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Global Capital and the Cross-Section of International Equity Return Comovement

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Abstract

What makes a country's stock market more correlated with the U.S. stock market than others? This paper documents and investigates theoretically a strong positive cross-sectional relationship between the share of an equity market held by foreign investors, U.S. investors in particular, and the return correlations of 40 equity markets with the U.S. market. We argue that frictions impeding the cross-border holding of equity are key determinants of cross-border positions and equity market return correlations across countries. We develop an asset pricing model that illustrates how heterogeneity in cross-border asset holding costs can generate the observed cross-sections of cross-border positions, return correlations, and alphas with respect to a global market factor. We provide empirical evidence consistent with the model's predictions. Overall, our results suggest that the portfolio demand channel emphasized in theoretical models of asset return comovement is indeed the primary driver of the cross-section of international equity return comovement, but only after taking into account the cross-sectional variation in frictions impeding equity investments across borders.

Keywords: Comovement, cross-section of correlations, discount rate effect, international asset pricing

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1 Introduction

The degree to which the stock market returns of two countries comove varies greatly across countries. Despite an apparent secular increase in average cross-country equity return correlations since the early 1990s, heterogeneity across different countries in these correlations remains high in recent years. For example, the U.S. stock market has had a monthly excess return correlation of 82% with the U.K. stock market, but only a modest correlation of 39% with the Colombian stock market. What are the key drivers of the cross-section of country-level equity correlations?

The sources of this heterogeneity in equity return comovement across countries are not clear. On the one hand, even in a world with minimal financial integration and cross-border holdings of assets, equity returns of two countries may comove because the fundamentals of the real sectors, and thus the stock market dividend streams, of the two countries are correlated. Such comovement driven by cash-flow fundamentals may, for example, reflect trade links between the two countries. On the other hand, the equity returns of two countries may comove if investors in one country hold assets in the other, even if the cash-flow fundamentals of the two countries are independent of one another. We refer to the latter as the portfolio demand channel of return comovement. Hence, understanding the drivers of the cross-sectional heterogeneity in return comovement can yield important insights about the degree of asset and goods market integration across countries, the propagation of business cycles and financial crises across borders, and the empirical relevance of different theories of asset return comovement (e.g. Hau and Rey (2004), Cochrane, Longstaff, and Santa-Clara (2008), and Martin (2013)).

In this paper, we offer evidence that the latter portfolio demand channel is the key determinant of the cross-section of equity market correlations. Moreover, we argue that heterogeneity in this cross-section is driven primarily by differences across countries in the severity of financial frictions that foreign investors face when investing in a given equity market.

We document that the share of a stock market held by U.S. investors, henceforth referred to as the U.S. investor (cross-border) position, has strong explanatory power for the cross-country variation in correlations of the foreign market's excess return with the U.S. market return. This is, to our knowledge, the first paper to document the robust nature of this cross-sectional relationship, illustrated in Figure 1. In our sample of 40 countries, the U.S. position in a country averaged over 2000-2017 explains about 40% of the cross-sectional variation in the return correlations over the same period. A country with a U.S. position that is one standard deviation higher than that of another country is predicted to have a return correlation with the U.S. that is higher by 9 percentage points. (For comparison, the cross-sectional standard deviation of

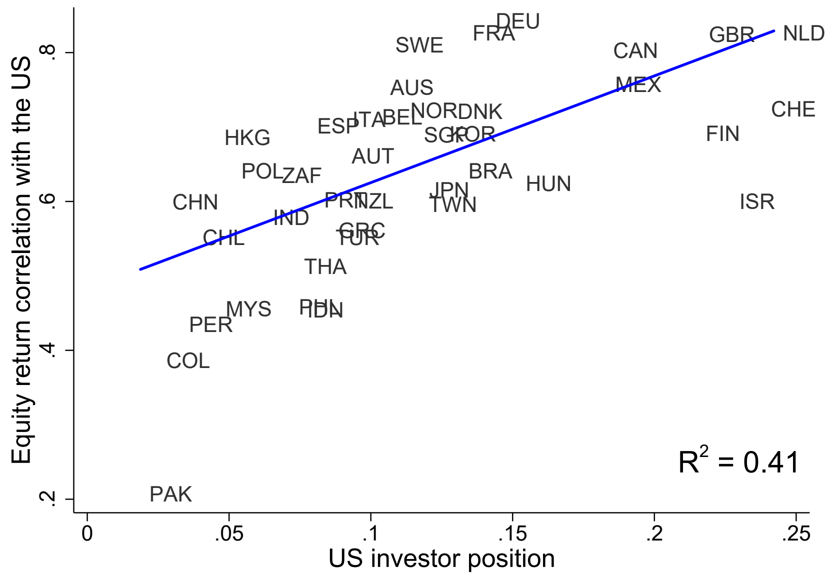

Figure 1: **Equity Return Correlation And U.S. Investor Position**

The figures show that, in a cross-section of 40 countries and over the baseline sample period, 2000m1-2017m12, the U.S. investor position in the country's equity market explains how correlated the country's equity excess return is with the U.S. equity excess return. All excess returns are in USD and are computed in excess of the one-month U.S. T-bill rate.

the return correlations is 14%.) Importantly, the effect of the U.S. position remains large and significant after controlling for indicators of real sector comovement, such as the size of bilateral trade and the GDP correlation between the country and the U.S., and for market size. The measure also retains its explanatory power when extending the sample period back to 1986. Other measures of cross-border positions, such as the share of an equity market held by all foreign investors and a measure of the relative holdings of U.S. equity by a country's investors, are also successful in explaining the cross-section of return correlations.

Decomposing the USD-denominated return to the equity market of a country in excess of the U.S. short rate into the local-currency return in excess of the local short rate and the foreign exchange return, we find that cross-border positions mainly explain cross-sectional variation in the correlations between U.S. returns and local-currency equity premia. There is also a positive and statistically significant relationship between cross-border positions and the correlations between U.S. returns and foreign currency excess returns, but this relationship is considerably weaker.

What does the strong explanatory power of cross-border positions for cross-country equity return correlations tell us about the drivers of heterogeneity in international equity return comovement across countries? To answer this question, we need to understand the determinants of cross-border positions. Under frictionless access to international equity markets by all agents, standard portfolio choice theory for the portfolio allocation of investors active in different equity markets (global equity investors) predicts that these investors should hold smaller cross-border positions, controlling for market size, in equity markets with higher return comovement with their overall portfolio return, unless these equity markets compensate them with a higher expected return. However, we find that cross-border positions do not predict higher average returns in the cross-section of equity markets. The observed cross-sectional patterns are instead consistent with the presence of positive and heterogeneous cross-border asset holding costs across countries, which make excess returns attainable by foreign investors in an equity market lower than those attainable by local investors. These holding costs may capture different forms of frictions, including the differential tax treatment of local and foreign investors, poor regulatory frameworks and inadequate property rights protection (see e.g. Ahearne, Griever, and Warnock (2004), Chan, Covrig, and Ng (2005), Portes and Rey (2005), and Camanho, Hau, and Rey (2017)).

Consistent with the key role of frictions, we find that more than 60% of the cross-sectional variation in U.S. cross-border positions is explained by two measures of frictions incurred when investing in a given equity market: first, the share of a country's equity market that is deemed to be accessible to, or investable by, foreign investors according to MSCI investability criteria, an indicator of the openness of a country's equity market; and second, the share of the equity market cross-listed on U.S. stock exchanges. Relatedly, the results of an instrumental-variables regression using the degree of market investability and the fraction of cross-listed stocks as instruments for the U.S. investor position show that differences across countries in U.S. investor position driven by frictions have a strong explanatory power for the cross-section of equity return correlations. In further support of our argument that the ease of investing in a given foreign stock is an important driver of both U.S. investor position and the return correlation with the U.S., we study the change in U.S. investor position on foreign stocks around major index redefinitions. We find that that the time-series change in U.S. investor position on a foreign stock as a result of an index redefinition leads to a change in the stock's return correlation with the U.S. stock market of a magnitude similar to what we find in the cross-section.

To make sense of the cross-sectional patterns, we develop an asset pricing model focusing on the implications of frictions in cross-border investments for return comovement. In our setting, the cross-border holding costs of an equity market normalized by its capitalization map directly into alphas with respect to the benchmark (frictionless) global investor CAPM model. The model endogenizes returns across equity markets as a function of fundamentals, both the level of holding costs incurred by foreigners and the cash flow characteristics in each equity market. Through closed-form characterizations of valuation ratios and return volatility across different countries, we show that the activity of global investors amplifies return volatility relative to volatility in cash-flow fundamentals and causes fluctuations in countries' valuation ratios. Importantly, the magnitude of this amplification is decreasing in the holding cost incurred by global investors, so that heterogeneity in holding costs across countries translates into heterogeneity in the degree to which the return of an equity market comoves with the returns of other markets.

Our model also implies that the share of each market held by global investors is decreasing in the magnitude of holding costs. More generally, if the cross-section of cross-border positions is indeed mainly driven by financial frictions, the portfolio demand channel can account for the strong positive cross-sectional relationship between cross-border positions and return correlations. When investors rebalance their portfolio across different equity markets following a shock to the return of one equity market (e.g. the U.S.), the price impact of this portfolio rebalancing is likely to be greater in countries where foreign investors hold a larger share of the equity market. Indeed, we find that positive U.S. return shocks, as identified through a VAR (discussed below), are associated with concurrent increases in the share of non-U.S. equity markets held by foreign investors. Thus, heterogeneity in holding costs can jointly reproduce the robust cross-sectional patterns that we document in this paper.

Our asset pricing model further implies that, if the cross-section of return comovement is indeed primarily driven by heterogeneity in financial frictions, return correlations should mainly reflect comovement in discount rates (future expected returns) across countries, rather than comovement of cash-flow shocks. And it is discount-rate comovement across countries that should be explained by cross-border positions.

To investigate these key predictions of the portfolio demand channel of return comovement, we perform a VAR-based Campbell-Shiller return decomposition for a number of countries in our dataset. This approach decomposes unexpected equity return realizations into two components: return shocks driven by news about the future cash flows (dividend streams) of an equity market; and return shocks driven by news about discount rates (future expected returns) of the market. The return decomposition in turn allows us to decompose the overall return covariance across countries into discount-rate-driven covariance and cash-flow-driven covariance, following Ammer and Mei (1996).

We find that the explanatory power of the U.S. cross-border position for return correlations indeed mainly stems from its ability to predict (largely transitory) comovement in discount rates across countries. A further decomposition of discount rate news for a foreign equity market into U.S. real rate news, foreign currency premium news, and local equity premium news shows that cross-border positions mainly reflect the degree of comovement between U.S. and local equity premia. In a related analysis, we also show that U.S. investor positions in foreign countries can explain the degree of a foreign country's stock return predictability by the U.S. dividend yield in the post-2000 period, the latter captured by the R-squared of a univariate predictive regression of one-year equity excess returns on the U.S. dividend yield. These results lend further support to our claim that the cross-section of cross-border positions primarily reflects differential integration of countries with global financial markets.

Finally, we study the asset pricing implications of our model. Our model suggests that an econometrician who has a correct proxy for the global investor's SDF but does not observe holding costs may falsely reject the pricing model based on pricing errors due to unobserved holding costs. In this case, however, the pricing errors or alphas should be cross-sectionally related to other moments driven by holding costs. We find that this is the case for alphas with respect to the global stock market factor. These alphas are predominantly positive, consistent with these alphas reflecting at least in part holding costs arising from frictions in the cross-border holding of equity. More importantly, the cross-section of these alphas can be explained well by other moments driven by frictions such as U.S. investor positions (or total foreigin investor positions), return correlations with the U.S., and global CAPM betas.

In summary, our findings suggest that frictions impeding the cross-border holding of equity, the subject of a large literature in international finance on "home bias" and "foreign bias," play an important role in determining not only cross-border holdings but also the comovement between equity markets. Our results also suggest that the portfolio demand channel emphasized in theoretical models of asset return comovement is indeed important empirically. However, applying this insight to the cross-section of international equity return comovement requires taking into account the cross-sectional variation in frictions impeding equity investments across borders.

Related literature This paper is part of a large literature that studies the sources of asset return comovement across countries.[1] Our contribution relative to this literature is to study how heterogeneity in the degree of financial integration across countries relates to cross-sectional variation in equity market return correlations. Our cross-sectional analysis at the country level allows us to gauge the impact of financial integration on cross-country equity return comovement, a challenging question to address using available time-series data. Boyer, Kumagai, and Yuan (2006) and Faias and Ferreira (2017) also adopt a cross-sectional approach to study international stock return comovement, albeit at the individual stock rather than the country level.[2]

[1]Examples in this literature include Heston and Rouwenhorst (1994), Bekaert and Harvey (1995, 2000), Longin and Solnik (1995), Bohn and Tesar (1996), Brennan and Cao (1997), Stulz (1999), Froot, O'Connell, and Seasholes (2001), citeGrinblattHowDistanceLanguage2001, Forbes and Rigobon (2002), Bekaert, Harvey, and Lumsdaine (2002), Karolyi and Stulz (2003), Goetzmann, Li, and Rouwenhorst (2005), Chan, Covrig, and Ng (2005), Quinn and Voth (2008), Froot and Ramadorai (2008), Bekaert, Hodrick, and Zhang (2009), Pukthuanthong and Roll (2009), Bartram et al. (2015), Bena et al. (2017), Xu (2017), and Viceira and Wang (2018), among others.

[2]Our focus on a cross-section of assets and on the portfolio choice of a group of investors who are marginal with respect to these assets also has parallels in other areas of asset pricing. For example, Haddad and Muir (2018) argue that the differential degree of predictability of different asset classes by the level of intermediary risk-bearing capacity can help quantify how much variation in risk premia is caused by intermediaries (market segmentation).

Our results are also relevant for a large literature in international finance that attempts to explain the international home bias puzzle, that is, the empirical regularity that the share of financial capital invested domestically is puzzlingly large relative to the apparent diversification benefits of international investments. Lewis (1995) and Coeurdacier and Rey (2013) offer comprehensive surveys of this literature. Part of this literature has offered explanations based on transaction costs faced by foreign investors, which share obvious similarities with our holding costs formulation of financial frictions. Although estimates of literal transaction costs, such as the different tax treatment of foreign investors relative to domestic investors, are generally deemed too small to justify the large degree of home bias, implicit costs such as informational asymmetries between foreign and local investors have similar implications for portfolio choice. For example, Gârleanu, Panageas, and Yu (2017) model portfolio bias as a result of information asymmetries about individual securities in a location, and show that their model with heterogeneous asset selection ability is isomorphic to a setting with investor- and asset-class-specific taxes.[3] Although informational asymmetries could be part of the story, following Bekaert (1995), Bekaert, Harvey, and Lundblad (2007), Bekaert et al. (2014), and other papers on international equity market integration, we emphasize other sources of implicit barriers to cross-border investment, such as low-quality regulatory and legal frameworks offering insufficient property rights protection, the lack of a sufficient number of large, liquid stocks, and the lack of cross-listed securities. In ongoing work, we investigate different metrics of financial market integration and development in relation to our inferred holding costs across countries.

Our VAR-based decomposition of cross-country equity return comovement follows the return news covariance decomposition methodology of Ammer and Mei (1996), which in turn builds on Campbell (1991) and Campbell and Ammer (1993). We confirm the findings of a similar recent analysis by Viceira and Wang (2018), who find an increase in average return correlations and in discount-rate-driven comovement across countries since 2000. Our main novel contribution is our finding that cross-border positions mainly explain discount-rate news comovement, and local-currency equity premium news comovement in particular.

Our empirical and theoretical analysis also relates to a theoretical literature, especially Cochrane, Longstaff, and Santa-Clara (2008) and Martin (2013), studying the comovement between the returns of multiple assets held by the same agents, what we refer to as the portfolio demand channel of return comovement. These models assume a representative agent who owns the entirety of all assets, and as a result feature no portfolio rebalancing in equilibrium. In these models, relative market size is the key determinant of return comovement. Instead, we emphasize that heterogeneity in cross-border positions across countries is essential in order for the portfolio demand channel to explain the observed cross-section of international equity return

[3]The limited market integration model of Gârleanu, Panageas, and Yu (2015) also features heterogeneity in participation costs in a given market based on the location of investors and investigates the implications of this heterogeneity for asset prices, the diversity of observed portfolio policies, and market fragmentation.

comovement. The impact of portfolio rebalancing by foreign investors in a country in response to a U.S. return shock is increasing in the share of the equity market held by foreign investors. A recent study by Camanho, Hau, and Rey (2017) offers micro-level evidence for the relevance of the portfolio rebalancing channel using data on the portfolio allocation of international equity funds.

Our analysis of the equilibrium determinants of cross-border positions also relates to models studying the asset pricing implications of arbitrage activity across markets, e.g. Gromb and Vayanos (2002), Kondor and Vayanos (2016), and Cho (2018), among many others. These models endogenize the equilibrium positions of arbitrageurs as a function of the return characteristics of different markets, but typically assume frictionless access to the different markets by the arbitrageurs.

This paper investigates international comovement in asset returns mainly from the perspective of U.S. investors. Similarly, part of the large literature on the carry trade studies the cross-section of foreign-currency returns from the perspective of U.S. investors, e.g. Lustig and Verdelhan (2011). A conclusion from our analysis is that U.S. cross-border equity positions mainly explain the cross-sectional variation in the correlations between local-currency excess equity returns in different countries and U.S. excess equity return, rather than cross-sectional variation in the correlations between foreign-exchange returns and the U.S. excess equity return, although the cross-sectional relationship between the latter and cross-border positions is positive. These results are relevant for studies of the factor structure of equity returns across countries, which typically find that foreign exchange risk is priced in the cross-section of equity returns (e.g. Brusa, Ramadorai, and Verdelhan (2015)).

Paper Outline Section 2 describes the data used in the paper. Section 3 presents the key cross-sectional patterns between cross-border positions, return correlations, and indicators of frictions that are the focus of this paper. Section 4 presents the theoretical framework of this paper. Section 5 discusses evidence supportive of the model's predictions. Section 6 concludes.

2 Data Description

In this section, we introduce the main data sources, key variables, and return factor proxies used in the empirical analysis.

Sample period We focus on the sample period of 2000m1-2017m12, which we refer to the baseline sample period. This choice is driven by data availability. The data on U.S. investor cross-border positions in other countries (from the Treasury International Capital, see below), our key cross-sectional variable, are available at yearly frequency only from 2003. Before 2003, the data are available sparsely in 2001, 1997, and 1994. Similarly, the data on the countries' short-term Treasury bill rate, also important for our analysis, are available from around 2000 for many countries. In parts of the analysis, we also report results over the 1986m1-2017m12 period or the pre-2000 sample of 1986m1-1999m12 for comparison.

List of stock markets Our baseline analyses use a set of 40 stock markets in addition to the U.S. stock market, reported in Table 1. This is a comprehensive list of countries satisfying four criteria: (1) U.S. investors hold portfolio equity positions of $1 billion or more according to TIC, (2) the country is not considered a tax haven,[4] (3) data on monthly stock market returns, U.S. investor portfolio equity positions, and yearly market capitalizations used in the cross-sectional analysis are available since 1994 or earlier, and (4) state variables used in the VAR analysis (dividend-price ratio, inflation, short-term government yield, long-term government yield, and exchange rate) are available since 2006 or earlier.[5] The list covers all major stock markets as well as a large number of emerging markets.

Return correlation Our baseline measure of international equity return comovement is the correlation between the monthly excess return to a country's stock market and the excess return to the U.S market. All returns are in USD.

Excess returns on stock markets The monthly excess returns to a country's stock market is the end-of-month MSCI broad country index return in USD (e.g., "MSUTDK$" for the United Kingdom) from Datastream minus the one-month U.S. Treasury bill rate from Kenneth French's website. The broad country index is the most comprehensive country index offered by the MSCI and is broader than the MSCI investable market index. The smallest and most illiquid stocks, however, are excluded from the broad country index.[6] Complete returns data for every country in our sample are available starting in 1993. The U.S. stock market return is the U.S. market portfolio from Kenneth French's website.

Measures of fundamental cash-flow exposure We consider two measures of a stock market's fundamental cash-flow exposure to the U.S. equity return. These are total trade with the U.S. and GDP correlation with the U.S., which we interpret as proxies for determinants of return comovement related to cash-flow

[4]This excludes Anguilla, Bahamas, Bermuda, British Virgin Islands, Cayman Islands, Curacao, Guernsey, Ireland, Isle of Man, Jersey, Luxembourg, Liberia, Panama, Panama, Marshall Islands, and Mauritius.

[5]Criteria (3) and (4) guarantee that the cross-sectional analysis in the pre-2000 period is based on at least 7 years' data and that the country-specific VAR estimation in the post-2001 period is based on at least 12 years' data.

[6]For more details, see https://www.msci.com/index-methodology.

fundamentals. *Total trade with the U.S.* is measured by the sum of the country's export and import with the U.S. as a fraction of the country's GDP. The resulting annual series is averaged over a given sample period to yield a measure used in the cross-sectional analysis. *GDP correlation* is the correlation of a country's real GDP growth shocks and the U.S.'s real GDP growth shocks, where the shocks are captured by the residuals from a country-specific AR(1) model, over a sample period. For the parts of the analysis where the foreigner-holdings-weighted average return is used in place of the U.S. return, GDP correlation is the correlation between a country's GDP residuals and a weighted average of all countries' GDP residuals, where the weights are given by foreign investors' relative holdings in a given country (same as weights used in the construction of the global investor portfolio proxy). The trade data are from the U.S. Census Bureau, the GDP data are from the World Bank and Global Financial Data (GFD), and the consumer price index data used to obtain the real GDP are from GFD.

Cross-border positions and market size We also consider cross-border position as an explanatory variable for return comovement. Since our main measure of return comovement is with respect to the U.S., our baseline measure of cross-border position is the fraction of a country's stock market owned by the U.S. investors. Specifically, the *U.S. investor position* in a country is the total portfolio equity position that U.S. residents hold in that country, as reported by the Treasury International Capital (TIC) data, divided by the country's stock market capitalization obtained from GFD. The data are available every year since 2003 and also during the years 2001, 1997, and 1994. The data for each country are time-averaged over a sample period to yield the measure used in the cross-sectional analysis.[7]

An alternative measure of cross-border position is *total foreign position*, which is defined as total portfolio equity liability in the international investment position of a country (equity holdings of foreign investors) normalized by the stock market capitalization of that country. Our total portfolio equity liability data augments the 1970-2011 series generously provided by Philip Lane to 2017 using data from the IMF's international investment position (IIP) statistics. We use these data to construct a proxy to the portfolio of the representative global equity investor. Also, if total portfolio equity liability is an approximately constant multiple of the U.S. position, the total foreign position series is a reasonable proxy for the U.S. position and is available for a longer time period than the latter. We also use the IMF's Coordinated Portfolio Investment Survey–Reported Portfolio Investment Assets by Economy of Nonresident Issuer to obtain data on pairwise cross-country positions.

[7]The TIC portfolio equity position includes limited partnership shares, which makes the data a poor representation of public equity positions in countries that are considered tax havens. We therefore exclude countries considered to be tax havens from our analysis. For the other countries, the public equity segment of the market is much larger than other segments of the equity market so that the equity positions from the TIC are a good proxy for public equity positions of U.S. residents.

Similar to the U.S. investor position in a country, the position taken by the country's residents in the U.S. market can also contribute to return comovement with the U.S. For instance, if investors from foreign countries hold large positions in the US relative to the size of their stock market, a shock to the U.S. equity return could generate a rebalancing motive for these investors. To capture this effect, we consider *a country's position in the U.S.*, defined as the country's holdings of equity securities in the U.S., normalized by that country's stock market capitalization. These data are available from the TIC yearly since 2002 and also for the years 2000, 1994, 1989, 1978, and 1974.

Motivated by the fact that relative market size is an important determinant of asset return comovement in models of the portfolio demand channel (e.g. Martin (2013)), we also control for the *size of the equity market*, defined as the time-series average over a given sample period of the ratio of a country's stock market capitalization over that of the U.S. market.

Measures of frictions in cross-border holding of equity Our analysis also considers different forms of frictions when investing in a foreign stock market, such as the differential tax treatment of local and foreign investors, inability of investors to access parts of the equity market, the absence of cross-listed securities, poor regulatory frameworks and inadequate property rights protection, concerns regarding the expropriation by local interests of gains to investments by foreigners, and other implicit costs associated with foreign equity investments. Our first empirical measure is the share of an equity market that is deemed to be accessible to, or investable by, foreign investors, measured as the market value of all stocks that are part of MSCI's Investable Index for a country divided by the total equity market capitalization of that country. We call the latter measure investability. MSCI's criteria for inclusion of a stock into their investable indices include the presence of direct restrictions on investments by foreigners and measures of the stock's liquidity. Additional variables include the fraction of the stock market cross-listed on U.S. stock exchanges either directly or as an ADR ("cross listings") (Ahearne, Griever, and Warnock (2004)), geographical distance of the country from the U.S. (Portes and Rey (2005)), and exchange rate volatility (Hau and Rey (2006), Camanho, Hau, and Rey (2018)).

VAR state variables In Section 5, we augment our analysis in Section 3 using a decomposition of return news for each country obtained from VAR models. Here, the following data are used in the estimation of the VAR models: (1) dividend-price ratios from Datastream; (2) inflation rates based on the consumer price index from GFD; (3) short-term government bill yields (3-month yields) from GFD and Datastream; (4) long-term government bond yields (10-year yields) from GFD and Datastream; and (5) exchange rates from the Bank of International Settlement. Details on these data are available in Appendix B.

Descriptive statistics

Figure 2 plots the 40 countries' post-2001 equity return comovements with the U.S., the subject of our cross-sectional analysis. It reveals rich heterogeneity in the return comovement ranging from a correlation of 0.21 (Pakistan) to 0.84 (Germany).

Table 2 describes the cross-sectional average of the different variables we construct for our baseline sample (2000m1-2017m12), the pre-2000 sample (1986m1–1999m12), and the full sample (1986m1-2017m12). It reveals a number of interesting patterns. First, U.S. investor position, the share of an equity market owned by U.S. investors, has a cross-sectional average of 0.11, substantially lower than the share of world financial wealth owned by the U.S. (around 1/3). This suggests that despite the globalization of financial markets, U.S. investors still prefer investing in the U.S. market due to various frictions they face when investing in foreign equities. Similarly, a country's position in the U.S., the country's holding of U.S. equity as a fraction of its stock market capitalization, has a cross-sectional average of 0.08, much lower than the world market share of the U.S. (around 1/2). This suggests that there are also substantial frictions that other countries face when investing in U.S. equity.

The table also reveals interesting time-series patterns. It shows that the average equity return correlation of the 40 countries with the U.S. has risen from an average of 0.38 in the pre-2000 period to 0.64 in the post-2000 period. At the same time, cross-sectional average cross-border positions have also increased over the two sample periods: from 0.08 to 0.11 for the U.S. position in other countries, from 0.15 to 0.30 for the total foreign position in the countries, and from 0.03 to 0.08 for the countries' positions in the U.S. equity market. Figure A1 plots the average trends in international equity return correlations and cross-border positions over time. Fundamental correlation as measured by the GDP correlation has also increased from -0.08 to 0.32 on average between the two sample periods, although total trade with the U.S. has not changed on average. Hence, a time-series comparison across the two sample periods points to both cross-border positions and cash-flow-related fundamentals as potential determinants of the cross-sectional heterogeneity in international equity return comovement in our baseline post-2000 period.

3 Understanding the Cross-section of Stock Market Return Comovement

3.1 The explanatory power of cross-border positions

We begin by investigating the cross-sectional determinants of equity return correlations between foreign stock markets and the U.S. stock market, displayed in Figure 2. We estimate the following empirical model:

$$\rho_{US,j} = \boldsymbol{x}_j' \boldsymbol{b} + \epsilon_j, \tag{1}$$

where $\rho_{US,j}$ is the correlation of monthly excess returns to the stock markets of the U.S. and country j, and x_j is a vector of potential cross-sectional determinants of the return correlation such as the U.S. investor position in country j or a measure of the correlation of cash-flow fundamentals between the U.S. and country j.

Panel A of Table 3 presents the results for our baseline sample period (2000m1–2017m12). The U.S. investor position in the country has by far the strongest explanatory power. A country with a U.S. position that is one standard deviation higher than that of another country is predicted to have a return correlation with the U.S. that is higher by 9% points on average. For a comparison, the cross-sectional standard deviation of the return correlation is 14%.

The explanatory power of U.S. investor position for the cross-section of return correlations remains strong after controlling for the country's position in the U.S., determinants related to cash-flow fundamentals, and relative equity market size. A country's position in the U.S. (holdings of the U.S. market by investors in a given country normalized by the capitalization of that country's stock market) also has a significant positive effect on the return correlation, even after controlling for the U.S. investor position. Our proxies for comovement in cash flow fundamentals between the U.S. and a foreign country, trade with the U.S., and GDP correlation with the U.S. cannot explain the cross-section of international equity return correlations.

Panel B repeats the regression on the full sample period from 1986m1–2017m12, where we use the longest available time series for the returns and regressors of each country to compute the time-series averages used in the cross-sectional regressions. We see that both the coefficient estimate for the U.S. investor position and the R^2 remain largely unchanged for all regression models when using the full sample period. The country's position in the U.S. also retains its strong explanatory power in the longer sample.

We repeat our cross-sectional regression under alternative sepcifications. First, Table A2 studies a log-

log relationship between U.S. investor position and return correlation. It shows that a 1% increase in U.S. investor position leads to a 0.3% increase in the country's correlation with the U.S., with the former explaining more than 50% of the cross-sectional variation in the latter for the baseline sample period of 2000m1–2017m12. Second, Table A1 shows that equity return correlations also have a strong positive relationship with another measure of cross-border positions, total foreign position, that is, the share of the market held by all foreign investors rather than just U.S. investors. Third, repeating the regression for the subsample of the 21 developed countries in our sample that are part of the MSCI Developed Markets Index, we find that the coefficient on U.S. investor position and a country's position in the U.S. is positive but no longer statistically significant. The finding is supportive of our view that financial frictions, which we expect to be more severe in developing markets than in developed countries, are key determinants of the cross-sections of both cross-border positions and return correlations across countries.

Next, given that all country returns in our sample are denominated in a common currency, the US dollar, we ask whether the explanatory power of cross-border position for return comovement is due to the comovement of U.S. excess returns with foreign currency excess returns (denoted $\widetilde{\rho}_{US,j}^{FX}$) or the comovement of U.S. excess returs with foreign equity market excess returns in local currency (denoted $\widetilde{\rho}_{US,j}^{local}$).[8] Table 4 shows that the U.S. investor position has strong explanatory power for both components of the return correlation. However, the coefficient in the $\widetilde{\rho}_{US,j}^{local}$ accounts for about 80% of the baseline coefficient; the share of cross-sectional variation in correlation components explained by the U.S. investor position, as captured by the adjusted R^2, is also significantly higher for $\widetilde{\rho}_{US,j}^{local}$. The positive and statistically significant explanatory power of U.S. investor positions for the cross-section of foreign currency excess returns is an interesting finding that is of relevance to the international finance literature on exchange rate determination, and we plan to investigate it further in future work.

[8] Formally, we consider an additive decomposition of the excess foreign equity market return denominated in U.S. dollars (which is in excess of the US short rate) into the local-currency stock market excess return (in excess of the local short share) and the foreign exchange excess return using the following approximate identity:

$$R_{jt+1}^{\$} - Y_{US,t} \approx \underbrace{R_{j,t+1}^{local} - Y_{j,t}}_{\text{stock market excess return in local currency}} + \underbrace{\frac{(1+Y_{j,t})\,Q_{j,t+1}}{(1+Y_{US,t})\,Q_{j,t}} - 1}_{\text{FX excess return, } R_{j,t+1}^{FX}}, \tag{2}$$

where $R_{j,t+1}^{\$}$ is the net simple stock return of country j expressed in U.S. dollars (USD), $Y_{US,t}$ is the U.S. short rate, $R_{j,t+1}^{local}$ is the country's stock return in local currency, $Y_{j,t}$ is the short rate of country j, and $Q_{j,t+1}$ is the exchange rate between USD and the currency of country j, in USD per unit of foreign currency. Using this decomposition we decompose the return correlation between the U.S. excess return and the USD-denominated foreign equity market return as:

$$\begin{aligned}\rho_{US,j} &= \widetilde{\rho}_{US,j}^{local} + \widetilde{\rho}_{US,j}^{FX} \\ &= \frac{\text{Cov}(R_{US,t+1} - Y_{US,t}, R_{j,t+1}^{local} - Y_{jt})}{\text{Std}(R_{US,t+1} - Y_{US,t})\text{Std}(R_{j,t+1}^{\$} - Y_{US,t})} + \frac{\text{Cov}(R_{US,t+1} - Y_{US,t}, R_{j,t+1}^{FX})}{\text{Std}(R_{US,t+1} - Y_{US,t})\text{Std}(R_{j,t+1}^{\$} - Y_{US,t})}\end{aligned} \tag{3}$$

Finally, since correlation with the U.S. market is an important component of a country's exposure to the global stock market, one may wonder whether U.S. investor positions also explain the cross-section of stock market *betas* with respect to the global market factor, an important pricing factor in several international asset pricing models. Table 5 shows that controlling for return volatility, U.S. investor position indeed plays an important role in determining the cross-section of global CAPM betas. Controlling for return volatility is important for this result since holding all else constant, a stock market with higher return volatility tends to attract lower demand from foreign investors, which may cause the coefficient on U.S. investor position to be biased downward.

3.2 The cross-section of frictions in the cross-border holding of equity

We show that the cross-sectional heterogeneity in return comovements arises more intrinsically from differences in holding costs across stock markets, a catch-all term we use for various frictions in cross-border equity holdings including restrictions on foreign holdings, tax on foreign investors, trading costs such as illiquidity, and information costs.

Next, Table 6 relates measures of holding costs to the cross-section of U.S. investor positions and return correlations with the U.S. stock market. Panel A shows that investability and cross listings explain more than half of the cross-sectional variation in U.S. investor positions. Other variables do not have a statistically significant effect, with both distance and exchange rate volatility having a sign opposite from what one may expect. The strong explanatory power of investability and cross listings implies that although the globalization of the financial market has led to time-series reduction in frictions in cross-border investing, substantial heterogeneity of frictions remains in the cross section.

Panel B use measures of holding costs as instrument variables to show that differences in U.S. investor position due to holding costs lead to differences in return correlations with the U.S. stock market. The coefficient on the instrumented U.S. investor position is positive and significant in all regression specifications, consistent with frictions determining both cross-border positions and equity market return correlations across stock markets. The coefficient is slightly larger than the OLS coefficient estimate in Figure 2, which is not surprising since holding all else equal, a high return correlation between an equity market and the U.S. market should lead U.S. investors to reduce their exposure to that equity market.

An alternative way to show that frictions generate differences in U.S. investor positions and return comovements is to show that time-series changes in U.S. investor position on stocks due to a redefinition of a major index leads to a change in the stock's correlation with the U.S. stock market. To do this, we obtain stock level data on index redefinitions between 2001 and 2010 from Claessens and Yafeh (2012) and U.S. institution and fund ("U.S. investor") holdings of foreign stocks as well as international stock returns data from Factset Lionshares.[9] For each month of 2001–2010, we compute the change in a foreign stock's (from 40 baseline countries) excess return correlation with the U.S. stock market over the 48 months surrounding that month.[10] We also compute the change in U.S. investor positions on stocks (U.S. institution and fund positions divided by the stock's market capitalization) from 12 months before to 12 months after.

Table 7 shows that a change of 1 percentage point in the U.S. investor position on a stock around index redefinition generates a 2.6 percentage point increase in the stock's correlation with the U.S. This number is statistically different from zero and similar in magnitude to the coefficients on U.S. investor position found in Table 3 and Table 6. Overall, our findings in this subsection point to cross-sectional heterogeneity in holding costs as the primary driver of cross-sectional heterogeneity in the degree to which a stock market comoves with the U.S. stock market.

4 An International Asset Pricing Model with Holding Costs

In this section, we present an asset pricing model that can rationalize the cross-sectional patterns documented in the previous subsection. The model features agents (global investors) who invest across the equity markets of different countries but incur proportional holding costs in their cross-border investments.

Consider a world with one or more large economies and a continuum of unit mass of small open economies. We refer to the latter continuum of countries, which is the focus of our analysis, as the "Rest of the World" (RoW). Taking as given the overall portfolio return of global equity investors who are active across all equity markets around the world, we analytically derive the valuation ratio, return volatility, and return correlation with global investors' portfolio for an RoW equity market, as a function of the fundamentals of this market.

Pricing kernel To obtain closed-form analytical expressions for the second moments of returns across countries, we posit a tractable law of motion for the pricing kernel faced by global equity investors:

$$\frac{dM_t}{M_t} = -r_f dt - \omega_t dB_t, \tag{4}$$

[9] We are able to closely match the cross-section of U.S. investor positions from TIC by summing up the U.S. institution and fund holdings for each foreign country.

[10] We winsorize stock returns at the 0.1% and 99.9% levels each month to minimize the influence of recording errors.

where B_t is a one-dimensional Brownian motion capturing all sources of risk to which the portfolio of global investors is exposed in equilibrium, and the riskfree rate is constant over time. The price of global risk ω_t evolves as

$$d\omega_t = \rho_\omega \left(\overline{\omega} - \omega_t\right) dt - \sigma_\omega \omega_t dB_t, \tag{5}$$

with ρ_ω, $\overline{\omega}$, $\sigma_\omega > 0$. The restriction $\sigma_\omega > 0$ corresponds to an assumption of countercyclical risk premia, the empirically relevant case.

Dynamics for the pricing kernel in international capital markets like those of equations (4) and (5) can in general be obtained in the context of a fully specified asset pricing model of the world economy, where the dividend streams of every country (including those of the large economies), and the preferences and asset investment technologies of all economic agents are explicitly defined. Directly positing a tractable form for the equilibrium dynamics of the pricing kernel allows us to obtain intuitive, closed-form characterizations of the heterogeneity in the properties of equity returns across different countries.

Cash flows We assume that the dividend stream of country j, $j \in [0, 1]$ follows a geometric Brownian motion

$$\frac{dD_{jt}}{D_{jt}} = \mu dt + \sigma dB_t + \sigma^Z dZ_{jt}, \tag{6}$$

where μ, $\sigma > 0$, and $\sigma^Z > 0$ are constants. Z_{jt} is a Brownian motion capturing country-specific risk that is independently distributed across RoW countries. Because the country is assumed to be small, any such risk is assumed to be fully diversified away in portfolios of global investors who invest broadly in all RoW countries. Thus, these dividend dynamics are consistent with the assumed pricing kernel dynamics (4) and (5) under the assumption that RoW countries are small open economies.

Holding cost formulation A unit mass of global investors can also take *nonnegative* positions in the N equity markets but incur proportional *holding costs* $c_{jt} \geq 0$ in market $j = 1, \ldots, N$, that is, the effective dividend flow they receive is $D_{jt} - c_{jt}P_{jt}$ per unit of time. The return to global investors' holdings of asset j is

$$dR^*_{jt} = \frac{D_{jt} - c_{jt}P_{jt}}{P_{jt}} dt + \frac{dP_{jt}}{P_{jt}} = dR_{jt} - c_{jt}dt. \tag{7}$$

The fundamentals of all RoW countries (law of motion of dividends (6)) are assumed to be identical, with the exception of time-invariant, proportional equity holding costs $c_j \geq 0$ faced by global investors in a given equity market j.

Denote the price-dividend (valuation) ratios of the RoW equity markets by $v_{jt} \equiv P_{jt}/D_{jt}$ and the proportional drift and diffusion coefficients of v_{jt} by μ_{vjt}, σ^B_{vjt}, and σ^Z_{vjt}, that is,

$$\frac{dv_{jt}}{v_{jt}} = \mu_{vjt} dt + \sigma^B_{vjt} dB_t + \sigma^Z_{vjt} dZ_{jt}. \tag{8}$$

Like v_{jt} itself, the coefficients in the law of motion of v_{jt} are also (time-invariant) functions of c_j and ω_t. The return to equity market j for global and local investors is given by

$$dR^*_{jt} = \left(r_f + \omega_t \sigma^B_{Rjt}\right) dt + \sigma^B_{Rjt} dB_t + \sigma^Z_{Rjt} dZ_{jt} \tag{9}$$

$$dR_{jt} = dR^*_{jt} + c_j dt, \tag{10}$$

respectively, where $\sigma^B_{Rjt} = \sigma + \sigma^B_v(c_j, \omega_t)$, and $\sigma^Z_{Rjt} = \sigma^Z + \sigma^Z_v(c_j, \omega_t)$.[11]

Note that equations (9) and (10) imply that holding costs c_j map directly to CAPM alphas with respect to the global markets factor (equivalently, global investors' portfolio return).

4.1 The Cross-Section of Valuation Ratios

We first characterize analytical the valuation ratios of the RoW equity markets in which global investors are active in equilibrium, $x_{jt} > 0$, as a function of their holding cost c_j and the global state variable ω_t, that is, $v_{jt} = v(c_j, \omega_t)$.[12] The next proposition offers a closed-form characterization of the valuation ratio as a function of a country's fundamentals.

Proposition 1 (Valuation Ratios)**.** *Assume $\sigma_\omega = \sigma$. The valuation ratio $v_{it} \equiv P_{jt}/D_{jt}$ of RoW country j where global investors are active ($x_{jt} > 0$) is affine in the price of global risk ω_t and is given by*

$$v(c_j, \omega_t) = \left(\mathcal{R}_j + \frac{\sigma \rho_\omega \overline{\omega}}{\mathcal{R}_j + \rho_\omega + \sigma \sigma_\omega}\right)^{-1} \left[1 - \frac{\sigma}{\mathcal{R}_j + \rho_\omega + \sigma \sigma_\omega} \omega_t\right], \tag{11}$$

where

$$\mathcal{R}_j \equiv c_j + r_f - \mu. \tag{12}$$

The valuation ratio has proportional exposure to global risk

$$\sigma^B_v(c_j, \omega_t) = \frac{\sigma \sigma_\omega \omega_t}{\mathcal{R}_j + \rho_\omega + \sigma\left(\sigma_\omega - \omega_t\right)} > 0, \tag{13}$$

[11] These expressions follow directly from Ito's Lemma and the definition of the price-dividend ratio.

[12] Here, we allow for the possibility that RoW equity investments are subject to short-sale constraints, that is, global investors cannot take negative positions in a market. Global investors are unconstrained in a market whenever they hold a strictly positive (aggregate) position, $x_{jt} > 0$.

which is decreasing in the holding cost c_j and increasing in the price of global risk ω_t. The valuation ratio is not affected by country-specific risk, $\sigma_v^Z = 0$.

This proposition shows that the activity of global investors amplifies return volatility relative to volatility in fundamentals and causes fluctuations in countries' valuation ratios, $\sigma_{Rjt}^B = \sigma + \sigma_{vjt}^B > \sigma$. The magnitude of this amplification is decreasing in the holding cost c_j driving heterogeneity across RoW countries in the model. Intuitively, the less integrated the country is with global financial markets, the lower the comovement of its equity market with global markets.

The assumption $\sigma_\omega = \sigma$ is a knife-edge parametric restriction that implies that the valuation ratio is exactly linear, in the spirit of the linearity-generating process assumptions of Gabaix (2009). However, expression (11) is a good approximation to the valuation ratio for empirically plausible parametrizations as long as the two volatilities σ_ω and σ are of the same order of magnitude.[13]

4.2 The Cross-Section of Return Correlations

When (some) global investors have log utility, the portfolio return of these investors has the same exposure to the different sources of risk as the pricing kernel, up to a negative sign. Therefore, the correlation $\rho_{jt} = \rho_t(dR_{pt}, dR_{jt})$ between the overall portfolio return dR_{pt} of log-utility global investors equals $\rho_t(-dM_t/M_t, dR_{jt})$. This will be our model analog for the return correlation between the U.S., the large economy of this setting, and a country j. For analytical convenience, we characterize a monotonically increasing transformation of the correlation measure,

$$\widetilde{\rho} \equiv \frac{\rho}{\sqrt{1-\rho^2}}. \tag{14}$$

This transformation of the correlation measure varies between $-\infty$ and $+\infty$ as the correlation varies between -1 and 1.

Corollary 1 (Return Correlations)**.** *For any market j where global investors are active, $x_{jt} > 0$, the transformed correlation between the return to market j and the portfolio of log-utility global investors is given by*

$$\widetilde{\rho}_t(dR_{pt}, dR_{jt}) = \frac{\sigma_{Rjt}^B}{\sigma_{Rjt}^Z} = \frac{\sigma + \sigma_v^B(c_j, \omega_t)}{\sigma^Z}, \tag{15}$$

which is decreasing in the holding cost c_j and increasing in the price of global risk ω_t.

[13] The residual term in the Backward Kolmogorov equation for the valuation ratio under the conjecture of an affine functional form is quadratic in ω_t and proportional to the difference $\sigma_\omega - \sigma$.

This corollary shows that the model can rationalize the negative relationship between estimated global investor CAPM alphas and return correlations between the U.S. and other countries that we document in this paper, provided that holding costs are indeed the key driver of heterogeneity in these correlations across countries.

To make predictions about the cross-border position of global investors across RoW markets, that is, the share x_{jt} of the market value of each market j held by global investors, we need to additionally specify a model for the demand for equity by the other investors active in an RoW market.Specifying such a model typically introduces additional state variables related to the relative wealth of different types of agents, making the model solution computationally cumbersome.

In such extensions of the model we generally expect that the cross-border position x_{jt} is a decreasing function of the holding cost c_j, especially after controlling for the relative size of each market. The reason is that a higher c_j implies an increasing expected return differential for the RoW investments of local investors relative to those of global investors.

4.3 Discount-Rate-Driven Return Comovement

In this model with fully permanent dividend growth shocks, the comovement between log-utility global investors' portfolio returns and contemporaneous dividend growth in a country fully captures the comovement between global investors' portfolio returns and cash flow news for that country. Fluctuations in valuation ratios purely reflect fluctuations in discount rates (future expected returns). Therefore, in the spirit of the two-beta CAPM model of Campbell and Vuolteenaho (2004), we can decompose the beta of global investors' return on wealth with equity market j into local cash-flow and local discount-rate betas in our model as

$$\beta_{Wjt} = \beta_t^{CF} + \beta_{jt}^{DR} \tag{16}$$

$$= \frac{\sigma}{\omega_t} + \frac{\sigma_v(c_j, \omega_t)}{\omega_t}. \tag{17}$$

In our model, heterogeneity in holding costs is reflected in heterogeneity in local discount-rate betas rather than cash-flow betas. Thus, two key predictions of our model is that heterogeneity in return correlations is mainly discount-rate-driven and that global CAPM alphas and global investor cross-border positions mainly explain discount-rate-driven return comovement rather than cash-flow-driven return comovement. We confirm these predictions in Section 5, which constrast with explanations of the cross-sectional heterogeneity in correlations based on heterogeneity in cash-flow-related fundamentals, such as cash flow volatility σ in our setting.

5 Empirical Patterns Consistent with the Model

We show that the model in the previous section can jointly account for several additional phernomena observed in the data. In particular, we offer evidence consistent with the prediction that, if heterogeneity in holding costs across countries is the key determinant of the cross-section of international equity return comovement, then cross-border positions should mainly explain comovement in discount rate news across countries rather than comovement in cash flow (dividend growth) news. First, we show that the time-series return predictability of countries using the U.S. dividend-price ratio is increasing in the U.S. investor position in the country. Second, we perform a VAR-based Campbell-Shiller decomposition of equity market returns in our sample that allows us to formally decompose return news comovement across countries into discount-rate-driven comovement and cash-flow-driven comovement. We also show that the cross-section of alphas with respect to the global CAPM is consistent with the presence of heterogeneous holding costs.

5.1 Cross-Section of Return Predictability Using the U.S. Dividend-Price Ratio

Table 8 shows that the predictability of an equity market return using the U.S. dividend-price ratio is increasing in the U.S. investor position in the equity market over our baseline sample period. We measure predictability as the R^2 of a time-series predictive regression of the one-year excess return to a foreign equity market on the U.S. dividend-price ratio over our baseline sample period. Although fluctuations in the U.S. stock market's dividend-price ratio can in theory reflect either dividend-growth news or discount-rate news or both, it is well known from the literature that they mainly reflect discount-rate fluctuations.[14] Hence, we can interpret a greater degree of predictability of a foreign equity market's return from the U.S. dividend-price ratio as a simple proxy for the degree of comovement in discount rates between the foreign equity market and the U.S. market, following Campbell and Hamao (1992). Therefore, the results of Table 8 suggest that cross-border positions have explanatory power for the cross-section of discount-rate comovement across countries.

[14] See, for example, Chapter 5 in Campbell (2018) for a textbook treatment.

5.2 Evidence from a VAR-Based Return News Decomposition

To investigate the cross-sectional relationship between cross-border positions and return comovement more formally, we decompose the time series of return news (unexpected returns) in each country into discount rate news and cash flow news using a vector autoregressive (VAR) model for each market's return, following Campbell (1991) and Campbell and Ammer (1993).

We begin by presenting our VAR model. Further details and results on the VAR analysis are reported in Online Appendix D. Let $r^c_{e,t+1} = r^{c,N}_{e,t+1} + q^{c,N}_{t+1} - q^{c,N}_t - \pi^{US}_{t+1}$ be the one-period-ahead real log return on the stock market of country c in terms of the U.S. consumption good; that is, nominal local-currency return is converted to U.S. dollar using the realized exchanged rate and further adjusted for U.S. inflation. Here, $q^{c,N}_t$ is the log spot nominal exchange rate between the currency of country c and the U.S., and π^{US}_{t+1} is log U.S. CPI inflation. Unless otherwise indicated by an N subscript, all returns and cash flows are real and in terms of the U.S. consumption good. We define the realized real U.S. short rate as $r^{US}_{f,t+1} = y^{US,N}_{1,t} - \pi^{US}_{t+1}$, where $y^{US,N}_{1,t}$ is the nominal U.S. short yield. Note that this is not known at time t because U.S. inflation is stochastic, so the asset is risk-free only in nominal terms. We use tilde notation to denote the revision in expectations at time $t+1$, that is, for some variable x_{t+j}, $\widetilde{x}_{t+j} \equiv (\mathbb{E}_{t+1} - \mathbb{E}_t)[x_{t+j}]$.

For each country c, we impose the model

$$z^c_{t+1} = \mu^c + B^c z^c_t + u^c_{t+1}, \tag{18}$$

where, for $c \neq US$, z^c_t is the 8-by-1 vector

$$z^c_t = \left[r^c_{e,t}, d^c_t - p^c_t, y^{c,N}_{1,t}, \pi^c_t, y^{c,N}_{10,t} - y^{c,N}_{1,t}, y^{c,N}_{1,t} - y^{US,N}_{1,t}, q^{c,N}_t, d^{US}_t - p^{US}_t\right]', \tag{19}$$

and, for $c = US$, z^c_t is the 6-by-1 vector

$$z^{US}_t = \left[r^{US}_{e,t}, d^{US}_t - p^{US}_t, y^{US,N}_{1,t}, \pi^{US}_t, y^{US,N}_{10,t} - y^{US,N}_{1,t}, y^{US,N}_{BAA,t} - y^{US,N}_{AAA,t}\right]', \tag{20}$$

where $y^{US,N}_{BAA,t} - y^{US,N}_{AAA,t}$ is the default spread defined as the log difference in the yield on BAA-rated U.S. corporate bonds and AAA-rated U.S. corporate bonds. Note that $\widetilde{z}_{t+1+j} = (B^c)^j u_{t+1}$.[15]

[15] Including the default spread allows the model to better rationalize the stock market movements during the financial crisis of 2008-2009 (Campbell, Giglio, and Polk (2013)).

Return covariance decomposition Using the Campbell-Shiller return decomposition, discount rate news and cash flow news are estimated as[16]

$$\widetilde{r}^c_{e,t+1} = N^c_{CF,t+1} - N^c_{DR,t+1}, \tag{21}$$

$$N^c_{CF,t+1} = \sum_{j=0}^{\infty} \rho^j \widetilde{\Delta d}^c_{t+1+j} = e1' \left(I + \rho B^c \left(I - \rho B^c \right)^{-1} \right) u^c_{t+1}, \tag{22}$$

$$N^c_{DR,t+1} = \sum_{j=1}^{\infty} \rho^j \widetilde{r}^c_{e,t+1+j} = e1' \rho B^c \left(I - \rho B^c \right)^{-1} u^c_{t+1} \tag{23}$$

respectively, where $e1' = [1, 0, \ldots, 0]$. This decomposition applies for both foreign countries and the U.S. This return decomposition allows us to obtain, for each equity market, the following decomposition of its return covariance with the US stock market,

$$\begin{aligned} \text{Cov}_t \left(r^c_{e,t+1}, r^{US}_{e,t+1} \right) =& \text{Cov}_t \left(N^c_{DR,t+1}, N^{US}_{DR,t+1} \right) + \text{Cov}_t \left(N^c_{CF,t+1}, N^{US}_{CF,t+1} \right) \\ & - \text{Cov}_t \left(N^c_{DR,t+1}, N^{US}_{CF,t+1} \right) - \text{Cov}_t \left(N^c_{CF,t+1}, N^{US}_{DR,t+1} \right), \end{aligned} \tag{24}$$

and to investigate how each term on the right-hand side varies with our measures of cross-border positions acros countries.

Discount rate news decomposition For countries other than the U.S., we further decompose discount rate news into real rate news, foreign exchange premium news, and local equity premium news, in order to see how each of these three components contribute to the covariances on the right-hand side of (24) and how each of these components depend on cross-border positions.

We use the following decomposition of realized equity returns:

$$r^c_{e,t+1} = r^{US}_{f,t+1} + xr^c_{fx,t+1} + xr^{c,\text{local}}_{e,t+1}, \tag{25}$$

where

$$xr^c_{fx,t+1} \equiv y^{c,N}_{1,t} + q^{c,N}_{t+1} - q^{c,N}_t - y^{US,N}_{1,t} \tag{26}$$

[16]Here, $\rho = 1/(1 + \exp(\overline{d-p}))$ where $\overline{d-p}$ is the long-run average of the log dividend-price ratio. Estimating $\overline{d-p}$ separately for each country leads some countries to have extreme high ρ and hence extremely volatile return news subcomponents in the pre-2000 period with shorter sample period. To address this issue, use the ρ of $0.96^{1/12}$ (monthly data) used in the literature for all countries.

is the excess return on foreign exchange, and

$$xr^{c,\text{local}}_{e,t+1} \equiv r^{c,N}_{e,t+1} - y^{c,N}_{1,t} \tag{27}$$

is the local excess equity return (i.e. in excess of the local short rate).

Equation (25) implies the following decomposition of discount rate news for each country:

$$N^c_{DR,t+1} = N^c_{RR,t+1} + N^c_{FX,t+1} + N^c_{RP,t+1} \tag{28}$$

where

$$N^c_{RR,t+1} \equiv \sum_{j=1}^{\infty} \rho^j \widetilde{r}^{US}_{f,t+1+j} = \left[e3'\rho\left(I - \rho B^{US}\right)^{-1} - e4'\rho B^{US}\left(I - \rho B^{US}\right)^{-1}\right] u^{US}_{t+1} \tag{29}$$

is U.S. real rate news,

$$N^c_{FX,t+1} \equiv \sum_{j=1}^{\infty} \rho^j \widetilde{xr}^c_{fx,t+1+j} = \left[e6'\rho\left(I - \rho B^c\right)^{-1} + e7'\rho(B^c - I)(I - \rho B^c)^{-1}\right] u^c_{t+1} \tag{30}$$

is foreign exchange premium news (for $c \neq US$), and[17]

$$N^c_{RP,t+1} \equiv \sum_{j=1}^{\infty} \rho^j \widetilde{xr}^{c,\text{local}}_{e,t+1+j} = N^c_{DR,t+1} - N^{US}_{RR,t+1} - N^c_{FX,t+1} \tag{31}$$

is local-currency equity premium (risk premium) news.

Empirical Findings Table A4 reports the cross-sectional average correlation among components of U.S. return news and foreign country return news for different sample periods. For our sample of 40 countries and our baseline sample period, 2000m1-2017m12, Panel A shows that the pair with the largest correlation is that of U.S. discount-rate news and foreign country local-currency equity premium news (a correlation of 0.47), followed by the correlation between U.S. discount-rate news and foreign currency premium news (a correlation of 0.18) and that between U.S. cash-flow news and foreign country cash-flow news (a correlation of 0.15).

Comparing the magnitudes of the correlations in the post-2000 sample relative to those in the pre-2000 sample for the 15 countries with data available in both periods, we see a large increase in the correlation between U.S. discount-rate news and foreign country risk-premium news from 0.39 to 0.69. This result is

[17] We set $N^{US}_{FX,t+1} \equiv 0$.

consistent with a similar VAR decomposition of return correlations by Viceira and Wang (2018), who also find that the increase in return correlations since the 1990s is mainly due to an increase in cross-country discount-rate comovement.[18]

Table 9 confirms the key prediction of our theory that the explanatory power of cross-border positions is due to discount-rate-driven comovement between countries. The table shows that U.S. investor position has significant explanatory power for the correlation between U.S. return news and foreign country local-currency premium news (Panel A). When there is a positive shock to the U.S. return, countries with a large U.S. investor position tend to experience a positive contemporaneous return shock, and hence negative discount-rate news. The sign of this response is consistent with portfolio rebalancing by global equity investors away from the U.S. market and towards foreign equity markets in response to positive U.S. return shocks.

In contrast, the U.S. investor position does not explain the cross-section of the correlation of U.S. return news with either foreign-country cash-flow news (Panel B) or foreign exchange premium news (Panel C). Instead, as one would expect, GDP correlation, a proxy for cash-flow comovement between countries, has strong explanatory power for the correlation between U.S. return news and foreign-country cash-flow news. Although the precise coefficient estimates are somewhat sensitive to choices we make in the implementation of the VAR, the fact that the U.S. investor position does not explain the correlation between U.S. return news and foreign exchange premium news is consistent with the conclusions from the additive decomposition of equity market correlations with the U.S. reported in Table A1, according to which the U.S. position mainly explains the correlation between the U.S excess return and the foreign equity excess return in local currency. Instead, trade with U.S. and market size can explain the cross-section of this correlation. The currencies of countries that are smaller or have bigger trade volumes with U.S. relative to their own equity market capitalization tend to appreciate in response to positive U.S. news leading to a negative correlation between foreign-currency-premium news (future expected foreign exchange returns) and U.S. return news.

5.3 Explaining Global CAPM Alphas

In the model presented in the previous section, the global investor's stochastic discount factor (SDF) prices the cross-section of returns net of holding costs. Nevertheless, an econometrician who has a correct proxy for global investors' SDF but does not observe holding costs may falsely reject the pricing model based on pricing errors due to unobserved holding costs. In this case, however, the pricing errors or alphas should be

[18]We also find an increase in the correlation between U.S. cash-flow news and foreign country cash-flow news from 0.11 to 0.28 on average for the 15 countries, consistent with an increase in the average correlations between GDP growth residuals for these countries from -0.04 to 0.28 (see Panel B of Table 2).

cross-sectionally related to other moments driven by holding costs. Hence, even if the global stock market return represents a reasonable proxy for the SDF of global investors, one may falsely reject the global CAPM model (e.g., Solnik (1974), Adler and Dumas (1983)) if part of global CAPM alphas that represent holding costs. In this case, however, global CAPM alphas would feature a negative relationship with U.S. investor positions and exposures to the U.S. or the global stock market.

We find consistent evidence in our data. Figure 3 shows that global CAPM alphas are predominantly positive when the U.S. 1-month Treasury rate is used as the risk-free rate, consistent with these alphas reflecting at least in part holding costs arising from frictions in cross-border holdings of equity. More importantly, the cross-section of these alphas can be explained with reasonable precision by U.S. investor positions (or total foreigin investor position), return correlations with the U.S., and global CAPM betas, consistent with the model's predictions that holding costs have a negative cross-sectional effect on global investor positions and return correlations in the model. This suggests that the tests of international factor pricing models may need to explicitly account for pricing errors due to holding costs.

6 Conclusion

In this paper, we document and investigate the implications of a novel empirical finding: a strong positive cross-sectional relationship between the share of an equity market that is held by U.S. investors and this equity market's return correlation with the U.S. equity market. In the context of an asset pricing model from the perspective of investors active across different equity markets, we argue that the cross-section of cross-border positions is hard to reconcile with frictionless access of these equity markets, and that cross-border asset holding costs appear to be the key determinant of cross-border positions and equity market return correlations. Our results imply that the cross-sectional heterogeneity in the degree of asset market integration across countries determines not only cross-border holdings of equity but also the comovement of equity returns across countries. They also suggest that the portfolio demand channel emphasized in theoretical models of asset return comovement is indeed the primary driver of the cross-section of international return comovement, but only after taking into account the cross-sectional variation in the degree of frictions impeding equity investments across borders.

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Tables and Figures

Table 1: **List of Countries**

The table lists the 40 countries used in the paper.

			Data availability											
			Pre-2000	Monthly returns		U.S. investor position		Country's position in the U.S.		Total foreign position		Market cap	
No	Country	Label	VAR	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	AUS	Australia	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1979	2017
2	AUT	Austria	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
3	BEL	Belgium	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
4	BRA	Brazil		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2017
5	CAN	Canada	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
6	CHL	Chile		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2017
7	CHN	China		1993m1	2018m8	1994	2017	1974	2017	1981	2017	1991	2017
8	COL	Colombia		1993m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2017
9	DNK	Denmark	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2012
10	FIN	Finland		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1982	2012
11	FRA	France	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
12	DEU	Germany	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
13	GRC	Greece		1988m1	2018m8	1994	2017	1974	2017	1986	2017	1988	2017
14	HKG	Hong Kong		1970m1	2018m8	1994	2017	1974	2017	1979	2017	1975	2017
15	HUN	Hungary		1991m2	2018m12	1994	2017	1974	2017	1984	2011	1991	2017
16	IND	India		1993m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2017
17	IDN	Indonesia		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2017
18	ISR	Israel		1993m1	2018m8	1994	2017	1974	2017	1970	2017	1979	2017
19	ITA	Italy		1970m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2014
20	JPN	Japan	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
21	KOR	Korea		1988m1	2018m8	1994	2017	1974	2017	1971	2017	1979	2017
22	MYS	Malaysia		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1981	2017
23	MEX	Mexico		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
24	NLD	Netherlands	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
25	NZL	New Zealand	✓	1988m1	2018m8	1994	2017	1974	2017	1970	2017	1985	2017
26	NOR	Norway	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1981	2017
27	PAK	Pakistan		1993m1	2018m8	1994	2017	1974	2017	1970	2011	1988	2016
28	PER	Peru		1993m1	2018m8	1994	2017	1974	2017	1990	2017	1989	2017
29	PHL	Philippines		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2017
30	POL	Poland		1993m1	2018m8	1994	2017	1974	2017	1975	2017	1991	2017
31	PRT	Portugal		1988m1	2018m8	1994	2017	1974	2017	1971	2017	1977	2017
32	SGP	Singapore		1970m1	2018m8	1994	2017	1974	2017	1970	2017	1979	2017
33	ZAF	South Africa		1993m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
34	ESP	Spain	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
35	SWE	Sweden	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2012
36	CHE	Switzerland	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017
37	TWN	Taiwan		1988m1	2018m8	1994	2017	1974	2017	1976	2011	1962	2017
38	THA	Thailand		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2017
39	TUR	Turkey		1988m1	2018m8	1994	2017	1974	2017	1970	2017	1988	2017
40	GBR	United Kingdom	✓	1970m1	2018m8	1994	2017	1974	2017	1970	2017	1975	2017

Table 2: **Descriptive Statistics**

All excess returns are in US dollars, in excess of the 1-month Treasury bill rate. U.S. position in a country is U.S. investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. A country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. Total trade of a country with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are time-series averages within the sample period except GDP correlation, which is already a cross-sectional variable. All variables are cross-sectionally demeaned.

Panel A. 40 countries used in the cross-sectional analysis

	2000-2017 (Baseline)			1986-1999 (Pre-2000)			1986-2017		
	Mean	Median	Stdev	Mean	Median	Stdev	Mean	Median	Stdev
Equity return correlation with the US	0.64	0.64	0.14	0.38	0.41	0.16	0.52	0.50	0.13
US investor position	0.11	0.10	0.06	0.08	0.07	0.05	0.10	0.09	0.05
Total foreign position	0.30	0.26	0.16	0.15	0.13	0.10	0.23	0.22	0.12
Country's position in the US	0.08	0.05	0.09	0.03	0.02	0.04	0.06	0.04	0.07
Total trade with the US	0.08	0.04	0.09	0.08	0.04	0.10	0.08	0.04	0.09
GDP correlation	0.32	0.28	0.17	-0.06	-0.08	0.20	0.16	0.14	0.13
Size of equity market	0.04	0.02	0.05	0.04	0.02	0.08	0.04	0.02	0.07

Panel B. 15 countries used in the pre-2000 VAR analysis

	2000-2017 (Baseline)			1986-1999 (Pre-2000)			1986-2017		
	Mean	Median	Stdev	Mean	Median	Stdev	Mean	Median	Stdev
Equity return correlation with the US	0.74	0.72	0.08	0.47	0.50	0.15	0.62	0.63	0.10
US investor position	0.14	0.12	0.05	0.10	0.09	0.04	0.13	0.11	0.05
Total foreign position	0.38	0.33	0.15	0.20	0.18	0.12	0.30	0.27	0.13
Country's position in the US	0.14	0.12	0.11	0.05	0.03	0.05	0.11	0.10	0.07
Total trade with the US	0.07	0.04	0.09	0.06	0.04	0.09	0.06	0.04	0.09
GDP correlation	0.28	0.19	0.17	-0.04	-0.08	0.11	0.17	0.11	0.14
Size of equity market	0.06	0.05	0.06	0.08	0.04	0.12	0.07	0.04	0.10

Table 3: **Cross-section of Equity Market Return Correlations with the U.S.**

$$\text{Baseline:} \quad \rho_{US,j} = b_0 + b_1 U.S.\ position_j + \epsilon_j$$

The table shows that cross-border positions explain the cross-section of the correlation between equity market excess returns and the U.S. stock market excess return. All excess returns are in US dollars, in excess of the 1-month Treasury bill rate. U.S. investor position in a country is U.S. investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. A country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. A country's total trade with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are time-series averages within the sample period except GDP correlation, which is already a cross-sectional variable. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level.

Panel A. Baseline period (2000m1–2017m12)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	**1.43**					**1.23**	**1.46**	**1.44**	**1.33**	**1.13**	**1.11**
	(4.35)					(3.59)	(4.32)	(4.35)	(4.57)	(3.76)	(3.80)
Country's position in the US		**0.66**				**0.31**				**0.35**	**0.33**
		(2.96)				(3.00)				(3.56)	(3.85)
Total trade with the US			0.10				-0.09			-0.12	
			(0.46)				(-0.57)			(-0.88)	
GDP correlation				0.04				0.05			0.02
				(0.36)				(0.55)			(0.27)
Size of equity market					**1.04**				0.77	0.80	**0.79**
					(2.05)				(2.02)	(2.02)	(2.07)
Constant	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**
	(38.15)	(32.80)	(29.38)	(29.35)	(31.61)	(38.81)	(37.74)	(37.76)	(40.28)	(41.05)	(40.84)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.39	0.18	-0.02	-0.02	0.12	0.41	0.38	0.38	0.46	0.48	0.47

Panel B. 1986m1–2017m12

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	**1.59**					**1.19**	**1.55**	**1.55**	**1.56**	**1.15**	**1.15**
	(5.61)					(4.47)	(5.54)	(5.62)	(5.83)	(4.54)	(4.52)
Country's position in the US		**1.12**				**0.69**				**0.67**	**0.67**
		(4.46)				(3.73)				(4.14)	(3.77)
Total trade with the US			0.29				0.15			0.07	
			(1.27)				(0.78)			(0.53)	
GDP correlation				0.28				**0.23**			**0.21**
				(1.97)				(2.38)			(2.29)
Size of equity market					0.33				0.22	0.22	0.16
					(0.71)				(0.60)	(0.63)	(0.51)
Constant	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**
	(31.77)	(29.74)	(24.93)	(25.41)	(24.84)	(34.28)	(31.64)	(32.87)	(31.71)	(33.88)	(35.30)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.39	0.31	0.01	0.05	0.01	0.48	0.39	0.43	0.39	0.47	0.51

Table 4: **Cross-section of Equity Market Return Correlations with the U.S.: An Additive Decomposition**

$$\text{Baseline:} \quad \{\widetilde{\rho}^{local}_{US,j}, \widetilde{\rho}^{FX}_{US,j}\} = b_0 + b_1 U.S.\ position_j + \epsilon_j$$

$$\rho_{US,j} = \widetilde{\rho}^{local}_{US,j} + \widetilde{\rho}^{FX}_{US,j} = \frac{\text{Cov}(R_{US,t+1} - Y_{US,t}, R^{local}_{j,t+1} - Y_{jt})}{\text{Std}(R_{US,t+1} - Y_{US,t})\text{Std}(R^{\$}_{j,t+1} - Y_{US,t})} + \frac{\text{Cov}(R_{US,t+1} - Y_{US,t}, R^{FX}_{j,t+1})}{\text{Std}(R_{US,t+1} - Y_{US,t})\text{Std}(R^{\$}_{j,t+1} - Y_{US,t})}$$

Foreign equity return in local currency is in excess of the local short rate used in the VAR analysis. Foreign currency excess return is defined as the USD-denominated return from investing in the foreign short asset by borrowing at the US short rate. All excess returns are in US dollars, in excess of the 1-month Treasury bill rate. U.S. investor position in a country is U.S. investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. A country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. A country's total trade with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are time-series averages within the baseline sample period, 2000m1–2017m12, except GDP correlation, which is already a cross-sectional variable. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level.

Panel A. Adjusted correlation of US equity excess return with the foreign equity excess return in local currency, $\widetilde{\rho}^{local}_{US,j}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	**1.17**					**1.05**	**1.21**	**1.17**	**1.01**	**0.89**	**0.85**
	(4.10)					(3.36)	(4.07)	(4.04)	(4.42)	(3.53)	(3.46)
Country's position in the US		**0.49**				0.18				**0.24**	0.23
		(2.73)				(1.56)				(2.19)	(1.92)
Total trade with the US			0.01				-0.14			-0.16	
			(0.09)				(-1.10)			(-1.29)	
GDP correlation				-0.04				-0.04			-0.06
				(-0.33)				(-0.32)			(-0.69)
Size of equity market					**1.42**				**1.21**	**1.23**	**1.24**
					(4.48)				(4.66)	(4.41)	(4.50)
Constant	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
	(30.14)	(26.63)	(24.90)	(24.94)	(29.81)	(30.06)	(29.96)	(29.80)	(35.96)	(36.26)	(36.07)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.30	0.10	-0.03	-0.02	0.28	0.30	0.29	0.28	0.51	0.52	0.51

Panel B. Adjusted correlation of US equity excess return with the foreign currency excess return, $\widetilde{\rho}^{FX}_{US,j}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	**0.24**					**0.20**	**0.26**	**0.24**	**0.24**	**0.20**	**0.19**
	(3.40)					(2.25)	(4.00)	(3.24)	(3.28)	(2.44)	(2.15)
Country's position in the US		0.12				0.06				0.07	0.07
		(1.39)				(0.79)				(0.81)	(0.88)
Total trade with the US			-0.03				-0.06			-0.07	
			(-0.28)				(-0.69)			(-0.84)	
GDP correlation				-0.03				-0.03			-0.03
				(-0.66)				(-0.71)			(-0.79)
Size of equity market					0.08				0.03	0.04	0.04
					(0.56)				(0.28)	(0.31)	(0.33)
Constant	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**
	(7.01)	(6.76)	(6.48)	(6.51)	(6.50)	(6.99)	(6.99)	(6.97)	(6.92)	(6.91)	(6.88)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.13	0.06	-0.02	-0.01	-0.02	0.12	0.12	0.12	0.10	0.10	0.09

Table 5: **Explaining the Cross-section of Global CAPM Betas**

$$\text{Baseline:} \quad \beta_{j,GCAPM} = b_0 + b_1\sigma_j + b_2 U.S.\ position_j + \epsilon_j$$

The table shows that cross-border positions explain the cross-section of betas with respect to the global stock market. U.S. investor position in a country is U.S. investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. A country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. A country's total trade with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are time-series averages within the sample period except GDP correlation, which is already a cross-sectional variable. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level. The sample period is 2000m1–2017m12.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Return volatility	**0.09**	**0.11**	**0.11**	**0.11**	**0.12**					
	(4.46)	(7.90)	(6.51)	(5.62)	(7.76)					
US investor position		**1.78**			**1.56**					
		(2.77)			(2.29)					
Total foreign position			**0.70**							
			(3.39)							
Country's position in the US				**0.81**	0.43					
				(3.56)	(1.86)					
Log return volatility						**0.54**	**0.76**	**0.67**	**0.86**	**0.90**
						(3.08)	(8.63)	(5.27)	(5.54)	(8.71)
Log US investor position							**0.24**			**0.22**
							(3.03)			(2.85)
Log total foreign position								**0.23**		
								(3.12)		
Log country's position in the US									**0.07**	0.04
									(2.32)	(1.95)
Constant	**1.16**	**1.16**	**1.16**	**1.16**	**1.16**	0.00	0.00	0.00	0.00	0.00
	(31.80)	(35.12)	(35.51)	(32.89)	(35.13)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	40	40	40	40	40	40	40	40	40	40
R^2	0.32	0.46	0.47	0.39	0.48	0.22	0.54	0.44	0.33	0.56

Table 6: **Cross-section of Equity Market Correlations with the U.S.: Role of Frictions**

$$\text{Baseline:} \quad \rho_{US,j} = b_0 + b_1 \widehat{U.S.\ position}_j + \epsilon_j$$

The table shows that cross-border positions explain the cross-section of countries' equity excess return correlation with the U.S. Excess returns are computed in USD and using the 1-month US Treasury bill rate. U.S. investor position in a country is U.S. investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. The instrumental variables for U.S. position are the fraction of the stock market that is investable by foreigners, as defined by the MSCI, and the fraction of the stock market that is traded in the U.S. through cross listing or ADR. Contiguity and distance measures are from Mayer and Zignago (2005). Exchange rate volatility is the standard deviation of the foreign exchange excess return defined as $\frac{(1+Y_{j,t})Q_{j,t+1}}{(1+Y_{US,t})Q_{j,t}} - 1$, where $Y_{j,t}$ is the short rate of country j, $Y_{US,t}$ is the U.S. short rate, and $Q_{j,t+1}$ is the exchange rate between USD and the currency of country j in USD per unit of foreign currency. Country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. Total trade with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are a time-series average within the baseline sample period (2000m1-2017m12) except GDP correlation, which is already a cross-sectional variable computed over the same sample period. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level.

Panel A. First-stage OLS: Determinants of U.S. investor position

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Investability	**0.37**		**0.29**	**0.31**	**0.29**	**0.28**	**0.28**	**0.28**	**0.29**	**0.30**	**0.25**	**0.26**
	(5.81)		(5.34)	(5.23)	(5.35)	(4.83)	(4.40)	(4.47)	(5.05)	(5.07)	(2.88)	(3.15)
Fraction cross-listed		**0.32**	**0.26**	**0.32**	**0.31**	**0.26**	**0.25**	**0.30**	**0.27**	**0.26**	**0.34**	**0.31**
		(3.28)	(2.60)	(4.46)	(3.02)	(2.56)	(2.41)	(2.83)	(2.66)	(2.58)	(4.15)	(3.66)
Log distance				0.02							0.03	0.02
				(1.42)							(1.36)	(1.27)
Contiguity					-0.04						0.02	-0.00
					(-0.56)						(0.29)	(-0.01)
Exchange rate volatility						0.00					0.01	0.01
						(0.61)					(0.65)	(0.82)
Country's position in the US							0.07				0.09	0.08
							(0.78)				(1.01)	(1.01)
Total trade with the US								-0.07			-0.09	
								(-0.55)			(-0.80)	
GDP correlation									-0.02			-0.01
									(-0.45)			(-0.24)
Size of equity market										-0.01	0.02	0.01
										(-0.14)	(0.12)	(0.12)
Constant	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**
	(14.06)	(14.12)	(17.54)	(17.72)	(17.55)	(17.35)	(17.48)	(17.42)	(17.35)	(17.31)	(16.93)	(16.86)
Observations	40	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.36	0.36	0.59	0.60	0.59	0.58	0.58	0.58	0.58	0.58	0.56	0.55

Cross-section of Equity Market Correlations with the U.S.: Role of Frictions (Cont'd)

Panel B. Second-stage 2SLS: Variation in U.S. investor position due to frictions and correlation with the U.S.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
US investor position	**1.80**	**1.62**	**1.83**	**1.78**	**1.63**	**1.43**	**1.39**
	(4.69)	(3.82)	(4.36)	(4.66)	(4.83)	(3.69)	(3.79)
Country's position in the US		0.19				**0.26**	**0.25**
		(1.47)				(2.16)	(2.05)
Total trade with the US			-0.13			-0.14	
			(-0.95)			(-1.13)	
GDP correlation				0.05			0.03
				(0.57)			(0.34)
Size of equity market					0.71	0.74	**0.74**
					(1.88)	(1.92)	(2.02)
Constant	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**
	(38.31)	(39.48)	(38.39)	(38.49)	(41.19)	(43.26)	(43.11)
Observations	40	40	40	40	40	40	40

Table 7: **Equity Market Correlations with the U.S. and U.S. Investor Positions: An Instrumental Variable Approach Using Index Redefinitions**

$$\text{Baseline:} \quad \Delta\rho_{US,j,t+1} = b_0 + b_1 \Delta U.S.\ \widehat{position}_{j,t+1} + +\epsilon_j$$

The table uses panel data of U.S. investor position and U.S. return correlation changes in an individual foreign stock. U.S. investor position change is the stock's U.S. holdings divided by market capitalization from 12 months before to 12 months after. U.S. return correlation change is the difference in the stock's excess return correlation with the U.S. stock market over 24 months before and 24 months after. Index inclusion/exclusion data are from Claessens and Yafeh (2012). Sample period is 2001m1–2010m12. Reported in parentheses are t-statistics based on cluster-robust standard errors. Boldface denotes significance at the 5% level.

	Dependent variable: Δ U.S. investor position	Δ Return correlation (reduced form)	Δ Return correlation (2SLS)
	(1)	(2)	(3)
Index exclusion	**-0.005**	**-0.034**	
	(-2.10)	(-2.33)	
Index inclusion	**0.013**	**0.030**	
	(4.37)	(2.68)	
Δ U.S. investor position			**2.577**
			(2.78)
Constant	**0.005**	**0.022**	0.009
	(4245.68)	(4457.38)	(1.84)
Observations	1,996,973	1,996,973	1,996,973
Clusters	5,280	5,280	5,280
F statistic	12.04		
Fixed effect	Country-month	Country-month	Country-month
Std err. cluster	Country-month	Country-month	Country-month
IV			Index inclusion/exclusion

Table 8: **Cross-Section of Predictability Using U.S. Dividend-Price Ratio**

$$\text{Baseline:} \quad R^2_{1st\,stage,j} = b_0 + b_1 U.S.\,position_j + \epsilon_j$$

The table shows that the time-series return predictability of countries using the U.S. dividend-price ratio increases in the U.S. cross-border position in the country. Return predictability is measured as the R^2 of the time-series regression of the one-year excess return to a foreign equity market on the US dividend-price ratio over the baseline sample period, 2000m1-2017m12. All excess returns are in US dollars, in excess of the 1-month Treasury bill rate. U.S. position in a country is U.S. investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. A country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. Total trade of a country with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are time-series averages within the baseline sample period except GDP correlation, which is already a cross-sectional variable. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	**0.53**					**0.55**	**0.51**	**0.53**	**0.46**	**0.45**	**0.48**
	(3.45)					(2.86)	(3.28)	(3.32)	(3.00)	(2.46)	(2.42)
Country's position in the US		0.13				-0.03				-0.03	-0.03
		(0.72)				(-0.23)				(-0.19)	(-0.17)
Total trade with the US			0.14				0.07			0.08	
			(0.93)				(0.42)			(0.46)	
GDP correlation				0.06				0.06			0.06
				(0.80)				(0.75)			(0.76)
Size of equity market					**0.66**				**0.57**	**0.57**	**0.55**
					(3.52)				(3.11)	(3.12)	(3.05)
Constant	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**
	(11.78)	(10.96)	(10.97)	(10.94)	(11.78)	(11.64)	(11.66)	(11.75)	(12.46)	(12.17)	(12.24)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.13	-0.01	-0.00	-0.01	0.13	0.11	0.11	0.12	0.22	0.18	0.19

Table 9: **VAR Analysis: Cross-section of Correlations in U.S. Return News with Subcomponents of Country Return News**

The table studies the determinants of the cross-sectional heterogeneity in the correlation between U.S. return news and the components of foreign country return news. All variables are time-series averages within the baseline sample period (2000m1-2017m12) except GDP correlation, which is already a cross-sectional variable. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level.

Panel A. Correlation with country risk-premium news

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	**-1.88**					**-1.57**	**-1.86**	**-1.88**	**-1.68**	**-1.33**	**-1.35**
	(-3.10)					(-2.52)	(-3.04)	(-3.10)	(-3.29)	(-2.48)	(-2.55)
Country's position in the US		-0.92				-0.47				-0.51	-0.50
		(-1.96)				(-1.43)				(-1.73)	(-1.67)
Total trade with the US			-0.32				-0.08			-0.03	
			(-0.78)				(-0.22)			(-0.12)	
GDP correlation				-0.07				-0.07			-0.04
				(-0.29)				(-0.32)			(-0.16)
Size of equity market					**-1.81**				-1.47	-1.52	-1.51
					(-2.08)				(-1.84)	(-1.87)	(-1.88)
Constant	**-0.52**	**-0.52**	**-0.52**	**-0.52**	**-0.52**	**-0.52**	**-0.52**	**-0.52**	**-0.52**	**-0.52**	**-0.52**
	(-14.68)	(-13.88)	(-13.13)	(-13.06)	(-13.97)	(-14.71)	(-14.50)	(-14.51)	(-15.30)	(-15.19)	(-15.20)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.19	0.09	-0.01	-0.02	0.10	0.19	0.17	0.17	0.25	0.24	0.24

Panel B. Correlation with country cash-flow news

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	-0.38					-0.52	-0.50	-0.37	-0.35	-0.56	-0.42
	(-0.66)					(-0.87)	(-0.90)	(-0.70)	(-0.58)	(-0.87)	(-0.70)
Country's position in the US		0.06				0.21				0.14	0.14
		(0.14)				(0.52)				(0.32)	(0.38)
Total trade with the US			0.39				0.45			0.43	
			(1.07)				(1.20)			(1.11)	
GDP correlation				**0.41**				**0.41**			**0.41**
				(2.23)				(2.15)			(2.15)
Size of equity market					-0.31				-0.24	-0.22	-0.31
					(-0.43)				(-0.30)	(-0.26)	(-0.38)
Constant	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**
	(3.11)	(3.10)	(3.13)	(3.28)	(3.10)	(3.08)	(3.12)	(3.25)	(3.08)	(3.05)	(3.18)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	-0.01	-0.03	-0.00	0.09	-0.02	-0.04	-0.01	0.07	-0.04	-0.06	0.03

Panel C. Correlation with country currency-premium news

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	-0.04					0.08	0.19	-0.04	-0.38	-0.16	-0.34
	(-0.06)					(0.12)	(0.28)	(-0.06)	(-0.60)	(-0.23)	(-0.49)
Country's position in the US		-0.16				-0.19				-0.00	-0.08
		(-0.51)				(-0.61)				(-0.00)	(-0.23)
Total trade with the US			**-0.81**				**-0.84**			**-0.81**	
			(-4.46)				(-3.92)			(-3.53)	
GDP correlation				-0.15				-0.15			-0.18
				(-0.76)				(-0.75)			(-1.15)
Size of equity market					**2.54**				**2.62**	**2.60**	**2.65**
					(2.59)				(2.51)	(2.34)	(2.36)
Constant	**-0.32**	**-0.32**	**-0.32**	**-0.32**	**-0.32**	**-0.32**	**-0.32**	**-0.32**	**-0.32**	**-0.32**	**-0.32**
	(-9.24)	(-9.27)	(-9.78)	(-9.31)	(-11.22)	(-9.14)	(-9.67)	(-9.18)	(-11.16)	(-11.82)	(-11.04)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	-0.03	-0.02	0.08	-0.01	0.30	-0.05	0.06	-0.04	0.30	0.37	0.28

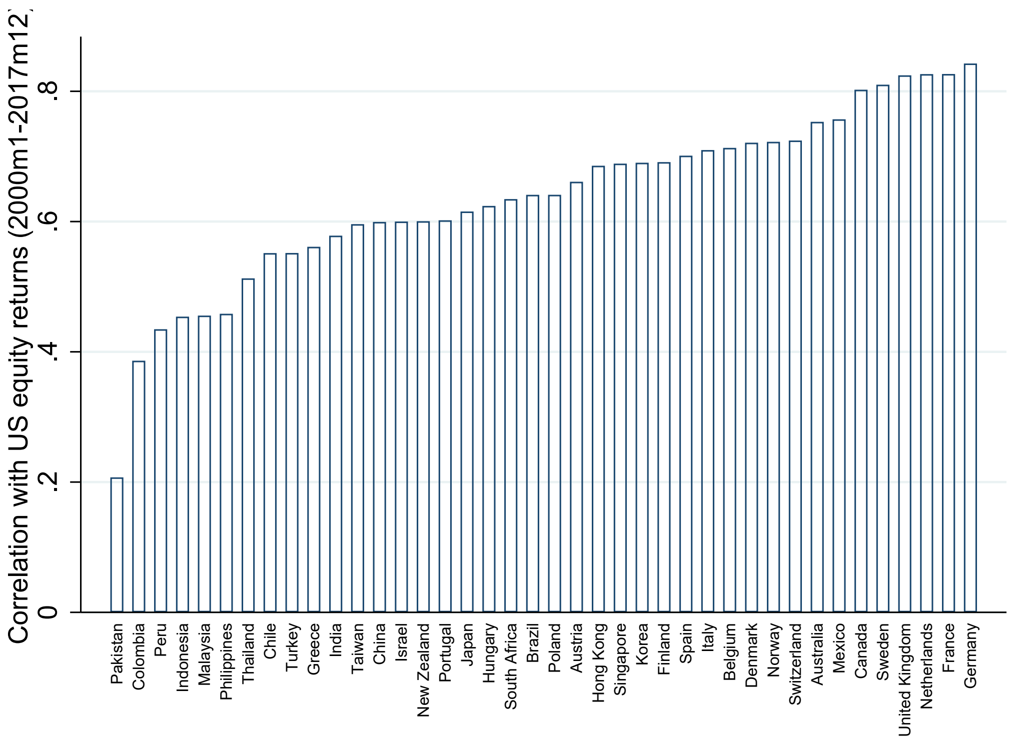

Figure 2: **Cross-Section of International Equity Return Correlations**

The figure presents the correlation of monthly equity excess returns between the U.S. and a foreign country over our baseline sample period from 2000m1 to 2017m12. All excess returns are in USD and are computed in excess of the one-month U.S. T-bill rate.

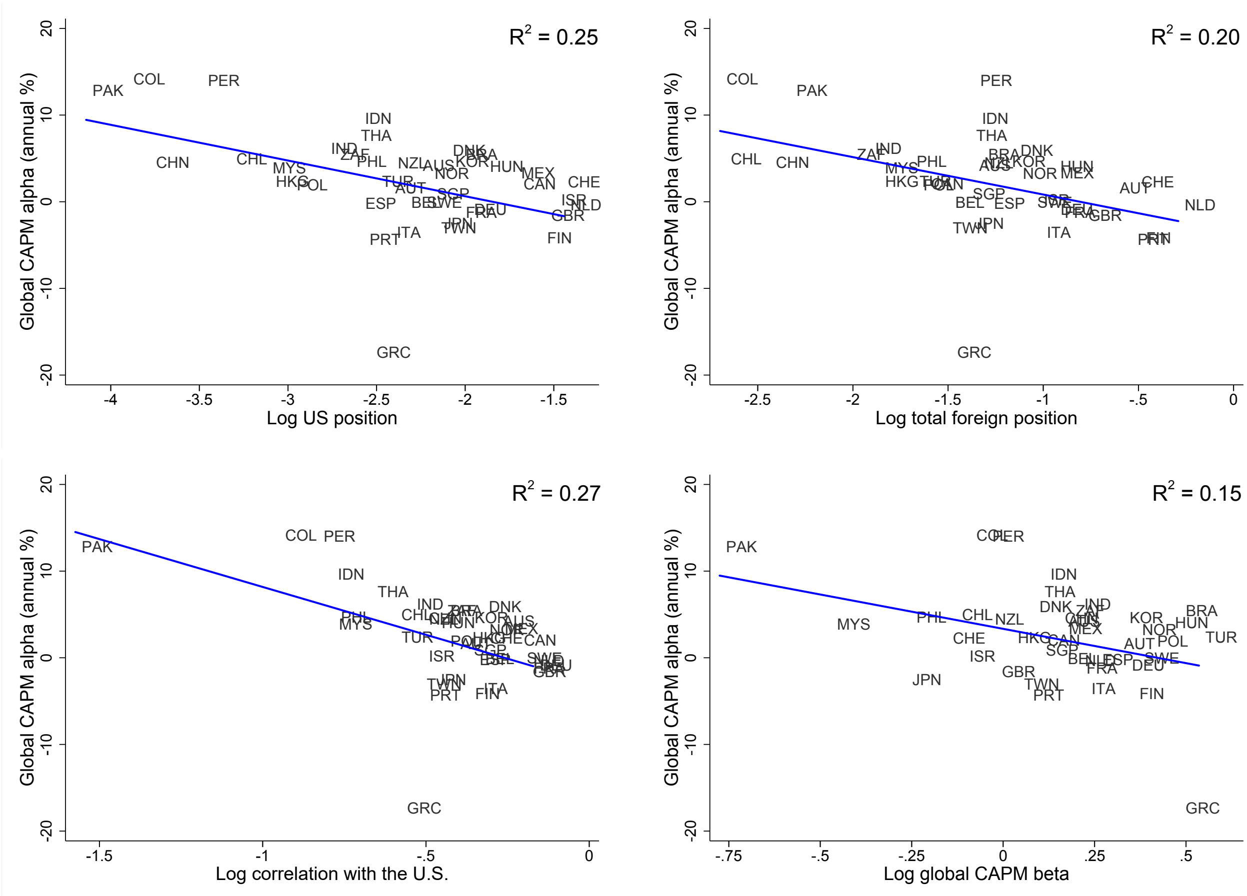

Figure 3: **Global CAPM Alphas Are Related to Other Cross-Sectional Moments**

These figures show that the deviations from the global CAPM can be rationalized as holding costs, which in equilibrium are revealed by the cross-section of U.S. investor positions, total foreign positions, correlations with the U.S., and global CAPM betas. The global stock market factor is from Kenneth French's website. Sample period: 2000m1-2017m12.

A Additional Tables and Figures

Table A1: **Cross-section of Equity Market Return Correlations and Total Foreign Positions**

$$\text{Baseline:} \quad \rho_{US,j} = b_0 + b_1 Foreign\,position_j + \epsilon_j$$

This table repeats table 3 but with total foreign position in a country instead of U.S. position in the country as the main cross-border position proxy. All excess returns are in US dollars, in excess of the 1-month Treasury bill rate. Total foreign position is foreign investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. A country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. A country's total trade with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are time-series averages within the sample period except GDP correlation, which is already a cross-sectional variable. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level.

Panel A. Baseline period (2000m1–2017m12)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Total foreign position	**0.46**					**0.38**	**0.49**	**0.51**	**0.47**	**0.41**	**0.43**
	(3.86)					(3.20)	(4.09)	(4.55)	(4.65)	(3.92)	(4.45)
Country's position in the US		**0.66**				**0.45**				**0.39**	**0.39**
		(2.96)				(2.60)				(3.84)	(3.29)
Total trade with the US			0.10				0.25			0.14	
			(0.46)				(1.25)			(0.91)	
GDP correlation				0.04				0.16			0.12
				(0.36)				(1.81)			(1.31)
Size of equity market					**1.04**				**1.08**	**1.05**	**1.04**
					(2.05)				(2.56)	(2.64)	(2.84)
Constant	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**	**0.64**
	(34.74)	(32.80)	(29.38)	(29.35)	(31.61)	(36.48)	(34.90)	(35.30)	(38.62)	(40.67)	(41.25)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.27	0.18	-0.02	-0.02	0.12	0.34	0.28	0.29	0.41	0.47	0.48

Panel B. 1986m1–2017m12

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Total foreign position	**0.54**					**0.34**	**0.61**	**0.65**	**0.54**	**0.43**	**0.46**
	(4.03)					(2.19)	(4.71)	(5.49)	(4.24)	(2.99)	(3.46)
Country's position in the US		**1.12**				**0.87**				**0.69**	**0.72**
		(4.46)				(3.04)				(3.70)	(2.83)
Total trade with the US			0.29				0.46			0.29	
			(1.27)				(2.00)			(1.87)	
GDP correlation				0.28				**0.42**			**0.34**
				(1.97)				(3.77)			(3.98)
Size of equity market					0.33				0.35	0.32	0.22
					(0.71)				(0.84)	(0.88)	(0.74)
Constant	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**
	(28.07)	(29.74)	(24.93)	(25.41)	(24.84)	(31.21)	(29.62)	(31.33)	(28.37)	(31.99)	(34.11)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.22	0.31	0.01	0.05	0.01	0.37	0.30	0.38	0.24	0.40	0.47

Table A2: **Cross-section of Equity Market Return Correlations with the U.S.: A Log Relationship**

$$\text{Baseline:} \quad \log \rho_{US,j} = b_0 + b_1 \log U.S.\ position_j + \epsilon_j$$

The table shows that cross-border positions explain the cross-section of the correlation between equity market excess returns and the U.S. stock market excess return. All excess returns are in US dollars, in excess of the 1-month Treasury bill rate. U.S. investor position in a country is U.S. investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. A country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. A country's total trade with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are time-series averages within the sample period except GDP correlation, which is already a cross-sectional variable. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level.

Panel A. Baseline period (2000m1–2017m12)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Log of US investor position	**0.29**					**0.25**	**0.29**	**0.29**	**0.28**	**0.24**	**0.24**
	(3.95)					(3.53)	(3.92)	(3.98)	(4.24)	(3.88)	(4.02)
Log of country's position in the US		**0.09**				**0.04**				**0.04**	**0.04**
		(3.16)				(2.75)				(2.98)	(2.64)
Total trade with the US			0.19				-0.10			-0.21	
			(0.51)				(-0.51)			(-1.25)	
GDP correlation				0.00				0.08			0.04
				(0.02)				(0.56)			(0.27)
Size of equity market					**1.84**				1.36	1.25	1.25
					(2.11)				(1.85)	(1.64)	(1.71)
Constant	**-0.48**	**-0.48**	**-0.48**	**-0.48**	**-0.48**	**-0.48**	**-0.48**	**-0.48**	**-0.48**	**-0.48**	**-0.48**
	(-17.01)	(-13.51)	(-11.53)	(-11.50)	(-12.25)	(-17.68)	(-16.81)	(-16.84)	(-18.10)	(-18.57)	(-18.47)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.53	0.26	-0.02	-0.03	0.10	0.57	0.52	0.52	0.59	0.61	0.60

Panel B. 1986m1–2017m12

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Log of US investor position	**0.32**					**0.25**	**0.31**	**0.32**	**0.31**	**0.25**	**0.25**
	(3.92)					(3.10)	(3.87)	(3.92)	(3.97)	(3.12)	(3.18)
Log of country's position in the US		**0.12**				**0.07**				**0.07**	**0.07**
		(4.02)				(2.89)				(2.74)	(2.80)
Total trade with the US			0.56				0.37			0.19	
			(1.32)				(1.21)			(0.83)	
GDP correlation				0.49				**0.49**			**0.43**
				(1.78)				(2.49)			(2.51)
Size of equity market					0.68				0.44	0.30	0.17
					(0.75)				(0.55)	(0.42)	(0.26)
Constant	**-0.69**	**-0.69**	**-0.69**	**-0.69**	**-0.69**	**-0.69**	**-0.69**	**-0.69**	**-0.69**	**-0.69**	**-0.69**
	(-20.00)	(-18.02)	(-15.14)	(-15.29)	(-15.12)	(-21.59)	(-19.97)	(-20.67)	(-19.94)	(-21.19)	(-22.01)
Observations	40	40	40	40	40	40	40	40	40	40	40
Adjusted R^2	0.43	0.30	0.00	0.03	0.00	0.51	0.43	0.47	0.43	0.49	0.53

Table A3: **Cross-section of Equity Market Return Correlations with the U.S.: 21 Developed Countries**

$$\text{Baseline:} \quad \rho_{US,j} = b_0 + b_1 U.S.\ position_j + \epsilon_j$$

This table repeats Panel A of Table 3 for the subsample of 21 developed countries that are part of the MSCI Developed Markets Index. It shows that inclusion of developing markets is essential for the strong cross-sectional relationship between cross-border positions and return correlations. All excess returns are in US dollars, in excess of the 1-month Treasury bill rate. U.S. investor position in a country is U.S. investors' aggregate holding of equity securities in that country, normalized by that country's stock market capitalization. A country's position in the U.S. is the country's holdings of equity securities in the U.S., normalized by the country's stock market capitalization. A country's total trade with the U.S. is the sum of imports and exports with the U.S., normalized by the country's GDP. GDP correlation is the time-series correlation between real GDP growth rate shocks in a country and in the U.S., where GDP growth shocks are inferred from an AR(1) model. The size of equity market is the country's stock market capitalization normalized by that of the U.S. All variables are time-series averages within the baseline sample period, 2000m1-2017m12, except GDP correlation, which is already a cross-sectional variable over the same sample period. All variables are cross-sectionally demeaned. Reported in parentheses are t-statistics based on heteroskedasticity-robust standard errors. Boldface denotes significance at the 5% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
US investor position	0.42					0.37	0.41	0.42	0.39	0.32	0.36
	(1.39)					(1.16)	(1.39)	(1.41)	(1.34)	(1.10)	(1.07)
Country's position in the US		0.16				0.10				0.16	0.08
		(1.17)				(0.81)				(1.22)	(0.55)
Total trade with the US			0.06				0.01			-0.05	
			(0.39)				(0.08)			(-0.31)	
GDP correlation				0.15				**0.15**			0.13
				(1.58)				(2.16)			(1.13)
Size of equity market					0.37				0.33	0.40	0.29
					(0.75)				(0.70)	(0.76)	(0.63)
Constant	**0.72**	**0.72**	**0.72**	**0.72**	**0.72**	**0.72**	**0.72**	**0.72**	**0.72**	**0.72**	**0.72**
	(42.80)	(41.53)	(40.77)	(43.28)	(42.07)	(42.00)	(41.66)	(44.69)	(42.93)	(41.33)	(43.15)
Observations	21	21	21	21	21	21	21	21	21	21	21
Adjusted R^2	0.05	-0.01	-0.05	0.07	0.02	0.01	-0.00	0.13	0.06	-0.02	0.07

Table A4: **VAR Analysis: Correlations Among Subcomponents of U.S. and Foreign Country Returns**

The table reports the cross-sectional average of the correlation between a subcomponent of US return (cash-flow news or discount-rate news) and subcomponent of foreign country return (cash-flow news, real-rate news, foreign exchange return news, and local-currency equity premium news). Subscripts CF, DR, RR, FX, and RP denote cash-flow news, discount-rate news (innovation in future expected returns), U.S. real-rate news (innovation in the 1-month U.S. Treasury bill rate), foreign exchange premium news, and local-currency equity premium (risk premium) news.

Panel A. Baseline sample (2000m1–2017m12)
(average across 40 countries)

	$N^{c}_{CF,t}$	$N^{US}_{RR,t}$	$N^{c}_{FX,t}$	$N^{c}_{RP,t}$
$N^{US}_{CF,t}$	0.15	-0.38	-0.13	0.06
$N^{US}_{DR,t}$	0.02	-0.60	0.18	0.47

Panel B. Pre-2000 sample (1986m1–1999m12)
(average across 15 countries)

	$N^{c}_{CF,t}$	$N^{US}_{RR,t}$	$N^{c}_{FX,t}$	$N^{c}_{RP,t}$
$N^{US}_{CF,t}$	0.11	0.55	-0.11	-0.21
$N^{US}_{DR,t}$	-0.04	-0.74	0.12	0.39

Panel C. Baseline sample (2000m1-2017m12)
(average across the 15 countries with pre-2000 data)

	$N^{c}_{CF,t}$	$N^{US}_{RR,t}$	$N^{c}_{FX,t}$	$N^{c}_{RP,t}$
$N^{US}_{CF,t}$	0.28	-0.41	-0.20	0.21
$N^{US}_{DR,t}$	0.11	-0.60	0.09	0.69

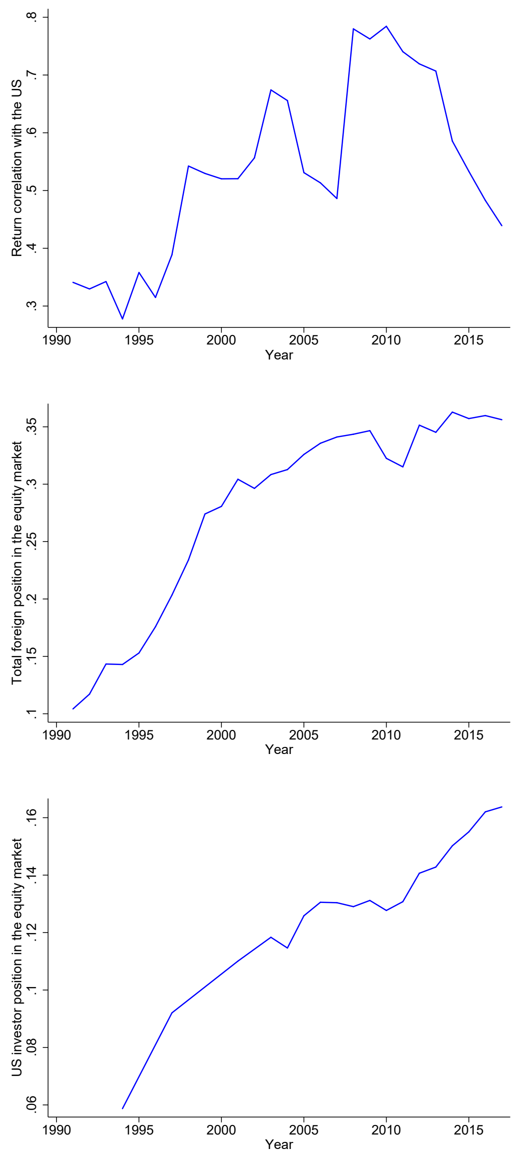

Figure A1: **Time-Series Patterns in International Equity Return Correlations and Cross-Border Positions (1990-2017)**

The figures plot the average trends in international equity return correlations and cross-border positions over time. Equity return correlation is the trailing 36-month correlation between the U.S. equity excess return and foreign equity excess return. Both returns are in excess of the 1-month U.S. Treasury bill rate. Both total foreign investor position and U.S. investor position are normalized by the country's market capitalization. All figures are value-weighted averages across 31 countries (relative to the 40 baseline countries, this excludes 9 countries with no stock return data in the 1980s), where the weight is the market capitalization at the end of the previous year. U.S. investor position is available starting in 1994.

B Additional Details on Data Sources

Market capitalization Our main source of market capitalization is the "market capitalization of listed countries (current US$)" from the Global Financial Data (GFD). The code is CM.MKT.LCAP.CD.XXX with "XXX" being the 3-digit country code. The data are available at the annual frequency.

Some noteworthy points:

- The data for the United Kingdom ends early in 2012, so we use the European Central Bank data to find the growth rate of market capitalization from 2012. We apply this growth rate to obtain market capitalizations for 2013-2017.
- Some data in the 2010s missing for other countries as well: Czech Republic, Denmark, Finland, Italy, Kenya, Pakistan, and Sweden. We do not make further adjustments for these countries.
- The standard GFD market capitalization data are unavailable for Taiwan, so we use "Taiwan SE Capitalization, Value Traded (USD) (SCTWNM)."

Short term interest rate data Our main source of short term yield data is the GFD. For consistency, we use the 3-month rates but convert them back to 1 month unit through a division by 3. For some countries, the yield data are only available quarterly. In these cases, we assume that the yield does not change over the months of the quarter. For countries with short or missing short-term government bill data, we do the following:

- Austria: Use the 1-year note yield.
- Chile: Use the 3-month bill data for 1997-2012Q3 and use the 1-month rate to obtain predicted 3-month rates for the rest of the sample.
- Finland: Use the 2-year note yield.
- Korea: Use the 3-month CD rate.
- Peru: Use the savings deposit yield.
- Turkey: Use the 3-month rate, but for missing periods, use the 1-year yield to obtain predicted 3-month rates for the rest of the sample.
- United Arab Emirates: Use the 3-month interbank rate.
- Portugal and Indonesia: Data from Datastream.

Long term interest rate data We mainly use the 10-year government bond yield from the GFD. Notes:

- Nigeria: No access to GFD 10-year yield data.
- Peru: Downloaded from the Reserve Bank of Peru
- Turkey: 10-year rate starts late. Extrapolate using 5-year yield afterward.

- United Arab Emirates: No data.
- Brazil, China, Israel, Indonesia: Data missing or short, so we use Datastream.
- Brazil: has some missing data. Assume no change in the long rate for those gaps.

Inflation rates We use the not-seasonally-adjusted (NSA) consumer price index inflation rates from the GFD. Notes:

- Australia: Only quarterly inflation. Assume inflation rate constant over the quarters.
- New Zealand: Only quarter inflation from 1943m2. Assume inflation rate constant over the quarters.
- United Arab Emirates: Short data.
- Hungary: CPI inflation data has a few missing months. Assume constant growth inflation for those.

Additional notes The U.S. VAR includes the default spread as a state variable. The default spread is the difference between Moody's BAA-rated U.S.corporate bond yield and AAA-reated U.S.corporate bond yield downloaded from GFD. The VAR for Italy generates extreme return news subcomponents in the pre-2000 period and therefore is excluded from the pre-2000 VAR.

C Theory Appendix

Sections C.1– C.3 in this appendix present an capital asset pricing model under holding costs from the perspective of global equity investors in a more general version of the model setting of Section 4. Section C.4 contains proofs of the results in Section 4 and the previous subsections of this appendix.

C.1 General Setting

There are N equity markets (assets) in unit supply, each with price (market value) P_{jt}, paying dividend D_{jt} to local investors, for $j = 1, ..., N$, all expressed in units of a single consumption good common across countries.

The return to local investors' holdings of asset j is

$$dR_j = \frac{D_{jt}}{P_{jt}}dt + \frac{dP_{jt}}{P_{jt}} = \left(\frac{D_{jt}}{P_{jt}} + \mu_{Pjt}\right)dt + \sigma'_{Rjt}dB_t, \tag{32}$$

where μ_{Pjt} is the proportional drift of the price process, B_t is a K-dimensional Brownian motion capturing all sources of risk in the returns to equity markets in different countries, and σ_{Rjt} is the $K \times 1$ vector of return exposures to the sources of risk captured by B_t. We also write the return process in (32) as

$$dR_j = (r_{ft} + \pi_{jt})\, dt + \sigma'_{Rjt} dB_t, \tag{33}$$

where r_{ft} is the riskfree rate and π_{jt} is the risk premium on market j attainable by local investors. The fact that the riskfree rate is common across countries, when expressed in the same (real) units, corresponds to an assumption of frictionless trade in a riskfree asset across all countries. Note that we do not model explicitly the goods market and exchange rates, although exchange rate risk is part of the overall risk of foreign equity returns expressed in a common numeraire.

A unit mass of global investors can also take *nonnegative* positions in the N equity markets but incur proportional *holding costs* $c_{jt} \geq 0$ in market $j = 1, \ldots, N$, that is, the effective dividend flow they receive is $D_{jt} - c_{jt}P_{jt}$ per unit of time. The return to global investors' holdings of asset j is

$$dR^*_{jt} = \frac{D_{jt} - c_{jt}P_{jt}}{P_{jt}} dt + \frac{dP_{jt}}{P_{jt}} = dR_{jt} - c_{jt}dt. \tag{34}$$

These holding costs may represent different forms of frictions, such as the differential tax treatment of local and foreign investors, inability of investors to access parts of the equity market, the absence of cross-listed securities, poor regulatory frameworks and inadequate property rights protection, concerns regarding the expropriation by local interests of gains to investments by foreigners, and other implicit costs associated with foreign equity investments. Note that our formulation of these costs is restrictive in that holding costs are locally deterministic, so that second moments of returns are the same for both local and global investors.

Markets are complete with respect to B_t, but the equity markets are the only risky assets in positive net supply available to global investors. Global investors may also have a nonzero net aggregate position in the riskfree asset, borrowing against or lending to other agents, such as local investors in different countries. The pricing kernel faced by global investors follows

$$\frac{dM_t}{M_t} = -r_{ft}dt - \omega'_t dB_t, \tag{35}$$

where ω_t is the $K \times 1$ vector of the prices of risk (Sharpe ratios) for the Brownian motions in B_t.

The wealth of a global investor i evolves as

$$\frac{dW_{it}}{W_{it}} = dR_{Wit} - cw_{it}dt, \tag{36}$$

where

$$dR_{Wit} = \left(r_{ft} + \omega'_t\theta_{it}\right) dt + \theta'_{it}dB_t \tag{37}$$

is the return on his wealth, cw_{it} is his consumption-wealth ratio C_{it}/W_{it}, and the $K \times 1$ vector θ_{it} corresponds to his chosen exposures to the sources of risk in B_t. By market clearing and the fact that the N equity markets are the only risky assets in positive net supply,

$$\theta_t = \sum_{j=1}^{N} x_{jt} \frac{P_{jt}}{W_t} \sigma_{Rjt}, \tag{38}$$

where θ_t is the exposure of the aggregate wealth of global investors to the sources of risk in B_t, x_{jt} denotes the share of equity market j held by global investors, and W_t is the aggregate wealth of global investors.

C.2 A Global Investor CAPM with Holding Costs

In this subsection, global investors are assumed to have log utility over their consumption stream. A standard result from portfolio choice theory is the following:

Lemma 1 (Portfolio choice under log utility)**.** *Global investor i chooses risk exposures equal to the prices of risk, $\theta_{it} = \omega_t$.*

Assuming that the $N \times N$ covariance matrix of equity returns $\Sigma_t = Var_t(dR) = \sigma_{Rt}\sigma'_{Rt}$ is invertible (this requires $K \geq N$), where $\sigma_{Rt} = [\sigma'_{R1t}, ..., \sigma'_{RNt}]'$, his optimal portfolio choice can be equivalently expressed in terms of his shares of wealth invested in the N equity markets as:

$$\Theta_{it} = \Sigma_t^{-1} \Pi_t, \tag{39}$$

where Θ_{it} and Π_t are the $N \times 1$ vectors of portfolio shares Θ_{ijt} and equity premia π_{jt}, respectively.

Since global investors have the same portfolio policies as a proportion of their wealth,

$$\theta_t = \omega_t. \tag{40}$$

Define the (scaled) *global investor portfolio return* as:

$$dR_{pt} = \sum_{n=1}^{N} x_{nt} s_{nt} dR_{nt}, \tag{41}$$

where $s_{nt} = P_{nt} / \sum_{n=1}^{N} P_{nt}$ is the relative size (market value) of market n. Combining equations (35), (40), and (41), we have the following pricing equation for any market j with respect to which global investors are not constrained:

$$\pi_{jt} - c_{jt} = \omega'_t \sigma_{Rjt} \tag{42}$$

$$= \mathrm{Cov}_t(dR_{Wt}, dR_{jt}) \tag{43}$$

$$= \left(\frac{P_t}{W_t}\right) \mathrm{Cov}_t(dR_{pt}, dR_{jt}). \tag{44}$$

This implies the following proposition:

Proposition 2 (Global Investor CAPM with Holding Costs)**.** *Local investors' expected excess return to an equity market j in which global investors are active (have strictly positive holdings) is given by*

$$\pi_{jt} = c_{jt} + \beta_{jpt}\lambda_{pt}, \tag{45}$$

where

$$\beta_{jpt} = \frac{Cov_t(dR_{jt}, dR_{pt})}{Var_t(dR_{pt})} \tag{46}$$

is the beta of the asset with the global investor portfolio factor, and

$$\lambda_{pt} = \frac{P_t}{W_t} Var_t(dR_{pt}) \tag{47}$$

is the price of risk of the global investor portfolio factor.

We refer to the version of the model with no holding costs, $c_{jt} = 0$ for all j and t, as the frictionless *model.*

This model, with or without holding costs, is a one-factor asset pricing model with the global investor portfolio return as its factor. The global CAPM, whose single factor is the return on the global equity market portfolio, is a special case of this model under the additional assumption that all (unconstrained) investors hold each equity market in proportion to its market value. In this case, the global equity market portfolio is the mean-variance efficient risky portfolio and its price is $\lambda_{pt} = \mathrm{Var}_t(dR_{Wt})$, since $P_t = W_t$ by market clearing.

We construct an empirical proxy for the return to global investors' risky asset portfolio using foreigners' holdings of equity in each country. However, this return time series is highly correlated with the global equity market portfolio return and the implied alphas and betas for different equity markets are very similar to those under the global CAPM. Hence, for simplicity we focus on the benchmark of the global CAPM in the main text (e.g. Section 5.3).

C.3 The Global Investor Intertemporal CAPM With Holding Costs

If global investors have scale-independent, Epstein-Zin (EZ) preferences with coefficient of relative risk aversion different from unity (the log utility case), the contemporaneous covariance of returns with the overall portfolio return of global investors ceases to be the right summary measure of asset risk for these investors. Instead, investors also care about the covariance of asset returns with news about their future portfolio returns.

Formally, assume in this continuous-time setting that global investors' preferences are of the stochastic differential utility form (Duffie and Epstein (1992)) of the Kreps-Porteus type. Let

$$U_{it} = \frac{1}{1-\gamma}\left(W_{it}V_{it}\right)^{1-\gamma} \tag{48}$$

denote the lifetime utility of global investors. V_{it} denotes the value of a unit of wealth for these investors, which is related to the quality of their future investment opportunities. Let μ_{Vit} and σ_{Vit} (a $K\times 1$ vector) denote its proportional drift and volatility:

$$\frac{dV_{it}}{V_{it}} = \mu_{Vit}dt + \sigma'_{Vit}dB_t. \tag{49}$$

Lemma 2 (Portfolio choice under general EZ preferences)**.** *Global investor i with coefficient of risk aversion γ chooses risk exposures*

$$\theta_{it} = \frac{1}{\gamma}\omega_t - \frac{\gamma-1}{\gamma}\sigma_{Vit} \tag{50}$$

Assuming Σ_t, defined in Lemma 1 is invertible, his optimal portfolio choice can be equivalently expressed in terms of his shares of wealth invested in the equity markets as:

$$\Theta_{it} = \frac{1}{\gamma}\Sigma_t^{-1}\Pi_t - \frac{\gamma-1}{\gamma}\Sigma_t^{-1}\sigma_{Rt}\sigma_{Vit}. \tag{51}$$

Steps similar to those in Section C.2 yield the following proposition.

Proposition 3 (Global Investor Intertemporal CAPM with Holding Costs)**.** *If global investors have Epstein-Zin preferences with coefficient of relative risk aversion γ, local investors' expected excess return to equity market $j = 1, ..., N$ satisfies*

$$\pi_{jt} = \alpha_{jt} + \beta_{jpt}\lambda_{pt} + \beta_{jVt}\lambda_{Vt}, \tag{52}$$

where β_{jpt} is as defined in equation (46)*,*

$$\beta_{jVt} = \frac{Cov_t(dR_{jt}, dV_t)}{Var_t(dV_t)} \tag{53}$$

is the beta of the asset with global investors' marginal value of wealth, and the prices of risk of the two factors are given by

$$\lambda_{pt} = \gamma\frac{P_t}{W_t}Var_t(dR_{pt}) \tag{54}$$

$$\lambda_{Vt} = (\gamma-1)Var_t(dV_t). \tag{55}$$

To understand intuitively the implications of the new terms on the right-hand side (RHS) of equations (50), (51), and (52), consider the case where all returns are homoskedastic. In this case, the intertemporal CAPM model of Campbell (1993) implies that[19]

$$dV_t - \mathbb{E}_t[dV_t] \approx \left(\frac{P_t}{W_t}\right) dH_t, \tag{56}$$

where

$$H_t \equiv \mathbb{E}_t\left[\sum_{\tau=1}^{\infty}\rho_{CS}^{\tau} r_{p,t+(1+\tau)\Delta}\right]. \tag{57}$$

[19]See Chapters 6 and 9 of Campbell (2018) for a textbook exposition.

Here, $r_{p+t+(1+\tau)\Delta}$ is the log of the gross discrete-time return over the time increment Δ realized at time $t+(1+\tau)\Delta$, and $\rho_{CS} = \rho_{CS}(\Delta)$ is the constant in the Campbell-Shiller loglinear return decomposition, applied to the global investor portfolio return.[20] In this case, the global investor ICAPM can be expressed as

$$\pi_{jt} = \alpha_{jt} + \beta_{jpt}\lambda_{pt} + \beta_{jHt}\lambda_{Ht}, \tag{58}$$

where

$$\beta_{jHt} = \frac{\text{Cov}_t(dR_{jt}, dH_t)}{\text{Var}_t(dH_t)} \tag{59}$$

is the beta of the asset with the innovations in the discounted sum of future expected returns (portfolio discount rates) on the RHS of equation (57), and

$$\lambda_{Ht} = (\gamma - 1)\frac{P_t}{W_t}\text{Var}_t(dH_t) \tag{60}$$

is the price of risk of the portfolio discount rate factor.

In the empirically relevant case with $\gamma > 1$, assets that do badly at times when investors revise downwards their expectations of future portfolio returns are perceived to be riskier by global investors, for a given contemporaneous correlation between asset returns and portfolio returns. As a result, they command higher risk premia, all else equal.

Therefore, the generalization to Epstein-Zin preferences raises the possibility that countries with low foreign investor positions and low contemporaneous return correlations with the portfolio of global investors are in fact risky investments because their returns are highly correlated with future expected returns to global investors' portfolio. This could justify their high observed average excess returns even in the absense of holding costs. In future work, we intend to extend our empirical analysis to the ICAPM model of equation (58) in order to test whether this new theoretical possibility relative to the CAPM of Proposition 2 is empirically relevant.

C.4 Proofs of Analytical Results

To Be Added.

[20]This decomposition is exact if global investors have a unit elasticity of intertemporal substitution, so that they choose a constant consumption-wealth ratio cw, which appears in the budget constraint (36).