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Climate Transition Risk: Equity Pricing and Currency Markets

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ABSTRACT

This paper examines how climate transition risk is priced in international equity markets and transmitted to currencies. Using portfolio sorting and asset pricing tests across 35 countries from January 2000 to September 2024, it finds a significant climate transition risk premium in emerging markets (EMs) but not in developed markets (DMs). The equity premium is accompanied by currency depreciation, consistent with portfolio rebalancing as the transmission mechanism, but is not fully offset, implying that climate transition risk contributes to deviations from Uncovered Equity Parity. The premium emerges only after the 2015 Paris Agreement, suggesting greater investor awareness of EMs' higher exposure to transition risk. Further tests show that weaker climate policy credibility and greater reliance on energy exports help explain the effect in EMs. By contrast, physical climate risk is not significantly priced. The results are robust to alternative measures of transition risk, portfolio construction methods, and asset pricing specifications.

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“There is growing recognition, particularly, for Emerging Market and Developing Economies, that climate is no longer just an environmental concern but a systemic financial risk, one that directly shapes sovereign credit ratings, investor behaviour and capital flows” (World Economic Forum, 2025).

1. Introduction

The growing recognition that climate change poses systemic risks to the global economy has reshaped financial markets and investment decisions. A key inflection point was the Paris Agreement, adopted at the COP21 conference in December 2015, under which 196 countries committed to net-zero emissions targets. This marked a shift in investor attention toward climate transition risk, defined as the financial exposures arising from the transition to a low-carbon economy, driven by policy, regulatory, technological, and market changes.¹ Recent evidence shows that climate transition risk is priced at the firm level: investors demand higher expected returns for firms with greater carbon emissions (Bolton and Kacperczyk, 2021, 2023). At the same time, central banks and institutional investors have begun incorporating transition risk into international asset allocation decisions (Bolton et al., 2025), while the Network for Greening the Financial System (NGFS, 2019) highlights its potential to amplify macro-financial vulnerabilities through labour markets, interest rates, and exchange rates. In support of these concerns, Gavriilidis et al. (2026) provide empirical evidence that heightened climate policy uncertainty in the US depresses output and private investment. Whether such macroeconomic transmission of climate transition risk extends to currency markets, and through which channel, remains an open question that motivates the cross-country analysis in this paper.

The contributions of this paper to the literature are threefold. First, we exploit cross-country heterogeneity in climate transition risk to test its pricing in international equity portfolios, with particular attention to differences between emerging markets (EMs) and developed markets (DMs), against the backdrop of the Paris Agreement. Second, we test whether and through

¹ The terms 'climate transition risk' and 'transition risk' are used interchangeably throughout the paper.

which channel country-level climate transition risk transmits to FX markets, a dimension that remains underexplored despite its direct relevance for international investors and central banks. Third, we show that differences in policy credibility and energy-export dependence between EMs and DMs help explain the market-segmented pricing of transition risk.

In a world of mobile capital, cross-country heterogeneity in climate transition risk can induce portfolio reallocation across equity markets. Investors may shift capital away from high-risk countries toward less exposed ones, generating equity outflows that put downward pressure on local currencies.² If exchange rate adjustments do not fully offset the associated equity premia, transition risk becomes a source of systematic deviations from uncovered equity parity (UEP). Conversely, if investors pursue transition risk premia, capital may flow toward high-risk countries, leading to currency movements that reinforce equity returns and amplify UEP deviations. These channels, portfolio rebalancing and return chasing, constitute two competing mechanisms through which country-level transition risk is transmitted to currency markets.

Our study employs monthly data on benchmark local equity indices, bilateral exchange rates against the US dollar, and climate transition risk indices for 35 economies, EMs and DMs, from January 2000 to September 2024. We find that exposure to climate transition risk commands a systematic risk premium in international equity markets, but only for EMs and in the post-Paris period. Portfolio sorts reveal that higher transition risk commands a significant equity premium in EMs, with associated currency movements consistent primarily with the portfolio rebalancing channel. The resulting currency depreciation does not fully offset the equity premium, generating positive foreign excess equity returns and hence systematic deviations from uncovered equity parity (UEP) predictions. These findings are corroborated by GMM asset pricing tests that control for a battery of traditional equity and currency risk factors,

² Managing trillions of dollars in cross-border assets, the portfolio decisions of central banks alone can shape global capital flows and foreign exchange markets (NGFS, 2019).

supporting a risk-based interpretation of transition risk pricing at the country level, distinct from standard EM risk exposures. As a placebo test, we repeat both the portfolio sorting and GMM pricing analyses replacing transition risk with physical climate risk and find no significant pricing for either, DMs or EMs, pre- and post-Paris. This placebo test further supports the interpretation that our findings are specific to transition risk exposure and its repricing around the Paris Agreement, rather than reflecting a broader EM risk premium.

A natural explanation for the EM-specific, post-Paris pricing is that EM countries entered this period with higher transition risk³ and less developed climate policy frameworks than DMs. The Paris Agreement, by establishing a common international framework for climate accountability, made this gap more visible to international investors. While directly testing this awareness channel lies beyond the scope of the paper, two complementary explanations capture its observable implications in the data and are formally tested. First, the same fiscal instruments associated with emissions reductions in DMs have no comparable effect in EMs, pointing to a policy credibility gap that the Paris Agreement made more salient to investors.⁴ Second, EMs' structural reliance on energy exports exposes them to decarbonization pressures, threatening export revenues and currency stability, in ways that have no equivalent in DMs.

³ According to the International Energy Agency (IEA, 2021) many EMs exhibit lower per-capita emissions due to lower consumption and less developed infrastructure, yet face higher transition risk because: (i) absolute emissions grow rapidly with population/economic expansion; (ii) heavy reliance on coal power, energy-intensive manufacturing, and fossil fuel exports creates stranding risk; (iii) transition costs are disproportionately high relative to income and fiscal capacity; (iv) social fragility from carbon-sector job losses; (v) ESG investor penalties for weak disclosure/governance; and (vi) exposure to climate-sensitive industries such as agriculture.

⁴ The FT article “How ESG strategies hurt emerging markets” (Mundy and Temple, 2022), based on interviews with 52 market professionals, documents a widespread perception that EM countries face investor penalties relative to DMs due to weaker ESG credentials and governance standards. This practitioner evidence is consistent with the policy credibility gap we formally test: international investors appear to require additional compensation for EM equities precisely because the institutional and regulatory frameworks underpinning climate commitments are perceived as less reliable.

Robustness tests confirm our findings of a significant pricing of climate transition risk for EM equity post-Paris. These tests include using country-level carbon emissions intensity as an alternative transition risk proxy, varying the number of portfolios and holding period, using MSCI equity indices to mitigate capital control concerns, extending the transition risk signal lag to rule out look-ahead bias, and implementing sequential Fama-MacBeth regressions as an alternative asset pricing framework.

Our results speak to three related but distinct literatures. First, they extend the growing evidence on transition risk premia from the firm level to aggregate country-level equity portfolios, incorporating a macroeconomic dimension through currency markets. Prior studies show that investors demand higher expected returns for carbon-intensive firms (Bolton and Kacperczyk, 2021, 2023; Pástor et al., 2022; Hsu et al., 2023). We show that this pricing extends to cross-country equity portfolios and that it transmits to currency markets through portfolio rebalancing. In this sense, our paper provides an aggregate asset pricing counterpart to firm-level evidence, linking carbon exposure to international capital flows and FX rate dynamics. Our findings are also consistent with the carbon home bias documented by Bolton et al. (2025), that is, the tendency of investors to underweight foreign high-emission firms, suggesting that such preferences can scale up to generate systematic cross-border reallocation effects.⁵

Second, our findings add to the international asset pricing literature by revealing climate transition risk as a state variable that jointly affects equity returns and exchange rates. Building on the theoretical UEP framework (Hau and Rey, 2006; Cenedese et al., 2016), we show that

⁵ A potential concern is that the USD excess returns of our long–short international equity portfolios reflect a carbon home bias rather than compensation for country-level transition risk. This explanation would predict a persistent premium across both DMs and EMs and throughout the sample period. This market- and time-specific pattern is difficult to reconcile with a purely home bias explanation and is instead consistent with a transition risk interpretation linked to the Paris Agreement.

transition risk generates significant excess foreign versus home equity returns, thereby introducing a novel climate-related source of UEP violations.

Third, our results shed new light on market segmentation in climate risk pricing. Existing firm-level analyses point to weaker or absent transition risk premia in advanced economies and stronger effects in emerging markets (Bolton and Kacperczyk, 2023; Boermans and Galema, 2025). We complement this evidence at the country level by showing that transition risk is priced in international equity portfolios for EMs but not for DMs, and by identifying the Paris Agreement as the key inflection point underlying this asymmetry. In connecting transition risk with FX markets, our findings add to Gavriilidis et al. (2026), who show that heightened climate policy uncertainty in the US depresses aggregate measures of output and private investment. Together, the evidence from equity markets, currency markets, and the real economy suggests that the consequences of climate transition risk are broader and more macroeconomic in nature than firm-level pricing studies alone would imply.

Our findings have direct implications for central banks, regulators, and investors. Elevated transition risk in emerging markets can trigger capital outflows and currency depreciation, amplifying macroeconomic vulnerabilities such as higher import costs, inflation, and external debt burdens. Flammer et al. (2026) show that institutional investors already view currency and political risk as key barriers to scaling sustainable investment in emerging markets; our results suggest that transition risk itself is an additional driver of such currency risk. For investors, this underscores the need to incorporate transition risk into currency hedging and international portfolio allocation decisions. More broadly, our findings support calls by the IMF and NGFS for transition finance frameworks that mitigate, rather than exacerbate, macro-financial vulnerabilities in emerging markets.

The remainder of this paper is organized as follows. Section 2 introduces the conceptual framework. Section 3 describes the data and methodology, and Section 4 discusses the main

findings. Section 5 presents robustness tests and additional analyses. Section 6 concludes. An Internet Appendix contains details of robustness tests as well as additional analyses.

2. Conceptual Framework

We adopt the perspective of a US investor holding a portfolio of *home* (H) equities, denominated in US dollars, and *foreign* (F) equities, denominated in local currency. Bilateral FX rates are quoted as US dollars (USD) per unit of foreign currency, so a negative FX return reflects depreciation of the foreign currency.

The *excess equity return* for our representative US investor, hereafter denoted rx_{t+1} , is defined as the difference between the foreign and US equity returns (both in USD units):

$$rx_{t+1} \equiv r_{t+1}^{F,\$} - r_{t+1}^H = (r_{t+1}^F + \Delta s_{t+1}) - r_{t+1}^H = (r_{t+1}^F - r_{t+1}^H) + \Delta s_{t+1} \quad (1)$$

where $r_{t+1}^{F,\$} = \ln(P_{t+1}^{F,\$}/P_t^{F,\$})$ is the foreign equity logarithmic return in USD from t to $t+1$, $r_{t+1}^F = \ln(P_{t+1}^F/P_t^F)$ is the foreign equity return in local currency, and $\Delta s_{t+1} = \ln(S_{t+1}/S_t)$ is the corresponding FX return over the same period. Thus, the *excess equity return* captures the additional USD return earned on foreign equity versus home equity which decomposes into the local-currency return differential, $r_{t+1}^F - r_{t+1}^H$, and the currency movement, Δs_{t+1} .

The portfolio rebalancing model of Hau and Rey (2006) generates the prediction that the *excess equity return* is zero in equilibrium. The model rests on three core assumptions. First, investors allocate wealth across home equity, foreign equity, and riskless bonds to maximize expected utility. Second, foreign-currency supply is imperfectly elastic, so portfolio rebalancing alters relative currency demand and generates FX rate movements. Third, investors cannot perfectly hedge FX risk. Under these conditions, when foreign equities outperform domestic ones their portfolio weight, and thus, FX exposure, rises mechanically, and investors rebalance (sell foreign, buy home) to restore their desired risk exposure, exerting downward pressure on the foreign currency. The cross-border capital flows generated by

portfolio rebalancing can neutralize the *excess equity return* in equilibrium—this is the relationship known as Uncovered Equity Parity (UEP) which can be formalized as follows:

$$E_t[rx_{t+1}] \equiv E_t[r_{t+1}^F - r_{t+1}^H + \Delta s_{t+1}] = 0. \quad (2)$$

This implies that the local-currency equity return differential $\Delta Equity_{t+1} \equiv r_{t+1}^F - r_{t+1}^H$ and FX return $\Delta FX_{t+1} \equiv \Delta s_{t+1}$ comove perfectly negatively. In other words, when foreign stock market returns are high, the foreign currency depreciates and vice versa, so any outperformance of foreign (versus home) equity is fully offset by the currency movement.

However, empirical evidence mostly rejects UEP. Local-currency equity return differentials and FX returns have been found to co-move negatively but imperfectly, or even positively (Chabot et al., 2014; Cenedese et al., 2016; Fuertes et al., 2019). The imperfect negative co-movement is consistent with *portfolio rebalancing* behaviour in the presence of market frictions that prevent perfect hedging and limit intermediary capacity to absorb currency flows (Hau and Rey, 2006; Gabaix and Maggiori, 2015).⁶ The positive co-movement instead arises from *return-chasing* behaviour, whereby capital inflows into outperforming foreign equities bid up both equity prices and their currency simultaneously.

Climate change is global but manifests unevenly across countries—through differences in aggregate carbon intensity, policy ambition, and carbon-related cash-flow shocks—generating systematic cross-country variation in climate transition risk (CTR) exposure that

⁶ FX risk cannot be perfectly hedged at the investor level because the future local-currency value of a foreign equity position is uncertain, making the required hedge size unknown, and also because hedging costs are substantial, particularly for EM currencies where forward markets are illiquid. Hau and Rey (2006) present evidence of very incomplete FX hedging for equity funds. Moreover, FX market intermediaries have limited capacity to absorb net currency demand, so when many investors rebalance simultaneously the resulting currency flows move FX rates rather than being absorbed without price impact (Gabaix and Maggiori, 2015). The first friction explains why the excess equity return is not arbitrated away, and the second explains why rebalancing generates FX movements.

are priced in equity markets (Bolton and Kacperczyk, 2023). Thus, the above two well-known mechanisms, *portfolio rebalancing* or *return-chasing*, represent channels through which CTR-driven equity premia can be transmitted to currency markets, as Figure 1 illustrates.

[Insert Figure 1 around here]

3. Data and Methodology

3.1. Data description

The analysis is based on a sample of 35 countries observed from January 2000 to September 2024. We select countries whose currencies are used extensively in international markets, as reflected in the coverage by the 2022 BIS Triennial Central Bank Survey of foreign exchange and over-the-counter derivatives markets. This ensures that our sample comprises economies with sufficiently liquid and internationally traded currencies, consistent with our focus on joint equity-FX pricing dynamics.⁷ Following IMF classification, 15 are DMs (Australia, Austria, Canada, Denmark, Finland, France, Germany, Hong Kong, Japan, Norway, Singapore, South Korea, Sweden, Switzerland, and the United Kingdom) and 20 are EMs (Argentina, Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, Romania, South Africa, Thailand, and Turkey).

For each country, we collect month-end local-currency prices of benchmark equity indices and bid, ask, and mid bilateral exchange rate quotes (local currency per USD). Exchange rates are inverted to express prices in USD per unit of local currency, consistent with the definitions in Section 2. All data are obtained from LSEG Datastream, with country codes for each variable listed in Table A.1 of the Internet Appendix. Equity and exchange rate

⁷ See BIS Triennial Central Bank Survey (2022) at <https://www.bis.org/statistics/rpfx22.htm>.

returns are computed as logarithmic month-to-month changes. Table A.2 reports annualized mean, median and standard deviations of domestic equity returns and FX returns.

Equity returns are higher on average in EMs than in DMs, at 9.55% versus 3.49% per annum, but are also substantially more volatile, with standard deviations of 23.60% and 9.05%, respectively, on average across countries. In contrast to DMs, EM currencies tend to depreciate over the sample period, as reflected in an average FX return of -3.77% p.a. This large depreciation is, however, driven in part by high-inflation economies such as Argentina and Turkey, as indicated by the more moderate median FX return of -0.41% p.a.

We proxy climate transition risk (CTR) using country-level indices constructed by LSEG Sovereign Sustainability Solutions at quarterly frequency (data codes are listed in Table A.1) and downloaded from LSEG Datastream. These indices are designed to capture countries' exposure to risks associated with the transition to a low-carbon economy, including those related to actual emission reductions and commitments towards net-zero. To facilitate interpretation, we reverse the indices (100 minus the original value) so that higher values correspond to greater transition risk, and interpolate them to monthly frequency. Summary statistics in Table A.2 indicate substantial cross-country heterogeneity within both groups. In particular, Russia and China exhibit relatively high transition risk among EMs, while Australia and Canada stand out among DMs. Transition risk is higher in EMs than in DMs, with mean (median) values of 42.97(40.29) and 37.16(27.64), respectively.

Figure 2 illustrates the evolution of climate transition risk by country group, plotting cross-country mean (Panel A) and median (Panel B) values from 2000 to 2024.

[Insert Figure 2 around here]

Two features stand out. First, EMs consistently exhibit higher transition risk than DMs throughout the sample period, reflecting their greater carbon intensity and less developed

climate policy frameworks. Second, the EM-DM gap in transition risk has widened markedly over time. DM transition risk follows a steady downward trend that predates the Paris Agreement, pointing to an earlier and more sustained pace of climate policy reform in advanced economies. By contrast, EM transition risk has remained broadly flat over the sample period, with only a modest decline after 2016, suggesting that the Paris Agreement did little to accelerate meaningful decarbonisation progress in these economies. Together, these dynamics underscore the structural divergence in climate transition exposure that motivates our empirical focus on the EM-DM distinction and the Paris Agreement as a potential inflection point in investor awareness of the transition risk gap between the two groups.

3.2. Methodology

A. Portfolio sorts

From the perspective of a US investor, we sort foreign countries at each month t into five bins (P_1, P_2, P_3, P_4, P_5) based on their one-quarter lagged climate transition risk index at $t - 3$, in order to mitigate look-ahead bias.⁸ P1 contains countries with the lowest transition risk, and those with the highest form P5. We then construct a zero-cost long–short portfolio that is long P5 and short P1. The portfolio is held for one month, after which the sorting procedure is repeated. Using Equation (1), the foreign excess return (i.e., the foreign–home equity return differential, in USD terms) of portfolio k can be expressed as:

$$rx_{t+1}^{P_k} = \frac{1}{N_{P_k}} \sum_{i \in P_k} (r_{i,t+1}^F + \Delta S_{i,t+1}) - r_{t+1}^H \quad (3)$$

where N_{P_k} is the number of country constituents. Thus, the *foreign excess return of the long–short portfolio*, in US dollar (home-currency) terms, decomposes as:

⁸ The interpolation of the CTR index assigns the same quarterly value to the three months within each quarter. Thus, a lag of three months ensures that the signal used in portfolio sorting at month-end t is available to investors at the start of that quarter.

$$\begin{aligned}
rx_{t+1}^{(P_5-P_1)} &= \Delta Equity_{t+1}^{(P_5-P_1)} + \Delta FX_{t+1}^{(P_5-P_1)} \\
&= \left(\frac{1}{N_{P_5}} \sum_{i \in P_5} r_{i,t+1}^F - \frac{1}{N_{P_1}} \sum_{j \in P_1} r_{j,t+1}^F \right) + \left(\frac{1}{N_{P_5}} \sum_{i \in P_5} \Delta S_{i,t+1} - \frac{1}{N_{P_1}} \sum_{j \in P_1} \Delta S_{j,t+1} \right) \quad (4)
\end{aligned}$$

where the first term in parentheses is the equity premium component and the second term captures the contribution from currency movements.

Following Colacito et al. (2020) and Neely et al. (2009), we embed half-quoted bid-ask spreads into currency returns. Net FX changes in Equation (4) are given by:

$$\widetilde{\Delta S}_{i,t+1} = \Delta S_{i,t+1} - TC_{long,t+1} \quad (5)$$

$$\widetilde{\Delta S}_{j,t+1} = -(\Delta S_{j,t+1} - TC_{short,t+1}) \quad (6)$$

where $i \in Q_5(\text{long})$ and $j \in Q_1(\text{short})$, with $TC_{long,t+1} = \ln\left(\frac{1+c_t}{1-c_{t+1}}\right)$ representing the two-way transaction cost⁹ for long positions and $TC_{short,t+1} = \ln\left(\frac{1-c_t}{1+c_{t+1}}\right)$ for short positions.

The half-spread is $c_t = \frac{s_t^{ask} - s_t^{bid}}{2s_t^{mid}}$, and $\Delta s_{t+1} = \ln(s_{t+1}^{mid}/s_t^{mid})$ uses mid prices.

Following the literature, we do not adjust equity returns for transaction costs because of the difficulty of obtaining reliable country-specific equity trading costs. As in Cenedese et al. (2016), we use MSCI equity indices which are investable via liquid ETFs and index futures at relatively low transaction costs as part of a battery of robustness tests to various issues.

B. Risk-factor based GMM tests

Having documented return differentials across CTR-sorted portfolios, we now ask whether climate transition risk is a priced systematic factor in a formal asset pricing framework. In the

⁹ The two-way transaction costs account for round-trip execution: buying (selling) foreign currency at the ask (bid) at time t and selling (buying) at the bid (ask) at time $t + 1$ for long (short) positions.

traditional beta representation, the expected excess return on each international portfolio is determined by its exposures to risk factors and the corresponding factor prices of risk:

$$E(rx_{j,t+1}) = \lambda_{climate} \beta_j^{climate} + \boldsymbol{\lambda}' \boldsymbol{\beta}_j, \quad j = 1, \dots, J, \quad t = 1, \dots, T, \quad (7)$$

where $rx_{j,t+1}$ denotes the excess USD return on test asset j from month t to $t + 1$, and $\beta_j^{climate}$ the exposure of portfolio j to the climate transition factor constructed as the excess returns of the long-short portfolios obtained with the CTR index as country sorting criteria, Equation (4). Our parameter of interest is $\lambda_{climate}$, the price of climate transition risk. The remaining risk factor prices $\boldsymbol{\lambda}$ and exposures $\boldsymbol{\beta}_j$ correspond to an array of 10 equity market risk factors and FX risk factors that have been proposed in the international asset pricing literature (e.g., Menkhoff et al., 2012a, b; Cenedese et al., 2016).

Estimation of the risk premia is carried out via one-step Generalized Method of Moments (Hansen, 1982; GMM) with the identity matrix as the weighting matrix. Statistical significance is assessed using Newey–West robust t -statistics. We also report the J -statistic for the overidentifying restrictions test of zero pricing errors. Appendix A.3 provides a detailed discussion of the GMM asset pricing formulation.

We consider five equity market risk factors: USD excess return on the MSCI World index, U.S. Fama–French size and value factors, U.S. momentum factor, and a global equity volatility factor constructed as the innovation from an AR(1) model fitted to monthly averages of daily absolute returns across the S&P 500, FTSE 100, NIKKEI 225, DAX, and CAC 40 indices. We consider five FX market risk factors: U.S. dollar, carry, momentum, volatility, and long-term yield. Table A.4 provides details on the construction of the control risk factors, key references, and construction method. Appendix A.5 shows the correlation structure.

Following Menkhoff et al. (2012a), Cenedese et al. (2016) and Lewellen et al. (2010) *inter alia*, the USD excess returns $rx_{j,t+1}$ in the left-hand-side of Equation (7) pertain to the $J = 20$

portfolios obtained by sorting the primary local equity indices into quintiles according to four signals: equity momentum, currency carry, currency momentum, and term spread.¹⁰

4. Empirical Results

4.1. Portfolio sorts: Climate risk premia and currency dynamics

We begin by analysing the equity portfolios P1 to P5 formed each month from the full cross-section of countries. Table 1, Panel A, presents the excess returns in USD of each portfolio, $rx_{t+1}^{P_k}$, $k = 1, \dots, 5$ in Equation (3), and the long-short portfolio, $rx_{t+1}^{(P_5-P_1)}$ in Equation (4).

[Insert Table 1 around here]

The portfolio of equity indices from countries with the highest (lowest) climate transition risk, P5 (P1), yields a positive (negative) average excess return of 1.5141% (-0.1360%) per annum. The excess returns of the long (P5) - short (P1) equity portfolio average a significant 1.6501% p.a. (Newey-West t -statistic of 2.0766) and thus, the UEP condition is not supported by the data.¹¹

The last two columns of Panel A in Table 1 report the two components of the P5–P1 excess return: the change in equity prices in local currencies, $\Delta Equity_{t+1}^{(P_5-P_1)}$, which is significant and positive 4.0734% p.a. (t -stat of 2.0087) and the currency movement, $\Delta FX_{t+1}^{(P_5-P_1)}$, which is significantly and negative at -2.4233% p.a. (t -stat = -1.9809). The positive equity return differential, $\Delta Equity_{t+1}^{(P_5-P_1)}$, reveals that investors demand a transition risk premium. The

¹⁰ The currency carry and currency/equity momentum signals are as defined in Appendix A.4. The term spread, defined as the difference between the 10-year government bond yield and the 3-month interest rate (data sourced from LSEG Datastream) is included as a proxy for the slope of the yield curve, reflecting expectations about future inflation and economic growth conditions.

¹¹ UEP violation is corroborated by the negative correlation between the two monthly time-series of equity return differentials and FX returns, $\hat{\rho}_{\Delta Eq, FX} = -0.3110$. Crucially, the currency movements do not neutralize international equity return differentials and hence, the UEP condition is not supported (the null hypothesis $H_0: \rho_{\Delta Eq, FX} = -1$ is strongly rejected with a t -stat of 3.5630).

significant and negative FX movement, $\Delta FX_{t+1}^{(P_5-P_1)}$, suggests depreciation of these countries' currencies. The movement in opposite directions of equity return differentials, reflecting a transition risk pricing, and currencies is consistent with the portfolio rebalancing channel of Hau and Rey (2006) extending it to the climate transition risk context. Together, these results indicate that climate transition risk is priced in international equity markets, and that this pricing is transmitted into currency markets via the portfolio rebalancing channel.

[Insert Table 1 around here]

Next, we investigate the same international equity portfolio approach separately for the two groups of countries, DMs and EMs, reported in Panels B and C of Table 1, respectively. For DMs, we find that the high-low CTR portfolio strategy generates an insignificant average USD excess return and thus, climate transition risk is not priced. This zero excess return does not constitute per se evidence in favour of UEP because both components, equity return ($\Delta Equity$) and currency (ΔFX) are individually insignificant. Hence, the UEP condition is simply untestable in this context, as the condition requires a non-zero equity return differential to begin with.

By contrast, the high-low portfolio strategy implemented on EM countries yields a positive and significant average excess return of 1.5303% p.a. (t -stat = 2.4753). On the one hand, the equity return differential component $\Delta Equity_{t+1}^{(P_5-P_1)}$ is a positive and significant 3.7247% p.a. (t -stat = 1.9795) which suggests that investors demand compensation for climate transition risk exposure of EMs. On the other hand, the FX return component $\Delta FX_{t+1}^{(P_5-P_1)}$ is a negative and significant but smaller in magnitude -2.1944% p.a. (t -stat = -1.8837). Thus the equity premium associated with transition risk of EM countries triggers a portfolio rebalancing which is transmitted to their currencies, generating depreciation in high-CTR countries. Finally, the positive average excess return of the long-short portfolio suggests that UEP does not hold, a conclusion further reinforced by the negative correlation between the monthly

equity return differential and the monthly FX return series, at -0.4520 , significantly different from the minus unity value required for UEP to hold (t -stat = 3.1630).

To sum up, a long-short portfolio strategy for international equities of EM countries based on a climate transition risk signal generates a significant USD excess return. International investors demand a higher equity premium in EMs with greater transition risk, and portfolio rebalancing transmits the transition risk to their currencies inducing a depreciation. The currency depreciation is economically significant (offsetting approximately 60% of the equity premium) but falls short of the full adjustment that UEP would require. Thus, transition risk is another source of persistent, un-arbitraged excess returns in international equity portfolios.

Finally, we examine the pattern of excess returns of equity portfolios P1 (lowest CTR) to P5 (highest CTR) constructed from the EMs. Prima facie the portfolio excess returns evolve almost monotonically. However, tests for the spread among adjacent portfolios, as shown in Table A.6, are insignificant with the exception of long(P5)-short(P4). In fact, all long(P5)-short(P j) portfolios with $j = 1, \dots, 4$ exhibit significant excess returns. This suggests that the pricing of CTR revealed in Panel C of Table 1 by the significant long(P5)-short(P1) portfolio is driven by the most exposed countries. This is in line with Ilhan et al. (2021) which document that markets price climate transition policy uncertainty as a tail risk factor.

4.2. Risk factor-based approach: GMM tests

We now implement the GMM risk factor-based approach described in Section 3.2 to assess the pricing of climate transition risk. We present GMM estimation results for Equation (7) separately for DMs and EMs in Tables 2 and 3, respectively—the test portfolios and CTR factor are built in each case from the cross-section of countries at hand. For completeness, the GMM estimation results for the full cross-section of countries are reported in Table A.7.

[Insert Tables 2 and 3 around here]

Each table reports the factor prices of risk (λ_{CTR}, λ') from different two-factor models in columns (1) to (11), from a multifactor model in the spirit of Cenedese et al. (2016) in column (12), and from our “kitchen-sink” model in column (13). Before discussing the climate risk factor, we note that consistently across DMs and EMs, and all model specifications, the equity volatility risk factor, and the dollar, carry, and long-term yield currency risk factors are able significantly to price the cross-section of 20 international equity portfolios—broadly in line with the literature (e.g., Ang and Chen, 2010; Cenedese et al., 2016; Menkhoff, 2012a).

Consistently across asset pricing model specifications, the GMM estimation reveals no significant role for the CTR factor in the context of DMs (see Table 2). By contrast, the estimation for EMs (see Table 3) produces a positive and significant CTR price. For example, in model 12 the CTR price for EMs is 0.5732% per month (t -stat = 2.8107) or roughly 6.8784% p.a.; while the in the Cenedese et al. (2016) specification (model 13), the CTR price is 0.4342% per month (t -stat = 2.6945), or 5.2104% p.a. In parallel GMM estimations, replacing the US size, value, and momentum factors with their global counterparts (data also sourced from the Kenneth French data library), the unreported results confirm these findings with a significant CTR price for EMs of 0.4239% per month (t -stat = 3.0270) or 5.0868% p.a.¹²

Altogether, the results from two distinct methods, portfolio sorts and GMM pricing tests, concur in establishing that climate transition risk is priced in EM equity markets and transmits to currencies. The portfolio sorts reveal that the premium associated with equity of high-transition-risk EM countries exerts downward pressure on their currencies, consistent with cross-border portfolio rebalancing (Hau and Rey, 2006). The positive and significant price of climate transition risk confirmed by GMM reaffirms the UEP violations documented in the

¹² Using the gross excess return factors of Della Corte and Riddiough (2025) instead of net excess return factors yields a climate transition risk premium for EMs of 0.71% per month (8.52% p.a.).

portfolio sorting exercise: if climate transition risk commands a systematic equity premium that currency movements do not fully offset, UEP violations are a direct implication of its pricing.

4.3. Paris Agreement

As shown in Figure 2, the EM-DM gap in climate transition risk widened substantially following the Paris Agreement in December 2015, motivating a separate examination of transition risk pricing in international equity portfolios over the pre- and post-Paris periods. Table 4 summarizes the portfolio sorting results for DMs and EMs over these two periods.

[Insert Table 4 around here]

For DMs, the excess returns of all quintile portfolios (P1 to P5) and the high-low CTR portfolio are insignificant both before and after Paris, and the underlying local-currency equity return differential and FX components are likewise insignificant. This confirms our earlier finding that climate transition risk is not priced in portfolios of international DM equity.

For EMs, the pre- and post-Paris findings stand in stark contrast. Before the Paris Agreement, climate transition risk is not priced: the long-short portfolio delivers an insignificant USD excess return of 0.7322% p.a. (t -stat = 0.1653), with the underlying components, a local-currency equity return of 0.8001% p.a. and an FX return of -0.0722% p.a., also insignificant. By contrast, in the post-Paris period, the high-low CTR portfolio delivers a significant USD excess return of 3.9612% p.a. (t -stat = 3.3566). The underlying components move in opposite directions: local-currency equity returns of 10.0844% p.a. (t -stat = 2.6836) and currency depreciation of -6.1230% p.a. (t -stat = -2.8207), consistent with portfolio rebalancing as the transmission channel from international equities to currency markets.

Figure 3 complements the average-return evidence in Tables 1 and 4 by plotting the cumulative excess returns of the long-short international equity CTR portfolios over the full sample period (Panel A), the pre-Paris period (Panel B), and the post-Paris period (Panel C).

Panel A shows that the EM premium is not driven by isolated outlier months but instead reflects a persistent pattern that emerges after the Paris Agreement and widens thereafter. Panels B and C reinforce this finding by showing that the EM premium is muted before Paris and strengthens materially afterward, while no comparable sustained pattern is evident for DMs.

[Insert Figure 3 around here]

Next, we carry out GMM estimation of the asset pricing model, Equation (7), over the pre- and post-Paris periods. To preserve space, Table 5 reports results for two multifactor specifications—the pricing kernel of Cenedese et al. (2016) and the “kitchen sink” pricing model with our 10 control risk factors. Reaffirming the portfolio sorting evidence, the price of the climate transition risk factor is significant for EMs in the post-Paris period and insignificant for DMs throughout, consistently across both model specifications.

[Insert Table 5 around here]

Finally, to shed further light on the transition risk premium we implement GMM with one-year rolling windows focusing on the full model specification (i.e., using the 10 control risk factors). Figure 4 plots the sequential estimates of the price of climate transition risk for DMs (Panel A) and EMs (Panel B) alongside the 95% confidence bands. The main finding that climate transition risk begins to be priced for EM countries post-Paris is confirmed.¹³

[Insert Figure 4 around here]

Bolton and Kacperczyk (2023) document that the carbon transition risk premium is larger for firms in Asian markets, predominantly emerging, than for those in North American and European markets, and that this premium has strengthened post-Paris. Boermans and Galema

¹³ Painter (2020) identifies the 2006 Stern Review on the Economics of Climate Change, a landmark report highlighting the economic costs of climate change and the need for early policy action, as a key inflection point for the pricing of long-term physical climate risk in U.S. municipal bonds. Our analysis shows that international equity investors only began pricing EM transition risk post-Paris Agreement.

(2025) similarly show, at the firm level, an absence of climate transition premia in European equity markets. Our analysis complements these studies by moving to aggregate country-level evidence and by embedding transition risk pricing in an international framework that jointly accounts for equity and currency effects. In doing so, it shows that transition risk matters for cross-border portfolio allocation and exchange-rate adjustment.

4.4. Understanding the EM-specific, post-Paris transition risk premium

The EM-specific, post-Paris transition risk premium documented above naturally points to the Paris Agreement as a catalyst that made investors more aware of EMs' elevated transition risk exposure. While directly testing this awareness channel would require data on investor beliefs and portfolio intentions that are beyond the scope of this paper, two complementary and formally testable explanations help account for why EMs came into sharper investor focus after Paris. The first concerns climate policy credibility: the Paris Agreement made any gap in policy effectiveness between EMs and DMs more visible to international investors. The second concerns structural energy-export dependence, which leaves EM economies directly vulnerable to decarbonization pressures in ways that have no equivalent in DMs. We examine each in turn.

4.4.1 Climate policy credibility

A first candidate explanation for the EM-specific, post-Paris transition risk premium is a gap in climate policy credibility between EMs and DMs, one that the Paris Agreement plausibly made more visible to international investors. We investigate this by testing whether climate policy differentially mitigates transition risk and actual GHG emissions across the two country groups and across the pre- and post-Paris periods.

Following Hambel and van de Ploeg (2025), who use carbon taxes as a proxy for climate transition policy, we adopt energy tax revenue as a percentage of GDP (hereafter *EnTax*). We opt for this measure because it provides wider cross-country coverage, particularly for EMs

where carbon tax adoption remains limited.¹⁴ As reported in Table A.8, energy taxation is substantially stricter in DMs than EMs: the cross-country mean and median of *EnTax* are 1.44% and 1.57% for DMs, compared with 1.21% and 0.96% for EMs over the full sample. Disaggregating by subperiod reveals a partial convergence post-Paris, with the cross-country median at 1.33 for DMs and 1.28 for EMs. Pre-Paris, the coverage of *EnTax*, defined as the proportion of sample years during which the policy was active, stands at 83% for DMs and 73% for EMs. Both groups expanded coverage post-Paris, with the increase averaging 23% for EMs and 6% for DMs. This growing and converging adoption of energy taxation across both country groups supports its use as a proxy for climate policy stringency. Yet whether this catching-up has translated into meaningful reductions in transition risk for EMs remains an open question.

To address the above question, we estimate the following panel regression model:

$$CTR_{i,t} = \theta_1 EnTax_{i,t-4} + \theta_2 EnTax_{i,t-4} \times Paris_{t-4} + \theta_3 EnTax_{i,t-4} \times DM_i + \theta_4 EnTax_{i,t-4} \times DM_i \times Paris_{t-4} + \gamma' Z_{i,t-4} + \alpha_i + \mu_t + \varepsilon_{i,t} \quad (8)$$

where the dependent variable is the climate transition risk index from LSEG for country i at quarter t . The model includes two indicator variables: $Paris_t$, equal to 1 from 2016 to 2024, and DM_i , equal to 1 for developed markets. The controls, $Z_{i,t}$, are a set of macroeconomic fundamentals.¹⁵ The model is estimated by OLS with country fixed effects and year-quarter fixed effects; inferences are based on country-clustered standard errors.

¹⁴ According to the World Bank, the percentage of countries that had implemented either an ETS or carbon tax policy by end-2015 stood at 80% for DMs and just 15% for EMs, expanding to 93% and 45% respectively by end-2024. Energy tax revenue encompasses taxes levied on energy products including motor and heating fuels, collected from producers and/or final consumers. Annual observations on *EnTax* from <https://climatedata.imf.org/> are interpolated to quarterly.

¹⁵ The controls variables are real GDP per capita, current account balance to GDP, government debt to GDP, unemployment rate, inflation (year-on-year change in consumer price index), 3-month interest rate, and the term spread. Data are sourced from the Global Macro Database of Müller et al. (2025), available at <https://www.globalmacrodata.com>. Except for interest rate variables, the data are annual and linearly interpolated to quarterly frequency for the panel model estimation.

For EM countries, the association between climate transition risk and preceding *EnTax* is captured by θ_1 pre-Paris and $(\theta_1 + \theta_2)$ post-Paris. For DM countries, the corresponding parameters are $(\theta_1 + \theta_3)$ pre-Paris and $\sum_{j=1}^4 \theta_j$ post-Paris.

[Insert Table 6 around here]

Table 6, Panel A reveals a positive and significant θ_1 and a negative and significant θ_4 , while all remaining θ_j parameters are insignificant. This means that higher *EnTax* is associated with higher future transition risk levels for EMs in both sub-periods, whereas it is associated with lower transition risk for DMs post-Paris. In other words, the same fiscal instrument that effectively supports decarbonisation in DMs carries no such effect in EMs.

To probe the mechanism further, we re-estimate the panel regressions replacing the composite CTR index with its two sub-components from LSEG Datastream: (i) the GHG-to-GDP gap, measuring the deviation of current emissions from an income-based benchmark, and (ii) the NDC Implied Temperature Rise, reflecting the ambition of countries' climate pledges.¹⁶ As shown in Table A.8, both sub-components are substantially higher for EMs than DMs. Moreover, the EM-DM gap in the GHG-to-GDP component has widened post-Paris as borne out by the cross-country median falling from 27.82% to 14.74% for DMs but only from 45.98% to 36.96% for EMs. This is consistent with faster emissions reduction progress in advanced economies and further motivates the credibility gap rationale for our main findings.

¹⁶ The GHG-to-GDP gap measures the deviation of a country's consumed GHG emissions from an income-conditional benchmark (the expected emissions level for a country at its income level, derived from a cross-sectional sample of 130 countries). The NDC Implied Temperature Rise index translates each country's climate pledge into an implied global temperature rise by 2100, assuming all countries adopted that same pledge but accounting for country-specific factors including GDP, energy intensity, and carbon intensity of the energy mix. A higher value reflects less ambitious pledges; EMs' higher scores relative to DMs thus indicate weaker stated climate commitments. The index has remained broadly stable across sub-periods for both groups, with a slight post-Paris increase that likely reflects evolving structural factors, such as GDP trajectories and energy intensity, feeding into the index construction rather than a genuine weakening of pledge ambition.

Table 6 reports the results. The post-Paris energy tax effectiveness found for DMs is mirrored in the GHG-to-GDP gap results (Panel B) but not in those for NDC Implied Temperature Rise (Panel C). The GHG-to-GDP findings confirm that energy taxation in DMs translates into genuine reductions in actual emissions, whereas in EMs the same fiscal instrument appears to reflect extraction from a carbon-intensive economy rather than an effective decarbonisation lever. The absence of any significant association between energy taxation and NDC Implied Temperature Rise (for either country group, pre- or post-Paris) suggests that the emissions reductions induced by fiscal policy do not feed through into more ambitious formal climate pledges, at least over the horizon captured by our sample.

These findings help interpret the EM-specific, post-Paris pricing of transition risk documented above. The elevated and persistent CTR of EMs reflects not only structural factors (e.g., heavier reliance on traditional energy, examined in the next section) but also a policy credibility gap: the same fiscal instrument associated with emissions reductions in DMs carries no such effect in EMs. The Paris Agreement, by establishing a common international framework for climate accountability, plausibly made this credibility gap more visible to international investors, intensifying scrutiny of EM transition risk post-2015 and contributing to the time- and market-specific pricing patterns we document.

4.4.2 Energy-export dependence

A complementary explanation for the EM-specific, post-Paris contrast in transition risk pricing is that the Paris Agreement crystallised the threat posed by the global decarbonisation agenda to the fossil fuel export revenues from crude oil, refined petroleum products, and natural gas, upon which many emerging market economies depend. To test this, following Brun-Aguerre et al. (2017), we estimate for each country $i = 1, \dots, N$ a time-series regression of monthly FX returns (log change in spot rate defined as USD per unit of foreign currency) on the monthly returns of an energy commodity index:

$$\Delta FX_{i,t} = \alpha_i + \theta_i \Delta Comm_t + \gamma_i' \mathbf{Z}_{i,t-1} + \varepsilon_{i,t}, t = 1, \dots, T, \quad (9)$$

where $\Delta Comm_t$ represents the average of the log change in the S&P GSCI Energy index and the Bloomberg Energy index, entered contemporaneously because energy price variation is driven by global supply and demand conditions exogenous to any individual country's FX market. We augment the Brun-Aguerre et al. (2017) specification with a set of control variables, following the same macroeconomic fundamentals as in Equation (8), replacing the interest rate variables with the 3-month interest rate differential (foreign country i versus the US) and the long-term yield differential (10-year foreign government bond vs US Treasury bond), and adding the local equity market volatility differential versus the US (with volatility calculated monthly as the average of daily absolute equity returns) and FX rate volatility (average of daily absolute currency returns).¹⁷ The controls are lagged one month to mitigate potential endogeneity with FX returns, particularly for interest rate differentials which may be simultaneously determined within the same month. Following Brun-Aguerre et al. (2017), we adopt the slope coefficient of Equation (9) as *net energy exporter* indicator; a positive and significant $\hat{\theta}$ for a given country indicates that its currency appreciates when energy commodity prices rise, consistent with the behaviour of a net energy commodity exporter.

We then estimate a cross-sectional regression of the *net energy exporter* indicator $\hat{\theta}_i$, $i = 1, \dots, N$ on a constant and a dummy variable equal to 1 for EM countries,

$$\hat{\theta}_i = \phi_0 + \phi_1 EM_i + \varepsilon_i, i = 1, \dots, N. \quad (10)$$

The estimated coefficient ϕ_1 is positive and significant at 0.0121 (White t -stat = 2.1534), confirming that EMs behave on average as net energy exporters, making them structurally

¹⁷ The annually measured macroeconomic variables (GDP per capita, current account balance, government debt, unemployment, and inflation) are assigned the end-of-year value of the prior calendar year when interpolated to monthly, to avoid look-ahead bias. The correlation structure among the set of control variables, obtained from country-pooled data, is shown in Table A.9.

more exposed to the decarbonisation pressures that climate transition risk entails, with direct consequences for their export revenues and currency stability.

Taken together, these findings and those of the preceding section offer two complementary and mutually reinforcing explanations for the EM-specific, post-Paris pricing of transition risk. The structural reliance of EM economies on energy exports provides a fundamental rationale for their elevated and persistent transition risk exposure. This vulnerability predates Paris, but its implications for long-run export revenues and currency stability became more visible to international investors once a binding global decarbonisation commitment was established. The policy credibility gap, whereby the same fiscal instruments associated with emissions reductions in DMs carry no such effect in EMs, helps explain why the Paris Agreement served as the specific inflection point at which this risk became priced.

Together, these two channels suggest that Paris acted as a catalyst not only by making the EM policy credibility gap more visible to investors, but also by drawing their attention to the decarbonisation trajectory that most directly threatens EM export-dependent growth models. Next we revisit how this pricing transmits from EM equity markets into currency markets.

4.5. From equity to currency: Testing the portfolio rebalancing channel

The portfolio sorting exercise in Section 4.1 documented that transition risk pricing in long-short portfolios of EM equity post-Paris transmits into currency markets, with equity return differentials and currency movements running in opposite directions. This evidence is consistent with portfolio rebalancing as the transmission channel. We now test this mechanism more formally using a model-based approach inspired by Camanho et al. (2022).

We estimate the following panel model using monthly data pooled across countries:

$$\begin{aligned} \Delta FX_{it} = & \beta_1 \Delta Equity_{i,t-1} + \beta_2 CTR_{i,t-1} + \beta_3 \Delta Equity_{i,t-1} \times CTR_{i,t-1} + \beta_4 CTR_{i,t-1} \times Paris_{t-1} \\ & + \beta_5 \Delta Equity_{i,t-1} \times CTR_{i,t-1} \times Paris_{t-1} + \gamma' Z_{i,t-1} + \alpha_i + \mu_t + \varepsilon_{it} \end{aligned} \quad (11)$$

where the dependent variable ΔFX_{it} is the currency return of country i calculated as log change from month $t - 1$ to t in the spot rate (USD per unit of foreign currency), and the explanatory variables are the one-month lagged equity return differential measured in local currency, the climate transition risk index, and the Paris indicator which is equal to 1 from 2016 onwards. A one-month lag is motivated by the natural delays inherent in cross-border capital flows (settlement periods, custodian processing, and staggered investor responses), while also guarding against endogeneity bias from shocks that simultaneously affect equity return differentials and FX returns within the same month.

The model incorporates country and year-month fixed-effects. The same controls as in Equation (9) are used. Inferences are based on standard errors clustered at the country level.

[Insert Table 7 around here]

The transmission from equity return differentials to subsequent FX returns is captured by $\beta_1 + \beta_3 CTR_{i,t-1}$ pre-Paris and by $\beta_1 + (\beta_3 + \beta_5) CTR_{i,t-1}$ post-Paris. As suggested by the estimation results in Panel A of Table 7, the coefficients β_1 , β_3 and β_5 are insignificant for DMs; thus, both pre- and post-Paris the FX returns at month t are unrelated to the equity return differentials at $t - 1$. For EMs, the coefficients β_1 and β_3 are insignificant while β_5 is negative and significant at -0.0067 (t -stat = -1.9727). Panel B of Table 7 reports results for the same specification using contemporaneous regressors. Notwithstanding the potential for endogeneity bias, the results confirm a significant and negative β_5 and insignificant β_1 and β_3 , corroborating the direction of the effect.

The evidence in this section corroborates the transmission mechanism first observed in the portfolio sorting exercise of Section 4.1. The significant and negative post-Paris coefficient for EMs, which is absent throughout the sample period for DMs and in the pre-Paris period for EMs, confirms that equity return differentials driven by climate transition risk pricing transmit

to currency markets via the portfolio rebalancing channel. Yet the transmission is incomplete: the currency movement does not fully offset the local-currency equity return differential. This is consistent with the significant USD excess equity returns documented in Section 4.1 and establishes climate transition risk as a novel source of UEP violations.

4.6 Placebo test: Physical climate risk

In this analysis, we exploit the conceptual distinction between the transition and physical dimensions of climate risk. Transition risks are shaped by international climate agreements and carbon pricing regimes and are therefore inherently global. As argued throughout, the Paris Agreement represents a discrete and globally coordinated policy event that plausibly raised investor awareness of transition risk, particularly as regards EM assets. By contrast, physical climate risks are geographically concentrated and event-driven: floods, wildfires, and droughts are localised phenomena that do not arrive in a globally synchronised fashion. Unlike transition risk, physical risk is therefore more idiosyncratic in nature, and the Paris Agreement carries no plausible claim as a turning point in its pricing. We therefore do not expect our main findings to extend to physical climate risk and present this analysis as a placebo test.

As in Cheema-Fox et al. (2022), we proxy physical climate risk by the Notre Dame Global Adaptation Initiative (ND-GAIN) index which captures a country's vulnerability to physical climate disruptions such as heatwaves, floods and wildfires.¹⁸ The index is approximately 29% higher for EMs than DMs, as suggested by both mean and median in Table A.8, consistent with the fact that EMs face greater physical climate vulnerability due to geographic exposure and lower adaptive capacity (IPCC, 2022). This EM-DM gap mirrors the pattern for transition risk. A placebo variable that shares this feature but differs in its global

¹⁸ Annual observations on the ND-GAIN index, available at <https://gain.nd.edu/>, are interpolated to monthly for our analysis. Each month of a given year is set to the preceding calendar year value.

synchronisation properties provides a particularly clean test of whether our main findings are specific to transition risk or reflect a broader EM vulnerability premium.

The ND-GAIN index captures not only physical exposure but also adaptive capacity across sectors such as food, water, and infrastructure, which may partly reflect broader economic development and thus bear some relation to transition risk. Any such overlap makes this a more conservative placebo test, as it would bias toward finding a result. We employ the ND-GAIN index in levels and, as in Cheema-Fox et al. (2022), the 5-year logarithmic change in the index as a measure of momentum in physical vulnerability. As shown in Table A.10, the country-pooled correlation between the ND-GAIN index (momentum) and CTR index is 0.0049 (0.0124), confirming that they capture distinct dimensions of climate risk.

In Table 8, the USD excess returns of the long-short strategy based on the extreme quintiles by physical vulnerability (level) are insignificant for both DMs and EMs, and the two components, local-currency equity return and FX return, are also insignificant. This lack of pricing is observed both pre- and post-Paris. The evidence is reaffirmed by the portfolio sorts based on momentum in physical vulnerability which are reported in Table A.11. Moreover, the GMM pricing tests in Table A.12 for the two multi-factor specifications confirm that the physical climate risk factor, constructed from the ND-GAIN index or its 5-year change, is not priced. These findings broadly echo evidence from the literature suggesting that, in contrast with climate transition risk, physical climate risk is not priced by investors (e.g., Bolton and Kacperczyk, 2023; Faccini et al., 2023; Arteaga-Garavito et al., 2025).

[Insert Table 8 around here]

In the context of our paper, the fact that the same two methods, portfolio sorts and GMM tests, implemented on physical climate risk reveal no significant pricing suggests that the main findings of EM-specific, post-Paris transition risk pricing and its transmission to currency markets reflect the inherently global character of climate transition risk. Moreover, this

absence of physical risk pricing strengthens our interpretation that the Paris Agreement specifically raised investor awareness of the elevated and persistent transition risk in EMs, confirming that the EM-specific, post-Paris pricing and currency transmission documented in this paper are not a manifestation of a broader EM risk premium.

5. Robustness Tests

We have documented that climate transition risk commands an equity premium in international EM equity portfolios post-Paris, and this premium transmits into EM currency depreciation via portfolio rebalancing, though not fully, implying that Uncovered Equity Parity (UEP) does not hold. In this section we implement a battery of robustness tests that address, in turn: the choice of transition risk proxy, portfolio construction choices, capital market frictions and outliers, look-ahead bias in the transition risk signal, and the asset pricing methodology.

5.1 Carbon emissions intensity

As climate transition risk is unobserved, it has become common practice to present results for more than one proxy (Bolton and Kacperczyk, 2023; Aswani et al., 2024; Zhang, 2025). Our main analysis uses the CTR index from LSEG Sovereign Sustainability Solutions. We now adopt emissions intensity (total carbon emissions over GDP) from the European Commission Database for Global Atmospheric Research (EDGAR), which measures how much carbon a country emits relative to the size of its economy. Lower values indicate a less carbon-intensive economy and hence lower transition risk. Both means and medians, reported in Table A.8, reveal that emissions intensity is about twice as large in EMs as in DMs, consistent with the gap documented for the CTR index. The country-pooled correlation of emissions intensity with the CTR index at 0.5680 (0.5708 and 0.4580 with the GHG-to-GDP gap and NDC Implied Temperature Rise sub-components respectively) is moderate, as Table A.10 shows, confirming that they capture distinct dimensions of sovereign vulnerability to transition-related shocks.

The results of portfolio sorting exercise using the carbon emissions intensity (instead of CTR index) as the sorting variable are tabulated in Panel A of Table 9. For DMs, the USD excess returns of the long-short portfolio (rx) are statistically insignificant, and so are the two underlying components: local-currency equity return differential ($\Delta Equity$) and currency movement (ΔFX). Climate transition risk is not priced in international portfolios of DM equity.

[Insert Table 9 around here]

By contrast, the USD excess returns of the high emissions-low emission portfolio constructed from EM equities post-Paris are a significant 1.8447% p.a. ($t\text{-stat} = 2.2788$) which suggests that carbon transition risk is priced in international equity portfolios, and UEP does not hold. The positive and significant equity return differential of 4.5079% ($t\text{-stat} = 1.8806$) is accompanied by significant depreciation, although not fully offsetting, of -2.6632% ($t\text{-stat} = -1.9829$) which indicates that carbon transition risk is transmitted to currencies through portfolio rebalancing. Overall, the main findings are robust to using carbon emissions intensity as our sorting variable.

5.2 Different number of portfolios and holding period

We now alter two aspects of the portfolio analysis. First, we sort the countries into terciles (P1 to P3) and sextiles (P1 to P6) instead of quintiles. Second, we vary the holding period from one month to three and six months. The results are shown in Panels B and C of Table 9, respectively.

Across both aspects, number of portfolios and holding period, the pattern is consistent. For DMs, the long-short strategy yields statistically insignificant USD excess equity returns, and neither the equity nor the currency component is significant, before or after Paris. For EMs, significant long-short excess returns emerge exclusively in the post-Paris period and are absent before it. Both robustness tests confirm that the EM-specific, post-Paris transition risk premium and its currency transmission are robust to portfolio construction choices.

5.3 Emerging market capital controls and outliers

We address two further concerns in this subsection: first, whether EM capital market frictions distort the benchmark equity returns; second, whether any single EM country drives the results.

The main analysis uses domestic benchmark equity indices, which include all publicly listed stocks regardless of their accessibility to foreign investors. In countries with capital controls or foreign ownership restrictions, a concern particularly relevant for EMs, US investors may be unable to hold or trade a subset of these stocks, meaning the benchmark return may not accurately represent the investable opportunity set in practice.

To address the first concern, we repeat the portfolio sorting analysis of Section 4.1 using MSCI equity indices, which apply stringent size, liquidity, and foreign investability screens and are weighted by the float available to foreign investors rather than total market capitalisation. The returns on MSCI indices therefore more closely approximate what a US investor can actually earn in each country. Using MSCI indices also serves as an indirect control for equity transaction costs, as noted in Section 3.2, since these indices are tracked by liquid ETFs and index futures, making them practically investable at relatively low transaction costs.

To implement this robustness test, for each country we collect from LSEG Datastream two monthly time-series of MSCI equity indices, USD-denominated and local-currency-denominated, respectively. As in Cenedese et al. (2016), we recover the implied FX return from these data as $\widehat{\Delta s}_{i,t+1} = r_{i,t+1}^{F,\$} - r_{i,t+1}^F$ rather than calculating it from the LSEG Datastream spot series.¹⁹ MSCI index codes and summary statistics are reported in Tables A.1 and A.2.

The results are reported in Panel D of Table 9. The long-short portfolio continues to yield positive and significant excess returns of 3.4613% p.a. ($t = 3.0839$) for EM countries post-Paris,

¹⁹ MSCI constructs its USD-denominated index using the WM/Reuters 4pm London closing spot rate (now administered by LSEG), which differs from the local market closing prices underlying the LSEG Datastream spot series. Following Cenedese et al. (2016), we avoid mixing the two series in this analysis, as doing so would introduce a systematic timing mismatch into the return decomposition.

which is somewhat lower than the 3.9612 reported in Table 4, indicating that the latter might have included some market imperfections, and insignificant excess returns in all other cases. The decomposition into local-currency equity return differential and FX component reveals that both are statistically significant with opposite signs, consistent with portfolio rebalancing as the transmission channel. GMM estimation using MSCI indices (Table A.13) adds further robustness: the climate transition risk premium is positive and significant for EMs post-Paris at 0.5234 (t -stat = 2.1718) and 0.6097 (t -stat = 2.5454) across the two multifactor specifications, and insignificant in all other cases.

Finally, we assess whether the results are driven by any single EM country via a leave-one-out exercise, iteratively measuring the USD excess return of the long-short portfolio and estimating the GMM asset pricing model with cross-sections that exclude one country at a time. As Figure 5 shows, pre-Paris the USD excess returns and GMM estimates of the price of climate transition risk are insignificant across all country exclusions. Post-Paris, however, they are consistently positive and significant, with narrow ranges centered around the full-sample estimates reported in the main section of the paper (see Tables 3 and 4).

[Insert Figure 5 around here]

In sum, the findings in this section confirm that our main results are not a false positive driven by EM-specific capital market frictions, equity transaction costs, or outlier countries.

5.4 Extended climate-transition-risk signal lag

Reported emissions data are released with delays and subject to revisions, raising the concern that portfolio sorts based on the most recent available signal may inadvertently incorporate information not yet available to investors at the time of portfolio formation. Following Zhang (2025), we address this by sorting countries into portfolios using transition risk indices lagged by six months. The results are reported in Panel E of Table 9.

The portfolio exercise reveals for EM countries post-Paris a sizeable USD excess return for the high-low CTR portfolio of 2.9893% p.a. (t -stat = 2.3306), with an underlying equity return of 8.4649% p.a. (t -stat = 2.6117) and FX return of -5.4756% p.a. (t -stat = -2.7394), consistent with portfolio rebalancing as the transmission channel of climate transition risk from international equity portfolios to currencies, in line with the main analysis.

We also conduct the GMM estimation of the asset pricing model, Equation (7), with the climate factor constructed as the USD excess returns of the high-low CTR portfolio sorted on the six-month-lagged signal. According to the estimation results for both multifactor specifications in columns (7) and (8) of Table A.14, transition risk remains significantly priced in EM equity portfolios post-Paris at 0.6488% p.a. (t -stat = 2.4582) and 0.5385% p.a. (t -stat = 2.1854). Overall, the main findings on transition risk pricing in EM equity portfolios and its transmission to currencies remain robust to an extended transition risk signal lag.

5.5 Fama-MacBeth pricing tests

As a final robustness check, we implement the Fama-MacBeth (1973) two-step procedure, which provides an alternative to GMM that is less sensitive to the choice of moment conditions and accommodates time-varying factor exposures through rolling estimation. At step one, we estimate 36-month rolling time-series regressions of USD excess returns for the 20 test assets on the risk factors to obtain factor betas. At step two, we estimate a cross-sectional regression each month of excess returns on the estimated factor betas, $rx_i = \lambda_0 + \lambda_{climate}\hat{\beta}_i^{climate} + \lambda'\hat{\beta}_i + \varepsilon_i, i = 1, \dots, N$. The same 10 equity and currency risk factors serve as controls. Table 10 presents the risk prices (lambdas) averaged across the cross-sectional regressions.

[Insert Table 10 around here]

Focusing on the two multifactor specifications discussed earlier, the Fama-MacBeth estimation suggests that climate transition risk is significantly priced in international EM

equity portfolios after the Paris Agreement at 0.63% (t -stat = 2.16) and 0.52% (t -stat = 1.98) in columns (7) and (8), respectively. Climate transition risk is not significantly priced for DMs. We further implement a non-rolling variant following Fan et al. (2022), which yields insignificant transition risk prices for DMs, and somewhat larger but qualitatively consistent estimates for EMs, at 0.878% (t -stat = 3.072) and 0.816% (t -stat = 2.565) in the two multifactor specifications, further reinforcing the robustness of the main findings.

6. Conclusions

This paper investigates the pricing of climate transition risk in international equity portfolios and its transmission to currency markets. Sorting DM and EM countries into portfolios by a climate transition risk signal, reveals a premium that is market-specific (EM equities), time-sensitive (post-Paris), and transmits to currencies via portfolio rebalancing. The local-currency equity and currency components of the high-low EM portfolio excess return move in opposite directions, in line with the portfolio rebalancing channel. The capital flows implied by this rebalancing do not fully arbitrage away the premium, making climate transition risk a source of uncovered equity parity (UEP) violations. GMM asset pricing tests confirm that transition risk is a priced systematic factor in EM equity portfolios, consistent with these UEP violations being driven by a persistent and compensated risk premium rather than transitory mispricing.

Two complementary explanations for the EM-specific, post-Paris pricing are formally documented. First, climate fiscal instruments that coincide with emissions reductions in DMs carry no such effect in EMs, pointing to a policy credibility gap. Second, the structural reliance of EM economies on energy exports exposes them to decarbonisation pressures in ways that have no equivalent in DMs, threatening export revenues and, through them, currency stability. The Paris Agreement, as a globally coordinated accountability framework, acted as a catalyst

by drawing investors' attention to both vulnerabilities: the institutional gap in climate policy effectiveness and the structural dependence on energy exports.

The main findings survive a comprehensive battery of robustness tests. These include carbon emissions intensity as an alternative transition risk proxy, variations in portfolio construction as regards the number of portfolios and holding period, MSCI indices to address concerns about capital controls in EMs, and an extended transition risk signal lag to mitigate look-ahead bias concerns. Sequential Fama-MacBeth regressions as an alternative asset pricing framework corroborate the GMM evidence throughout.

This placebo test indicates that the EM-specific, post-Paris transition risk pricing we document is not a manifestation of a broader sensitivity of emerging economies to the physical effects of climate change, but instead reflects some of their structural features, namely their weaker climate policy frameworks and greater dependence on fossil fuel exports, that the Paris Agreement made salient to international investors, triggering its role as a pricing catalyst.

The findings carry implications for EM policymakers and international investors alike. For EM policymakers, the results underscore that climate policy credibility matters for asset pricing: fiscal instruments that coincide with emissions reductions in DMs appear to reflect fiscal extraction rather than genuine decarbonisation in EMs, and international investors price this credibility gap. Strengthening policy effectiveness in EMs, moving beyond nominal adoption toward measurable emissions outcomes, may reduce the transition risk premium demanded by international investors and lower the cost of capital.

For international investors, our findings establish climate transition risk as a compensated source of return variation in EM equity post-Paris. This risk carries a currency dimension that cannot be ignored: depreciation pressure does not fully offset the equity premium, generating excess USD returns that warrant consideration in currency hedging strategies and international portfolio allocation decisions, particularly for portfolios with significant EM exposure.

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Figure 1. Transmission channels from climate transition risk to currency markets.

The figure illustrates two potential channels, portfolio rebalancing and return-chasing, through which cross-country differences in climate transition risk (CTR) can transmit to currency markets. Adopting the perspective of a US investor, the superscripts H and F denote the home or domestic country (US) and foreign or local countries, respectively.

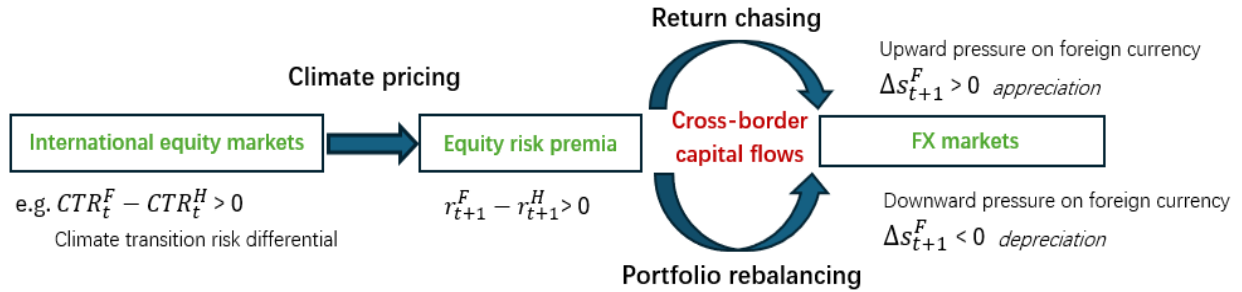


Figure 2. Climate transition risk: DM versus EM countries.

The figure plots the cross-sectional mean (Panel A) and cross-sectional median (Panel B) of the LSEG climate transition risk index for the developed markets (DMs) and emerging markets (EMs) in our sample covering the sample period 2000Q1 to 2024Q3. Higher values indicate higher transition risk. The green vertical line marks the Paris Agreement (December 2015).

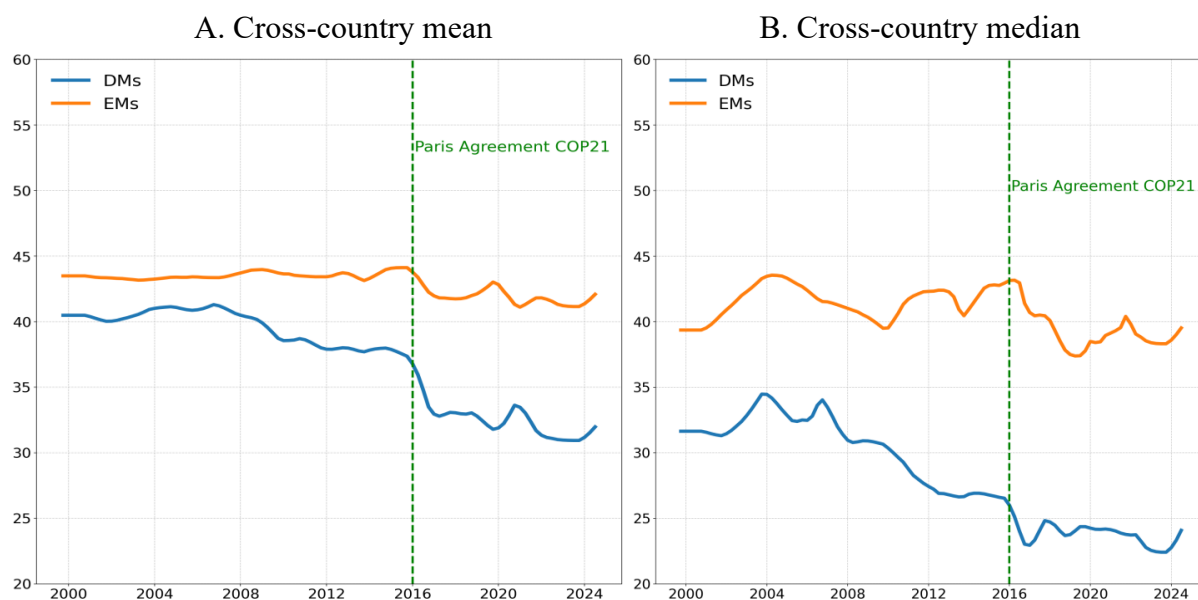


Figure 3. Cumulative excess equity returns of high-low CTR portfolios.

The figure plots cumulative monthly USD excess equity returns of the long-short portfolios formed on country-level climate transition risk (CTR) indices for developed markets (DMs) and emerging markets (EMs). Panel A shows the full-sample, Panel B the pre-Paris period (2000-2015) and Panel C the post-Paris period (2016- September 2024).

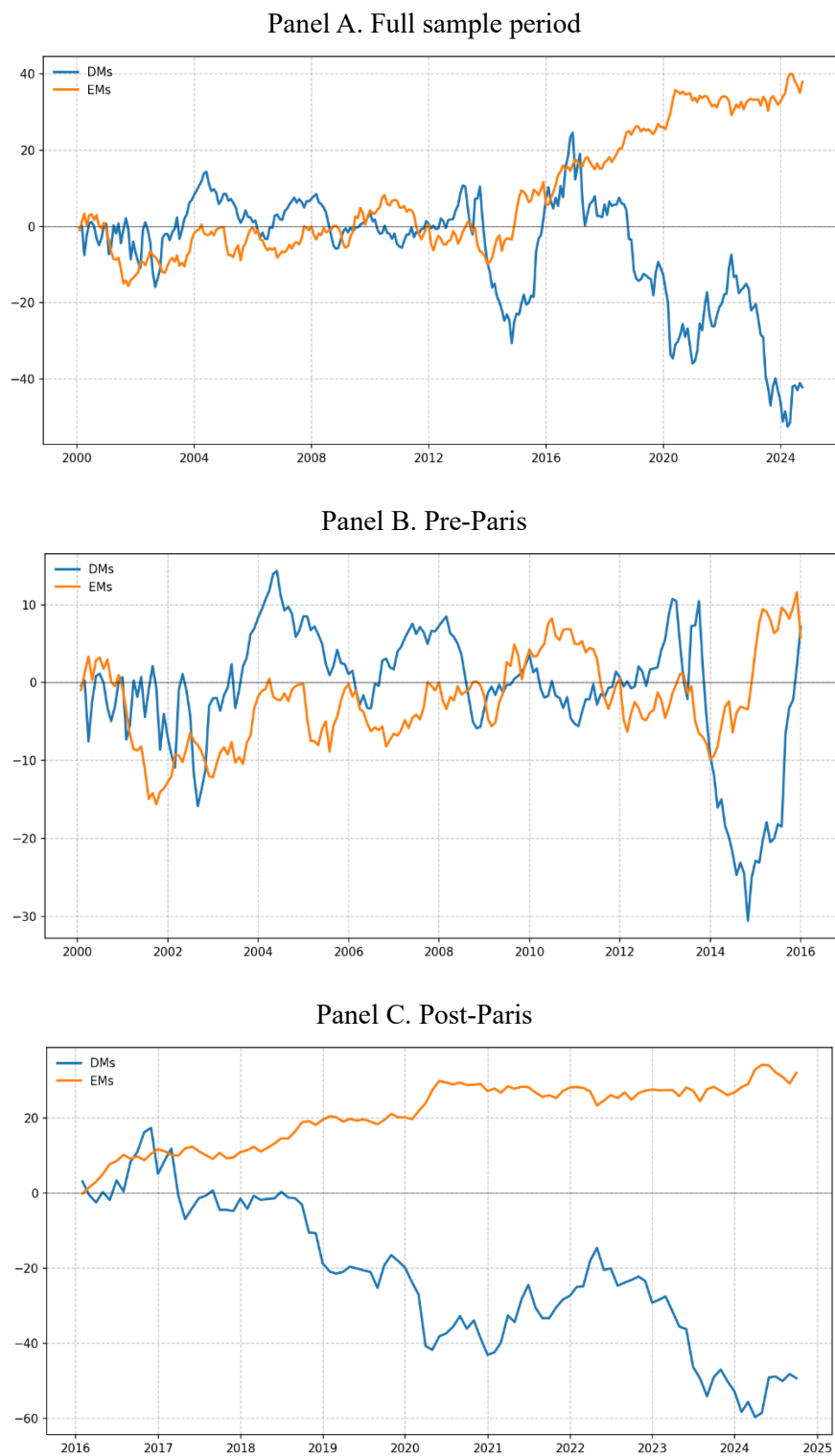


Figure 4. Price of climate transition risk: DM versus EM countries.

This figure plots the price of the climate transition risk factor in Equation (7), obtained by GMM estimation sequentially over 12-month rolling windows. The test assets are 20 international equity portfolios constructed by sorting each cross-section, DMs or EMs, into quintiles using equity momentum, currency carry, currency momentum, and term spread. The model specification includes the 10 equity and currency risk factors described in Appendix A.4 as controls. The blue area represents the 95% confidence interval, and the green vertical line marks the Paris Agreement (December 2015). The sample period is January 2000 to September 2024.

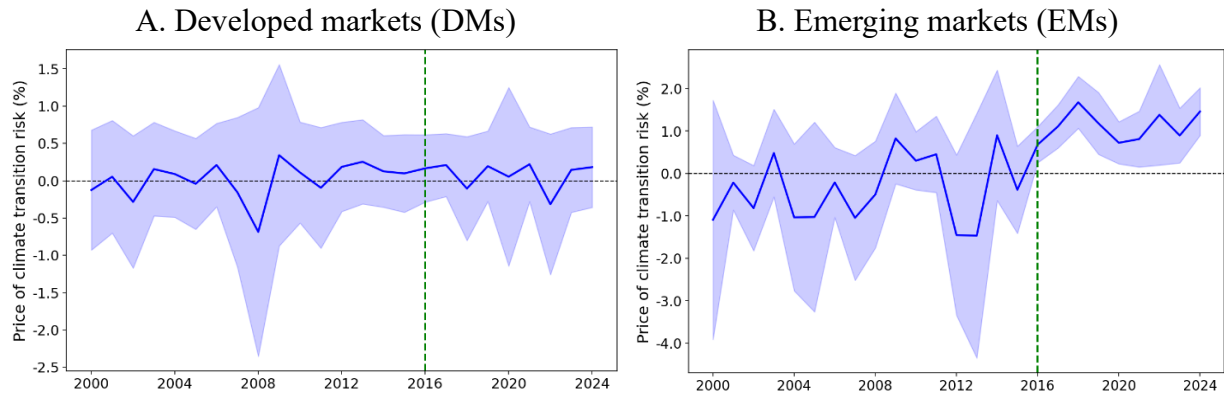


Figure 5. Climate transition risk pricing in EMs: Robustness to outlier countries.

This figure plots estimates of the climate transition risk premium obtained by iteratively excluding one EM country at a time from the cross-section. Panels A and B plot the USD excess returns of the long-short portfolio sorted by climate transition risk, pre- and post-Paris, respectively. Panels C and D plot the GMM price of climate transition risk for the pre- and post-Paris periods, respectively. In each panel, the horizontal axis represents the corresponding Newey-West t -statistic. The GMM model specification is Equation (7) with the full set of 10 equity and currency risk factors as controls.

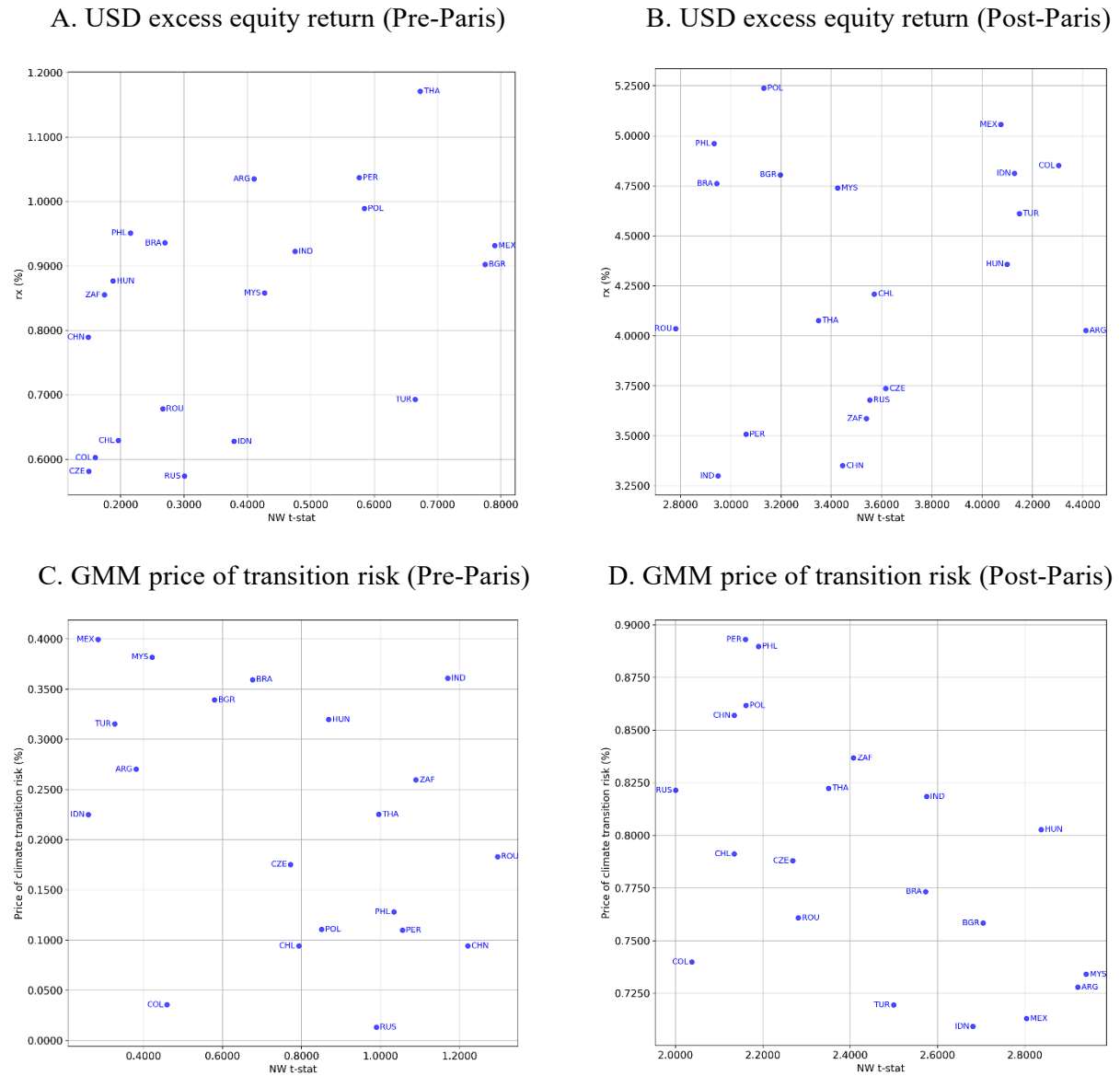


Table 1. Portfolio sorts by climate transition risk.

The table reports results from sorting country-level benchmark equity indices by climate transition risk. The holding period is one month and returns are annualised. Columns 1 to 5 report the USD excess equity returns of portfolios P1 to P5, where P1 (P5) contains the benchmark equity indices of countries with the lowest (highest) climate transition risk. Results are reported for three cross-sections: all countries, DMs, and EMs. The last three columns report the USD excess equity returns of the long(P5)-short(P1) portfolio, rx , and the underlying local-currency equity return differential, $\Delta Equity$, and currency return, ΔFX , as in Equation (4). Newey-West t -statistics for the significance of mean returns are in parentheses. The sample period is January 2000 to September 2024.

	P1 (Low)	P2	P3	P4	P5 (High)	P5-P1		
						rx	$\Delta Equity$	ΔFX
Panel A: All countries								
Mean	-0.1360 (-0.1663)	1.0213 (1.0702)	0.5422 (-0.5827)	1.6012 (1.6422)	1.5141 (1.8672)	1.6501 (2.0766)	4.0734 (2.0087)	-2.4233 (-1.9809)
Median	-0.0709	1.1939	0.3712	1.5729	1.3427	1.4821	3.8543	-2.2828
StdDev	2.3609	5.7120	4.5411	6.1508	5.7530	6.0222	15.3604	9.2310
Skewness	-0.5616	-0.2429	-0.7713	-0.5815	-0.0912	-0.3201	-0.4116	0.1842
Kurtosis	2.6834	1.3830	2.8634	3.7402	0.5332	2.1546	2.5325	1.8733
Sharpe ratio	-0.0225	0.1431	0.0833	0.2205	0.2532	0.2710	0.2625	-0.2601
AC(1)	0.1509	0.1209	0.0428	-0.2120	0.1946	0.3842	0.1602	-0.2309
Panel B: Developed markets (DMs)								
Mean	0.1794 (0.2864)	-3.6736 (-3.5353)	0.1534 (0.2222)	0.9006 (1.3858)	-1.4025 (-1.4579)	-1.5819 (-1.0801)	-1.0122 (-1.3779)	-0.5697 (-0.0668)
Median	0.0937	-3.8521	0.0539	0.9640	-1.4539	-1.4225	-0.8811	-0.4523
StdDev	4.8220	7.8544	5.1528	4.9334	7.2849	11.0537	5.5722	7.1827
Skewness	-0.3931	-0.5703	-0.5141	0.2320	-0.0928	-0.2515	-0.2927	0.1523
Kurtosis	2.9403	1.1804	3.4221	1.1516	2.0233	1.7829	2.3145	1.5446
Sharpe ratio	0.0419	-0.4706	0.0336	0.1804	-0.1948	-0.1420	-0.1810	-0.0803
AC(1)	0.2823	0.1136	0.0913	0.1249	0.1643	0.1315	0.0748	-0.2402
Panel C: Emerging markets (EMs)								
Mean	3.1222 (2.4509)	3.5231 (2.3783)	2.3809 (1.8459)	2.5741 (1.8579)	4.6525 (3.6572)	1.5303 (2.4753)	3.7247 (1.9795)	-2.1944 (-1.8837)
Median	3.4440	3.3319	2.2006	2.7445	4.6919	1.3534	3.5037	-2.0529
StdDev	10.8513	11.2318	9.7448	10.4701	9.6203	4.6821	14.2611	8.7913
Skewness	0.2945	0.6125	-0.2139	0.2749	-0.3812	-0.1831	-0.3534	0.1248
Kurtosis	2.7126	3.8237	2.9745	3.9545	2.8125	1.9216	2.7444	1.6542
Sharpe ratio	0.3203	0.3120	0.2424	0.2521	0.4826	0.3324	0.2624	-0.2529
AC(1)	0.2326	-0.1445	0.2141	0.3326	-0.4335	0.5522	0.2939	0.3226

Table 2. GMM pricing tests for developed markets.

The table reports GMM estimations for 20 test assets formed by sorting DM countries into quintiles by equity momentum, currency carry, currency momentum, and term spread. The climate factor is constructed as the USD excess returns of the high-low quintile portfolio of DM equities sorted by the climate transition risk index. The controls are 5 equity risk factors (World, US size, US value, US momentum, and volatility) and 5 currency risk factors (dollar, carry, momentum, volatility, and yield differential), specified in Section 3.2 and further detailed in Appendix A.4. Factor prices of risk are reported with Newey-West t -statistics in parentheses. The J -statistic tests the null hypothesis of zero pricing errors, with the corresponding p -value also reported. Columns (1) to (11) report two-factor models, column (12) the multifactor model of Cenedese et al. (2016), and column (13) the full model. The sample period is January 2000 to September 2024.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<i>Climate</i>	0.3308 (0.3843)	-0.2669 (-0.4351)	-0.3472 (-0.5827)	-0.1746 (-0.2812)	0.4473 (0.4222)	0.1256 (0.1533)	0.3172 (0.3458)	0.2841 (0.3123)	0.3617 (0.4022)	0.2284 (0.2607)	0.4156 (0.4762)	-0.3203 (-0.9322)	-0.5832 (-0.5286)
<i>World</i>		0.4436 (1.9589)										0.2615 (2.0884)	0.6214 (1.7252)
<i>Size</i>			0.4397 (0.9507)									0.3451 (0.4823)	0.5183 (0.8866)
<i>Value</i>				0.2453 (0.3221)								-0.3726 (-2.3913)	0.3629 (0.3992)
<i>Mom</i>					-0.3245 (-0.4846)							2.5169 (1.0577)	-0.4016 (-0.5179)
<i>Vol</i>						-0.2936 (-3.0219)						-0.5837 (-1.8910)	-0.3112 (-2.8742)
<i>Dollar</i>							0.3394 (2.3146)						0.4174 (2.4471)
<i>Carry</i> ^{FX}								-0.3147 (-2.1875)					-0.3923 (-2.3566)
<i>Mom</i> ^{FX}									-0.2851 (-0.4249)				-0.3547 (-0.4846)
<i>Vol</i> ^{FX}										-0.1094 (-2.7396)		-0.1377 (-2.4810)	-0.1268 (-2.5939)
<i>ΔYield</i>											0.0874 (2.1533)		0.0952 (1.9884)
<i>J</i> -statistic	64.7196	29.4906	16.8313	19.4708	25.4999	18.2671	14.7494	16.6792	15.2923	14.2436	16.3343	11.6397	4.1888
<i>p</i> -value	0.2462	0.0419	0.5344	0.3655	0.1141	0.4227	0.7424	0.5590	0.6443	0.7184	0.5754	0.5605	0.8498

Table 3. GMM pricing tests for emerging markets.

The table reports GMM estimations for 20 test assets formed by sorting EM countries into quintiles by equity momentum, currency carry, currency momentum, and term spread. The climate factor is constructed as the USD excess returns of the high-low quintile portfolio of EM equities sorted by the climate transition risk index. The controls are 5 equity risk factors (World, US size, US value, US momentum, and volatility) and 5 currency risk factors (dollar, carry, momentum, volatility, and yield differential), specified in Section 3.2 and further detailed in Appendix A.4. Factor prices of risk are reported with Newey-West t -statistics in parentheses. The J -statistic tests the null hypothesis of zero pricing errors, with the corresponding p -value also reported. Columns (1) to (11) report two-factor models, column (12) the multifactor model of Cenedese et al. (2016), and column (13) the full model. The sample period is January 2000 to September 2024.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<i>Climate</i>	0.9564 (2.4870)	1.8779 (1.9923)	1.8662 (1.3439)	2.1041 (1.5871)	1.9377 (2.1185)	1.7363 (2.3366)	2.0568 (1.8459)	2.0013 (2.6429)	1.0039 (1.9431)	1.4791 (1.7410)	1.2882 (3.0474)	0.5732 (2.8107)	0.4342 (2.6945)
<i>World</i>		0.8746 (1.1684)										0.5269 (1.1598)	-0.5445 (-1.2707)
<i>Size</i>			0.4363 (0.3123)									2.0403 (1.4721)	1.1898 (0.5726)
<i>Value</i>				-1.1037 (-2.3384)								-0.1342 (-1.6691)	-1.2215 (-2.8742)
<i>Mom</i>					-1.1356 (-1.0986)							-3.1318 (-0.3286)	-0.8985 (-0.2936)
<i>Vol</i>						-0.8489 (-2.1875)						-1.3102 (-2.2267)	-2.0704 (-1.9615)
<i>Dollar</i>							0.5874 (3.4582)						0.8709 (2.7569)
<i>Carry^{FX}</i>								-0.2875 (-2.3384)					-1.2647 (-3.5197)
<i>Mom^{FX}</i>									-0.4675 (-0.6864)				-1.6268 (-0.6864)
<i>Vol^{FX}</i>										-0.7416 (-0.7480)		-0.2490 (-2.1729)	-1.6736 (-0.6565)
<i>ΔYield</i>											0.1301 (2.3366)		0.1845 (2.1906)
<i>J</i> -statistic	25.4821	28.8524	37.6831	31.9247	22.7652	18.8914	12.2341	18.5438	18.0629	14.4722	14.0339	12.2143	4.0756
<i>p</i> -value	0.1692	0.0557	0.0113	0.0226	0.2372	0.4511	0.8498	0.4810	0.4511	0.7184	0.7375	0.5154	0.8527

Table 4. Portfolio sorts by climate transition risk: Pre- and post-Paris Agreement.

The table reports results from sorting country-level benchmark equity indices by climate transition risk over two sub-periods: January 2000 to December 2015 (pre-Paris) in Panel A, and January 2016 to September 2024 (post-Paris) in Panel B. The holding period is one month and returns are annualised. In each panel, columns 1 to 5 report the USD excess equity returns of portfolios P1 to P5, where P1 (P5) contains the benchmark equity indices of countries with the lowest (highest) level of climate transition risk. The last three columns report the USD excess equity returns of the long(P5)-short(P1) portfolio, rx , and the underlying local-currency equity return differential, $\Delta Equity$, and currency movement, ΔFX , as in Equation (4). Newey-West t -statistics for the significance of mean returns are shown in parentheses.

	Panel A: Pre-Paris Agreement								Panel B: Post-Paris Agreement							
	P1 (Low)	P2	P3	P4	P5 (High)	P5-P1			P1 (Low)	P2	P3	P4	P5 (High)	P5-P1		
						rx	$\Delta Equity$	ΔFX						rx	$\Delta Equity$	ΔFX
Developed markets (DMs)																
Mean	0.0329 (0.0695)	-3.0516 (-1.8376)	0.5778 (0.9427)	1.2931 (1.0163)	0.1155 (0.1739)	0.0826 (0.4496)	-0.3141 (-0.0953)	0.3901 (0.0993)	0.4509 (0.5092)	-3.1539 (-1.1211)	-0.6212 (-0.6995)	0.1829 (0.2607)	-3.3504 (-1.5818)	-3.8013 (-1.3200)	-3.2134 (-1.1994)	-0.5945 (-0.0668)
Median	0.0860	-5.0586	0.5898	1.3249	0.1278	0.1107	-0.3449	0.4252	0.4992	-1.1785	-0.6441	0.1966	-3.3731	-3.8141	-3.2309	-0.6147
StdDev	4.5227	7.3821	4.8543	4.4228	5.7809	2.8534	4.1234	3.4834	5.1826	6.2511	5.4208	5.1433	6.3522	5.7402	4.8532	3.9246
Skewness	-0.5142	-0.2403	-0.0658	-0.4625	-0.6845	-0.6776	-0.4906	-0.5434	-0.0684	-0.0755	-0.2237	-0.2587	-0.6119	-0.5822	-0.3561	-0.4406
Kurtosis	3.3797	3.0196	2.9131	3.9192	3.1215	3.3294	4.4171	4.2062	5.1749	4.8393	2.8212	3.8902	2.7594	4.1466	4.1783	2.6385
Sharpe ratio	0.0073	-0.6843	0.1189	0.2924	0.0226	0.0289	-0.0762	0.1125	0.0872	-0.1846	-0.1146	0.0356	-0.5274	-0.6622	-0.6621	-0.1515
AC(1)	0.0363	0.1112	0.0743	0.0857	0.0338	-0.0222	-0.0284	0.0283	0.1552	0.0219	0.1536	0.1616	0.0018	0.1507	-0.0323	0.1623
Emerging markets (EMs)																
Mean	5.0113 (2.0884)	3.8201 (1.3191)	3.3276 (1.1684)	1.4762 (0.6226)	5.7435 (2.4139)	0.7322 (0.1653)	0.8001 (0.3123)	-0.0722 (-0.3794)	0.8009 (0.6882)	2.1515 (2.1015)	0.6508 (0.6971)	1.9245 (1.8579)	4.7621 (4.9873)	3.9612 (3.3566)	10.0844 (2.6836)	-6.1230 (-2.8207)
Median	5.1111	4.8832	3.4362	3.5301	5.8657	0.8066	0.8356	-0.0795	0.8284	1.1852	0.7138	0.9798	4.7973	3.9886	10.1609	-6.1628
StdDev	11.5604	11.3913	10.9816	11.2229	10.3513	6.2525	5.8333	4.1525	7.0215	7.5712	5.9101	5.3116	6.5442	4.8231	8.1533	5.9305
Skewness	-0.4977	-0.4576	-0.5803	-0.5039	-0.4891	-0.2826	-0.5671	-0.1896	-0.4278	-0.6973	-0.3569	-0.1972	-0.0543	-0.5437	-0.5085	-0.1748
Kurtosis	5.1036	4.3002	4.4264	4.7986	2.4988	2.3546	2.8303	4.2857	3.1427	4.0535	4.6129	4.4656	2.8737	4.8193	2.7595	2.9109
Sharpe ratio	0.4335	0.4231	0.3034	0.3097	0.5549	0.1171	0.1372	-0.0174	0.1141	0.1521	0.1101	0.1741	0.7277	0.8213	1.2368	-1.0325
AC(1)	0.1419	-0.0119	0.0008	-0.0191	0.1221	0.1093	0.0754	-0.0151	0.0054	0.1337	0.0518	0.1241	0.1211	0.1403	-0.0008	0.1395

Table 5. GMM pricing tests: Pre- and post-Paris Agreement.

The table reports GMM estimations for 20 test assets formed by sorting DM (left panel) or EM (right panel) benchmark equity indices into quintiles using equity momentum, currency carry, currency momentum, and term spread. The climate factor is constructed as the USD excess returns of the high-low quintile portfolio sorted by the climate transition risk index. Factor prices of risk are reported with Newey-West t -statistics in parentheses. The sample period is January 2000 to December 2015 (pre-Paris), and January 2016 to September 2024 (post-Paris) periods. For further details, see the note to Table 2.

	Developed markets (DMs)				Emerging markets (EMs)			
	pre-Paris		post-Paris		pre-Paris		post-Paris	
<i>Climate</i>	0.2745 (0.8966)	0.4315 (1.1188)	-0.0044 (-1.3860)	0.0661 (0.9930)	0.3048 (1.5536)	0.3928 (1.6037)	0.8488 (3.4582)	0.9385 (2.1854)
<i>World</i>	0.4351 (0.6579)	-0.5817 (-1.1211)	1.968 (2.0442)	1.5528 (4.0057)	0.6232 (0.5212)	-0.3125 (-0.3864)	2.0238 (1.8672)	1.0646 (2.9946)
<i>Size</i>	1.0721 (1.5871)	0.9596 (2.3986)	-1.1554 (-0.5486)	-0.0902 (-0.1221)	1.0469 (1.8746)	1.1302 (2.3088)	-0.9926 (-0.5078)	-0.2132 (-0.0543)
<i>Value</i>	0.2768 (0.7848)	0.3674 (0.8951)	0.6371 (1.9205)	0.9286 (0.5562)	0.3432 (-0.8324)	0.1545 (0.7033)	0.7169 (1.7380)	1.1825 (1.1188)
<i>Mom</i>	0.3996 (0.4823)	0.6866 (1.6383)	-1.6462 (-0.7054)	-1.3431 (-1.2707)	0.3872 (-0.4707)	0.6818 (1.2141)	-1.9194 (-0.8862)	-1.6954 (-1.2019)
<i>Vol</i>	-1.5262 (-2.4424)	-0.5718 (-2.6564)	-2.7693 (-2.7901)	-1.1199 (-2.1374)	-1.4194 (-2.3675)	-0.5704 (-1.9948)	-2.2241 (-2.6410)	-1.8293 (-1.9948)
<i>Dollar</i>		0.2244 (1.7892)		1.0304 (3.3394)		0.3577 (1.8579)		0.8592 (3.5622)
<i>Carry^{FX}</i>		-0.3697 (-2.6410)		-0.0808 (-2.6915)		-0.2193 (-2.5524)		-0.6058 (-1.7583)
<i>Mom^{FX}</i>		0.1004 (0.4823)		-0.2531 (-0.4249)		0.2981 (0.3045)		-0.0144 (-0.1579)
<i>Vol^{FX}</i>	-0.4259 (-1.7583)	-0.9878 (-1.8058)	-0.6737 (-2.4561)	-0.0061 (-2.3893)	-0.3697 (-1.8587)	-0.8408 (-2.6060)	-0.8237 (-2.4370)	-0.1019 (-1.9809)
<i>ΔYield</i>		0.0651 (2.2481)		0.1719 (2.1654)		0.1617 (1.7102)		0.2165 (2.4288)
<i>J</i> -statistic	9.4907	5.6231	8.7204	3.9247	19.1951	5.1932	12.0466	7.0888
<i>p</i> -value	0.7375	0.6931	0.7975	0.8678	0.3839	0.7424	0.5251	0.5344

Table 6. Energy taxation and climate transition risk.

The table reports estimation results for the panel fixed effects model, Equation (8). The dependent variable is the climate transition risk index (Panel A) and its two sub-components: the GHG-to-GDP gap index (Panel B) and the Nationally Determined Contributions (NDC) Implied Temperature Rise index (Panel C). *EnTax* is energy tax revenue as a percentage of GDP, used as a proxy for climate policy effectiveness, interacted with two indicator variables: *Paris*, equal to 1 from 2016 onward, and *DM*, equal to 1 for developed market countries. The sample period is 2000Q1 to 2021Q4, with 3,088 country-quarter observations.

Panel A: Climate transition risk index							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>EnTax</i>	2.3498 (3.2418)	2.6292 (3.5790)	2.2608 (2.4672)	2.4379 (2.3819)	1.4067 (1.9939)	1.6778 (2.0645)	1.6653 (1.5052)
<i>EnTax</i> × <i>Paris</i>		-1.3517 (-0.8071)		-1.4559 (-0.8109)		-1.2867 (-0.9249)	-1.2942 (-0.9077)
<i>EnTax</i> × <i>DM</i>			0.4413 (0.1108)	1.0554 (0.2555)			0.0748 (0.0230)
<i>EnTax</i> × <i>DM</i> × <i>Paris</i>					-3.3937 (-2.4364)	-3.3751 (-2.4691)	-3.3714 (-2.6469)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.1466	0.1562	0.1468	0.1575	0.2271	0.2358	0.2358
Panel B: GHG-to-GDP performance index							
<i>EnTax</i>	4.2053 (3.8654)	4.7624 (4.2881)	3.7428 (3.3632)	4.1474 (3.0325)	2.6914 (2.6755)	3.2400 (2.6347)	2.9523 (1.8805)
<i>EnTax</i> × <i>Paris</i>		-3.0351 (-0.9611)		-3.3241 (-0.9929)		-2.9214 (-1.0790)	-3.0725 (-1.0979)
<i>EnTax</i> × <i>DM</i>			2.5804 (0.3462)	3.7273 (0.4891)			1.9204 (0.3090)
<i>EnTax</i> × <i>DM</i> × <i>Paris</i>					-5.3679 (-1.9653)	-5.3241 (-2.0145)	-5.2221 (-2.1765)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.1715	0.1839	0.1735	0.1879	0.2265	0.2379	0.2390
Panel C: NDC Implied Temperature Rise index							
<i>EnTax</i>	0.1942 (0.0647)	0.4952 (0.1624)	0.7125 (0.3214)	0.8651 (0.3811)	0.0561 (0.0220)	0.3611 (0.1436)	0.7312 (0.3575)
<i>EnTax</i> × <i>Paris</i>		-1.4564 (-0.3990)		-1.2548 (-0.3329)		-1.4472 (-0.4008)	-1.2268 (-0.3360)
<i>EnTax</i> × <i>DM</i>			-2.5697 (-0.2532)	-2.0405 (-0.1951)			-2.2105 (-0.2173)
<i>EnTax</i> × <i>DM</i> × <i>Paris</i>					-0.4969 (-0.1080)	-0.4760 (-0.1049)	-0.5846 (-0.1307)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.0497	0.0514	0.0510	0.0522	0.0500	0.0517	0.0525

Table 7. Model-based tests of portfolio rebalancing channel.

The table reports model-based tests of the portfolio rebalancing channel following Camanho et al. (2022). The panel fixed effects model, Equation (10), is estimated with monthly data separately for DM and EM countries. The dependent variable is the FX return, measured as the log change in the spot rate (USD per unit of foreign currency). $\Delta Equity$ is the local-currency equity return differential between the foreign country and the US. CTR is the country-level climate transition risk index. Paris is an indicator variable equal to 1 from 2016 onward. In Panel A the regressors are lagged one month with respect to the FX return while in Panel B they enter contemporaneously. Specifications labelled 'Controls: No' exclude the annual macroeconomic controls (GDP per capita, current account balance, government debt, unemployment, and inflation), interpolated to monthly frequency. The sample period is January 2000 to September 2024.

Variables	Panel A. One-month lagged variables				Panel B. Contemporaneous variables			
	DMs		EMs		DMs		EMs	
							(16)	
$\Delta Equity$	-0.0058	-0.1978	0.0158	0.0147	-0.1962	-0.0076	-0.2029	-0.2039
	(-0.0758)	(-0.5616)	(0.5553)	(0.4920)	(-0.5550)	(-0.0990)	(-1.9388)	(-1.9388)
CTR	4.5137	7.0839	2.0520	1.7197	5.1427	6.4148	2.1259	1.5895
	(1.7311)	(1.1311)	(0.5511)	(0.4932)	(1.8485)	(1.9906)	(0.5583)	(0.4491)
$\Delta Equity \times CTR$	-0.0024	0.0475	-0.0017	-0.0015	0.0472	-0.0021	-0.0493	-0.0005
	(-0.1179)	(0.5414)	(-1.8403)	(-0.1523)	(0.5349)	(-0.1004)	(-1.8457)	(-0.8502)
$CTR \times Paris$	-0.1315	-0.0984	-0.0077	0.0231	-0.1224	-0.1139	-0.0045	0.0335
	(-0.4451)	(-0.5370)	(-0.0583)	(0.1773)	(-0.4064)	(-0.6192)	(-0.0338)	(0.2415)
$\Delta Equity \times CTR \times Paris$	0.0020	-0.0018	-0.0067	-0.0071	-0.0017	0.0019	-0.0058	-0.0054
	(0.2504)	(-0.3069)	(-1.9729)	(-1.9514)	(-0.2809)	(0.2333)	(-1.8032)	(-1.7558)
Controls	Yes	No	Yes	No	Yes	No	Yes	No
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.0072	0.0056	0.0061	0.0033	0.0085	0.0042	0.0095	0.0067

Table 8. Portfolio sorts by physical climate risk.

The table reports results from sorting country-level benchmark equity indices by the ND-GAIN climate disruption vulnerability index for DMs and EMs over the period from January 2000 to December 2015 (pre-Paris; Panel A), and January 2016 to September 2024 (post-Paris; Panel B). Portfolios are held for one month and returns are annualised. In each panel, columns 1 to 5 report the USD excess equity returns of portfolios P1 to P5, where P1 (P5) contains the benchmark equity indices of countries with the lowest (highest) level of physical climate risk. The last three columns report the USD excess equity returns of the long(P5)-short(P1) portfolio, rx , and the underlying local-currency equity return differential, $\Delta Equity$, and currency movement, ΔFX , as in Equation (4). Newey-West t -statistics for the significance of mean returns are shown in parentheses.

	Panel A: Pre-Paris Agreement								Panel B: Post-Paris Agreement							
	P1 (Low)	P2	P3	P4	P5 (High)	P5-P1			P1 (Low)	P2	P3	P4	P5 (High)	P5-P1		
						<i>rx</i>	<i>ΔEquity</i>	<i>ΔFX</i>						<i>rx</i>	<i>ΔEquity</i>	<i>ΔFX</i>
Developed markets (DMs)																
Mean	1.1363 (0.8224)	1.1788 (0.8540)	0.0587 (0.0355)	-0.8444 (-0.5393)	-0.7758 (-0.3637)	-1.9121 (-0.8364)	-1.2412 (-0.5714)	-0.6709 (-0.6413)	-0.7108 (-0.3371)	0.8515 (0.5944)	0.3753 (0.2785)	0.3632 (0.2686)	1.6737 (0.8472)	2.3845 (0.6921)	1.8141 (0.6337)	0.5704 (0.4039)
Median	0.8777	1.2461	-0.0774	-0.7796	-0.5496	-1.5633	-0.9279	-0.8182	-0.7320	1.1125	0.2003	0.1474	1.5274	2.5819	2.0790	0.3275
StdDev	4.7649	5.0802	4.1040	4.4265	6.3964	4.2679	6.4771	5.0566	6.3446	5.0973	4.2714	4.2694	6.0745	3.7834	3.8683	6.1237
Skewness	-0.0147	-0.1801	-0.5844	-0.4225	-0.6338	-0.5683	-0.1011	-0.0824	-0.4864	0.0169	-0.1725	-0.6701	0.0623	-0.4900	-0.5774	-0.4517
Kurtosis	4.3963	2.7111	2.7585	3.9773	3.7166	2.6123	4.7270	4.1542	3.3289	2.8506	4.3175	3.8871	3.2273	4.8420	2.9482	4.4435
Sharpe ratio	0.2385	0.2320	0.0143	-0.1908	-0.1213	-0.4480	-0.1916	-0.1327	-0.1120	0.1670	0.0879	0.0851	0.2755	0.6303	0.4690	0.0931
AC(1)	0.1083	0.0415	0.0793	-0.0450	0.0580	0.0457	0.1466	0.0322	0.0645	0.0719	0.1191	0.0316	0.0633	0.0030	0.0819	0.1638
Emerging markets (EMs)																
Mean	0.3022 (0.1150)	-0.9156 (-0.5080)	-1.5907 (-0.7820)	-1.4361 (-0.8404)	-1.1505 (-0.5319)	-1.4527 (-0.3374)	-2.1023 (-0.4987)	0.6496 (0.5513)	-0.6045 (-0.3415)	-0.4747 (-0.2075)	-2.1053 (-0.9804)	-1.4791 (-0.6390)	-1.7909 (-0.9908)	-1.1864 (-0.2881)	-1.2213 (-0.2935)	0.0349 (0.0393)
Median	0.0620	-1.0748	-1.9708	-1.0631	-1.5362	-1.3798	-1.8023	0.4491	-0.5197	-0.3532	-1.8520	-1.6308	-2.0985	-1.1674	-1.5420	0.2585
StdDev	7.9299	5.9587	6.5026	5.9912	7.1358	3.6601	5.0136	4.2102	6.3142	6.8096	6.3283	6.0116	6.4965	4.6208	6.2745	5.9061
Skewness	-0.0567	-0.3091	-0.2558	-0.2232	-0.6127	-0.1554	-0.0191	-0.2430	-0.0058	-0.0060	-0.6158	-0.5849	-0.6831	-0.6187	-0.0251	-0.1860
Kurtosis	4.2885	4.1572	4.0849	4.8326	4.5736	3.4841	2.6087	3.5407	4.0078	3.6347	2.6664	4.8024	2.6385	4.5836	4.7566	4.4475
Sharpe ratio	0.0381	-0.1537	-0.2446	-0.2397	-0.1612	-0.3969	-0.4193	0.1543	-0.0957	-0.0697	-0.3327	-0.2460	-0.2757	-0.2567	-0.1946	0.0059
AC(1)	0.1126	0.1602	-0.0267	0.1270	0.1253	0.0200	-0.0101	-0.0392	0.0408	0.0045	0.0808	-0.0136	-0.0116	-0.0386	0.1655	-0.0204

Table 9. Portfolio sorts: Robustness tests.

The table reports the USD excess equity returns of long-short portfolios, rx , and the local-currency equity return and FX return components, as in Equation (4). Newey-West t -statistics are shown in parentheses. Panel A uses the country-level carbon emissions intensity (sorting signal). Panel B groups countries into three or six portfolios instead of the five used in the main analysis. Panel C uses three- and six-month holding periods instead of the one-month period used in the main analysis. Panel D uses country-level MSCI equity indices. Panel E uses the 6-month lagged climate transition risk index (sorting signal). The sample periods are Jan 2000–Dec 2015 (pre-Paris) and Jan 2016–Sep 2024 (post-Paris).

	Developed markets						Emerging markets					
	pre-Paris			post-Paris			pre-Paris			post-Paris		
	rx	$\Delta Equity$	ΔFX	rx	$\Delta Equity$	ΔFX	rx	$\Delta Equity$	ΔFX	rx	$\Delta Equity$	ΔFX
Panel A: Carbon emission intensity signal												
mean (P5-P1)	-0.7891	-0.0455	-0.7436	-2.7018	-2.1680	-0.5338	-2.1103	-2.1068	-0.0035	1.8447	4.5079	-2.6632
t -statistic	(-0.3191)	(-0.0249)	(-0.4357)	(-0.6757)	(-0.5816)	(-0.3485)	(-0.5067)	(-0.5406)	(-0.0035)	(2.2788)	(1.8806)	(-1.9829)
Panel B: Number of portfolios												
mean (P3-P1)	1.2883	1.2704	0.0179	-1.5263	-1.5214	-0.0049	0.3431	1.5826	-1.2395	3.3776	7.6042	-4.2266
t -statistic	(0.3032)	(0.4515)	(0.0428)	(-0.6724)	(-0.7830)	(0.0098)	(1.2448)	(0.7873)	(-1.2685)	(2.3964)	(1.8431)	(-2.5711)
mean (P6-P1)	-0.4888	0.4428	-0.9316	-2.3100	-2.6244	0.3144	1.4862	2.9299	-1.4437	5.1191	8.9596	-3.8405
t -statistic	(-0.3956)	(0.4113)	(-0.1641)	(-1.2252)	(-1.9481)	(-0.9151)	(0.1081)	(0.1358)	(-0.3819)	(2.2723)	(2.1861)	(-1.8939)
Panel C: Portfolio holding period												
mean (3 months)	-0.6559	-0.6191	-0.0368	-1.1332	-1.1503	0.0171	-0.1651	0.1288	-0.2939	4.9885	8.0499	-3.0614
t -statistic	(-0.3616)	(-0.3182)	(-0.0872)	(-1.1195)	(-0.9822)	(0.0420)	(0.0467)	(0.0367)	(-0.5665)	(2.5311)	(3.1421)	(-2.8228)
mean (6 months)	-0.5213	-0.4998	-0.0215	-1.2831	-1.2909	0.0078	-0.2906	-0.1402	-0.1504	4.9238	7.6858	-2.7620
t -statistic	(-0.3198)	(-0.2964)	(-0.0866)	(-1.0602)	(-1.3593)	(0.0617)	(-0.1053)	(-0.0456)	(-0.3661)	(3.7076)	(3.8842)	(-1.8510)
Panel D: MSCI equity indices												
mean (P5-P1)	0.0827	-0.7873	0.8700	-4.3251	-3.9051	-0.4200	0.5342	0.1942	0.3400	3.4613	8.7213	-5.2600
t -statistic	(0.0336)	(-0.3668)	(0.2914)	(-0.5586)	(-1.5873)	(-0.0584)	(0.3215)	(0.3129)	(0.7499)	(3.0839)	(2.6768)	(-2.5727)
Panel E: 6 month-lagged climate transition risk signal												
mean (P5-P1)	-0.9411	-0.8143	-0.1268	-3.0905	-3.0703	-0.0161	2.4014	2.9608	-0.5594	2.9893	8.4649	-5.4756
t -statistic	(-0.4362)	(-0.3674)	(-0.0895)	(-1.2417)	(-1.4367)	(-0.0048)	(0.5548)	(0.6690)	(-0.3727)	(2.3306)	(2.6117)	(-2.7394)

Table 10. Fama-MacBeth pricing tests.

The table reports average prices of risk from the second step of the Fama-MacBeth approach. At step one, factor betas are estimated via 36-month rolling time-series regressions of excess equity returns on the risk factors for each country. At step two, monthly cross-sectional regressions of excess returns on the estimated betas are conducted for the same 20 test assets used in the GMM approach. The controls are 5 equity and 5 currency risk factors specified in Section 3.2 and further detailed in Appendix A.4. The climate factor is constructed as the USD excess returns of the high-low quintile portfolio sorted by the climate transition risk index. Newey-West t-statistics are shown in parentheses. R-squared is the time-averaged coefficient of determination from the cross-sectional regressions. The sample period is January 2000 to December 2015 (pre-Paris) and January 2016 to September 2024 (post-Paris).

	Developed markets				Emerging markets			
	pre-Paris		post-Paris		pre-Paris		post-Paris	
<i>Climate</i>	-0.1427 (-0.2131)	0.2899 (0.8752)	0.2947 (0.3900)	0.2252 (0.3078)	0.4732 (1.1957)	0.3335 (1.1811)	0.6250 (2.1597)	0.5193 (1.9793)
<i>World</i>	0.3968 (0.6407)	-0.4846 (-1.3187)	1.9296 (2.3092)	1.6765 (4.4836)	-0.2151 (-1.7637)	-0.2784 (-2.1785)	1.9153 (1.8591)	1.0500 (2.8867)
<i>Size</i>	1.2575 (1.5525)	0.8347 (2.1564)	-0.9795 (-0.4870)	-0.0928 (-0.4018)	2.9897 (0.6092)	2.9414 (0.6190)	-0.8121 (-1.0075)	-0.2964 (-0.0118)
<i>Value</i>	0.3491 (0.5511)	0.3332 (0.8853)	0.5697 (1.6627)	0.9406 (0.5708)	1.4712 (1.0118)	1.4250 (0.9005)	0.9464 (1.8970)	1.3796 (1.5641)
<i>Mom</i>	0.3006 (0.5088)	0.7501 (1.4730)	-1.7416 (-0.9185)	-1.2296 (-1.6419)	1.3586 (0.2407)	1.2489 (0.2200)	-2.2177 (-0.7479)	-1.6652 (-1.4979)
<i>Vol</i>	-1.5551 (-2.1218)	-0.5803 (-2.6828)	-2.7039 (-2.7761)	-1.1543 (-2.0914)	-3.7062 (-2.4003)	-3.1472 (-2.2354)	-1.4674 (-2.1921)	-1.7355 (-2.0469)
<i>Dollar</i>		0.2070 (1.7526)		1.0593 (3.4900)		2.1573 (1.9300)		0.9267 (3.0745)
<i>Carry^{FX}</i>		-0.4269 (-2.6466)		-0.0608 (-2.1444)		-0.0869 (-0.0744)		-0.5036 (-1.8259)
<i>Mom^{FX}</i>		0.1365 (0.5330)		-0.2301 (-0.5483)		1.1618 (1.4018)		0.0453 (0.0091)
<i>Vol^{FX}</i>	-0.3202 (-1.6908)	-0.9548 (-1.8999)	-0.6722 (-2.7686)	0.0383 (2.0405)	-1.4178 (-1.8541)	-1.4603 (-1.7412)	-0.8347 (-2.1671)	-0.5939 (-1.9900)
<i>ΔYield</i>		0.1128 (2.1499)		0.1828 (2.1416)		-1.2451 (-0.9828)		0.1929 (3.0621)
<i>R-squared</i>	0.3355	0.3539	0.3599	0.3904	0.3384	0.3317	0.4778	0.4439

Internet APPENDIX

Climate Transition Risk: Equity Pricing and Currency Markets

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This Internet Appendix provides additional results supporting and supplementing the analysis in the manuscript *Climate Transition Risk: Equity Pricing and Currency Markets*.

A.1. Sample countries and LSEG Datastream codes.

This table lists, for each sample country, the LSEG Datastream codes for the spot and (one-month) forward exchange rate expressed as domestic currency per US dollar (columns 2 and 3), the benchmark local equity index (column 4), the corresponding MSCI international equity index (column 5), and the climate transition risk index (column 6).

	FX rates		Equity indices		Climate transition risk (CTR) index
	Spot	Forward	Benchmark local	MSCI international	
Panel A. Developed markets (DMs)					
Australia	AUSTDOI	USAUD1F	ASX200I	MSAUSTL	AUSOVABAR
Austria	AUSTSC\$	USATS1F	ATXINDEX	MSASTRL	OESOVABAR
Canada	NDOLL\$	USCAD1F	TTOSP60	MSCNDAL	CNSOVABAR
Denmark	DANISH\$	USDKK1F	COSEASH	MSDNMKL	DKSOVABAR
Finland	FINMAR\$	USFIM1F	HEXINDEX	MSFIND	FNSOVABAR
France	FRENFR\$	USFRF1F	FRCAC40	MSFRNCL	FRSOVABAR
Germany	DMARKE\$	USDEM1F	DAXINDEX	MSGERML	BDSOVABAR
Hong Kong	HKDOLL\$	USHKD1F	HNGKNGI	MSHGKGL	HKSOVABAR
Japan	JAPAYE\$	JE1MUSD	JAPDOWA	MSJPANL	JPSOVABAR
Norway	NORKRO\$	USNOK1F	NWSHRPRCF	MSNWAYL	NWSOVABAR
Singapore	SINGDO\$	USSGD1F	SNGPORI	MSSINGL	SPSOVABAR
Korea	TDKRWSP	USKRW1F	KORCOMP	MSKOREL	KOSOVABAR
Sweden	SWEKRO\$	TDSEK1M	SWEDOMX	MSSWDNL	SDSOVABAR
Switzerland	SWISSF\$	USCHF1F	SWISSMI	MSSWITL	SWSOVABAR
United Kingdom	UKDOLLR	UKUSD1F	FTSE100	MSUTDKL	UKSOVABAR
Panel B. Emerging markets (EMs)					
Argentina	TDARSSP	USARS1F	ARGMERV	MSARGTL	AGSOVABAR
Brazil	TDBRLSP	USBRL1F	BRSHRPRCF	MSBRAZL	BRSOVABAR
Bulgaria	TDBGNSP	USBGN1F	BSSOFIX	MSBLGNL	BLSOVABAR
Chile	TDCLPSP	USCLP1F	IGPAGEN	MSCHILL	CLSOVABAR
China	TDCNYSP	TDCNY1M	CHSASHR	MSCHINL	CHSOVABAR
Columbia	TDCOPSP	USCOP1F	CBSHRPRCF	MSCOLML	CBSOVABAR
Czech Republic	TDCZKSP	USCZK1F	CZPXIDX	MSCZCHL	CZSOVABAR
Hungary	TDHUFSP	USHUF1F	BUXINDEX	MSHUNGL	HNSOVABAR
India	TDINRSP	USINR1F	ICRI500	MSINDIL	INSOVABAR
Indonesia	TDIDRSP	USIDR1F	JAKCOMP	MSINDFL	IDSOVABAR
Malaysia	TDMYRSP	MYUSN1M	FBMKLCI	MSMALFL	MYSOVABAR
Mexico	TDMXNSP	USMXN1F	MXIPC35	MSMEXFL	MXSOVABAR
Peru	TDPENSP	USPEN1F	PEGENRL	MSPERU\$	PESOVABAR
Philippines	TDPHPSP	USPHP1F	PSECOMP	MSPHLFL	PHSOVABAR
Poland	TDPLNSP	USPLN1F	POSHRPRCF	MSPLNDL	POSOVABAR
Russia	TDRUBSP	USRUB1F	RS:MOC		RSSOVABAR
Romania	TDRONSP	USRON1F	RMBETRL	MSROMNL	RMSOVABAR
South Africa	TDZARSP	USZAR1F	JSEOVER	MSSARFL	SASOVABAR
Thailand	TDTHBSP	USTHB1F	BNGKSET	MSTHAFL	THSOVABAR
Turkey	TDTRYSP	USTRY1F	TRKIST	MSTURKL	TKSOVABAR

A.2. Summary statistics for equity returns, FX returns, and climate transition risk.

The table reports mean, median and standard deviation for country-level equity returns (using both benchmark local equity indices and MSCI equity indices), FX returns, and climate transition risk index (CTR). DM countries are presented in Panel A and EM countries in Panel B. All returns are annualized. Higher CTR index values indicate greater risk. The sample period is January 2000 to September 2024.

	Equity returns (in local currency)						FX returns			CTR index		
	Benchmark local index			MSCI international index								
	Mean	Median	StDev	Mean	Median	StDev	Mean	Median	StDev	Mean	Median	StDev
Panel A. Developed markets (DMs)												
Australia	4.0500	13.1964	9.3540	4.0378	12.5602	9.8392	0.3790	1.7862	13.9337	77.2866	78.5600	2.7980
Austria	4.8132	16.4076	12.2000	1.7886	13.8721	17.4859	0.2693	-0.3661	22.6067	27.5121	27.9400	2.8821
Canada	4.5720	11.7888	8.4731	4.5165	11.0632	10.3512	0.3575	0.4733	15.4963	73.8246	74.6800	1.9302
Denmark	9.0876	13.6404	9.9916	9.1049	14.5391	12.5592	2.5228	2.1583	16.7198	27.3716	27.6300	5.4230
Finland	-0.3924	6.0420	9.3539	-3.6075	1.2036	18.1674	0.3790	1.7760	24.3097	21.6965	20.0500	4.2785
France	1.4196	8.2728	9.3322	1.2491	9.2448	12.4412	0.3682	1.5403	18.5135	18.3474	18.1600	3.2036
Germany	4.6872	10.6248	9.3540	1.0755	6.9060	14.5616	0.3790	1.8047	21.0177	29.3208	27.6400	4.5814
Hong Kong	0.5544	6.7800	9.3542	0.9213	6.1177	15.1027	0.3790	1.7825	21.2519	60.7349	64.0900	4.7992
Japan	2.9832	8.8956	9.0742	1.9422	8.2838	12.2567	-0.7853	-1.3124	19.7578	41.5416	44.8000	6.0977
Norway	8.3028	16.4112	0.5304	3.9322	10.1839	13.8194	-0.0142	-0.0155	17.6721	9.7415	9.6600	1.5552
Singapore	1.7136	9.0072	9.6337	0.3422	8.0945	13.8264	-1.4672	-0.3864	18.4453	71.4310	76.5500	9.3081
South Korea	3.9876	8.2764	10.4495	4.7232	7.1098	15.9646	-0.5872	1.0889	21.6835	62.2624	62.8900	2.5124
Sweden	3.6204	9.4896	11.6839	3.1702	6.5361	14.3529	-1.0925	-1.5733	19.0727	2.7386	2.6700	1.5265
Switzerland	2.0604	8.1732	11.4131	1.8278	10.0698	9.5107	-0.7339	-0.6530	13.9368	10.9491	11.6400	1.8613
United Kingdom	0.9288	7.8972	5.5094	0.7246	8.6613	9.7446	1.0168	0.8597	14.3230	22.6454	22.7600	7.4769
Mean	3.4926		9.0472	2.3832		13.3322	0.0913		18.5827	37.1603		4.0156
Median		9.0072	9.3540		8.6613	13.8194		0.8597	18.5135		27.6400	3.2036
Panel B. Emerging markets (EMs)												
Argentina	32.6460	25.9836	40.5393	12.1513	21.4134	43.5127	-27.7152	-10.5816	26.7539	53.4738	54.8500	2.9655
Brazil	8.2536	9.6168	24.4406	6.3101	7.0746	22.7922	-4.3572	1.5468	15.8607	37.8757	38.3900	3.1152
Bulgaria	8.5776	3.3912	26.1110	-5.5192	-7.7408	27.1275	0.3552	-0.6540	9.4452	47.6793	48.2900	2.3552
Chile	7.6068	5.3052	15.7731	3.7155	0.5959	17.0288	-2.1000	-1.8048	12.1431	13.5780	13.0100	3.5736
China	2.6256	7.8432	26.1519	2.5901	10.8131	26.5154	0.8172	0.0000	3.4021	74.7133	74.5500	1.6688
Colombia	1.9980	6.7692	18.7003	10.4513	18.1415	24.5665	-3.1200	-1.7412	13.4916	21.4165	21.0200	1.8134
Czech Republic	4.9308	9.4320	20.8653	4.8002	4.4270	21.5180	1.8648	2.6916	12.0714	58.6329	60.1100	5.5883
Hungary	9.1980	11.3208	23.1260	5.6810	13.9724	25.5830	-1.4124	3.3288	14.0203	33.9633	31.6100	6.5920
India	12.6084	18.8256	25.6676	10.5316	12.6582	22.7476	-3.0624	-1.4052	10.7231	26.9277	26.6700	2.0268
Indonesia	10.3248	13.4016	20.0953	8.1103	17.4699	23.4334	-2.6664	-0.5004	6.9279	42.9432	42.1900	3.9269
Malaysia	3.3480	6.1188	13.6278	2.1332	4.4086	14.3603	-0.5508	1.6176	6.5586	56.1478	55.7300	1.3526
Mexico	8.6304	11.6772	19.1925	7.1126	9.8983	17.8936	-2.9760	0.0000	11.5143	26.3155	24.9600	4.5236
Peru	11.1144	8.3820	26.2385	9.6785	13.4884	28.6836	-0.3144	0.2112	5.3105	25.4288	24.9700	1.3640
Philippines	5.0520	14.4000	19.8441	3.2827	8.7699	20.7229	-1.3092	-0.3240	5.9884	15.3662	15.2100	1.6714
Poland	6.1788	7.1724	20.9350	0.1022	1.4583	23.2447	0.3996	0.3972	13.2970	53.8038	55.0800	5.1365
Romania	14.4228	18.1152	27.7956	5.0141	15.7499	28.5520	-3.7236	-2.1900	10.3916	34.3054	36.0900	6.5045
Russia	10.5336	18.2136	27.4672				-4.9020	-1.0848	17.4490	93.4054	93.3100	1.0582
South Africa	9.7560	15.0588	16.6769	7.7065	7.6117	16.8294	-4.2996	1.7556	16.3409	62.9446	63.5200	1.6808
Thailand	4.6992	7.2432	21.7736	3.3998	7.1760	23.2898	0.5196	-11.0148	7.0654	35.0281	33.6500	4.0261
Turkey	19.1784	21.2436	36.9585	15.0473	24.1075	34.0537	-16.8900	-1.6080	18.8575	45.4288	45.7500	6.2521
Mean	9.5842		23.5990	5.9105		24.3397	-3.7721		11.8806	42.9689		3.3598
Median		10.4688	22.4498		9.8983	23.2898		-0.4122	11.7928		40.2900	3.0403

A.3. GMM estimation of factor risk premia.

Let $rx_{j,t+1}$ denote the foreign excess return on portfolio j from t to $t + 1$, as defined in Equation (1) of the main text. Without arbitrage opportunities, risk-adjusted excess returns must satisfy the Euler equation, which implies the J moment conditions:

$$E_t[rx_{j,t+1}m_{t+1}^F] = 0, \quad j = 1, \dots, J \quad (\text{A3.I})$$

where m_{t+1}^F is the stochastic discount factor (SDF) dictated by a set of $k = 1, \dots, K$ risk factors. We assume a linear specification of the form:

$$m_{t+1}^F = 1 - \mathbf{b}'(\mathbf{F}_{t+1} - \boldsymbol{\mu}), \quad (\text{A3.II})$$

where $\mathbf{F}_{t+1}$ is the vector of risk factors, $\boldsymbol{\mu}$ the vector of factor means, and $\mathbf{b}$ the vector of loadings. Combining the Euler equation and the linear SDF specification leads to the conventional beta representation (Equation (7) in the paper) in which the expected excess return on portfolio j is given by the sum of each factor's price of risk (λ_k) times the corresponding factor exposure (β_k).

GMM provides estimates of the SDF loadings $\mathbf{b}$ on the risk factors, from which the factor prices of risk $\boldsymbol{\lambda}$ are recovered as:

$$\boldsymbol{\lambda} = \Omega_F \mathbf{b}, \quad (\text{A3.III})$$

where $\Omega_F = E[(\mathbf{F}_{t+1} - \boldsymbol{\mu})(\mathbf{F}_{t+1} - \boldsymbol{\mu})']$ is the covariance matrix of the risk factors. The factor exposures (betas) of portfolio j are obtained by regressing $rx_{j,t+1}$ on the K risk factors $\mathbf{F}_{t+1}$, including an intercept that captures the pricing error.

The J -statistic tests the hypothesis that pricing errors are jointly zero ($H_0: \alpha_1 = \alpha_2 = \dots = \alpha_J = 0$) and is distributed as chi-squared with degrees of freedom equal to the number of overidentifying restrictions (the number of test portfolios minus the number of estimated parameters).

A.4. Traditional risk factors in international equity pricing.

The table provides details on the 10 equity and currency risk factors utilized as control variables in the GMM and Fama-MacBeth asset pricing tests: the columns contain name abbreviation for the tables, definition or each signal and relevant equation, key references, and data sources.

Name	Definition	Signal	Key references	Sources
Panel A. Equity risk factors				
<i>World</i>	Monthly excess returns of MSCI World index using 1m US Treasury bill rate as risk-free rate proxy.	$r_t^{Mkt} - rf_t$	Solnik & McLeavey (2008)	Authors' own calculation
<i>Size</i>	US monthly returns of a portfolio of stocks with small market capitalization minus large-cap stocks.	$MarketCap_t$	Fama & French (1989)	Kenneth R. French - Data Library
<i>Value</i>	US monthly returns of a portfolio of high book-to-market (value) stocks minus a portfolio of low book-to-market (growth) stocks.	$Book_t/Market_t$	Fama & French (1989)	Kenneth R. French - Data Library
<i>Mom</i>	Average return spread between prior winner and loser stocks among US stocks formed on size and past returns. High and Low are stocks ranked by their cumulative return from month $t-12$ to $t-2$. Small and Big are stocks below or above median US market capitalization at $t-1$.	$\sum_{j=2}^{12} \log(P_{t-j}/P_{t-j-1})$	Carhart (1997)	Kenneth R. French - Data Library
<i>Vol</i>	Residuals of AR(1) model fitted to monthly series of average absolute daily returns across 5 broad stock indices: US SP500, UK FTSE 100, Japan NIKKEI 225, Germany DAX and France CAC 40. D is the number of days per month.	$\frac{1}{D} \sum_{d=1}^D \left[\sum_{k=1}^5 \left(\frac{ r_{k,d} }{5} \right) \right]$	Ang et al.(2006)	Authors' own calculation
Panel B. Currency risk factors				
<i>Dollar</i>	Monthly average net excess returns of $K=78$ currencies against the US dollar.	$\frac{1}{K} \sum_{k=1}^K \Delta S_{k,t}^f$	Lustig et al. (2011)	Della Corte and Riddiough (2025)
<i>Carry^{FX}</i>	Monthly net returns of a portfolio long (short) the 20% of $K=78$ currencies with the highest (lowest) short-term interest differential.	$i_{1m} - i_{1m}^{US}$	Lustig et al. (2011)	Della Corte and Riddiough (2025)
<i>Mom^{FX}</i>	Monthly net returns of a portfolio long 20% of $K=78$ currencies with highest past 1-month return (winners) and short 20% of K currencies with lowest past 1-month return (losers).	$\log(S_{t-1}/S_{t-2})$	Menkhoff et al (2012b)	Della Corte and Riddiough (2025)
<i>Vol^{FX}</i>	Residuals of AR(1) model fitted to monthly series of average daily absolute returns across M currencies. D is the number of days per month. $M=35$ is the number of countries in our sample.	$\frac{1}{D} \sum_{d=1}^D \left[\sum_{m=1}^M \left(\frac{ \Delta S_{m,d} }{M} \right) \right]$	Menkhoff et al (2012a)	Authors' own calculation
<i>$\Delta Yield^{FX}$</i>	Monthly net returns of a portfolio long (short) 20% of M currencies from countries with highest (lowest) long-term yield differentials. $M=35$ is the number of countries in our sample.	$i_{10y} - i_{10y}^{US}$	Ang & Chen (2010)	Authors' own calculation

A.5. Correlation structure of risk factors in international equity pricing.

The table presents in heatmap format the correlations among the monthly observations for the 10 equity and currency risk factors from the literature used as candidate control variables in our asset pricing models. See Appendix A.4 for detailed definitions of each risk factor. CTR is the climate factor constructed from our sample of 35 countries as the USD excess returns of the long-short portfolio of benchmark equity indices sorted by climate transition risk.

World	1.0000	0.2609	-0.0248	-0.3798	-0.5154	0.5168	0.3844	0.0894	-0.1946	-0.0752	0.0655
Size	0.2609	1.0000	-0.1419	-0.0062	-0.1384	0.1036	0.0453	0.0391	0.0492	0.0599	0.0149
Value	-0.0248	-0.1419	1.0000	-0.1870	-0.0687	0.1155	0.1220	0.0204	0.0179	0.0919	0.0888
Mom	-0.3798	-0.0062	-0.1870	1.0000	0.1018	-0.2079	-0.2603	-0.0916	0.1183	0.0224	-0.0730
Vol	-0.5154	-0.1384	-0.0687	0.1018	1.0000	-0.4179	-0.3518	-0.2651	0.1776	0.0199	-0.0385
Dollar	0.5168	0.1036	0.1155	-0.2079	-0.4179	1.0000	0.3856	0.1200	-0.0469	0.0635	0.0490
Carry ^{FX}	0.3844	0.0453	0.1220	-0.2603	-0.3518	0.3856	1.0000	0.4979	-0.2119	-0.0007	-0.0056
Mom ^{FX}	0.0894	0.0391	0.0204	-0.0916	-0.2651	0.1200	0.4979	1.0000	-0.0496	0.0312	0.0299
Vol ^{FX}	-0.1946	0.0492	0.0179	0.1183	0.1776	-0.0469	-0.2119	-0.0496	1.0000	0.0488	-0.0695
ΔYield	-0.0752	0.0599	0.0919	0.0224	0.0199	0.0635	-0.0007	0.0312	0.0488	1.0000	0.0872
CTR	0.0655	0.0149	0.0888	-0.0730	-0.0385	0.0490	-0.0056	0.0299	-0.0695	0.0872	1.0000
	World	Size	Value	Mom	Vol	Dollar	Carry ^{FX}	Mom ^{FX}	Vol ^{FX}	ΔYield	CTR

A.6. Tests for alternative quintile portfolio spreads.

The table reports mean USD excess returns and significance tests for long-short portfolios using alternative pairs of equity quintiles obtained from the cross-section of EM countries. Returns are annualised. Newey-West t -statistics are shown in parentheses. The quintile portfolios P1 to P5 are summarized in Table 1, Panel C. The sample period is January 2000 to September 2024.

	Long				
	P1 (Low)	P2	P3	P4	P5 (High)
Short	P1	0.4009 (0.4753)	-0.7413 (-1.2768)	-0.5481 (-0.7385)	1.5303 (2.4753)
	P2		-1.1422 (-1.7982)	-0.9490 (-1.3042)	1.1294 (1.9573)
	P3			0.1932 (0.2982)	2.2716 (3.4136)
	P4				2.0784 (3.1724)
	P5				

A.7. GMM estimation results for the full cross-section of countries.

This table presents GMM estimations for 20 test assets formed by sorting the countries into quintiles by equity momentum, currency carry, currency momentum, and term spread. The climate factor is constructed as the USD excess returns of the high-low quintile portfolio sorted by the climate transition risk index. The controls are 5 equity factors (World, US size, US value, US momentum, and volatility), and 5 currency factors (dollar, carry, momentum, volatility, and yield differential) specified in Section 3.2 and further detailed in Appendix A.4. Factor prices of risk are reported with Newey-West t-statistics in parentheses. The J -statistic tests the null hypothesis of zero pricing errors, with the corresponding p -value also reported. Columns (1) to (11) report two-factor models, column (12) reports a multifactor model of Cenedese et al. (2016), column (13) reports the full model. The sample period is January 2000 to September 2024.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<i>Climate</i>	0.4912 (1.8459)	0.8413 (1.4184)	0.9326 (1.4657)	1.2593 (1.5769)	1.6123 (1.9205)	1.3165 (1.7022)	1.4528 (1.6528)	1.0603 (1.3608)	0.7533 (1.1023)	1.3706 (1.7410)	1.0946 (1.2427)	0.3559 (1.7662)	0.2504 (1.5536)
<i>World</i>		0.9888 (1.2636)										0.3749 (1.3221)	-0.6655 (-1.2226)
<i>Size</i>			0.5675 (0.2792)									1.4377 (1.6764)	1.3918 (0.5160)
<i>Value</i>				-1.1896 (-2.1471)								-0.2237 (-1.6916)	-1.1612 (-3.1137)
<i>Mom</i>					-1.2477 (-1.1197)							-3.6487 (-0.3063)	-0.9425 (-0.0755)
<i>Vol</i>						-0.9841 (-2.2267)						-1.5444 (-2.2583)	-1.9543 (-1.8376)
<i>Dollar</i>							0.7047 (3.5622)						1.0313 (2.7603)
<i>Carrv^{FX}</i>								-0.3643 (-2.1931)					-0.4589 (-3.5826)
<i>Mom^{FX}</i>									-0.6001 (-0.8521)				-0.6663 (-0.5692)
<i>Vol^{FX}</i>										-0.7038 (-0.5486)		-0.3403 (-1.9731)	-0.2016 (-0.6864)
<i>ΔYield</i>											0.2198 (2.4139)		0.2682 (2.2790)
<i>J</i> -statistic	20.5132	31.9623	31.0959	17.5228	19.2218	18.4655	19.0782	17.8924	24.4607	21.0682	17.8262	9.0042	4.0119
<i>p</i> -value	0.3655	0.0226	0.0357	0.4988	0.3839	0.4322	0.3998	0.4650	0.1409	0.2805	0.4711	0.7761	0.8678

A.8. Summary statistics for climate-related variables.

EnTax is energy tax revenue as a percentage of GDP and Coverage is the proportion of sample years with an active energy tax policy in place. GHG-to-GDP is an index expressing the gap between a country's actual emissions and an income-adjusted benchmark derived from a cross-section of 130 countries. Nationally Determined Contribution (NDC) Implied Temperature Rise is an index expressing the implied global temperature increase by 2100 if all countries adopted the country's emissions pledge. Carbon intensity is measured in tons of CO₂ emissions per unit of GDP, expressed in thousands of US dollars. Physical risk is an index of country vulnerability to climate-related physical disruptions. DM (EM) mean and median are computed as the cross-country averages of country-level time-series means and medians, respectively. The sample period is 2000 to 2024, except for EnTax, for which data are available up to 2021.

Panel A: Full sample period (2000-2024)									
	EnTax			GHG-to-GDP		NDC Impl Temp Rise		Physical risk	
	Mean	Median	Coverage	Mean	Median	Mean	Median	Mean	Median
Developed markets (DMs)									
Australia	1.28	1.21	100%	65.19	67.89	89.26	89.21	0.32	0.33
Austria	1.55	1.56	100%	25.06	25.50	29.91	29.85	0.30	0.30
Canada	0.92	0.91	27%	68.08	69.95	79.53	79.40	0.28	0.28
Denmark	2.31	2.33	100%	16.48	16.46	38.09	38.03	0.34	0.34
Finland	1.88	1.92	100%	22.64	18.77	20.61	20.60	0.28	0.28
France	1.55	1.57	100%	14.25	13.77	22.30	22.30	0.31	0.31
Germany	1.78	1.81	100%	23.65	20.53	34.80	34.72	0.30	0.30
Hong Kong	–	–	0%	93.12	100.00	28.19	28.18	–	–
Japan	0.92	0.96	100%	37.35	44.13	45.52	45.45	0.37	0.37
Norway	1.33	1.28	100%	12.34	12.18	7.12	7.15	0.26	0.26
Singapore	0.15	0.15	18%	66.77	77.34	75.84	75.75	0.40	0.40
South Korea	1.76	1.83	77%	56.41	57.56	68.02	67.96	0.36	0.36
Sweden	1.93	1.98	100%	5.39	5.26	0.00	0.00	0.32	0.32
Switzerland	0.96	0.96	59%	5.70	7.13	16.14	16.15	0.28	0.28
UK	1.78	1.77	100%	22.10	22.23	22.88	22.89	0.28	0.28
<i>DM mean</i>	<i>1.44</i>			<i>35.64</i>		<i>38.55</i>		<i>0.31</i>	
<i>DM median</i>		<i>1.57</i>			<i>22.23</i>		<i>29.85</i>		<i>0.30</i>
Emerging Markets (EMs)									
Argentina	0.97	0.96	100%	50.64	53.43	56.37	56.27	0.40	0.40
Brazil	0.06	0.06	27%	31.76	32.77	44.12	44.11	0.38	0.38
Bulgaria	2.50	2.49	100%	68.96	70.05	26.43	26.41	0.36	0.36
Chile	0.90	0.91	23%	20.90	20.39	6.39	6.37	0.35	0.35
China	0.40	0.27	59%	70.11	69.83	79.36	79.27	0.39	0.39
Colombia	0.59	0.53	27%	23.74	23.11	19.16	19.14	0.42	0.42
Czech Republic	2.05	2.07	100%	63.00	66.00	53.93	53.80	0.26	0.26
Hungary	2.11	2.13	100%	36.07	30.51	31.61	31.57	0.36	0.36
India	–	–	0%	37.96	37.26	15.78	15.84	0.52	0.52
Indonesia	–	–	0%	33.14	31.35	53.11	53.04	0.47	0.47
Malaysia	0.07	0.07	14%	62.36	61.61	49.93	49.97	0.38	0.38
Mexico	0.34	0.70	100%	31.05	28.57	21.67	21.67	0.39	0.39
Peru	0.75	0.53	100%	13.75	12.92	37.15	37.01	0.43	0.42
Philippines	0.31	0.22	77%	9.07	8.74	21.68	21.68	0.47	0.47
Poland	2.13	2.18	100%	69.41	72.36	37.87	37.81	0.31	0.31
Romania	1.88	1.84	100%	55.81	59.60	12.46	12.44	0.42	0.42
Russia	–	–	0%	91.60	91.48	95.16	95.13	0.33	0.33
South Africa	1.86	1.82	95%	81.42	82.55	44.41	44.41	0.40	0.40
Thailand	1.39	1.44	27%	39.79	36.97	30.26	30.34	0.44	0.43
Turkey	2.23	2.34	100%	38.93	39.40	51.74	51.66	0.39	0.38
<i>EM mean</i>	<i>1.21</i>			<i>46.47</i>		<i>39.43</i>		<i>0.39</i>	
<i>EM median</i>		<i>0.96</i>			<i>38.33</i>		<i>37.41</i>		<i>0.39</i>

(Cont.) A.8. Summary statistics for climate-related variables.

Panel B: Pre-Paris Agreement period (2000-2015)

	EnTax			GHG-to-GDP gap		NDC Impl Temp Rise		Physical risk	
	Mean	Median	Coverage	Mean	Median	Mean	Median	Mean	Median
Developed Markets (DMs)									
Australia	1.40	1.41	100%	68.75	68.90	89.21	89.21	0.33	0.33
Austria	1.61	1.58	100%	28.38	26.80	29.85	29.85	0.30	0.30
Canada	0.89	0.89	6%	70.43	70.18	79.40	79.40	0.28	0.29
Denmark	2.48	2.40	100%	23.72	25.25	38.03	38.03	0.33	0.33
Finland	1.85	1.90	100%	27.19	27.82	20.60	20.60	0.28	0.28
France	1.50	1.49	100%	17.75	19.95	22.30	22.30	0.31	0.31
Germany	1.92	1.88	100%	28.88	27.38	34.72	34.72	0.31	0.31
Hong Kong	–	–	–	99.82	100.00	28.18	28.18	–	–
Japan	0.96	0.98	100%	45.87	45.92	45.45	45.45	0.37	0.37
Norway	1.37	1.31	100%	12.90	13.14	7.15	7.15	0.26	0.26
Singapore	0.14	0.14	6%	79.89	79.68	75.75	75.75	0.40	0.40
South Korea	1.81	1.84	100%	59.44	59.33	67.96	67.96	0.37	0.37
Sweden	2.06	2.09	100%	7.00	7.94	0.00	0.00	0.32	0.32
Switzerland	0.94	0.93	50%	8.29	7.96	16.15	16.15	0.29	0.29
United Kingdom	1.82	1.78	100%	31.87	36.76	22.89	22.89	0.28	0.28
<i>DM mean</i>	<i>1.48</i>			<i>40.68</i>		<i>38.51</i>		<i>0.32</i>	
<i>DM median</i>		<i>1.53</i>			<i>27.82</i>		<i>29.85</i>		<i>0.31</i>
Emerging Markets (EMs)									
Argentina	1.01	0.98	100%	47.64	45.83	56.27	56.27	0.40	0.40
Brazil	0.05	0.05	6%	28.94	26.39	44.11	44.11	0.38	0.38
Bulgaria	2.49	2.47	100%	67.09	68.76	26.41	26.41	0.36	0.36
Chile	0.88	0.88	6%	16.64	15.73	6.37	6.37	0.35	0.36
China	0.40	0.27	81%	70.34	69.75	79.27	79.27	0.40	0.40
Colombia	0.75	0.75	6%	22.67	22.14	19.14	19.14	0.43	0.43
Czech Republic	2.12	2.12	100%	68.04	67.08	53.80	53.80	0.26	0.26
Hungary	2.16	2.16	100%	42.93	46.14	31.56	31.56	0.37	0.37
India	–	–	–	38.70	39.35	15.84	15.84	0.53	0.53
Indonesia	–	–	–	29.58	29.82	53.04	53.04	0.48	0.48
Malaysia	–	–	–	62.76	61.66	49.97	49.97	0.39	0.39
Mexico	0.06	-0.02	100%	27.67	26.54	21.67	21.67	0.39	0.39
Peru	0.86	0.74	100%	14.49	13.53	37.01	37.01	0.44	0.44
Philippines	0.23	0.20	69%	7.82	6.28	21.68	21.68	0.48	0.48
Poland	2.10	2.13	100%	76.31	78.11	37.81	37.81	0.31	0.31
Romania	1.86	1.76	100%	64.85	67.63	12.44	12.44	0.43	0.43
Russia	–	–	–	92.67	92.32	95.12	95.12	0.34	0.33
South Africa	1.68	1.58	100%	83.62	83.56	44.41	44.41	0.41	0.41
Thailand	1.02	1.02	6%	43.45	43.65	30.34	30.34	0.44	0.43
Turkey	2.52	2.48	100%	46.77	49.59	51.66	51.66	0.39	0.39
<i>EM mean</i>	<i>1.26</i>			<i>47.65</i>		<i>39.40</i>		<i>0.40</i>	
<i>EM median</i>		<i>0.96</i>			<i>45.98</i>		<i>37.41</i>		<i>0.40</i>

(Cont.) A.8. Summary statistics for climate-related variables.

Panel C: Post-Paris Agreement period (2016-2024)

	EnTax			GHG-to-GDP gap		NDC Impl Temp Rise		Physical risk	
	Mean	Median	Coverage	Mean	Median	Mean	Median	Mean	Median
Developed Markets (DMs)									
Australia	0.95	0.96	100%	58.69	60.28	89.36	89.21	0.32	0.32
Austria	1.38	1.40	100%	18.99	18.23	30.02	29.85	0.30	0.30
Canada	0.93	0.91	83%	63.80	63.68	79.77	79.41	0.28	0.28
Denmark	1.84	1.83	100%	3.26	2.87	38.20	38.03	0.34	0.34
Finland	1.95	1.95	100%	14.32	14.74	20.63	20.60	0.28	0.28
France	1.69	1.71	100%	7.85	7.55	22.29	22.30	0.30	0.30
Germany	1.42	1.43	100%	14.08	13.64	34.96	34.72	0.30	0.30
Hong Kong	–	–	–	80.86	79.16	28.20	28.18	–	–
Japan	0.82	0.83	100%	21.78	18.67	45.64	45.45	0.37	0.37
Norway	1.24	1.28	100%	11.33	10.39	7.07	7.14	0.26	0.26
Singapore	0.15	0.15	50%	42.79	40.74	76.00	75.75	0.39	0.39
South Korea	1.01	1.01	17%	50.89	49.87	68.13	67.96	0.36	0.36
Sweden	1.58	1.60	100%	2.44	2.03	0.00	0.00	0.32	0.32
Switzerland	0.98	0.98	83%	0.98	0.26	16.13	16.15	0.26	0.26
United Kingdom	1.70	1.74	100%	4.24	3.02	22.86	22.89	0.29	0.28
<i>DM mean</i>	<i>1.26</i>			<i>26.42</i>		<i>38.62</i>		<i>0.31</i>	
<i>DM median</i>		<i>1.34</i>			<i>14.74</i>		<i>29.85</i>		<i>0.30</i>
Emerging Markets (EMs)									
Argentina	0.86	0.82	100%	56.06	56.39	56.56	56.27	0.39	0.38
Brazil	0.06	0.06	83%	36.85	37.01	44.13	44.11	0.37	0.37
Bulgaria	2.53	2.59	100%	72.35	70.68	26.47	26.41	0.34	0.35
Chile	0.91	0.91	67%	28.63	27.66	6.43	6.37	0.33	0.33
China	–	–	–	69.71	70.05	79.54	79.27	0.38	0.38
Colombia	0.55	0.51	83%	25.67	27.09	19.20	19.14	0.41	0.41
Czech Republic	1.89	1.89	100%	53.87	56.19	54.16	53.80	0.26	0.26
Hungary	1.95	1.94	100%	23.63	24.14	31.69	31.57	0.35	0.35
India	–	–	–	36.62	36.91	15.67	15.84	0.49	0.49
Indonesia	–	–	–	39.60	35.81	53.23	53.04	0.45	0.44
Malaysia	0.07	0.07	50%	61.65	61.37	49.86	49.98	0.37	0.37
Mexico	1.09	1.11	100%	37.19	32.58	21.67	21.67	0.38	0.38
Peru	0.45	0.45	100%	12.40	11.39	37.40	37.01	0.41	0.42
Philippines	0.47	0.55	100%	11.33	10.61	21.68	21.68	0.46	0.46
Poland	2.21	2.25	100%	56.92	58.60	37.98	37.81	0.30	0.30
Romania	1.94	1.91	100%	39.44	38.89	12.50	12.44	0.41	0.41
Russia	–	–	–	89.66	89.45	95.23	95.13	0.33	0.32
South Africa	2.46	2.45	83%	77.44	77.39	44.43	44.41	0.40	0.40
Thailand	1.47	1.51	83%	33.16	32.09	30.13	30.34	0.44	0.44
Turkey	1.48	1.45	100%	24.73	22.58	51.88	51.66	0.38	0.38
<i>EM mean</i>	<i>1.27</i>			<i>44.34</i>		<i>39.49</i>		<i>0.38</i>	
<i>EM median</i>		<i>1.28</i>			<i>36.96</i>		<i>37.41</i>		<i>0.38</i>

A.9. Correlation structure of macroeconomic control variables in panel regressions.

The table presents in heatmap form the correlations among the country-pooled control variables used in the panel regression, Equation (10). The following variables are measured annually and interpolated to monthly frequency: real output per capita (lnGDP), current account balance to GDP (CA/GDP), government debt to GDP (Debt/GDP), unemployment rate, and inflation (year-on-year change in consumer price index). The following variables are measured at monthly frequency: term spread (10-year government bond yield minus 3-month interest rate), 3-month interest rate differential with the US (Δ Interest), 10-year government bond yield differential with the US (Δ Yield), FX rate volatility (Vol^{FX}), and equity market volatility differential versus the US (Δ Vol). The sample period is January 2000 to September 2024.

lnGDP	1.0000	0.0426	0.0354	-0.1175	0.0913	0.0912	0.1133	0.0032	0.0079	0.0513
CA/GDP	0.0426	1.0000	0.1072	-0.3203	-0.3061	0.0521	-0.3184	-0.0053	-0.0044	-0.1887
Debt/GDP	0.0354	0.1072	1.0000	-0.0296	-0.1067	-0.0605	-0.1672	-0.0004	-0.0079	-0.0081
Unemployment	-0.1175	-0.3203	-0.0296	1.0000	0.1659	0.1706	0.3070	-0.0087	0.0570	0.2740
Inflation	0.0913	-0.3061	-0.1067	0.1659	1.0000	-0.3113	0.6491	-0.0043	0.1409	0.2427
Term spread	0.0912	0.0521	-0.0605	0.1706	-0.3113	1.0000	-0.5134	-0.0009	-0.0845	-0.1154
Δ Interest	0.1133	-0.3184	-0.1672	0.3070	0.6491	-0.5134	1.0000	-0.0054	0.1584	0.2733
Δ Yield	0.0032	-0.0053	-0.0004	-0.0087	-0.0043	-0.0009	-0.0054	1.0000	0.1004	0.1086
Vol^{FX}	0.0079	-0.0044	-0.0079	0.0570	0.1409	-0.0845	0.1584	0.1004	1.0000	0.4034
Δ Vol	0.0513	-0.1887	-0.0081	0.2740	0.2427	-0.1154	0.2733	0.1086	0.4034	1.0000
lnGDP										
CA/GDP										
Debt/GDP										
Unemployment										
Inflation										
Term spread										
Δ Interest										
Δ Yield										
Vol^{FX}										
Δ Vol										

A.10. Correlation structure for climate-related risk variables and energy tax.

The table presents in heatmap format the correlations among the country-pooled climate-related variables and energy tax revenue variable used in the paper. CTR is the LSEG climate transition risk index, GHG-to-GDP performance is an index that measures the gap between the country's actual and expected emissions according to its level of economic development, and Nationally Determined Contributions (NDC) Implied Temperature Rise measures how much the global temperature would rise by 2100 if all countries adopted this country's NDC pledge. Carbon intensity is total carbon emissions relative to GDP. Physical (level) and Physical (mom) are the level and 5-year log change of the Notre Dame Global Adaptation Initiative (ND-GAIN) index that measures a country's vulnerability to physical climate change. EnTax is energy tax revenue relative to GDP.

CTR	1.0000	0.8969	0.8609	0.0361	0.5680	0.0049	0.0124
GHG-to-GDP Performance	0.8969	1.0000	0.7556	0.1531	0.5708	0.0720	-0.0115
NDC Implied Temp Rise	0.8609	0.7556	1.0000	0.0219	0.4580	-0.0602	-0.0014
EnTax	0.0361	0.1531	0.0219	1.0000	-0.0245	-0.3599	0.1865
Carbon Intensity	0.5680	0.5708	0.4580	-0.0245	1.0000	0.2632	-0.0510
Physical (level)	0.0049	0.0720	-0.0602	-0.3599	0.2632	1.0000	-0.2391
Physical (mom)	0.0124	-0.0115	-0.0014	0.1865	-0.0510	-0.2391	1.0000
	CTR	GHG-to-GDP Performance	NDC Implied Temp Rise	EnTax	Carbon Intensity	Physical (level)	Physical (mom)

A.11. Portfolio sorts by momentum in physical climate risk.

The table reports results from sorting country-level benchmark equity indices by the 5-year log change in the ND-GAIN index as proxy for momentum in physical climate risk for DMs and EMs over the period from January 2000 to December 2015 (pre-Paris; Panel A), and January 2016 to September 2024 (post-Paris; Panel B). Portfolios are held for one month and returns are annualised. In each panel, columns 1 to 5 report the USD excess equity returns of portfolios P1 to P5, where P1 (P5) contains the benchmark equity indices of countries with the lowest (highest) level of physical climate risk momentum. The last three columns report the USD excess equity returns of the long(P5)-short(P1) portfolio, rx , and the underlying local-currency equity return, $\Delta Equity$, and currency movement, ΔFX , as in Equation (4). Newey-West t -statistics for the significance of mean returns are shown in parentheses.

	Panel A: Pre-Paris Agreement								Panel B: Post-Paris Agreement							
	P1 (Low)	P2	P3	P4	P5 (High)	rx	$\Delta Equity$	ΔFX	P1 (Low)	P2	P3	P4	P5 (High)	rx	$\Delta Equity$	ΔFX
Developed markets (DMs)																
Mean	-0.3483 (-0.2521)	0.7960 (0.4885)	-0.6214 (-0.2858)	1.8568 (0.8917)	0.9946 (0.6140)	1.3429 (0.3810)	1.2384 (0.0523)	0.1045 (0.6390)	0.9971 (0.6294)	1.0631 (0.9157)	-0.5743 (-0.2867)	1.0673 (0.5752)	-0.1798 (-0.1459)	-1.1769 (-0.1683)	1.2036 (0.8568)	-2.3805 (-0.1443)
Median	-0.6339	0.4003	-0.9756	1.4889	1.2755	1.1867	1.1654	0.0392	1.3813	1.2308	-0.3470	1.1297	-0.2566	-1.0153	1.2429	-2.1911
StdDev	4.0725	5.6407	4.5964	5.7453	5.8630	4.3342	4.7354	3.6082	4.6769	4.1059	6.4501	6.3651	4.3711	5.1973	5.8623	5.0382
Skewness	-0.0786	-0.6587	-0.0592	-0.5386	-0.5758	-0.3577	-0.5259	-0.3207	-0.2108	-0.5615	-0.1909	-0.1402	-0.3207	-0.1816	-0.3549	0.0091
Kurtosis	2.9955	4.0148	4.8195	2.8123	4.3366	4.0275	3.9708	3.0640	2.6363	2.7293	3.9310	4.1231	2.7980	4.1311	4.0650	4.8026
Sharpe ratio	-0.0855	0.1411	-0.1352	0.3232	0.1696	0.3098	0.2615	0.0290	0.2132	0.2589	-0.0890	0.1677	-0.0411	-0.2264	0.2053	-0.4725
AC(1)	0.1503	0.1263	0.1199	0.0610	-0.0075	0.0896	0.0197	0.0759	0.0856	-0.0096	-0.0181	0.1569	-0.0205	0.0196	0.0293	0.0608
Emerging markets (EMs)																
Mean	0.3608 (0.2184)	1.1077 (0.4826)	-0.0302 (-0.0108)	1.2520 (0.4538)	0.4694 (0.2088)	0.1086 (0.4759)	-0.5034 (-0.6552)	0.6120 (1.2723)	0.4824 (0.1715)	0.0657 (0.0285)	0.4659 (0.2163)	2.8190 (1.2590)	2.5034 (1.0945)	2.0210 (0.7752)	1.4884 (0.2419)	0.5326 (1.1166)
Median	0.2281	1.3929	0.3365	1.1623	0.2021	0.3235	-0.2232	0.5308	0.1957	0.0412	0.2995	3.0939	2.3967	1.7743	1.5672	0.9180
StdDev	5.6945	5.5514	5.9189	7.9068	7.3378	4.9477	5.2614	3.8149	8.4367	8.1437	5.6563	5.7944	8.1702	4.5166	4.4226	5.4013
Skewness	-0.5616	-0.4022	0.0964	-0.1873	-0.0310	-0.0184	-0.4275	0.0339	-0.3414	-0.5795	-0.3078	-0.1899	-0.2684	-0.6801	-0.6941	-0.2037
Kurtosis	3.2847	2.8840	4.4303	2.5268	4.9728	3.7620	3.7470	4.0771	3.4814	2.9523	3.9661	4.1229	3.3461	4.8187	3.1951	3.6938
Sharpe ratio	0.0634	0.1995	-0.0051	0.1583	0.0640	0.0219	-0.0957	0.1604	0.0572	0.0081	0.0824	0.4865	0.3064	0.4475	0.3365	0.0986
AC(1)	0.1134	0.0822	0.0184	-0.0040	0.0723	0.1501	0.0669	-0.0109	-0.0324	0.1496	0.0585	0.0974	0.1358	0.0486	0.1047	0.1175

A.12. GMM pricing tests: Physical climate risk factor.

The table presents GMM estimations analogous to those in Tables 2 and 3, with the transition risk factor replaced by a physical climate risk factor. The physical climate risk factor is obtained as the USD excess returns of the high-low quintile portfolio of DM (or EM) equities sorted by the ND-GAIN index (level) in Panel A, or its 5-year log change (momentum) in Panel B. The J -statistic tests the null hypothesis of zero pricing errors, with the corresponding p -value also reported. For each country group, the first column shows the multifactor model of Cenedese et al. (2016) and the second column the full model. Factor prices of risk are reported with Newey-West t -statistics in parentheses. The periods are January 2000 to December 2015 (pre-Paris) and January 2016 to September 2024 (post-Paris).

	Panel A. Climate physical risk (level)								Panel B. Climate physical risk (5-year momentum)							
	DMs				EMs				DMs				EMs			
	pre-Paris		post-Paris		pre-Paris		post-Paris		pre-Paris		post-Paris		pre-Paris		post-Paris	
<i>Physical</i>	-0.0209	-0.0629	0.2188	0.3243	0.1620	-0.0220	-0.2012	-0.0584	-0.1374	-0.1643	-0.0589	0.1428	-0.2055	0.2603	-0.3091	0.1705
	(-0.3308)	(-0.5070)	(1.0291)	(1.3751)	(0.8292)	(-0.4158)	(-1.0575)	(-0.5662)	(-0.7906)	(-0.8456)	(-0.4682)	(0.8685)	(-1.0732)	(1.2232)	(-1.4219)	(0.8211)
<i>World</i>	0.3914	-0.7776	2.2829	1.8807	0.7537	-0.4010	1.9437	1.1597	0.3891	-0.6910	2.2823	1.8977	0.5774	-0.2442	2.2544	1.1686
	(0.5793)	(-0.9150)	(2.3265)	(3.6820)	(0.4464)	(-0.3354)	(1.5669)	(2.6186)	(0.5827)	(-1.2850)	(2.0012)	(3.6489)	(0.6129)	(-0.3604)	(1.6063)	(2.9597)
<i>Size</i>	1.0314	0.8225	-1.1058	-0.0819	1.0407	1.1150	-1.0205	-0.2065	1.2384	0.7918	-1.1289	0.0345	1.0413	1.0927	-1.1999	-0.2832
	(1.5465)	(2.5149)	(-0.5520)	(-0.1432)	(1.5415)	(2.3117)	(-0.4274)	(-0.0556)	(1.3147)	(2.1962)	(-0.5930)	(0.1329)	(1.8915)	(2.4694)	(-0.6083)	(-0.0461)
<i>Value</i>	0.1069	0.2499	0.8460	1.1652	0.2718	0.1059	0.5644	1.2524	0.3404	0.4282	0.6756	1.0129	0.4734	0.2538	0.8051	1.2757
	(0.8273)	(0.7827)	(1.7033)	(0.4806)	(0.8906)	(0.6933)	(1.8914)	(1.2649)	(0.6938)	(0.9432)	(1.8578)	(0.5243)	(0.8055)	(0.6840)	(1.8962)	(1.2901)
<i>Mom</i>	0.4760	0.6918	-1.5976	-1.0322	0.3713	0.5957	-2.0878	-1.8403	0.4846	0.5344	-1.9973	-1.3203	0.3745	0.4669	-2.1410	-1.6419
	(0.4452)	(1.6330)	(-0.6153)	(-1.4942)	(0.3969)	(1.0834)	(-0.9885)	(-1.0944)	(0.4559)	(1.3903)	(-0.6872)	(-1.4585)	(0.5080)	(1.1548)	(-0.9046)	(-1.1560)
<i>Vol</i>	-1.8163	-0.5921	-3.2023	-1.3087	-1.5353	-0.5812	-2.4323	-1.9794	-1.3587	-0.6500	-3.1463	-1.2946	-1.4292	-0.7087	-1.9470	-1.6491
	(-2.4586)	(-2.5039)	(-2.6901)	(-2.1617)	(-2.1881)	(-1.9972)	(-2.9605)	(-2.1494)	(-2.3384)	(-2.4124)	(-2.8052)	(-2.1407)	(-2.6901)	(-2.0814)	(-2.3960)	(-2.1590)
<i>Dollar</i>		0.2571		1.0871		0.5434		1.1338		0.1629		1.0094		0.3324		0.7451
		(1.9065)		(2.9629)		(1.5591)		(4.0217)		(1.8984)		(3.2245)		(1.7059)		(3.1677)
<i>Carrv^{FX}</i>		-0.3363		-0.0602		-0.1737		-0.7137		-0.5153		-0.1673		-0.1092		-0.5644
		(-2.5091)		(-2.4258)		(-2.7367)		(-1.8403)		(-2.7223)		(-2.9980)		(-2.6865)		(-1.7023)
<i>Mom^{FX}</i>		0.0375		-0.2447		0.2708		-0.0874		0.0940		-0.4013		0.2348		0.0214
		(0.4552)		(-0.3453)		(0.3028)		(-0.1378)		(0.5165)		(-0.4506)		(0.3333)		(0.1352)
<i>Vol^{FX}</i>	-0.5168	-0.8959	-0.7044	-0.0051	-0.2833	-0.7750	-0.8188	-0.2241	-0.4267	-1.0027	-0.6805	-0.1436	-0.3993	-0.8426	-0.9425	-0.1268
	(-1.8970)	(-1.8251)	(-2.5550)	(-2.5415)	(-1.8979)	(-2.4615)	(-2.6460)	(-1.9953)	(-1.4644)	(-1.9075)	(-2.5864)	(-2.2106)	(-1.5265)	(-2.5701)	(-2.3730)	(-2.0069)
<i>ΔYield</i>		0.0974		0.2127		0.1707		0.3981		0.1032		0.0397		0.2377		0.3346
		(2.1318)		(2.1277)		(1.8932)		(2.6766)		(2.4551)		(2.4870)		(1.8916)		(2.7618)
<i>J</i> -statistic	5.8619	2.4046	5.4868	1.7851	14.4445	6.2829	12.6942	8.4686	6.0253	2.7356	5.3700	1.5019	14.3024	6.3133	13.2750	8.6698
<i>p</i> -value	0.6627	0.6618	0.7045	0.7752	0.3433	0.7113	0.4717	0.4877	0.6444	0.6030	0.7174	0.8263	0.3529	0.7082	0.4268	0.4683

A.13. GMM pricing tests for transition risk using MSCI equity indices.

The table presents GMM estimations analogous to those in Tables 2 and 3, replacing the benchmark local equity indices with MSCI country-level equity indices. The J -statistic tests the null hypothesis of zero pricing errors, with the corresponding p -value also reported. For each country group and period, the first column shows the multifactor model of Cenedese et al. (2016) and the second column the full model. Factor prices of risk are reported with Newey-West t -statistics in parentheses. The periods are January 2000 to December 2015 (pre-Paris) and January 2016 to September 2024 (post-Paris).

	Developed markets				Emerging markets			
	pre-Paris		post-Paris		pre-Paris		post-Paris	
<i>Climate</i>	0.3097 (1.1132)	0.4042 (1.2273)	-0.0049 (-1.3697)	0.0529 (0.7497)	0.1840 (1.4331)	0.2217 (1.5967)	0.5234 (2.1718)	0.6097 (2.5454)
<i>World</i>	0.4019 (0.6213)	-0.4654 (-0.5476)	2.6322 (2.4809)	1.4074 (2.9570)	1.4091 (1.1348)	-0.2763 (-0.3727)	2.0354 (1.8927)	-1.3418 (-0.2508)
<i>Size</i>	0.9555 (1.2442)	0.8861 (2.4547)	-2.3174 (-1.2012)	-0.9250 (-1.1248)	1.1261 (1.9012)	1.1536 (2.1048)	-1.7418 (-0.9258)	0.9378 (0.2763)
<i>Value</i>	0.4773 (1.4544)	0.6284 (1.3379)	0.5813 (1.7501)	0.9278 (0.4810)	0.2746 (-0.6076)	0.3037 (1.3193)	0.9445 (1.9008)	1.5250 (1.4363)
<i>Mom</i>	0.6182 (0.8196)	0.5493 (0.7093)	-1.3170 (-0.3577)	-1.0745 (-0.4706)	0.8224 (-1.0078)	0.5454 (0.3358)	-1.5889 (-0.6529)	-2.0739 (-0.6651)
<i>Vol</i>	-1.4530 (-2.1593)	-0.8218 (-2.7508)	-2.7381 (-2.7662)	-1.4987 (-2.5448)	-1.7051 (-2.3423)	-0.7907 (-2.5481)	-2.6902 (-3.3503)	-2.5056 (-1.8932)
<i>Dollar</i>		0.2015 (1.7204)		1.1571 (3.2905)		0.4426 (1.9136)		0.9295 (2.7485)
<i>Carry^{FX}</i>		-0.5639 (-3.6246)		-0.1273 (-3.6193)		-0.2035 (-2.0557)		-1.1474 (-2.7296)
<i>Mom^{FX}</i>		0.3222 (1.3396)		-0.3035 (-0.5592)		1.2465 (1.1703)		-3.0035 (-1.2839)
<i>Vol^{FX}</i>	-0.4006 (-1.7058)	-1.2337 (-1.8180)	-0.6675 (-2.3678)	-0.0056 (-2.2077)	-0.3473 (-1.7879)	-1.0726 (-2.9568)	-0.8947 (-2.4313)	-2.6016 (-0.8916)
<i>ΔYield</i>		0.0709 (2.2393)		0.2105 (2.1555)		0.1716 (1.7245)		0.2052 (2.1825)
<i>J</i> -statistic	12.7181	8.0628	16.2032	10.4668	13.6794	7.5557	14.8316	10.5105
<i>p</i> -value	0.4698	0.5278	0.2383	0.3140	0.3968	0.5795	0.3180	0.3108

A.14. GMM pricing tests for transition risk based on six-month-lagged CTR indices.

The table presents GMM estimations analogous to those in Tables 2 and 3, with the climate factor obtained as the USD excess returns of the high-low quintile portfolio of DM (or EM) equities sorted by the six-month-lagged CTR index. The J -statistic tests the null hypothesis of zero pricing errors, with the corresponding p -value also reported. For each country group and period, the first column shows the multifactor model of Cenedese et al. (2016) and the second column the full model. Factor prices of risk are reported with Newey-West t -statistics in parentheses. The periods are January 2000 to December 2015 (pre-Paris) and January 2016 to September 2024 (post-Paris).

	Developed markets				Emerging markets			
	pre-Paris		post-Paris		pre-Paris		post-Paris	
<i>Climate</i>	0.2745	0.4315	-0.0044	0.0664	0.3048	0.3928	0.6488	0.5385
	(-0.8966)	(1.1188)	(-1.3860)	(-0.9930)	(1.0536)	(1.1037)	(2.4582)	(2.1854)
<i>World</i>	0.4351	-0.5817	1.9680	1.5528	0.6232	-0.3125	2.0238	1.0646
	(0.6579)	(-1.1211)	(2.0442)	(4.0057)	(0.5212)	(-0.3864)	(1.8672)	(2.9946)
<i>Size</i>	1.0721	0.9596	-1.1554	-0.0902	1.0469	1.1302	-0.9926	-0.2132
	(1.5871)	(2.3986)	(-0.5486)	(-0.1221)	(1.8746)	(2.3088)	(-0.5078)	(-0.0543)
<i>Value</i>	0.2768	0.3674	0.6371	0.9286	0.3432	0.1545	0.7169	1.1825
	(0.7848)	(0.8951)	(1.9205)	(0.5562)	(-0.8324)	(0.7033)	(1.7380)	(1.1188)
<i>Mom</i>	0.3996	0.6866	-1.6462	-1.3430	0.3872	0.6818	-1.9194	-1.6954
	(0.4823)	(1.6383)	(-0.7054)	(-1.2707)	(-0.4707)	(1.2141)	(-0.8862)	(-1.2019)
<i>Vol</i>	-1.5262	-0.5718	-2.7693	-1.1199	-1.4194	-0.5704	-2.2241	-1.8293
	(-2.4424)	(-2.6564)	(-2.7901)	(-2.1374)	(-2.3675)	(-1.9948)	(-2.6410)	(-1.9948)
<i>Dollar</i>		0.2244		1.0304		0.3577		0.8592
		(1.7892)		(3.3394)		(1.8579)		(3.5622)
<i>Carry^{FX}</i>		-0.3697		-0.0808		-0.2193		-0.6058
		(-2.6410)		(-2.6915)		(-2.5524)		(-1.7583)
<i>Mom^{FX}</i>		0.1004		-0.2531		0.2981		-0.0144
		(0.4823)		(-0.4249)		(0.3045)		(-0.1579)
<i>Vol^{FX}</i>	-0.4259	-0.9878	-0.6737	-0.0061	-0.3697	-0.8408	-0.8237	-0.1019
	(-1.7583)	(-1.8058)	(-2.4561)	(-2.3893)	(-1.8587)	(-2.6060)	(-2.4370)	(-1.9809)
<i>ΔYield</i>		0.0651		0.1719		0.1617		0.2165
		(2.2481)		(2.1654)		(1.7102)		(2.4288)
<i>J</i> -statistic	5.1570	4.1198	4.7277	2.5434	11.1855	9.2332	9.3076	8.2510
<i>p</i> -value	0.7407	0.3900	0.7862	0.6369	0.5953	0.4160	0.7493	0.5091