Global Equity Fund Performance Evaluation with Equity and Currency Style Factors

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Abstract

We propose a method for global equity fund performance evaluation that extends existing research by addressing both equity and currency factor exposures. Returns in excess of the risk-free rate are decomposed into contributions arising from the market, exposure to six equity and three currency ‘style factors’, and alpha. The method supports an understanding of how exposures to both equity and currency factors contribute to the performance of funds investing across markets. We apply the method using a database that includes holdings for USD-based institutional global equity funds from 2002 to 2012. We find that USD-based global equity managers generate negative but insignificant alpha after accounting for equity and currency style factors. We also find that performance varies with style: significant negative alpha is generated over the period by funds exposed to value, low momentum and low return on equity. Our results are relevant to institutional investors and investment consultants who wish to better understand the sources of performance for global equity funds.

Keywords

Global equities, performance evaluation, active management, currency

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1. Introduction

Global equities for institutional and retail investors are an important asset class that has experienced considerable growth in recent years. From 2004 to 2014, world equity mutual funds received net inflows of 639 billion US dollars (USD) from US investors alone, while domestic equity mutual funds experienced net outflows of USD 647 billion (Investment Company Institute, 2015). Investment in global equities is often adopted through active equity funds that select stocks from multiple countries. Further, around half of the investment opportunities in world equities exist outside of the US.\(^1\) Despite the importance of global equity funds, comparatively little is known about their performance and exposures, reflecting the fact that data on these funds has been less readily available than for domestic funds. Evaluation of the sources of performance for active global equity funds is important to inform the structuring of global equity portfolios, including the use of active versus passive management and the management of currency. In addition, the literature does not contain a well-integrated method suitable for evaluating the performance of global equity managers, whose portfolios consist of exposure to equity and currency factors. While academic researchers have considered a range of equity factors in the context of international investing, currency exposures have so far either been glossed over through examining returns in USD, or treated in a piecemeal fashion.

We address these issues and contribute to the literature in four main ways. First, we propose a method for explaining stock returns, and subsequently fund performance, in international markets that accounts for contributions from both equity and currency factors. Our method incorporates a market factor, plus six equity factors and three currency factors that are well-recognized in the literature, thus expanding the set of style factors used to explain performance. Second, in doing so, we provide the means to apply holdings-based performance evaluation in global equity markets, which offers advantages related to contemporaneous identification of factor exposures on a period-by-period basis. Our cross-sectional holdings-based approach for estimating factor exposures and factor returns, and hence extracting alpha, contrasts with the application of time-series regressions to USD returns that dominates the extant literature (see Huij and Derwall, 2011; Busse, Goyal and Wahal, 2014; Breloer, Scholz and Wilkens, 2014; Brusa, Ramadorai and Verdelhan, 2015; Tsai and Wu, 2015; Gerakos, Linnainmaa and Morse, 2016). Third, we demonstrate our method by employing a unique database of returns and portfolio holdings for a sample of 90 institutional global equity funds, making use of the holdings data to estimate style factor exposures and hence isolate the sources of returns for this fund class. Fourth, we examine how performance varies across global equity funds with different style characteristics. We find

\(^1\) The weight of non-US countries in the MSCI All Country World Index (ACWI) was 46% at June 2016 (MSCI, 2016a).
no evidence that the average fund in our sample possesses any skill in stock or currency selection after accounting for style factor exposures; but do find that performance varies with style.

The comprehensive holdings-based fund performance evaluation method that we develop is the central feature of this study. The asset pricing literature proposes a large number of factors that systematically explain the cross-section of stock returns. In addition to the market factor, we select six equity factors that are widely cited within the literature, specifically: Value, Size, Momentum (MOM), Investment-to-Assets (I/A), Return-on-Equity (ROE) and Illiquidity (ILLIQ). While our equity factor analysis draws on existing research and extends it to a global setting, our main contribution is the incorporation of currency factors into the model in a structured manner. The majority of empirical research that aims to identify common factors in international stock returns (with the notable exception of Brusa et al., 2015), analyzes returns in USD and hence does not address the potential role of currency factors (e.g. Fama and French, 2012; Hou, Karolyi and Kho, 2011; Griffin, 2002). Our model incorporates three currency factors: Trend, which captures currency momentum; Carry, which reflects interest rate differentials; and a measure of ‘value’ based on deviation from purchasing power parity (PPP-deviation). These three factors are well-recognized in the literature, and are in common use among industry participants (see Brusa et al., 2015; Pojarliev and Levich, 2012, 2011; Burnside, Eichenbaum and Rebelo, 2011; Menkhoff, Sarno, Schmeling and Schrmpf, 2011; Lustig et al., 2011; Okunev and White, 2003; Taylor, 2002).2 We find that all six equity factors and three currency factors are important in explaining the returns for global funds. Our method accommodates the analysis of the equity and currency factor exposures and returns on three levels: analysis of hedged returns using equity factors; analysis of currency returns using currency factors; and analysis of unhedged equity returns using both equity and currency factors in combination.

Our method for estimating factor exposures and factor returns differs from existing academic studies. Most research adopts a returns-based approach that involves sorting stocks to form factor-mimicking long-short portfolios, and then estimating factor returns from differences between the high- and low-exposure portfolios (Fama and French, 2012; Carhart, 1997; Fama and French, 1993; Jegadeesh and Titman, 1993). Factor loadings are then estimated using a times-series regression of stock or fund returns on factor returns. Our method entails estimating factor exposures for the stocks in our market universe during each period based on directly-observed characteristics. Factor returns are extracted through cross-sectional multivariate regressions of stock returns in excess of the risk-free rate on standardized ZScores for the characteristics. Fund performance is then attributed using portfolio

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2 Pojarliev and Levich (2012; 2011) also include a volatility factor in their models to account for volatility in foreign exchange markets. However, as we are not evaluating the performance of managers who invest in currency markets, we do not consider currency market volatility in our models.
holdings to calculate weighted-average factor exposures during each period, with alpha estimated as a residual after extracting the return contributions arising from both the market and factor exposures. The method is similar to MSCI Barra’s portfolio analysis and evaluation models, which are widely used in the investment industry, and is highlighted as a key approach by Chan, Dimmock and Lakonishok (2009). The advantage of this method is that fund style factor exposures can be estimated directly using holdings data for each period, thus ensuring that the estimated factor exposures reflect fund positioning at each point in time. By contrast, returns-based time-series approaches determine an average exposure over a period of time, and can be less accurate and informative when factor exposures vary over time. Additionally, the main holdings-based approach used in the fund management literature – that of Daniel, Grinblatt, Titman and Wermers (1997) – assigns stocks to 125 benchmark portfolios based around three equity factors, using 5 x 5 x 5 sorting. This approach does not readily scale to a larger number of equity factors, especially where the available stock universe is more limited such as in countries other than the US. Further, it is not apparent how the approach of Daniel et al. (1997) could be redesigned to effectively incorporate currency factors. Our method provides a way forward for holdings-based analysis in a global setting where the dimension of factor exposures is too great for a characteristic-based benchmark approach to handle.

The use of holdings data to better understand the performance of global equity funds has not previously been explored in any depth. The main exceptions are Busse et al. (2014), who use country-weight data to examine country selection ability in a time-series regression setting; and Gallagher et al. (2016), who use holdings data to perform an attribution of the benchmark-relative returns of global equity funds. We draw on a database of quarterly holdings for 90 global equity funds over the period 2002 to 2012. The data is sourced through BNY Mellon via Russell Investments, and reflects segregated institutional mandates. Academic research on institutional global equity funds is quite limited due to a lack of readily available data. Expanding research on the performance of institutional funds is important given that they manage considerably more assets than pooled retail mutual funds, and their performance may differ from retail funds due to differences in agency relationships and redemption arrangements. Institutional investors require information on active global equity fund performance to

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3 We initially investigated applying a version of the holdings-based analysis of Daniel et al. (1997) to our sample of global equity funds. However, the resulting alpha estimates were found to contain a substantial component related to currency fluctuations. Constructing benchmark portfolios with currencies was not feasible, as the available stocks within individual countries is variable and often insufficient. This provided the motivation to consider an alternative approach that could accommodate the incorporation of a broader range of factors, including currency factors.

4 Three exceptions include Busse et al. (2014), Gallagher et al. (2016) and Gerakos et al. (2016). However, these studies use different methods to the analysis presented in this study, e.g. time-series regressions with a more limited factor menu than our model, or attribution analysis.

5 Gerakos et al. (2016) estimate that worldwide institutional assets stood at USD 64 trillion in 2012, compared to USD 27 trillion in retail mutual funds. Further, institutions delegate USD 43 trillion of their assets to external mandates of the type we are examining.
assist them in deciding between active and passive management investment decisions, as well as in manager selection.

Our key findings are as follows. Our model indicates that both equity and currency factors are important in explaining variation in global equity returns. Statistically significant positive return premiums are earned on average over the sample period for five of the six equity factors, with Value and ROE generating the strongest returns, followed by ILLIQ, I/A and then Size (small stocks outperform large stocks). The exception is MOM, which posts volatile performance over the sample period. We also find that currency factors make an important additional contribution to explaining both currency returns and unhedged stock returns. For instance, average adjusted R² increases noticeably from 5.30% under an equity-only model of hedged returns, to 8.76% under the combined model of unhedged returns which includes both equity and currency factors. Under the combined model, the PPP-deviation factor is associated with significant positive returns on average, while average returns to Carry are positive yet insignificant. Performance of the Trend factor oscillates between positive and negative, and is insignificant on average. Overall, the increase in explanatory power from the inclusion of the currency style factors underpins the importance of accounting for currency in explaining stock returns and, by implication, fund performance.

With regard to the fund factor exposures, similar to the US fund literature (see Daniel et al., 1997), our sample of global equity funds is tilted towards larger stocks relative to the local market. Meanwhile, our fund sample is slightly underweight momentum. On average, the funds are also slightly positively exposed to ROE, but do not vary substantially from the market in terms of exposure to Value, I/A and ILLIQ. In relation to the currency factors, a significant negative exposure to Carry reveals that the average fund in our sample tilts away from countries with higher interest rates. Exposure to PPP-deviation varies from 2002 to 2012, with a minor tilt toward undervalued currencies on average. Exposure to Trend is insignificant. Nevertheless, although currency exposures may be moderate on average across the sample of funds over our sample period, all three currency factors are important in explaining variation in currency returns and hence fund performance over time.

Attribution of fund returns confirms the importance of accounting for factor exposures in identifying the sources of fund performance. After adjusting for the returns arising from equity factor exposures, our sample of funds generates alpha of -0.24% per quarter on average. Similarly, once the returns arising from currency exposures are accounted for under the combined model, average alpha is estimated at -0.18% per quarter. While neither the equity model nor the combined model generates average alpha values that are statistically significant, perhaps due a limited sample size, they are nevertheless economically meaningful at -0.96% p.a. and -0.72% p.a. respectively. In addition, alpha
would be further eroded once fees are accounted for; Gallagher et al. (2016) indicate that fees on global equity funds are in the order of 0.7% p.a. for institutional investors. The findings suggest that the average global equity fund in our sample provides exposure to various equity and currency factors, but does not demonstrate any particular stock or currency selection skill. Our analysis indicates that failure to account for exposure to systematic equity and currency factors may lead to fund managers being rewarded for performance that might be obtained at a lower cost through passive investments or more mechanical means of tracking factors such as ‘smart beta’ products. Furthermore, our findings support the notion that investors should look to manage currency exposures at the overall plan level, in contrast to accepting the currency exposures generated by active managers in an unhedged setting.

We examine the performance associated with selected styles by dividing the fund sample according to high- and low-exposure to Value, Size, MOM and ROE. Funds exposed to high Value, low MOM and low ROE are estimated to have generated statistically significant negative alpha over the sample period. Funds exposed to both high and low Size (i.e. smaller and larger stocks) also underperformed, but not significantly. Funds that were exposed to growth stocks, larger stocks, stocks with high profitability and stocks with high momentum all fared better; generating modestly positive but insignificant average alpha after adjusting for factor exposures. This analysis reveals that style matters for global equity funds; and that outperforming factors like Value might be more reliably captured through the more mechanical means referred to above, rather than through employing active value managers.

Finally, we test a version of our model under which the developed market and emerging market portfolio components are analyzed as separate regions. Such an approach is warranted given differing liquidity levels, information environments, and market, economic and political structures (Lesmond, 2005; Bekaert and Harvey, 2003 and Diamonte, Liew and Stevens, 1996). This approach generates similar average alpha after accounting for both equity and currency style factors of -0.18% per quarter (-0.72% p.a.). However, the explanatory power of the regional regressions is higher than under the global model, hinting at the possibility of market segmentation. This analysis uncovers a number of differences between developed and emerging market regions. The most notable relates to the performance arising from exposure to \textit{ILLIQ}, which is significantly positive only for emerging markets. We also uncover differences in the contribution of the various currency factors to returns; and a greater tendency for funds to underweight small caps in emerging markets.

The remainder of this paper is structured as follows. Section 2 provides background to the analysis. Section 3 provides details on the data. Section 4 outlines our research design. Results are presented in Section 5, followed by reporting of the robustness tests in Section 6. Finally, we offer concluding remarks in Section 7.
2. Background

A multitude of factors have been identified that are associated with the structure of equity returns (e.g. Harvey, Liu and Zhu, 2015). In addition to the market factor included in a standard capital asset pricing model (CAPM), we select for our analysis six equity factors that have received broad acceptance by researchers. The first three of Value, Size and MOM stem from the seminal papers by Fama and French (1993), Jegadeesh and Titman (1993) and Carhart (1997) that paved the way for the ubiquitous four-factor model. A number of studies highlight the profitability of momentum strategies internationally (e.g., Rouwenhorst, 1999, 1998; Chan, Hameed, and Tong, 2000; Chui, Titman, and Wei, 2010; Fama and French, 2012; Asness, Moskowitz and Pedersen, 2015). Additionally, in markets around the world, value stocks have been found to outperform growth stocks and a size premium to exist (Fama and French, 1998; Bauman, Conover and Miller, 1998). Factors highlighting the ‘quality’ of a stock have recently gained traction, specifically profitability and investment (Fama and French, 2015; Hou et al., 2014; Chen et al., 2011). This gives rise to our fourth and fifth equity factors, I/A and ROE. Finally, market illiquidity is also known to affect stock returns (see Amihud, 2002; Pistor and Stambaugh, 2003; Acharya and Pedersen, 2005), including in international markets (Amihud et al., 2015). The need to control for illiquidity is heightened by the fact that we examine returns across a wide range of markets, including emerging markets, which raises the possibility that global funds are exposed to illiquidity. We use the ILLIQ measure of Amihud (2002), which is widely-used in the literature and has been shown to provide a relatively effective measure of illiquidity, especially price impact (see Goyenko, Holden and Trzcinka, 2009).

Brusa et al. (2015) provide a detailed survey of the relevant asset pricing literature in an international context. The international CAPM recognises the role for currency factors, and raises the notion that international equity investors may be compensated for bearing currency risk. Specifically, it includes a world market portfolio and a series of additional factors to reflect the bilateral exchange rates between the major currencies across the world. In a similar vein, a number of papers examine the performance of factor models in international equity markets. Fama and French (2012) propose an international four-factor model including the market, value, size and momentum. They test local, regional and global versions of the model, with mixed results. Hou et al. (2011) find that a model incorporating momentum along with cash flow-to-price as a value measure provides a better fit for global stock returns than its Fama-French three-factor counterpart. Furthermore, Griffin (2002) shows that local models are more useful in explaining average stock returns than world and international versions of the Fama-French three-factor model for stocks from the US, Canada, Japan and the UK. However, these papers
considering common equity factors in international stock returns all ignore the issue of currency by converting stock returns data into USD to facilitate comparisons. An exception is Brusa et al. (2015) who propose an extended version of the international CAPM in the form of a three-factor model based on index data that includes a global equity factor denominated in local currencies, plus two currency factors of ‘dollar’ and ‘carry’. The authors show that their model improves upon global versions of the Fama and French (2012) model. Furthermore, Brusa et al. (2015) find that international mutual funds are compensated for bearing currency risk, thus raising the potential importance of incorporating currency factors when analysing the performance of funds that operate in international markets.

We build on the concepts considered by Brusa et al. (2015). However, our research differs in a number of notable ways. First, Brusa et al. (2015) examine retail international mutual funds and hedge funds, whereas our focus is on institutional global equity funds. Second, our modelling method differs. We estimate factor exposures of stocks based on characteristics, and extract factor returns using cross-sectional regressions; and then employ portfolio holdings data to estimate the factor exposures of funds and extract alpha. In contrast, Brusa et al. (2015) analyze fund returns, and estimate factor returns and loadings through time-series analysis. Third, we consider a broader range of factors, including six equity and three currency factors.

We extend the cross-sectional regression-based benchmark method that Chan et al. (2009) apply in evaluating US equity funds, by expanding the set of equity factors considered, including currency factors, and using our method to evaluate global equity managers. Chan et al. (2009, p.4582) state that this model is “well known and extensively applied in financial research”. The method is also similar to that of Barra (1998): an approach that forms the basis of their performance evaluation and attribution models which are widely used by investment practitioners. This method involves multivariate cross-sectional regressions of stock returns on standardized stock characteristics in each period. The resulting parameter estimates represent the factor return associated with exposure to a unit of each characteristic during a given period. An advantage of this approach is that characteristic scores are able to respond instantaneously to changes in stock attributes (e.g. a dramatic fall in company earnings), and this feeds into the estimates of factor returns. In contrast, factor loadings generated by time-series regression models do not adjust rapidly to changes, as the estimation window covers a period of time (often 60 months).6

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6 The disadvantage of our method is the potential for an error-in-variables bias, as errors are not diversified across a number of factors since the regression for each factor is run separately in each period. Also, the reliability of the factor return estimates is subject to limited multicollinearity between the factors: we check this during our analysis.
One of our main contributions is to expand the analysis of returns in international equity markets by including a comprehensive set of well-known currency factors alongside equity factors. The three currency factors we employ capture ‘carry’, ‘trend’ and ‘value’, which reflect factors identified in the literature and in common usage within currency markets. The carry factor reflects strategies that aim to exploit interest rate differentials between countries, in which an investor borrows from (or shorts) countries with low interest rates, and invests (goes long) in countries with high interest rates. Empirical analysis reveals that exchange rates have not completely adjusted to arbitrage away interest rate differentials, resulting in the failure of uncovered interest rate parity (Burnside et al., 2011; Lustig et al., 2011). A carry factor replicates the return to a basket of high interest rate currencies net of a set of low interest rate currencies. Momentum in currency markets is highlighted by a number of papers, such that currencies that have been increasing in value continue to generate high returns (Burnside et al., 2011; Menkhoff et al., 2012; Moskowitz, Ooi and Pedersen, 2012; Okunev and White, 2003). This gives rise to the trend factor, which represents the return on currencies that have generated positive returns in the past, relative to the returns from a group of currencies with less attractive returns. The value factor we consider is based on deviations from purchasing power parity (PPP-deviation), which is one measure of currency value. This theory states that the exchange rate between two countries will eventually adjust so that the purchasing power of each currency will be in equilibrium. Taylor (2002) provides a comprehensive review of the research in this area; and studies a wide-ranging dataset of 20 currencies, attributing deviations to nominal exchange rate volatility. Pojarliev and Levich (2012) present a comprehensive review of currency style factors and active currency investing by institutional managers, highlighting the role of the three factors that we employ. In recent years, a number of index products have emerged that seek to exploit the returns to these three currency factors, for example the Deutsche Bank FX Indices and Russell Investments Conscious Currency Indexes (Toner and Fjelstad, 2013).

We also contribute to the literature on the performance of fund managers in international markets. In addition to Brusa et al. (2015), several papers consider retail international and global equity fund performance. Tsai and Wu (2015) examine international and global equity retail funds, and show that on average the total performance and security selection abilities of both foreign and global funds are significantly negative and exhibit short term predictability. Breloer et al. (2014) examine a sample of US-based international and global retail funds using a version of the international, index-based Fama and French (1993) three-factor model, extended to include country and sector momentum. They find that more than 50% of funds exhibit significant exposure to at least one of these factors. Turtle and Zhang (2012) determine that the performance of international (developed and emerging market) funds located in the US varies across market regimes. Huij and Derwall (2011) investigate the relation

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7 International funds invest outside of the local market; whereas global funds invest across all markets in the world, incorporating the local market.
between the performance of global equity funds domiciled in the US and portfolio concentration. They find that funds with higher levels of tracking error outperform their more diversified counterparts, mainly due to exposure to a number of market segments (styles, sectors and countries). We note that this body of research is dominated by time-series multivariate regression techniques.

Meanwhile, research examining institutional global equity funds is sparser. This reflects in part the lack of readily accessible, publicly available databases for institutional funds, most notably separately managed (or segregated) mandates. Research into such institutional funds usually relies on accessing data held by asset consultants or custodians. We utilize such a database, obtaining both returns data and portfolio holdings. Three notable papers access similar datasets in order to examine the returns of institutional funds. Gallagher et al. (2016) use holdings data to attribute the benchmark-relative returns of 143 institutional global equity funds into contributions from market, currency and security selection. They find that global funds beat their indices by around 1.2% to 1.4% p.a. on average, largely through security selection. These authors draw on an expanded version of the dataset used in this study, including funds based in a range of currencies. The other two studies use a time-series regression approach. Busse et al. (2014) use returns and country weight data to evaluate institutional global equity funds over the period 1991-2009. They uncover significant alpha under a one-factor model, which disappears under the four-factor model. Gerakos et al. (2016) examine a broad sample of institutional mandates across multiple sectors from 2000 to 2012. While their overall sample significantly outperforms their benchmarks by an average of 0.96% p.a. before fees and 0.49% p.a. after fees, the ‘global public equity’ sub-sample is reported to outperform by an insignificant 0.58% p.a. prior to fees and zero after fees. We build on this research by expanding the range of factors examined, including adding currency factors, and utilizing holdings data to directly identify and analyze the style factor exposures held by these funds.

Examining the performance of institutional funds is important. Not only do such funds contain considerably more assets than retail mutual funds (see Gerakos et al., 2016), but there are also reasons why the performance of the two groups may differ. Institutional mandates can benefit from closer monitoring by informed investors/clients, and may be less exposed to any agency problems arising within fund families. Further, because institutional mandates are often managed as segregated accounts, they are not subject to the costs associated with providing immediate liquidity that arise within pooled, open-ended funds. These costs have been shown to reduce fund returns by around 1% p.a. or more (for instance, see Edelen, 1999; Coval and Stafford, 2007; Chen et al., 2010). Hence our research offers an opportunity to expand the understanding of an important investor class, including discrete accounts where fund liquidity shocks are mitigated.
3. Data

3.1 Fund Holdings Data

We use a dataset of quarterly stock holdings and reported returns for 90 institutional active global equity funds whose portfolios are managed in USD. The dataset was developed using data from BNY Mellon in conjunction with Russell Investments, and extends from 2002 to 2012. The holdings data comprises stock weights. However, we do not have access to asset values for the funds. Each ‘fund’ in the sample is a separately managed institutional strategy, with a long-only mandate. The coverage of stock holdings is limited to the equity portion of the fund, and does not include cash, derivatives or other non-stock holdings data.

The sample data may suffer from self-selection bias, given that managers may (to a degree) have some choice of the account for which data is provided to BNY Mellon, or may omit some holdings information. It is not possible to quantify the impact of any such self-selection bias. In order to limit the potential impact of self-selection bias and other unobserved effects (e.g. intra-quarter trading); we exclude fund-quarter observations where the return gap between the holdings-based and reported portfolio returns is greater (less) than the 95th (5th) percentile. The median return gap for the funds from 2002 to 2012 is 0%, thus we are confident that the holdings data is representative of the funds’ portfolios. The data does not suffer from survivorship biases, as the BNY Mellon database retains funds which go out of business or which discontinue involvement. These funds are identified as inactive when this occurs.

Our sample is representative of segregated global equity mandates that are used by institutional clients such as Russell Investments, but not necessarily the full range of global equity products in existence or pooled funds where data is more broadly available and hence often the focus of academic research. To gauge the potential for the findings to vary across samples, we compared our funds with the USD-based global equity funds in the Morningstar Direct database. While the Morningstar database was found to contain a similar number of 98 comparable funds, closer examination reveals minimal overlap with only 29 funds being able to be matched based on the organisation and strategy name. In addition, only seven of the matched funds had return correlations exceeding 0.5. Comparing the average reported returns, our sample outperformed the Morningstar sample by an average of 0.57% per quarter.

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8 BNY Mellon is a custodian that collects and maintains the dataset upon which to conduct analysis. Blake et al. (2013) use quarterly returns for 2,385 UK pension funds provided by BNY Mellon. Christopherson et al. (1998) also use data from a related source, being Russell Data Services (RDS).
9 Holdings-based portfolio returns are estimated by weighting stock returns by stock weights as at the end of the prior calendar-quarter.
(2.31% p.a.), significant at the 1% level. This highlights that our sample differs considerably to retail-oriented pooled funds, and suggests that caution should be used in generalising from the results. The performance difference could arise from either selection biases, or it may reflect important differences in the structure and agency environment surrounding the two types of funds.

Table 1 presents descriptive data for our fund sample. Panel A reports broad sample statistics for the number of funds and the number of stocks held, with yearly observations reflecting averages over the four quarters. The number of sample funds increases from an average of 12 in 2002 to 63 in 2012. The number of stocks held is relatively stable over the sample period, ranging from 120 to 195. Panel B provides the average weighting by region as at December of each year.10 The fund sample holds stocks from 43 different countries, encompassing 33 currencies across seven regions. The funds consistently hold the greatest proportion of their portfolios in stocks from North America (47% on average), followed by developed markets (DM) in Europe and the Middle East (35% on average). Average weightings in Asia-Pacific (DM) grew by 19% to 6.9% from 2002 to 2012; whereas the average weight in Japanese stocks fell by 32% to 11.2%. Despite the funds increasing their holdings in Latin America and Asia-Pacific emerging markets (EM) over the sample period, EM still only constitute 8.6% of holdings at the end of 2012. We also compare the quarterly reported returns for our sample to the returns to the MSCI ACWI benchmark. The average (median) $R^2$ from these regressions is 93% (95%). The average (median) standard error is 2.5% per quarter (2.3%), consistent with a tracking error of around 4.5%-5.0% per annum.

**INSERT TABLE 1**

### 3.2 Equity Style Factor Data

We create a global stock dataset in order to compute global style factors in a similar manner to Busse et al. (2014); Hou et al. (2011) and Griffin (2002). Appendix A provides further information regarding the creation of this dataset.

We examine both hedged and unhedged USD returns. For the equity analysis, we estimate hedged returns based on the covered interest rate parity relation. These estimates are formed by obtaining short-term interest rates from Datastream.11 Our proxy for the risk-free rate is the three-month US

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10 The regional classification follows MSCI (2016b). Frontier, standalone and unclassified markets are omitted from Panel B, as they represent a minute portion of the sample.
11 The interest rates used are listed in Appendix B for the countries included in our final dataset.
Treasury Bill rate. We create quarterly returns using compounding of the component monthly returns. Additionally, once a stock is delisted, Datastream includes the last value for a given variable for that stock in any future time periods. Therefore we remove all data after a stock’s delisting date where applicable. We apply a minimum market capitalization filter of USD 50 million after examining the distribution of market capitalization for the stocks held by the funds, in order to ensure that our results are not influenced by small, illiquid stocks that are not in the potential investment universe of most funds. In the interests of consistency, we also remove stocks from our fund holdings dataset that have a market value less than USD 50 million. Our final holdings dataset contains 99.8% (99%) of the stocks held by the funds by stock weight (number).

Calculation of the stock characteristics that are used to estimate the equity style factors closely follows the literature. Value is measured as the equal-weight average of cash flow-to-price (CF/P) and book-to-market (B/M). CF/P is calculated as (positive) funds from operations for quarter \( t-2 \) over market value as at the end of quarter \( t-1 \); and B/M is measured as (positive) book value of common equity for quarter \( t-2 \) over market value as at the end of quarter \( t-1 \). Size is based on market capitalization as at the end of each quarter \( t-1 \). MOM is the prior 11-month local currency return, skip one month, using returns for the period ending as at the end of each quarter \( t-1 \). I/A equals the total assets for quarter \( t-2 \) divided by total assets for quarter \( t-3 \). ROE is computed as income before extraordinary items, divided by book equity for quarter \( t-2 \). ILLIQ is represented by Amihud’s (2002) illiquidity measure, which is estimated as the average ratio of the daily absolute return to the (dollar) trading volume per day, averaged over quarter \( t-1 \). The equity style factor variables are winsorized at the 1st and 99th percentiles for each quarter, within each country, to reduce the potential for distortion by outliers. Similarly, the stock holdings of the funds are winsorized at the 1st and 99th percentiles for each equity variable by year.

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12 We employ Ince and Porter’s (2006) monthly return screen cited in Hou et al. (2011), whereby any monthly return above 300% that is reversed within one month is treated as missing.
13 We include CF/P in light of Hou et al.’s (2011) results. B/M is also used given its prominence in the literature. We found the composite measure to provide a superior value strategy, generating greater outperformance than both factors individually.
14 We also generate results where the equity variables and holdings are not winsorized. These are consistent with those reported, as are the results generated when the equity variables are winsorized and the holdings are not winsorized. We focus on the version of the results in which both the stock variables and holdings are winsorized, which leads to a better fit under the regression model.
15 Missing characteristic values for stocks held by the funds are set to zero and these holdings are included in further analysis, thus that the stock weights are not affected.
3.3 Currency Style Factor Data

Quarterly spot exchange rates are primarily sourced from the International Monetary Fund’s (IMF) International Financial Statistics (IFS) database.\textsuperscript{16} The period average of the three component months is used. All exchange rates are quoted in USD relative to units of local currency. In each quarter \( t \), we use the currency style factors as at quarter \( t-1 \). Again our calculations closely follow the literature.

\textit{Trend} is the difference between the spot rate averaged over three months and the spot rate averaged over 12 months, divided by the spot rate averaged over 12 months. For example, \textit{Trend} for March of year \( t \) is the spot rate averaged across October, November and December of year \( t-1 \), minus the spot rate averaged from January to December of year \( t-1 \), divided by the spot rate averaged from January to December of year \( t-1 \). The calculation is similar to that of the AFX Currency Management Index used by Pojarliev (2011), although in our case we are calculating a moving average on a quarterly basis in order to be comparable with the calculation of \textit{MOM} for equities.

\textit{Carry} is determined by estimating forward rates using covered interest rate parity. Specifically, we calculate \textit{Carry} as \( \left[ \frac{(1+ \text{Risk-Free Rate Foreign})}{(1+ \text{Risk-Free Rate Local})} - 1 \right] \) using three-month risk-free rates. The calculation is in a similar vein to the Deutsche Bank G10 Harvest Index used by Pojarliev (2011).

The \textit{PPP-deviation} factor, which is a ‘value’ factor for currencies, is based on percentage deviation from PPP. The estimation of PPP is based on Consumer Price Index (CPI) data for All Items, predominantly taken from the IMF’s IFS database. \textit{PPP-deviation} is calculated by dividing a dynamically re-based measure of PPP versus the USD by the quarterly spot rate versus the USD, minus one. Refer to Appendix C for a detailed description of the calculations. If \textit{PPP-deviation} is positive (negative), then the domestic currency is undervalued (overvalued) relative to the USD. Similarly, Pojarliev (2011) uses the Deutsche Bank Currency Value Index, which compares relative PPP deflated by monthly CPI differentials to current spot rates as a measure of fair value.

Our final dataset used for our regression analysis, detailed in the next section, contains 579,395 quarterly-stock observations for 25,549 firms representing 37 countries\textsuperscript{17} and 28 currencies. We restrict our analysis to stocks where data is available for all six equity characteristics and the three currency

\textsuperscript{16} Due to unavailability of month-end data, the average quarterly spot rate for the Czech Republic is sourced from the OECD and for Taiwan from MSCI via Datastream.

\textsuperscript{17} Argentina and Brazil are excluded due to the high volatility of their currencies; this is consistent with Barra (1998).
factors. Since the USD is used as the base currency when determining the currency characteristic values all US stocks have Carry, Trend and PPP-deviation values of zero.

4. Research Design

Our overall aim is to attribute fund excess returns in USD, defined as unhedged returns less the risk-free rate ($ExRetUH$), into contributions from the market, equity and currency ‘style’ factors and a ‘total’ alpha ($AlphaEC$). The latter reflects any skill in selecting both stocks and currencies, after accounting for returns arising from exposure to both equity and currency factors. We also separate the analysis into two components that explain hedged excess equity returns and currency excess returns, respectively. The equity component attributes excess equity returns hedged into USD ($ExRetH$) into contributions from the market (hedged), equity factors and an equity alpha ($AlphaE$). The latter provides a measure of stock selection skill, after accounting for returns arising from exposure to common equity factors. The currency component attributes the currency surprise ($CSurp$) into contributions from the market (unhedged relative to hedged market returns in USD), currency factors and a currency alpha ($AlphaC$). The latter provides a measure of currency selection skill, after accounting for returns arising from exposure to common currency factors. Currency surprise is estimated from the difference between the unhedged and hedged returns. The three sets of analysis reveal different elements of fund performance. Results from the two components need not sum precisely to the combined results, due to relying on regressions with different sets of explanatory variables, and the fact that the combined analysis embeds the cross-product term between equity and currency returns. Figure 1 sets out the analysis structure.

**INSERT FIGURE 1**

The fund attribution analysis rests on a cross-sectional characteristic-based ‘style factor’ model of equity and currency returns. The model estimates variations from the market return during a period arising from returns associated with exposure to selected characteristics (i.e. factors) in a multivariate setting. The ‘market’ is defined as the hedged and unhedged equity return for the equity and combined analysis; while for the currency analysis the market return is defined with respect to the difference between unhedged and hedged returns in USD on the overall market.

The analysis is undertaken during each quarter in four stages:

1: Calculation of exposures of stocks to each factor, as measured by standardized scores ($ZScores$) on characteristics that represent each factor.
2: Returns to style factors are extracted through a cross-sectional regression of stock excess returns on their factor ZScores. As the mean of each factor exposure is zero, the intercept represents the market return, and the estimated slope coefficients reflect the marginal return for a one standard deviation exposure to each factor.

3: Fund exposures to each style factor during each quarter are estimated as the weighted average ZScores across the stocks held based on the weight of each stock in the portfolio.

4: Fund excess returns are attributed into contributions arising from the market, factor exposures (calculated as the product of factor exposures and factor returns), and alpha (the residual).

Quarterly estimates are then averaged across time (yearly, and the full sample) for the purposes of reporting the results.

4.1 Equity Style Factor Analysis

This section describes the method of analysis of hedged equity returns using the six equity style factors: Value, Size, MOM, I/A, ROE and LIQU. As we are identifying the return to equity style factors only in a hedged environment, we do not consider the influence of currency in this setting. Given that forward exchange rate contracts reflect interest rate differentials under the covered interest rate parity relation, the analysis of hedged equity returns has the effect of making an implicit adjustment for differences in interest rates, and hence return structures across countries.

1: Standardization of Equity Style Factors

The standardized ZScore exposure for stock i to equity style factor ef during quarter t is estimated from data at the end of quarter t-1 to avoid look-ahead bias. It is calculated as the difference between the stock’s raw exposure (\(RawExp\)) and the market capitalization weighted average exposure (\(Mkt.Avg\)) for all stocks in country c, for equity style factor ef, divided by the equal-weighted standard deviation (\(Std.Dev\)) for all stocks in country c, for that equity style factor ef. The method ensures that the market universe has a market capitalization-weighted mean of zero and a standard deviation of one, i.e. the “market portfolio” for the local market is factor neutral. Our measures of equity style factor exposure are based on characteristics representing each factor, e.g. market capitalization for Size, or an average of CF/P and B/M for Value. Equation (1) describes the calculation.

\[
Z\text{Score}_{i,t-1,ef} = \frac{(RawExp_{i,t-1,ef} - Mkt.Avg_{c,t-1,ef})}{Std.Dev_{c,t-1,ef}}
\]
Table 2 presents the time-series average of the market capitalization-weighted quarterly correlations between the ZScore values for each style factor.\textsuperscript{18} The average correlations are all small. We also examine the distribution of the correlations between the equity factors in each quarter, and find that they are all low.\textsuperscript{19} This confirms that multicollinearity is limited, indicating that there are no major issues with combining the variables in a regression model.

**INSERT TABLE 2**

2: *Equity Style Factor Returns*

The equity style factor returns are estimated through cross-sectional multivariate regressions of the hedged USD stock return in excess of the risk-free rate in quarter \( t \) (\( \text{ExSRetH}_{it} \)) on the ZScore exposures for each of the six equity style factors (\( ef \)), for each stock \( i \) from quarter \( t-1 \). The regression is described by equation (2):

\[
\text{ExSRetH}_{it} = \lambda_{0,t} + \sum_{ef=1}^{6} Z\text{Score}_{i,t-1,ef} \ast \lambda_{ef,t} + \nu_{i,t}
\] (2)

*Where:*

- \( \lambda_{0,t} \) = intercept; represents the hedged return on the market portfolio for quarter \( t \)
- \( \lambda_{ef} \) = return to one-unit of standardized exposure to equity factor \( ef \) during quarter \( t \)
- \( \nu_{i,t} \) = error term; expected value of zero

The regression approach is similar to that of MSCI Barra, whose models are widely used by investment practitioners and acknowledged as a valid approach by Chan et al. (2009). The parameter estimates generated by the model are interpreted as the return to one-unit of standardized exposure to each style factor during quarter \( t \). The standardization of style factor scores ensures consistency of units across the regression estimates. To ensure that outliers do not influence the model, any ZScores that are greater (less) than +4.0 (-4.0) are set to +4.0 (-4.0).\textsuperscript{20} Each stock \( i \) is weighted by its market capitalization as at quarter \( t-1 \), thus establishing consistency with the market definition while ensuring that undue weight is not applied to small stocks.

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\textsuperscript{18} We examine the correlations between the factor exposures to ensure that no two variables are highly correlated, as this could result in the generation of unreliable parameter estimates under the multivariate regressions.

\textsuperscript{19} There are five quarters in which the correlation between any two equity factors is greater than 0.3, and none in which the correlations are greater than 0.4.

\textsuperscript{20} This differs from Barra (1998), who delete observations with ZScores greater (less) than 10.
3: Fund Exposures to Equity Style Factors

We compute the exposure to each style factor $ef$ for fund $j$ in each quarter $t-1$ as the weighted-average of the ZScore exposures across all stocks held, as described by equation (3). The weight applied ($W_{i,j,t-1}$) is the weight of each stock $i$, held by fund $j$ in quarter $t-1$.

$$ZScore_{ef,j,t-1} = \sum_{i=1}^{N}(ZScore_{i,ef,j,t-1} \times W_{i,j,t-1})$$ (3)

4: Attribution of Hedged Excess Fund Returns

The contribution to excess returns from exposure to equity factor $ef$ for fund $j$ in quarter $t$ ($EFRC_{ef,j,t}$) is estimated as the product of the factor exposure and the factor return, as described by equation (4). Alpha arising from exposure to the equity factors ($AlphaE$) is estimated for fund $j$ in quarter $t$, by extracting out the market return ($\lambda_{0,t}$) and the sum of returns attributable to exposure to the six equity factors. The calculation is described by equation (5), which effectively estimates the alpha component from USD hedged returns in excess of the risk-free rate ($ExFRetH$) as a residual after accounting for returns arising from exposure to the market and the style factors. The calculation of $ExFRetH$ is defined by equation (6).

$$EFRC_{ef,j,t} = ZScore_{ef,j,t-1} \times \lambda_{ef,t}$$ (4)

$$AlphaE_{j,t} = ExFRetH_{j,t} - \lambda_{0,t} - \sum_{ef=1}^{EF} EFRC_{ef,j,t}$$ (5)

Where,

$$ExFRetH_{j,t} = \sum_{i=1}^{N}(ExSRetH_{i,j,t} \times W_{i,j,t-1})$$ (6)

$ExSRetH_{i,j,t}$ is the hedged stock return in USD to each stock $i$ held by fund $j$, in excess of the risk-free rate for quarter $t$. $W_{i,j,t-1}$ is the weight of each stock $i$, held by fund $j$ in quarter $t-1$.

4.2 Currency Style Factor Analysis

The component of returns that is attributable to the currency surprise ($CSurpS$) is analyzed using three currency style factors identified in the literature as drivers of currency returns: Trend, Carry and PPP-deviation (a measure of value). Currency surprise captures the portion of stock returns that is not able to be mitigated using forward exchange rate contracts, as determined by interest rate differentials under covered interest rate parity. We separate the unhedged USD return into the hedged component (estimated as the sum of the local currency return and the risk-free rate differential), and the currency surprise (reflecting the difference between the unhedged and hedged return). $CSurpS$ with respect to
stock $i$ in quarter $t$ is estimated by equation (7), i.e. the ratio of one plus the USD unhedged return and the hedged return, less one.\[21\]

$$CSurp_S_{it} = \frac{(1 + ExRetUH_{it})}{(1 + ExRetH_{it})} - 1$$ (7)

Describing returns in this manner effectively treats currency surprise as an excess currency return, which is in turn related to the aforementioned currency factors. The performance attribution literature undertakes similar delineations to identify active currency selection and the currency surprise for global fund returns (Ankrim and Hensel, 1994; Singer and Karnosky, 1995).

1: Standardization of Currency Style Factors

The currency factors are standardized in a similar manner to the equity style factors. The estimation is described by equation (8). The standardized ZScore exposure for stock $i$ for currency style factor $cf$ during quarter $t$ is calculated by taking the difference between its raw exposure ($RawExp$) to currency style factor $cf$ and the market capitalization-weighted average exposure ($MktAvg$) for all stocks during quarter $t-1$, and dividing by the equal-weighted standard deviation ($StdDev$) across all stocks for that currency style factor $cf$ in quarter $t-1$. For example, the Carry ZScore for a UK-listed stock is the Carry characteristic value for the UK Pound (based on the observed risk-free rate differential versus the US), less the market capitalization-weighted average Carry value across all stocks in the market universe, then divided by the equal-weighted standard deviation of the Carry characteristic based on all stocks included in the dataset in a given quarter.

$$ZScore_{i,t,cf} = \frac{(RawExp_{i,t,cf} - MktAvg_{t-1,cf})}{StdDev_{t-1,cf}}$$ (8)

Table 2 reports the correlations between the ZScores for the currency style factors weighted by market capitalization. All correlations are low on average, indicating that there are no meaningful multicollinearity issues for the regression model.\[22\]

2: Currency Style Factor Returns

Similar to the generation of the equity style factor returns, the currency style factor returns are generated from cross-sectional multivariate regressions of $CSurp_S_{it}$ against the standardized stock exposures for each currency style factor from the prior quarter. As previously, ZScores greater (less)

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21 This approach abstracts from the cross-product term, which we do not analyze explicitly. The cross-product term is subsumed in the unhedged returns, and hence may influence the results under the combined analysis.

22 Although, there is one quarter in which the correlation between the ZScores for Carry and Trend is 0.76 and one quarter in which the correlation between the ZScores for Carry and PPP-deviation is 0.62. As a robustness test we generate results excluding these two quarters and they are consistent with those presented.
than +4.0 (-4.0) are set to +4.0 (-4.0). The resulting coefficients ($\lambda_{ij}$) can be interpreted as the return to an exposure that is one standard deviation away from the mean for each currency style factor during quarter $t$. Each stock $i$ is weighted by its market capitalization as at quarter $t-1$, thus establishing consistency with the market while ensuring that small stocks are not overrepresented. The regression we estimate is described by equation (9):

$$CSurpS_{it} = \lambda_{0t} + \sum_{cf=1}^{3} ZScore_{it-1,cf} * \lambda_{cf,t} + v_{it}$$  \hspace{1cm} (9)

Where:
- $\lambda_{0t}$ = intercept; represents the currency surprise for the market portfolio for quarter $t$
- $\lambda_{cf,t}$ = return to one-unit of standardized exposure to currency factor $cf$ during quarter $t$
- $v_{it}$ = error term; expected value of zero

3: Fund Exposures to Currency Style Factors

Fund exposures to currency style factors in quarter $t$ are estimated with reference to portfolio weights and ZScores for quarter $t-1$ (i.e. beginning of quarter $t$). We compute the exposure to each currency style factor $cf$ for fund $j$ for each quarter as the weighted-average of the ZScore exposures to each stock $i$ held by the fund. The weight applied is $W_{ij,t-1}$, i.e. the weight of each stock $i$, held by fund $j$ in quarter $t-1$. Formula (10) describes the calculation.

$$ZScore_{cf,j,t-1} = \sum_{i=1}^{N}(ZScore_{i,cf,j,t-1} * W_{ij,t-1})$$ \hspace{1cm} (10)

Given that the USD is the base currency, all USD-based stocks will not have a standardized currency style factor value for any of the three currency factors. Hence USD-based stocks are assigned a ZScore value of zero. This ensures that the weights (i.e. $W_{ij,t-1}$) used to calculate the average ZScore value for each fund are consistent with the portfolio weights.

4: Attribution of Currency Surprise Returns for Funds

The contribution to excess returns from exposure to currency factor $cf$ for fund $j$ in quarter $t$ ($CFRC_{ij,t}$) is estimated as the product of currency factor exposures and currency factor returns, and is described by equation (11). Fund alpha arising from currency exposure ($AlphaC$) is estimated for fund $j$ in quarter $t$ by extracting out the currency surprise for the market and the sum of the returns attributable to exposure to the three currency factors. The calculation is described by equation (12), and effectively isolates the alpha component of the currency surprise for fund $j$ ($CSurpF_{ij,t}$) as defined by equation (13).
\[ CFRC_{cf,j,t} = ZScore_{cf,j,t-1} \ast \lambda_{cf,t} \]  

(11)

\[ AlphaC_{j,t} = CSurpF_{j,t} - \lambda_{0,t} - \sum_{cf=1}^{3} CFRC_{cf,j,t} \]  

(12)

Where,

\[ CSurpF_{j,t} = \sum_{i=1}^{N} (CSurpS_{i,j,t} \ast W_{i,j,t-1}) \]  

(13)

\( CSurpS_{i,j,t} \) is the currency surprise for each stock \( i \) held by fund \( j \) during quarter \( t \). \( W_{i,j,t} \) is the weight of each stock \( i \), held by fund \( j \) in quarter \( t-1 \).

### 4.3 Combined Equity and Currency Style Factor Analysis

The combined analysis relates unhedged equity returns to the six equity style factors (Value, Size, MOM, I/A, ROE and ILLIQ) and the three currency style factors (Trend, Carry and PPP-deviation).\(^{23}\) For these purposes, we only need to describe the regression model as it involves a different dependent variable and a wider set of factors. The independent variables (i.e. the style factor ZScores) are consistent with those explained previously. The fund exposures to each style factor are also consistent with those generated in the equity and currency sections separately. Nevertheless, the factor returns and parameter estimates will differ due to the alternative model specification. There are three notable differences between the combined analysis and the separate equity and currency analysis. First, the independent variable includes both the hedged equity and currency return components, which are now being related to new factors. It is possible that the equity factors could be related to the currency returns; or that the currency factors could be related to the hedged equity returns. Second, the unhedged USD return embeds the cross-product term between the currency surprise and the hedged equity returns which were factored out of the analysis of hedged equity and currency surprise returns. Third, all factors are being included simultaneously, and although their correlations are low, they are not completely orthogonal. Thus, the factor returns and hence the return attribution and fund alpha estimates may vary from those revealed under the equity and currency analysis, although the method of calculation is equivalent to that described previously.

\(^{23}\) The Barra Global Equity Model is used to decompose the risk in a portfolio across common factors including country, industry and equity style factors. Barra considers the “currency return” in their Global Equity Model. However, this is simply the risk-free market return plus changes in the exchange rate for a given market (Barra, 1998). We augment this approach by considering currency “style” factors namely Trend, Carry and PPP-deviation.
1: Standardization of Equity and Currency Style Factors

We use the standardized equity and currency style factors previously created. As previously discussed, Table 2 reports the time-series averages of the quarterly correlations over the sample period for the factors, which are low across all factors on average.\(^\text{24}\)

2: Equity and Currency Style Factor Returns

The dependent variable in our cross-sectional multivariate regressions is the USD unhedged stock return in excess of the risk-free rate for each stock \(i\) in quarter \(t\) (\(\text{ExSRetUH}_{it}\)). Comparable to the separate equity and currency factor regressions, we weight each stock by its market capitalization as at quarter \(t-1\). The regression model is described by equation (14):

\[
\text{ExSRetUH}_{it} = \lambda_{0,t} + \sum_{ef=1}^{6} Z\text{Score}_{i,t-1,ef} * \lambda_{ef,t} + \sum_{cf=1}^{3} Z\text{Score}_{i,t-1,cf} * \lambda_{cf,t} + \nu_{i,t}
\]

(14)

Where;

- \(\lambda_{0,t}\) = intercept; represents the unhedged return to the market portfolio for quarter \(t\)
- \(\lambda_{ef,t}\) = return to one-unit of standardized exposure to equity factor \(ef\) during quarter \(t\)
- \(\lambda_{cf,t}\) = return to one-unit of standardized exposure to currency factor \(cf\) during quarter \(t\)
- \(\nu_{i,t}\) = error term; expected value of zero

3: Fund Exposures to Equity and Currency Style Factors

The fund exposures for each of the equity and currency style factors are computed in the same manner as outlined previously, and are hence identical.

4: Attribution of Unhedged Excess Fund Returns

The method of attributing unhedged excess fund returns is similar to that applied for the hedged and currency surprise returns, although the estimates will differ as a consequence of differences in the dependent variable and estimated factor returns. \(\text{AlphaEC}\) for fund \(j\) in quarter \(t\) is computed as the unhedged excess return (\(\text{ExFRetUH}\)) to fund \(j\) in quarter \(t\), minus the market return and the sum of contributions from exposures to the six equity factors (\(\text{EFRC}\)) and three currency factors (\(\text{CFRC}\)). The estimation is described by equation (15).

\(^{24}\) The correlations between the equity and currency style factors are zero on average. We investigate this further by calculating the correlations within each country using the 44 sample quarters; the results are consistent. We also examine equal-weight correlations and find that the resulting values are larger, but still low or near zero. Thus the magnitude of the correlations presented in Table 2 appears due to the underlying data distribution, albeit attenuated when market capitalization weighting is applied.
\[ \text{AlphaEC}_{j,t} = \text{ExFRetUH}_{j,t} - \lambda_{0,t} - \sum_{ef=1}^{\delta} \text{EFRC}_{ef,j,t} - \sum_{cf=1}^{\gamma} \text{CFRC}_{cf,j,t} \] (15)

\[ \text{ExFRetUH}_{j,t} = \sum_{i=1}^{N} (\text{ExSRetUH}_{i,j,t} \times W_{i,j,t-1}) \] (16)

\( \text{ExSRetUH}_{i,j,t} \) is the USD unhedged stock return to each stock \( i \) held by fund \( j \), in excess of the risk-free rate for quarter \( t \). \( W_{i,j,t} \) is the weight of each stock \( i \), held by fund \( j \) in quarter \( t-1 \).

5. Results

We initially report the results of the separate analyses of hedged returns based on exposure to the six equity style factors and currency returns using the three currency style factors, before reporting results for the combined analysis examining unhedged returns with both sets of factors included. This is followed by presenting results where the sample is broken down by developed and emerging market regions. Finally, we report on the findings where fund performance is related to style exposures.

5.1 Results for Analysis of Hedged Returns Using Equity Factors

Table 3 contains the results for the analysis of hedged returns using equity style factors. Panel A reports the average equity factor exposures across the sample of funds. The weighted ZScore exposure for each factor is calculated for each fund-quarter based on the weight of each stock in the portfolio. The equal-weight average ZScores for each equity factor (\( \text{ef} \)) across all funds in quarter \( t \) are then determined. The average of the four quarterly values for each year is provided, as well as the time-series average. The standard deviation (\( \text{Std Dev} \)) for each variable over the 44 sample quarters is also reported. The proportion of significant quarters (\( \% \text{Sig Qtrs} \)) indicates the percentage of sample quarters in which the average ZScore exposure is significant at the 5% level. The proportion of quarters in which the average ZScore exposure is positive (\( \% \text{Qtrs} > 0 \)) is also provided. These statistics indicate the significance and consistency of the average ZScore exposures for the fund sample.

**INSERT TABLE 3**

The average \( \text{Value} \) ZScore over the sample period is -0.02, significant at the 1% level. Furthermore, the exposures are negative in 59% of the quarters. This indicates that our global equity fund sample

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25 Since we do not have asset-weights for the fund sample, we can only calculate equal-weight averages.
26 We also compute the pooled average exposures and fund returns based on the 1,649 quarterly fund observations in our sample. These estimates are consistent with the time-series averages presented in Table 3.
exhibits a slight by consistent tilt away from value stocks relative to the local market. The average Value ZScore is significant at the 5% level in 11% of the sample quarters. Of course, the sample averages may be obscuring style differences across funds. For example, the exposures of value and growth funds may be offsetting each other within the full sample. We break down the sample by fund style further below. An average Size ZScore exposure towards small stocks of -0.55 (significant at the 1% level) indicates that overall the funds prefer large stocks over small stocks. This is consistent with previous research on US funds (Daniel et al., 1997; Gallagher, Gardner, Schmidt and Walter, 2014). Further, the Size ZScore is negative in all of the sample quarters. Under-exposure to MOM is detected, with the average ZScore of -0.05 being significant at the 1% level. Additionally, 82% of quarters have a negative average exposure to MOM. This indicates that the average fund in the sample is not a momentum investor. The average I/A ZScore is marginally negative in all sample years, and the time-series average of -0.02 is significant at the 5% level. The I/A ZScore average is negative in 75% of quarters. Thus, the funds hold stocks which have slightly lower levels of investment relative to the market universe. Funds in our sample prefer stocks with higher profitability than the market, with an average ROE ZScore of 0.06, significant at the 1% level. This is consistent with the US fund characteristics literature (Covrig et al., 2006). The ROE ZScore is also positive in 98% of the sample quarters, and the average across the funds is significant in 59% of these quarters. The average ILLIQ ZScore stands at -0.02, which while small is significant at the 1% level. Average ILLIQ exposure is negative 100% of the time and significant during 98% of the 44 sample quarters. Therefore, the sample funds appear to consistently prefer stocks with slightly lower than average illiquidity. The standard deviations indicate that the ZScore for Size varies the most at 0.21, whilst for the other factors it ranges from 0.01 for ILLIQ to 0.06 for MOM.

Panel B presents the average coefficient estimates from the cross-sectional multivariate regression of hedged excess stock returns (ExSRetH) on the standardized ZScore exposures across the stock universe. Under this regression, the intercept represents the return to a stock with zero factor exposures, which equates to the market return. The slope coefficients can be interpreted as the incremental quarterly return arising from a one-unit ZScore exposure to each factor. Coefficients are estimated quarterly, and then averaged over each year and the entire sample period. The average market return based on the intercept is 1.51% per quarter (not statistically significant). The market return is positive in 66% of the quarters and significant at the 5% level in 100% of quarters. The performance of the intercept is almost identical to that of the market capitalization-weighted average excess hedged return to all stocks (i.e. the market return, as reported in the first column of Panel B), which indicates that our model is well specified.
The strongest performing style factor over the sample period is ROE, with a highly significant average return of 1.81% (7.44% p.a.) per one-unit of ZScore exposure. The return to ROE is positive in 93% of quarters and statistically significant in 91% of quarters. Value and ILLIQ also perform well, with average quarterly returns per unit of exposure of 1.80% (7.40% p.a.) and 0.73% (2.95% p.a.), respectively. Value is significant in 89% of the sample quarters, and positive 82% of the time. ILLIQ is significant in 59% of quarters, and positive 66% of the time. The quarterly standard deviations for Value, ROE and ILLIQ are moderate at 2.07%, 1.84% and 1.68%. The average return per unit of exposure to Size is 0.20%, significant at the 1% level, and is interpreted as the return to small stocks relative to large stocks. Returns to Size are positive in 66% of quarters, and significant 82% of the time. Thus Size is an important factor in terms of explanatory power for global stock returns. Additionally, Size is the least volatile of all of the style factors with a quarterly standard deviation of 0.48% (0.96% p.a.). The return per unit of exposure to MOM is 0.11% on average and not statistically significant. This is not surprising given that performance fluctuates considerably over the sample period, which is clear from the substantial standard deviation of 3.28% per quarter (6.56% p.a.). In particular, MOM underperforms considerably in 2009 with an average quarterly return of -4.35%. This is consistent with the performance of the Fama and French factors for the US, as well as internationally.\(^{27}\) Nonetheless, MOM is a decidedly relevant factor for explaining returns, with 91% of quarterly returns significant at the 5% level. I/A has an average return of 0.39% over the sample period, which is highly significant. Furthermore, it performs positively in 68% of quarters, and the proportion of significant quarters is 66%. An average R\(^2\) of 5.34% and an adjusted R\(^2\) of 5.30% indicate that only a modest portion of the variance of hedged quarterly stock returns is explained by the factors, with the bulk of variance seemingly attributable to idiosyncratic risk.

The contribution to average fund returns arising from the equity style factor exposures can be approximated by multiplying the average quarterly ZScore in each year from Panel A by the average quarterly style factor return for that year from Panel B.\(^{28}\) The time-series averages of these quarterly contributions (% Contrib) are reported at the bottom of Panel B. It is clear that the funds’ negative exposures to small stocks contribute negatively to fund performance, noting that Size performs positively on average over the sample period. The under-exposure to Size subtracts -0.12% (-0.48% p.a.) from returns, the largest of any factor. The funds’ average positive exposures to ROE contribute positively to returns at a rate of 0.10% per quarter (0.39% p.a.). Negative exposures to Value and MOM reduce the average fund return by -0.05% (-0.19% p.a.) and -0.03% (-0.10% p.a.), respectively. Negligible contributions arise on average from exposures to I/A and ILLIQ.

\(^{27}\) The Fama-French factor returns for the US and Internationally are available for download from Ken French’s data library: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

\(^{28}\) The average factor contributions as calculated from the product of two averages are indicative only; and we do not estimate their statistical significance.
Panel C reports the average quarterly fund returns for each year and over the sample period. The excess fund return on a hedged basis (\( \text{ExFRetH} \)) is reported; while alpha (\( \text{AlphaE} \)) reflects fund returns after adjusting for the returns that are attributable to exposure to the market and equity style factors. The average hedged excess fund return of 1.17% is not statistically significant. Excess returns are negative in 2002 and 2008 in conjunction with the tech-crash and Global Financial Crisis, as well as in 2011. Excess returns are significant in 93% of sample quarters, and positive about two-thirds of the time. After accounting for exposure to the factors, there is no evidence of outperformance on average, with \( \text{AlphaE} \) averaging only -0.24% per quarter (-0.96% p.a.) which is insignificant. Evidently the funds do not exhibit consistent skill in selecting stocks that outperform their local equity markets, over and above any returns that can be related to equity style factors. Alpha is statistically significant 45% of the time, and positive in 41% of the quarters. The risk associated with pursuing alpha is reflected by a standard deviation for \( \text{AlphaE} \) of 1.22% per quarter (2.44% p.a.).

5.2 Results for Analysis of Currency Returns Using Currency Factors

Table 4 reports the results for the analysis of currency returns using the currency style factors.\(^{29}\) Table 4 follows a comparable format to the equity analysis of Table 3, except that estimates are formed with respect to the excess return contribution arising from currency, which is evaluated with respect to exposure to the three currency factors of Trend (momentum), Carry (interest rate differentials) and PPP-deviation (value).

Panel A reports the average currency factor exposures across the sample of funds. Exposure to Trend is slightly positive with an average ZScore of 0.01, although this is statistically insignificant. Positive exposures on average are recorded in all years except 2005, 2008, 2010 and 2012, and in 57% of quarters. The standard deviation for Trend is 0.08 per quarter. The Trend factor is statistically significant in 52% of quarters. These estimates are consistent with a slight tendency towards holding stocks based in countries with rising currencies, although this does not appear to be a significant exposure on average for the overall fund sample. Average exposure to Carry is -0.09 and significant at the 1% level; and has the highest standard deviation at 0.10. Exposure to Carry is negative 82% of the time, with the largest average exposure of -0.23 recorded in 2012. The proportion of statistically significant quarters is 50%. Evidently, there is a tendency for funds to invest in stocks based in countries with relatively low interest rates. Exposure to PPP-deviation is also negative at -0.02 on average and significant at the 1% level. Exposures are negative in 64% of quarters; and the standard deviation is the lowest of all factors.

\(^{29}\) Additionally, we determine the pooled average exposures and fund returns based on the 1,649 quarterly fund observations in our sample. The results are comparable to the time-series averages presented in Table 4.
at 0.04. These results indicate that the funds tend to hold stocks denominated in currencies that are overvalued, and while small, that this exposure is relatively consistent. In summary, the average fund in our sample tends to be very slightly long Trend, but short both Carry and to a lesser extent PPP-deviation where exposures are more meaningful.

**INSERT TABLE 4**

Panel B summarizes the results of the cross-sectional multivariate analysis in which the currency surprise with respect to the sample of stocks (CSurpS) is regressed on the currency style factor ZScores during each quarter. The quarterly averages ZScores and parameter estimates in each year and over time are reported. The intercept represents the currency surprise for the market portfolio, i.e. the difference between the unhedged USD return and the hedged USD return for all stocks in our universe. The coefficients on the factor exposures of Trend, Carry and PPP-deviation capture the currency return arising from one-unit of standardized exposure to each factor over a quarter. The adjusted R² values average 23.05%. This indicates that the currency factors explain a greater proportion of currency returns than the equity factors explain of hedged stock returns, recalling that the reported average adjusted R² in Table 3 is 5.30%. Further, the factor return estimates are statistically significant in 95%, 89% and 98% of quarters for Trend, Carry and PPP-deviation, respectively. The return for a one-unit ZScore exposure to Carry is estimated to average -0.68%, which is significant at 10%; and its performance is negative 66% of the time. Therefore, currencies from low yielding countries have outperformed those with high interest rates during our sample period. The average return to Trend and PPP-deviation are not significant, and the associated factor returns vary from positive to negative with the percentage of positive quarters ranging from 50% for PPP-deviation to 52% for Trend. The Carry factor is the most volatile, with a standard deviation of 1.81% per quarter. PPP-deviation is the least volatile, with a standard deviation of 0.99% per quarter. While the average effect on returns from Trend and PPP-deviation is marginal and inconsistent, all three currency factors are nevertheless important in explaining variability in the returns that arise from currency exposure.

In order to approximate the average contribution to fund returns arising from currency factors, we calculate the product of the average fund factor exposure and return for each factor in each year. The time-series average contributions (% Contrib) are reported at the bottom of Panel B. The tendency for the funds to tilt away from Carry on average contributes 0.08% per quarter (0.32% p.a.) to returns, given that the Carry factor underperforms. The average exposures and factor returns for Trend and PPP-deviation are low; therefore the contribution of each is negligible on average. Thus, while exposure to currency factors may be important in explaining the time-series variation in fund returns related to currency, with the exception of Carry these exposures only have a small return impact on average.
Panel C reports the average quarterly currency surprise for the funds ($CSurpF$) and the currency alpha value ($AlphaC$). The latter indicates the portion of the currency surprise incurred by the funds that is not explained by returns arising from exposure to the currency surprise for the overall market and the three currency factors. Whether $AlphaC$ might be interpreted as indicative of manager skill in selecting currencies depends on whether currency exposures are intended, or are unintentional by-products of security selection decisions. Regardless, $AlphaC$ provides a measure of the extent to which the currency returns embedded in total fund returns cannot be explained by exposure to currency factors. The average return contribution from currency surprise for the funds ($CSurpF$) is 0.40%, which is insignificant. Further, the magnitude is similar to the currency surprise across all stocks ($CSurpS$) of 0.32%, as is the pattern over time. This hints that the contribution of the currency surprise to fund returns may be ancillary, stemming from the structure of the global stock universe. Alpha after accounting for returns arising from exposure to the currency factors ($AlphaC$) is insignificant with an average of -0.01%. Alpha is positive in 52% of quarters. $AlphaC$ has a standard deviation of 0.27% per quarter, and is statistically significant in 48% of sample quarters. Evidently, the currency returns associated with the market and the three currency factors explain a substantial portion of average fund returns arising from currency, since the alpha value is minute and insignificant.

5.3 Results for Analysis of Unhedged Returns Combining Equity and Currency Factors

Table 5 reports the results for analysis of unhedged returns combining both the equity and currency factors. As the fund exposures for the equity and currency factors are exactly the same as those presented in Table 3 and Table 4, we omit these exposures from Table 5.

**INSERT TABLE 5**

Panel A reports the average coefficient estimates from the cross-sectional multivariate regression of unhedged excess stock returns ($ExSRetUH$) on the standardized ZScore exposures for all nine factors plus an intercept. These regressions are run quarterly, and both yearly and time-series averages are reported. The average coefficients on the factor exposures represent the unhedged excess stock return per quarter arising from one-unit of standardized exposure to each factor. The intercept represents the unhedged excess return to the market portfolio. The average intercept is 1.90%, although this is not significant given the sample size in conjunction with high variability. A similar pattern of market performance is exhibited to that reported in Table 3, indicating that the hedged equity return component dominates the currency component as a source of unhedged returns. The difference

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30 We also calculate pooled average fund returns. These are consistent with the time-series averages presented in Table 5.
between the intercept and the market capitalization-weighted average unhedged excess return to all stocks in our universe is minor, confirming that our model is well-defined.

The combined model might be considered an extension of the equity style factor model from a hedged environment with no exposure to currency risk, to an unhedged setting where currency style factors may also contribute to total (i.e. unhedged) returns. The estimates for the equity style factors – Value, Size, MOM, I/A, ROE and ILLIQ – are similar over time and on average to those reported in Table 3. Comparable estimates emerge for the factor return coefficients, as well as their standard deviations, percentage of statistically significant quarters and percentage of positive quarters. Again, the largest returns arise from exposure to the Value, ROE and ILLIQ factors, with significant average quarterly returns of 1.82%, 1.80% and 0.75% to one-unit of standardized exposure, respectively. Returns for exposure to the Size factor (small minus large) are 0.21% on average and significant at the 1% level. The average return to I/A is 0.42%, and significant at the 1% level. The average return to a unit of MOM exposure is 0.12%, although this is insignificant.

The interpretation of the currency factors – Trend, Carry and PPP-deviation – differs to the currency-only analysis reported in Table 4 as the dependent variable is now the unhedged excess stock return (ExSRetUH) rather than the currency surprise. The estimates thus indicate how currency factors are related to total excess stock returns in USD, in conjunction with the equity style factors. The PPP-deviation factor emerges as a positive contributor to unhedged stock returns, with an average quarterly return of 0.76%, significant at the 5% level. Additionally, 82% of quarters are statistically significant. The PPP-deviation factor underperforms in only 34% of quarters. In Table 4 we show that the funds are consistently underweight in undervalued currencies. Thus funds are not taking advantage of the available return premium. In contrast, the returns to the Carry and Trend factors vary between positive and negative from 2002 to 2012, with insignificant time-series averages. The proportion of significant quarters is 86% for Trend and 84% for Carry, confirming that both are relevant factors for explaining return variation. The percentage of positive quarters is 52% for Trend and 57% for Carry.

Some meaningful differences emerge in the returns associated with currency factor exposures between the currency model and the combined model. Specifically, average quarterly returns to one-unit ZScore exposure to the Carry factor move from a significant -0.68% under the currency model, to an insignificant +0.34% under the combined model. Average quarterly returns associated with PPP-deviation factor move from an insignificant +0.02% under the currency model, to a significant +0.76% under the combined model. Investigation reveals that this occurs because the Carry and PPP-deviation
factors are correlated with hedged equity returns. Specifically, stocks that are based in countries with higher interest rates and cheaper currencies appear to have outperformed over the sample period. This suggests that currency factors may contain some marginal information that assists in explaining the cross-sectional distribution of equity returns as well as currency returns.

Again we estimate the average contribution to unhedged fund returns arising from equity and currency style factors through examining the product of the average quarterly exposures in each year (from Table 3 and Table 4) and the average quarterly factor returns in each year (from Table 5). The time-series average of these quarterly contributions are reported at the bottom of Panel A. Similar to the equity-only analysis, we find that Size has the greatest impact on returns with an average quarterly contribution of -0.22% (-0.87% p.a.). ROE again contributes positively, albeit to a less extent, with an average of 0.02% per quarter (0.07% p.a.). MOM contributions are also consistent with Table 3 at -0.03% (-0.14% p.a.). However, the average contribution of Value is negligible; and I/A now contributes -0.03% per quarter (-0.14% p.a.). In relation to the currency factors, negative exposure to Carry (i.e. a preference for low-yielding currencies) results in negative return contributions of -0.18% per quarter (-0.72% p.a.). The contributions from the other equity and currency factors are minor. Overall, the contributions from factor exposures contribute negatively to performance. This indicates either that the average fund in our sample was either biased towards underperforming styles, or demonstrated no skill in factor timing, over the sample period.

Panel B presents the quarterly average unhedged excess return for the fund sample (ExFRetUH). These follow a similar pattern to the average hedged excess fund returns in Table 3. The percentage of significant quarters and the proportion of positive quarters are the same at 93% and 66%, respectively. The quarterly average total alpha after accounting for returns from exposure to the market and both equity and currency factors (AlphaEC) stands at -0.18% per quarter. While this is statistically insignificant, it might be viewed as economically meaningful at about -0.72% p.a. It follows a similar pattern to AlphaE under the equity-only results. The proportion of significant quarters and the proportion of positive quarters change marginally, falling slightly from 45% to 36% and increasing from 41% to 52%, respectively. Overall, we detect no evidence that the average global equity fund manager possesses any skill in stock or currency selection.

Figure 2 presents a histogram of the AlphaEC (i.e. alpha after accounting for returns to market, equity and currency factor exposure) estimates across the 1,649 fund-quarter observations in our dataset. The median underperformance is -0.02% per quarter, or -0.08% annualized. In total, 50% of fund-quarter

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31 Recall that Table 2 reveals relatively low correlations between the currency factors and the equity factors, suggesting that the changes in the currency factor return estimates are not due to multicollinearity.
observations are positive, comprising: 30% between 0% and +2%; 14% between +2% and +4%; and 6% in excess of, or equal to +4%. Of the negative observations, 28% are between -2% and 0%; 16% are between -2 and -4%; and 7% are below or equal to -4%. In unreported analysis, we find that a majority of funds generate negative AlphaEC in seven out of the 11 years. The exceptions are 2002, 2008, 2011 and 2012, when the proportion of outperforming funds ranges from 51% to 64%.

### INSERT FIGURE 2

Various aspects of the results indicate that currency provides an important additional source of variation in its own right. First, the fact that the equity style factor results are little changed when moving from a hedged to an unhedged environment is consistent with the currency factors adding explanatory power for unhedged returns over and above that contained in the equity factors. This also accords with the very low correlations between the equity and currency factors reported in Table 2. Second, explanatory power increases notably when moving from the model of hedged equity returns reported in Table 3 to the combined analysis reported in Table 5. The average adjusted $R^2$ increases from 5.30% for the equity-only model to 8.76% for the combined model. Adjusted $R^2$ is also higher in all years, and improves substantially in 2002, 2003, 2004 and 2008. Third, the standard deviation of alpha falls once currency factors are included in its calculation, with a standard deviation of 1.22% for AlphaE reported in Table 3 compared to 1.12% for AlphaEC in Table 5. These findings underline the importance of accounting for currency exposure when analysing stock returns and the performance of global equity funds. Essentially, a substantial piece of the story would be missed if currency style factors are not considered when evaluating global equity fund performance.

### 5.4 Developed versus Emerging Market Regions

Our model assumes that global equity managers employ a blanket investment process across international equity markets. However, it is possible that managers may approach investment in certain market segments in a differing manner. Further, it is feasible that dissimilarities might exist between developed and emerging markets due to aspects such as differing liquidity levels, the information environment, and market, economic and political structures (Lesmond, 2005; Bekaert and Harvey, 2003 and Diamonte, Liew and Stevens, 1996). If this is the case, global fund managers may adopt different investment approaches in the two segments. In addition, the determinants of stock returns, including the role played by various factors, may differ across regions or markets if they are not completely integrated.
In order to test whether the analysis and findings are robust to our assumption regarding a common integrated market and a consistent approach by global managers, we generate results on a regional basis by delineating between developed and emerging markets. Specifically, we follow a similar procedure to that underpinning Panel A in Table 3 and Table 4 in estimating fund factor exposures, except that calculations are based on weighted averages per region and quarter for each fund. In particular, the average exposures are calculated by weighting the ZScore exposures for each stock in a fund’s portfolio by its weight as a proportion of the total weight of stocks held in the same region, i.e. the stock weights are normalized within each region so that they sum to 100%. The equal-weighted average quarterly exposures across all funds are then determined for each region. Table 6 reports the time-series averages of the quarterly ZScore exposures for the funds by region over the 44 sample quarters.

**INSERT TABLE 6**

For developed markets, the average fund exposures to the equity and currency factors are similar to those reported in Table 3 and Table 4, respectively. However, some notable differences emerge in relation to emerging markets. For average equity factor exposures, the main difference is a larger negative exposure to small stocks. This indicates that the funds invest in stocks that are larger than the market average to a greater extent in emerging markets than developed markets. Further, exposure to the ROE factor is not as evident in the emerging markets, with only 5% of quarters statistically significant; although the funds hold average exposure similar to that in developed markets. Key differences for currency factor exposures in emerging markets include a weakly significant negative exposure to Trend (versus an insignificant exposure in developed markets); and highly significant positive exposures of 1.01 and 1.37 to Carry and PPP-deviation, respectively. The latter compare to negative exposures of -0.12 and -0.06 in developed markets. Additionally, the proportion of significant quarters is much higher for Carry and PPP-deviation in emerging markets, where 100% of quarters have a positive value, compared to 0% and 5% in the developed markets, respectively. Evidently, when investing in emerging markets, the average fund tilts towards countries with higher interest rates and undervalued currencies.

We also generate factor returns by region based on the combined model, under an analysis that is otherwise consistent with that underpinning Table 5. The results are reported in Table 7. Panel A presents the factor returns, as determined under separate cross-sectional multivariate regressions for each region. The average adjusted R² is 10.01% for developed markets, and 18.71% for emerging markets. This suggests that the individual regional regressions provide greater explanatory power.

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32 We report on and discuss a more granular regional categorization under the robustness testing. Our allocation of countries into developed and emerging markets follows the classification of MSCI (2016b).
noting that the average adjusted $R^2$ for the combined model as reported in Table 5 was 8.76%. However, the average factor returns are similar to those under the combined model presented in Table 5 for the most part, suggesting that similar factors are relevant for pricing in both regions. For example, Value and ROE exposure is associated with the highest returns in both regions. The main difference is for $ILLIQ$, where the average return for one-unit of ZScore exposure in developed markets is 0.15% and insignificant, while that for emerging markets is 1.30% and highly significant. This is consistent with emerging markets comprising smaller, less liquid stocks. Thus the average return to $ILLIQ$ exposure of 0.75% per quarter (significant at the 5% level) as reported in Table 5 largely arises from emerging market stocks. The standard deviation of $ILLIQ$ is also higher in emerging markets at 3.10% per quarter, compared to 1.57% per quarter in developed markets. Another notable difference is that the magnitude and volatility of the Trend factor are both much higher in the emerging markets. Also, the average quarterly return associated with the PPP-deviation factor is stronger in emerging markets at 1.27%, which is significant at the 5% level; versus an insignificant 0.68% in developed markets. While we do not formally test for market segmentation, the higher adjusted $R^2$ observed for both regional models along with some notable differences in factor returns hint at the possibility of some degree of market segmentation.

**INSERT TABLE 7**

To estimate the contribution of each factor to returns generated within each region, we multiply the average quarterly factor exposures in each year by the average quarterly factor returns in each year. The time-series average of the yearly contributions (% Contrib) is reported at the bottom of Panel A. Value, Size and MOM contribute negatively to alpha in both regions with quarterly averages in developing (emerging) markets of -0.04% (-0.11%), -0.12% (-0.23%) and -0.02% (-0.08%), respectively. The contribution of $I/A$ is negligible in both regions; whilst ROE adds to quarterly returns by 0.09% in both developed and emerging markets. $ILLIQ$’s contribution is minute in developed markets, whereas it lowers emerging market returns by -0.04% per quarter. Although there is a substantial illiquidity premium in emerging markets, the average fund nevertheless consistently tilts away from illiquid stocks. The most substantial difference in return contributions from factor exposure between the two regions relates to currency factors. In developed markets, all three currency factors contribute negatively, including -0.03% per quarter for Trend, -0.07% for Carry and -0.02% for PPP-deviation. In emerging markets, all three currency factors make substantial positive average contributions of 0.36%, 0.49% and 2.18% per quarter for Trend, Carry and PPP-deviation, respectively. However, given that emerging markets represent only 7.57% of the stocks held by the funds on average from 2002 to 2012, the impact at the portfolio level is not substantial. Evidently, the impact of currency factor exposures on the returns of our global equity funds differs substantially between the two regions. Given the
differences in economic development and often currency stability, such dissimilarities are perhaps not surprising.

Panel B reports estimates of fund returns ($ExFRetUH$) and alpha ($AlphaEC$) for each region. Calculations follow the same method underpinning Table 5, except stock and factor returns are weighted by the proportion of the total weight for all stocks held by a fund within each region. The equal-weight average quarterly returns across all funds are then determined for each region. The time-series average quarterly unhedged excess return values are provided. The average fund returns in developed markets are similar to those reported in Table 5. Again we find no evidence of outperformance in developed markets, with average alpha estimated at an insignificant -0.19% per quarter. In emerging markets the average excess fund return is 5.04% and significant at the 5% level. Further, average $AlphaEC$ is economically meaningful, although not significant, at 1.04% per quarter (4.23% p.a.). Hence the average global fund in our sample has managed to extract a positive return contribution from emerging markets, while they have not been able to do so in developed markets. We also compute an aggregate $AlphaEC$ value for the portfolio by weighting the value for each region based on the weight of stocks held in that region. The resulting average $AlphaEC$ value of -0.18% (-0.72% p.a.) is the same as under the combined analysis reported in Table 5. The standard deviation of alpha is lower at 0.91% compared to 1.12% in Table 5; as is the proportion of significant quarters and positive quarters at 25% (36% in Table 5) and 45% (52% in Table 5), respectively.

Overall, similar conclusions with regard to overall fund performance emerge based on the regional analysis. However, some differences in fund exposures and factor returns are observed that highlight differences in the market composition and style factors amongst the two regions, which hint at the possibility of a level of segmentation between developed and emerging markets. Further, some differences appear in fund factor exposures and how well they perform within each region, suggesting that the approach to forming a portfolio might differ between developed and emerging markets.

### 5.5 Fund Style Analysis

The analysis so far has considered style factor exposures and alpha on average across our sample of global equity funds. These broad averages may obscure variation in performance by funds with differing style biases. Previous research on US equity mutual funds shows that performance differences exist across style groups (Davis, 2001; Daniel et al., 1997). To investigate this possibility, we split our fund sample into ‘high’ and ‘low’ groups during each quarter, based on exposures to $Value$, $Size$, $MOM$ and $ROE$ as measured by fund $Z$Scores. $Value$ exposure reflects the value versus growth style delineation; $Size$ captures small-cap versus large-cap; $MOM$ exposure might be expected to be relatively
high for funds that follow a ‘market-orientated’ style; while ROE is a proxy for quality investing. Table 8 summarises average factor exposures, excess fund returns (ExFRetUH) and alpha (AlphaEC) for the high and low groups within the four style exposure categories. These results reflect the equal-weight average return to a fund-of-fund portfolio that invests equally in the funds with the highest or lowest exposure to each style during each quarter. Given the size of the sample, we only perform the analysis by dissecting the funds into two groups based on one factor at a time, and do not consider intersections such as Size-Value, etc.

**INSERT TABLE 8**

The average alpha estimates reveal that low Value (i.e. growth) funds outperform high Value funds by 0.70% per quarter; funds with low exposure to Size (i.e. those investing in larger stocks) slightly outperform those with high Size exposure (i.e. those investing in small caps) by 0.01% per quarter; and that high MOM and high ROE funds outperform low MOM and low ROE funds by 0.75% and 0.63% per quarter, respectively. These differences are both statistically significant and economically meaningful for all style factor exposures except Size. This suggests that fund style matters for alpha generation potential in global equity markets. Further, average alphas are significantly negative for the high Value, low MOM and low ROE groups; while the opposing low Value, high MOM and high ROE groups generated alpha that was modestly positive but insignificant. In interpreting these results, it should be borne in mind that alpha only reveals the returns arising from stock selection after accounting for the return contribution from factor exposures. Thus the results reveal the fund styles where it would have been better to avoid active management over the sample period. For example, value funds appear to have performed particularly poorly, while value itself was an outperforming factor. The implication is that pursuit of the value premium might have been better accessed through more mechanical means such as buying an ETF or forming a factor-mimicking portfolio, rather than using active global equity fund managers that employ a value style.

We undertook further investigation to establish whether funds of differing styles had a propensity for ancillary factor exposures. The split on Value indicates that growth funds hold larger stocks with higher ROE values; while value funds are exposed to negative MOM. The main ancillary exposure differences

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33 The average number of funds in the low (high) group is 18 (19) per quarter. The minimum (maximum) number of funds is 4 (32) for both groups.

34 The analysis presented in Table 8 represents the time-series average returns to fund-of-fund portfolios created in each quarter. We also determine the results with funds classified into style categories based on the proportion of quarters in which their average exposure falls into the low/high style category. For example, we classify funds as Value funds if they fall into the high value category in 70% or more of the sample quarters. Average alpha for the high Value group under this definition is -0.58%, significant at the 5% level. The average quarterly alpha to funds similarly identified as low MOM funds is -0.88%, significant at the 1% level; while alpha for the low ROE funds is -0.58%, significant at the 10% level. These results are consistent with those reported in Table 8, and if anything marginally stronger.
between the two Size groups is that large-cap funds tend to hold growth (i.e. low Value) stocks with better ROE. When the sample is split on MOM, the high MOM funds hold stocks with less exposure to Value and higher exposure to ROE. Finally, dissecting the sample based on ROE, the high ROE group tends to hold larger stocks with less exposure to Value than the low ROE fund group. While currency factor exposures did not differ substantially between the high and low groups for each style in the main, funds with a bias toward large-caps tended to hold stocks from countries in which the currency is slightly more overvalued than small-cap funds, as measured by PPP-deviation ZScores. In unreported tests, we find that high I/A funds outperform low I/A funds by 0.47% (significant at 5% level), and that low illiquidity funds outperform the high illiquidity funds by 0.14% (not significant). Since these factors are not widely used to determine fund style, they are omitted from Table 8.

6. Robustness Tests

We undertake various robustness tests to gauge the consistency and reliability of the results. The combined model results are re-estimated using B/M or CF/P in isolation as single measures, instead of the composite Value factor. The results are consistent with those presented in Table 5. We test different market capitalization cut-offs for inclusion of stocks in the market universe, specifically USD 10 million and USD 100 million, relative to the USD 50 million used in the original analysis. This produced qualitatively similar results. We examine the distribution of the correlations between the equity and currency factors, and find 11 quarters in which the correlation between two variables is greater than 0.5, although only two of these exceed 0.6. We run the analysis excluding these 11 quarters and find consistent results. This confirms the absence of multicollinearity issues.

We complete the equity and combined analysis under a range of equity style factor models, where two through to six equity factors are included in addition to a market factor (i.e. the intercept). We summarise the results in Table 9. The analysis reveals that models including all six equity style factors plus a market factor (i.e. the ‘seven-factor’ model) have the greatest explanatory power based on both R^2 and adjusted R^2 values. This indicates that all six equity style factors are contributing to explaining returns. Furthermore, the R^2 and adjusted R^2 values for the combined model equivalent which includes the three currency factors are higher than the equity only model for all alternative model versions.

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INSERT TABLE 9
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35 Table 2 reports the average correlations.
36 There is one quarter in which the correlation between the ZScores for Carry and Trend is 0.76, and one quarter in which the correlation between the ZScores for Carry and PPP-deviation is 0.62.
37 Two versions of the five-factor model are run, one includes I/A as the fifth factor and the other includes ROE.
We undertook analysis with stocks assigned into seven more granular geographical regions, using MSCI’s classification system (MSCI, 2016b). These groupings represent a finer version of the broader developed/emerging market segmentation reported in Table 6 and Table 7. We can only run the equity-analysis consistent with that presented in Table 3, as it is not possible to create currency factors when the model is run by geographic region given only one currency exists for two regions of Japan and North America (Canadian Dollar in the latter case). As a result, there is no variation in the currency factors in each quarter for these sub-regions, and the currency and combined regression are not viable. The results of this analysis for the equity model run by these geographic regions are consistent with those presented in Table 3 and the section ‘Developed versus Emerging Market Regions’.

After having undertaken a range of tests, we conclude that the finding that the average global equity fund does not add value after accounting for returns from equity and currency style factors is robust to the analysis method.

7. Conclusion

We propose a comprehensive method to identify the factors impacting stock returns in international markets, and then show how it can be used to evaluate the performance of global equity funds. The method considers return contributions from both hedged equity returns and currency returns, and incorporates a broad range of well-known equity and currency style factors. We implement the model by calculating factor exposures for the stocks in our market universe during each quarter based on characteristics, and estimating factor returns through cross-sectional multivariate regressions of stock excess returns on standardized ZScores for the characteristics. Fund performance is evaluated using portfolio holdings to calculate factor exposures during each quarter. Alpha is then calculated by extracting returns arising from exposure to the market and the factor exposures. The method supports the separate assessment of hedged fund returns using equity factors, fund currency returns using currency factors, as well as total (unhedged) fund returns using a combination of both equity and currency factors.

Consistent with the extant literature, we identify equity return premiums related to Value, Size, investment (I/A), profitability (ROE) and illiquidity (ILLIQ) factors. However, due to ample negative returns to momentum (MOM) in 2009, we do not detect a statistically significant positive return premium to this factor over our sample period. Nevertheless, all six equity factors are found to be

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38 Regions for this analysis include Asia-Pacific Developed Markets (DM), Europe and the Middle East DM, North America DM, Japan DM, Asia-Pacific Emerging Markets (EM), Europe, the Middle East and Africa EM, and Latin America EM.
important in explaining variability in stock returns and the performance of global equity funds. Additionally, we examine three currency style factors. Over the analysis period, we identify a significantly negative return premium to Carry within currency returns, and a significantly positive premium within unhedged stock returns to undervalued currencies as measured by PPP-deviation. Similar to the equity factors, the currency factors are found to be important in explaining variability in unhedged stock returns and the performance of global equity funds. Indeed, we find that currency factors make a substantial contribution to the explanatory power of international stock returns.

We apply our factor model to a sample of 90 USD-based global equity funds, calculating their factor exposures, and estimating alpha after accounting for returns arising from these factor exposures as well as the market. The use of stock holdings data allows us to estimate fund exposures to each factor directly in each quarter, rather than relying on time series regression analysis to extract factor loadings. The funds in our sample are exposed on average to larger stocks, and tilt modestly towards stocks with positive ROE and away from stocks with high momentum. They also favour stocks from countries with lower interest rates. Analysis of hedged fund returns reveals underperformance of -0.24% per quarter (-0.96% p.a.), after accounting for returns arising from equity factor exposures. While this is not statistically significant for our sample, it is economically meaningful. In addition, we find that exposure to currency factors are a meaningful source of return variability, suggesting that it is important to account for currency as well as equity factors when evaluating the sources of fund returns. In particular, the adjusted R² increases from 5.30% to 8.76% once the three currency factors are included. Again, analysis of total (unhedged) fund returns reveals no evidence of stock selection skill, with average alpha estimated at -0.18% (-0.72% p.a.), which is not significant. The volatility of alpha falls from 1.22% when only equity factors are considered, to 1.12% once currency factors are also accounted for. This result further highlights the relevance of both equity and currency style factor exposures in explaining global equity fund returns.

We test a version of our equity and currency factor model where developed market and emerging market components are analyzed separately. The average alpha estimate determined is almost identical for this version of results at -0.18% per quarter (-0.72% p.a.); although the funds generate positive but insignificant alpha in emerging markets averaging 1.04% per quarter (4.16% p.a.). The regional regressions provide greater explanatory power, hinting at the possibility of market segmentation. The analysis also highlights a number of differences between developed and emerging market regions, the most notable of which relates to the performance of ILLIQ and the contribution of currency factors to fund returns.
We also find that style exposure is related to alpha generation for global equity funds. Funds that are exposed to value, low momentum and low profitability incur statistically significant negative alpha over the sample period. By contrast, funds that are exposed to growth stocks and stocks with high profitability and high momentum fared better, generating alpha that was modestly positive but insignificant. Our analysis suggests that outperforming factors like value might have been more reliably captured through mechanical means such as ETFs, rather than through employing active value managers.

This study presents a method for identifying the sources of returns in global equity markets that integrates both equity and currency factors into a single framework. The method provides a means of using portfolio holdings data to identify the sources of performance for funds that invest in international equity markets, as well as identifying the style factor exposures embedded in their portfolios. Importantly, the results imply that when structuring a global equity investment mandate, it is beneficial to manage the currency component externally – perhaps through the use of an overlay manager – since global equity managers do not appear to have currency selection skill. We trust that the method will prove a valuable addition to the armoury of both academic researchers, and investment industry practitioners such as institutional investors and investment consultants.
References


APPENDIX A
Market Universe Dataset Creation

We begin by obtaining a list from Datastream of all publicly traded stocks on the major exchange of 46 countries in the MSCI All Country World Index (MSCI ACWI) for which a SEDOL code is available. We also include six countries which Hou et al. (2011) include, which are not in the MSCI ACWI, resulting in a total of 52 countries covering 40 currencies. The major exchange is determined as the exchange which accounts for the greatest market capitalization of stocks in a given country (World Federation of Exchanges (WFE), 2015). We include multiple exchanges for the United States (NYSE, AMEX and NASDAQ), China (Shenzhen and Shanghai exchanges) and India (Bombay and National exchanges), given that there is more than one exchange which represents a significant portion of the market. We also include two exchanges for the United Arab Emirates (Abu Dhabi Securities Exchange and Dubai Financial Market) in order to increase the sample size for this country.

In order to exclude cross-listings, we specify that a stock must be the major security for a company, and the primary quote and the pricing currency must be the same currency as that of the country in which the exchange is located. Stocks classified as dead or suspended are retained so that the sample is not affected by survivorship bias. Furthermore, we set an Instrument Type variable from Datastream equal to ‘Equity’ to ensure we omit American Depositary Receipts, Closed-End Funds, Exchange-Traded Funds, Profit Participation Certificates, Global Depositary Receipts, Investment Trusts, Non-Voting Depository Receipts and Preference Share Warrants. This results in a sample of almost 60,000 stocks which represent 94% of global equity market capitalization as at December 2012 (WFE, 2015). We use the variable Security Type Description (the Datastream symbol is TRAD) from Datastream, supplemented by Security Type 1 (the Bloomberg symbol is SECURITY_TYP) from Bloomberg to identify common/ordinary shares, which results in a sample of approximately 53,000 stocks.

Market data is obtained from Datastream including adjusted prices, market capitalizations, total returns (including dividends) and adjusted trading volumes. Quarterly accounting data is obtained from Worldscope via Datastream; specifically we use Funds from Operations (the Worldscope Symbol is WC04201), Common Equity (WC03501), Total Assets (WC02999) and Net Income before Extra Items (WC01551).
### APPENDIX B

**Risk-Free Rates by Country**

<table>
<thead>
<tr>
<th>Country / Region</th>
<th>Risk-Free Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Australia Dealer Bill 90 Day - Middle Rate</td>
</tr>
<tr>
<td>Canada</td>
<td>Canada Treasury Bill 3 Month - Middle Rate</td>
</tr>
<tr>
<td>Chile</td>
<td>Chile Repo 7 Day - Middle Rate</td>
</tr>
<tr>
<td>China</td>
<td>China Relending Rate 3 Month - Middle Rate</td>
</tr>
<tr>
<td>Denmark</td>
<td>Denmark Interbank 3 Month - Offered Rate</td>
</tr>
<tr>
<td>Egypt</td>
<td>Egypt Discount Rate Rate - Middle Rate</td>
</tr>
<tr>
<td>Euro Area</td>
<td>EURIBOR 3 Month - Offered Rate</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Hong Kong Interbank 3 Month - Offered Rate</td>
</tr>
<tr>
<td>India</td>
<td>Mumbai Interbank 3 Month - Middle Rate</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Indonesian Interbank 3 Month - Middle Rate</td>
</tr>
<tr>
<td>Israel</td>
<td>Israel Treasury-Bill Secondary 3 Month - Middle Rate</td>
</tr>
<tr>
<td>Japan</td>
<td>Japan Gensaki Treasury-Bill 1 Month</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Malaysia Treasury-Bill Band 4 - Middle Rate</td>
</tr>
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<td>Mexico</td>
<td>Mexico Cetes Secondary Market 28 Day - Middle Rate</td>
</tr>
<tr>
<td>New Zealand</td>
<td>New Zealand Depo 3 Month - Middle Rate</td>
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<tr>
<td>Norway</td>
<td>Norway Interbank 3 Month - Offered Rate</td>
</tr>
<tr>
<td>Philippines</td>
<td>Philippine Treasury Bill 91 Day - Middle Rate</td>
</tr>
<tr>
<td>Poland</td>
<td>Poland Interbank 3 Month - Offered Rate</td>
</tr>
<tr>
<td>Russia</td>
<td>Russia Interbank 31 to 90 Day - Middle Rate</td>
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<td>Singapore</td>
<td>Singapore Treasury-Bill 3 Month - Middle Rate</td>
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<td>South Africa</td>
<td>South African Interbank - Middle Rate</td>
</tr>
<tr>
<td>South Korea</td>
<td>Korea 91 Days - Middle Rate</td>
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<td>Sweden</td>
<td>Sweden Treasury Bill 90 Day - Middle Rate</td>
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<tr>
<td>Switzerland</td>
<td>Swiss Liquid Financing Rate - Middle Rate</td>
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<td>Taiwan</td>
<td>Taiwan Money Market 90 Days - Middle Rate</td>
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<tr>
<td>Thailand</td>
<td>Thailand Interbank Overnight - Middle Rate</td>
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<td>United Kingdom</td>
<td>UK Treasury Bill Tender 3M - Middle Rate</td>
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<tr>
<td>United States</td>
<td>US Treasury-Bill Secondary Market 3 Month - Middle Rate</td>
</tr>
</tbody>
</table>
APPENDIX C

Detailed Measurement of the \textit{PPP-deviation} Factor

The \textit{PPP-deviation} factor is a measure of currency value versus USD, based on the deviation from purchasing power parity (PPP). PPP is estimated with reference to relative inflation movements versus a base that is intended to reflect equilibrium where the exchange rate aligns with PPP. We calibrate the PPP base under the assumption that the average deviation from PPP has equalled zero historically (i.e. that the exchange rate has fluctuated around PPP). We use an expanding window to perform the calibration, based on a long data history which extends back to 1960 for many countries.

Inflation data is based on the Consumer Price Index (CPI). CPI for All Items is predominantly drawn from either the IMF’s IFS database, or from the Organisation for Economic Co-operation and Development (OECD) database for countries where the history is longer. The base year for these CPI indices is 2010. CPI data for Taiwan is sourced from National Statistics Taiwan. For the eleven countries with the Euro as their currency, the Harmonised Index of Consumer Prices (HICP) for the Euro area from 1990 is used as the measure of consumer prices, sourced from the European Central Bank. The period Q1 1970 to Q4 1989 is backfilled by computing the weighted-average PPP for 12 of the 19 European Union member countries with required data from Q1 1970 to Q4 1989, weighted by Gross Domestic Product (USD, expenditure approach, at current prices). This data is sourced from the OECD.

In order to base PPP, we initially calculate the average spot rate (USD to local currency) and average PPP (CPI US / CPI local) using an expanding window that captures all available historical data for a currency. PPP is hence recalibrated each quarter from Q4 2001 to Q3 2012. The average in Q4 2001 extending from Q1 1960 (at the earliest) to Q3 2001. We base the PPP values by multiplying them by the Spot Rate Average / PPP Average, thus ensuring that the PPP values accord with the assumption that the average spot rate aligns with average PPP over the available history.

There are 23 currencies for which PPP is computed over a historical period of at least 41 years, four currencies use at least a 32 year history, and three currencies use at least a 22 year history. China, Czech Republic, Sri Lanka, Russia and Taiwan only have data available to compute the averages over an initial period of 9 to 14 years, respectively. We can only obtain data for Qatar, the United Arab Emirates and Venezuela from 2003, 2007 and 2008 respectively, and therefore omit them from the analysis. Argentina and Brazil are not included due to the volatility of their currencies. The five countries with limited data histories and the five omitted countries represent a minute portion of stock holdings data.
Table 1 presents summary statistics for the sample of 90 global equity funds managed in USD from 2002 to 2012. Panel A provides broad sample data. ‘No. of Funds’ is the average number of funds in the sample and ‘No. of Stocks Held’ is the average number of stocks held per fund, over the four quarters of each year. Panel B details the average fund weights in each region as at December of each year. The time-series averages of the yearly values for each item are also provided. ‘DM’ indicates a Developed Market region, and ‘EM’ an Emerging Market region.
Table 2 presents the time-series average of the cross-sectional quarterly correlations across stocks from 2002 to 2012 between the ZScore values for each equity style factor; Value, Size, Momentum (MOM), Investment-to-Assets (I/A), Return-on-Equity (ROE) and Illiquidity (ILLIQ); and for each currency style factor; Trend, Carry and deviation from Purchasing Power Parity (PPP-deviation). ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Note: The correlations between the equity and currency style factors are zero on average. We investigate this further by calculating the correlations within each country using the 44 sample quarters; the results are consistent. We also examine equal-weight correlations and find that the resulting values are larger, but still low or near zero. Thus the magnitude of the correlations presented in Table 2 appears due to the underlying data distribution, albeit attenuated when market capitalization weighting is applied.
### Table 3: Equity Factor Analysis

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<tr>
<th>Year</th>
<th>Value</th>
<th>Size</th>
<th>MOM</th>
<th>I/A</th>
<th>ROE</th>
<th>ILLIQ</th>
<th>Excess Stock Return Hedged (ExSRetH)</th>
<th>Intercept</th>
<th>Value</th>
<th>Size</th>
<th>MOM</th>
<th>I/A</th>
<th>ROE</th>
<th>ILLIQ</th>
<th>R²</th>
<th>Adj. R²</th>
<th>Excess Return vs Rf, Hedged (ExFRetH)</th>
<th>Alpha after accounting for Equity Factors (AlphaE)</th>
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<tr>
<th>Time-Series</th>
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<th>% Contrib</th>
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</table>

*Table 3 Panel A reports the average quarterly exposures for each of the equity style factors from 2002 to 2012 for our sample of funds. The equally-weighted average of the ZScores for each equity factor (q) across all funds in quarter t is calculated. The average of the four quarterly estimates for each year is provided, as well as the time-series mean. The standard deviation (Std Dev) for each variable over the 44 sample quarters is also reported. The proportion of significant quarters (% Sig, Qtrs) indicates the percentage of sample quarters in which the average ZScore exposure is significant at the 5% level. The proportion of quarters in which the average ZScore exposure is positive (% Qtrs > 0) is also provided. Panel B presents the results of the cross-sectional multivariate regressions which use the standardised ZScore exposures for the universe of stocks as the independent variables. The dependent variable is the hedged excess stock return (ExSRetH). Intercept, Value, Size, Momentum (MOM), Investment-to-Assets (I/A), Return-on-Equity (ROE) and Illiquidity (ILLIQ) parameter estimates from the regressions are reported, and are interpreted as the quarterly exposure to each intercept. The intercept represents the hedged return to the market portfolio. The contributions to average fund returns arising from the equity style factor exposures can be approximated by multiplying the average quarterly ZScore in each year from Panel A by the average quarterly style factor return for that year from Panel B. The time-series averages of these quarterly contributions (% Contrib) are reported in Panel B. The R² and Adjusted (Adj.) R² values are also provided. Panel C provides the average quarterly fund returns for each year and over the sample period. The excess fund return versus the risk-free rate (Rf) on a hedged basis (ExFRetH) is reported, as is the corresponding alpha value (AlphaE) which accounts for the portion of this return which is not explained by exposure to the market and the equity style factors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.*
<table>
<thead>
<tr>
<th>Year</th>
<th>Trend</th>
<th>Carry</th>
<th>PPP-deviation</th>
<th>Panel B: Cross-Sectional Multivariate Regression (%)</th>
<th>Panel C: Fund Returns (%)</th>
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<tr>
<td></td>
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<td>Currency Surprise for Stocks (CSurpS)</td>
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<td>0.02</td>
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<td>-0.04</td>
<td>1.23</td>
<td>1.27</td>
</tr>
<tr>
<td>2007</td>
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<td>-0.01</td>
<td>-0.02</td>
<td>1.23</td>
<td>1.23</td>
</tr>
<tr>
<td>2008</td>
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<td>-0.08</td>
<td>0.02</td>
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<td>-1.51</td>
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<tr>
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<td>0.01</td>
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<td>0.60</td>
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<td>-0.23</td>
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<tr>
<td>2011</td>
<td>0.06</td>
<td>-0.21</td>
<td>0.03</td>
<td>-0.57</td>
<td>-0.55</td>
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<tr>
<td>2012</td>
<td>-0.04</td>
<td>-0.21</td>
<td>0.03</td>
<td>-0.15</td>
<td>-0.15</td>
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</tbody>
</table>

Table 4 Panel A reports the average quarterly exposures for each of the currency style factors from 2002 to 2012 for our sample of funds. The equally-weighted average of the Zscores for each currency factor (g) across all funds in quarter t is calculated. The average of the four quarterly estimates for each year is provided, as well as the time-series mean. The standard deviation (Std Dev) for each variable over the 44 sample quarters is also reported. The proportion of significant quarters (% Sig. Qtrs) indicates the percentage of sample quarters in which the average Zscore exposure is significant at the 5% level. The proportion of quarters in which the average Zscore exposure is positive (% Qtrs > 0) is also provided. Panel B summarises the results of the cross-sectional multivariate regressions which use the Zscores for the currency style factors as the independent variables. The dependent variable is the currency surprise for each stock in the market universe (CSurpF). Intercept, Trend, Carry and deviation from Purchasing Power Parity (PPP-deviation) parameter estimates from the regressions are reported, and are interpreted as the quarterly return to each. The Intercept represents the currency surprise for the market portfolio, i.e. the difference between the unhedged US dollar (USD) return and the hedged USD return. The contributions to average fund return arising from the currency style factor exposures can be approximated by multiplying the average quarterly Zscore in each year from Panel A by the average quarterly style factor return for that year from Panel B. The time-series averages of these quarterly contributions (% Contrib) are reported in Panel B. The R² and Adjusted (Adj.) R² values are also provided. Panel C reports the average quarterly currency surprise for the funds (CSurpF) and the currency alpha value (AlphaC). AlphaC indicates the portion of the currency surprise for the funds which is not explained by exposure to the market and the three common currency factors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.
### Table 5

**Equity and Currency Factor Combined Analysis**

<table>
<thead>
<tr>
<th>Year</th>
<th>Excess Stock Return Unhedged (ExSRetUH)</th>
<th>Intercept</th>
<th>Value</th>
<th>Size</th>
<th>MOM</th>
<th>I/A</th>
<th>ROE</th>
<th>ILLIQ</th>
<th>Trend</th>
<th>Carry</th>
<th>PPP-deviation</th>
<th>R²</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>-4.16</td>
<td>-4.17</td>
<td>-1.23</td>
<td>0.84</td>
<td>1.24</td>
<td>4.04</td>
<td>0.20</td>
<td>2.03</td>
<td>0.82</td>
<td>3.98</td>
<td>1.12</td>
<td>14.51</td>
<td>14.43</td>
</tr>
<tr>
<td>2003</td>
<td>8.79</td>
<td>8.75</td>
<td>0.94</td>
<td>-0.61</td>
<td>1.19</td>
<td>2.21</td>
<td>0.37</td>
<td>-0.46</td>
<td>0.07</td>
<td>-0.68</td>
<td>-0.10</td>
<td>10.57</td>
<td>10.50</td>
</tr>
<tr>
<td>2004</td>
<td>4.18</td>
<td>4.18</td>
<td>-0.73</td>
<td>0.49</td>
<td>-0.16</td>
<td>2.23</td>
<td>0.36</td>
<td>0.36</td>
<td>0.18</td>
<td>1.05</td>
<td>0.71</td>
<td>8.37</td>
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<td>2005</td>
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<td>2.39</td>
<td>0.49</td>
<td>-0.72</td>
<td>1.02</td>
<td>1.46</td>
<td>0.22</td>
<td>1.58</td>
<td>0.45</td>
<td>1.22</td>
<td>-0.42</td>
<td>4.51</td>
<td>4.45</td>
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<tr>
<td>2006</td>
<td>4.21</td>
<td>4.27</td>
<td>0.06</td>
<td>2.84</td>
<td>-0.50</td>
<td>2.07</td>
<td>0.20</td>
<td>0.28</td>
<td>0.34</td>
<td>0.99</td>
<td>-0.56</td>
<td>6.47</td>
<td>6.40</td>
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<tr>
<td>2007</td>
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<td>3.04</td>
<td>1.30</td>
<td>2.27</td>
<td>1.91</td>
<td>1.08</td>
<td>-0.11</td>
<td>1.30</td>
<td>0.57</td>
<td>2.57</td>
<td>1.92</td>
<td>6.12</td>
<td>6.07</td>
</tr>
<tr>
<td>2008</td>
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<td>-13.64</td>
<td>-0.04</td>
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<td>0.20</td>
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<td>3.20</td>
<td>1.27</td>
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<td>10.82</td>
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<td>10.13</td>
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<td>3.05</td>
<td>2.24</td>
<td>1.88</td>
<td>0.63</td>
<td>-4.48</td>
<td>0.71</td>
<td>1.83</td>
<td>1.34</td>
<td>13.65</td>
<td>13.58</td>
</tr>
<tr>
<td>2010</td>
<td>4.17</td>
<td>4.11</td>
<td>0.67</td>
<td>0.61</td>
<td>1.09</td>
<td>1.03</td>
<td>0.56</td>
<td>0.67</td>
<td>0.33</td>
<td>1.59</td>
<td>2.05</td>
<td>7.17</td>
<td>7.11</td>
</tr>
<tr>
<td>2011</td>
<td>-2.33</td>
<td>-2.33</td>
<td>-1.24</td>
<td>-1.36</td>
<td>-0.15</td>
<td>0.20</td>
<td>-0.10</td>
<td>-0.57</td>
<td>-0.25</td>
<td>2.85</td>
<td>0.70</td>
<td>7.54</td>
<td>7.48</td>
</tr>
<tr>
<td>2012</td>
<td>4.18</td>
<td>4.18</td>
<td>-0.81</td>
<td>-0.39</td>
<td>0.28</td>
<td>1.91</td>
<td>0.16</td>
<td>0.35</td>
<td>0.92</td>
<td>1.19</td>
<td>0.20</td>
<td>7.30</td>
<td>7.24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Time-Series Average</th>
<th>Std Dev</th>
<th>% Sig.</th>
<th>% Qtrs &gt; 0</th>
<th>% Contrib</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>1.92 (1.24)</td>
<td>10.22</td>
<td>98</td>
<td>64</td>
<td>0.00</td>
</tr>
<tr>
<td>2003</td>
<td>1.82 (1.83)</td>
<td>10.24</td>
<td>98</td>
<td>64</td>
<td>-0.22</td>
</tr>
<tr>
<td>2004</td>
<td>0.21 (0.22)</td>
<td>2.09</td>
<td>89</td>
<td>82</td>
<td>-0.03</td>
</tr>
<tr>
<td>2005</td>
<td>0.12 (0.23)</td>
<td>3.07</td>
<td>84</td>
<td>82</td>
<td>-0.03</td>
</tr>
<tr>
<td>2006</td>
<td>0.12 (0.23)</td>
<td>3.04</td>
<td>91</td>
<td>66</td>
<td>0.02</td>
</tr>
<tr>
<td>2007</td>
<td>0.42 (0.23)</td>
<td>1.84</td>
<td>91</td>
<td>64</td>
<td>0.00</td>
</tr>
<tr>
<td>2008</td>
<td>1.80 (0.37)</td>
<td>1.69</td>
<td>91</td>
<td>68</td>
<td>0.00</td>
</tr>
<tr>
<td>2009</td>
<td>0.75 (0.68)</td>
<td>1.69</td>
<td>91</td>
<td>70</td>
<td>0.00</td>
</tr>
<tr>
<td>2010</td>
<td>-0.05 (0.00)</td>
<td>2.15</td>
<td>86</td>
<td>93</td>
<td>0.00</td>
</tr>
<tr>
<td>2011</td>
<td>0.34 (0.00)</td>
<td>2.18</td>
<td>84</td>
<td>66</td>
<td>0.00</td>
</tr>
<tr>
<td>2012</td>
<td>0.76 (0.00)</td>
<td>4.99</td>
<td>82</td>
<td>52</td>
<td>-0.18</td>
</tr>
</tbody>
</table>

Table 5 reports the results of the analysis where the equity and currency factors are included similarly from 2002 to 2012. The fund exposures for the equity and currency factors are the same as those presented in Table 3 and Table 4, respectively. All variable estimates are the average of the four quarterly values for each year. The time-series mean is also reported. Panel A provides the multivariate cross-sectional regression results. The dependent variable is the unhedged excess stock return (ExSRetUH). Intercept, Value, Size, Momentum (MOM), Investment-to-Assets (I/A), Return-on-Equity (ROE) and Illiquidity (ILLIQ), Trend, Carry and deviation from Purchasing Power Parity (PPP-deviation) parameter estimates from the regressions are reported, and are interpreted as the quarterly return to each factor. The Intercept represents the unhedged return to the market portfolio. The proportion of significant returns (% Sig) indicates the percentage of sample quarters in which the parameter estimate is significant at the 5% level. The proportion of quarters in which the parameter estimate is positive (% Qtrs > 0) is also provided. The R² and Adjusted (Adj.) R² values are also reported. The contributions to average fund returns arising from the style factor exposures can be approximated by multiplying the average quarterly ZScore in each year from Panel A in Table 3 and Table 4 by the average quarterly style factor return for that year from Panel A of Table 5. The time-series averages of these quarterly contributions (% Contrib) are presented. Panel B provides the average quarterly fund returns. The excess fund return on an unhedged basis (ExFRetUH) is reported; as is the corresponding alpha value, which accounts for the portion of this return that is not explained by exposure to the market and the equity and currency style factors (AlphaEC). ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.
TABLE 6
Fund Exposures by Region

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Size</th>
<th>MOM</th>
<th>I/A</th>
<th>ROE</th>
<th>ILLIQ</th>
<th>Trend</th>
<th>Carry</th>
<th>PPP-deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Developed Markets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time-Series</strong></td>
<td>-0.02***</td>
<td>-0.54***</td>
<td>-0.05***</td>
<td>-0.02**</td>
<td>0.06***</td>
<td>-0.02***</td>
<td>0.02</td>
<td>-0.12***</td>
<td>-0.06***</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>(-2.84)</td>
<td>(-17.03)</td>
<td>(-5.69)</td>
<td>(-4.31)</td>
<td>(13.27)</td>
<td>(-20.35)</td>
<td>(1.30)</td>
<td>(-7.50)</td>
<td>(-9.79)</td>
</tr>
<tr>
<td><strong>Std Dev</strong></td>
<td>0.04</td>
<td>0.21</td>
<td>0.06</td>
<td>0.03</td>
<td>0.03</td>
<td>0.01</td>
<td>0.09</td>
<td>0.11</td>
<td>0.04</td>
</tr>
<tr>
<td>% Sig. Qtrs</td>
<td>14</td>
<td>86</td>
<td>43</td>
<td>36</td>
<td>61</td>
<td>98</td>
<td>57</td>
<td>61</td>
<td>68</td>
</tr>
<tr>
<td>% Qtrs &gt; 0</td>
<td>41</td>
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<td>18</td>
<td>25</td>
<td>98</td>
<td>0</td>
<td>61</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td><strong>Emerging Markets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time-Series</strong></td>
<td>-0.04***</td>
<td>-0.93***</td>
<td>-0.07**</td>
<td>-0.01</td>
<td>0.07***</td>
<td>-0.04***</td>
<td>-0.21*</td>
<td>1.01***</td>
<td>1.37***</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>(-3.23)</td>
<td>(-10.45)</td>
<td>(-2.49)</td>
<td>(-0.37)</td>
<td>(3.11)</td>
<td>(-14.46)</td>
<td>(-1.78)</td>
<td>(14.10)</td>
<td>(23.64)</td>
</tr>
<tr>
<td><strong>Std Dev</strong></td>
<td>0.08</td>
<td>0.59</td>
<td>0.19</td>
<td>0.13</td>
<td>0.15</td>
<td>0.02</td>
<td>0.76</td>
<td>0.48</td>
<td>0.39</td>
</tr>
<tr>
<td>% Sig. Qtrs</td>
<td>9</td>
<td>61</td>
<td>23</td>
<td>27</td>
<td>5</td>
<td>93</td>
<td>61</td>
<td>91</td>
<td>98</td>
</tr>
<tr>
<td>% Qtrs &gt; 0</td>
<td>25</td>
<td>0</td>
<td>30</td>
<td>41</td>
<td>68</td>
<td>0</td>
<td>43</td>
<td>100</td>
<td>100</td>
</tr>
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</table>

Table 6 reports the average quarterly exposures for each of the equity and currency style factors from 2002 to 2012 for our sample of funds within Developed Markets and Emerging Markets. The average exposures are calculated by weighting the ZScore exposures for each stock in a fund’s portfolio by its weight as a proportion of the total stock weights for stocks held in the same region i.e. the stock weights are normalized within each region so that they sum to 100%. The equal-weight average of the ZScores for each equity factor (gf) across all funds in quarter t is calculated for each region. The time-series mean based on the 44 sample quarters is provided. The standard deviation (Std Dev) for each variable over the sample period is also reported. The proportion of significant quarters (% Sig. Qtrs) indicates the percentage of sample quarters in which the average ZScore exposure is significant at the 5% level. The proportion of quarters in which the average ZScore exposure is positive (% Qtrs > 0) is also provided. *** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.
### Table 7

**Equity and Currency Factor Combined Analysis by Region**

#### Panel A: Cross-Sectional Multivariate Regression (%)

<table>
<thead>
<tr>
<th>Excess Stock Return Unhedged (ExSRetUH)</th>
<th>Intercept Value Size MOM I/A ROE ILLIQ Trend Carry PPP-deviation R²</th>
<th>Adj. R²</th>
<th>Developed Markets</th>
<th>Emerging Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time-Series</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.81</td>
<td>1.90</td>
<td>1.81***</td>
<td>0.19***</td>
</tr>
<tr>
<td>Std Dev</td>
<td>10.19</td>
<td>10.27</td>
<td>2.43</td>
<td>0.47</td>
</tr>
<tr>
<td>% Sig. Qtrs</td>
<td>98</td>
<td>98</td>
<td>86</td>
<td>82</td>
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<td>% Qtrs &gt; 0</td>
<td>66</td>
<td>66</td>
<td>80</td>
<td>61</td>
</tr>
<tr>
<td>% Contrib</td>
<td>-0.04</td>
<td>-0.12</td>
<td>-0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td><strong>Emerging Markets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>3.19*</td>
<td>1.66</td>
<td>2.16***</td>
<td>0.29**</td>
</tr>
<tr>
<td>Std Dev</td>
<td>12.19</td>
<td>14.10</td>
<td>2.52</td>
<td>0.74</td>
</tr>
<tr>
<td>% Sig. Qtrs</td>
<td>95</td>
<td>95</td>
<td>77</td>
<td>70</td>
</tr>
<tr>
<td>% Qtrs &gt; 0</td>
<td>66</td>
<td>61</td>
<td>84</td>
<td>70</td>
</tr>
<tr>
<td>% Contrib</td>
<td>-0.11</td>
<td>-0.23</td>
<td>-0.08</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

#### Panel B: Fund Returns (%)

<table>
<thead>
<tr>
<th>Excess Return vs Rf Unhedged (ExFRetUH)</th>
<th>Alpha after accounting for Equity and Currency Factors (AlphaEC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed Markets</td>
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<tr>
<td>Average</td>
<td>1.56</td>
</tr>
<tr>
<td>Std Dev</td>
<td>9.91</td>
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<tr>
<td>% Contrib</td>
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</tr>
<tr>
<td>Emerging Markets</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>66</td>
</tr>
</tbody>
</table>

Table 7 reports the results of the simultaneous analysis of the equity and currency factors from 2002 to 2012 within Developed Markets and Emerging Markets. Panel A provides the multivariate cross-sectional regression results. The dependent variable is the unhedged excess stock return (ExSRetUH), Intercept, Value, Size, Momentum (MOM), Investment-to-Assets (I/A), Return-on-Equity (ROE) and Illiquidity (ILLIQ), Trend, Carry and deviation from Purchasing Power Parity (PPP-deviation) parameter estimates from the regressions are reported, and are interpreted as the quarterly return to each. The time-series mean for each variable is presented. The Intercept represents the unhedged return to the market portfolio in each region. The standard deviation (Std Dev) for each variable over the sample period is also reported. The proportion of significant quarters (% Sig Qtrs) indicates the percentage of sample quarters in which the parameter estimate is significant at the 5% level. The proportion of quarters in which the parameter estimate is positive (% Qtrs > 0) is also provided. The contributions to average fund returns arising from the equity and currency style factor exposures are approximated for each region by multiplying the average quarterly ZScore in each year by the average quarterly style factor return for that year. The time-series averages of these quarterly contributions (% Contrib) are reported. The R² and Adjusted (Adj.) R² values are also provided. Panel B provides the average quarterly fund returns. The excess fund return on an unhedged basis (ExFRetUH) is reported; as is the corresponding alpha value, which is estimated as the portion of this return which is not explained by exposure to the market and the equity and currency style factors (AlphaEC). The average returns in each region are calculated by weighting the returns for each stock in a fund’s portfolio by its weight as a proportion of the total weight of stocks held in the same region i.e. the stock weights are normalized within each region so that they sum to 100%. The equal-weight average returns across all funds are then determined for each region. Panel B reports the time-series average of the quarterly returns for the funds by region over the 44 sample quarters. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.
### TABLE 8
**Fund Style Analysis**

<table>
<thead>
<tr>
<th>Panel A: Quarterly Z-Score Exposures for Funds</th>
<th>Panel B: Fund Returns (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fund Group</strong></td>
<td><strong>Value</strong></td>
</tr>
<tr>
<td><strong>Value Groups</strong></td>
<td>0.12***</td>
</tr>
<tr>
<td><strong>Growth</strong></td>
<td>-0.16***</td>
</tr>
<tr>
<td><strong>Size Groups</strong></td>
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</tr>
<tr>
<td><strong>Small</strong></td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Large</strong></td>
<td>-0.04***</td>
</tr>
<tr>
<td><strong>Momentum (MOM) Groups</strong></td>
<td>0.02</td>
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<tr>
<td><strong>Low</strong></td>
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</tr>
<tr>
<td><strong>ROE Groups</strong></td>
<td>0.02</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>-0.07***</td>
</tr>
</tbody>
</table>

Table 8 summarizes the average exposure and alpha values when the funds are split into two groups based on their Value, Size, Momentum (MOM) and Return-on-Equity (ROE) ZScores in each quarter t-1. The time-series mean is reported. These results indicate the equal-weight average return to a fund-of-fund portfolio which invests in the funds which have the highest/lowest exposure to a given style in the previous quarter. Both unhedged excess returns (ExFRetUH) and alpha relative to both the equity and currency style factors (AlphaEC) are reported for each group. The difference in alpha between the two groups is also calculated. Significance tests for the difference in alpha are based on a paired sample t-test. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.
### Table 9: Average Quarterly Model Parameters from 2002 to 2012

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Panel A: Equity Only</th>
<th>Panel B: Equity &amp; Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3F 4F 5Fa 5Fb 6F 7F</td>
<td>3F + Curr 4F + Curr 5Fa + Curr 5Fb + Curr 6F + Curr 7F + Curr</td>
</tr>
<tr>
<td><strong>Dep Var</strong></td>
<td>1.52 1.52 1.52 1.52 1.52 1.52</td>
<td>1.92 1.92 1.92 1.92 1.92 1.92</td>
</tr>
<tr>
<td></td>
<td>(1.12) (1.12) (1.12) (1.12) (1.12) (1.12)</td>
<td>(1.24) (1.24) (1.24) (1.24) (1.24) (1.24)</td>
</tr>
<tr>
<td><strong>Intercept</strong></td>
<td>1.51 1.51 1.52 1.50 1.51 1.52</td>
<td>1.90 1.90 1.91 1.89 1.90 1.90</td>
</tr>
<tr>
<td></td>
<td>(1.11) (1.11) (1.12) (1.10) (1.11) (1.11)</td>
<td>(1.23) (1.24) (1.24) (1.23) (1.23) (1.23)</td>
</tr>
<tr>
<td><strong>Value</strong></td>
<td>1.67 *** 1.63 *** 1.63 *** 1.78 *** 1.79 *** 1.80 ***</td>
<td>1.70 *** 1.65 *** 1.66 *** 1.81 *** 1.81 *** 1.82 ***</td>
</tr>
<tr>
<td></td>
<td>(3.92) (5.00) (5.04) (5.66) (5.69) (5.76)</td>
<td>(3.93) (5.04) (5.09) (5.69) (5.73) (5.80)</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>0.17 *** 0.14 0.14 *** 0.22 *** 0.21 *** 0.20 ***</td>
<td>0.18 ** 0.15 * 0.15 * 0.22 *** 0.22 *** 0.21 ***</td>
</tr>
<tr>
<td></td>
<td>(2.17) (1.87) (1.87) (3.01) (2.99) (2.84)</td>
<td>(2.24) (1.95) (1.95) (3.09) (3.07) (2.92)</td>
</tr>
<tr>
<td><strong>MOM</strong></td>
<td>0.46 0.41 0.12 0.10 0.11</td>
<td>-0.47 0.42 0.13 0.11 0.12</td>
</tr>
<tr>
<td></td>
<td>(0.89) (0.81) (0.25) (0.21) (0.22)</td>
<td>- (0.89) (0.80) (0.26) (0.22) (0.23)</td>
</tr>
<tr>
<td><strong>ROE</strong></td>
<td>-0.56 *** -0.39 *** 0.39 ***</td>
<td>-0.58 *** 0.42 *** 0.42 ***</td>
</tr>
<tr>
<td></td>
<td>(4.81) (3.61) (3.59)</td>
<td>(4.85) (3.72) (3.70)</td>
</tr>
<tr>
<td><strong>ILLIQ</strong></td>
<td>1.83 *** 1.79 *** 1.81 ***</td>
<td>1.82 *** 1.78 *** 1.80 ***</td>
</tr>
<tr>
<td></td>
<td>(6.57) (6.49) (6.52)</td>
<td>(6.53) (6.45) (6.48)</td>
</tr>
<tr>
<td><strong>Trend</strong></td>
<td>- 0.73 **</td>
<td>- 0.75 **</td>
</tr>
<tr>
<td></td>
<td>(2.87)</td>
<td>(2.93)</td>
</tr>
<tr>
<td><strong>Carry</strong></td>
<td>- 0.05</td>
<td>-0.05 -0.05 -0.05 -0.05</td>
</tr>
<tr>
<td></td>
<td>(0.15) (0.15) (0.15) (0.15) (0.15)</td>
<td>(0.15) (0.15) (0.15) (0.15) (0.15)</td>
</tr>
<tr>
<td><strong>PPP. deviation</strong></td>
<td>0.34 0.34 0.34 0.34 0.34</td>
<td>0.76 ** 0.76 ** 0.76 ** 0.76 ** 0.76 **</td>
</tr>
<tr>
<td></td>
<td>(0.77) (0.77) (0.77) (0.78) (0.78)</td>
<td>(0.78) (0.78) (0.78) (0.78) (0.78)</td>
</tr>
<tr>
<td><strong>R^2 (%)</strong></td>
<td>2.29 4.15 4.30 5.14 5.25 5.34</td>
<td>5.85 7.67 7.83 8.62 8.74 8.83</td>
</tr>
<tr>
<td><strong>Adj. R^2 (%)</strong></td>
<td>2.28 4.13 4.27 5.11 5.21 5.30</td>
<td>5.81 7.63 7.78 8.57 8.68 8.76</td>
</tr>
<tr>
<td><strong>Alpha (%)</strong></td>
<td>-0.20 -0.18 -0.18 -0.24 -0.24 -0.24</td>
<td>-0.13 -0.12 -0.12 -0.18 -0.18 -0.18</td>
</tr>
<tr>
<td></td>
<td>(-1.01) (-0.97) (-0.97) (-1.32) (-1.31) (-1.30)</td>
<td>(-0.75) (-0.69) (-0.68) (-1.07) (-1.06) (-1.04)</td>
</tr>
<tr>
<td><strong>Alpha Std Dev (%)</strong></td>
<td>1.28 1.24 1.23 1.23 1.23 1.22</td>
<td>1.19 1.14 1.13 1.13 1.13 1.12</td>
</tr>
</tbody>
</table>

Table 9 reports the results of cross-sectional multivariate regression models run in each quarter from 2002 to 2012 that include three-factors (3F), four-factors (4F), five-factors (5F), six-factors (6F) and seven-factors (7F). Intercept, Value, Size, Momentum (MOM), Investment-to-Assets (I/A), Return-on-Equity (ROE), Illiquidity (ILLIQ), Trend, Carry and deviation from Purchasing Power Parity (PPP-deviation) are the time-series average parameter estimates from the regressions, and are interpreted as the quarterly return to each. There are two versions of the 5F models, one which includes I/A (5Fa), and the other includes ROE (5Fb). Panel A reports the results for equity only factor models. In this instance the dependent variable (Dep Var) is the hedged excess stock return (ExSRedH). Panel B presents the results for the factor models which also include the three currency (Curr) factors. In this instance, the two sets of factors are examined concurrently; and the dependent variable is the unhedged excess stock return (ExSRedUH). The Intercept represents the hedged (unhedged) return to the market portfolio in Panel A (Panel B). The R^2 and Adjusted (Adj) R^2 values are also provided. In Panel A the Alpha value represents AlphaE which is the portion of the time-series average quarterly hedged fund returns that is not explained by exposure to the market and the equity style factors. In Panel B the Alpha value represents AlphaEC which accounts for the portion of the time-series average quarterly excess unhedged fund returns which is not explained by exposure to the market and the equity currency style factors. The standard deviation (Std Dev) of these alpha values is also reported. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.
Figure 1 shows how the three sets of analyses relate to each other. Overall we explain the quarterly unhedged excess fund returns, defined as the raw USD return less the risk-free rate (ExFRetUH), as a function of exposure to the market plus equity and currency factors. We can do so by relating ExFRetUH to equity and currency factors, attributing into return contributions arising from the market, factors exposures and alpha (AlphaEC). The latter is estimated as a residual. Alternatively, we can divide ExFRetUH into two components; the quarterly hedged excess return (ExFRetH) and the currency surprise ((1+ExFRetUH)/(1+ExFRetH) - 1). In this case, we examine hedged returns using only the equity factors, allowing equity alpha (AlphaE) to be estimated. Currency surprise is examined using the currency factors, allowing currency alpha (AlphaC) to be estimated.
FIGURE 2

Distribution of Alpha after Accounting for Equity and Currency Style Factors

Figure 2 presents a histogram of the quarterly alpha estimates ($\text{Alpha}_{EC}$) across all fund-quarter observations between 2002 and 2012, defined as the portion of unhedged equity returns that are not explained by exposure to the market and the equity and currency factors.