The annualized return of the portfolio is just 0.95% per annum and a quarter of funds entered currency portfolios that generated *negative* average currency excess returns of less than -1.15% per annum.

To better understand this result, we investigate the cross-sectional performance of currency portfolios across five groups of portfolio builders (G1 to G5). The funds are grouped according to the Sharpe ratio of their currency portfolio. We observe a large spread in performance. The average Sharpe ratio for G5 funds is a healthy 0.77 and the average currency excess return is 6.3 percent per annum, while for G1 funds, the average Sharpe ratio is -0.75 and the average annualized return is -4.25 percent, highlighting significant performance differences across the industry. The volatility and size of the currency portfolios tends to be quite similar across groups, however. Annualized volatility ranges from 7.0 to 8.3 percent and the portfolios are, on average, between 9 and 16 percent of a fund's TNA. We also observe similar levels of tracking error across the five groups, and thus it does not appear that the relative underperformance of some funds is the outcome of more accurate benchmark tracking.

Digging deeper, we investigate whether there are systematic differences in the main currencies selected across groups. In Table A.5 of the Online Appendix, we report the top five investment currencies and the top five funding currencies for each group. In general, all groups display similar behavior, tending to be long the Australian dollar and Swedish krone, and short the Japanese yen and euro. In support of a carry-based trade, G5 funds are more likely to invest in emerging market currencies, such as the Indian rupee and the Mexican peso. In contrast, G1 funds tend to also invest in low-yielding currencies, including the euro and Swiss franc, and also fund in higher-yielding currencies, such as the Norwegian krone, the South Korean won, and

²⁸Our primary focus is on portfolio builders and exposure managers. We also present results for occasional users across alternative categorization schemes in Tables B.4 and B.5 in the Online Appendix.

²⁹See, for example, Jordà and Taylor (2012), Asness et al. (2013), Bakshi and Panayotov (2013), Kroencke et al. (2014), Maurer et al. (2023) and Riddiough and Zhang (2025) for evidence on the potential gains to combining currency strategies.

the Israeli shekel. However, when we split the sample to test if funds generating the strongest investment performance during the first half of the sample continue to do so during the second half, we find no evidence of persistence in currency-picking skill.³⁰

It is important to understand how this range of currency portfolio performance impacted funds' overall investment performance. To investigate, we estimate the performance of each fund by excluding the impact of currency forwards. To obtain these estimates, we subtract the return on fund i 's currency forward positions from its actual total net return. That is,

$$R_{i,t} = R_{i,t}^{actual} - R_{i,t}^{for},$$

where $R_{i,t}^{for} = \sum_j \widetilde{n}f_{i,j,t} \times ExR_{j,t+1}^{for}$ is the return on the currency forward portfolio, $\widetilde{n}f_{i,j,t}$ is the net forward position (long minus short) in currency j scaled by TNA, and $ExR_{j,t+1}^{for}$ is the return on a long forward contract on currency j .

We observe a small overall effect. On average, funds in G3 through to G5 increased their overall Sharpe ratios by 0.01 by including the currency portfolio. Therefore, even funds whose average currency performance was relatively weak still experienced gains through the diversification benefits provided by the currency portfolio. In contrast, the weaker performing currency portfolios did result in a drag on total performance of -0.01 , on average.

It may be wondered why we do not observe a larger impact on fund performance among the more extreme groups. The principal reason is that the size of the currency portfolio is too small to materially impact performance. Studies that recommend a separate currency portfolio generally suggest a large currency portfolio. For example, a currency portfolio of 33% combined with 67% allocation to the underlying portfolio of stocks and bonds (Kroencke et al., 2014). The funds in our sample construct currency portfolios with lower weights, but crucially they also *refrain* from holding a currency portfolio in some quarters. Indeed, when we average across *all* quarters, i.e., including those quarters in which a fund did not hold a currency portfolio, the typical sizes (in absolute value terms) of the currency portfolios among G1 and G5 funds are 6.97 and 5.84 percent of TNA.

In Panel B, we present the results for exposure managers. The literature on currency management in international equity portfolios has highlighted the need to dynamically vary hedge ratios (e.g., Glen and Jorion, 1993; Campbell et al., 2010; Boudoukh et al., 2019; Opie and Riddiough, 2020). We therefore split the group of exposure managers based on whether they principally adopt a “static” or “dynamic” approach. We label funds based on the time-

³⁰Results are available upon request.

series volatility of their hedge ratio, with funds above the median level denoted as dynamic.

Consistent with this sorting, the time-series (*ts*) volatility of the hedge ratio is almost three times higher for dynamic funds (24%) compared to static funds (9%). Within each group, we also compute the average volatility of currency-level hedge ratios, which we refer to as “cross-sectional” (*cs*) volatility, since funds which are more dynamic in changing their hedge ratio over time may also vary hedge ratios *across currencies* more frequently. However, comparing between the two groups, we observe almost identical values (22% and 21%). As with portfolio builders, we also compare the investment performance of funds relative to not using currency forwards. Across both groups, we find that excess returns and Sharpe ratios would have been modestly lower, on average, had funds *not* entered currency forwards. The largest average gain of 24bps per annum in excess return and 0.02 in Sharpe ratio is observed for the dynamic funds, consistent with the previously identified superiority of the dynamic approach.

In sum, while a small group of portfolio builders generate substantial currency excess returns and high currency portfolio Sharpe ratios, we find little evidence of persistence in this skill. Moreover, the inability of portfolio builders as a group to outperform non-users is driven by a mix of generally weak currency portfolio returns combined with a lack of consistency in entering forward positions. Currency forwards *do* enhance the investment performance of exposure managers, especially for those able to engage in more dynamic forms of currency management. However, the overall improvement is relatively mild, especially compared to the gains suggested within the academic literature, limiting the ability to identify a statistically significant incremental gain from using currency forwards relative to non-users. In the final section, we try to resolve this tension between funds’ actual performance and the large gains indicated by the normative literature on currency hedging.

To do so, we investigate potential performance gains that funds could have achieved hypothetically through using alternative approaches to either portfolio building or exposure management, and assess the realism of adopting such an approach.

5 Alternative Approaches to Currency Management

In this final section, we explore the impact of funds using alternative approaches to currency management. The objective is to understand, first, whether further investment gains were available to portfolio builders and exposure managers, consistent with those documented in earlier academic studies, and second, to shed light on the constraints facing funds that may

prevent these approaches to currency management from being implemented in practice. To undertake this task, we begin by stripping out the impact of forward contracts on each funds' investment performance as done previously in Section 4. We then add to their underlying equity portfolio either a new currency portfolio, in the case of portfolio builders, or an alternative currency hedging strategy, in the case of exposure managers. We purposely choose simple alternative strategies, available to funds from the outset of the sample.

In the case of portfolio builders, we fully hedge the underlying equity portfolio and then add one of three alternative currency portfolios. The first two alternatives are simple carry trades (Glen and Jorion, 1993; Lustig et al., 2011; Hassan and Mano, 2019). The first carry trade takes positions in only G9 currencies, and the second enters positions in a broader group of 25 developed and emerging market currencies (G25). For the G9 carry trade, we form the strategy by entering long forward positions in the three currencies with the highest interest rates and short forward positions in the three currencies with the lowest interest rates. For the broader strategy, we enter long and short positions in five currencies, rather than three.³¹ The third strategy combines carry, momentum, and value across the 25 currencies. We denote this the "combo" trade. We size the currency portfolio to equal 25 percent of each fund's TNA.

For exposure managers, we also consider three alternatives. The first approach is to fully hedge all currency exposure. The second approach is to engage in a carry trade by fully hedging only currencies with lower interest rates than in the United States, leaving all other currencies unhedged (Glen and Jorion, 1993, recommend this strategy). The third approach minimizes the variance of the portfolio within a simple mean-variance setting in which the expected excess returns of the currencies are assumed to be zero.³²

To maintain realism, we consider the impact of transaction costs and margin requirements. To incorporate transaction costs, we include the full bid-ask spread on all foreign exchange transactions. To include the impact of margin requirements, we set an initial margin requirement of 10 percent. This initial margin needs to be maintained within an interest-bearing cash collateral account, and is therefore not invested in the underlying equity portfolio. Throughout the month, we also track the returns on each fund's required forward contracts to assess whether additional margin needed to be posted.³³

³¹The 25 currencies include the G9 plus the currencies of Brazil (BRL), Chile (CLP), Colombia (COP), Indonesia (IDR), Iceland (ISK), Israel (ILS), South Korea (KRW), Mexico (MXN), Malaysia (MYR), Philippines (PHP), Poland (PLN), Russia (RUB), Singapore (SGD), Thailand (THB), Turkey (TRY), South Africa (ZAR).

³²See, e.g., Jorion (1994) and Campbell et al. (2010). We estimate the asset-currency covariances using a rolling window of 60-months.

³³We estimate the daily variation margin for each forward position following Bardoscia et al. (2021) and find

The results of this exercise are presented in Table 7. We report the results for portfolio builders in Panel A, and the results for exposure managers in Panel B. The first column contains the funds' average reported performance, while the remaining columns show the change in performance when adopting the alternative approaches to currency management. Strikingly, across all six alternatives, we observe that the Sharpe ratios of the funds would have been statistically significantly higher. The average increase is almost 40 percent in the case of the G25 carry trade for portfolio builders, and is frequently seen to elevate the Sharpe ratio by over 20 percent, on average. In Figure 8, we further highlight these gains. The figure presents the average return and standard deviation of every user fund (denoted by blue crosses). We add to the plot the average return and standard deviation for each fund under an alternative approach to currency management (denoted by red diamonds). For portfolio builders, we add the G25 carry trade portfolio, while for exposure managers and occasional users, we overlay their portfolio with a minimum-variance portfolio. We fit a quadratic polynomial to both sets of data to highlight the discrepancy in investment performance. Through the inclusion of the alternative forms of currency management, the fitted line under the alternative approach shifts down, indicating a sizable reduction in the level of portfolio volatility, which is the primary driver of the higher Sharpe ratio.³⁴

Funds face, however, an important economic friction that studies frequently fail to take into account. Although the Sharpe ratio is the typical benchmark for investment performance gains, it can be at odds with a fund's underlying mandate. As noted earlier, the funds we study typically aim to maximize investor capital appreciation or total returns. Of course, this objective is related to maximizing returns for a given risk tolerance, but funds may be unable to obtain higher Sharpe ratios if it substantially lowers returns.³⁵ We observe this trade-off in the data. Although the Sharpe ratio is always higher, the returns generated by the funds

that the maximum daily loss on a funds' aggregate forward positions never exceeded five percent of forward notional amounts under the currency management approaches we tested over our sample period. We therefore scale each fund's equity portfolio to keep a total of 15% of forward notional amounts in cash to meet both initial and variation margin requirements. However, we assume the additional 5% cash buffer does not earn any interest given that variation margins need to be posted on a daily basis.

³⁴We show similar performance gains for non-users in Figure A.6 of the Online Appendix. The reduction in portfolio volatility is partly mechanical, since funds divert part of their portfolio away from the underlying equity portfolio towards a risk-free cash account. The finding extends, however, beyond this mechanical effect. Switching from equity to cash should not result in a higher Sharpe ratio, and given the large equity premium, should substantially reduce a fund's total return.

³⁵The Sharpe ratio is related to investor preferences. Ben-David et al. (2022), for example, find that *Morningstar* ratings, which are almost perfectly correlated with Sharpe ratios, are the *primary* driver of investor flows into equity funds. Similarly, Duong Dang et al. (2022) find that Sharpe ratios, specifically, are the most important determinant of flows into corporate bond funds. But investors may only be satisfied with a higher Sharpe ratio provided that a fund is within a reasonable distance of its target benchmark.

are typically lower, up to almost 100 bps in the case of the combo strategy. Similarly, the tracking error is also observed to be higher in each case. Funds therefore run the risk of not delivering investors’ anticipated return performance, potentially leading to an outflow from the fund. Moreover, even for the broader carry trade strategy that would have had less impact on the total return, the higher tracking error may still cause serious misgivings, as it could impact the assessment of a manager’s investment performance.

In summary, the evidence in this section supports the academic literature on optimal currency management. Simple strategies offer large incremental benefits and would have substantially enhanced funds’ Sharpe ratios, the most common benchmark in the literature. The findings also point, however, to a need for additional benchmarks in the academic literature. Given the need to hold margin or simply to have cash available to cover forward losses, the impact of a proposed strategy on a fund’s total return and deviation from the benchmark return should be given far greater prominence. Indeed, the surprising finding by Sialm and Zhu (2024) that fixed-income funds hedge only 18 percent of their foreign currency exposure is easier to rationalize on this basis—hedging a larger fraction could create too large a drag on returns and deviation from the benchmark for managers to tolerate.

6 Conclusions

As US investors turn to international equity markets as a source of portfolio diversification, internationally focused equity mutual funds, managing nearly \$3 trillion in assets, are becoming increasingly important in the financial landscape. These funds expose investors to risks and returns in foreign exchange markets. Although various approaches to currency management have been proposed for equity fund managers, frequently pointing towards large potential gains, we have little evidence on how equity managers proceed with currency management in practice.

This paper contributes by shedding new light on the practice of currency management. Studying a sample of more than 1,500 international equity mutual funds in the United States, we hand collect a data set of over 55,000 net currency forward positions to provide unique insights into the behavior of these funds. Despite the apparent gains to actively using currency forwards, we find that most of the funds we study do not use forwards. This surprising result is consistent with the cost of forward use. Forward contracts can result in large losses, and there is an inherent timing mismatch in which a fund intends to hold an asset over a long term but is forced to enter forward contracts with comparatively short maturity. Thus, a forced sale

of the underlying portfolio may be required, which is especially difficult for funds holding less liquid securities. Consistent with these costs, we find that funds with the least liquid equity portfolios and the highest volatility in investor flows are less likely to use forward contracts.

We identify two primary forms of behavior among active users of currency forwards. Funds either build a separate currency portfolio, frequently including currencies not part of the underlying equity portfolio, or selectively reduce currency exposure by entering principally short forward contracts. In aggregate, neither approach results in superior fund-level investment performance relative to non users. In fact, we observe slightly lower Sharpe ratios among portfolio builders, the dominant form of active currency management.

To attempt to rationalize this puzzling finding, we re-imagine each funds' portfolio every month to assess how an alternative form of currency management would have impacted their ex-post performance. Consistent with the normative literature on currency hedging, we find that a range of naïve strategies would have offered superior investment gains, as measured by the Sharpe ratio. However, these gains would have been made at the expense of significantly lower excess returns and higher tracking error. In light of this observation, funds' observed behavior of entering smaller currency portfolios, principally on the most liquid currencies, appears to be a rational response to their underlying mandate. The findings are therefore especially revealing of how economic frictions interact with currency management decisions. Various fund-level factors serve as disincentives to the use of currency forwards, while “optimal” approaches to currency management presented in the literature may fail to maximize a fund's joint aims of generating higher total returns while also minimizing deviations from a stated benchmark.

In favor of the earlier literature, we do find evidence that a carry trade offers investors a source of incremental gains, even in the presence of margin constraints and transaction costs. However, whether a fund chooses to act on this finding must be judiciously balanced against the fund's tolerance for higher tracking error and additional risk arising from forward losses, especially during periods of stress when foreign exchange market illiquidity spikes.

References

- Aldunate, F., Da, Z., Larrain, B., Sialm, C., 2025. Pension fund flows, exchange rates, and covered interest rate parity. *Journal of Financial Economics* 170, 104075.
- Almazan, A., Brown, K. C., Carlson, M., Chapman, D. A., 2004. Why constrain your mutual fund manager? *Journal of Financial Economics* 73, 289–321.
- Aragon, G. O., Martin, J. S., 2012. A unique view of hedge fund derivatives usage: Safeguard or speculation? *Journal of Financial Economics* 105, 436–456.
- Asness, C. S., Moskowitz, T. J., Pedersen, L. H., 2013. Value and momentum everywhere. *Journal of Finance* 68, 929–985.
- Bakshi, G., Panayotov, G., 2013. Predictability of currency carry trades and asset pricing implications. *Journal of Financial Economics* 110, 139–163.
- Bardoscia, M., Ferrara, G., Vause, N., Yoganayagam, M., 2021. Simulating liquidity stress in the derivatives market. *Journal of Economic Dynamics & Control* 133, 104215.
- Barroso, P., Reichenecker, J.-A., Menichetti, M. J., 2022. Hedging with an edge: Parametric currency overlay. *Management Science* 68, 669–689.
- Ben-David, I., Li, J., Rossi, A., Song, Y., 2022. What do mutual fund investors really care about? *Review of Financial Studies* 35, 1723–1774.
- Ben Zeev, N., Nathan, D., 2024. Shorting the dollar when global stock markets roar: The equity hedging channel of exchange rate determination. *Review of Asset Pricing Studies* 14, 640–666.
- Berk, J. B., van Binsbergen, J. H., 2015. Measuring skill in the mutual fund industry. *Journal of Financial Economics* 118, 1–20.
- BIS, 2020. Margin requirements for non-centrally cleared derivatives. Bank of International Settlements policy paper.
- BIS, 2025. Triennial central bank survey. OTC foreign exchange turnover in April 2025. Monetary and Economics Department, 1–21.

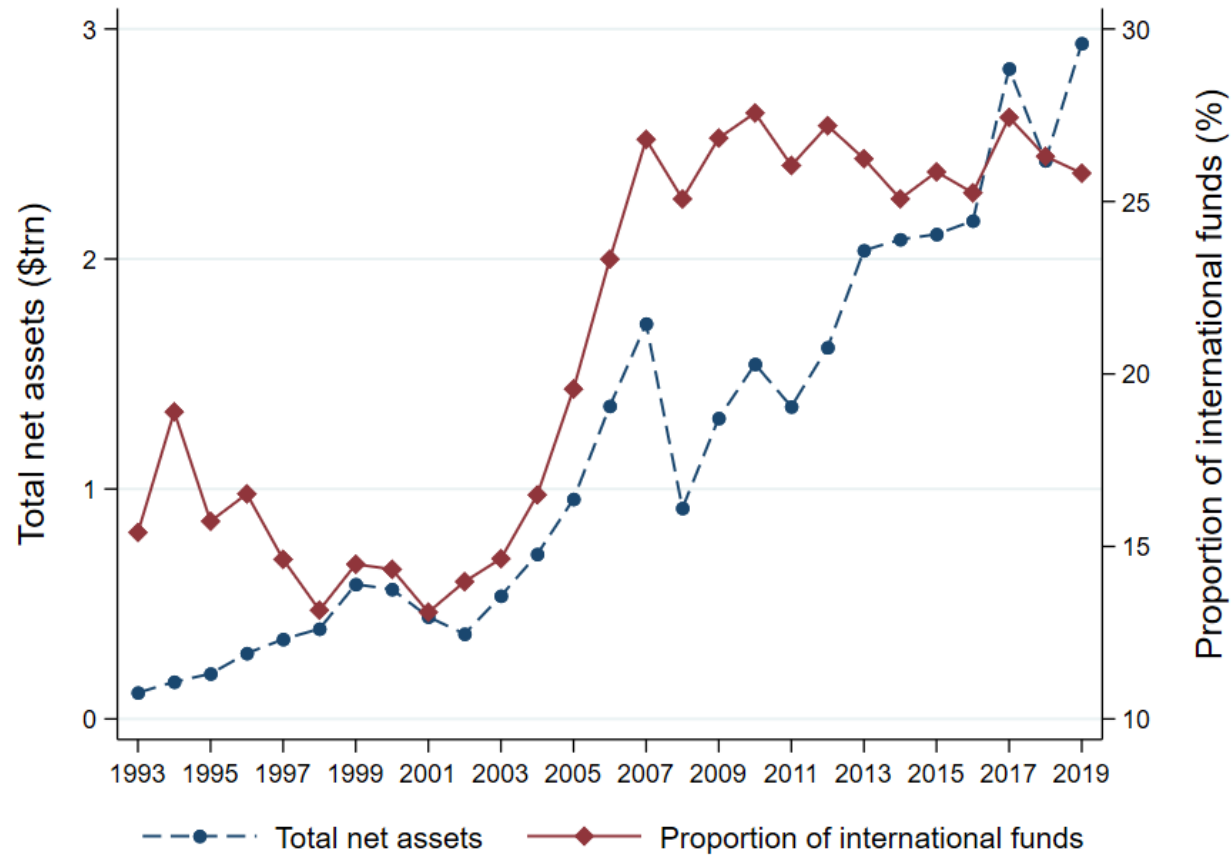
- Boudoukh, J., Richardson, M., Thapar, A., Wang, F., 2019. Optimal currency hedging for international equity portfolios. *Financial Analysts Journal* 75, 65–83.
- Bräuer, L., Hau, H., 2023. Can time-varying currency risk hedging explain exchange rates. Unpublished working paper.
- Bräuer, L., Hau, H., 2024. Fund-level FX hedging redux. Unpublished working paper.
- Burger, J. D., Warnock, F. E., Warnock, V. C., 2018. Currency matters: Analyzing international bond portfolios. *Journal of International Economics* 114, 376–388.
- Camanho, N., Hau, H., Rey, H., 2022. Global portfolio rebalancing and exchange rates. *Review of Financial Studies* 35, 5228–5274.
- Campbell, J. Y., Serfaty-De Medeiros, K., Viceira, L. M., 2010. Global currency hedging. *Journal of Finance* 65, 87–121.
- Cenedese, G., Payne, R., Sarno, L., Valente, G., 2016. What do stock markets tell us about exchange rates? *Review of Finance* 20, 1045–1080.
- Cheema-Fox, A., Greenwood, R., 2024. How do global portfolio investors hedge currency risk? Unpublished working paper.
- Chen, N., Zhou, H., 2025. Managing emerging market currency risk. Unpublished working paper.
- Chen, Q., Goldstein, I., Jiang, W., 2010. Payoff complementarities and financial fragility: Evidence from mutual fund outflows. *Journal of Financial Economics* 97, 239–262.
- Czech, R., Huang, S., Lou, D., Wang, T., 2025. Unintended consequences of holding dollar assets. Unpublished working paper.
- De Leo, P., Keller, L., Zou, D., 2025. Speculation, forward exchange demand, and cip deviations in emerging economies. Unpublished working paper.
- Deli, D. N., Varma, R., 2002. Contracting in the investment management industry: Evidence from mutual funds. *Journal of Financial Economics* 63, 79–98.
- Du, W., Huber, A., 2024. Dollar asset holding and hedging around the globe. Unpublished working paper.

- Du, W., Tepper, A., Verdelhan, A., 2018. Deviations from covered interest rate parity. *Journal of Finance* 73, 915–957.
- Duong Dang, T., Hollstein, F., Prokopczuk, M., 2022. How do corporate bond investors measure performance? Evidence from mutual fund flows. *Journal of Banking and Finance* 142, 106553.
- Dupuy, P., 2021. Risk-adjusted return managed carry trade. *Journal of Banking and Finance* 129, 106172.
- Dupuy, P., Haushalter, D., Meunier, L., 2024. Risk managers on managing foreign exchange risk. Unpublished working paper.
- Eun, C. S., Huang, W., Lai, S., 2008. International diversification with large- and small-cap stocks. *Journal of Financial and Quantitative Analysis* 43, 489–524.
- Glen, J., Jorion, P., 1993. Currency hedging for international portfolios. *Journal of Finance* 48, 1865–1886.
- Goldstein, I., Jiang, H., Ng, D. T., 2017. Investor flows and fragility in corporate bond funds. *Journal of Financial Economics* 126, 592–613.
- Hassan, T. A., 2013. Country size, currency unions, and international asset returns. *Journal of Finance* 68, 2269–2308.
- Hassan, T. A., Mano, R. C., 2019. Forward and spot exchange rates in a multi-currency world. *Quarterly Journal of Economics* 134, 397–450.
- Jiang, W., Ou, J., Zhu, Z., 2021. Mutual fund holdings of credit default swaps: Liquidity, yield, and risk. *The Journal of Finance* 76, 537–586.
- Jordà, O., Taylor, A. M., 2012. The carry trade and fundamentals: Nothing to fear but FEER itself. *Journal of International Economics* 88, 74–90.
- Jorion, P., 1994. Mean/variance analysis of currency overlays. *Financial Analysts Journal* 50, 48–56.
- Kaniel, R., Wang, P., 2025. Unmasking mutual fund derivative use. *Review of Financial Studies* 38, 1120–1166.

- Koski, J. L., Pontiff, J., 1999. How are derivatives used? Evidence from the mutual fund industry. *Journal of Finance* 54, 791–816.
- Kroencke, T. A., Schindler, F., Schrimpf, A., 2014. International diversification benefits with foreign exchange investment styles. *Review of Finance* 18, 1847–1883.
- Kubitza, C., Sigaux, J.-D., Vandeweyer, Q., 2024. Cross-currency basis risk and international capital flows. Unpublished working paper.
- Lustig, H., Roussanov, N., Verdelhan, A., 2011. Common risk factors in currency markets. *Review of Financial Studies* 24, 3731–3777.
- Maggiori, M., Neiman, B., Schreger, J., 2020. International currencies and capital allocation. *Journal of Political Economy* 128, 2019–2066.
- Massa, M., Wang, Y., Zhang, H., 2016. Benchmarking and currency risk. *Journal of Financial and Quantitative Analysis* 51, 629–654.
- Maurer, T. A., Tô, T.-D., Tran, N.-K., 2023. Market timing and predictability in FX markets. *Review of Finance* 27, 223–246.
- Menkhoff, L., Sarno, L., Schmeling, M., Schrimpf, A., 2012. Currency momentum strategies. *Journal of Financial Economics* 106, 660–684.
- Menkhoff, L., Sarno, L., Schmeling, M., Schrimpf, A., 2017. Currency value. *Review of Financial Studies* 30, 416–441.
- Opie, W., Riddiough, S. J., 2020. Global currency hedging with common risk factors. *Journal of Financial Economics* 136, 780–805.
- Pástor, L., Stambaugh, R. F., Taylor, L. A., 2015. Scale and skill in active management. *Journal of Financial Economics* 116, 23–45.
- Pojarliev, M., Levich, R. M., 2014. Should investors avoid or seek out currency risk? How to resolve a long-standing puzzle. Unpublished working paper.
- Ranaldo, A., Söderlind, P., 2010. Safe haven currencies. *Review of Finance* 14, 385–407.
- Ranaldo, A., Somogyi, F., 2021. Asymmetric information risk in FX markets. *Journal of Financial Economics* 140, 391–411.

- Richmond, R. J., 2019. Trade network centrality and currency risk premia. *Journal of Finance* 74, 1315–1361.
- Riddiough, S. J., Zhang, H., 2025. Cross-border M&A flows, economic growth, and foreign exchange rates. *Review of Financial Studies* forthcoming.
- Sialm, C., Zhu, Q., 2024. Currency management by international fixed income mutual funds. *Journal of Finance* 79, 4037–4081.
- Solnik, B. H., 1974. Why not diversify internationally rather than domestically? *Financial Analysts Journal* 30, 48–54.

Figure 1: The Growth of US International Equity Mutual Funds



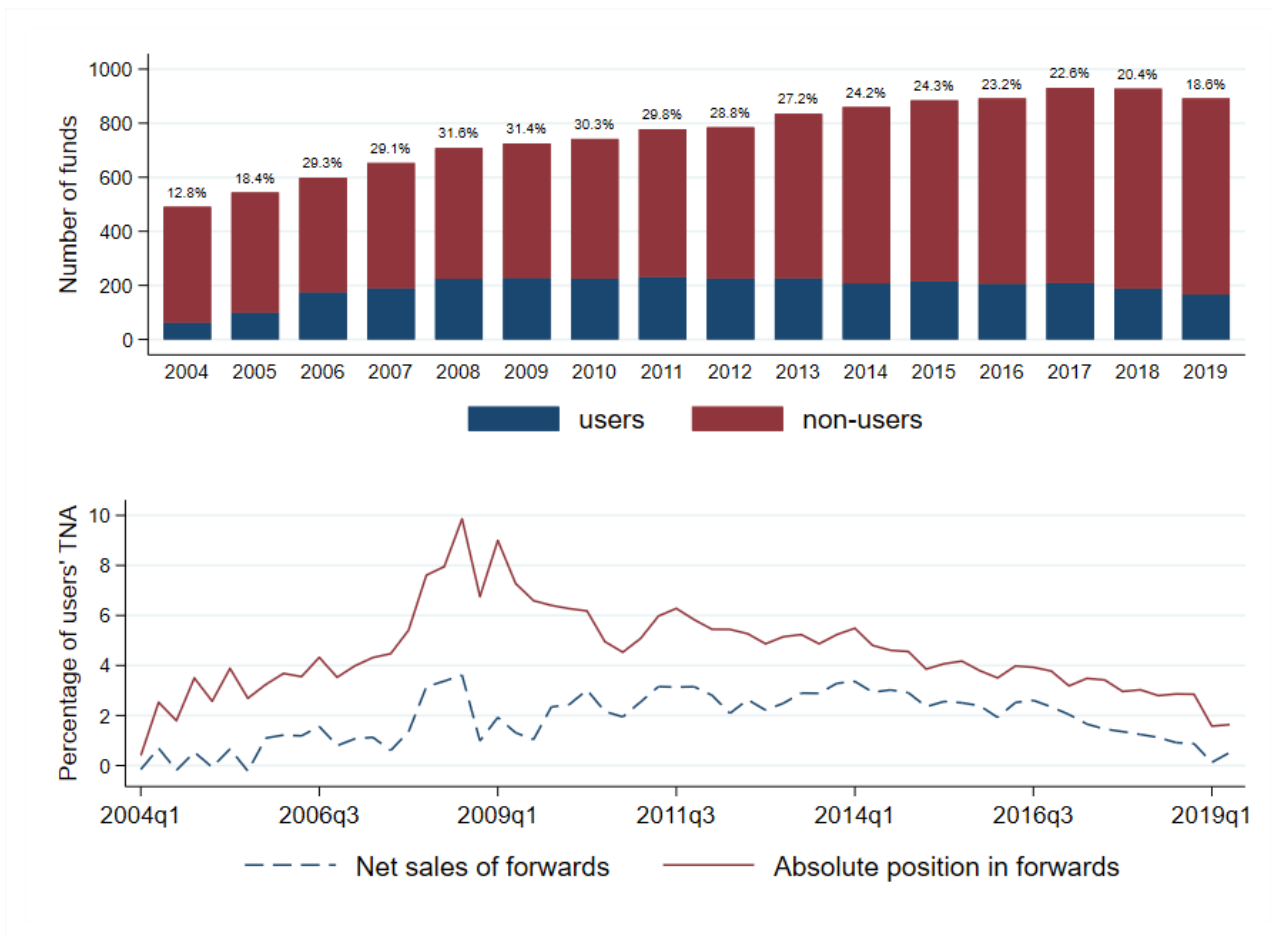
The figure presents the total net assets (in \$trillions) of US-domiciled international mutual funds and their share in the assets managed by all equity mutual funds. Data source: Investment Company Institute (ICI) Fact Book.

Figure 2: Extract of Currency Forward Positions for AB International Value Fund

Counterparty	Contracts to Deliver (000)	In Exchange For (000)	Settlement Date	Unrealized Appreciation/ (Depreciation)
HSBC Bank USA	USD 2,502	SGD 3,374	6/17/19	\$ (45,882)
HSBC Bank USA	USD 1,855	CNY 12,537	7/25/19	(43,495)
JPMorgan Chase Bank, NA	GBP 1,077	USD 1,426	6/17/19	63,026
JPMorgan Chase Bank, NA	NOK 16,984	USD 1,958	6/17/19	16,768
JPMorgan Chase Bank, NA	USD 560	GBP 434	6/17/19	(11,226)
JPMorgan Chase Bank, NA	USD 555	JPY 61,169	6/17/19	9,925
Morgan Stanley & Co., Inc.	BRL 9,378	USD 2,371	6/04/19	(19,146)
Morgan Stanley & Co., Inc.	USD 2,340	BRL 9,378	6/04/19	49,481
Morgan Stanley & Co., Inc.	EUR 1,826	USD 2,068	6/17/19	25,835
Morgan Stanley & Co., Inc.	JPY 164,617	USD 1,490	6/17/19	(30,929)
Morgan Stanley & Co., Inc.	USD 939	EUR 831	6/17/19	(9,737)
Morgan Stanley & Co., Inc.	USD 519	JPY 57,540	6/17/19	12,657
Morgan Stanley & Co., Inc.	BRL 7,846	USD 1,949	7/02/19	(45,583)
Morgan Stanley & Co., Inc.	KRW 780,901	USD 658	8/26/19	(737)
Morgan Stanley & Co., Inc.	USD 222	KRW 262,398	8/26/19	(512)
Natwest Markets PLC	USD 935	EUR 817	6/17/19	(20,541)
Natwest Markets PLC	USD 952	CLP 663,798	7/12/19	(17,122)
Natwest Markets PLC	EUR 725	USD 818	9/13/19	1,600
Standard Chartered Bank	BRL 3,528	USD 893	6/04/19	(5,817)
Standard Chartered Bank	USD 895	BRL 3,528	6/04/19	3,822

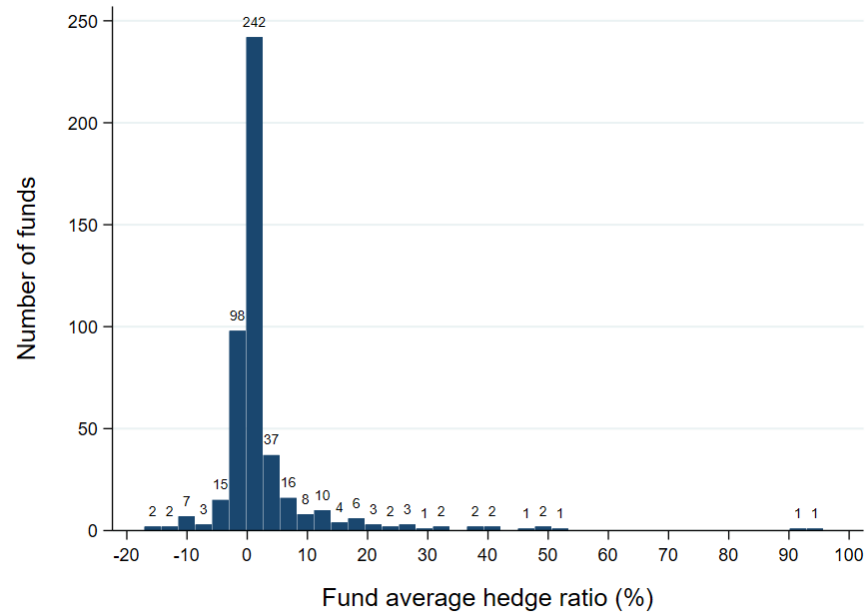
The figure presents an extract of the foreign currency forward contracts held by AB International Value Fund as of May 2019. The extract displays the dealer name (counterparty), the amount and currency the fund has contracted to deliver (Contracts to Deliver), the amount and currency the fund has contracted to receive (In Exchange For), the settlement date, and the current US dollar gain or loss on the contract (Unrealized Appreciation/(Depreciation)).

Figure 3: The Time Series of Currency Forward Usage

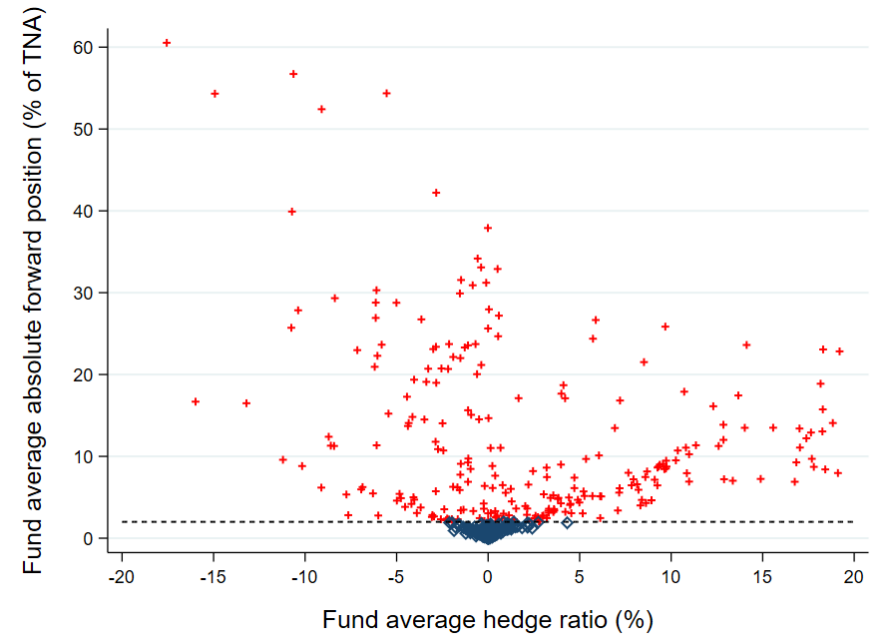


The top graph presents the total number of funds in the sample each year, split between funds that used currency forward contracts during the year (users) and those which did not use currency forward contracts (non-users). The bottom graph presents two time series: (i) the total notional amount of currency forward contracts (expressed as the net short position) relative to the funds' total TNA (dashed blue line) and (ii) the total absolute position in forwards, which sums the absolute notional values of both short and long currency forward contracts vis-a-vis the US dollar, relative to the funds' total TNA (red line). The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Figure 4: Hedge Ratios and Absolute Currency Forward Positions



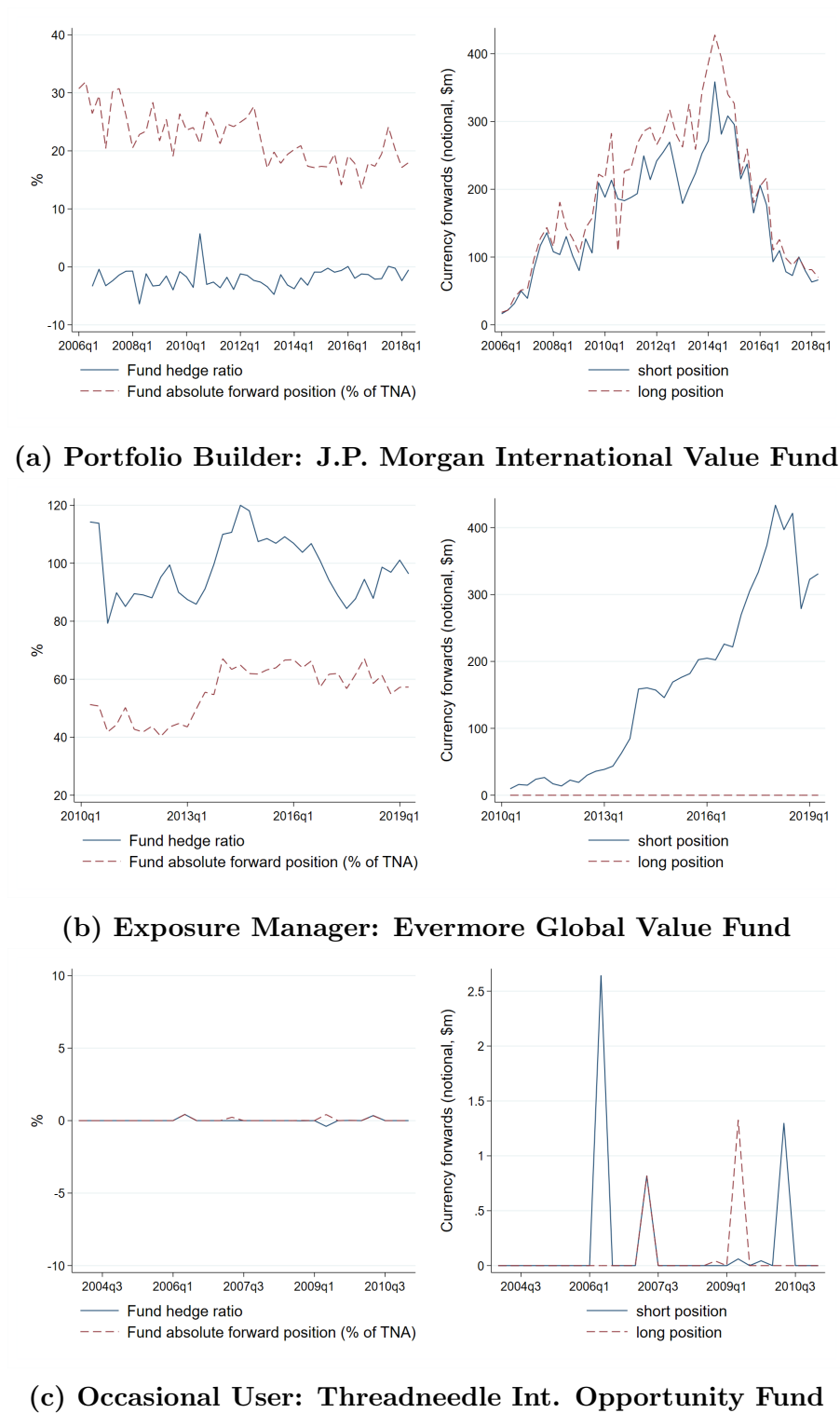
(a)



(b)

The left-hand graph presents the histogram of average hedge ratios across funds that used currency forward contracts. The right-hand graph presents a scatter plot of funds' average absolute forward positions (y-axis) against their average hedge ratios (x-axis), calculated over the quarters in which the funds held outstanding forward contracts. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Figure 5: Currency Management Styles



The figure presents the time series of hedge ratios and the total notional dollar values (\$million) of long and short currency forward contracts for three funds: J.P. Morgan International Value Fund (top graph, the “Portfolio Builder”); Evermore Global Value Fund (middle graph, the “Exposure Manager”); and Threadneedle International Opportunity Fund (bottom graph, the “Occasional User”). The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Figure 6: Currency Exposure Across Currency Management Styles



The figure presents a scatter plot of funds' average weight in foreign countries (x-axis) plotted against their average currency exposure after accounting for their currency forward positions (y-axis). The plot includes a 45-degree solid line with dashed-lines indicating a (+/-) 5% boundary. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Figure 7: The Use of Currency Forwards by Portfolio Builders and Exposure Managers



The left-hand graph presents a heat plot showing the average portfolio weights for G9 currencies across the group of portfolio builders. The currencies are ordered from highest to lowest average portfolio weights (i.e., from investment currencies to funding currencies). The size of each square reflects the number of contracts entered by portfolio builders. The right-hand graph presents the average abnormal hedge ratios for G9 currencies (the difference between the hedge ratio for the currency and the hedge ratio for the fund) across the group of exposure managers. The currencies are ordered from the highest to the lowest average abnormal hedge ratios. The size of each square reflects the number of contracts entered by exposure managers. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Figure 8: Average Return and Standard Deviation of User Funds



The figure presents a scatter plot of user funds' actual average returns (x-axis) plotted against their average standard deviation (y-axis, blue crosses) and user funds' potential average returns and standard deviation (red diamonds) under alternative currency management schemes. For portfolio builders we add a G25 currency carry trade portfolio. For exposure managers and occasional users, we overlay the portfolio with the minimum-variance approach of Campbell et al. (2010). The solid and dashed lines are fitted quadratic polynomials. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table 1: The Characteristics of User and Non-User Funds

	Panel A: Fund Characteristics							
	Users (471 Funds)			Non-Users (808 Funds)			Difference	
	Obs	Mean	Std	Obs	Mean	Std	U-NU	Logit
<i>Portfolio weight outside US (%)</i>	17,188	82.2	18.9	23,786	83.0	19.2	-0.82	0.14
<i>Weight in safe haven currencies (%)</i>	17,183	16.7	12.1	23,786	14.4	14.1	2.3***	-0.07
<i>No. countries invested</i>	17,188	16.8	6.95	23,786	16.0	7.46	0.78***	0.23***
<i>Portfolio weight in non G3 (%)</i>	17,188	40.0	25.5	23,786	47.2	29.6	-7.2***	-0.37***
<i>Asset illiquidity</i>	19,107	0.12	0.32	25,594	0.16	0.36	-0.04***	-0.22***
<i>Flow volatility (%)</i>	16,323	11.8	7.25	20,972	14.0	8.65	-2.2***	-0.21***
<i>Number of funds in family</i>	19,107	9.1	8.0	25,594	11.9	11.8	-2.8***	-0.30***
<i>Fund TNA (\$ millions)</i>	18,320	2,096	10,097	24,473	1,192	3,007	904***	0.52***
<i>Fund age (years)</i>	19,107	12.6	8.52	25,594	10.2	8.28	2.4***	0.07
<i>Fund expense ratio (% annual)</i>	17,573	1.25	0.46	22,749	1.19	0.49	0.07**	0.35***
<i>Cash holding (% of TNA)</i>	18,726	2.49	3.78	24,838	2.48	3.59	0.01	-0.12
<i>Fund turnover ratio (% annual)</i>	17,517	70.4	53.8	22,610	55.2	48.1	15.2***	0.36***
<i>Fund distribution (%)</i>	18,829	0.91	2.52	25,100	0.82	2.27	0.08***	0.13*
<i>Can speculate</i>	19,107	0.46	0.50	25,514	0.41	0.49	0.05**	0.34***
<i>Institutional share (% of TNA)</i>	18,597	36.5	38.2	24,863	41.5	42.5	-5.0**	-0.05
<i>Index funds</i>	19,107	0.08	0.27	25,594	0.10	0.30	-0.02	0.07

Panel B: Investment Performance							
	Users			Non-users			Difference
	Obs	Mean	Std	Obs	Mean	Std	U-NU
<i>Gross return (%)</i>	17,306	2.20	9.38	22,289	2.25	9.28	-0.05
<i>Net return (%)</i>	18,482	1.85	9.42	24,500	1.93	9.32	-0.07
<i>Benchmark adj return (%)</i>	18,237	-0.06	2.62	24,185	0.02	2.66	-0.08
<i>Stdev net return (%)</i>	18,482	9.29	2.02	24,500	9.09	2.40	0.20**
<i>Sharpe ratio</i>	18,473	0.16	0.10	24,477	0.18	0.13	-0.02*
<i>Tracking error (%)</i>	18,237	2.31	1.21	24,185	2.33	1.25	-0.01
<i>Fund management fee (% annual)</i>	16,638	0.80	0.30	21,226	0.79	0.34	0.01

The table presents summary statistics for the international equity mutual funds in the sample. For each fund characteristic, we present the number of fund-quarter observations (Obs), the average (Mean), and the standard deviation (Std). The statistics are split across funds that use currency forward contracts during the sample (Users) and those which do not (Non-Users). The difference between the average fund characteristics for user and non-user funds is calculated and presented in the column headed U-NU, where significance levels are based on p -values calculated using a permutation test with 1000 resamples. The last column of Panel A reports logit regression result based on standardized average fund characteristics listed in the first column (we use the natural log of fund TNA in the logit regression). The sample period is from Q1 2004 to Q2 2019. Fund characteristics are defined in Table A.2 of the Online Appendix, all values are quarterly unless indicated otherwise. Further details on the funds and data sources can be found in Section 1.

Table 2: Flow-Performance Relationship and Forward Usage

	Non-Users	Users	
	Flow	Flow	Hedge Ratio
<i>Negative BM-adjusted return</i>	0.17 (0.10)	0.38*** (0.06)	-0.12** (0.04)
<i>Positive BM-adjusted return</i>	0.55*** (0.11)	0.45*** (0.10)	0.03 (0.04)
<i>Portfolio weight outside US</i>	-0.24*** (0.05)	-0.04 (0.04)	0.03 (0.04)
<i>Weight in safe haven currencies (%)</i>	0.11** (0.05)	-0.06 (0.04)	0.15** (0.06)
<i>Weight in non G3 (%)</i>	0.00 (0.04)	-0.03 (0.04)	0.02 (0.04)
<i>No. countries invested</i>	0.14** (0.07)	0.06 (0.05)	-0.05 (0.04)
<i>Fund turnover ratio (% annual)</i>	-0.02** (0.01)	-0.01* (0.01)	0.00 (0.01)
<i>Fund expense ratio (% annual)</i>	-2.29 (1.75)	-5.81*** (1.57)	1.80 (1.29)
<i>Log(fund TNA)</i>	-3.66*** (0.41)	-3.04*** (0.42)	0.28 (0.37)
<i>Log(family TNA)</i>	0.89* (0.53)	0.68 (0.49)	-0.57 (0.43)
Observations	17,113	13,184	13,684
Fund FEs	Yes	Yes	Yes
Quarter FEs	Yes	Yes	Yes
Adj. R^2	0.20	0.20	0.66

The table presents coefficient estimates from fixed-effects panel regressions. The dependent variable is quarterly fund flow in the first two columns and the hedge ratio in the last column. Negative BM-adjusted return equals $\min(\text{BM-adjusted return}, 0)$ and Positive BM-adjusted return equals $\max(0, \text{BM-adjusted return})$, where BM-adjusted return is fund return minus the return on the benchmark index specified in fund prospectus. Other fund characteristics are defined in Table A.2 of the Online Appendix. All independent variables are lagged by one quarter and each regression includes fund and quarter fixed effects. Standard errors clustered by fund and quarter are presented in parentheses. Significance of the coefficients at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table 3: The Use of Currency Forward Contracts Across Currency Management Styles

	Portfolio Builders		Exposure Managers		Occasional Users	
	(202 Funds)		(66 Funds)		(203 Funds)	
	Mean	Std	Mean	Std	Mean	Std
<i>Fund quarters using forwards (%)</i>	59.8	27.1	67.5	27.8	33.3	28.2
<i>No. of currencies with forwards</i>	6.6	5.3	4.8	4.3	2.9	2.1
<i>Fund hedge ratio (%)</i>	0.1	6.4	27.7	19.6	-0.1	2.6
<i>Absolute fund forwards (% of TNA)</i>	12.4	11.8	18.7	12.1	1.5	3.0
	Positions	NUP	Positions	NUP	Positions	NUP
<i>Euro (EUR)</i>	3,746	95	1,181	20	1,352	16
<i>Japanese yen (JPY)</i>	3,531	75	1,004	2	1,379	2
<i>British pound sterling (GBP)</i>	3,214	11	939	4	1,225	10
<i>Australian dollar (AUD)</i>	2,701	254	547	39	929	13
<i>Swiss franc (CHF)</i>	2,444	86	757	7	584	0
<i>Canadian dollar (CAD)</i>	1,980	158	498	14	368	15
<i>Swedish kronor (SEK)</i>	2,009	267	346	18	437	5
<i>Hong Kong dollar (HKD)</i>	1,777	110	235	18	763	43
<i>Norwegian Krone (NOK)</i>	1,788	376	346	32	258	10
<i>Singapore dollar (SGD)</i>	1,586	412	307	13	372	16
<i>Danish Krone (DKK)</i>	1,107	325	253	7	226	11
<i>South Korean won (KRW)</i>	943	53	259	24	174	0
<i>South African rand (ZAR)</i>	849	126	120	9	389	2
<i>Brazilian real (BRL)</i>	799	39	148	3	226	1
<i>Mexican peso (MXN)</i>	805	136	138	9	213	4
<i>New Zealand dollar (NZD)</i>	885	397	143	36	52	6
<i>Other</i>	7400	1354	742	45	1141	39
Total	37,564	4,274	7,963	300	10,088	193
<i>No. of net long positions</i>	19,730		1,147		6,106	

The table presents statistics on the use of currency forward contracts across user types. The total number of funds in each group is shown in parentheses. For each characteristic, we present the average (Mean) and standard deviation (Std) across funds. Fund hedge ratio and absolute fund forwards are calculated over the quarters a fund had forward positions. If a fund had multiple outstanding forward contracts on the same foreign currency (against the USD) at quarter-end, they are netted and recorded as a single contract. We also report the number of net forward contracts (Positions) and the number of net contracts without underlying equity positions (NUP). Currencies are presented in descending order based on the total number of net forward positions. The data are quarterly, beginning in Q1 2004 and ending in Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table 4: Investment Performance of Active User Funds

	Active Users			Non-users			Difference		
	Obs	Mean	Std	Obs	Mean	Std	U-NU	PB-NU	EM-NU
<i>Gross return (%)</i>	10,037	2.12	9.09	22,289	2.25	9.28	-0.12	-0.15	-0.04
<i>Net return (%)</i>	10,697	1.77	9.16	24,500	1.93	9.32	-0.15	-0.18	-0.05
<i>Benchmark adj return (pros, %)</i>	10,635	-0.06	2.68	24,185	0.02	2.66	-0.08	-0.10	-0.02
<i>Stdev net return (%)</i>	10,697	9.03	1.98	24,500	9.09	2.40	-0.06	0.25**	-1.11***
<i>Sharpe ratio</i>	10,697	0.16	0.09	24,477	0.18	0.13	-0.02*	-0.03**	0.03
<i>Tracking error (pros, %)</i>	10,635	2.40	1.18	24,185	2.33	1.25	0.07	-0.16**	0.83***
<i>Fund management fee (% annual)</i>	9,798	0.81	0.27	21,226	0.79	0.34	0.03	0.01	0.08**

The table presents investment performance comparison between active user funds and non-user funds. For each performance measure, we present the number of fund-quarter observations (Obs), the average (Mean), and the standard deviation (Std). The difference between the average fund characteristics for active user and non-user funds is calculated and presented in the column headed U-NU, where significance levels are based on p -values calculated using a permutation test with 1000 resamples. The difference between portfolio builders (exposure managers) and non-users is also included under PB-NU (EM-NU). The sample period is from Q1 2004 to Q2 2019. Fund characteristics are defined in Table A.2 of the Online Appendix, all values are quarterly unless indicated otherwise. Further details on the funds and data sources can be found in Section 1.

Table 5: The Determinants of Currency Forward Positions

	Portfolio Builders		Exposure Managers	
	(1)	(2)	(3)	(4)
<i>Country weight</i>	-0.520*** (0.071)	-1.723*** (0.153)	0.701*** (0.082)	0.580*** (0.096)
<i>Carry</i>	0.355*** (0.126)	0.181 (0.147)	-0.378*** (0.125)	0.097 (0.101)
<i>Momentum</i>	0.270*** (0.037)	0.266*** (0.035)	-0.139*** (0.037)	-0.113*** (0.032)
<i>Value</i>	0.033 (0.026)	0.029 (0.028)	-0.018 (0.024)	-0.027 (0.024)
<i>Bid-ask spread</i>	-0.011 (0.021)	-0.027 (0.022)	0.023 (0.019)	-0.015 (0.019)
<i>EM dummy</i>	-4.824*** (1.163)		-4.637*** (1.243)	
<i>Volatility</i>			0.472*** (0.107)	0.038 (0.087)
<i>Equity return</i>			-0.001 (0.021)	0.026 (0.018)
Observations	32,864	32,499	27,425	27,365
Fund \times Quarter FEs	Yes	Yes	Yes	Yes
Fund \times Currency FEs	No	Yes	No	Yes
Adj R^2	0.151	0.474	0.315	0.628

The table presents coefficient estimates from fixed-effects panel regressions. The dependent variable is the currency portfolio weight of fund i for currency/country j in quarter t in columns (1) and (2), and it is the hedge ratio of fund i for currency/country j in quarter t in columns (3) and (4). The independent variables include fund i 's portfolio weight in country j , the exchange rate return (*Momentum*), the forward discount (*Carry*), the deviation from the real exchange rate (*Value*), the bid-ask spread, the 12-month currency return volatility, the MSCI equity index return for country j , and a dummy variable equal to $\mathbf{1}$ if the currency is issued by an emerging market economy (*EM dummy*). All independent variables are lagged by one quarter. All regressions include fund \times quarter fixed effects and the regressions in columns (2) and (4) also include fund \times currency fixed effects. Standard errors clustered at the fund \times currency level are presented in parentheses. Significance of the coefficients at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table 6: The Impact of Currency Forward Positions on Fund Performance

Panel A: Portfolio Builders					
	SR	Mean	Median	p25	p75
<i>All funds</i>	0.08	0.95	0.88	-1.15	2.84
	G1	G2	G3	G4	G5
	<i>Currency Portfolios (Actual)</i>				
<i>Sharpe ratio</i>	-0.75	-0.09	-0.13	0.35	0.77
<i>Portfolio return (%)</i>	-4.25	-0.79	0.96	2.69	6.28
<i>Stdev portfolio return (%)</i>	7.00	7.92	7.47	7.74	8.26
<i>Currency portfolio size (% of TNA)</i>	9.79	14.4	15.5	12.3	9.29
<i>Tracking error (%)</i>	4.12	3.98	4.68	4.18	4.39
Counterfactual portfolio without currency forwards (relative to actual performance)					
Δ <i>Excess return</i>	0.16***	0.02	-0.10***	-0.15***	-0.16***
Δ <i>Sharpe ratio</i>	0.01***	0.00	-0.01***	-0.01***	-0.01***
Panel B: Exposure Managers					
	<i>Hedging Style</i>				
	Static	Dynamic			
<i>Hedge ratio volatility (ts)</i>	8.8	23.7			
<i>Hedge ratio volatility (cs)</i>	22.0	20.6			
Unhedged portfolio (relative to actual performance)					
Δ <i>Excess return</i>	-0.11*	-0.24***			
Δ <i>Sharpe ratio</i>	-0.01**	-0.02***			

The table presents statistics on the (annualized) investment performance of portfolio builders (Panel A) and exposure managers (Panel B). The first row of Panel A presents the aggregate summary statistics across all portfolio builders pertaining to their currency-specific portfolio of currency forward contracts. The values include the average Sharpe ratio (**SR**), mean, median, 25th and 75th percentiles of the return distribution. Funds are then split into five equally sized groups based on their sample currency portfolio Sharpe ratio from low (G1) to high (G5). The performance of the currency portfolio and the impact on fund performance from removing funds' own forward positions are presented for the five groups. Panel B splits exposure managers into two groups (static and dynamic) based on their Hedge ratio volatility (*ts*), which is the time-series standard deviation of the fund's hedge ratio (measured across all currencies hedged). Hedge ratio volatility (*cs*) is the average cross-sectional standard deviation of hedge ratios (i.e., the within fund standard deviation each quarter) measured across hedged currencies. The impact on fund performance from removing funds' own forward positions is reported under Unhedged portfolio. Significance of Δ *Sharpe ratio* at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019.

Table 7: The Performance of Alternative Currency Management Approaches

Panel A: Portfolio Builders				
		<i>Incremental Performance</i>		
	Actual	G9 Carry	G25 Carry	Combo
<i>Mean excess return (%)</i>	3.44	-0.72***	0.03	-0.96***
<i>Std excess return (%)</i>	17.5	-4.22***	-4.45***	-5.47***
<i>Sharpe ratio</i>	0.22	0.02***	0.08***	0.02**
<i>Tracking error (%)</i>	4.54	2.77***	3.28***	3.48***

Panel B: Exposure Managers				
		<i>Incremental Performance</i>		
	Actual	Full Hedge	Carry	Min-Var
<i>Mean excess return (%)</i>	5.37	-0.28**	-0.03	-0.21*
<i>Std excess return (%)</i>	14.2	-2.76***	-1.38***	-2.76***
<i>Sharpe ratio</i>	0.42	0.09***	0.05***	0.09***
<i>Tracking error (%)</i>	5.87	1.66***	0.71***	1.49***

The table presents the average portfolio performance gains from various approaches to currency management for active user funds. The full sample includes 190 portfolio builders and 61 exposure managers that have at least 12 monthly returns under all approaches. Performance gain (annualized) relative to portfolio builders' actual performance is reported when combining funds' fully hedged equity portfolio with a separate currency portfolio with a weight of 25%. G9 (G25) carry is a long/short portfolio constructed using G9 (G25) currencies. Combo is an equally weighted portfolio of carry, value, and momentum long/short portfolios constructed using G25 currencies. Performance gain relative to exposure managers' actual performance is reported for the following strategies: Full hedge completely eliminates the currency exposure using forwards; Carry fully hedges currencies of countries that had lower interest rates compared to the US; Minimum-variance hedge implements dynamic hedge ratios that minimize the portfolio variance. Significance of the performance difference at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019. All approaches are implemented using monthly data and incorporate transaction costs as well as margin provisions. Further details on the funds and the hedging approaches can be found in Section 5.

Online Appendix

On the Use of Currency Forwards: Evidence from International Equity Mutual Funds

Not for publication

Contents

SECTION A: SUPPLEMENTARY ANALYSIS

Table A.1: Funds' Stated Investment Objectives

The investment objectives from a selection of funds' prospectuses.

Table A.2: Variable Definitions

Full descriptions of variables used in the empirical analysis.

Table A.3: Investment Performance of Active User Funds

Summary statistics for portfolio builders and exposure managers

Table A.4: Additional Determinants of Currency Forward Positions

Fixed-effects panel regression to assess (i) whether volatility-adjusted carry has greater impact than pure carry on the currency portfolio weights of portfolio builders; (ii) The impact of cross-currency bases on currency portfolio weights and hedge ratios.

Table A.5: Top Long-and-Short Currencies of Portfolio Builders

Top-5 long and top-5 short currencies based on currency weights in the currency portfolios of portfolio builders, split across groups G1 to G5.

Figure A.1: Users Across Morningstar Fund Categories

Figure A.2: Funds' Stated Use of Currency Forward Contracts

Extracts from fund prospectuses on the potential usage of currency forward contracts.

Figure A.3: The Split Between Active and Index Equity Mutual Funds

Pie charts showing the breakdown in currency hedging styles across active and index US equity mutual funds.

Figure A.4: The Split Between Types of International Equity Mutual Funds.

Pie charts showing the breakdown in currency hedging styles across foreign funds, world funds, emerging market funds, and regional funds.

Figure A.5: Currency Exposure Across Different Types of Mutual Funds

Reproduction of Figure 6 in the main paper, differentiating by the type of fund.

Figure A.6: Average Return and Standard Deviation of Non-User Funds

SECTION B: FURTHER ANALYSES

Table B.1: Currency Management Styles.

Replicating the top panel of Table 3 using the alternative categorization schemes.

Table B.2: The Determinants of Portfolio Weights Among Portfolio Builders
Replicating the results in Table 5 using the alternative categorization schemes.

Table B.3: The Determinants of Hedge Ratios Among Exposure Managers
Replicating the results in Table 5 using the alternative categorization schemes.

Table B.4: The Determinants of Occasional Users Hedge Ratios
Replicating the results in Table 5 using the alternative categorization schemes for occasional users.

Table B.5: The Determinants of Occasional Users Portfolio Weights
Replicating the results in Table 5 using the alternative categorization schemes for occasional users.

SECTION C: DATA APPENDIX

Full details on how the main dataset was constructed.

Table A.1: Funds' Stated Investment Objectives

Fund Name	Investment objective
BNY Mellon International Fund	The fund seeks long-term capital growth.
Harbor International Fund	The Fund seeks long-term total return, principally from growth of capital.
Voya Diversified International Fund	The Fund's investment objective is to seek long-term growth of capital.
TCW International Growth Fund	The Fund's investment objective is to seek long term capital appreciation.
Putnam International Value Fund	Putnam International Value Fund seeks capital growth. Current income is a secondary objective.
Artisan International Small-Mid Fund	The Fund seeks maximum long-term capital growth.
Dreyfus Boston Company International Small Cap Fund	The fund seeks long-term growth of capital.
Vanguard Global Equity Fund	The Fund seeks to provide long-term capital appreciation.
SGA Global Growth Fund	The Fund's investment objective is long-term capital appreciation.
AllianceBernstein Global Value Fund	The Fund's investment objective is long-term growth of capital.
Evergreen Global Large Cap Equity Fund	The Fund seeks to provide shareholders with long-term growth of capital.
Eaton Vance Global Small Cap Fund	The Fund's investment objective is to seek long-term total return.
AllianzGI NFJ Global Dividend Value Fund	The Fund seeks long-term growth of capital and income.
GMO Global Developed Equity Allocation Fund	Total return greater than that of its benchmark, the MSCI World Index.
Pioneer Europe Select Equity Fund	Long-term growth of capital.
Janus Henderson European Focus Fund	The Henderson European Focus Fund's investment objective is to achieve long-term capital appreciation primarily through investment in equities of European companies.
MFS Emerging Markets Equity Fund	The fund's investment objective is to seek capital appreciation.
Invesco Asia Pacific Growth Fund	The Fund's investment objective is long-term growth of capital.
AB Asia ex Japan Equity Portfolio	The Fund's investment objective is to seek long-term growth of capital.
T Rowe Price Japan Fund	The fund seeks long-term growth of capital by investing primarily in the common stocks of companies located (or with primary operations) in Japan.
Wasatch Emerging India Fund	The Fund's investment objective is long-term growth of capital.
Fidelity Advisor Latin America Fund	The fund seeks long-term growth of capital.
Columbia Greater China Fund	The Fund seeks long-term capital appreciation.

The table presents investment objective from fund prospectus (form N-1A) for selected funds.

Table A.2: Variable Definitions

Variable	Description
Portfolio weight outside US (%)	Sum of non-US country weights from <i>Morningstar</i> .
Portfolio weight in safe haven currencies (%)	Sum of country weights in Japan and Switzerland.
Portfolio weight in non-G3 (%)	Sum of country weights in currencies that are not the euro, Japanese yen, or British pound sterling.
No. of countries invested in	No. of unique foreign currencies that a fund's investments are denominated in. We count Eurozone countries as one country in this calculation.
Net Return (%)	Quarterly fund return net of fees and expenses.
Std. Net Return (%)	Standard deviation of net returns.
Benchmark adj. return (%)	Net return minus the return on the benchmark index specified in fund prospectus.
Tracking error (%)	Standard deviation of quarterly benchmark-adjusted returns.
Gross Return (%)	Quarterly net return plus 1/4 of the annual expense ratio.
Fund Flow (%)	Quarterly fund flow is $\frac{AUM_t - AUM_{t-1} \times (1 + GrossReturn_t)}{AUM_{t-1}}$, where <i>Gross Return</i> is the quarterly net return plus 1/4 of the annual expense ratio.
Flow Volatility (%)	Standard deviation of quarterly fund flow.
Fund turnover ratio (% annual)	Minimum of aggregated sales or aggregated purchases of securities, divided by the average 12-month Total Net Assets of the fund as reported by <i>CRSP</i> .
Fund expense ratio (% annual)	Ratio of total investment that shareholders pay for the fund's operating expenses as reported by <i>CRSP</i> .
Fund management fee (% annual)	Management fee/Average Net Assets as reported by <i>CRSP</i> .
Fund distribution (%)	The quarterly average of monthly fund distribution of dividends and capital gains as a percentage of Net Asset Value (NAV).

Fund age (Years)	Fund age in years calculated using the earliest inception date of all share classes of a fund.
Fund TNA	Total asset under management of a fund at quarter end.
Family TNA	Total asset under management of a fund family at quarter end.
Institutional share (% of TNA)	Proportion of a fund's TNA held in institutional share classes (definition according to <i>Morningstar</i>)
Asset illiquidity	Dummy variable = 1 for small-cap, mid-cap, or single country funds excluding UK, Japan, and Canada as defined by Chen, Goldstein, and Jiang (2010).
Fund forwards as % of TNA	Net forward position in each currency aggregated at the fund level and scaled by TNA.
Absolute value of fund forwards as % of TNA	Absolute value of net forward position in each currency aggregated at the fund level and scaled by TNA.
Fund hedge ratio (%)	Total net forward currency sale positions as a percentage of total investment in foreign currencies.
Fund exposure as % of TNA	Total country weights in foreign currencies as a percentage of TNA plus total currency forward positions as a percentage of TNA.
Volatility (%)	Realised volatility for a currency constructed as the square root of the sum of squares of daily log changes in the exchange rate against the USD over a year.
Country weight (%)	Proportion of a fund's TNA invested in a country.
Momentum (%)	Rate of change in the value of a foreign currency from a US perspective.
Carry (%)	The annualized forward discount calculated as the difference between the log of spot and forward exchange rates.
Volatility-adjusted carry	Carry divided by annualised currency realised volatility.
Value (%)	Deviation from the real exchange rate as constructed by Asness et al. (2013). It is the negative of the 5-year return on the exchange rate from 4.5 to 5.5 years ago divided by the spot exchange rate today minus the log difference in the change in consumer price index (CPI) in the foreign country relative to the US over the same period.

Bid-ask spread (%)	The difference between the bid- and ask- price of a foreign currency (in USD) divided by the mid-price.
Equity return (%)	Quarterly return on MSCI country indices in local currencies.
EM dummy	Dummy variable =1 for currencies of economies classified as emerging by MSCI.
Cross-currency basis	Difference between the US dollar interest rate and the synthetic dollar interest rate (foreign currency interest rate converted into US dollars using currency forwards) as defined by Du et al. (2018).
Foreign fund	Dummy variable = 1 if a fund belongs to any of the following <i>Morningstar</i> categories: “US Fund Foreign Large Value,” “US Fund Foreign Large Blend,” “US Fund Foreign Large Growth,” “US Fund Foreign Small/Mid Value,” “US Fund Foreign Small/Mid Blend,” and “US Fund Foreign Small/Mid Growth.”
World fund	Dummy variable = 1 if a fund belongs to any of the following <i>Morningstar</i> categories: “US Fund World Large Stock” and “US Fund World Small/Mid Stock.”
Emerging market fund	Dummy variable = 1 if a fund belongs to any of the following <i>Morningstar</i> categories: “US Fund Diversified Emerging Mkts,” “US Fund Latin America Stock,” “US Fund China Region,” and “US Fund India Equity.”
Regional fund	Dummy variable = 1 if a fund belongs to any of the following <i>Morningstar</i> categories: “US Fund Diversified Pacific/Asia,” “US Fund Europe Stock,” “US Fund Pacific/Asia ex-Japan Stock,” “US Fund Japan Stock,” and “US Fund Miscellaneous Region.”
Index fund	Dummy variable = 1 if a fund is an index fund.
Can speculate	Dummy variable = 1 if a fund states in its prospectus that it may use currency forwards for non-hedging purposes.

Table A.3: Investment Performance of Active User Funds

	Portfolio Builders			Exposure managers		
	Obs	Mean	Std	Obs	Mean	Std
<i>Gross return (%)</i>	7,737	2.10	9.35	2,300	2.21	8.17
<i>Net return (%)</i>	8,237	1.74	9.42	2,460	1.88	8.24
<i>Benchmark adj return (pros, %)</i>	8,175	-0.08	2.43	2,460	-0.01	3.38
<i>Stdev net return (%)</i>	8,237	9.34	1.74	2,460	7.98	2.34
<i>Sharpe ratio</i>	8,237	0.14	0.08	2,460	0.20	0.11
<i>Tracking error (pros, %)</i>	8,175	2.17	1.08	2,460	3.15	1.19
<i>Fund management fee (% annual)</i>	7,552	0.80	0.27	2,246	0.87	0.25

The table presents additional summary statistics for portfolio builders and exposure managers. For each performance measure, we present the number of fund-quarter observations (Obs), the average (Mean), and the standard deviation (Std). The sample period is from Q1 2004 to Q2 2019. Fund characteristics are defined in Table A.2 of the Online Appendix, all values are quarterly unless indicated otherwise. Further details on the funds and data sources can be found in Section 1.

Table A.4: Additional Determinants of Currency Forward Positions

	Portfolio Builders		Exposure Managers
	(1)	(2)	(3)
<i>Volatility-adjusted carry</i>	4.644*** (1.111)		
<i>Cross-currency basis</i>		-0.0314 (0.075)	-0.366*** (0.087)
<i>Country weight</i>	-0.539*** (0.070)	-0.861*** (0.104)	0.702*** (0.103)
<i>Momentum</i>	0.245*** (0.038)	0.411*** (0.057)	-0.079 (0.068)
<i>Carry</i>		0.109 (0.454)	0.306 (0.613)
<i>Value</i>	0.038 (0.026)	0.037 (0.047)	-0.002 (0.055)
<i>Bid-ask spread</i>	-0.015 (0.021)	-1.266*** (0.252)	-0.196 (0.360)
<i>EM dummy</i>	-4.691*** (1.125)		
<i>Volatility</i>			0.337 (0.261)
<i>Equity return</i>			0.063 (0.045)
Observations	32,864	19,524	13,488
Fund \times Quarter FEs	Yes	Yes	Yes
Adj R^2	0.152	0.153	0.442

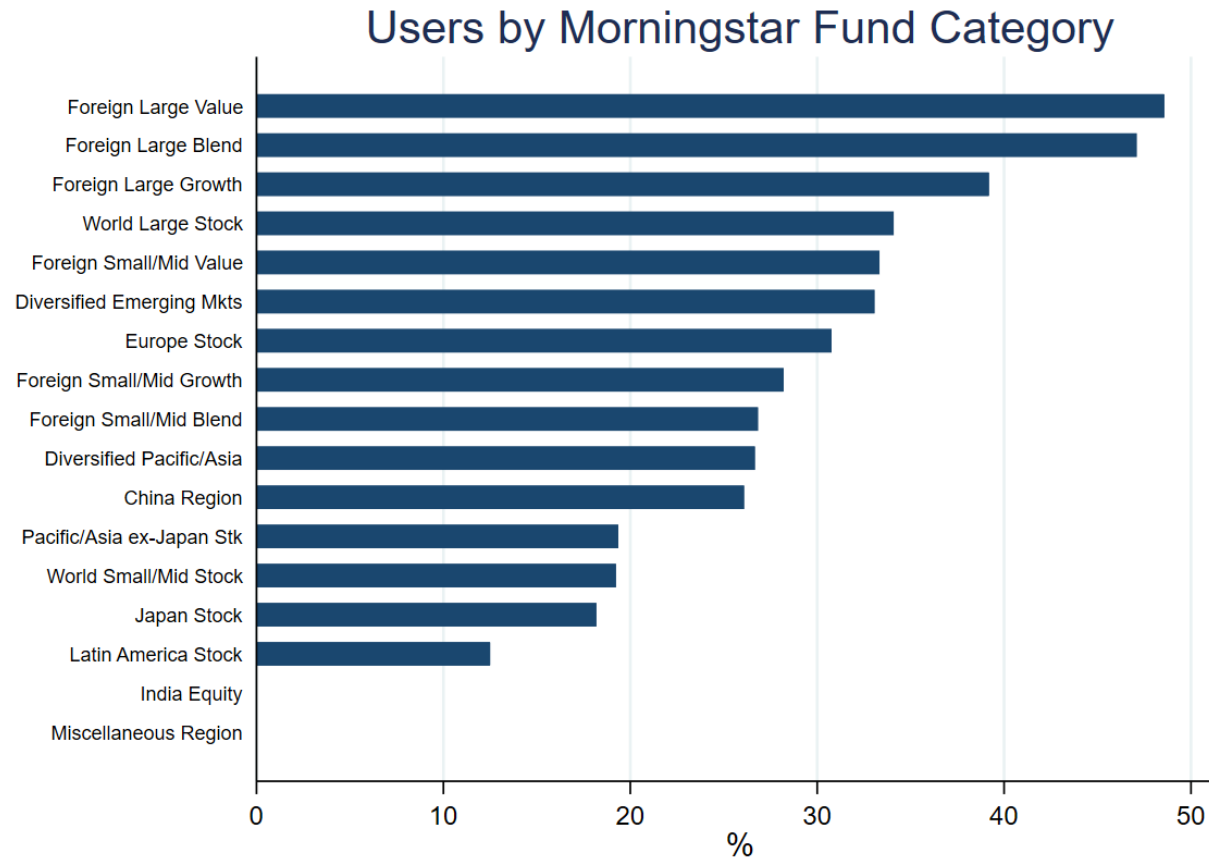
The table presents coefficient estimates from fixed-effects panel regressions. The dependent variable is the currency portfolio weight of fund i for currency/country j in quarter t in columns (1) and (2), and it is the hedge ratio of fund i for currency/country j in quarter t in column (3). The independent variables include the forward discount adjusted by the prior three months' volatility of the exchange rate (*Volatility-adjusted carry*), the deviation from the CIP condition for G9 currencies (*Cross-currency basis*), fund i 's portfolio weight in country j , the exchange rate return (*Momentum*), the forward discount (*Carry*), the deviation from the real exchange rate (*Value*), the bid-ask spread, a dummy variable equal to **1** if the currency is issued by an emerging market economy (*EM dummy*), the 12-month currency return volatility, and the MSCI equity index return for country j . All independent variables are lagged by one quarter except for the cross-currency basis. All regressions include fund \times quarter fixed effects and standard errors clustered at the fund \times currency level are presented in parentheses. Significance of the coefficients at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table A.5: Top Long-and-Short Currencies of Portfolio Builders

	G1	G2	G3	G4	G5
	<i>Top Long Currencies</i>				
1	GBP	AUD	AUD	AUD	AUD
2	AUD	EUR	SEK	SEK	SEK
3	CHF	GBP	INR	SGD	INR
4	EUR	SEK	NOK	CAD	SGD
5	MYR	KRW	NZD	BRL	MXN
	<i>Top Short Currencies</i>				
1	JPY	JPY	EUR	EUR	EUR
2	NOK	CNY	GBP	JPY	GBP
3	CNY	HKD	MXN	GBP	CHF
4	KRW	THB	TRY	CNY	ZAR
5	ILS	PHP	PHP	NZD	JPY

The table presents the most bought and sold currency forwards across five groups of portfolio builders. Funds are split into five equally sized groups based on their sample currency portfolio Sharpe ratio from low (G1) to high (G5). Within each fund group, currencies are ranked by the currency portfolio weight in each currency averaged across funds, and the first currency in the top (bottom) panel has the highest (lowest) average currency portfolio weight. The sample period is from Q1 2004 to Q2 2019. Further details on the funds can be found in Section 4.

Figure A.1: Users Across Morningstar Fund Categories



The figure presents the fraction of funds that use currency forwards within each *Morningstar* category. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Figure A.2: Funds' Stated Use of Currency Forward Contracts

1. Derivative Financial Instruments

The Fund may use derivatives in an effort to earn income and enhance returns, to replace more traditional direct investments, to obtain exposure to otherwise inaccessible markets (collectively, "investment purposes"), or to hedge or adjust the risk profile of its portfolio.

The principal type of derivative utilized by the Fund, as well as the methods in which they may be used are:

- **Forward Currency Exchange Contracts**

The Fund may enter into forward currency exchange contracts in order to hedge its exposure to changes in foreign currency exchange rates on its foreign portfolio holdings, to hedge certain firm purchase and sale commitments denominated in foreign currencies and for non-hedging purposes as a means of making direct investments in foreign currencies, as described below under "Currency Transactions".

A forward currency exchange contract is a commitment to purchase or sell a foreign currency at a future date at a negotiated forward rate. The gain or loss arising from the difference between the original contract and the closing of such contract would be included in net realized gain or loss on forward currency exchange contracts. Fluctuations in the value of open forward currency exchange contracts are recorded for financial reporting purposes as unrealized appreciation and/or depreciation by the Fund. Risks may arise from the potential inability of a counterparty to meet the terms of a contract and from unanticipated movements in the value of a foreign currency relative to the U.S. dollar.

(a) AB International Value Fund

The Fund may enter into forward foreign currency exchange contracts, which are a type of derivative. A forward foreign currency exchange contract is an agreement to buy or sell a country's currency at a specific price on a specific date, usually 30, 60, or 90 days in the future. In other words, the contract guarantees an exchange rate on a given date. Managers of funds that invest in foreign securities can use these contracts to guard against unfavorable changes in currency exchange rates. These contracts, however, would not prevent the Fund's securities from falling in value during foreign market downswings. Note that the Fund will not enter into such contracts for speculative purposes. Under normal circumstances, the Fund will not commit more than 20% of its assets to forward foreign currency exchange contracts.

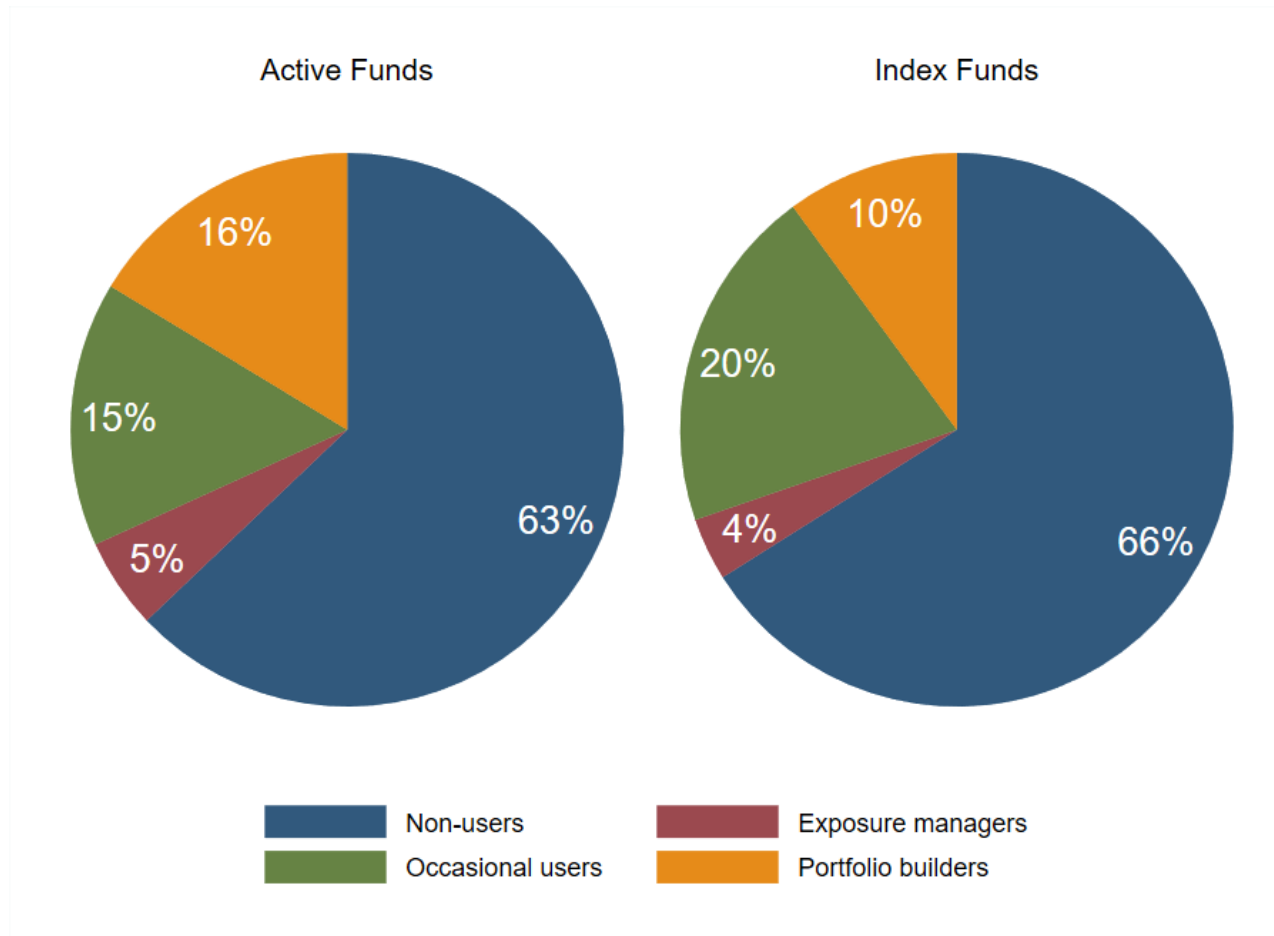
(b) Vanguard Global Equity Fund

Non-Hedging Foreign Currency Trading Risk. The Fund may engage in forward foreign currency transactions for both hedging and non-hedging purposes. The Investment Adviser may purchase or sell foreign currencies through the use of forward contracts based on the Investment Adviser's judgment regarding the direction of the market for a particular foreign currency or currencies. In pursuing this strategy, the Investment Adviser seeks to profit from anticipated movements in currency rates by establishing "long" and/or "short" positions in forward contracts on various foreign currencies. Foreign exchange rates can be extremely volatile and a variance in the degree of volatility of the market or in the direction of the market from that anticipated by the Investment Adviser may produce significant losses to the Fund. Some of these transactions may also be subject to interest rate risk.

(c) Goldman Sachs Total Emerging Markets Income Fund

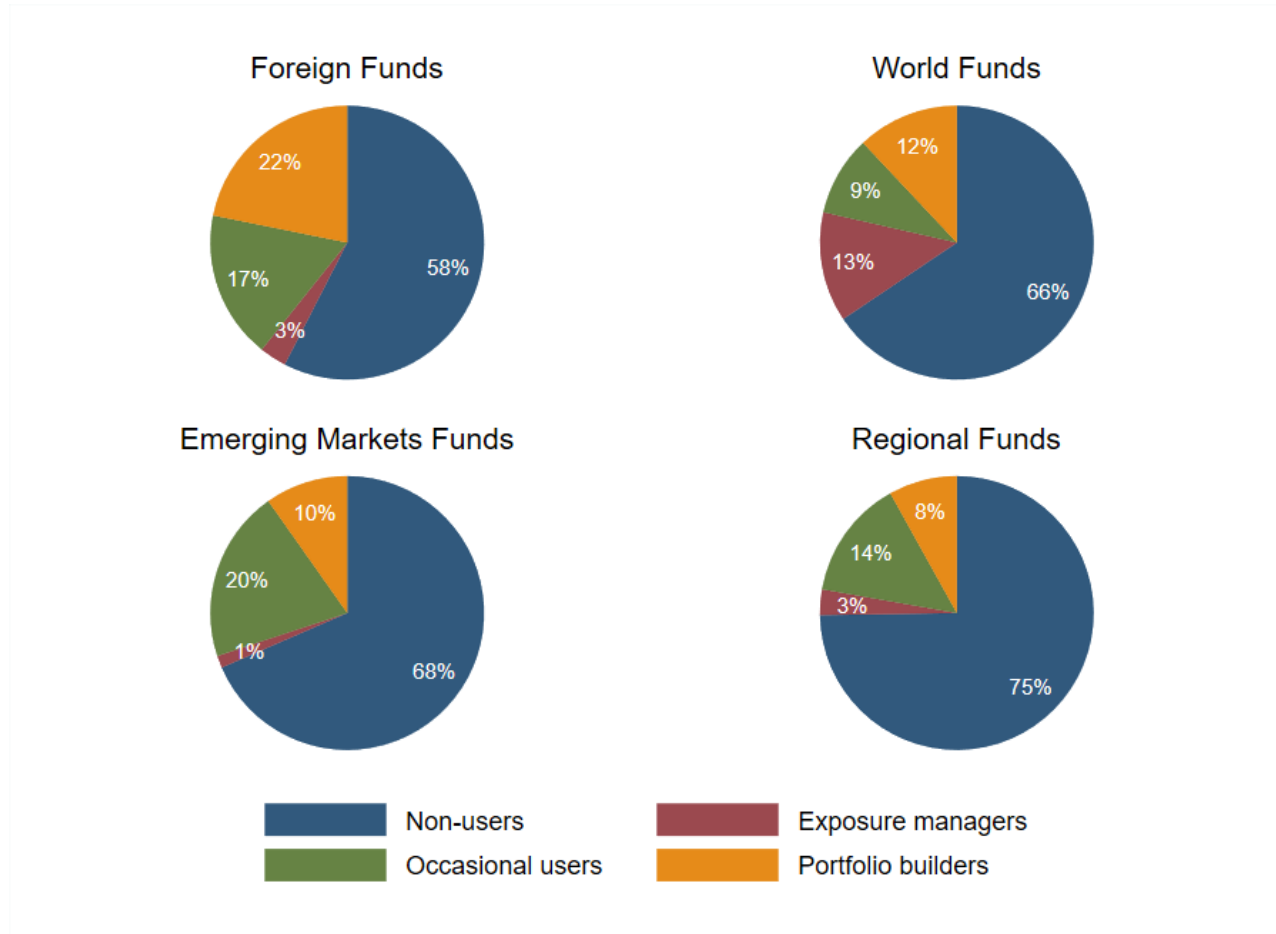
The figure presents extracts from fund reports and prospectuses concerning their potential use of foreign currency forward contracts. Panel A is extracted from the May 2019 N-CSR form of AB International Value Fund, Panel B is extracted from the prospectus (form N-1A) of the Vanguard Global Equity Fund, and Panel C is extracted from the prospectus (form N-1A) of Goldman Sachs Total Emerging Markets Income Fund.

Figure A.3: The Split Between Active and Index Equity Mutual Funds



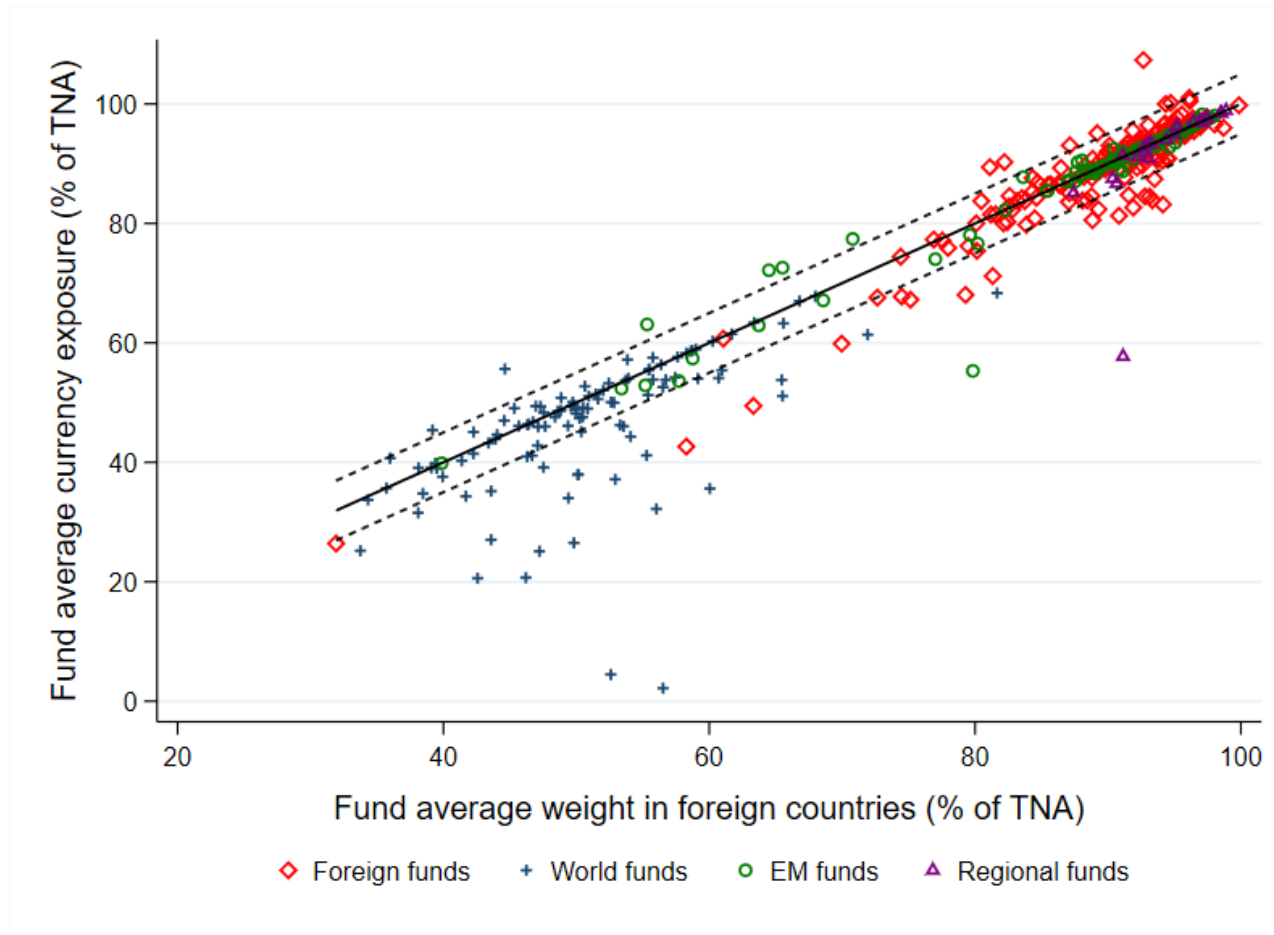
The figure presents pie charts that split the active and passive funds in our sample between users and non-users of currency forward contracts. Within the group of user funds, the funds are split between portfolio builders, exposure managers, and occasional users. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Figure A.4: The Split Between Types of International Equity Mutual Funds



The figure presents pie charts that split users and non-users of currency forward contracts across the different types of international equity mutual funds: foreign funds, world funds, emerging market funds, and regional funds. For each type of funds, the group of user funds are split between portfolio builders, exposure managers, and occasional users. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Figure A.5: Currency Exposure Across Different Types of Mutual Funds



The figure presents a scatter plot of funds' average weight in foreign countries (x-axis) plotted against their average currency exposure after accounting for their forward positions (y-axis). The plot includes a 45-degree solid line with dashed-lines indicating a (+/-) 5% boundary. Funds are classified into the following four categories: foreign funds (red diamonds), world funds (blue crosses), EM funds (green circles) and regional funds (purple triangles). **The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.**

Figure A.6: Average Return and Standard Deviation of Non-User Funds



The figure presents a scatter plot of non-user funds' actual average returns (x-axis) plotted against their average standard deviation (y-axis, blue crosses) and the funds' potential average returns and standard deviation (red diamonds) under the alternative currency management scheme of minimum-variance hedge of Campbell et al. (2010). The solid and dashed lines are fitted quadratic polynomials. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Section B: Alternative Categorization Schemes

We describe our approach to assigning currency management styles in Section 3.3. The approach is based on selecting thresholds in funds' hedge ratios, absolute forward positions, and the proportion of quarters in which funds use currency forwards. We investigate whether the results on the determination of hedge ratios, among exposure managers, and the determination of currency portfolio weights, among portfolio builders, are affected when changing categorization scheme.

In total, we consider seven alternative approaches. The first six are based on changing threshold values. We vary the required proportion of active quarters from 10% to 50% and set the absolute forward position at 2% or 5%. The final categorization scheme is based on a two-step procedure using the k -means machine learning algorithm, which provides a way to cluster funds into three groups that is free from an arbitrary threshold decision.

Table B.1 reports the breakdown of funds across currency management styles for the seven different categorization schemes. We tend to find that there is more stability in the classification of funds as exposure managers. This is unsurprising given that an exposure manager is a fund with a high hedge ratio that regularly uses currency forwards. Changing the thresholds makes relatively little difference in this categorization. The machine learning approach stands out as being stricter, requiring an even higher hedge ratio to define an exposure manager—the average hedge ratio for this classification is 40%, relative to around 28% for the threshold-based approach. The biggest switches take place between portfolio builders and occasional users. These two styles can look similar: Although some funds clearly operate large long-short positions, other funds may simply be engaging in larger liquidity trades. For that reason, we see significant movement between the two categories. Indeed, being especially conservative, such that the currency portfolio is required to be at least 5% of the fund's TNA, we observe a switch of around 70 funds from being classified as portfolio builders to occasional users. Using these alternative categorization schemes, we repeat the full-specification analysis documented in Table 5.

Tables B.2 and B.3 report results. Across the two tables, we see qualitatively identical results to those observed in the main tables. For exposure managers, no matter the classification approach, country weights, momentum, carry, volatility, and the emerging market dummy variable are always highly statistically significant. We find virtually no evidence of any other variable being important in the alternative specifications. The same pattern is observed for

the portfolio builders, and, moreover, the coefficient estimates based on the machine learning categorized funds are almost identical to those we observe for the main sample and all other alternative categorizations.

In sum, the additional analyses confirm that our main results are not highly sensitive to the choice of categorization scheme, and thus the determinants of currency forward usage that we concluded to be important in the main analysis continue to remain so following these tests.

As specified in the main body of the paper, we classify forward users into three groups based on three indicator variables: (i) the percentage of quarters in which the fund uses currency forwards; (ii) the average hedge ratio over the quarters in which the fund uses currency forwards; and (iii) the absolute forward position averaged over the quarters in which the fund uses currency forwards. A fund is classified as an exposure manager if it uses forwards in at least $x\%$ of quarters, and has an average hedge ratio of at least $a\%$ during those quarters. We classify a fund as a portfolio builder if it uses forwards in at least $x\%$ of quarters, its hedge ratio is below $a\%$ and its absolute forward position is at least $b\%$ of TNA, when averaged over those quarters. We treat the remainder of the user funds as occasional users, which either use forwards in less than $x\%$ of quarters, or whose absolute forward position is, on average, less than $b\%$ of their TNA. We have the following variations of the cut-off values for x , a , and b :

- **v1:** $x=50$; $a=10$; $b=2$
- **v2:** $x=25$; $a=10$; $b=2$
- **v3:** $x=20$; $a=10$; $b=2$
- **v4:** $x=20$; $a=10$; $b=5$
- **v5:** $x=10$; $a=10$; $b=2$ (the version adopted in the main-body of the paper)
- **v6:** $x=10$; $a=10$; $b=5$

As an additional robustness check, we also cluster funds into three groups in a two-step procedure using the k-means machine learning algorithm (**v7**).³⁶ In each step, the funds are partitioned into six clusters based on their similarities in terms of two indicator variables. In step one, we use (as indicator variables) fund average hedge ratios calculated, respectively, over the entire sample and over the quarters that a fund used forwards. In step two, we use (as indicator variables) fund average absolute forward positions calculated, respectively, over the entire sample and over the quarters that a fund used forwards. We then assign funds in

³⁶Kmeans is a partition cluster-analysis method which breaks the observations into a distinct number of non-overlapping groups. It follows an iterative process to cluster observations into k groups based on how close each observation is to the group mean. The process stops when no observation changes group.

the resulting clusters to three groups based on the clusters' average hedge ratios and average absolute forward positions. Specifically, exposure managers consist of clusters with high average fund hedge ratios, portfolio builders consist of clusters with low or negative average fund hedge ratios but high average absolute forward positions, and occasional users consist of clusters that are low on both measures.

Table B.1: Currency Management Styles

	(v1)	(v2)	(v3)	(v4)	(v5)	(v6)	(v7)
	<i>Exposure Managers</i>						
<i>Number of funds</i>	48	59	59	59	66	66	34
<i>Fund quarters with currency forwards (%)</i>	82.0	73.7	73.7	73.7	67.5	67.5	77.2
<i>Average number of currencies with forward contracts</i>	5.6	5.0	5.0	5.0	4.8	4.8	6.1
<i>Average fund forwards as % of TNA</i>	-17.1	-16.2	-16.2	-16.2	-16.5	-16.5	-22.5
<i>Average fund hedge ratio</i>	28.9	27.7	27.7	27.7	27.7	27.7	39.8
<i>Average absolute value of fund forwards as % of TNA</i>	20.0	18.7	18.7	18.7	18.7	18.7	25.4
	<i>Portfolio Builders</i>						
<i>Number of funds</i>	135	169	181	122	202	132	191
<i>Fund quarters with currency forwards (%)</i>	75.7	68.2	65.1	68.9	59.8	64.7	59.1
<i>Average number of currencies with forward contracts</i>	7.9	7.2	6.9	8.6	6.6	8.2	6.8
<i>Average fund forwards as % of TNA</i>	0.1	0.1	-0.0	0.5	-0.3	0.2	-1.3
<i>Average fund hedge ratio</i>	-0.4	-0.4	-0.3	-1.2	0.1	-0.8	1.7
<i>Average absolute value of fund forwards as % of TNA</i>	14.7	13.5	13.0	17.8	12.4	17.2	14.7
	<i>Occasional Users</i>						
<i>Number of funds</i>	288	243	231	290	203	273	246
<i>Fund quarters with currency forwards (%)</i>	31.7	30.5	31.0	36.3	33.3	37.7	38.1
<i>Average number of currencies with forward contracts</i>	3.1	3.0	3.0	3.1	2.9	3.0	3.0
<i>Average fund forwards as % of TNA</i>	-1.1	-0.8	-0.7	-0.8	0.1	-0.2	-0.5
<i>Average fund hedge ratio</i>	1.7	1.1	1.0	1.1	-0.1	0.4	0.6
<i>Average absolute value of fund forwards as % of TNA</i>	3.8	2.7	2.5	2.6	1.5	1.9	1.5

The table presents summary statistics for international equity mutual funds that use currency forward contracts during the sample. Each column reflects a different approach to identifying exposure managers, portfolio builders, and occasional users. The three panels split the funds based on their style of currency forward usage. For each characteristic of currency forward usage, we present the average (Mean) across funds. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table B.2: The Determinants of Portfolio Weights Among Portfolio Builders

	(v1)	(v2)	(v3)	(v4)	(v5)	(v6)	(v7)
<i>Country weight</i>	-0.530*** (0.076)	-0.533*** (0.072)	-0.522*** (0.071)	-0.636*** (0.075)	-0.520*** (0.071)	-0.633*** (0.074)	-0.605*** (0.073)
<i>Momentum</i>	0.279*** (0.037)	0.272*** (0.037)	0.276*** (0.037)	0.289*** (0.039)	0.270*** (0.037)	0.278*** (0.039)	0.260*** (0.038)
<i>Carry</i>	0.319** (0.132)	0.362*** (0.128)	0.375*** (0.128)	0.456*** (0.139)	0.355*** (0.126)	0.445*** (0.137)	0.406*** (0.138)
<i>Value</i>	0.050* (0.027)	0.040 (0.026)	0.036 (0.026)	0.036 (0.029)	0.033 (0.026)	0.033 (0.029)	0.038 (0.027)
<i>Bid-ask spread</i>	-0.017 (0.022)	-0.015 (0.021)	-0.017 (0.021)	-0.028 (0.024)	-0.011 (0.021)	-0.024 (0.023)	-0.025 (0.024)
<i>EM dummy</i>	-4.169*** (1.211)	-4.763*** (1.180)	-4.829*** (1.172)	-5.896*** (1.217)	-4.824*** (1.163)	-5.950*** (1.211)	-5.828*** (1.217)
Observations	30,292	32,259	32,528	27,740	32,864	27,935	30,920
Fund \times Quarter FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.145	0.148	0.149	0.103	0.151	0.105	0.190

The table presents coefficient estimates from fixed-effects panel regressions. Each column reflects a different approach to identifying portfolio builders. The dependent variable is the currency portfolio weight of fund i for currency/country j in quarter t . The independent variables include fund i 's portfolio weight in country j , the exchange rate return (*Momentum*), the forward discount (*Carry*), the deviation from the real exchange rate (*Value*), the bid-ask spread, and a dummy variable equal to 1 if the currency is issued by an emerging market economy (*EM dummy*). All independent variables are lagged by one quarter. All regressions include fund \times quarter fixed effects and standard errors clustered at the fund \times currency level are presented in parentheses. Significance of the coefficients at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table B.3: The Determinants of Hedge Ratios Among Exposure Managers

	(v1)	(v2)	(v3)	(v4)	(v5)	(v6)	(v7)
<i>Country weight</i>	0.903*** (0.116)	0.776*** (0.093)	0.776*** (0.093)	0.776*** (0.093)	0.701*** (0.082)	0.701*** (0.082)	1.316*** (0.129)
<i>Momentum</i>	-0.148*** (0.048)	-0.144*** (0.042)	-0.144*** (0.042)	-0.144*** (0.042)	-0.139*** (0.037)	-0.139*** (0.037)	-0.209*** (0.061)
<i>Carry</i>	-0.436** (0.180)	-0.397** (0.155)	-0.397** (0.155)	-0.397** (0.155)	-0.378*** (0.125)	-0.378*** (0.125)	-0.687*** (0.235)
<i>Value</i>	-0.020 (0.032)	-0.028 (0.028)	-0.028 (0.028)	-0.028 (0.028)	-0.018 (0.024)	-0.018 (0.024)	0.008 (0.040)
<i>Bid-ask spread</i>	0.027 (0.026)	0.023 (0.023)	0.023 (0.023)	0.023 (0.023)	0.023 (0.019)	0.023 (0.019)	0.074** (0.036)
<i>Volatility</i>	0.567*** (0.144)	0.506*** (0.124)	0.506*** (0.124)	0.506*** (0.124)	0.472*** (0.107)	0.472*** (0.107)	0.709*** (0.180)
<i>Equity return</i>	0.001 (0.028)	-0.003 (0.024)	-0.003 (0.024)	-0.003 (0.024)	-0.001 (0.021)	-0.001 (0.021)	-0.000 (0.035)
<i>EM dummy</i>	-5.607*** (1.644)	-4.830*** (1.425)	-4.830*** (1.425)	-4.830*** (1.425)	-4.637*** (1.243)	-4.637*** (1.243)	-8.296*** (1.995)
Observations	20,016	23,983	23,983	23,983	27,425	27,425	14,189
Fund \times Quarter FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.300	0.300	0.300	0.300	0.315	0.315	0.355

The table presents coefficient estimates from fixed-effects panel regressions. Each column reflects a different approach to identifying exposure managers. The dependent variable is the hedge ratio of fund i for currency/country j in quarter t . The independent variables include fund i 's portfolio weight in country j , the exchange rate return (*Momentum*), the forward discount (*Carry*), the deviation from the real exchange rate (*Value*), the bid-ask spread, the 12-month currency return volatility, the MSCI equity index return for country j , and a dummy variable equal to $\mathbf{1}$ if the currency is issued by an emerging market economy (*EM dummy*). All independent variables are lagged by one quarter. All regressions include fund \times quarter fixed effects and standard errors clustered at the fund \times currency level are presented in parentheses. Significance of the coefficients at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table B.4: The Determinants of Hedge Ratios Among Occasional Users

	(v1)	(v2)	(v3)	(v4)	(v5)	(v6)	(v7)
<i>Country weight</i>	0.028*** (0.006)	0.005** (0.003)	0.005** (0.002)	0.007* (0.004)	-0.000 (0.002)	0.003 (0.004)	0.008* (0.004)
<i>Momentum</i>	-0.016*** (0.006)	-0.006 (0.004)	-0.007** (0.004)	-0.010** (0.005)	-0.007** (0.003)	-0.011** (0.005)	-0.011** (0.005)
<i>Carry</i>	-0.029*** (0.011)	-0.026*** (0.006)	-0.021*** (0.006)	-0.019** (0.008)	-0.012** (0.005)	-0.013 (0.009)	-0.011 (0.009)
<i>Value</i>	0.007** (0.003)	0.002 (0.002)	0.002 (0.001)	0.002 (0.002)	-0.001 (0.001)	0.001 (0.002)	-0.003 (0.002)
<i>Bid-ask spread</i>	0.001 (0.002)	-0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.002 (0.001)
<i>Volatility</i>	0.006 (0.010)	0.022*** (0.006)	0.025*** (0.006)	0.022*** (0.008)	0.014*** (0.004)	0.013 (0.008)	0.025*** (0.007)
<i>Equity return</i>	0.003 (0.003)	-0.001 (0.002)	0.000 (0.002)	0.003 (0.002)	0.001 (0.002)	0.003 (0.002)	0.002 (0.002)
<i>EM dummy</i>	0.557*** (0.125)	0.189** (0.085)	0.165** (0.077)	0.082 (0.134)	0.136** (0.056)	0.045 (0.134)	-0.070 (0.131)
Observations	162,441	141,772	135,577	171,956	115,827	161,029	144,574
Fund \times Quarter FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R^2	0.084	0.144	0.181	0.095	0.014	0.021	0.017

The table presents coefficient estimates from fixed-effects panel regressions. Each column reflects a different approach to identifying occasional users. The dependent variable is the hedge ratio of fund i for currency/country j in quarter t . The independent variables include fund i 's portfolio weight in country j , the exchange rate return (*Momentum*), the forward discount (*Carry*), the deviation from the real exchange rate (*Value*), the bid-ask spread, the 12-month currency return volatility, the MSCI equity index return for country j , and a dummy variable equal to $\mathbf{1}$ if the currency is issued by an emerging market economy (*EM dummy*). All independent variables are lagged by one quarter. All regressions include fund \times quarter fixed effects and standard errors clustered at the fund \times currency level are presented in parentheses. Significance of the coefficients at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.

Table B.5: The Determinants of Portfolio Weights Among Occasional Users

	(v1)	(v2)	(v3)	(v4)	(v5)	(v6)	(v7)
<i>Country weight</i>	−0.047 (0.113)	0.203** (0.100)	0.193* (0.103)	0.128 (0.085)	0.221** (0.106)	0.140 (0.086)	0.019 (0.094)
<i>Momentum</i>	0.075 (0.078)	0.063 (0.087)	0.045 (0.089)	0.097 (0.068)	0.061 (0.090)	0.120* (0.069)	0.097 (0.074)
<i>Carry</i>	0.067 (0.214)	−0.047 (0.215)	−0.099 (0.215)	−0.148 (0.178)	0.027 (0.228)	−0.111 (0.184)	0.007 (0.181)
<i>Value</i>	−0.003 (0.036)	0.023 (0.035)	0.037 (0.036)	0.034 (0.030)	0.054 (0.036)	0.043 (0.030)	0.060* (0.032)
<i>Bid-ask spread</i>	−0.005 (0.027)	−0.018 (0.031)	0.012 (0.031)	0.007 (0.026)	−0.040 (0.032)	−0.006 (0.027)	−0.004 (0.026)
<i>EM dummy</i>	−2.96 (1.806)	−0.147 (2.030)	0.337 (2.083)	1.774 (2.162)	0.376 (2.136)	2.104 (2.195)	2.214 (2.061)
Observations	11,368	9,122	8,853	13,641	8,358	13,287	12,065
Fund × Quarter FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.199	0.209	0.207	0.234	0.198	0.230	0.206

The table presents coefficient estimates from fixed-effects panel regressions. Each column reflects a different approach to identifying occasional users. The dependent variable is the currency portfolio weight of fund i for currency/country j in quarter t . The independent variables include fund i 's portfolio weight in country j , the exchange rate return (*Momentum*), the forward discount (*Carry*), the deviation from the real exchange rate (*Value*), the bid-ask spread, and a dummy variable equal to 1 if the currency is issued by an emerging market economy (*EM dummy*). All independent variables are lagged by one quarter. All regressions include fund × quarter fixed effects and standard errors clustered at the fund × currency level are presented in parentheses. Significance of the coefficients at the 10%, 5%, and 1% levels of statistical significance are denoted by the superscripts *, **, and ***. The sample period is from Q1 2004 to Q2 2019. Further details on the funds and data sources can be found in Section 1.