What Do Stock Markets Tell Us About Exchange Rates?*

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Abstract

The sign of the correlation between equity returns and exchange rate returns can be positive or negative in theory. Using data for a broad set of 42 countries, we find that exchange rate movements are in fact unrelated to differentials in country-level equity returns. Consequently, a trading strategy that invests in countries with the highest expected equity returns and shorts those with the lowest generates substantial returns and Sharpe ratios. These returns partially reflect compensation for global equity volatility risk, but significant excess returns remain after controlling for exposure to standard risk factors.

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"US stocks rallied, sending benchmark indices to the highest level since 2007, [...] while the dollar weakened" (Bloomberg, September 13 2012)

"Stocks have been strengthening, but currencies tell a different story. [...] There is a major disconnect between how stocks are moving and how currencies are moving" (CNBC, August 20 2012)

1. Introduction

If a country's equity market is expected to outperform that of other countries, should we expect its currency to appreciate or depreciate? The answer to this question is of great importance to international equity investors, policy makers and, of course, to academics. An investor holding foreign equities is naturally exposed to exchange rate fluctuations. Both portfolio performance and the decision regarding whether to hedge foreign exchange (FX) risk will depend on the covariance between equity and currency returns, as well as expected returns and return volatilities. The relation between equity and currency returns is also important for policy makers as valuation changes induced by FX and equity returns generate significant swings in international investment positions, and the recent crisis has been characterized by increased amplitude of these valuation swings. However, while a vast literature has investigated the link between interest rate differentials and exchange rates across countries, little is known about the relation between exchange rates and international equity returns.[1] This paper fills this gap by providing empirical evidence on whether expected returns on foreign equity portfolios are systematically associated to currency movements.

To begin our analysis, we illustrate how standard no-arbitrage asset pricing theory allows for the sign of the correlation between equity returns and currency returns to be positive,

[1] See, e.g., Engel (1996) for a survey of the literature on links between interest rates and FX rates. For recent contributions, see e.g. Burnside, Eichenbaum, Kleshchelski, and Rebelo (2011), Lustig, Roussanov, and Verdelhan (2011), and Menkhoff, Sarno, Schmeling, and Schrimpf (2012a).

negative, or even zero. International equity portfolio returns are exposed to both equity market and FX risk, and international investors are compensated for bearing these risks through a set of risk premia. The correlation between exchange rate returns and equity return differentials expressed in domestic currency will therefore depend on the covariance of equity and FX returns with the stochastic discount factor that determines risk premia in international financial markets.

Some special cases of our setup deliver additional restrictions that tie down the correlation. First, there is the case in which expected excess returns on international equity investments are zero (i.e. FX returns and equity returns have a perfect negative correlation). This can of course be achieved by assuming that investors are risk neutral. The same result is delivered by the theoretical model of Hau and Rey (2006), although the underlying mechanism is different. Hau and Rey (2006) argue that, if investors cannot perfectly hedge their FX exposure, when a foreign equity market outperforms domestic equities one will observe a depreciation of the foreign currency due to portfolio rebalancing: when foreign equities outperform, the FX exposure of domestic investors increases, so that they sell some of the foreign equity to reduce FX risk. These sales of foreign currency-denominated assets have a negative impact on the exchange rate—defined in this paper as the domestic price of the foreign currency—and this depreciation in the exchange rate completely offsets the difference in equity returns across markets. This is the Uncovered Equity Parity (UEP) condition, which implies a correlation of minus unity between expected equity return differentials and currency returns, and a zero expected excess return to international equity investment.

An alternative outcome is that the correlation between international equity returns and currency returns is positive as an effect of return-chasing by investors. A large literature shows that investors often increase their holdings in markets that have recently outperformed; see e.g. Froot, Scharfstein, and Stein (1992); Bohn and Tesar (1996); Griffin, Nardari, and Stulz (2004); Chabot, Ghysels, and Jagannathan (2014). This behavior would, in contrast to the portfolio rebalancing mechanism in Hau and Rey (2006), generate demand pressure for the currencies of countries with strong equity markets, causing their appreciation and generating a positive correlation between equity returns and currency returns.

The examples above suggest that the sign of the correlation between equity and FX returns is not clear theoretically. The first contribution of our paper is to establish the empirical correlation between these returns. There is not much evidence in the literature that exchange rate movements offset or substantially reduce expected differences in equity returns across countries (see, e.g., Hau and Rey, 2006; Cho, Choi, Kim, and Kim, 2012; Melvin and Prins, 2015). However, while existing studies have examined the correlation using statistical methods in a time-series setting, in this paper we take an economic value approach in a cross-sectional portfolio setting. We consider an investor who builds a portfolio designed to capture differences in the expected returns of international equity markets since this setup allows us to evaluate the economic importance of UEP deviations directly and at the same time measure the correlation between equity and currency returns in a broad cross-section of countries. The second contribution of our work is to assess whether the resulting portfolio returns can be explained as compensation for risk.

Similar to the recent literature on FX carry trade strategies (Burnside et al., 2011; Lustig et al., 2011; Menkhoff et al., 2012a) we sort equity indices into portfolios according to their *expected* future return differentials with the domestic equity market. We proxy expected equity returns with three predictive variables: dividend yields, term spreads, and trailing cumulative past returns (momentum). These variables are among the most popular candidates proposed in the literature on equity return predictability (e.g., see Rapach and Zhou, 2013, and the references therein).[2] Specifically, using a sample of 42 countries over a period

[2]While other variables have also been used in the literature for individual stock markets, we focus on these three variables because they are available for a large cross-section of countries. Barberis (2000), Cochrane (2008) and Rangvid, Schmeling, and Schrimpf (2014) relate equity returns to dividend yields, while Campbell and Thompson (2008) and Hjalmarsson (2010) analyze both dividend yields and term spreads.

covering November 1983 to September 2011, we study a trading strategy that goes long markets with the highest expected equity returns and short those with the lowest. Since this strategy is essentially designed to exploit UEP violations, we term it the 'UEP strategy'. We find that this strategy earns an average US-dollar excess return between 7% and 12% per annum, depending on the predictor used to forecast equity returns. The returns from the strategy can be decomposed into a local-currency equity differential component and a pure exchange rate component. The local-currency equity return component accounts almost entirely for the total return. Put differently, the exchange rate component of the total dollar return is close to zero, on average. This result suggests that exchange rate changes fail to offset realized equity return differentials, UEP is systematically violated, and the correlation between equity returns and currency returns is essentially zero in the cross section of currencies.

After documenting the existence of sizeable returns from the UEP portfolio strategy, we investigate a risk explanation for these returns. We use standard asset pricing methods to test the pricing power of a number of risk factors conventionally used in international equity and FX markets. This analysis provides evidence that the large average returns can be explained, in part, as compensation for risk. Global equity volatility risk has the strongest cross-sectional pricing power. However, risk exposure does not tell the whole story as, while our portfolios have significant exposures to global equity volatility risk, they still provide substantial risk-adjusted returns (alpha) and larger Sharpe ratios than conventional strategies based on US-specific or global factors.

In a final set of empirical exercises we demonstrate that the main conclusions regarding the return generating power of the UEP strategy are robust to focusing on the most recent decade of data, focusing on a restricted cross-section of countries, including market transac-

We also create 12-month momentum-based forecasts as first used by Jegadeesh and Titman (1993) and more recently by Asness, Moskowitz, and Pedersen (2013).

tions costs and using returns derived from exchange-traded funds (ETFs) rather than index levels.

Related Literature This paper is related to several strands of literature. One strand focuses directly on the validity of UEP. Hau and Rey (2006) provide the first empirical evidence for a sample of 17 OECD countries. Their results suggest that although the exchange rate and equity return differentials co-move negatively, the correlation is far from perfect. Similar conclusions are reached by Cappiello and De Santis (2007), Kim (2011) and Melvin and Prins (2015).[3] Using data for US investors' bilateral portfolio reallocations and equity and currency returns, Curcuru, Thomas, Warnock, and Wongswan (2014) find that portfolio reallocations and past returns are related negatively, consistent with UEP. However they argue that what drives this result is not a desire to reduce currency exposure, as predicted by UEP, but tactical reallocations toward equity markets that subsequently outperform.

Relative to the empirical research cited above, the innovation of this study is the use of a portfolio-based approach to assess economic significance rather than focussing on time-series tests. In contrast to preceding studies, our approach also allows us to characterize the risk exposures of an investment strategy that exploits deviations from UEP. There are strong parallels between our research design and that of work that investigates the validity of Uncovered Interest Rate Parity (UIP). UIP states that exchange rates should adjust to prevent investors from exploiting interest rate differentials across countries. UEP makes a similar statement about movements in exchange rates and expected equity market return differentials. Our finding that exchange rates do not offset expected equity return differentials echoes similar results in the UIP literature (e.g., Fama, 1984). Also, our empirical setup and

[3]Dunne, Hau, and Moore (2010), in a recent high-frequency evaluation of UEP, argue that macroeconomic models of equity and exchange rate returns do not explain high-frequency variation of daily returns. However, they find that about 60% of daily returns in the S&P100 index can be explained jointly by exchange rate returns and aggregate order flows in both equity and FX markets.

the finding that an international equity allocation strategy delivers positive returns mirrors the analysis in recent papers that study FX carry trade returns (Burnside et al., 2011; Lustig et al., 2011; Menkhoff et al., 2012a; Dobrynskaya, 2014). It is worth noting, however, that the returns from our equity investment strategy and those of the FX carry trade are very different. Their empirical correlation is roughly zero.

The work of Koijen, Moskowitz, Pedersen, and Vrugt (2013) is also related to ours. They study a global equity carry strategy in which countries are ranked on dividend yield estimates implicit in equity index futures prices. While their aim is to analyze the performance of the carry strategy, ours is to examine the exchange rate response to expected equity market movements.[4] We also conduct our analysis using three different predictors of equity market returns, for a much broader cross-section of countries and over a longer time-series.

Finally, our work is related to that of Asness et al. (2013), who demonstrate the profitability of value and momentum investment rules for various asset classes, including international equity markets. We also use momentum to build expected equity returns and our sorting on dividend yields can be interpreted as an international value signal, although Asness et al. (2013) use book-to-market instead. Again, though, our focus is on what these equity market forecasts can tell us about exchange rate variation rather than whether value and momentum rules are profitable per se.

The rest of the paper is set out as follows. Section 2. provides some theoretical background and motivates the UEP strategy. Section 3. describes empirical methods. Sections 4. and 5. report the main results, while Section 6. describes some extensions and robustness checks. A final section concludes. A separate Internet Appendix contains details of further robustness

[4] Also, Koijen et al. (2013) employ a forward looking measure of dividends obtained from equity futures prices under the risk-neutral measure, while we adopt a more conventional approach by sorting equity markets on the basis of the information in current dividend yields, consistent with a large literature on stock return predictability (Welch and Goyal, 2008).

tests as well as additional analysis.

2. Theoretical Motivation and Testable Predictions

2.1. Theoretical Motivation

In this section we describe the basic relation between international equity returns and FX returns in a standard no-arbitrage asset pricing setup (see, e.g., Cochrane, 2005). This setup allows us to show that the correlation between equity returns and FX returns can take any sign, and can be equal to zero. As a special case, one obtains UEP, albeit without relying on the imperfect hedging assumption used by Hau and Rey (2006).

In the absence of arbitrage opportunities, asset prices satisfy the following Euler equation:

$$E_t\left(R^j_{t+1} m^h_{t+1}\right) = 1, \tag{1}$$

where R^j_{t+1} is the gross return on asset j, m^h_{t+1} is the stochastic discount factor (SDF) of country h's investor, and $E_t\left[m^h_{t+1}\right] = 1/R^h_{f,t}$ is the period-t price of a one-period, risk-free zero-coupon bond in country h.

Equation (1) must hold for all investments. In particular, it must be satisfied for a position in the domestic equity market; denote the return on the domestic equity market by $R^h_{r,t+1}$. It must also hold for an investment in the foreign equity market. Assume that a domestic investor takes a position in a foreign equity market that provides a local-currency return $R^j_{r,t+1}$ at time $t{+}1$. If we define S_t to be the nominal bilateral exchange rate expressed as the price of foreign currency in terms of domestic currency, then the return on the foreign investment from the domestic investor's perspective is $R^j_{r,t+1}\frac{S_{t+1}}{S_t}$. Absence of arbitrage requires that the following conditions hold:

$$1 = E_t\left(R^j_{r,t+1}\frac{S_{t+1}}{S_t} m^h_{t+1}\right) = E_t\left(R^h_{t+1} m^h_{t+1}\right). \tag{2}$$

Under risk neutrality, the SDF is constant and so Equation (2) implies that $E_t\left(R^j_{r,t+1}\frac{S_{t+1}}{S_t} - R^h_{t+1}\right) =$

0. Thus, under risk neutrality we retrieve an empirical prediction that is analogous to that of Hau and Rey (2006), i.e. that investors should expect any differences in equity returns across countries to be eliminated by currency movements, consistent with a perfect negative correlation between exchange rate changes and the differential in equity returns.[5]

In the general risk averse case, we can manipulate our pricing equations to derive expected excess returns from international equity investments and to show how the correlation between equity return differentials and exchange rate depreciation is determined. First, we can rewrite the pricing equation for the domestic equity market as follows:

$$1 = E_t\left(R^h_{r,t+1} m^h_{t+1}\right) = E_t\left(R^h_{r,t+1}\right)\frac{1}{R^h_{f,t}} + \text{cov}_t\left(m^h_{t+1}, R^h_{r,t+1}\right). \tag{3}$$

Similarly, we can expand the pricing equation for the foreign equity market (i.e. the first equality in Equation (2)) to give:

$$1 = E_t\left(R^j_{r,t+1}\right) E_t\left(\frac{S_{t+1}}{S_t}\right)\frac{1}{R^h_{f,t}} + \text{cov}_t\left(m^h_{t+1}, \frac{R^j_{r,t+1} S_{t+1}}{S_t}\right) + \text{cov}_t\left(R^j_{r,t+1}, \frac{S_{t+1}}{S_t}\right)\frac{1}{R^h_{f,t}}. \tag{4}$$

Combining Equations (3) and (4) and assuming log-normal returns we obtain:

$$E_t\left(erx^{j,h}_{t+1}\right) = rp^j_{r,t+1} - rp^h_{r,t+1} + \eta_{t+1}, \tag{5}$$

where $erx^{j,h}_{t+1} = r^j_{r,t+1} + \Delta s_{t+1} - r^h_{r,t+1}$ is the excess return on the foreign equity position. We also term $erx^{j,h}_{t+1}$ the 'UEP deviation' since it captures the return from a long-short strat-

[5]In Hau and Rey (2006), risk averse investors form portfolios of domestic and foreign equities, and the investment flows generated by their portfolio decisions determine exchange rates (as well as equity prices). The two key assumptions in their model are, first, that investors cannot completely hedge FX risk and, second, that supply of FX is not perfectly elastic. The implication of the first assumption is that differences in equity returns across countries will generate a desire by investors to rebalance their equity portfolios. This will generate order flow in FX markets which, due to the second assumption, leads to changes in equilibrium exchange rates.

egy that invests in the foreign equity market while shorting the domestic equity market, adjusting for changes in the exchange rate. We further define the foreign equity risk premium as $rp^j_{r,t+1} = \ln\left[1 - \text{cov}_t\left(m^h_{t+1}, R^j_{r,t+1}\frac{S_{t+1}}{S_t}\right)\right]$ and the domestic equity risk premium as $rp^h_{r,t+1} = \ln\left[1 - \text{cov}_t\left(m^h_{t+1}, R^h_{r,t+1}\right)\right]$. Finally, $\eta_{t+1} = \frac{1}{2}\text{var}_t\left(r^h_{r,t+1}\right) - \frac{1}{2}\text{var}_t\left(r^j_{r,t+1}\right) - \frac{1}{2}\text{var}_t\left(\Delta s_{t+1}\right) - \text{cov}_t\left(r^j_{r,t+1}, \Delta s_{t+1}\right)$ is a term that collects second moments. Note that, following the extant literature on exchange rates and international parity conditions, we work in logarithms to derive Equation (5) for ease of exposition and notation. When returns are small, continuously compounded (log) returns are approximately equal to simple returns. Throughout the empirical analysis, however, we use simple returns.

Equation (5) demonstrates that when risk premia are nonzero and time-varying, UEP deviations reflect compensation for risk arising from both international equity markets and FX markets. Rewriting Equation (5), we can see that the correlation between equity and FX returns will depend on the variance and covariance properties of the risk premia terms:

$$E_t\Delta s_{t+1} = -E_t\left(r^j_{r,t+1} - r^h_{r,t+1}\right) + \left(rp^j_{r,t+1} - rp^h_{r,t+1}\right) + \eta_{t+1}. \tag{6}$$

The above equation is the analogue of the 'risk-adjusted' UIP condition (e.g., Sarno, Schneider, and Wagner, 2012) for equities rather than bonds and, analogous to the UIP case in Fama (1984), the properties of the risk premia will affect the correlation of exchange rate returns and equity return differentials. For example, take a baseline case where we abstract from the η_{t+1} terms and assume that the combined risk premium term on the right-hand side of Equation (6) is uncorrelated with expected equity market return differentials. Then, the correlation between $E_t\left(r^j_{r,t+1} - r^h_{r,t+1}\right)$ and $E_t\Delta s_{t+1}$ is negative but its size depends on the variability of the risk premia: as risk premia become more volatile relative to equity market return differentials, i.e. the variance of $rp^j_{r,t+1} - rp^h_{r,t+1}$ increases relative to the variance of $E_t\left(r^j_{r,t+1} - r^h_{r,t+1}\right)$, the correlation between $E_t\left(r^j_{r,t+1} - r^h_{r,t+1}\right)$ and $E_t\Delta s_{t+1}$ is driven towards zero. If instead, we allow the covariance between risk premia and expected equity return differentials to be nonzero, then the model can deliver a positive correlation between currency and equity returns.[6]

An existing literature also suggests that a positive correlation between international equity returns and currency returns can be expected as an effect of trend chasing (Froot et al., 1992; Bohn and Tesar, 1996; Griffin et al., 2004; Chabot et al., 2014). If investors target equity markets that have experienced large returns in the recent past in the expectation that they will continue to outperform, one would expect that simultaneous demand pressure on currency and equity markets generates a positive correlation between equity and FX returns.

Overall, the simple analysis above shows that the correlation between equity and FX returns cannot be pinned down easily in theory. The main goal of this paper is to provide empirical evidence on the relationship between equity returns and FX returns using data for a large sample of countries.

2.2. Empirical Predictions in a Portfolio Approach

In the empirical analysis, we take the US as the domestic country and employ a cross-sectional portfolio-based approach. Specifically, we use a given predictor variable (e.g., the dividend yield) to provide informative forecasts of local-currency equity returns. Using this predictor, and without the need to estimate a fully fledged forecasting model, we sort countries into portfolios. We then calculate the returns in US dollars for each portfolio.

Positive average returns from a strategy that invests in countries with strong predicted equity returns (long portfolio) and shorts those with low or negative predicted equity returns (short portfolio), which we call the UEP strategy, would indicate that exchange rate movements do not offset equity market return differentials and provide a measure of the economic magnitude of the violation of UEP. The return from the UEP strategy is approxi-

[6] This comes from noting that, abstracting from the terms in η_{t+1}, we have $\text{cov}\left(E_t\Delta s_{t+1}, E_t(r^j_{r,t+1} - r^h_{r,t+1})\right) = -\text{var}\left(E_t(r^j_{r,t+1} - r^h_{r,t+1})\right) + \text{cov}\left(rp^j_{r,t+1} - rp^h_{r,t+1}, E_t(r^j_{r,t+1} - r^h_{r,t+1})\right)$. A positive correlation then exists if $\text{cov}\left(rp^j_{r,t+1} - rp^h_{r,t+1}, E_t\left(r^j_{r,t+1} - r^h_{r,t+1}\right)\right) > \text{var}\left(E_t\left(r^j_{r,t+1} - r^h_{r,t+1}\right)\right)$.

mately equal to an exchange rate component, i.e. the exchange rate change, minus an equity component, i.e. the differential in equity returns in the long and short portfolio. If expected exchange rate movements at least partly offset the positive expected differential in equity returns, that would suggest a negative relationship between expected equity returns and FX returns. Finally, if the FX return component of the UEP strategy is positive, that would suggest a positive correlation between equity and FX returns, which could be rationalized by return-chasing behavior.

We use country-level dividend yields, term spreads, and momentum variables as our predictors. These variables are studied in the vast literature on the predictability of equity returns (see, e.g., Welch and Goyal, 2008; Campbell and Thompson, 2008; Cochrane, 2008; Hjalmarsson, 2010; Ferreira and Santa-Clara, 2011; Rapach and Zhou, 2013). These predictors are also available for a large cross-section of countries, allowing us to expand the number of markets usually analyzed in the literature. The three predictive variables represent distinct views of what drives equity returns. Dividends are routinely used as fundamentals to explain equity returns, and predictions based on dividend yields can be seen as a basis for value strategies (see, e.g., Cochrane, 2008). The term spread, i.e. the difference between long- and short-term yields, may predict returns because it captures compensation for risk common to all long-term securities, as suggested by Fama and French (1989). We also use a momentum variable in light of the large body of research that has documented that a strategy of buying equities with high recent returns and selling equities with low recent returns results in large average excess returns (see, e.g., Jegadeesh and Titman, 1993, and Asness et al., 2013). We compute momentum-based predictions of future equity returns using trailing cumulative 12-month returns as in Jegadeesh and Titman (1993) and Asness et al. (2013).

It is worthwhile noting that, in the portfolio formation exercise, we build a set of portfolios for each forecasting variable separately, rather than a single forecasting model for returns, and then a single set of portfolios, from a combination of the three predictors. We choose this approach since we want to investigate whether the results are robust to the choice of different predictors for computing expected equity returns. It is not our goal to construct an econometrically optimal forecasting model for index returns. Thus, we do not run any forecasting regressions for the purpose of ranking equity markets.[7]

3. The Empirical Framework

3.1. Portfolio Formation

We construct the UEP strategy as follows: every month, we sort the equity markets in our sample by a candidate predictor variable. The three predictors we employ are dividend yields, term spreads, and momentum. Dividend yields are rolling 12-month cumulative dividends scaled by beginning of year price level. Term spreads are the difference in yields between 10-year government bonds and 3-month bills in each country. We calculate momentum using cumulative returns over a trailing 12-month period.[8]

We then assign each country to one of five portfolios. The one fifth of countries whose equity indices have the lowest expected equity return differential with the US equity market are allocated to the first portfolio (P1), the next fifth to the second portfolio (P2), and so on until the quintile of markets with equity indices exhibiting the highest expected return differential with the US are allocated to the fifth portfolio (P5). Thus, P1 contains equity markets with low expected returns as proxied by either low momentum, low dividend yields

[7]However, in a further exercise, we do compute the return improvement from combining the returns from the strategies based on the three different predictors. The results of this exercise are discussed later in the text and reported in the Internet Appendix.

[8]In line with several studies on momentum strategies we skip the last month's return in computing the momentum signal. This is because some studies show that there exists a reversal or contrarian effect in equity returns at the one month level which may be related to liquidity or microstructure issues; see, e.g., Korajczyk and Sadka (2004).

or low term spreads. P5, on the other hand, contains high-expected-return investments with strong momentum, high dividend yields, or large term spreads. For each predictor variable we form a long-short portfolio, obtained by going long P5 and short P1, that we call HML^{UEP}. In the dividend yield case, for example, this zero-investment portfolio is long equity markets with high dividend yields and short equity markets with low dividend yields. All of the portfolios are held for one month and their holding period return is measured in US dollars. In order to understand the source of profitability from our strategy, we decompose the HML^{UEP} return into two components: (i) the return on the international equity positions in their local currencies (HML^{EQ}), and (ii) the FX component of the HML^{UEP} portfolio return (HML^{FX}). The sign of HML^{FX} is informative about the correlation between FX returns and the differential in equity returns. For example, a negative correlation would imply that, while the HML^{EQ} returns may be positive on average, the HML^{FX} component should contribute negatively to the total return. Strictly speaking, UEP implies the much stronger condition that, even though $\text{HML}^{EQ} > 0$, we must have $\text{HML}^{EQ} + \text{HML}^{FX} = 0$.

It is important to point out that this international equity strategy can be implemented using exchange traded funds (ETFs) and index futures contracts. Our empirical investigation in Section 4. employs MSCI equity indices that are used as a basis for a variety of financial products, including futures and ETFs. Given that many of the products linked to the MSCI indices are highly liquid and subject to relatively low transaction costs, the returns from our international equity strategy are not merely theoretical, especially over the last decade or so. In robustness exercises we use market-derived transaction costs estimates to argue that trading costs are very unlikely to offset the returns to our strategy. Further, we show that using returns on ETF contracts rather than index returns does not materially change our results or conclusions.

3.2. Asset Pricing Tests

The simple no-arbitrage asset pricing framework in Section 2 shows that, in general, expected excess returns on foreign equity positions will contain risk premia generated by domestic equity risk and the combination of foreign equity risk and FX risk. This means that if there are positive average returns from implementing the UEP strategy discussed above, these returns may reflect compensation for risk.

We analyze this question in the empirical work using standard asset pricing methods, estimating linear SDF models for excess returns. Denote the excess return on portfolio i by rx^i_{t+1}. This excess return, in our setting, will be the excess return on a portfolio of international investments measured in US dollars. Excess returns must satisfy the Euler equation

$$E_t\left(rx^i_{t+1} m^h_{t+1}\right) = 0. \tag{7}$$

Consider a vector of risk factors, denoted h_{t+1}, with a corresponding vector of factor means, μ_h. We assume a linear functional form for the SDF:

$$m^h_{t+1} = 1 - b'(h_{t+1} - \mu_h), \tag{8}$$

where the vector b gives the SDF's loadings on each of the risk factors. Combining the linear SDF and the Euler Equation (7) leads to the conventional beta representation for excess returns:

$$E(rx^i) = \lambda' \beta_i \tag{9}$$

where λ is a vector of factor risk premia and β_i is a vector of asset i's betas to the risk factors.

We estimate the parameters of Equation (9) using the Generalized Methods of Moments (GMM) of Hansen (1982). We use a one-step approach, with the identity matrix as the GMM weighting matrix. We also compute the J-statistic for the null hypothesis that the pricing errors are zero. In addition to the GMM estimation, we employ the traditional two-pass Fama-MacBeth (FMB) approach (Fama and MacBeth, 1973) and calculate standard errors using the Shanken (1992) correction. The Fama-MacBeth results are reported in the Internet Appendix to the paper.

With regards to the risk factors h_{t+1}, we select those that are most relevant for understanding the cross-section of international equity portfolio and currency returns. The first obvious candidate is the US-dollar excess return on the MSCI World portfolio, in the spirit of the International CAPM (see Solnik and McLeavey, 2008, Ch. 4, and the references therein). The other candidate factors are global FX volatility as in Menkhoff et al. (2012a), global equity volatility as in Ang, Hodrick, Xing, and Zhang (2006), the US Fama-French size and value factors and a US momentum factor (Carhart, 1997). We also use the global size, value and momentum factors of Fama and French (2012). The US and global size, value and momentum factors are from Ken French's website. We denote these factors as Size^{US}, Value^{US}, Mom^{US} and Size^{G}, Value^{G}, and Mom^{G} respectively.

We measure monthly global FX volatility as in Menkhoff et al. (2012a). We begin with daily absolute returns for the cross-section of individual currencies. We then take a cross-sectional average every day and finally average the daily values up to the monthly frequency. Thus, global FX volatility is measured as

$$\text{Vol}_t^{FX} = \frac{1}{T_t} \sum_{\tau \in T_t} \left[\sum_{k \in K_\tau} \left(\frac{|r_\tau^k|}{K_\tau} \right) \right], \tag{10}$$

where $|r_\tau^k|$ is the daily absolute return for currency k on day τ, K_τ is the number of currencies available on day τ, and T_t is the total number of trading days in month t. As in Menkhoff et al. (2012a), in the empirical analysis we use volatility innovations, calculated as the residuals of a first-order autoregressive process for the global volatility level.

We build a measure of global equity volatility innovations, denoted as Vol^{EQ}, in a similar fashion to the above, using the local returns of the following equity indices: the US Russell

1000, the UK FTSE-100, Japan's TOPIX, Germany's DAX, and France's CAC 40. We use these indices rather than MSCI data as daily returns on MSCI indices were not available at the beginning of our sample period.[9]

4. Data and Portfolio Results

4.1. Data and Descriptive Statistics

For each country we measure equity market performance using MSCI equity index data obtained from Thomson Datastream. We collect total return indices in local currency and US dollars. The sample period runs from November 1983 to September 2011, but the number of equity indices for which data are available varies over time. We convert daily data into non-overlapping monthly observations by sampling on the last business day of each month.

We choose these indices for several reasons. First, MSCI indices have been widely employed in other empirical studies (see, e.g., Hau and Rey, 2006; Bhojraj and Swaminathan, 2006; Rizova, 2010) so their characteristics are well known to academics and practitioners. Second, MSCI usually does not make retroactive changes to the reported returns of the various indices (see, e.g., Madhavan, 2003). Third, a wide variety of products (including mutual funds, ETFs, listed index futures and options, over-the-counter derivatives) are linked to these indices. MSCI estimates that over seven trillion US dollars were benchmarked to MSCI indices as of June 2011.

To construct the equity return predictors we retrieve dividend yield data from MSCI, while data on term spreads are extracted from Global Financial Data. Exchange rate data are obtained from Barclays Bank International (BBI) and Reuters via Thomson Datastream.

[9] We have also tried alternative measures of global equity volatility risk and global FX volatility risk inspired by range-based volatility estimation (see, e.g., Alizadeh, Brandt, and Diebold, 2002). These measures use the percentage high-low range of the equity index or exchange rate instead of the absolute return in Equation (10). As there is no qualitative difference in these and the volatility results we report in the paper, we omit them. They are available on request.

The dataset covers 42 countries: Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Czech Republic, Denmark, Egypt, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Kuwait, Malaysia, Mexico, Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Ukraine, the United Kingdom, and the United States.[10]

4.2. The UEP Portfolio Strategy

Table I reports descriptive statistics for the international equity portfolio returns, expressed in US dollars, constructed using the predictions of equity returns originating from dividend yields (Panel a), term spreads (Panel b) and momentum (Panel c), respectively. In all cases, sorting equities by expected equity return differentials generates a large cross-sectional average spread in mean portfolio returns: in fact, the average return on the HML^{UEP} portfolio ranges between 7% and 12% per annum across different predictors, with the momentum (term spread) HML^{UEP} portfolio exhibiting the largest (smallest) average annual return. For each predictor, the average portfolio return increases as we move from P1 to P5, and this increasing pattern is monotonic except for the case of the term spread. The portfolios containing equity indices with the lowest (highest) predicted local returns yield negative (positive) excess returns in US dollars. It is thus immediately clear, albeit unsurprising, that a strict form of UEP where FX movements eliminate predictable return differentials across international equity markets does not hold in our broad cross-section of countries.

[TABLE I ABOUT HERE]

[10]The summary statistics of the international equity index returns, expressed both in local currency and US dollars, and the FX depreciation rates are reported in Table A.I of the Internet Appendix. Also, before proceeding with the portfolio analysis, it is worth mentioning that we examined the relationship between FX returns and the differential in equity returns, also testing the null hypothesis of UEP, through time-series regression analysis. We provide full details on these regressions in the Internet Appendix, Section B.

Volatilities are broadly similar across portfolios, with those for HML^{UEP} in excess of 16 percent per annum for all of the predictive variables. Sharpe ratios are also almost monotonically increasing from P1 to P5, and the annualized Sharpe ratio of the HML^{UEP} portfolio ranges between 0.42 and 0.70 across the three predictors.

A more refined insight into the drivers of these returns is provided by the decomposition of HML^{UEP} returns into the returns generated by equity market movements in local-currency terms (HML^{EQ}), and the returns due to changes in exchange rates (HML^{FX}). In all cases, the local-currency component HML^{EQ} accounts for almost all of the returns from the strategy; the FX component is relatively small and not statistically different from zero. The fact that, on average across the three different predictors, the mean return on the FX component is close to zero suggests the absence of correlation between equity returns and FX returns. Exchange rates show no tendency to erode the predictable returns from international equity investment.

Panel (a) of Figure 1 shows the cumulative HML^{UEP} return from the UEP strategy computed using the three different predictive variables over the entire sample period. Panel (b) of Figure 1 presents, as benchmarks, cumulative returns from the FX carry trade strategy as in Menkhoff et al. (2012a) and the cumulative returns from the MSCI World index in excess of the 1-month US T-bill rate. The evidence of strong performance of the UEP strategy, highlighted in Table I, is further reinforced when compared against alternative international strategies. In fact, over the full sample period, with the exception of the late 1980s, the cumulative excess returns from the UEP strategy computed using dividend yields or momentum are always higher than those exhibited by the two benchmark strategies. For these two predictors of equity returns, at the end of the sample our international equity strategy delivers a cumulative excess return 100 percentage points greater than the cumulative return on the FX carry trade and more than 150 percentage points greater than that of a buy-and-hold strategy for the MSCI World index. However, the end-of-sample cumulative performance of the strategy computed using the term spread as a predictor is only slightly better than that of the MSCI World index but about 50 percentage points smaller than the cumulative FX carry return.[11] It is also worth noting that each of our three HML^{UEP} return series are slightly negatively correlated with returns from FX carry: the correlations of the returns from the dividend yield, term spread and momentum HML^{UEP} portfolios with carry returns are -0.08, -0.12 and -0.02, respectively.

Figure 2 shows the two components of the returns of the UEP strategy, i.e. HML^{FX} and HML^{EQ}. Consistent with the results in Table I, the figure illustrates that most of the excess returns from the strategy originate from the equity component, whereas the FX component is negligible. This result is also in line with those of Cenedese and Mallucci (2015), who find that news about exchange rate changes contributes little, if anything, to the variance of unexpected equity returns. The returns one can earn from forecasting international equity indices in local-currency terms are not offset by movements in exchange rates, regardless of the predictor used to forecast equity returns. Overall, and returning to the question in the title of this paper, equity returns tell us very little, if anything at all, about movements in exchange rates.

While not important for the main thrust of the analysis, it is worth noting that the three sets of HML^{UEP} returns are only slightly correlated across predictors. In fact, the average pairwise correlation between HML^{UEP} returns across the three different predictive variables equals 0.17. This finding suggests that (i) our different predictors convey different information regarding future equity returns and, more importantly, (ii) a combined strategy

[11] Further details about the dynamics of the portfolios can be found in Tables A.VII and A.VIII of the Internet Appendix. More specifically, different predictors generate different turnover patterns in the HML^{UEP} portfolios. Persistent predictors, such as dividend yields or term spreads, generate comparatively low turnovers when compared to more volatile predictors, such as momentum. In fact, the absolute change in the HML^{UEP} portfolio weights in a given month generated by the momentum signal is nearly twice as large as that exhibited by dividend yields.

will deliver a better risk/return trade-off through diversification of the individual strategies' idiosyncratic risk. For example, a simple strategy that equally weights the HML^{UEP} returns originating from the three different predictors delivers an annualized Sharpe ratio of 0.86, as reported in Table A.IX of the Internet Appendix.

The results also have some implications for the role that currency hedging might play in international equity investment management. At first sight, the results reported in Table I may lead one to the conclusion that currency hedging would generate no consistent benefits to investors concerned only about risk-adjusted portfolio performance, i.e. Sharpe ratios. In fact, the Sharpe ratios of the local-currency return component of our strategies (HML^{EQ}) are virtually identical to the Sharpe ratios of the total return (HML^{UEP}). However, in Table I we can also see that the standard deviation of HML^{EQ} returns are always below the corresponding number for HML^{UEP}, and currency returns have a significant role to play in maximum drawdowns for HML^{UEP} portfolio returns, as shown in Table A.X of the Internet Appendix. This second set of findings suggests some benefit from hedging currency risk. Overall, we view these results as showing that currency hedging is a decision that ought to be associated with the horizon of the investment. A long-term investor, e.g. a sovereign wealth fund, may not need to hedge, since over long investment horizons the role of currency risk is minimal. However, a long-term investor who has to match regular liabilities, e.g. a pension fund, or a short-term investor, e.g. a hedge fund, may wish to consider hedging since, although infrequent, adverse currency movements may damage the overall performance of the international equity portfolios.

5. Asset Pricing Tests

The results of the preceding section demonstrate the existence of large returns from the UEP strategy. We now test whether these returns can be explained as compensation for risk using the asset pricing methods described in Section III.B. We begin with GMM estimations of asset pricing models with linear representations for the SDF; we report Fama-MacBeth regressions in the Internet Appendix, showing that the results are qualitatively identical to the GMM results. We then proceed to run time series regressions of portfolio returns on risk factors and test for significant intercepts, i.e. alphas, in these regressions.

5.1. GMM Estimations

We estimate the factor risk premia λ and the factor betas β in the asset pricing model described in Section III.B using GMM. In our baseline models, each SDF specification contains two risk factors. The first of these is always the excess return on the MSCI World portfolio. We then cycle through the rest of our risk factors in turn to assess the pricing power of a given second factor. We estimate the asset pricing models for a cross-section containing 15 portfolios. This set comprises the five portfolios generated by sorting on dividend yields, the five created by sorting on term spreads and the five momentum-sorted portfolios. In doing so, we follow the prescription of Lewellen, Nagel, and Shanken (2010) to include portfolios sorted by different variables in the same empirical asset pricing model, as explaining the returns of all of these portfolios jointly provides a tougher test for the proposed model.

Table A.II in the Internet Appendix reports descriptive statistics for the factors that are used in the cross-sectional asset pricing exercise. The time-series averages of the volatility factors are zero by construction. The global equity volatility measure, Vol^{EQ} , has a standard deviation that is two times larger than that of Vol^{FX}, indicating the presence of more extreme returns in international equity markets than in FX markets. The Sharpe ratios of the MSCI World portfolio, the US value and momentum factors are, on average, around 0.4. The global value and momentum factors have Sharpe ratios that are higher than that of the MSCI World portfolio. The US size factor is the only factor with a negative Sharpe ratio, although it is close to zero. Two of the three HML^{UEP} portfolios have much larger Sharpe Ratios than the risk factors, the exception being that based on the term spread which also has a Sharpe Ratio around 0.4.

Table II reports the results of the asset pricing tests. For each model, the table provides the estimated loadings of the SDF on each risk factor, i.e. the b coefficients from Equation (8) and the risk premia associated with each risk factor, i.e. the λ coefficients from Equation (9). Robust standard errors are provided for each estimate and the J-test of zero pricing errors is also provided for each model, along with its p-value.

[TABLE II ABOUT HERE]

First, it is worth noting that, in all the estimated models, the MSCI World factor has a risk premium that is statistically indistinguishable from zero. Coupled with the evidence, reported later in Table IV, that the long portfolio of the UEP strategy (P5) and the short portfolio (P1) both have betas on the MSCI World factor that are very close to zero and are statistically insignificant, we can infer that the UEP portfolio strategy is essentially neutral with respect to the world stock market. However, looking across specifications, all of the other factor risk premia are statistically significant at least at the 10% significance level, and all have the expected sign. The volatility factors have negative risk premia while the US Fama-French factors are associated with positive risk premia.

With regard to overall model fit, the J-statistics indicate that the most successful model is that which includes global equity volatility risk as the second risk factor. This is the only case for which we fail to reject the null hypothesis of zero pricing errors. While we are not keen to draw very strong conclusions regarding the fit of our models, given the potentially low power of the tests in a setting with only 15 portfolios, this analysis suggests that variation in mean returns across international equity portfolios can be at least partially explained as compensation for bearing international equity volatility risk. Markets that tend to deliver positive returns when international equity volatility is high are useful as volatility hedges and thus deliver lower expected returns than markets that have returns which are negatively correlated with global volatility.

In Table III we present GMM estimations from three-factor models rather than two-factor models, and these results corroborate the evidence on the importance of global equity volatility risk. When we estimate models that always include the MSCI World index and global equity volatility risk on the right hand side, plus one other factor, the third factor premium is never significant and global equity volatility risk is always significant.

[TABLE III ABOUT HERE]

The evidence so far suggests that only a global equity volatility risk factor, instead of local US factors, is priced in our cross-section of average returns. This result echoes the evidence suggesting that there are common patterns in average returns across international equity markets (e.g., Fama and French, 2012). Therefore we refine and extend the investigation of the UEP strategy by including a set of global factors that have been found to be successful in explaining the cross-section of international equity returns. In line with Fama and French (2012), we consider global size, value and momentum factors.

It is worth noting that the results based on the global factors are not directly comparable with those reported in previous tables. The global factors are only available from July 1990 and they are constructed using a limited sample of developed markets.[12] Hence, the length of the sample period is reduced relative to that for all of our previous estimations by around one third. The results of both GMM and Fama-MacBeth pricing exercises where we substitute global for US Fama-French factors are reported in the Internet Appendix. They indicate that the global momentum and size factors are statistically significant at the 10% level *and* can adequately price the cross-section of 15 portfolios in our sample. The global value factor is statistically insignificant and unable to price the cross-section of 15 international portfolios. However, global equity volatility risk produces, over this shorter sample period, a reasonably

[12]Further details about the construction of Fama-French global factors can be found at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/details_global.html.

high R^2 and the largest p-value for the test of the null hypothesis of zero pricing errors. The other two significant factors generate either lower R^2 or much smaller p-values for the J-statistic.

A graphical view of the cross-sectional asset pricing results can be seen in Figures 3 and 4, which plot mean returns on the 15 portfolios against predicted returns from the various asset pricing models. An asset pricing model that performs perfectly should have all portfolios lining up along the solid 45 degree line. Figure 3 demonstrates the relative success of the global equity volatility risk factor. Only in this case is the cloud of points representing the portfolios upward sloping and close to the 45 degree line. In all other cases, the points in the plot trace out a roughly horizontal line. Figure 4 also shows that global Fama-French factors perform somewhat better than the US factors. It is worth noting, though, that while global equity volatility risk performs best of all the factors, some of the pricing errors it generates are large. Looking at Figure 3, for example, it is clear that the portfolios with low mean returns, i.e. the P1 portfolios from each of the three sorting variables, are priced rather poorly. Thus, while our pricing errors are statistically not different from zero, their economic significance might not be small.

In sum, the results from this section help us understand better the returns from the UEP strategy reported in Section 4.2.. We should not expect currency movements to entirely eliminate the predictable returns available to those investing internationally as these expected returns are, at least in part, compensation for bearing global equity volatility risk.

5.2. Time-series Tests

We complement the cross-sectional results from Table II with time-series regressions of the returns on our 15 portfolios on all risk factors simultaneously. This is likely to be a more powerful test than the cross-sectional regressions described above, which rely on 15 data points, as it accounts jointly for all of the risk factors over the full sample period.[13]

For each of the 15 portfolios we regress returns on risk factors. Where the risk factors are not themselves portfolio returns, i.e. for Vol^{EQ} and Vol^{FX}, we employ factor mimicking portfolios, obtained as fitted values from regressions of the factor realizations on the set of 15 base assets. Converting non-tradable factors into portfolio returns allows us to scrutinize the factor price of risk in a more natural way (see, e.g., Breeden, Gibbons, and Litzenberger, 1989; Ang et al., 2006; Menkhoff et al., 2012a).[14]

[TABLE IV ABOUT HERE]

Table IV presents results from this analysis. The key estimates in the table are the intercepts for the 15 portfolios. At a 10% significance level, four of these intercepts are statistically significant, all are negative and all of those significant cases are portfolios P1 or P2 for a given sorting variable. The Gibbons-Ross-Shanken test for the null hypothesis that the alphas are jointly zero decisively rejects the null at the 1% significance level. Thus, the time-series evidence suggests that markets with low dividend yields, momentum or term spreads have significantly negative excess returns. The alpha from a long-short strategy that buys P5 and shorts P1 is in the range from roughly 7.5% to 10% per annum across the three predictors, and is strongly significantly different from zero in each case—with p-values of 0.1% for the dividend yield predictor, 1.75% for term spreads, and 2.6% for momentum. It is worth noting that this evidence is similar to that obtained when looking at Figure 3 in our

[13] The inclusion of all risk factors simultaneously is not feasible in the cross-sectional asset pricing exercise because of the small size of the cross-section of portfolios in our data.

[14] The correlation between the factor-mimicking portfolio returns and the raw factors is equal to 0.3 and 0.35 for Vol^{FX} and Vol^{EQ}, respectively. These figures are in line with similar computations carried out in different contexts (see, e.g., Adrian, Etula, and Muir, 2014). For both factor-mimicking portfolios the average excess returns are very close to and statistically insignificantly different from the factor price of risk obtained for the cross-section of the same base assets. These results are comforting since they imply that the factors price themselves and that there are no arbitrage opportunities (Lewellen et al., 2010).

cross-sectional work. Even the best fitting risk factor in the cross-sectional analysis, global equity volatility, priced these low mean return portfolios badly.

Looking at the risk factor exposures, we see that the world stock market return is significant in a few cases, but the betas on this factor tend to be close to zero. If one computes the world stock market betas for the long-short strategy that buys P5 and shorts P1 for each of our three predictors, they are small. They range between -0.1 and 0 and in none of the three cases are they statistically significant. The volatility factor exposures for our individual portfolios are usually significant and negative. In the case of global equity volatility, the factor exposures tend to rise in magnitude as we move from P1 to P5 for each of the three alternative sorting variables. When equity volatility is high, the P5 portfolios tend to deliver lower returns than do the P1 portfolios, and thus an investor who dislikes volatility risk demands a larger mean return from the P5 portfolios than he does from the P1 portfolios.

5.3. Summary and Discussion of Empirical Results

The results thus far deliver several key messages. First, an investor can capture differences in expected equity returns across countries and make substantial returns in US dollars, in the range from 7% to 12% per annum. This finding clearly indicates that exchange rate changes do not offset expected equity return differentials, and the evidence is similar to that in the FX carry literature, which finds that exchange rate changes do not offset the profits available from exploiting international interest rate differentials. It is tempting to think of the strategy studied here as the FX carry trade using equities rather than bonds. However, this is not the case because the returns from the UEP strategy are virtually uncorrelated with the returns from the FX carry trade.

These large returns may be due to a combination of risk premia arising in equity and FX markets. The asset pricing tests suggest that there is some value to this argument. Global equity factors are useful in pricing the cross-section of 15 international equity portfolios.

Although all of these results point towards a risk explanation for the large returns of the UEP strategy, it is important to emphasize that risk premia only account for a fraction of the returns generated by the strategy over time. The time-series evidence tells us that, while risk exposures of our 15 portfolios are significant, positive and statistically significant excess returns of up to 10% per annum remain. This suggests that there may be additional drivers of our portfolio returns.[15]

6. Further Analysis

We perform a number of additional tests and find that our baseline results are robust to various modeling choices.

6.1. Different Numbers of Portfolios and Alternative Samples

In the first exercise, we assess how the results change as we vary the number of portfolios used to set up the UEP strategy, and as we change the sample period used to assess the economic value of the strategy. We report the results of these exercises in Tables V and VI, respectively. Table V shows the descriptive statistics of the HML^{UEP} portfolio returns when the number of portfolios used to set up the UEP strategy ranges between three and six for the three different equity return predictors. The results are qualitatively and quantitatively similar to those reported in Table I.

[TABLE V ABOUT HERE]

Table VI reports the same descriptive statistics when both the number of portfolios ranges between three and six and the sample period used to assess the UEP strategy is

[15] Among those potential alternatives, additional sources of risk, e.g. political risk, as well as limits to arbitrage (Menkhoff, Sarno, Schmeling, and Schrimpf, 2012b; Della Corte, Ramadorai, and Sarno, 2015) could represent plausible candidates that may be able to rationalize the fraction of returns currently left unexplained. We leave these potential explanations for future work.

limited to the last ten years of the sample. In comparison to the figures reported in Table I, i.e. when the number of portfolios is equal to five, the average returns computed over the shorter sample period are smaller, around 7% per annum when the predictors of equity returns are the dividend yield and momentum. In line with the evidence reported in Table I, the strategy based on term spreads delivers performance that is substantially lower than that based on the other two predictors. Overall, these results suggest that the quality of the various predictors might have deteriorated over time especially during and after the 1990s (see, e.g., Welch and Goyal, 2008). However, on balance, the reduction in average returns is generally offset by a similar reduction in the portfolio return volatility. This ultimately leads to Sharpe ratios for the strategies that are qualitatively similar to those presented in Section 4.. The only exception is the strategy based on term spreads, which now has a Sharpe ratio close to zero and shows little ability to predict equity returns.[16]

[TABLE VI ABOUT HERE]

6.2. Varying the Universe of Countries

Next, we investigate whether the baseline results reported in Section 4. are driven by the behavior of a particular country, or subset of countries, within the sample. We do this in different ways: first, we compute the returns of the UEP strategy using only a small sample of 16 major equity markets. Second, we investigate the returns generated by the UEP strategy if we leave out one equity market in the sample at a time.

[TABLE VII ABOUT HERE]

[16]This is not surprising given that term spreads are small and highly correlated across countries during the last ten years of our sample, which contains the global crisis period of 2007–2011. The average cross-sectional standard deviation of term spreads is 1.37% in the last ten years of the sample and is about half the standard deviation in the first part of the sample. Thus, in the last decade of our data, the lack of cross-sectional dispersion in term spreads means that there is little information in those data.

The results from the first set of these robustness checks are reported in Table VII. In this table we report, in three separate panels, the summary statistics of the HML portfolio returns for each of the three predictors, and their decomposition into equity and FX components. Overall, when the UEP strategy is constructed using only 16 developed equity markets, the results confirm the evidence reported in Table I. In fact, the average returns from the various strategies are roughly consistent with those reported for the full set of equity markets, with Sharpe ratios that are equal to about 0.5 on average across predictors. As already noted in Tables V and VI, when term spreads are used as predictors of future equity returns, the statistics of interest are lower.

We also study how omitting one of our sample countries at a time from the analysis affects the Sharpe ratios of the strategies. Figure A.1 in the Internet Appendix presents results from this exercise in histogram form. The Sharpe ratios of the UEP strategy are not substantially affected by the exclusion of any single equity market. The distributions of Sharpe ratios are centered on the values reported in Table I and the lowest Sharpe ratios in each distribution do not differ from the average by more than 0.1.

6.3. Return Computations, Transactions Costs and Real-world Implementation

Thus far we have computed our country-level equity market returns using MSCI index data. An alternative approach uses tradeable ETF prices to compute country-level returns. To evaluate whether using ETF returns rather than index returns makes any difference to our baseline results, we collect data on iShares ETFs that track the MSCI country indices in our sample. This places limitations on our data, both in the time-series and the cross-section. The oldest ETFs in our sample start trading in 1996 and many only began trading a few years after this date. For the US we use the SPDR S&P500 ETF, because the US market MSCI ETF from iShares only starts in 2010. Further, some countries do not have an iShares ETF for their MSCI index at all. Thus, the maximum time-series dimension of our ETF data is only around 15 years and the maximum cross-sectional dimension of these data is 34, rather than 42, countries.

[TABLE VIII ABOUT HERE]

Table VIII compares, for each of the three signals, the performance of the UEP strategy, first using returns derived from ETF prices and second using returns based on index levels. Note that in constructing our returns from index levels, we restrict the cross-section to include only those countries with a tradeable ETF and also restrict the time-series dimension to match the span of the ETF returns. The key result from this table is that, if one examines the HML returns for each signal, there is virtually no difference between the results that use ETF data and those that use index data. Average returns and Sharpe ratios are almost identical and, for both sources of returns, the average return when using momentum and dividend yield as predictors are significant at the 5% level despite the restricted time-series and cross-section of the data. Finally, in each panel of the table we present the correlation between the HML returns based on ETF data with those based on index data. In all three cases the correlation is well above 0.9. Thus whether one uses returns based on traded ETF prices or on index levels has little impact on our results, which suggests that the UEP strategy can be implemented using available ETFs.

A reasonable question to ask is whether the returns achieved by these strategies are robust to the inclusion of transactions costs. To estimate costs we spoke to a Delta-One trading desk at a global investment bank to discuss how strategies such as ours might be implemented and what costs might be realized. They suggested that, in current markets, our set of country-level returns were all tradeable, but that the precise manner that one could gain exposure to them would vary across countries. A large subset of country-level returns are easily tradeable in very liquid index futures markets. A second set of countries can be traded using liquid ETFs. Then there is a set of residual countries that would need to be traded in illiquid ETF or futures markets. As for numerical estimates of trading costs, they gave us country-level spread estimates that fell into four bins. These are shown in Table A.XII in the Internet Appendix. One can see from this table how the most developed markets can be traded at very tight spreads around 4 bps, while some emerging markets have spread estimates closer to 100 bps.

Using these spread data, Table IX presents gross returns and returns net of transactions costs for each of our three signals. Note that in this analysis returns are based on index levels and cover the full cross-sectional dimension of the data. We present return statistics for the last 10 years only, as our spread estimates are likely to be most accurate for this subsample. Trading costs are set to half of the bid-ask spread.

[TABLE IX ABOUT HERE]

The effects of transactions costs on returns are relatively small. In the dividend yield case costs amount to around 90 bps per annum and 150 bps per annum for the momentum signal, but net returns in both these cases are still strong, at close to 6% per annum. However, for the term spread signal, the close to zero gross returns observed over the last decade in Table VI turn slightly negative once transactions costs are included in Table IX.

Overall, neither changing the source of the return data nor the inclusion of transactions costs alter our main conclusions. For the momentum and dividend yield signals, one could have exploited the failure of UEP to make substantial returns, net of trading costs.

6.4. Alternative Proxies for Global Equity Volatility Risk

The final check we carry out assesses whether the pricing power exhibited by global equity volatility risk is simply proxying for a US equity volatility effect similar to that documented in Ang et al. (2006). We carry out this exercise by estimating two-factor asset pricing models where in addition to the MSCI World Index we use the VIX, an index of the implied volatility of the US equity market. In one specification (Model 1) we compute volatility shocks by using the residuals of an AR(1) applied to the VIX time series, while in another specification we compute the innovations by first-differencing the same time series (Model 2). We also report estimates of a model (Model 3) that uses a global equity volatility risk factor based on combining daily equity return data from different sources. We use the Russell, FTSE, CAC, DAX and TOPIX data early in the sample to build our volatility factor, but once daily MSCI return data become available we use those data instead.

The results of this exercise are reported in Table A.XI in the Internet Appendix and they clearly show that while global equity volatility risk successfully explains the cross-section of international equity portfolios, the VIX does not. In fact, for both Models 1 and 2, none of the parameter estimates, including the estimated price of risk, are statistically significant and the J-statistics reject the null of zero pricing errors.

7. Conclusions

This paper investigates the relationship between international equity returns and FX returns using a portfolio approach that is designed to exploit differentials in expected equity returns across countries. In the empirical analysis we follow the recent literature on currency markets and carry trade strategies, and sort equity markets into portfolios according to their expected return differentials with the US equity market. Equity index returns are forecast using three different but well-known predictors: dividend yields, term spreads and 12-month momentum.

Using a sample of 42 countries, over a period spanning November 1983 to September 2011, we show that investing in the highest expected equity return quintile portfolio and shorting the lowest expected equity return quintile portfolio generates significant excess returns between 7% and 12% per annum across the three different predictors. The returns are entirely driven by differentials in local equity market returns across countries, with exchange rates not responding at all to relative stock market performance. These returns can be linked to exposures to some international risk factors, notably global equity market volatility risk, but even after accounting for these risk factors, sizeable average returns remain. In fact, the international equity strategy provides alphas of up to 10% per annum and larger Sharpe ratios than conventional currency and equity strategies.

Overall, this study provides evidence that exchange rate movements fail to offset differentials in country-level equity returns and, to return to the question in the title of this paper, stock market returns tell us very little about exchange rates.

Table I. Descriptive Statistics of Portfolio Returns

The table reports descriptive statistics for the monthly returns of the international equity portfolios sorted by signals based on local return momentum, dividend yields and term spreads. The holding period is one month. Returns are measured in US dollars and in excess of the US market return. The sample of 42 country indices runs from November 1983 to September 2011. Portfolio 1 (P1) contains the one fifth of country indices that have the lowest value of the signal, whereas portfolio 5 (P5) contains the country indices with the highest values of the signal. HML^{UEP} gives statistics for US-dollar returns on the portfolio that is long P5 and short P1, HML^{EQ} is the return on the positions in local currency and HML^{FX} is the FX component of the HML^{UEP} portfolio return. By definition, $\text{HML}^{UEP} = \text{HML}^{EQ} + \text{HML}^{FX}$. Numbers in brackets are t-statistics for the null that the sample mean return is zero. AC(1) is the first-order autocorrelation.

Panel (a): Dividend yields

	P1	P2	P3	P4	P5	HML^{UEP}	HML^{EQ}	HML^{FX}
Mean	-3.09	2.61	5.58	7.48	8.28	11.37	12.66	-1.29
	[-0.81]	[0.87]	[2.07]	[2.95]	[2.83]	[3.38]	[4.06]	[-1.24]
Median	-0.22	5.47	9.04	7.06	3.96	11.33	10.12	-0.67
Std. Dev.	18.80	14.82	13.54	13.61	14.54	16.20	14.91	5.32
Skew	0.27	-0.07	-0.14	0.03	0.26	-0.38	0.03	-0.84
Kurtosis	4.74	3.49	3.46	3.49	3.80	5.67	4.85	8.93
Sharpe	-0.16	0.18	0.41	0.55	0.57	0.70	0.85	-0.24
AC(1)	0.12	0.11	0.07	-0.06	0.09	0.17	0.18	0.03

Panel (b): Term spreads

	P1	P2	P3	P4	P5	HML^{UEP}	HML^{EQ}	HML^{FX}
Mean	-0.72	3.88	3.39	3.05	6.26	6.98	6.84	0.14
	[-0.22]	[1.39]	[1.25]	[1.12]	[1.82]	[2.17]	[2.36]	[0.11]
Median	1.35	5.73	5.30	0.86	4.76	1.61	2.26	0.57
Std. Dev.	15.87	14.00	13.85	13.89	17.54	16.45	14.91	6.47
Skew	-0.59	-0.05	-0.03	0.15	0.41	0.78	0.87	-0.04
Kurtosis	5.83	2.85	3.84	3.30	5.36	5.79	6.60	4.58
Sharpe	-0.05	0.28	0.25	0.22	0.36	0.42	0.46	0.02
AC(1)	0.10	0.07	0.06	0.02	0.04	0.03	0.02	0.04

Panel (c): Momentum

	P1	P2	P3	P4	P5	HML^{UEP}	HML^{EQ}	HML^{FX}
Mean	-1.71	-1.20	4.70	7.72	10.58	12.29	10.44	1.85
	[-0.46]	[-0.42]	[1.74]	[2.74]	[3.17]	[3.14]	[2.85]	[1.33]
Median	-0.45	-1.74	4.21	7.13	9.42	13.63	12.35	0.26
Std. Dev.	17.75	14.21	13.87	14.66	17.59	19.86	18.29	6.83
Skew	-0.05	-0.15	0.03	0.16	0.02	-0.47	-0.52	1.01
Kurtosis	4.15	3.86	3.66	3.60	4.56	5.57	4.86	9.69
Sharpe	-0.10	-0.08	0.34	0.53	0.60	0.62	0.57	0.27
AC(1)	0.20	0.08	0.02	-0.00	-0.03	0.05	0.08	0.12

Table II. GMM asset pricing model estimates

The table reports coefficients from one-step GMM estimations of the two factor asset pricing model. The analysis uses the five portfolios from each of our sorting variables (dividend yields, term spreads and momentum) simultaneously, giving 15 cross-sectional observations. In every specification of the model the first factor is the MSCI World excess return (World) while the choice of the second factor varies across models. The final two rows of the table give the GMM J-statistic and its p-value.

	Model 1		Model 2		Model 3		Model 4		Model 5	
	$\hat{b}$	$\hat{\lambda}$	$\hat{b}$	$\hat{\lambda}$	$\hat{b}$	$\hat{\lambda}$	$\hat{b}$	$\hat{\lambda}$	$\hat{b}$	$\hat{\lambda}$
World	-5.9253	-0.0039	-18.7013	-0.0151	-2.1065	-0.0016	-0.2707	-0.0065	9.1885	0.0116
	[-1.3186]	[-0.4431]	[-1.7716]	[-0.9209]	[-0.4339]	[-0.1614]	[-0.0592]	[-0.6689]	[1.5309]	[0.9992]
Vol^{FX}	-7.2425	-0.0710								
	[-1.8930]	[-2.0634]								
Vol^{EQ}			-4.2229	-0.1650						
			[-2.6703]	[-2.8942]						
Size^{US}					14.8296	0.0153				
					[1.9649]	[1.8737]				
Value^{US}							22.9026	0.0223		
							[2.2265]	[2.1784]		
Mom^{US}									15.0631	0.0297
									[2.3320]	[2.3272]
J-stat	24.0221		9.1355		29.9720		25.6726		22.7898	
p-value	[0.0309]		[0.7626]		[0.0048]		[0.0188]		[0.0443]	

Table III. GMM three factor pricing model estimates

The table reports coefficients from one-step GMM estimations of a three factor asset pricing model. The analysis uses the five portfolios from each of our sorting variables (dividend yields, term spreads and momentum) simultaneously, giving 15 cross-sectional observations. In every specification of the model the first factor is the MSCI World excess return (World) the second is the global equity volatility factor (Vol^{EQ}) and the choice of the third factor varies across models. The final two rows of the table give the GMM J-statistic and its p-value.

	Model 1		Model 2		Model 3		Model 4	
	$\hat{b}$	$\hat{\lambda}$	$\hat{b}$	$\hat{\lambda}$	$\hat{b}$	$\hat{\lambda}$	$\hat{b}$	$\hat{\lambda}$
World	-16.6754	-0.0114	-16.5914	-0.0087	-18.8223	-0.0186	-9.0898	-0.0067
	[-1.9638]	[-0.9658]	[-1.7888]	[-0.7027]	[-1.8868]	[-1.3322]	[-1.2919]	[-0.5925]
Vol^{EQ}	-24.4586	-0.0355	-25.1859	-0.0408	-19.6438	-0.0284	-14.3510	-0.0259
	[-1.8019]	[-2.8920]	[-2.0523]	[-2.5954]	[-2.4653]	[-2.2739]	[-2.1482]	[-2.2267]
Vol^{FX}	17.9771	0.0004						
	[0.4715]	[0.0321]						
$Size^{US}$			-12.5098	-0.0067				
			[-0.6729]	[-0.3858]				
$Value^{US}$					6.6840	0.0092		
					[0.5050]	[0.7510]		
Mom^{US}							8.0796	0.0216
							[1.0712]	[1.3596]
J-stat	9.0337		8.5598		8.9920		12.7194	
p-value	[0.7001]		[0.7400]		[0.7036]		[0.3898]	

Table IV. Time-series regressions of portfolio returns on factors and factor mimicking portfolios

The table reports coefficients from time-series regressions of portfolio returns on factors. The right-hand side variables are factor mimicking portfolios for our volatility proxies and the US Fama-French factors. Data are monthly. Newey and West (1987) t-statistics are reported in parentheses. The final two rows give the R^2 of the time series regression and the annualized alpha in percentage points implied by the regression constant.

	Div yield					Term spread					Momentum				
	P1	P2	P3	P4	P5	P1	P2	P3	P4	P5	P1	P2	P3	P4	P5
Constant	-0.006	-0.001	0.001	0.002	0.002	-0.004	-0.001	0.000	-0.002	0.003	-0.004	-0.004	0.001	0.002	0.002
	[-2.220]	[-0.690]	[0.878]	[1.420]	[1.410]	[-1.834]	[-0.298]	[0.160]	[-1.186]	[0.984]	[-1.734]	[-1.991]	[0.675]	[0.830]	[1.434]
World	0.105	0.099	0.087	-0.004	0.029	0.046	0.115	0.077	0.177	0.024	0.109	0.119	0.042	0.046	-0.008
	[1.457]	[1.762]	[1.937]	[-0.099]	[0.643]	[0.846]	[2.034]	[1.550]	[3.526]	[0.386]	[1.992]	[2.345]	[0.751]	[0.888]	[-0.210]
Vol^{FX}	-0.711	-0.013	-0.947	-0.471	-0.447	-0.811	0.040	-0.843	-0.177	-0.627	-0.984	-0.871	-0.335	-0.267	-0.060
	[-3.731]	[-0.090]	[-9.316]	[-5.469]	[-4.539]	[-5.458]	[0.280]	[-7.001]	[-1.807]	[-4.027]	[-6.588]	[-7.059]	[-2.515]	[-2.169]	[-0.697]
Vol^{EQ}	-0.100	-0.213	0.014	-0.143	-0.160	-0.037	-0.174	0.050	-0.161	-0.061	-0.030	0.027	-0.065	-0.182	-0.382
	[-1.502]	[-4.065]	[0.400]	[-5.357]	[-4.865]	[-0.776]	[-3.448]	[1.181]	[-4.825]	[-1.258]	[-0.600]	[0.663]	[-1.327]	[-4.223]	[-14.378]
Size^{US}	0.111	0.185	0.098	0.114	0.121	0.173	0.131	0.122	0.096	0.137	0.038	0.195	0.240	0.059	0.101
	[1.119]	[2.521]	[1.577]	[2.079]	[2.038]	[2.439]	[1.698]	[1.733]	[1.408]	[1.518]	[0.481]	[2.842]	[3.159]	[0.847]	[2.034]
Value^{US}	0.101	0.046	0.084	0.160	0.141	0.191	0.164	0.136	0.205	0.113	0.040	0.140	0.136	0.207	0.006
	[1.217]	[0.677]	[1.595]	[3.183]	[2.600]	[2.776]	[2.345]	[2.050]	[3.521]	[1.422]	[0.538]	[2.061]	[2.042]	[3.055]	[0.094]
Mom^{US}	-0.105	-0.064	0.049	0.010	0.041	-0.022	0.032	0.051	0.019	-0.068	-0.173	-0.010	-0.006	0.070	0.048
	[-1.923]	[-1.526]	[1.487]	[0.309]	[1.235]	[-0.526]	[0.726]	[1.254]	[0.517]	[-1.188]	[-3.847]	[-0.230]	[-0.131]	[1.753]	[1.430]
R^2	0.373	0.392	0.543	0.534	0.514	0.427	0.283	0.342	0.421	0.263	0.470	0.452	0.240	0.435	0.721
Annual alpha	-7.422	-1.754	1.661	2.662	2.851	-4.718	-0.785	0.381	-2.470	3.123	-4.881	-4.520	1.792	1.874	2.703

Table V. Portfolio return statistics by number of portfolios

Descriptive statistics for monthly returns on international equity portfolios based on local return momentum, dividend yield and term spreads sorts. Returns are in excess of the US market return. The sample of 42 countries runs from November 1983 to September 2011. We present total US-dollar HML^{UEP} returns, the local-currency equity component of HML^{UEP} returns and the FX component of the HML^{UEP} returns for various choices of the number of portfolios into which the cross-section is split. Numbers in brackets are t-statistics for the null that the sample mean return is zero. AC(1) is the first-order autocorrelation.

(a) Dividend yield

Portfolios		3			4			5			6	
	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX
Mean	8.59	9.06	-0.47	11.68	12.03	-0.35	11.37	12.66	-1.29	11.56	12.56	-1.00
	[3.79]	[4.37]	[-0.64]	[4.20]	[4.71]	[-0.41]	[3.64]	[4.40]	[-1.26]	[3.21]	[3.80]	[-0.85]
Median	9.69	8.01	0.74	9.32	9.59	0.40	11.33	10.12	-0.67	12.53	9.77	0.55
Std. Dev.	11.75	10.76	3.80	14.44	13.25	4.41	16.20	14.91	5.32	18.68	17.15	6.13
Skew	-0.08	0.15	-0.83	-0.28	0.11	-1.12	-0.38	0.03	-0.84	-0.46	0.13	-1.19
Kurtosis	5.04	4.25	7.04	5.95	5.01	10.38	5.67	4.85	8.93	7.22	5.77	10.25
Sharpe	0.73	0.84	-0.12	0.81	0.91	-0.08	0.70	0.85	-0.24	0.62	0.73	-0.16
AC(1)	0.17	0.17	0.10	0.16	0.16	0.04	0.17	0.18	0.03	0.12	0.14	-0.01

(b) Term spread

Portfolios		3			4			5			6	
	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX
Mean	4.71	4.86	-0.15	5.33	5.46	-0.12	6.98	6.84	0.14	5.91	6.25	-0.33
	[2.15]	[2.40]	[-0.15]	[1.99]	[2.23]	[-0.10]	[2.20]	[2.38]	[0.11]	[1.69]	[1.98]	[-0.25]
Median	3.47	3.24	-1.08	2.40	4.09	-0.99	1.61	2.26	0.57	1.87	0.93	-0.21
Std. Dev.	11.37	10.50	5.28	13.90	12.70	6.12	16.45	14.91	6.47	18.13	16.40	6.89
Skew	0.44	0.65	-0.04	0.48	0.62	0.12	0.78	0.87	-0.04	0.76	0.89	-0.17
Kurtosis	4.49	4.64	4.72	4.54	4.92	4.76	5.79	6.60	4.58	5.41	6.16	4.04
Sharpe	0.41	0.46	-0.03	0.38	0.43	-0.02	0.42	0.46	0.02	0.33	0.38	-0.05
AC(1)	0.08	0.09	0.06	0.05	0.07	0.04	0.03	0.02	0.04	0.03	0.04	0.04

(c) Momentum

Portfolios		3			4			5			6	
	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX
Mean	11.97	9.77	2.20	12.89	10.59	2.30	12.29	10.44	1.85	12.95	10.96	1.99
	[4.14]	[3.73]	[2.22]	[3.74]	[3.33]	[1.92]	[3.21]	[2.96]	[1.41]	[3.13]	[2.84]	[1.36]
Median	13.36	11.46	1.15	14.89	13.03	-0.09	13.63	12.35	0.26	15.30	12.35	1.02
Std. Dev.	15.01	13.58	5.14	17.90	16.48	6.22	19.86	18.29	6.83	21.50	20.05	7.60
Skew	-0.40	-0.54	0.50	-0.26	-0.44	0.91	-0.47	-0.52	1.01	-0.40	-0.52	0.58
Kurtosis	5.15	4.58	6.63	5.17	4.40	8.42	5.57	4.86	9.69	5.15	5.25	8.08
Sharpe	0.80	0.72	0.43	0.72	0.64	0.37	0.62	0.57	0.27	0.60	0.55	0.26
AC(1)	0.10	0.10	0.15	0.09	0.11	0.18	0.05	0.08	0.12	0.04	0.10	0.08

Table VI. Portfolio return statistics by number of portfolios, last 10 years

Descriptive statistics for monthly returns on international equity portfolios based on local currency return momentum, dividend yield and term spreads sorts. Returns are in excess of the US market return. The statistics in the table are based on a cross-section of 42 countries and return data from the decade ending in September 2011. We give total US-dollar HML^{UEP} returns, the local-currency equity component of the HML^{UEP} returns and the FX component of the HML^{UEP} returns for various choices of the number of portfolios into which the cross-section is split. Numbers in brackets are t-statistics for the null that the sample mean return is zero. AC(1) is the first-order autocorrelation.

(a) Dividend yield

Portfolios	3			4			5			6		
	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX
Mean	5.29	4.48	0.81	6.38	5.32	1.06	6.80	6.10	0.70	8.77	7.66	1.11
	[2.07]	[1.75]	[0.81]	[2.13]	[1.82]	[0.84]	[1.97]	[1.79]	[0.48]	[2.17]	[1.99]	[0.62]
Median	6.06	3.44	1.67	4.90	1.64	1.37	5.64	0.79	1.36	4.53	3.99	2.60
Std. Dev.	8.09	8.08	3.17	9.46	9.27	3.99	10.91	10.77	4.62	12.76	12.15	5.64
Skew	-0.16	0.02	-0.48	0.11	0.19	-0.49	-0.05	-0.02	-0.49	0.37	0.39	-0.47
Kurtosis	4.36	4.00	4.37	2.97	3.18	3.96	3.44	3.59	3.80	3.51	3.78	3.86
Sharpe	0.65	0.55	0.26	0.67	0.57	0.26	0.62	0.57	0.15	0.69	0.63	0.20
AC(1)	0.12	0.11	-0.12	0.04	0.09	-0.13	0.04	0.07	-0.14	-0.01	0.07	-0.24

(b) Term spread

Portfolios	3			4			5			6		
	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX
Mean	-0.17	0.90	-1.08	0.66	2.13	-1.47	0.38	2.36	-1.98	-2.44	1.00	-3.44
	[-0.07]	[0.44]	[-0.79]	[0.23]	[0.85]	[-0.90]	[0.12]	[0.86]	[-1.11]	[-0.66]	[0.31]	[-1.69]
Median	1.94	2.39	-2.33	1.93	1.44	-3.33	0.80	1.05	-4.94	0.85	0.67	-5.18
Std. Dev.	7.38	6.51	4.28	8.95	7.93	5.19	10.10	8.70	5.65	11.69	10.20	6.45
Skew	-0.49	-0.37	0.26	-0.03	-0.04	0.20	-0.24	-0.28	0.17	-0.30	-0.27	0.03
Kurtosis	4.46	3.64	3.42	4.73	3.33	3.03	3.63	3.16	2.98	3.02	3.60	2.83
Sharpe	-0.02	0.14	-0.25	0.07	0.27	-0.28	0.04	0.27	-0.35	-0.21	0.10	-0.53
AC(1)	-0.00	-0.11	0.11	0.03	-0.05	0.13	0.11	0.04	0.11	0.14	0.09	0.12

(c) Momentum

Portfolios	3			4			5			6		
	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX	Total	Equity	FX
Mean	7.44	8.62	-1.18	7.65	10.02	-2.38	7.33	10.09	-2.75	7.60	11.30	-3.70
	[2.20]	[2.55]	[-0.98]	[1.95]	[2.53]	[-1.67]	[1.64]	[2.30]	[-1.73]	[1.54]	[2.40]	[-2.12]
Median	11.75	11.48	-1.24	11.73	12.62	-2.49	7.68	11.69	-2.11	9.53	10.84	-2.58
Std. Dev.	10.70	10.70	3.82	12.40	12.55	4.51	14.11	13.85	5.04	15.55	14.89	5.52
Skew	-0.35	-0.26	-0.36	-0.41	-0.23	-0.43	-0.41	-0.29	-0.16	-0.33	-0.08	-0.35
Kurtosis	3.32	3.93	3.97	3.10	3.28	3.85	3.15	3.24	3.87	3.44	3.49	3.36
Sharpe	0.70	0.81	-0.31	0.62	0.80	-0.53	0.52	0.73	-0.55	0.49	0.76	-0.67
AC(1)	-0.01	0.02	0.13	-0.06	-0.01	0.10	-0.08	-0.05	-0.02	-0.07	-0.08	0.01

Table VII. HML^{UEP} Return Components, restricted cross-section

The table reports descriptive statistics for the monthly HML^{UEP} returns of the international equity portfolios sorted by signals based on local return momentum, dividend yields and term spreads. Sorts split the cross-section into five portfolios. The holding period is one month. Returns are measured in US dollars and in excess of the US market return. The sample of includes a cross-section of only 16 developed countries and runs from November 1983 to September 2011. Total returns are decomposed into a local currency equity return and an FX contribution. Numbers in brackets are t-statistics for the null that the sample mean return is zero. AC(1) is the first-order autocorrelation.

(a) Dividend yield

	Total	Equity	FX
Mean	9.943	11.135	-1.193
	[3.809]	[4.578]	[-1.073]
Median	8.349	8.095	-0.786
Std. Dev.	13.544	12.620	5.764
Skew	0.044	0.448	-0.183
Kurtosis	5.619	5.406	4.771
Sharpe	0.734	0.882	-0.207
AC(1)	0.128	0.171	-0.012

(b) Term spread

	Total	Equity	FX
Mean	3.970	5.205	-1.235
	[1.416]	[2.047]	[-0.952]
Median	3.746	4.488	-0.387
Std. Dev.	14.551	13.193	6.733
Skew	0.609	0.556	-0.033
Kurtosis	6.879	7.383	4.176
Sharpe	0.273	0.395	-0.183
AC(1)	-0.048	-0.018	-0.026

(c) Momentum

	Total	Equity	FX
Mean	10.917	8.790	2.127
	[3.221]	[2.857]	[1.576]
Median	13.328	9.199	4.005
Std. Dev.	17.586	15.961	7.001
Skew	-0.573	-0.396	-0.206
Kurtosis	6.212	5.664	3.888
Sharpe	0.621	0.551	0.304
AC(1)	-0.053	-0.035	0.016

Table VIII. Descriptive Statistics of ETF and Index Portfolio Returns

The table reports descriptive statistics for the monthly returns of the international equity portfolios sorted by signals based on local return momentum, dividend yields and term spreads. The holding period is one month. For each signal, returns are derived first from prices of ETF contracts and then from index levels and are measured in US dollars and in excess of the US return. We then compare the return profiles from these two data sources. The sample consists of at most 33 countries and runs from March 1996 to September 2011. Portfolio 1 (P1) contains the one fifth of countries that have the lowest value of the signal, whereas portfolio 5 (P5) contains the countries with the highest values of the signal. HML^{UEP} gives statistics for US-dollar returns on the portfolio that is long P5 and short P1, HML^{EQ} is the return on the positions in local currency and HML^{FX} is the FX component of the HML^{UEP} portfolio return. By definition, $HML^{UEP} = HML^{EQ} + HML^{FX}$. Numbers in brackets are t-statistics for the null that the sample mean return is zero. AC(1) is the first-order autocorrelation.

Panel (a): Dividend yields

	P1	P2	P3	P4	P5	HML^{UEP}	HML^{EQ}	HML^{FX}
ETF returns								
Mean	-4.35	6.55	3.32	1.16	4.61	8.96	8.98	-0.02
	[-1.29[	[1.94]	[1.05]	[0.35]	[1.29]	[2.96]	[3.38]	[-0.01]
Median	-2.11	9.72	3.96	0.99	2.16	6.56	4.39	2.13
Std. Dev.	12.62	13.10	12.70	12.71	13.72	12.14	10.78	6.81
Skew	0.12	-0.14	0.02	-0.06	0.19	0.55	0.33	-0.08
Kurtosis	3.45	4.37	4.11	4.21	2.85	3.82	3.15	4.54
Sharpe	-0.34	0.50	0.26	0.09	0.34	0.74	0.83	0.00
AC(1)	0.11	0.02	-0.04	0.02	0.06	-0.04	-0.06	-0.18
Index returns								
Mean	-3.24	6.97	3.35	2.71	5.51	8.75	8.77	-0.02
	[-1.01]	[2.10]	[1.06]	[0.82]	[1.60]	[2.96]	[3.40]	[-0.01]
Median	-4.47	10.69	4.32	6.52	3.07	5.96	5.52	2.13
Std. Dev.	12.36	12.78	12.59	12.81	13.17	11.85	10.28	6.81
Skew	0.02	-0.10	0.02	-0.34	0.16	0.41	0.22	-0.08
Kurtosis	3.09	3.73	4.78	3.66	2.72	3.69	3.04	4.54
Sharpe	-0.26	0.54	0.27	0.21	0.42	0.74	0.85	0.00
AC(1)	0.05	0.04	-0.03	0.02	0.05	-0.03	-0.02	-0.18
HML^{UEP} return correlation for ETFs and Indices								0.94

Table VIII. (continued)

Panel (b): Term spreads

	P1	P2	P3	P4	P5	HML^{UEP}	HML^{EQ}	HML^{FX}
ETF returns								
Mean	2.37	1.53	3.39	-0.05	3.56	1.19	3.29	-2.11
	[0.80]	[0.46]	[1.04]	[-0.02]	[0.98]	[0.36]	[1.03]	[-1.36]
Median	1.57	4.28	5.17	0.03	2.02	-4.14	2.77	-3.40
Std. Dev.	11.98	13.12	12.57	12.95	14.13	12.75	12.17	6.35
Skew	-0.28	0.00	-0.18	-0.18	1.10	1.69	1.90	0.14
Kurtosis	4.21	3.76	3.03	3.22	9.17	14.22	14.76	3.34
Sharpe	0.20	0.12	0.27	0.00	0.25	0.09	0.27	-0.33
AC(1)	-0.04	0.01	0.04	0.05	0.03	0.04	0.07	-0.08
Index returns								
Mean	3.43	2.45	3.54	0.49	4.27	0.83	2.94	-2.11
	[1.18]	[0.72]	[1.07]	[0.14]	[1.26]	[0.28]	[1.01]	[-1.36]
Median	2.06	5.66	8.42	1.56	5.00	-2.62	4.15	-3.40
Std. Dev.	11.51	13.03	12.71	13.26	13.31	11.72	11.14	6.35
Skew	-0.28	-0.17	-0.35	-0.30	0.11	0.39	0.57	0.14
Kurtosis	3.48	3.56	3.40	3.53	4.89	6.44	6.20	3.34
Sharpe	0.30	0.19	0.28	0.04	0.32	0.07	0.26	-0.33
AC(1)	-0.01	0.07	0.04	0.03	0.01	0.04	0.06	-0.08
HML^{UEP} return correlation for ETFs and Indices								0.94

Table VIII. (continued)

Panel (c): Momentum

	P1	P2	P3	P4	P5	HML^{UEP}	HML^{EQ}	HML^{FX}
ETF returns								
Mean	-3.31	1.64	3.87	3.76	5.63	8.94	10.43	-1.49
	[-0.74]	[0.52]	[1.22]	[1.14]	[1.55]	[1.99]	[2.49]	[-0.81]
Median	-0.90	3.55	5.49	-0.35	8.38	9.01	16.91	-2.66
Std. Dev.	15.55	12.10	12.46	13.24	14.19	15.86	14.84	7.02
Skew	0.56	-0.05	-0.28	0.18	-0.27	-0.46	-0.87	0.12
Kurtosis	6.82	4.05	4.26	3.26	2.84	7.15	8.14	3.57
Sharpe	-0.21	0.14	0.31	0.28	0.40	0.56	0.70	-0.21
AC(1)	0.30	0.05	0.00	-0.04	0.01	0.24	0.24	0.07
Index returns								
Mean	-2.93	1.70	5.21	5.08	6.86	9.79	11.28	-1.49
	[-0.69]	[0.53]	[1.58]	[1.60]	[1.99]	[2.30]	[2.82]	[-0.81]
Median	1.19	5.92	8.95	4.11	9.34	9.83	17.56	-2.66
Std. Dev.	15.08	12.20	12.88	12.94	13.77	15.41	14.45	7.02
Skew	-0.03	-0.30	-0.31	0.16	-0.33	-0.08	-0.29	0.12
Kurtosis	4.09	3.41	4.24	3.29	2.81	4.10	4.56	3.57
Sharpe	-0.19	0.14	0.40	0.39	0.50	0.64	0.78	-0.21
AC(1)	0.22	0.08	0.01	-0.06	-0.03	0.18	0.19	0.07
HML^{UEP} return correlation for ETFs and Indices								0.93

Table IX. Portfolio returns net of trading costs

The table reports descriptive statistics for the monthly HML^{UEP} returns of the international equity portfolios sorted by signals based on local return momentum, dividend yields and term spreads. The holding period is one month. Returns are measured in US dollars and in excess of the US market return. The sample contains 42 country indices. For each signal we present gross returns and returns net of trading costs for data from the last 10 years in our sample only, i.e. the ten years up to September 2011. Trading costs are computed using the data contained in Table A.XII.

Panel (a): Dividend yields

	Gross	Net
Mean	6.80	5.92
Median	5.64	4.99
Std. Dev.	10.91	10.91
Skew	-0.05	-0.04
Kurtosis	3.44	3.45
Sharpe	0.62	0.54
AC(1)	0.04	0.04

Panel (b): Term spreads

	Gross	Net
Mean	0.38	-0.32
Median	0.80	0.46
Std. Dev.	10.10	10.08
Skew	-0.24	-0.24
Kurtosis	3.63	3.66
Sharpe	0.04	-0.03
AC(1)	0.11	0.11

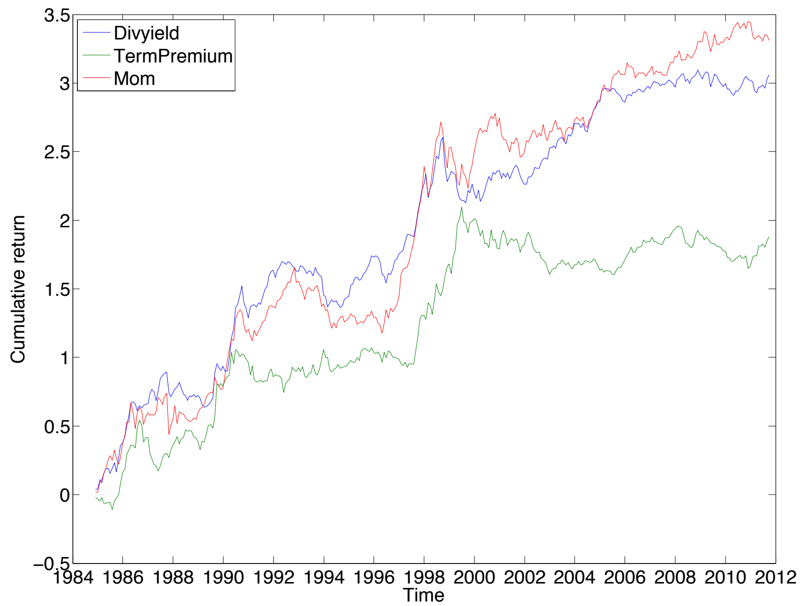
Panel (c): Momentum

	Gross	Net
Mean	7.33	5.83
Median	7.68	6.95
Std. Dev.	14.11	14.11
Skew	-0.41	-0.41
Kurtosis	3.15	3.16
Sharpe	0.52	0.41
AC(1)	-0.08	-0.09

Figure 1: Cumulative return comparison: international equity portfolios, FX carry and the MSCI World index

For each of our equity index forecasting methods (i.e. momentum, dividend yields and term spreads), we plot the cumulative HML^{UEP} return in US dollars. Alongside those we plot the cumulative HML return on a standard FX carry strategy and the cumulative excess return on the MSCI World index.

(a) HML^{UEP} returns using different predictor variables



(b) Excess returns on MSCI World and FX Carry

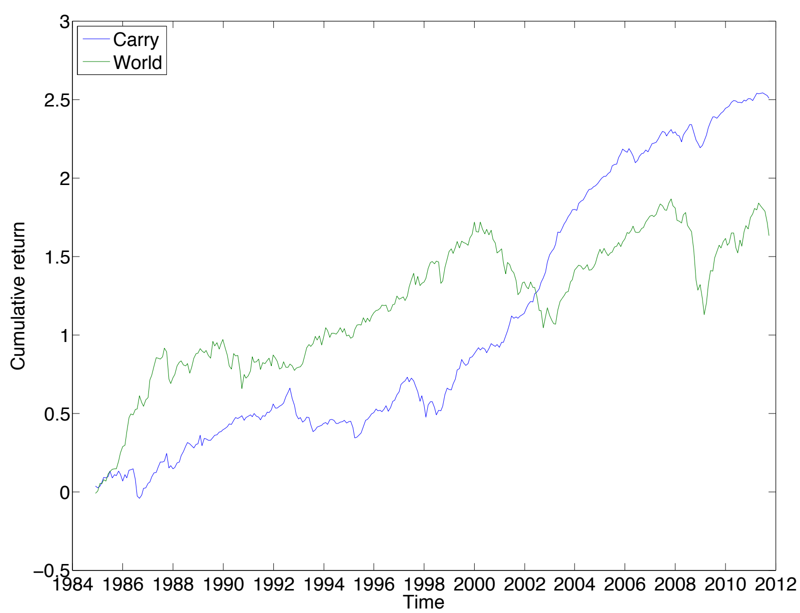
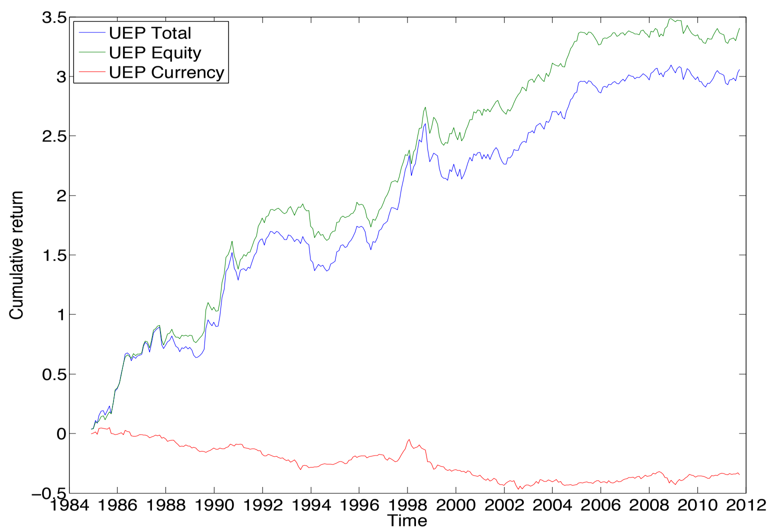


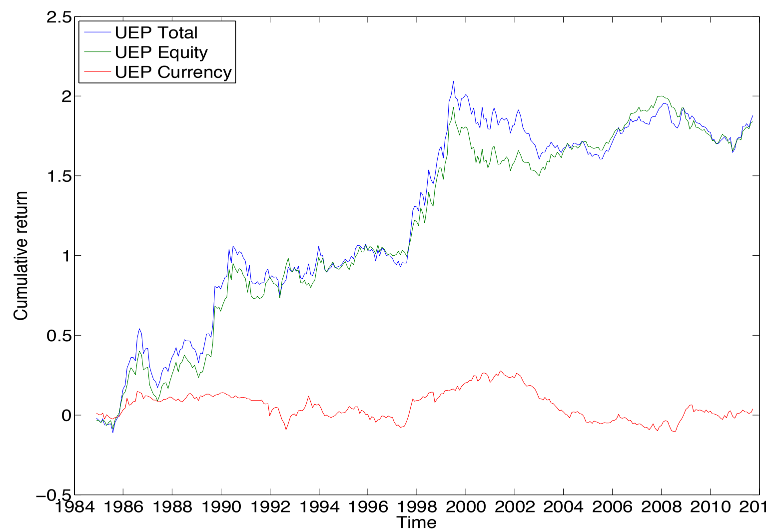
Figure 2: Cumulative return components: international equity portfolios

For each of our equity index forecasting methods (i.e. momentum, dividend yields and term spreads), we plot the cumulative HML^{UEP} US-dollar return. We also plot the cumulative HML^{UEP} return in local currency and then FX component of the HML return. Results are based on splitting the cross-section of countries into five portfolios.

(a) Dividend yield



(b) Term spread



(c) Momentum

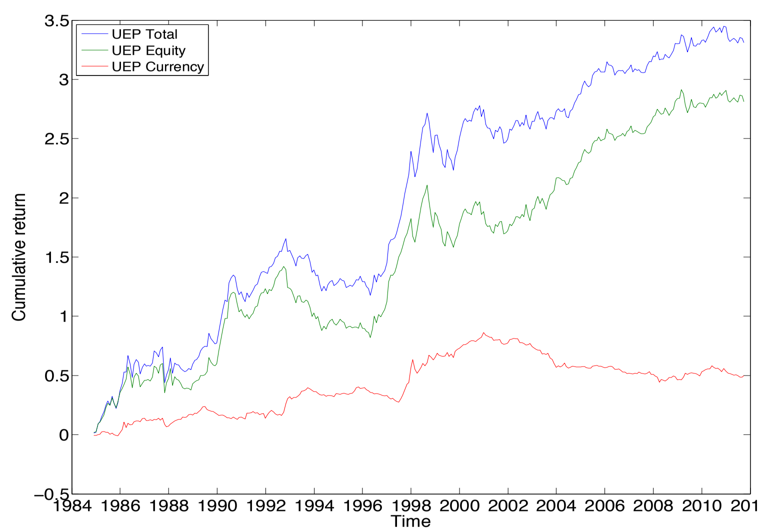
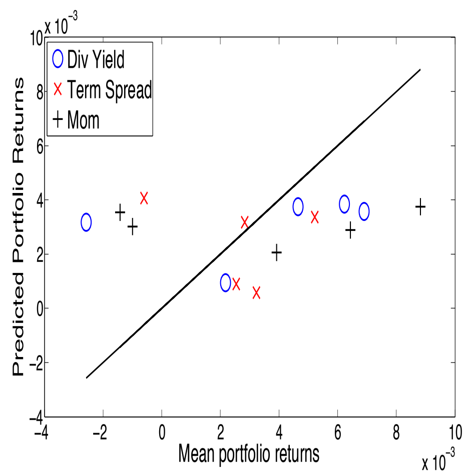


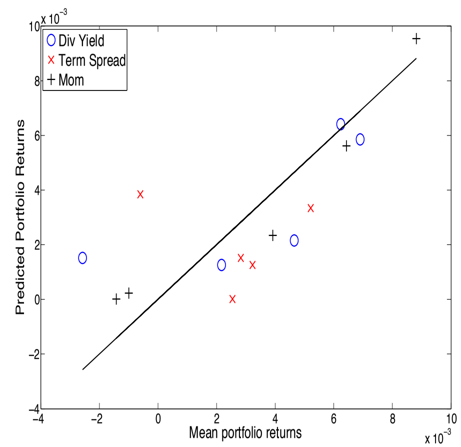
Figure 3: Pricing performance of 2-factor models: US factors

Each panel plots expected returns for the 15 combined portfolios against the expected returns delivered by a two factor model where the first factor is the MSCI World and the second factor is, in turn, residual FX volatility, residual equity volatility, US size, US value and US momentum. All models are estimated using one-step GMM. A 45° line is shown for comparison

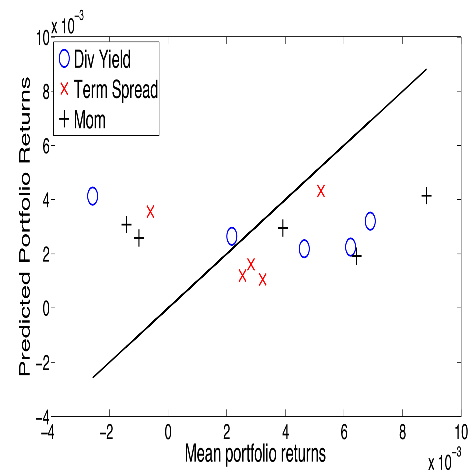
(a) Vol^{FX}



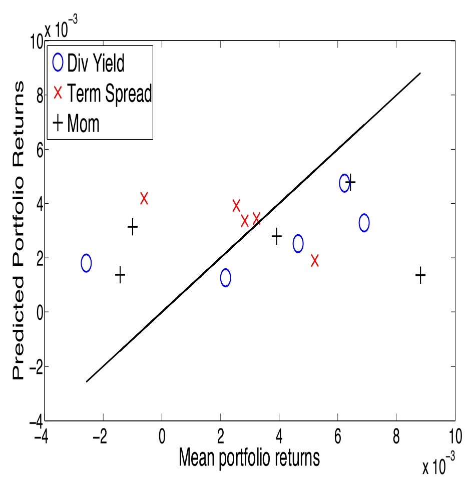
(b) Vol^{EQ}



(c) Size^{US}



(d) Value^{US}



(e) Mom^{US}

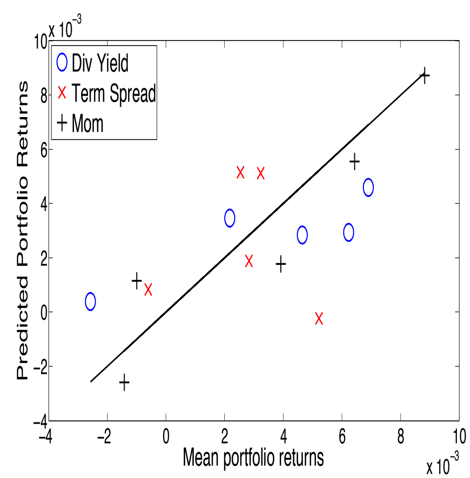
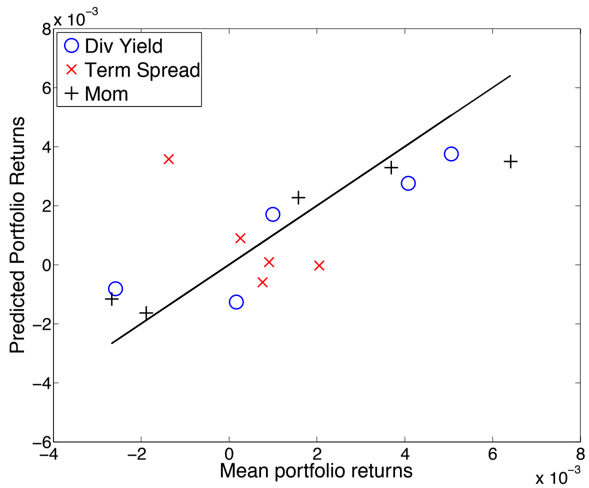


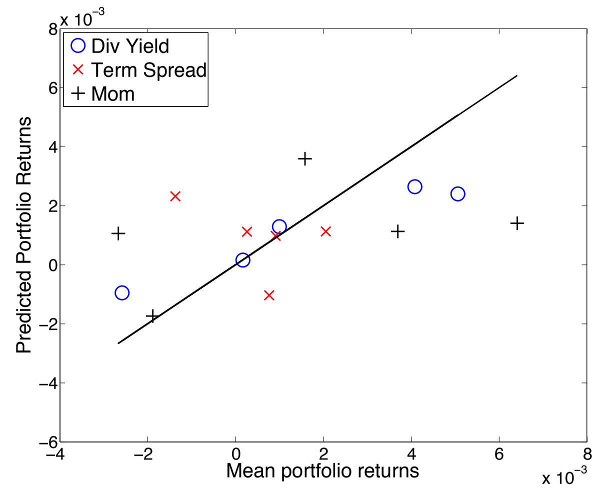
Figure 4: Pricing performance of 2-factor models: global factors

Each panel plots expected returns for the 15 combined portfolios against the expected returns delivered by a two factor model where the first factor is the MSCI World and the second factor is, in turn, residual equity volatility, global size, global value and global momentum. All models are estimated using one-step GMM. A 45° line is shown for comparison

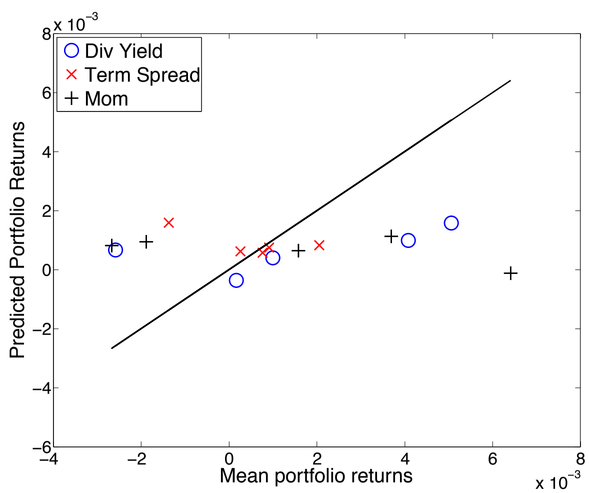
(a) Vol^{EQ}



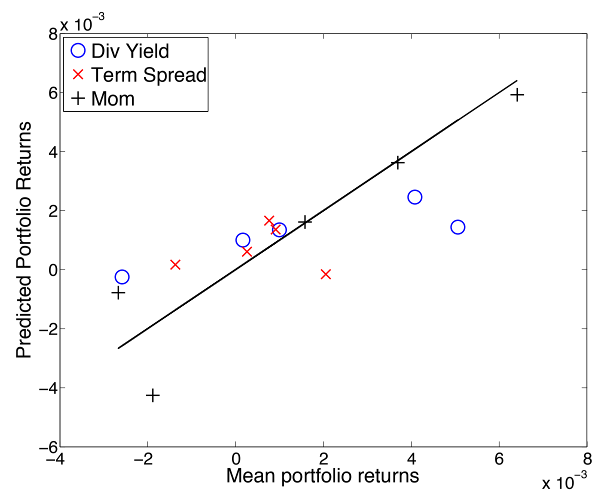
(b) Size^{G}



(c) Value^{G}



(d) Mom^{G}



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