Institutional Investment and International Risk-sharing

Lucie Y. Lu

University of Melbourne

First draft: Feb, 2021

This version: December 22, 2024

Click for latest version

*e-mail: lucie.lu@unimelb.edu.au; website: www.yiliulu.com. This paper is based on the second chapter of my doctoral thesis. I am grateful to Ines Chaieb, Jan Ericsson, Vihang Errunza, and Alexandre Jeanneret for their support and guidance. I thank Amir Akbari, Daniel Andrei, Patrick Augustin, Laurent Barras, Paul Beaumont, Sébastien Betermier, Francesca Carrieri, Adolfo de Motta, Anisha Ghosh, Mattias Herrmann (discussant), Weiyu Jiang, Evan Jo, Hugues Langlois, Marius Mihai (discussant), Ella Patelli, Luca Pezzo (discussant), Thomas Rivera, Guillaume Roussellet, Ali Shahrad, David Schumacher, Valeri Sokolovski, Stephen Szaura, David Volkman (discussant), Gregory Weitzner, Yu Xia, Terry Zhang (discussant), and seminar participants at McGill University, HEC Montréal, Stevens Institute of Technology, Monash Business School, the University of Melbourne, the University of Guelph, HEC Lausanne, Kelley School of Business, SFU, the University of Sydney, World Symposium of Banking and Finance 2021, World Finance Conference 2022, Bank of Canada GSPA 2022, SFA 2022, SWFA 2023, and AFBC 2023 for helpful comments. I thank Hugues Langlois for sharing lots of helpful Matlab code. This research is supported by the Research Computing Services (RCS) at the University of Melbourne. I also thank Calcul Québec and Compute Canada for access to the supercomputer Cedar. All errors are my own.

Institutional Investment and International Risk-sharing

ABSTRACT

I develop a new asset pricing model where global institutional investors and local retail investors have non-overlapping investment opportunities. Institutional investors facilitate international risk-sharing between home-biased retail investors, which depends on their mandate, risk-bearing capacity, and substitutability of securities across countries. Securities earn a world market risk premium and an *institutional local risk premium* based on institutional risk aversion. Securities not held by institutions earn a *retail local risk premium* determined by retail investors' risk aversion. The model is estimated using equity returns in 38 markets. The average annual institutional local risk premium is 2.76% in developed markets and 6.27% in emerging markets, while the retail local risk premium is 1.71% and 2.65% , respectively. Higher global institutional ownership lowers the cost of capital in emerging markets.

JEL classification: G12, G15, F30, G20.

Keywords: international asset pricing, institutional investors, market integration.

A long-standing question in international asset pricing is whether financial assets are priced locally or globally (Karolyi and Stulz, 2003). The answer to this question is crucial for optimal international portfolio choice, the performance evaluation of global asset managers, and the calculation of the cost of capital for firms worldwide. Existing theories that focus on explicit investment barriers predict that financial assets not subject to direct investment restrictions should be priced solely by global risk factors.

Despite the lifting of explicit investment barriers due to financial globalization over the past few decades, the pricing of internationally traded assets continues to depend strongly on local risk factors (Lewis, 2011). Furthermore, globalization measures have limited explanatory power regarding the convergence in asset pricing across markets (Bekaert, Harvey, Kiguel, et al., 2016). The significance of local risk factors suggests that not all investors diversify globally. To determine how financial assets are priced, it is crucial to consider whether they are primarily held by global or local investors.

I develop and estimate a new asset pricing model that accounts for the non-overlapping investment opportunity sets of global versus local investors. Global investors, whom I refer to as *institutional investors*, are willing to diversify internationally but must do so through institutions to overcome international trading frictions. *Institutional investors* diversify globally but only invest in a subset of assets within each country, constrained by their mandates. Local investors, referred to as *retail investors*, invest only domestically, but they invest in all available assets.[1] This setup nests existing partially segmented market structures (e.g., Chaieb and Errunza, 2007, Greenwood, Hanson, and Liao, 2018) as special cases. The model makes two distinct predictions. First, assets held by global investors also earn a local risk premium. Second, the market-wide local risk premium can be decomposed into an *institutional local (market) risk premium*, dependent on institutional investors' risk aversion, and a *retail local (market) risk premium*, dependent on retail investors' risk aversion. I estimate

[1]Here, retail investors include all local investors who primarily diversify within their domestic market. I refer to them as *retail investors* because the literature has provided abundant direct evidence of the strong local bias of retail investors, which is influenced by implicit barriers related to cultural and informational environments (Karlsson and Nordén, 2007; Seasholes and Zhu, 2010).

the model using equity returns and ownership by global institutional investors across 38 economies. The results indicate that both local risk premiums are economically significant across a wide range of economies. Additionally, emerging market firms with higher global institutional ownership face lower costs of capital.

The single-period equilibrium model includes both a domestic and a foreign country. Securities included in the institutional mandate are defined as *institutional securities*, while the remaining securities, held only by retail investors, are defined as *retail securities*. Due to the home bias of retail investors, markets are partially segmented across country borders. Additionally, due to the limited mandate of institutional investors, markets are also segmented between institutional and retail securities within each country. While the assumption of market segmentation might seem extreme, unlike Zerbib, 2022, who interpret segmentation literally as exclusionary screening, here segmentation is considered a limiting case to capture the heterogeneous preferences of global versus local investors. Cross-border risk-sharing is facilitated by institutional investors investing in institutional securities from both countries. Consequently, the degree of international risk-sharing depends on three aspects of institutional investments: the *coverage* of their mandate, the *correlation* between institutional securities from different countries, and their risk-bearing *capacity*.

To understand the risk-sharing mechanism in the model, consider a scenario where the domestic country is the U.S. and the foreign country is China. Take, for example, two companies in China: Cathay Biotech, a biotech company classified as an institutional security, and Zoneco, a fishery company classified as a retail security. Global institutional investors, such as CalPERS (California Public Employees' Retirement System), can invest in institutional securities like Cathay Biotech but are restricted from directly investing in retail securities like Zoneco. However, CalPERS can still gain partial exposure to the Chinese market by investing in institutional securities, thereby accessing the component of Chinese investment opportunities that these securities can replicate, defined as the investment opportunities' *attainable returns*. Since institutional investors are global investors, only these attainable returns contribute to international risk-sharing. Consequently, the extent of international risk-sharing depends firstly on the coverage of global investors' investment mandates, specifically the investment opportunities spanned by institutional securities. Conversely, Chinese retail investors must bear the residual risk associated with retail securities, which cannot be replicated by institutional securities and, therefore, cannot be shared with institutional investors. As a result, retail investors require a *retail local risk premium* as compensation for bearing this risk, with the premium increasing with their risk aversion.

Cross-border risk-sharing is facilitated by institutional investors, as retail investors from different countries do not invest in common securities. Referring back to the previous example, CalPERS hedges its investment in Chinese institutional securities by selling an optimally mimicking portfolio of U.S. institutional securities, such as Apple, to home-biased U.S. retail investors. For these retail investors, this portfolio serves as the best "homemade" substitute for Chinese investments. Due to this international risk-sharing, securities earn an *attainable world market risk premium* for their covariance with the world market portfolio of attainable returns, representing the global risk that is shared through institutional investment.

The effectiveness of such cross-border risk-sharing depends on the degree of substitutability between institutional securities from different countries.[2] In the extreme case of perfect substitutability, perfect replicating portfolios for Chinese institutional securities could be constructed using U.S. institutional securities, and vice versa. In such a scenario, risk-sharing would be perfect across domestic and foreign institutional securities, resulting in both sets of securities being priced by the same risk factors and earning identical risk premiums. However, when substitutability is not perfect, institutional investors, along with local retail investors, must bear the residual risk associated with domestic institutional securities that cannot be fully hedged with foreign institutional securities. This residual local risk leads to an *institutional local risk premium*, which increases with the risk aversion of institutional investors.

[2] Substitutability refers to the extent to which a security can be replicated by other securities. Greenwood, Hanson, and Liao, 2018 also discuss the notion of substitutability.

In summary, the model predicts three sources of risk premiums in equilibrium. All securities earn an attainable world market risk premium and an institutional local risk premium. The institutional local risk premium arises from imperfect cross-border risk-sharing. Additionally, retail securities earn a retail local risk premium due to imperfect risk-sharing between institutional investors and local retail investors.

These theoretical results can help explain how the rise of global institutional investment influences firms' cost of capital. Over the past two decades, institutional investors have significantly increased their international diversification and ownership stakes in public firms (Faias and Ferreira, 2017). The proportion of total market capitalization owned by global institutional investors, defined as those allocating more than 20% of their equity investments internationally, has grown from 3.65% to 17.59% between 2000 and 2023. In contrast, other investors, such as local institutions, retail investors, and insiders, have shown persistent home bias (Chaieb, Errunza, and Lu, 2023).

The model suggests that the growth of global institutional investment could mitigate the effects of this home bias by enhancing international risk-sharing. Specifically, an increase in the risk-bearing capacity of global institutions, as indicated by the growth in their assets under management (AUM), is associated with a lower institutional local risk premium. Additionally, the expansion of their investment mandate into more niche market segments, such as emerging markets small-cap value, should decrease the retail local risk premium.

Another application is decomposing market-wide local risk premiums into institutional and retail components, which helps estimate the different contributions of global and local investors to local risk premiums. This decomposition is valuable for identifying whether a distressed episode originates from shocks to the risk-bearing capacity of the global financial sector or to local risk aversion. Finally, the asset pricing results provide a refined benchmark for assessing global asset managers' performance: a positive alpha relative to a world plus local market two-factor benchmark may result from overweighting retail securities rather than demonstrating superior skills.

I validate the model by focusing on global equity markets. Mapping the theory to the data involves two main challenges. The first challenge is identifying the group of global investors. To address this, I utilize FactSet institutional holdings data and define global institutions as those institutional investors that allocate at least 20% of their total AUM globally. The second challenge is classifying institutional versus retail securities. The investment mandate of the aggregate global institutional investor is inferred based on security-level global institutional ownership. Securities with global institutional ownership above a certain threshold are classified as institutional securities, while the remainder are considered retail securities.

The model is estimated using monthly individual stock returns data from the Compustat Global database, covering the period from January 2000 to December 2020 across 38 countries. I first perform a simple Fama and MacBeth, 1973 two-pass regression to test whether the institutional local factor and the retail local factor are significantly priced in the cross-section of individual stocks. The results show widespread evidence supporting the significance of both local factors. Specifically, the institutional local factor is significantly and positively priced in 15 out of 23 developed markets (DMs) and in 9 out of 15 emerging markets (EMs). Meanwhile, the retail local factor is significantly and positively priced in 7 out of 23 DMs and in 6 out of 15 EMs.

To further quantify different risk premiums and analyze their variations over time and across individual stocks, a second estimation is conducted using the conditional two-pass regression framework developed by Gagliardini, Ossola, and Scaillet, 2016 (GOS). The GOS framework employs both common and stock-specific instruments to model time-varying risk premiums and factor exposures, allowing for the estimation of country-level as well as individual stock-level time-varying risk premiums.

The estimation reveals two main findings: First, both the institutional local and retail local premiums are economically significant in both developed markets (DMs) and emerging markets (EMs). On average, the institutional local premium is 2.76% in DMs and 6.27% in

EMs, while the retail local premium averages 1.71% in DMs and 2.65% in EMs. Consistent with the theoretical prediction, the institutional local risk premium is lower in countries with higher levels of global institutional ownership, which serves as a proxy for the risk-bearing capacity of institutional investors in each country. Second, in DMs, the time variation in the total risk premium is primarily driven by the attainable world premium and the institutional local premium. In contrast, in EMs, the retail local risk premium also plays a significant role in the variation of the total risk premium.

Lastly, I quantify the effect of global institutional ownership on firms' cost of capital by conducting panel regressions of model-implied risk premiums on lagged firm-level global institutional ownership. After controlling for firm-level variables and country-time fixed effects, a 1% increase in global institutional ownership is associated with a reduction of 8.1 basis points in the total risk premium in emerging markets (EMs). This finding suggests that higher global institutional ownership reduces the cost of capital for firms in EMs.

Literature Review This paper builds on the literature on international asset pricing, which has motivated the existence of local risk premiums in two main ways. First, some studies assume that the pricing kernel is linear in the local market factor (e.g., Bekaert, 1995, Bekaert, Harvey, Lundblad, et al., 2007). This assumption leads to a market-level local risk premium that depends on securities' covariance with their local market portfolio. Second, formal asset pricing theories derive equilibrium risk premiums based on assumptions about different types of market segmentation (e.g., Errunza and Losq, 1985, Alexander, Eun, and Janakiramanan, 1987, De Jong and De Roon, 2005, Chaieb and Errunza, 2007, Chaieb, Errunza, and Langlois, 2021). These models typically distinguish between investable securities, accessible to all investors, and uninvestable securities, accessible only to local investors, assuming full diversification into investable securities by investors. As a result, a common prediction is that investable securities are priced globally by the world market portfolio, while uninvestable securities earn local risk premiums due to their covariance with noninvestable market risk that cannot be spanned by investable securities.

Contrary to these predictions, the empirical literature on international factor models often finds that local models outperform global ones, even in the absence of explicit barriers (Griffin, 2002; Hou, Karolyi, and Kho, 2011; Fama and French, 2012; Petzev, Schrimpf, and Wagner, 2016; Karolyi and Wu, 2018; Hollstein, 2020; Chaieb, Langlois, and Scaillet, 2021). Therefore, investability alone does not fully characterize the structure of global equity markets. This paper contributes to the literature by incorporating realistic investor heterogeneity and nesting existing local risk premiums as special cases. The concept of the institutional local risk premium captures market-level attainable returns that are priced locally, akin to the local market risk premium in pricing-kernel-based models. The prediction that all securities earn an institutional local risk premium helps bridge the gap between theoretical predictions and empirical observations. Both the institutional and retail local risk premiums resemble the local risk premiums in existing theories of segmentation, as they arise from local risks in one market segment that cannot be hedged by another segment.

The theoretical framework of this paper also connects to two other strands in the finance literature. The first strand addresses the asset pricing implications of under-diversification caused by information frictions, preferences, or exclusionary screening (Merton, 1987; Fama and French, 2007; Luo and Balvers, 2017; Zerbib, 2022). This paper diverges from Merton, 1987 by relaxing the assumption that returns are generated by a one-factor model, which is unrealistic in an international context. By doing so, it allows for a non-diagonal covariance structure across the local components of asset returns. This approach aligns with Luo and Balvers, 2017 and Zerbib, 2022; however, unlike these studies, I consider a more general case where multiple groups of investors under-diversify, resulting in non-overlapping investment opportunity sets so that no common investable assets are available to all investors.[3] Consequently, the local systematic risk in each market segment is priced separately, determined by the international diversification of global investors.

[3] In Merton, 1987, the investable asset is a forward contract tracking the single factor.

The second thread is the theoretical literature on arbitrage activities and market integration, where arbitrageurs trade across segmented markets. Market integration is limited by frictions such as collateral constraints (Gromb and Vayanos, 2002), holding costs (Tuckman and Vila, 1992), or slow-moving capital (Greenwood, Hanson, and Liao, 2018). In this paper, institutional investors act as "arbitrageurs" by investing across country borders, leading to institutional securities from different countries being priced identically to the extent that they can perfectly replicate each other.[4] The main friction considered here is the limited mandate of the "arbitrageur." Although retail securities from two countries do not share a common investor, institutional investors can indirectly integrate these markets through their correlation with the respective local institutional securities.

The empirical results in this paper contribute to a growing body of literature investigating how institutional investment influences asset returns. In a U.S. domestic context, Edelen, Ince, and Kadlec, 2016 find that institutional demand is negatively associated with long-term stock returns, a relationship that cannot be attributed to price reversals. Pavlova and Sikorskaya, 2023 demonstrate that inelastic demand from benchmarked institutional investors predicts lower future stock returns. However, studies examining institutional investment in the context of international asset pricing are less common. Bartram et al., 2015 show that the pricing of stocks can be explained by their co-movement with foreign stocks that share similar institutional investors. Faias and Ferreira, 2017 document that industry and global factors are more significant than country factors in explaining return variations for stocks with higher institutional ownership. While they focus on the variance explained by global versus local factors, this paper emphasizes quantifying the impact of institutional ownership on the levels of global and local risk premiums. Kacperczyk, Sundaresan, and Wang, 2021 find that foreign institutional ownership enhances price informativeness by replacing less-informed local retail investors, thereby reducing firms' cost of equity. This paper complements these findings by highlighting that global institutional ownership lowers the cost

[4] Strictly speaking, unless there is perfect replication, there is no risk-free arbitrage for the institutional investors.

of capital through improved cross-border risk-sharing across segmented markets.

The paper proceeds as follows: Section I develops an asset pricing model featuring mandate-constrained global institutional investors and home-biased retail investors; Section II outlines the empirical framework; Section III presents the empirical results; and Section IV concludes.

I. Model

A. Setup and Assumptions

Consider an economy with two countries: domestic (D) and foreign (F). In this section and in Appendix A, bold font is used to represent vectors, $'$ denotes the transposition operator, and the superscript * indicates foreign securities.

Assumption 1 (No currency risk). In line with the international asset pricing literature that focuses on investment barriers (e.g., Stulz, 1981), I assume that purchasing power parity (PPP) holds and there is no currency risk. All security returns are denominated in the domestic currency.

Assumption 2 (Agents). There are three types of investors: *institutional investors* are global investors who invest in both countries, *domestic retail investors* and *foreign retail investors* are fully home-biased.[5] The term *choice set* refers to the set of securities considered by an investor when making portfolio decisions. Retail investors' choice sets consist solely of their domestic securities. Institutional investors, however, are constrained by their mandate and consider only a subset of securities from each country. Following Koijen, Richmond,

[5]For simplicity, this model does not differentiate between domestic and foreign institutional investors, treating them as a single type. The institutional investors represent large global financial institutions that trade across country borders. Local institutions that only invest domestically are not distinguished from retail investors. This is justified by the relatively small domestic local institutional sector in most sample countries. As of the end of 2023, domestic local institutional ownership averaged 3.84% in DMs and 2.19% in EMs, suggesting their smaller impact compared to other investor types. The home bias of domestic institutional investors are studied in (Chan, Covrig, and Ng, 2005; Lau, Ng, and Zhang, 2010).

and Yogo, 2023, it is assumed that their mandate is exogenous.[6] Without loss of generality, the model has one representative institutional investor (i), one representative domestic retail investor (d), and one representative foreign retail investor (f).

Assumption 3 (One-period portfolio choice). Agents have CARA preferences. Investors receive an endowment and trade at time t to maximize their utility over wealth at time $t+1$. Each investor $k \in \{d, f, i\}$ has an absolute risk aversion parameter γ^k and solves the following single-period portfolio choice problem:

$$\max_{\mathbf{x}_t^k} \mathbb{E}[U(W_{t+1}^k)] = \max_{\mathbf{x}_t^k} \mathbb{E}[-\exp(-\gamma^k W_{t+1}^k)]$$

$$W_{t+1}^k = W_t^k(1 + r_f) + \sum_{j \in \mathcal{C}^k} x_{j,t}^k r_{j,t+1}$$

where investor k chooses their optimal dollar investment $\mathbf{x}_t^k = [x_{1,t}^k, \cdots, x_{j,t}^k, \cdots, x_{|\mathcal{C}^k|,t}^k]'$ for all securities j in their choice set $\mathcal{C}^k$ containing $|\mathcal{C}^k|$ securities, and $r_{j,t+1}$ is the excess return of security j.

Assumption 4 (Market structure). There are N risky securities. A market segment is defined as a set of securities that share the same group of investors. Due to the home bias of retail investors and the limited mandate of institutional investors, four market segments arise. Domestic and foreign securities included in the institutional investor's mandate are termed domestic and foreign *institutional securities* (labeled as I and I^*, respectively), while the remaining securities, only held by retail investors, are termed domestic and foreign *retail securities* (labeled as R and R^*, respectively). The $N = N_R + N_I + N_{I^*} + N_{R^*}$ risky securities are partitioned into four segments: N_R domestic retail securities, N_I domestic institutional securities, N_{I^*} foreign institutional securities, and N_{R^*} foreign retail securities. For simplicity,

[6] The limited investment mandate of global institutional investors may be due to factors such as limited information (Merton, 1987), regulatory constraints, environmental, social, and governance (ESG) concerns (Matos, 2020), and information costs (De Marco, Macchiavelli, and Valchev, 2022).

time subscripts are omitted.

Assumption 5 (Security returns). $\mathbf{r}_R$, $\mathbf{r}_I$, $\mathbf{r}_{I^*}$, and $\mathbf{r}_{R^*}$ denote the column vectors of excess returns of domestic retail, domestic institutional, foreign institutional, and foreign retail securities, respectively. For example, the $N_I \times 1$ vector of excess returns on domestic institutional securities is $\mathbf{r}_I = [r_{I_1}, \cdots, r_{I_{N_I}}]'$. The one-period excess returns of securities are assumed to be jointly normally distributed. Additionally, the covariance structure between the returns of risky securities is assumed to be exogenous. A $N_I \times N_R$ matrix V_{IR} represents the covariance matrix between domestic institutional and domestic retail securities, while V_{jI} denotes a $1 \times N_I$ vector containing the covariances between security j and domestic institutional securities. Similar notation is used for other covariance matrices and vectors. Consistent with many CAPM-type models, the supply of risky securities is assumed to be exogenous in terms of their market capitalization.[7] Security risk premiums, denoted as μ, are endogenously determined in equilibrium by investors' optimization and market clearing conditions.

Assumption 6 (Borrowing and short-selling). Investors can borrow and lend at the risk-free rate r_f, which is denominated in the domestic currency. There are no short-sale constraints.

A distinct feature of this setup, compared to existing international asset pricing models with partial segmentation (e.g., Alexander, Eun, and Janakiramanan, 1987; Chaieb and Errunza, 2007), is the absence of a common set of investable securities available to all investors. Specifically, due to their home bias, retail investors from different countries have non-overlapping choice sets and must rely on trading with institutional investors for international risk-sharing. This shifts the focus of international risk-sharing from security-level investability to the diversification strategies of global investors. Although Merton, 1987 also assumes non-overlapping investment sets across investors when investing in firms, he im-

[7] See Zerbib, 2022 for a recent example.

poses a factor structure on asset returns and assumes that all investors can commonly trade a forward contract on the common factor.

The current market structure resembles those featuring an arbitrageur trading in two segmented markets, such as in Gromb and Vayanos, 2002 and Greenwood, Hanson, and Liao, 2018. However, unlike these models, where the arbitrageur can trade all securities, the institution in my model operates under a limited mandate. Additionally, rather than focusing on a single security in each segmented market, this model considers a more general case with multiple securities in each segment, without imposing strict restrictions on their covariance structure.

B. Equilibrium risk premiums

The model is symmetric between the domestic and foreign countries; therefore, the following discussion focuses on the equilibrium results for domestic investors and securities. The results for the foreign country are entirely symmetric and, consequently, are not repeated.

I define the *domestic market portfolio* D as the value-weighted portfolio of all domestic securities. The excess return on this portfolio is denoted by r_D, and its total market capitalization is denoted by M_D. The value-weighted portfolios of domestic institutional and domestic retail securities are referred to as the domestic *institutional portfolio* I and the *domestic retail portfolio* R, respectively. The excess returns on these portfolios are denoted by r_I and r_R, and their total market capitalizations are denoted by M_I and M_R. The foreign market, institutional, and retail portfolios are defined analogously, with their excess returns denoted as r_F, r_{I^*}, and r_{R^*}, and their total market capitalizations denoted as M_F, M_{I^*}, and M_{R^*}.

Given the set of institutional securities, the return of any domestic investment j can be decomposed into a component replicable using domestic institutional securities and a residual component. This is done by performing a multiple regression of its return r_j onto the returns of domestic institutional securities. The *attainable return* $\hat{r}_j$ of security j is defined as the return on the mimicking portfolio, termed the *attainable portfolio*:

$$\hat{r}_j = B_{jI}\mathbf{r}_I \tag{1}$$

where $B_{jI} = V_{jI}V_{II}^{-1}$ is a row vector of regression coefficients. The attainable exposure $\hat{r}_j$ represents the component of security j's return that can be attained by the institutional investor. The residual $\varepsilon_j = r_j - \hat{r}_j$ is the component of security j that is only accessible to the domestic retail investor. By definition, the return of any institutional security is attainable. If a domestic retail security can be perfectly replicated by a portfolio of domestic institutional securities, it is considered attainable, even if not directly invested by the institutional investor.

The *attainable domestic market portfolio* $\hat{D}$ is defined as the portfolio of domestic institutional securities that optimally mimics the domestic market portfolio, with its excess return denoted as $r_{\hat{D}}$. The attainable domestic market portfolio is the value-weighted portfolio of the domestic institutional portfolio and the attainable return of the domestic retail portfolio $\hat{r}_R$:

$$r_{\hat{D}} = \frac{M_I}{M_D} r_I + \frac{M_R}{M_D} \hat{r}_R \tag{2}$$

The attainable foreign market portfolio $\hat{F}$ is defined similarly. Due to its mandate constraint, the institutional investor does not invest in the domestic market portfolio but would invest in the attainable domestic market portfolio.

Because the institutional investor only trades foreign institutional securities with the home-biased foreign retail investor, international risk-sharing depends on the extent to which the attainable domestic market portfolio can be substituted by foreign institutional securities. To analyze this, I decompose the return on the attainable domestic market portfolio

$\hat{D}$ into a component that can be replicated by a portfolio of foreign institutional securities and a residual component that is beyond the reach of the foreign retail investor. I define the *substitute portfolio* for the domestic market portfolio D^s as the portfolio of foreign institutional securities that optimally mimics the attainable domestic market portfolio, referring to its return as the *substitute return*. The substitute portfolio is constructed by performing a multiple regression of the return on the attainable domestic market portfolio onto the returns of foreign institutional securities:

$$r_{D^s} = B_{\hat{D}I^*}\mathbf{r}_{I^*} \tag{3}$$

where $B_{\hat{D}I^*} = V_{\hat{D}I^*}V_{I^*I^*}^{-1}$ is a row vector of regression coefficients. In equilibrium, the institutional investor sells the substitute portfolio to the foreign retail investor, who considers it the optimal substitute for domestic investment. Appendix A.3 provides further details about the equilibrium investment by each investor.

The following proposition provides the equilibrium risk premiums of domestic securities.[8]

PROPOSITION 1 (Equilibrium Risk Premiums):

If Assumptions 1-6 are satisfied,

1. the equilibrium risk premium of any domestic securities j is:

$$\mu_j = \underbrace{\gamma M_W \mathbb{C}ov(\hat{r}_j, r_{\hat{W}})}_{\textit{attainable world market premium}} + \underbrace{\frac{\gamma^i}{\gamma^f}\gamma M_D \mathbb{C}ov\big(\hat{r}_j, r_{\hat{D}} - r_{D^s}\big)}_{\textit{institutional local premium}} + \underbrace{\gamma^d M_R \mathbb{C}ov\big(r_j, r_R - \hat{r}_R\big)}_{\textit{retail local premium}} \tag{4}$$

2. particularly,

[8] See Appendix A for proof.

(i) the risk premium of any domestic institutional security I_j is:

$$\mu_{I_j} = \underbrace{\gamma M_W \mathbb{C}ov(r_{I_j}, r_{\hat{W}})}_{\textit{attainable world market premium}} + \underbrace{\frac{\gamma^i}{\gamma^f}\gamma M_D \mathbb{C}ov\big(r_{I_j}, r_{\hat{D}} - r_{D^s}\big)}_{\textit{institutional local premium}} \quad (5)$$

(ii) the risk premium of any domestic retail security R_j is:

$$\mu_{R_j} = \underbrace{\gamma M_W \mathbb{C}ov(\hat{r}_{R_j}, r_{\hat{W}})}_{\textit{attainable world market premium}} + \underbrace{\frac{\gamma^i}{\gamma^f}\gamma M_D \mathbb{C}ov\big(\hat{r}_{R_j}, r_{\hat{D}} - r_{D^s}\big)}_{\textit{institutional local premium}} + \underbrace{\gamma^d M_R \mathbb{C}ov\big(r_{R_j}, r_R - \hat{r}_R\big)}_{\textit{retail local premium}} \quad (6)$$

where γ is the aggregate absolute risk aversion defined in A.27. $r_{\hat{W}}$ is the return on the attainable world market portfolio defined as the value-weighted portfolio of the attainable portfolios from each country.

$$r_{\hat{W}} = \frac{M_D}{M_W} r_{\hat{D}} + \frac{M_F}{M_W} r_{\hat{F}}$$
$$M_W = M_D + M_F$$

Domestic securities earn three types of risk premiums. The first risk premium, which I refer to as the *attainable world market risk premium*, compensates for the covariance between the attainable return of domestic security j and the attainable world market factor. The attainable world market factor represents the component of world market risk that is shared through institutional investors. γ denotes the aggregate absolute risk aversion of the economy. This aggregate risk aversion increases with the absolute correlation between domestic and foreign institutional securities because the equilibrium is derived from the first-order condition of the institutional investor.[9] The intuition behind this is that as institutional securities become more correlated across countries, there is less opportunity for diversification, leading to higher effective risk aversion.

[9] See Appendix A for a detailed discussion.

In addition to the attainable world market risk premium, domestic securities also earn two local risk premiums. The first local risk premium, which I define as the *institutional local premium*, compensates for the covariance between the attainable exposure of domestic security j and the institutional local risk factor. The *institutional local risk factor* is defined as the return difference between the attainable domestic market portfolio and its substitute portfolio.

$$f^{inst} = r_{\hat{D}} - r_{D^s} \tag{7}$$

This first local risk premium arises because the substitute portfolio does not perfectly replicate the attainable domestic market portfolio. As a result, institutions cannot perfectly hedge their positions in one country by trading institutional securities from another country. The price of institutional local risk increases with the risk aversion of the institutional investor, γ^i and decreases with the risk aversion of the foreign retail investor, γ^f. Intuitively, when the institutional investor is more risk-averse compared to the foreign retail investor, fewer foreign institutional securities are held by the institutional investor. The resulting reduction in international risk-sharing from domestic to foreign increases the domestic institutional local premium.

The attainable world premium and the institutional local premium depend on the attainable exposure of a security. This is because these two risk premiums are associated with cross-border risk sharing, and any covariance between securities from different countries must be transmitted through their attainable exposure, which is accessible to institutional investors.[10]

I define the second local risk premium as the *retail local risk premium*, which compensates for the covariance between security j's return and the residual in the domestic retail

[10]Karolyi and Wu, 2018 include a similar indirect covariance term in their empirical specification, but it involves the indirect covariance through an investable set accessible to all investors. In my model, the indirect correlation occurs through institutional securities within each country.

portfolio's return that is not attainable. I refer to this as the *retail local factor*:

$$f^{retail} = r_R - \hat{r}_R \tag{8}$$

This risk premium compensates for the component of security j's covariance with the domestic retail portfolio that cannot be explained by domestic institutional securities. The price of the retail local risk depends on the risk aversion of the domestic retail investor, γ^d, as this residual risk is held exclusively by the domestic retail investor. If j is a domestic institutional security, the retail local risk premium is zero because its return is orthogonal to the reatil local factor.

Appendix A shows that the general pricing result (4) implies the following beta representation:

$$\mu_j = \beta^{\hat{W}} \mu^{\hat{W}} + \beta_j^{inst} \mu^{inst} + \beta_j^{retail} \mu^{retail} \tag{9}$$

where $\mu^{\hat{W}}$, μ^{inst} and μ^{retail} are the risk premiums of the attainable world market factor, the institutional local factor and the retail local factor and βs are defined in (A.43), (A.44) and (A.45).

The relative importance of global versus local risk premiums depends on three aspects of global institutional investment. First, the *coverage* of the institution's mandate: if an asset is spanned by institutional securities, its retail local risk premium would be zero. Second, the substitutability (*correlation*) between domestic and foreign institutional securities determines the extent to which risk can be shared through cross-border institutional investment. Third, the risk-bearing *capacity* of the institutional investor, $\frac{1}{\gamma^i}$, determines the level of the institutional local risk premium.

The model encompasses existing models as special cases.[11] First, consider relaxing the assumption of retail investors' home bias. When retail investors fully diversify globally, in-

[11]Internet Appendix A provides detailed proofs.

stitutional (retail) securities are priced as eligible (ineligible) securities in Errunza and Losq, 1985. If retail investors' international diversification is limited to institutional securities, facing similar implicit barriers as institutional investors, the model aligns with the partial segmentation case described in Alexander, Eun, and Janakiramanan, 1987 and Chaieb and Errunza, 2007, now incorporating an institutional investor. In these cases, institutional securities are priced as globally accessible, investable assets, while retail securities are priced as local, uninvestable assets. Second, when institutional investors are not constrained by mandates, the market structure resembles that of Greenwood, Hanson, and Liao, 2018. Here, the retail local risk premium is zero, as risk-sharing is perfect between institutional and retail investors.

C. Testable implications

The theory has the following testable implications. First, the institutional local risk premium should be positive in countries with limited foreign retail investment, and the retail local risk premium should be positive in countries where institutional investors do not have a broad mandate. Second, although the model is static, it predicts that the institutional local premium increases when institutional investors' risk aversion rises relative to retail investors. Thus, in the time series, the institutional local premium should be higher when institutional investors are more risk-averse compared to retail investors. This scenario occurs when the risk-bearing capacity of financial institutions is reduced due to financial rather than fundamental shocks.[12] Third, in the cross-section, stocks with higher institutional ownership and stocks more correlated with local institutional securities should earn a higher attainable world premium, a higher institutional local premium, and a lower retail local premium. The price of the attainable world market factor reflects the risk-bearing capacity of all investors, while the price of the institutional local factor reflects the risk-bearing capacity of institutional and retail investors within a country. In contrast, the retail local risk premium

[12] Akbari, Carrieri, and Malkhozov, 2022 document instances when global institutions have less capacity to hold global securities due to tightening financial constraints.

reflects the risk-bearing capacity of local retail investors only. Since average risk aversion decreases with a larger investor base and better risk-sharing, the price of the retail local factor should be higher due to the lack of risk-sharing. Consequently, firms with higher institutional ownership or greater correlation with local institutional securities should face a lower cost of capital.[13]

II. Empirical Framework

This section introduces the empirical framework. I first explain the construction of the institutional and retail local factors, followed by a discussion of the econometric specification and identification technique used to estimate the risk premiums of individual stocks. The data sources for this study are also described. In the empirical sections, when the distinction between a vector and a scalar is clear from the context, I do not use bold font.

A. Constructing asset pricing factors

I first construct three pricing factors predicted by the theory, as defined in Section I.B. For each domestic country in the sample D, the returns on the attainable market portfolio $r_{\hat{D}}$ and the attainable retail portfolio $\hat{r}_R$ are estimated by regressing the returns of the market portfolio r_D and the retail portfolio r_R onto the return of the institutional portfolio r_I:

$$r_{\hat{D},t} = \beta_{\hat{D}I,t} r_{I,t}$$

$$\hat{r}_{R,t} = \beta_{RI,t} r_{I,t}$$

where $\beta_{\hat{D}I,t}$ and $\beta_{RI,t}$ are coefficients from 36-month rolling regressions.[14]

The retail local factor is defined as the return difference between the domestic retail

[13]Internet Appendix B provides more details about how a firm's risk premium changes after it is included in the mandate of institutional investors.

[14]Institutional stocks identified in January 2000 are used to construct the institutional portfolios for the rolling windows needed before 2000 when ownership data was not available.

portfolio and its attainable component.[15]

$$f_t^{retail} = r_{R,t} - \hat{r}_{R,t}$$

The institutional local factor is the component of the attainable domestic market portfolio that is not explained by the foreign institutional portfolio I^*:

$$f_t^{inst} = r_{\hat{D},t} - \beta_{\hat{D}I^*,t} r_{I^*,t}$$

where $\beta_{\hat{D}I^*,t}$ is the coefficient from a 36-month rolling regression.

Lastly, the attainable world market factor is constructed as the value-weighted portfolio of attainable market portfolios from each country. Figure 1 compares the Net Asset Value (NAV) evolution of a one-dollar investment at the beginning of the sample period in the world market portfolio—defined as the value-weighted portfolio of all stocks—and the attainable world market portfolio. The two portfolios exhibit the same trend, driven by their common component: institutional stocks, which typically have larger market capitalizations. The theory predicts that the attainable world market portfolio captures world market risk shared through institutional investors. Notably, the cumulative return of the attainable world market portfolio is higher than that of the world market portfolio, suggesting that institutional investors tend to invest in stocks with better performance.

[15]It is acknowledged that constructing country-level asset pricing factors involves separately estimating time-varying correlations and conditional volatilities, which may not be fully consistent with the covariance structure restrictions imposed on the conditional estimation. This approach is chosen for simplicity.

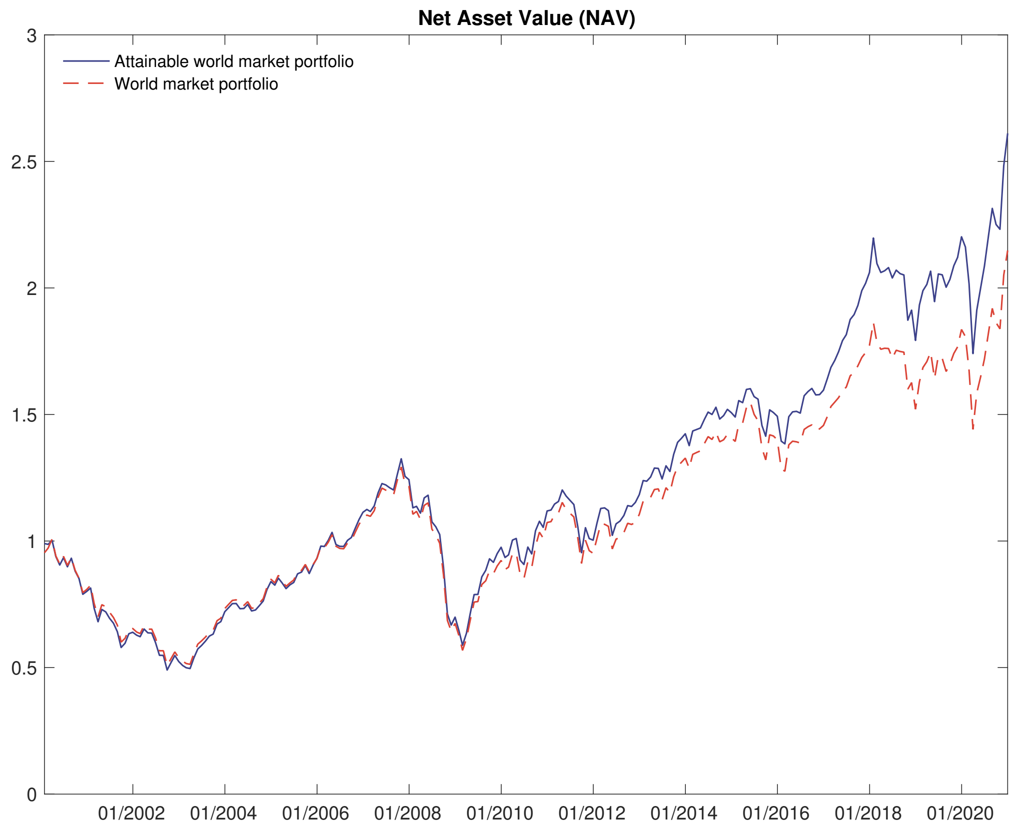

Figure 1. World market portfolio and attainable world market portfolio

This figure compares the world market portfolio and the attainable world market portfolio. It plots the evolution of the NAV over time of a one-dollar investment in the world market portfolio and the attainable world market portfolio at the start of the sample period in January 2000.

B. Econometric specification

The key predictions of the theory involve the impact of global institutional ownership on risk sharing and risk premiums. To estimate the model, it is important to retain as much meaningful variation in institutional ownership in the cross-section as possible. Given the small number of stocks in many countries and the limited coverage of ownership data, I estimate the model using individual stock returns.[16]

I begin by performing an unconditional estimation of the covariance formulation of the main pricing result in equation (4), estimating the price of covariance risks using the following

[16]As explained in Appendix B, to limit the effect of outliers, returns are winsorized at the 1% and 99% levels for each country-month.

empirical specification:

$$E[r_i] = \alpha_i + \lambda^{\hat{W}} cov(r_i, r_{\hat{W}}) + \lambda^{inst} cov(r_i, f^{inst}) + \lambda^{retail} cov(r_i, f^{retail}) \tag{10}$$

where $\lambda^{\hat{W}}$, λ^{inst} and λ^{retail} represent the prices of the attainable world market, institutional local, and retail local covariance risks, respectively. I use a two-pass cross-sectional regression approach (Fama and MacBeth, 1973), with Newey and West, 1987 standard errors to account for heteroskedasticity and serial correlation. In the first pass, for each stock, the three covariances are calculated using a 36-month rolling regression. In the second pass, for each month, a cross-sectional regression of returns on a constant and the covariances estimated from the first pass is performed. The estimated prices of risk are then averaged over the cross-sections.

To examine the time-variation in institutional and retail local risk premiums, I estimate a conditional version of the beta representation of the main pricing result (9). I use a two-pass regression technique developed by Gagliardini, Ossola, and Scaillet, 2016 and adapted by Chaieb, Langlois, and Scaillet, 2021 (CLS) for an international context. This technique extends the classic two-pass regression to accommodate a conditional setting, where time-varying factor exposures and factor risk premiums are specified as linear functions of lagged common and stock-specific instruments. This method is suitable for individual stocks and addresses the error-in-variables problem arising from the first-pass estimation.

The conditional version of the beta representation of the main pricing equation (9) for security i in country c implies that:[17]

$$E_{t-1}[r_{i,t}] = \beta'_{i,t} \mu_{c,t} \tag{11}$$

where $\mu_{c,t} = [\mu_t^{\hat{W}}, \mu_{c,t}^{inst}, \mu_{c,t}^{retail}]$ is a vector of conditional factor risk premiums and $\beta_{i,t} =$

[17] It is acknowledged that the model is static in nature, a full-fledged conditional model would induce additional risk premiums for hedging changes in investment opportunities, which is beyond the scope of this paper.

$[\beta^{\hat{W}}_{i,t}, \beta^{inst}_{i,t}, \beta^{retail}_{i,t}]'$ is a vector of factor loadings of stock i.

Assume that the excess return of security i in country c has the following linear factor structure:

$$r_{i,t} = \alpha_{i,t} + \beta'_{i,t} f_{c,t} + \varepsilon_{i,t} \tag{12}$$

where $f_{c,t} = [f^{\hat{W}}_t, f^{inst}_{c,t}, f^{retail}_{c,t}]'$ is a vector of factors constructed in Section II.A, $\beta_{i,t} = [\beta^{\hat{W}}_{i,t}, \beta^{inst}_{i,t}, \beta^{retail}_{i,t}]'$ is a vector of factor loadings of stock i.

The conditional pricing equation (11) and the linear empirical specification (12) lead to the following asset pricing restriction:

$$\alpha_{i,t} = \beta'_{i,t} \nu_{c,t} \tag{13}$$

where $\nu_{c,t} = \mu_{c,t} - E_{t-1}[f_{c,t}] = (\Lambda_c - F_c) Z_{c,t-1}$ represents the wedge between factor risk premiums and the conditional expected returns of factor portfolios. Although the asset pricing factors are theoretically tradable, practical implementation faces transaction costs due to rebalancing and short-selling. A non-zero $\nu_{c,t}$ captures these market imperfections (Gagliardini, Ossola, and Scaillet, 2016).

Factor exposures and risk premiums depend on conditional information through common and firm-specific instruments. First, factor loadings $\beta_{i,t}$ are a linear function of conditioning information at time $t-1$. This includes p lagged instruments $Z_{c,t-1}$, which are common to all stocks within a country c and q lagged instruments $Z_{i,t-1}$, which are stock-specific:

$$\beta_{i,t} = B_i Z_{c,t-1} + C_i Z_{i,t-1} \tag{14}$$

where B_i is a $3 \times p$ matrix and C_i is a $3 \times q$ matrix.

Second, the factor risk premiums in country c, $\mu_{c,t}$ are modeled as a linear function of common instruments:

$$\mu_{c,t} = \Lambda_c Z_{c,t-1} \tag{15}$$

Third, the conditional expectation of factors is specified as a linear function of lagged common instruments:

$$E_{t-1}[f_{c,t}] = F_c Z_{c,t-1} \tag{16}$$

The asset pricing restriction (13), together with the empirical specifications (14), (15), and (16), imply that:

$$\alpha_{i,t} = Z'_{c,t-1} B'_i (\Lambda_c - F_c) Z_{c,t-1} + Z'_{i,t-1} C'_i (\Lambda_c - F_c) Z_{c,t-1} \tag{17}$$

Thus, the intercept $\alpha_{i,t}$ in the linear specification (12) can be expressed as a quadratic function of lagged instruments. The term $\beta'_{i,t} f_{c,t}$ represents factors scaled by common instruments $Z_{c,t-1}$ and stock-specific instruments $Z_{i,t-1}$ under (14). Specification (12) is estimated in the first pass by regressing $r_{i,t}$ on these two groups of regressors from $\alpha_{i,t}$ and $\beta_{i,t} f_{c,t}$, respectively:

$$r_{i,t} = b'_{1,i} x_{1,i,t} + b'_{2,i} x_{2,i,t} + \varepsilon_{i,t} \tag{18}$$

where the first group, $x_{1,i,t}$, contains all interaction terms among instruments from the quadratic form in $\alpha_{i,t}$, and the second group, $x_{2,i,t}$, contains all factors scaled by instruments from $\beta'_{i,t} f_{c,t}$. Detailed definitions of each regressor are provided in Appendix C.1. The estimates for coefficients in the time-varying beta specification, $\hat{B}_i$ and $\hat{C}_i$, can be calculated from the first-step estimate for $\hat{b}_{2,i}$ using the relation (C.9) and the time-varying beta exposure $\hat{\beta}_{i,t}$ of each individual stock through (14).

Specifically, common instruments include a constant, the world dividend yield, and the country dividend yield. Thus, $Z_{c,t-1} = [1, DY_{t-1}, DY_{c,t-1}]$ and $p = 3$. The dividend yields are standardized to have zero mean and unit standard deviation. A stock's size percentile rank within its country is used as the stock-specific instrument, so $q = 1$.[18] As explained in Appendix C.1, using all instruments results in a total of 21 regressors in the time-series regression. In the data, the sample size for asset i can be small, resulting in unreliable estimates of $\hat{b}_i = (b'_{1,i}, b'_{2,i})'$. Therefore, GOS apply trimming conditions to select stocks from the first-pass regression that have more than 60 months of observations and a well-conditioned time series regression. CLS show that applying the same trimming condition to international data results in few or even zero stocks being kept for several countries. To include more stocks in the sample, they introduce an automatic selection procedure to select common instruments for each stock, reducing the number of regressors. I extend their procedure to impose selection on stock-specific instruments as well. Unlike CLS, who require that at least one stock-specific instrument be retained for a stock to be included, I drop the stock-specific instrument if it does not help explain the time variation in the stock's factor exposure. Details about the instrument selection procedure are provided in Appendix C.2.

The second-pass regression involves running a cross-sectional weighted least squares regression of $\hat{b}_{1,i}$ onto $\hat{b}_{3,i}$: $\hat{b}_{1,i} = \hat{b}_{3,i}\nu_c$, where $\hat{b}_3$ is a transformation of $\hat{b}_2$ defined in (C.4), and ν_c is the vectorized form of $\Lambda_c - F_c$ defined in (C.5). Finally, F_c is estimated by running a seemingly unrelated regression (SUR) of $f_{c,t}$ on the common instruments $Z_{c,t-1}$. Λ_c is obtained through the relation $\nu_c = \text{vec}(\Lambda'_c - F'_c)$. The loading of time-varying risk premiums $\mu_{c,t}$ on common instruments Λ_c in (15) has the following components:

[18] I do not use institutional ownership as an instrument because it is persistent in the data; using it would induce multicollinearity in the first-pass regression. For example, if the IO of stock i is relatively constant, then the interaction term $IO_{i,t-1}f_{c,t}$ would be highly correlated with $f_{c,t}$.

$$\Lambda_c = \begin{bmatrix} \Lambda_0^{\hat{W}} & \Lambda_{DY}^{\hat{W}} & \Lambda_{DY_c}^{\hat{W}} \\ \Lambda_0^{inst} & \Lambda_{DY}^{inst} & \Lambda_{DY_c}^{inst} \\ \Lambda_0^{retail} & \Lambda_{DY}^{retail} & \Lambda_{DY_c}^{retail} \end{bmatrix} \quad (19)$$

where Λ_0, Λ_{DY}, and Λ_{DY_c} are the loadings of time-varying risk premiums on the constant, world dividend yield, and country dividend yield, respectively. Because the world and country dividend yields are standardized to have zero mean and unit standard deviation, the value and significance of Λ_0 represent the levels and significance of the unconditional risk premiums. The country-level time-varying risk premiums is computed as $\hat{\mu}_{c,t} = \hat{\Lambda}_c Z_{c,t-1}$. Using time-varying factor loadings $\hat{\beta}_{i,t}$ estimated from the first pass and the risk premiums estimate $\hat{\mu}_{c,t}$ from the second pass, I calculate stock-level model-predicted risk premiums as $\mu_{i,t} = \beta'_{i,t}\mu_{c,t}$. Note that because $\beta'_{i,t}$ is estimated from the first-pass regression, the time-varying risk premiums can be calculated for all stocks included in the first-pass regression that have more than 60 months of observation, even if they are excluded from the second-pass regression. Further details about the estimation procedure and inference are discussed in Appendix C.

Two restrictions are imposed on the estimation following CLS. First, the loading of the conditional expectation of the attainable world factor on the country dividend yield, $F_{DY_c}^{\hat{W}}$, is set to zero. This condition ensures that the world factor has the same conditional expectation across countries. Second, for the sake of parsimony, factor loadings $\beta_{i,t}$, risk premiums $\nu_{c,t}$, and the conditional expectations of local factors $E_{t-1}[f_{c,t}^{inst}, f_{c,t}^{retail}]$ do not load on the global instrument. These restrictions have two implications. First, local risk premiums do not load on the global instrument, so $\Lambda_{DY}^{inst} = \Lambda_{DY}^{retail} = 0$. Second, the loading of the global risk premium on the global instrument is the same as the loading of the conditional expectation of the global factor on the global instrument, $\Lambda_{DY}^{\hat{W}} = F_{DY}^{\hat{W}}$. Thus, $\Lambda_{DY}^{\hat{W}}$ is the same across countries, and the global risk premium depends on the global instrument only through its conditional expectation, not through the risk premium ν_c.

C. Data

I consider a comprehensive global sample of 67,049 listed equities from 23 DMs and 15 EMs covered by Compustat Global, spanning from January 2000 to December 2020 at a monthly frequency.[19] I calculate monthly USD returns after applying standard filters.[20] Dividend yields at the country and world levels are downloaded from Datastream. The quarterly security-level ownership ratio by global institutions is calculated from 2000 Q1 to 2020 Q4 using the FactSet ownership database, following Ferreira and Matos, 2008. The definition of global institutions follows Bartram et al., 2015. For each quarter, I first calculate the country and region weights in the portfolio of each institution. An institution is classified as a global institution if the maximum percentage of its holdings in a country does not exceed 90% and the maximum percentage of its portfolio in a region does not exceed 80%. FactSet ownership and the Compustat universe are merged using commonly used identifiers (CUSIP, ISIN, SEDOL). An institutional ownership of zero is assigned to a Compustat observation that cannot be matched with FactSet. For each month, I use the ownership ratio available in the corresponding quarter. Details about data construction are provided in Appendix B.

I use firm-level ownership by global institutions to classify institutional and retail securities. A security is classified as an institutional security if its global institutional ownership exceeds the 50^{th} percentile in its country for the quarter and is higher than 1%. For each domestic country D, the domestic market portfolio D is constructed as the value-weighted portfolio of all stocks issued by firms domiciled in the country. The institutional portfolio I is the value-weighted portfolio of all domestic institutional stocks, and the retail portfolio R is the value-weighted portfolio of all domestic retail stocks. Additionally, the foreign

[19] The selection criteria are that these economies are included in the FTSE All Country World Index, have FactSet coverage since 2000, and have at least 10 stocks with positive global institutional ownership by the end of 2003.

[20] See the online appendix of Chaieb, Langlois, and Scaillet, 2021 for a detailed discussion of available sources for international equity data.

institutional portfolio I^* is the value-weighted portfolio of institutional stocks outside the country.

Figure 2 shows a heat map of the pairwise correlations between institutional portfolios and retail portfolios from different countries. The upper-triangular half of the figure presents the correlation between institutional portfolios from each pair of countries, while the lower-triangular half shows the correlation between retail portfolios. Countries are ordered by their region: Latin America, North America, Europe, Pacific developed, EMEA, and Asian emerging. Overall, high correlation is concentrated in the block among European and North American countries. The correlation between these markets and other markets, as well as the correlation among other markets, is lower. Additionally, the figure shows that the correlations between institutional portfolios in the upper-triangular half are higher than the correlations between retail portfolios in the lower-triangular half. The lower correlation between retail segments across countries reflects the fact that these remote markets do not share many common investors.[21]

[21]Although the correlation structure is exogenous in the model, ownership by common investors could increase the correlation between stocks (Anton and Polk, 2014).

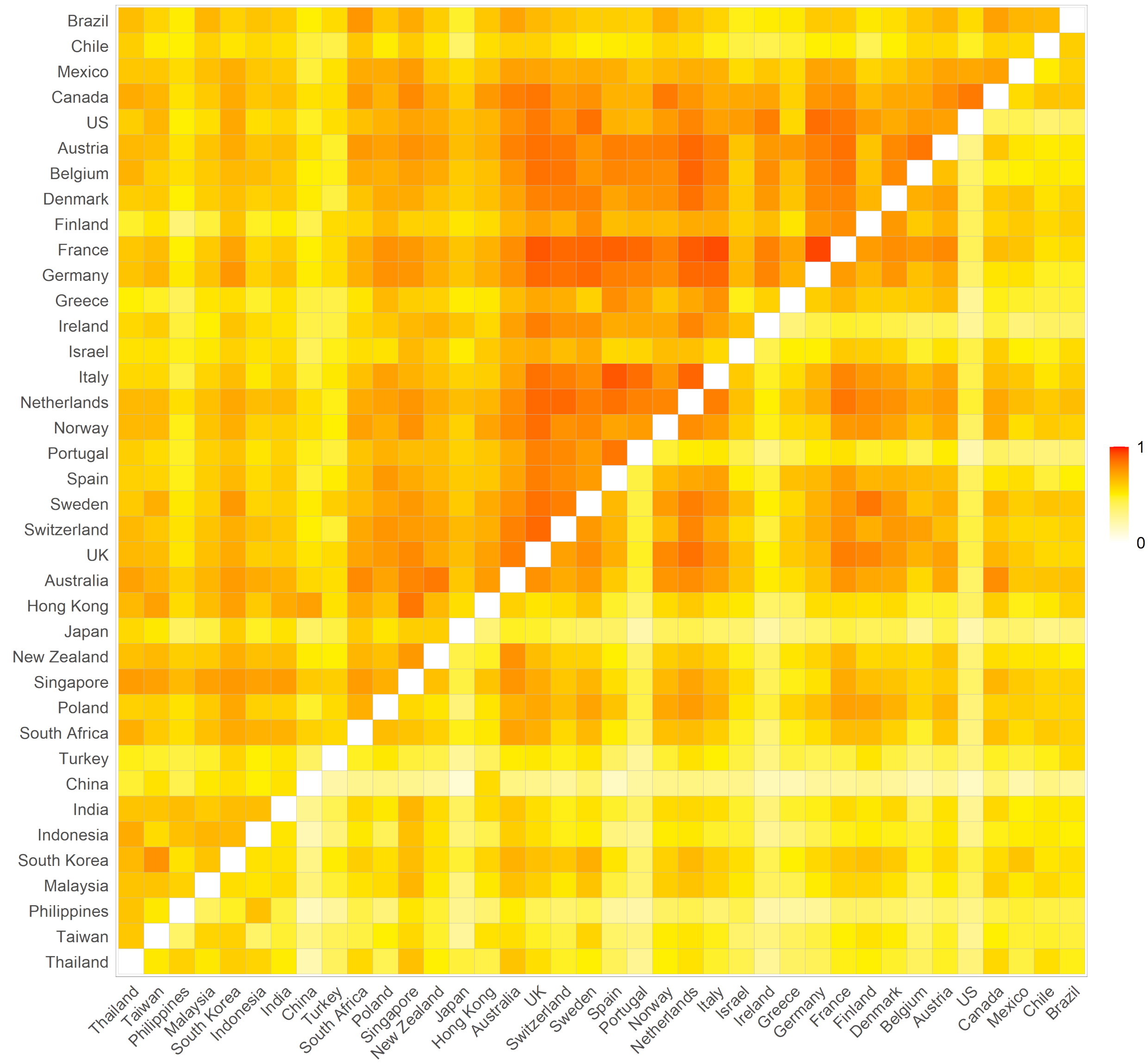

Figure 2. Pairwise correlation between institutional portfolios and between retail portfolios across markets

This figure shows the pairwise correlation between institutional and retail portfolios from different markets in the sample from January 2000 to December 2020. The upper triangular half of the matrix are the pairwise correlations between institutional portfolios from two markets. The lower triangular half of the matrix are the pairwise correlations between retail portfolios from two markets.

The institutional local factor and the retail local factor are constructed using rolling regressions explained in Section II.A. Table 1 reports for each country the total number of stocks in the data, the average proportion of institutional stocks to the total market capitalization of each country and the annualized average returns and volatilites of the institutional local factor and the retail local factor. In most DMs, institutional stocks represent more than 80% of total market capitalization. In US for example, the share of institutional securities in total market capitalization is as high as 91.1%. This average proportion is higher in DMs than in EMs because at the beginning of the sample, less than 50% of firms have global institutional ownership that is higher than 1% in many EMs. The average return of the institutional local factor is positive in 13 of 23 DMs and is positive in 12 of 15 EMs in the sample. On the other hand, the retail local factor is negative in 16 DMs and 14 EMs. Because the retail local factor is constructed as the residual return in the retail portfolio that cannot be explained by the institutional portfolio, its negative average return suggests that this residual component in retail securities performs badly in many countries during the sample period. This is consistent with what is shown in Figure 1 that the world market portfolio underperforms the attainable world market portfolio.

III. Empirical Results

This section presents and discusses the empirical results. First, I discuss the significance and level of the attainable world market premium, the institutional local premium, and the retail local premium across countries. Second, I analyze how institutional and retail local risk premiums vary over time in DMs and EMs. Third, I study how firm-level institutional ownership affects global and local risk premiums.

A. Significance and level of global and local risk premiums across countries

Table 2 presents the results of the unconditional estimation (10). It is expected that the price of institutional local risk will be positive and significant in markets without substantial foreign retail investment and where institutional securities are not highly correlated with foreign institutional securities. The price of retail local risk should be positive and significant in markets where institutional securities cannot span retail securities.

In the US, which serves as a benchmark for the most open and integrated market, only the price of the attainable world market risk is positive and significant. In other markets, the price of institutional local risk is positive and significant at the 5% level or less in 15 out of 23 DMs. The price of retail local risk is positive and significant in 7 DMs. Both institutional and retail local risk factors are significantly priced in Austria, Canada, and Israel, indicating that the two local factors explain different components of the cross-section of individual stock returns in these countries. In 10 DMs, only the institutional local risk is positively and significantly priced, suggesting that while institutional securities in these countries cannot be spanned by foreign institutional securities, institutional securities can span retail securities, leading to perfect risk-sharing between institutional and retail investors. In Denmark, Norway, and Singapore, only the retail local factor is significantly priced, implying that although institutional securities are priced globally, the retail local factor is needed to explain the returns of retail securities.

Overall, I find that institutional and retail factors are significantly priced across a wide range of DMs. There is also strong evidence for the significance of the two local factors in EMs. The institutional local factor is positively and significantly (at the 10% level or less) priced in 9 out of 15 emerging markets, and the retail local factor is positively and significantly priced in 6 emerging markets. Both institutional local and retail local factors are significantly priced in China, Indonesia, and the Philippines, indicating that retail securities in these countries could benefit from better risk-sharing if institutional investors expand their investment mandates. In India, Malaysia, Mexico, South Korea, Taiwan, and Turkey, only the institutional local factor is significant.

In summary, I find widespread evidence that the institutional and retail local factors are significantly and positively priced in the cross-section of individual stocks. There are also notable cross-country differences: in some countries, both institutional and retail local factors are significant, while in others, only one of the local factors is significantly priced.

I estimate time-varying factor risk premiums in the conditional estimation. In the conditional specification (15), time-varying risk premiums are linear in common instruments. Table 3 presents the estimates of the loadings of the attainable world market risk premium, the institutional local risk premium, and the retail local risk premium on the constant Λ_0 and on the local dividend yield Λ_{DY_c} in (15). As explained in Section II.B, coefficients $\Lambda_0^{\hat{W}}$, Λ_0^{inst}, and Λ_0^{retail} measure whether the unconditional risk premiums of the attainable world market factor, the institutional local factor, and the retail local factor are significant in the cross-section of individual stocks in each country.[22] Λ_{DY_c} measures whether the local premiums vary significantly over time with local market conditions proxied by the local dividend yield. Because I impose the restriction that $\Lambda_{DY}^{inst} = \Lambda_{DY}^{retail} = 0$ and that $\Lambda_{DY}^{\hat{W}}$ is the same across all countries, I only report the coefficients on the local instrument Λ_{DY_c}. Since I do not impose any restriction on the sign of the estimated unconditional risk premiums Λ_0s, some of the estimates can be negative due to estimation noise. This is not a new finding in this paper. In their study of US individual stocks, GOS find that the value premium is negative, and in their study of international individual stocks, CLS find that the average risk premiums of the excess country factor (defined as the difference between the country's market return and the world market return) are negative in DMs.

The unconditional attainable world market risk premium is significant and positive at the 5% level or below in 11 out of 23 DMs and 6 out of 15 EMs. The proportion of DMs and EMs with significant world risk premium is comparable but lower than CLS, who find 61% of DMs and 71% of EMs have significant world market risk premium using a larger set of 47 countries over a longer and earlier sample period from 1985 to 2018. The unconditional institutional local risk premium is positive in 15 out of 23 DMs. It is significantly positive at the 5% level or below in Belgium and Denmark and significantly positive at the 10% level in Hong Kong and Switzerland. The unconditional retail local risk premium is positive in

[22]To make valid inferences based on the GOS approach, there should not be any remaining factor structure in the residuals of (12). I calculate the diagnostic criteria of Gagliardini, Ossola, and Scaillet, 2019 and verify that the diagnostic criteria are negative in 34 countries except China, Greece, Ireland, and Spain, meaning that there is no remaining factor structure in the residuals in most of the sample countries.

15 out of 23 DMs. It is significant at the 5% level in Austria, Ireland, and Israel and at the 10% level in Hong Kong. In the unconditional estimation, I also find that the price of the institutional local risk is significant in Hong Kong, Denmark, and Switzerland, and the price of the retail local risk is significant in Austria and Israel. However, overall, I find less evidence for the statistical significance of the local risk premiums in DMs, although they are estimated to be positive in most of the sample countries.

There is stronger evidence for the significance of institutional and retail local risk premiums in EMs. The unconditional institutional local premium is positive in 12 out of 15 EMs. It is significant and positive at the 5% level or below in India, Indonesia, the Philippines, South Africa, and Thailand, and significant at the 10% level in Malaysia. The unconditional retail local premium is positive in 10 EMs. It is significant at the 5% level in Greece and significant at the 1% level in Turkey. Across all 23 DMs, only 5 countries have one of the local risk premiums that is positive and significant at the 5% level. Seven out of 15 EMs have at least one local risk premium that is significantly positive.

Compared to the unconditional test, fewer countries have significant average local risk premiums in the conditional estimation. This is because, in the conditional estimation, I apply trimming conditions and keep only stocks that have a sufficiently long sample period (60 months) and well-conditioned first-pass time-series regression, whereas in the unconditional estimation, I do not apply such trimming conditions. Therefore, the unconditional estimation keeps more stocks in the sample, as it requires only estimating covariance in the first step using a rolling window, which allows for more dispersion in the cross-section.

The trimming condition could explain the lack of significance of the retail local premium. Exposure to the retail local factor should better explain the cross-section of retail securities that are outside the investment mandate of global institutional investors. Retail stocks tend to be issued by younger firms with shorter time-series, which are likely to be excluded from the second-pass regression. Table 3 also reports the number of stocks used in the second-pass cross-sectional regression to estimate factor risk premiums. For most countries, compared to the total number of stocks used to construct pricing factors in Table 1, only about half of all stocks in the Compustat universe are included in the second-pass estimation. This likely explains why I do not find significant retail local risk premiums in most countries in the conditional estimation.

The proportion of countries with significant local risk premiums in the conditional estimation is lower than the findings of CLS, which reported that the excess country market risk premium is significantly positive in 43% of DMs and 54% of EMs in the world four-factor model with world market, size, value, and momentum factors. I find weaker evidence for the significance of local factors compared to CLS because their sample is earlier and includes more less-developed countries. Their sample starts in the 1990s for most countries, whereas my more recent sample starts in 2000. International stock markets have become more integrated in the recent sample. CLS are also able to include more countries because they do not require the availability of a sufficient number of institutional stocks to form the institutional portfolio in each country. The earlier sample period and the inclusion of markets with less global institutional investment could explain why they have more countries with significant local risk premiums.

On average, the institutional local risk premium is important in both DMs and EMs compared to the attainable world market risk premium. The unconditional institutional local risk premium is on average 2.76% in DMs, which is about half the level of the average unconditional attainable world market premium of 5.51% . In EMs, the average institutional local risk premium is 6.27% , which is higher than the attainable world market risk premium of 4.23% . The average unconditional retail local risk premium is 1.71% in DMs, and in EMs, it is 2.65% .

The institutional local premium is lower in DMs for two reasons. First, the theory predicts that the institutional local risk premium of a country should be lower when its institutional securities can be better substituted by foreign institutional securities. Institutional securities in DMs are more correlated with institutional securities from foreign countries, as shown in

Figure 2, which explains the lower institutional local risk premium in DMs. Second, the model predicts that the institutional local risk premium is lower when institutional investors investing in the country have higher risk-bearing capacity. I also plot the unconditional institutional risk premium against country-level average global institutional ownership in Figure 3. The institutional local risk premium decreases with average country institutional ownership, which is a proxy for the risk-bearing capacity of institutional investors investing in the country.

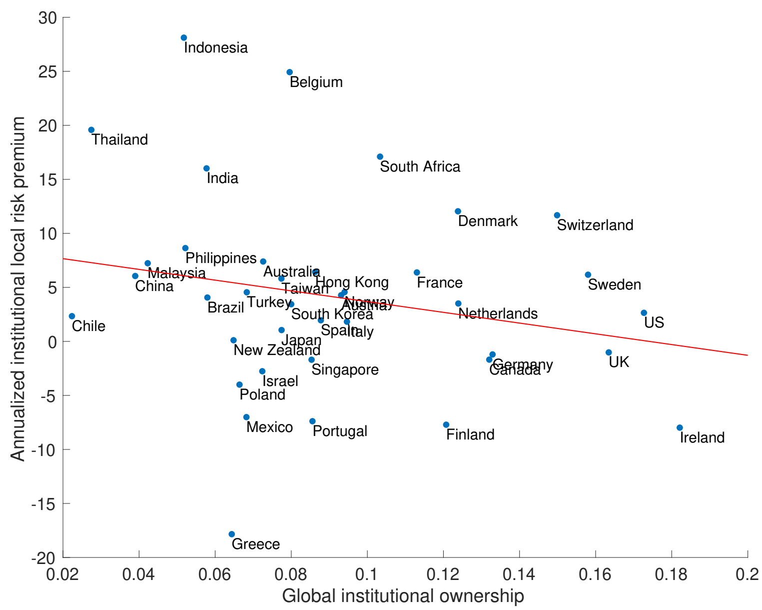

Figure 3. Unconditional institutional local risk premium and country level global institutional ownership

This figure plots the unconditional institutional local risk premium against average country-level global institutional ownership. The unconditional institutional local risk premium is estimated from the conditional estimation and reported in Table 3. Country-level global institutional ownership is the time-series average of the market capitalization of each country that is owned by global institutional investors.

B. How do global and local risk premiums vary over time?

The coefficient of DY_c reported in Table 3 indicates whether global and local risk premiums vary significantly over time with the country dividend yield. Country dividend yield has been widely used in existing studies as an instrument for conditional information and is a proxy for local market conditions. The country dividend yield significantly explains time-variation in the attainable world premium at a significance level of 5% or below in 8 out of 23 DMs and 5 out of 15 EMs. In DMs, the institutional local premium only varies significantly with the local dividend yield in Belgium and Portugal, but the retail local risk premium varies significantly with the local dividend yield in 4 DMs. Local dividend yield significantly explains the time variation in the institutional local risk premium in 5 EMs and the time variation in the retail local premium in 3 EMs.

Figure 4 plots the value-weighted average of time-varying annualized attainable world market premium, institutional local premium, and retail local premium across DMs. In each month, I calculate the value-weighted average using the aggregate market capitalization of each country. In DMs, both the attainable world market premium and the institutional local premium are important drivers of the time-varying total risk premium. These two risk premiums spiked during distressed episodes, including the Global Financial Crisis (GFC) and the COVID-19 crisis. In contrast, there is little variation in the retail local risk premium in DMs.

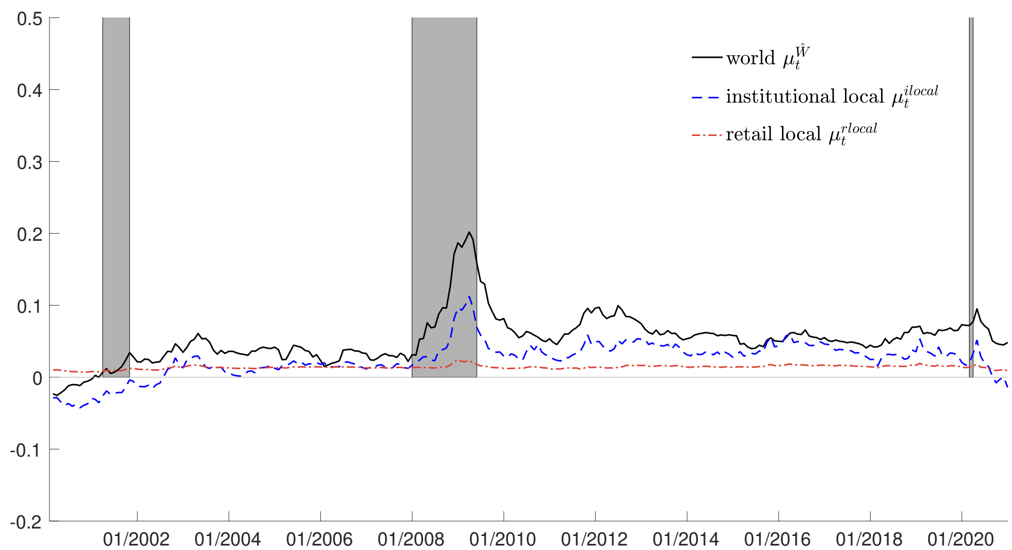

Figure 4. Annualized risk premiums in developed markets

This figure plots the value-weighted average across countries of annualized estimated time-varying attainable world market premium $\mu_{c,t}^{\hat{W}}$, institutional local premium $\mu_{c,t}^{inst}$ and retail local premium $\mu_{c,t}^{retail}$ in developed markets (DMs). For each country, the time-varying risk premium is calculated using estimated coefficients Λs reported in Table 3 and time-varying common instruments through (15). I report the average weighted by total market capitalization of each country.

Figure 5 plots the value-weighted time-varying risk premiums in EMs. The estimation reveals interesting time-series dynamics in EMs. First, the attainable world market premium is higher in the second half of the sample than in the first half. This is consistent with better risk-sharing in EMs due to the increase in the level of global institutional investment over time. Second, the retail local premium explains more of the time-variation of the total risk premium in EMs. Interestingly, the institutional and retail local risk premiums exhibit different dynamics during distressed episodes. During both the GFC and the COVID-19 crisis, the institutional local risk premium spiked. This finding is consistent with empirical evidence that institutional investors, especially foreign institutional investors, tend to reduce their average stock investments during periods of global market stress (Kacperczyk, Nosal, and Wang, 2022). This could be due to institutional investors being subject to tighter financial constraints and having reduced risk-bearing capacity (Akbari, Carrieri, and Malkhozov, 2022). In contrast, the retail local premium only increased during the COVID-19 crisis, not the GFC. The convergence of institutional and retail local risk premiums during the COVID-19 crisis and the divergence of the two risk premiums during the GFC indicate that the former episode arises from fundamental shocks, while the latter arises from financial shocks.

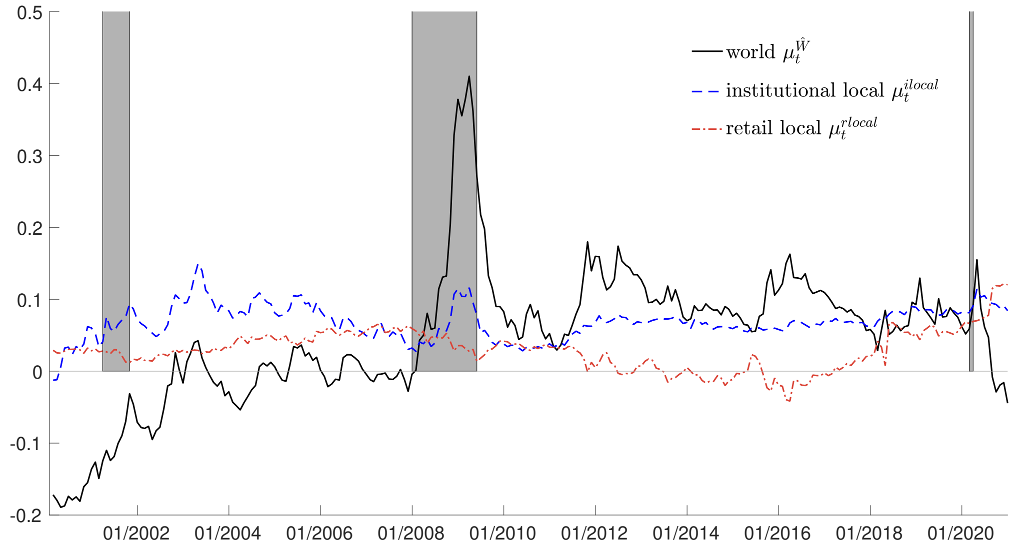

Figure 5. Annualized risk premium in emerging markets

This figure plots the value-weighted average across countries of annualized estimated time-varying attainable world market premium $\mu_{c,t}^{\hat{W}}$, institutional local premium $\mu_{c,t}^{inst}$ and retail local premium $\mu_{c,t}^{retail}$ in emerging markets (EMs). For each country, the time-varying risk premium is calculated using estimated coefficients Λs reported in Table 3 and time-varying common instruments through (15). I report the average weighted by total market capitalization of each country.

C. How does institutional ownership affect local and global risk premiums in the cross section?

Section III.A and Section III.B discussed how global and local risk premiums predicted by the model vary across countries and over time. In this section, I quantify how global institutional ownership affects the level of global and local risk premiums in the cross-section of individual stocks. As explained in Section II.B, from the conditional estimation, I calculate model-implied time-varying total risk premiums through $\mu_{i,t} = \beta'_{i,t}\mu_{c,t}$ for each individual stock that has more than 60 months of observation. I then analyze how stock-level risk premium and its global and local components vary with its global institutional ownership. Table 4 reports the average composition of the model-implied risk premiums of individual stocks. I first calculate the equal-weighted average of model-implied risk premiums across individual stocks for each month, then report the time-series average for each country. The average risk premium across individual stocks is similar to the country-level unconditional risk premium reported in Table 3.

To study how institutional ownership affects local and global risk premiums, I regress model-predicted risk premiums on institutional ownership, along with firm-level, country-level, and time-varying controls. Specifically, I consider as regressors the total risk premium $\mu_{i,t} = \beta'_{i,t}\mu_{c,t}$, the attainable world market premium $\mu^{\hat{W}}_{i,t} = \beta^{\hat{W}}_{i,t}$, the institutional local premium $\mu^{inst}_{i,t} = \beta^{inst}_{i,t}\mu^{inst}_{c,t}$ and the retail local premium $\mu^{retail}_{i,t} = \beta^{retail}_{i,t}\mu^{retail}_{c,t}$. I run the following panel regression:

$$\begin{aligned} y_{i,t} =& \beta_1 IO_{i,t-1} + \beta_2 \rho_i + \beta_3 X_{i,t-1} + \beta_4 CountryIO_{c,t-1} + \beta_5 CR_{t-1} + \varepsilon_{i,t} \\ & y \in \{\mu_{i,t}, \mu^{world}_{i,t}, \mu^{inst}_{i,t}, \mu^{retail}_{i,t}\} \end{aligned} \tag{20}$$

where $IO_{i,t-1}$ is the lagged firm-level institutional ownership, ρ_i is the time-invariant correlation between security i and the institutional portfolio of its country, and $X_{i,t-1}$ are lagged firm-level controls including log market capitalization (LOGMV), book-to-market ratio (BM), and dividend yield (DY). Because the model predicts that the institutional local risk premium depends on the risk-bearing capacity of global institutional investors, I also include two proxies for institutional risk-bearing capacity. $CountryIO_{c,t-1}$ is the lagged country-level global institutional ownership, calculated as the value-weighted global institutional ownership across all stocks in country c. Country-level institutional ownership captures variation in institutional risk-bearing capacity across countries. CR_{t-1} is the lagged intermediary capital ratio of He, Kelly, and Manela, 2017, which captures variation in institutional risk-bearing capacity over time. To control for omitted variables that vary with country and time, I also report an alternative specification in which I include country-time fixed effects. The theory predicts that in the cross-section, stocks with higher institutional ownership and stocks that are more correlated with institutional stocks are more attainable and should earn lower retail local risk premiums and higher attainable world market premiums.

Table 5 presents the results for DMs. The attainable world risk premium and the institutional local risk premium increase significantly with IO and ρ in both specifications. When controlling for country-month fixed effects, a 1% increase in firm-level IO predicts an increase of 1.4 bps in the attainable world market premium and an increase of 1.9 bps in the institutional local premium. This is consistent with the theory's prediction that stocks with higher institutional ownership and stocks that are more correlated with institutional stocks are more attainable and, hence, earn higher world and institutional local risk premiums.

The retail local premium decreases with firm-level IO in regression (7) with country and time controls but increases with IO in regression (8) with country-month fixed effects. The positively significant coefficient in (8) is small in terms of economic magnitude and can be explained by estimation noise in the risk premium from the conditional estimation, as the retail local factor is not significantly priced in most developed markets.

The net effect of institutional ownership on total risk premium in specification (2) with country-month fixed effects is positive. A 1% increase in global institutional ownership is associated with an increase in total risk premium by 3.6 bps. This suggests that in DMs, global institutional ownership could actually increase firms' cost of capital by increasing their exposure to global risk.

Additionally, the institutional local risk premium decreases significantly with country-level institutional ownership as well as the capital ratio. A 1% increase in $CountryIO$ is associated with a decrease of 3.4 bps in the institutional local risk premium in DMs, and a 1% increase in CR is associated with a decrease of 48 bps in the institutional local risk premium. This is consistent with the model prediction that the institutional local risk premium declines with the risk-bearing capacity of financial institutions, either across countries proxied by $CountryIO$ or over time proxied by CR.

I also compare the coefficient of each risk premium on CR to see to what extent the risk premium depends on the financial conditions of global institutional investors. The attainable world premium is more negatively affected by CR, with a 1% increase in CR associated with a decrease of 1.72% in the attainable world market premium. In contrast, the retail local premium is less affected by the intermediary capital ratio, with the effect of the same increase being only 37.7 bps. This reflects that the attainable world market premium and the institutional local risk premium depend on the risk-bearing capacity of institutional investors, whereas the retail local premium depends on the risk-bearing capacity of local retail investors.

In summary, in DMs, I find that institutional ownership increases the cost of capital in the cross-section.

Table 6 reports the results of the same regressions for EMs. There is a stark contrast to the results in DMs. As in DMs, higher institutional ownership significantly predicts a higher attainable world market risk premium. A 1% increase in firm-level IO predicts an increase in the attainable world market premium by 6.3 bps. Both the institutional local risk premium and the retail local risk premium are negatively and significantly predicted by firm-level IO. In specification (6) with country-time fixed effects, a 1% increase in IO is associated with a decrease in the institutional local risk premium by 4.3 bps.

This result might be puzzling at first sight because one would expect a stock to be more exposed to the institutional local factor if it has higher institutional ownership. However, the institutional local factor is constructed as the return difference between the attainable market portfolio and its substitute portfolio of foreign institutional securities. The exposure of a stock to the institutional local factor could decrease with institutional ownership if higher institutional ownership increases its correlation with the substitute portfolio.

As for the retail local risk premium, specification (8) with country-month fixed effects shows that a 1% increase in IO predicts a reduction of 10.2 bps in the retail local risk premium. This effect is economically important and consistent with the theory prediction that stocks with higher institutional ownership are more attainable and less exposed to the retail local factor, hence earning a lower retail local risk premium due to better risk-sharing. One could argue that this is due to the size effect because institutional ownership is higher in large stocks, and large stocks tend to have lower risk premiums.[23] However, it is worth noting that I discovered this negative relationship between the retail local premium and IO after controlling for firm size, so I am not simply capturing the size effect.

The net effect of a 1% increase in firm-level IO on total risk premium is a reduction of 8.1 bps. This effect is statistically significant and economically important. At the country level, an increase of 1% in $CountryIO$ in EMs predicts a decrease in the institutional local risk premium of 9.9 bps, which is consistent with the theory that higher global institutional risk-bearing capacity in a country lowers the institutional local premium. Lastly, in EMs, only the attainable world market risk premium is significantly and negatively predicted by CR.

In summary, I find strong evidence that EM firms could reduce their cost of capital by increasing global institutional investment, and this effect cannot be explained by firm size and country-time fixed effects.

IV. Concluding Remarks

I develop and estimate a new asset pricing model with home-biased retail investors and mandate-constrained global institutional investors. International risk-sharing depends on the coverage of institutional investors' mandates, their risk-bearing capacity, and the substitutability between institutional securities from different countries.

In addition to an attainable world market premium, securities earn an institutional local risk premium due to imperfect risk-sharing across country borders, which decreases with the risk-bearing capacity of institutional investors. Retail securities earn a retail local premium due to imperfect risk-sharing between institutional and retail investors in each country.

Existing international asset pricing theories focus on security-level investability and cannot explain why investable securities are priced by local factors. Instead, I focus on the

[23] It is well-documented that institutional investors have a strong preference for large and visible stocks; for international evidence, see Ferreira and Matos, 2008.

heterogeneous investment scopes of different investors. This enables a unique decomposition of market-wide local risk premium into an institutional component and a retail component. The theory provides an explanation for the importance of local factors and a framework for analyzing the effect of global institutional investment on equity risk premiums.

I estimate institutional and retail local premiums using individual stock returns from 38 markets. First, the institutional local premium and the retail local premium are statistically significant and economically important in a wide range of DMs and EMs. The institutional local risk premium is lower in countries with higher global institutional ownership. Second, local risk premiums are more important drivers of time-varying risk premiums in EMs than in DMs. Third, higher firm-level global institutional ownership improves international risk-sharing and reduces the cost of capital in EMs.

Appendices

A. Proof of model equilibrium

This appendix provides proof of the model equilibrium. Because the model is symmetric between domestic and foreign countries, the focus is on interpreting the results based on domestic securities and investors, with results about foreign securities and investors introduced where necessary.

1. Problem setup

To simplify notation, I omit time subscripts unless necessary. Domestic and foreign securities are partitioned into four segments and I stack the excess returns of securities into a $N \times 1$ vector $\mathbf{r} = [\mathbf{r}'_R, \mathbf{r}'_I, \mathbf{r}'_{I^*}, \mathbf{r}'_{R^*}]'$. The market capitalization of risky securities is exogenous and I use $\mathbf{s}_R$, $\mathbf{s}_I$, $\mathbf{s}_{I^*}$ and $\mathbf{s}_{R^*}$ to denote a vector of the total supply of risky securities in terms of their market capitalization. For example, $\mathbf{s}_I = [s_{I_1}, \cdots, s_{I_{N_I}}]'$ is a $N_I \times 1$ vector of the market capitalization of domestic institutional securities.

Investor $k \in \{d, f, i\}$ has CARA utility and solves one-period mean-variance portfolio choice problem by choosing the optimal dollar investment $\mathbf{x}^k$ of securities in her choice set $\mathcal{C}^k$. Specifically, $\mathcal{C}^d = \{R, I\}$, $\mathcal{C}^f = \{R^*, I^*\}$ and $\mathcal{C}^i = \{I, I^*\}$. The optimization problem investor k solves is:

$$\max_{\mathbf{x}^k_{X \in \mathcal{C}^k}} \mathbb{E}[U(W^k_{t+1})] = \max_{\mathbf{x}^k_{X \in \mathcal{C}^k}} \mathbb{E}[-\exp(-\gamma^k W^k_{t+1})]$$

$$W^k_{t+1} = W^k_t(1 + r_f) + \sum_{X \in \mathcal{C}^k} \mathbf{x}^{k\prime}_X \boldsymbol{r}_X$$

where γ^k is investor k's absolute risk aversion. X represents a market segment in investor k's choice set, for example, for the domestic retail investor, $X \in \{R, I\}$. $\mathbf{x}^k_X = [x_1, \cdots, x_{N_X}]'$

is a $N_X \times 1$ vector containing investor k's dollar investment in securities in segment X, $\mathbf{r}_X = [r_{X_1}, \cdots, r_{X_{N_X}}]$ is a vector of one-period excess returns of assets in segment X, and $\boldsymbol{\iota}$ is a vector of ones with the appropriate length.

With normally distributed returns, the expected utility of investor k is:

$$\mathbb{E}[U(W_{t+1}^k)] = -\exp\Big[-\gamma^k W_t^k(1+r_f)\Big]\exp\Big[-\gamma^k \sum_{X\in\mathcal{C}^k} \mathbf{x}_X^{k\prime}\boldsymbol{\mu}_X + \frac{(\gamma^k)^2}{2}\sum_{X,Y\in\mathcal{C}^k}\mathbf{x}_X^{k\prime}V_{XY}\mathbf{x}_Y^k\Big] \tag{A.1}$$

where $\boldsymbol{\mu}_X$ is a $n_X \times 1$ vector of risk premiums of securities in segment X. The optimization problem (A.1) is equivalent to:

$$\max_{\mathbf{x}_{X\in\mathcal{C}^k}^k} \sum_{X\in\mathcal{C}^k}\mathbf{x}_X^{k\prime}\boldsymbol{\mu}_X - \frac{\gamma^k}{2}\sum_{X,Y\in\mathcal{C}^k}\mathbf{x}_X^{k\prime}V_{XY}\mathbf{x}_Y^k \tag{A.2}$$

The first order condition (FOC) of each investor's portfolio choice depends on their choice sets, $\mathcal{C}$s. The FOC of the institutional investor i is:

$$V_{II}\mathbf{x}_I^i + V_{II^*}\mathbf{x}_{I^*}^i = \frac{1}{\gamma^i}\boldsymbol{\mu}_I \tag{A.3}$$

$$V_{I^*I}\mathbf{x}_I^i + V_{I^*I^*}\mathbf{x}_{I^*}^i = \frac{1}{\gamma^i}\boldsymbol{\mu}_{I^*} \tag{A.4}$$

The FOC of the domestic retail investor d is:

$$V_{RR}\mathbf{s}_R + V_{RI}\mathbf{x}_I^d = \frac{1}{\gamma^d}\boldsymbol{\mu}_R \tag{A.5}$$

$$V_{IR}\mathbf{s}_R + V_{II}\mathbf{x}_I^d = \frac{1}{\gamma^d}\boldsymbol{\mu}_I \tag{A.6}$$

The FOC of the foreign retail investor f:

$$V_{I^*I^*}\mathbf{x}^f_{I^*} + V_{I^*R^*}\mathbf{s}_{R^*} = \frac{1}{\gamma^f}\boldsymbol{\mu}_{I^*} \tag{A.7}$$

$$V_{R^*I^*}\mathbf{x}^f_{I^*} + V_{R^*R^*}\mathbf{s}_{R^*} = \frac{1}{\gamma^f}\boldsymbol{\mu}_{R^*} \tag{A.8}$$

where I used in the FOCs of domestic and foreign retail investors the following market-clearing conditions for domestic and foreign retail securities:

$$\mathbf{x}^d_R = \mathbf{s}_R$$

$$\mathbf{x}^f_{R^*} = \mathbf{s}_{R^*}$$

From (A.6) and (A.7), the dollar demand for institutional securities by retail investors can be expressed in terms of the risk premiums of institutional securities.

$$\mathbf{x}^d_I = V_{II}^{-1}[\frac{1}{\gamma^d}\boldsymbol{\mu}_I - V_{IR}\mathbf{s}_R] \tag{A.9}$$

$$\mathbf{x}^f_{I^*} = V_{I^*I^*}^{-1}[\frac{1}{\gamma^f}\boldsymbol{\mu}_{I^*} - V_{I^*R^*}\mathbf{s}_{R^*}] \tag{A.10}$$

Substituting in (A.9) into (A.5) yields an expression of the risk premiums of domestic retail securities in terms of the risk premiums of domestic institutional securities:

$$\boldsymbol{\mu}_R = V_{RI}V_{II}^{-1}\boldsymbol{\mu}_I + \gamma^d(V_{RR} - V_{RI}V_{II}^{-1}V_{IR})\mathbf{s}_R \tag{A.11}$$

The risk premiums of domestic retail securities have two components. The first term $V_{RI}V_{II}^{-1}\boldsymbol{\mu}_I$ reflects the risk premiums earned by retail securities for their returns spanned by their institutional counterpart. This expression is similar to the pricing equation for noninvestable assets of De Jong and De Roon, 2005 (Eq.9 of their paper). $V_{II}^{-1}V_{IR}$ is the regression coefficient of a multiple regression of domestic retail securities on domestic institutional securities. $V_{RR} - V_{RI}V_{II}^{-1}V_{IR}$ is the residual, conditional covariance among domestic retail securities that cannot be explained by this linear regression. Intuitively, the pricing of retail securities is "benchmarked" against their institutional counterpart, and the level of this risk premium depends on how well domestic institutional securities can span domestic retail securities. The second term is compensation for this residual covariance and depends on the absolute risk aversion of the retail investor γ^d.

To solve for equilibrium risk premiums and portfolio holdings, I invoke the market-clearing conditions for domestic and foreign institutional securities:

$$\mathbf{x}_I^d + \mathbf{x}_I^i = \mathbf{s}_I \tag{A.12}$$

$$\mathbf{x}_{I^*}^f + \mathbf{x}_{I^*}^i = \mathbf{s}_{I^*} \tag{A.13}$$

2. Equilibrium risk premiums

Proof. Using the market-clearing conditions for institutional securities (A.12) and (A.13), the dollar investment in institutional securities by the institutional investor is the residual market supply after subtracting the demand from retail investors:

$$\mathbf{x}_I^i = \mathbf{s}_I - V_{II}^{-1}[\frac{1}{\gamma^d}\boldsymbol{\mu}_I - V_{IR}\mathbf{s}_R] \tag{A.14}$$

$$\mathbf{x}_I^i = \mathbf{s}_{I^*} - V_{I^*I^*}^{-1}[\frac{1}{\gamma^f}\boldsymbol{\mu}_{I^*} - V_{I^*R^*}\mathbf{s}_{R^*}] \tag{A.15}$$

Substituting the institutional investor's investment in institutional securities (A.14) and (A.15) into its FOC (A.3) and (A.4) yields a linear system from which I solve for the institutional risk premiums $\boldsymbol{\mu}_I$ and $\boldsymbol{\mu}_{I^*}$:

$$\frac{1}{\gamma^i}\boldsymbol{\mu}_I = V_{II}\left[\mathbf{s}_I - V_{II}^{-1}(\frac{1}{\gamma^d}\boldsymbol{\mu}_I - V_{IR}\mathbf{s}_R)\right] + V_{II^*}\left[\mathbf{s}_{I^*} - V_{I^*I^*}^{-1}(\frac{1}{\gamma^f}\boldsymbol{\mu}_{I^*} - V_{I^*R^*}\mathbf{s}_{R^*})\right] \tag{A.16}$$

$$\frac{1}{\gamma^i}\boldsymbol{\mu}_{I^*} = V_{I^*I}\left[\mathbf{s}_I - V_{II}^{-1}(\frac{1}{\gamma^d}\boldsymbol{\mu}_I - V_{IR}\mathbf{s}_R)\right] + V_{I^*I^*}\left[\mathbf{s}_{I^*} - V_{I^*I^*}^{-1}(\frac{1}{\gamma^f}\boldsymbol{\mu}_{I^*} - V_{I^*R^*}\mathbf{s}_{R^*})\right] \tag{A.17}$$

Rewrite the linear system (A.16) and (A.17) more compactly in matrix form:

$$\begin{bmatrix} \frac{1}{\gamma^D}\mathbf{I} & \frac{1}{\gamma^f}V_{II^*}V_{I^*I^*}^{-1} \\ \frac{1}{\gamma^d}V_{I^*I}V_{II}^{-1} & \frac{1}{\gamma^F}\mathbf{I} \end{bmatrix} \begin{bmatrix} \boldsymbol{\mu}_I \\ \boldsymbol{\mu}_{I^*} \end{bmatrix} = \begin{bmatrix} V_{II}\mathbf{s}_I + V_{IR}\mathbf{s}_R + V_{II^*}\mathbf{s}_{I^*} + V_{II^*}V_{I^*I^*}^{-1}V_{I^*R^*}\mathbf{s}_{R^*} \\ V_{I^*I}\mathbf{s}_I + V_{I^*R^*}\mathbf{s}_{R^*} + V_{I^*I^*}\mathbf{s}_{I^*} + V_{I^*I}V_{II}^{-1}V_{IR}\mathbf{s}_R \end{bmatrix} \tag{A.18}$$

where I define the average risk aversion of investors in the domestic and foreign markets γ^D and γ^F as:

$$\frac{1}{\gamma^D} = \frac{1}{\gamma^d} + \frac{1}{\gamma^i} \tag{A.19}$$

$$\frac{1}{\gamma^F} = \frac{1}{\gamma^f} + \frac{1}{\gamma^i} \tag{A.20}$$

Rearranging the linear system (A.18) provides an expression of the risk premiums of institutional securities in terms of exogenous inputs:

$$\begin{bmatrix} \boldsymbol{\mu}_I \\ \boldsymbol{\mu}_{I^*} \end{bmatrix} = \begin{bmatrix} V_{II} & \mathbf{O} \\ \mathbf{O} & V_{I^*I^*} \end{bmatrix} \begin{bmatrix} \frac{1}{\gamma^D}V_{II} & \frac{1}{\gamma^f}V_{II^*} \\ \frac{1}{\gamma^d}V_{I^*I} & \frac{1}{\gamma^F}V_{I^*I^*} \end{bmatrix}^{-1} \begin{bmatrix} V_{II}\mathbf{s}_I + V_{IR}\mathbf{s}_R + V_{II^*}\mathbf{s}_{I^*} + V_{II^*}V_{I^*I^*}^{-1}V_{I^*R^*}\mathbf{s}_{R^*} \\ V_{I^*I}\mathbf{s}_I + V_{I^*R^*}\mathbf{s}_{R^*} + V_{I^*I^*}\mathbf{s}_{I^*} + V_{I^*I}V_{II}^{-1}V_{IR}\mathbf{s}_R \end{bmatrix} \tag{A.21}$$

$$= \begin{bmatrix} \gamma^D V_{II}\Phi_I^{-1} & -\frac{\gamma^D\gamma^F}{\gamma^f}V_{II}\Phi_I^{-1}V_{II^*}V_{I^*I^*}^{-1} \\ -\frac{\gamma^D\gamma^F}{\gamma^d}V_{I^*I^*}\Phi_{I^*}^{-1}V_{I^*I}V_{II}^{-1} & \gamma^F V_{I^*I^*}\Phi_{I^*}^{-1} \end{bmatrix} \begin{bmatrix} V_{II}\mathbf{s}_I + V_{IR}\mathbf{s}_R + V_{II^*}\mathbf{s}_{I^*} + V_{II^*}V_{I^*I^*}^{-1}V_{I^*R^*}\mathbf{s}_{R^*} \\ V_{I^*I}\mathbf{s}_I + V_{I^*R^*}\mathbf{s}_{R^*} + V_{I^*I^*}\mathbf{s}_{I^*} + V_{I^*I}V_{II}^{-1}V_{IR}\mathbf{s}_R \end{bmatrix}$$

where Φ_I and Φ_{I^*} are defined as follows:

$$\Phi_I = V_{II} - \frac{\gamma^D\gamma^F}{\gamma^d\gamma^f}V_{II^*}V_{I^*I^*}^{-1}V_{I^*I} \tag{A.22}$$

$$\Phi_{I^*} = V_{I^*I^*} - \frac{\gamma^D\gamma^F}{\gamma^d\gamma^f}V_{I^*I}V_{II}^{-1}V_{II^*} \tag{A.23}$$

Φ_I is the conditional covariance among domestic institutional securities that is not explained by the span of foreign institutional securities. Unlike the conditional covariance matrices in (A.11), here the amount of conditioning is adjusted by a factor of $\frac{\gamma^D\gamma^F}{\gamma^d\gamma^f}$. The higher this ratio, the lower the risk-bearing capacity of the institutional investor relative to retail investors.[24]

To simplify the conditional covariance matrix Φ_I and Φ_{I^*} , I assume that the following approximations holds:

$$\Phi_I^{-1} \approx \theta V_{II}^{-1} \tag{A.24}$$
$$\Phi_{I^*}^{-1} \approx \theta V_{I^*I^*}^{-1}$$

where $\theta > 1$ is a scalar that increases if domestic and foreign institutional securities can better substitute for each other.

The approximations hold exactly when there is only one institutional and one retail security in each country. Suppose $corr(r_I, r_{I^*}) = \rho$, then:

$$V_{II^*}V_{I^*I^*}^{-1}V_{I^*I} = \rho^2 V_{II}$$
$$V_{I^*I}V_{II}^{-1}V_{II^*} = \rho^2 V_{I^*I^*}$$

$\rho^2 < 1$ captures the fact that domestic and foreign institutional securities are not perfect substitutes. It measures the limited substitutability between securities in segmented markets. When $\rho^2 = 1$, $V_{II^*}V_{I^*I^*}^{-1}V_{I^*I} = V_{II}$ and $V_{I^*I}V_{II}^{-1}V_{II^*} = V_{I^*I^*}$, indicating that domestic and foreign institutional securities perfectly span each other. θ can be expressed as:

$$\theta = [1 - \frac{\gamma^D\gamma^F}{\gamma^d\gamma^f}\rho^2]^{-1}$$

[24] To see this, note that $\frac{\gamma^D\gamma^F}{\gamma^d\gamma^f} = \frac{(\gamma^i)^2}{(\gamma^d+\gamma^i)(\gamma^f+\gamma^i)}$, which increases with the risk aversion of the institutional investor γ^i, hence decreases with the risk-bearing capacity of the institutional investor.

θ is influenced by the institutional investor's decision to trade off risk across domestic and foreign institutional securities. This is determined by both ρ^2 and $\frac{\gamma^D\gamma^F}{\gamma^d\gamma^f}$. ρ^2 measures the diversification the institutional investor enjoys by investing in both domestic and foreign institutional securities. When the absolute correlation is higher, domestic and foreign institutional securities better substitute for each other, resulting in less diversification for the institution and a higher θ. When retail investors' relative wealth with respect to the institutional investor increases, $\frac{\gamma^D\gamma^F}{\gamma^d\gamma^f}$ increases, leading to an increase in θ.

Solving for the risk premiums of domestic institutional securities, using the approximation (A.24):

$$\boldsymbol{\mu}_I = \gamma^D V_{II}\Phi_I^{-1}\Big[(V_{II} - \frac{\gamma^F}{\gamma^f}V_{II^*}V_{I^*I^*}^{-1}V_{I^*I})\mathbf{s}_I + (V_{IR} - \frac{\gamma^F}{\gamma^f}V_{II^*}V_{I^*I^*}^{-1}V_{I^*I}V_{II}^{-1}V_{IR})\mathbf{s}_R + (1 - \frac{\gamma^F}{\gamma^f})V_{II^*}\mathbf{s}_{I^*} \tag{A.25}$$

$$+ (1 - \frac{\gamma^F}{\gamma^f})V_{II^*}V_{I^*I^*}^{-1}V_{I^*R^*}\mathbf{s}_{R^*}\Big]$$

$$= \gamma\big[V_{II}\mathbf{s}_I + V_{IR}\mathbf{s}_R + V_{II^*}\mathbf{s}_{I^*} + V_{II^*}V_{I^*I^*}^{-1}V_{I^*R^*}\mathbf{s}_{R^*}\big]$$

$$+ \frac{\gamma^i}{\gamma^f}\gamma\big[(V_{II} - V_{II^*}V_{I^*I^*}^{-1}V_{I^*I})\mathbf{s}_I + (V_{IR} - V_{II^*}V_{I^*I^*}^{-1}V_{I^*I}V_{II}^{-1}V_{IR})\mathbf{s}_R\big]$$

Substituting (A.25) into (A.11) provides the risk premiums of domestic retail securities:

$$\boldsymbol{\mu}_R = \gamma V_{RI}V_{II}^{-1}\big[V_{II}\mathbf{s}_I + V_{IR}\mathbf{s}_R + V_{II^*}\mathbf{s}_{I^*} + V_{II^*}V_{I^*I^*}^{-1}V_{I^*R^*}\mathbf{s}_{R^*}\big] \tag{A.26}$$

$$+ \frac{\gamma^i}{\gamma^f}\gamma V_{RI}V_{II}^{-1}\big[(V_{II} - V_{II^*}V_{I^*I^*}^{-1}V_{I^*I})\mathbf{s}_I + (V_{IR} - V_{II^*}V_{I^*I^*}^{-1}V_{I^*I}V_{II}^{-1}V_{IR})\mathbf{s}_R\big] + \gamma^d(V_{RR} - V_{II}^{-1}V_{IR})\mathbf{s}_R$$

where I use the fact that $1 - \frac{\gamma^F}{\gamma^f} = \frac{\gamma^F}{\gamma^i}$. γ is the aggregate risk aversion of the economy:

$$\gamma = \frac{\gamma^D\gamma^F}{\gamma^i}\theta \tag{A.27}$$

γ is easier to interpret in the special case when there is only one institutional security in each country. Assume that the correlation between domestic and foreign institutional securities is $corr(r_I, r_{I^*}) = \rho$, the aggregate risk-bearing capacity γ is:

$$\begin{aligned}\frac{1}{\gamma} &= \frac{\gamma^i}{\gamma^D\gamma^F}\theta^{-1} \\ &= \frac{(\gamma^d+\gamma^i)(\gamma^f+\gamma^i)}{\gamma^d\gamma^f\gamma^i}\frac{\gamma^d\gamma^f+\gamma^d\gamma^i+\gamma^f\gamma^i+(1-\rho^2)(\gamma^i)^2}{(\gamma^d+\gamma^i)(\gamma^f+\gamma^i)} \\ &= \frac{1}{\gamma^d}+\frac{1}{\gamma^f}+\frac{1}{\gamma^i}+(1-\rho^2)\frac{\gamma^i}{\gamma^d\gamma^f}\end{aligned} \tag{A.28}$$

When $\rho^2 = 1$, the aggregate risk-bearing capacity is the total risk-bearing capacity of the three representative investors in a frictionless economy. When $\rho^2 \neq 1$, the aggregate risk-bearing capacity decreases with ρ^2. Intuitively, as ρ^2 decreases, institutional investors enjoy more international diversification, resulting in higher aggregate risk-bearing capacity.

I define the *attainable return* of any domestic security j as the fitted value by regressing its return r_j onto domestic institutional securities:

$$\hat{r}_j = B_{jI}\mathbf{r}_I \tag{A.29}$$

where $B_{jI} = V_{jI}V_{II}^{-1}$ is a $1 \times N_I$ row vector of the multiple regression coefficients of regressing the return of security j onto domestic institutional securities.

I define the *attainable domestic market portfolio* $\hat{D}$ as the portfolio of domestic institutional securities that optimally mimic the domestic market portfolio. The return on this portfolio is the same as that of the value-weighted portfolio of the domestic institutional portfolio and the attainable domestic retail portfolio:

$$r_{\hat{D}} = \frac{\mathbf{s}_I'}{M_D}\mathbf{r}_I + \frac{\mathbf{s}_R'}{M_D}B_{RI}\mathbf{r}_I \tag{A.30}$$

where $B_{RI} = V_{RI}V_{II}^{-1}$ is an $n_R \times n_I$ matrix of multiple regression coefficients of retail securities on institutional securities. The *attainable foreign market portfolio* is defined in the same way. I define the value-weighted portfolio of the attainable domestic portfolio ($\hat{D}$) and the attainable foreign portfolio ($\hat{F}$) as the *attainable world market portfolio* ($\hat{W}$):

$$r_{\hat{W}} = \frac{M_D}{M_W} r_{\hat{D}} + \frac{M_F}{M_W} r_{\hat{F}} \tag{A.31}$$

The attainable world market portfolio represents the world market exposure that is attainable by investing in domestic and foreign institutional securities.

I define the *substitute portfolio* for the attainable domestic market portfolio as the portfolio of foreign institutional securities that optimally mimics the attainable domestic market portfolio. The return on this portfolio is the fitted value from a multiple linear regression of the attainable domestic market portfolio returns onto foreign institutional securities:

$$r_{D^s} = \frac{\mathbf{s}_I'}{M_D} B_{II^*} \mathbf{r}_{I^*} + \frac{\mathbf{s}_R'}{M_D} B_{RI} B_{II^*} \mathbf{r}_{I^*} \tag{A.32}$$

where $B_{II^*} = V_{II^*} V_{I^*I^*}^{-1}$ is a $n_I \times n_{I^*}$ matrix of multiple regression coefficients of domestic institutional securities on foreign institutional securities.

From (A.25), the equilibrium risk premiums of any domestic institutional security I_j can be expressed in terms of their covariance with aggregate factor portfolios as follows:

$$\begin{aligned}
\mu_{I_j} &= V_{I_jI}\mathbf{s}_I + V_{I_jR}\mathbf{s}_R + V_{I_jI^*}\mathbf{s}_{I^*} + V_{I_jI^*}V_{I^*I^*}^{-1}V_{I^*R^*}\mathbf{s}_{R^*} \\
&+ \frac{\gamma^i}{\gamma^f}\gamma\big[(V_{I_jI} - V_{I_jI^*}V_{I^*I^*}^{-1}V_{I^*I})\mathbf{s}_I + (V_{I_jR} - V_{I_jI^*}V_{I^*I^*}^{-1}V_{I^*I}V_{II}^{-1}V_{IR})\mathbf{s}_R\big] \\
&= M_D\mathbb{C}ov(r_{I_j}, \frac{\mathbf{s}_I'}{M_D}\mathbf{r}_I + \frac{\mathbf{s}_R'}{M_D}\mathbf{r}_R) + M_F\mathbb{C}ov(r_{I_j}, \frac{\mathbf{s}_{I^*}'}{M_F}\mathbf{r}_{I^*} + \frac{\mathbf{s}_{R^*}'}{M_F}B_{R^*I^*}\mathbf{r}_{I^*}) \\
&+ \frac{\gamma^i}{\gamma^f}\gamma M_D\mathbb{C}ov(r_{I_j}, \frac{\mathbf{s}_I'}{M_D}\mathbf{r}_I + \frac{\mathbf{s}_R'}{M_D}\mathbf{r}_R - \frac{\mathbf{s}_I'}{M_D}B_{II^*}\mathbf{r}_{I^*} - \frac{\mathbf{s}_R'}{M_D}B_{RI}B_{II^*}\mathbf{r}_{I^*}) \\
&= \gamma M_W\mathbb{C}ov(r_{I_j}, r_{\hat{W}}) + \frac{\gamma^i}{\gamma^f}\gamma M_D\mathbb{C}ov\big(r_{I_j}, r_{\hat{D}} - r_{D^s}\big)
\end{aligned} \tag{A.33}$$

where I use the fact that $\mathbb{C}ov(r_I, r_D) = \mathbb{C}ov(r_I, r_{\hat{D}})$. Domestic institutional securities earn two risk premiums. The first one is an attainable world risk premium for their covariance with the attainable world market return $r_{\hat{W}}$, which I also refer to as the *attainable world market factor* $f^{\hat{W}}$. The second one is for their covariance with the return difference between the attainable domestic market portfolio and its substitute portfolio of foreign securities, which I define as the *institutional local factor*:

$$f^{inst} = r_{\hat{D}} - r_{D^s} \tag{A.34}$$

From (A.26), the equilibrium risk premiums of any domestic retail security R_j can be expressed similarly in terms of its covariances with factor portfolios:

$$\mu_{R_j} = \gamma M_W \mathbb{C}ov(\hat{r}_{R_j}, r_{\hat{W}}) + \frac{\gamma^i}{\gamma^f}\gamma M_D \mathbb{C}ov\big(\hat{r}_{R_j}, r_{\hat{D}} - r_{D^s}\big) + \gamma^d M_R \mathbb{C}ov\big(r_{R_j}, r_R - \hat{r}_R\big) \tag{A.35}$$

where $\hat{r}_{R_j}$ is the attainable return of security R_j defined in (A.29).

Domestic retail securities earn a third risk premium for their covariance with the residual retail risk that is orthogonal to the span of institutional securities, which I define as the *retail local factor*:

$$f^{retail} = r_R - \hat{r}_R \tag{A.36}$$

The risk premium of any domestic security j can be expressed as the following generic expression:

$$\mu_j = \gamma M_W \mathbb{C}ov(\hat{r}_j, r_{\hat{W}}) + \frac{\gamma^i}{\gamma^f}\gamma M_D \mathbb{C}ov\big(\hat{r}_j, r_{\hat{D}} - r_{D^s}\big) + \gamma^d M_R \mathbb{C}ov\big(r_j - \hat{r}_j, r_R - \hat{r}_R\big) \tag{A.37}$$

where I used the fact that for institutional securities $r_{I_j} = \hat{r}_{I_j}$ and for retail securities $\mathbb{C}ov(\hat{r}_{R_j}, r_R - \hat{r}_R) = 0$.

□

The price of security j's attainable world market risk γM_W is the same across all four segments. The price of security j's institutional local risk is $\frac{\gamma^i}{\gamma^f}\gamma M_D$, which increases when the institutional investor becomes more risk averse relative to the foreign retail investor. The intuition is that when the institutional investor becomes more risk averse relative to the foreign retail investor ($\gamma^f \downarrow, \gamma^i \uparrow$), foreign securities are held more by the foreign retail investor and less by the institution. This change in ownership composition results in less international risk sharing, hence a higher institutional local premium relative to the attainable world premium. γ^i also has a direct level effect on the overall level of risk premium through the aggregate risk aversion γ, as can be seen from (A.28).

Consider the special case in which there is only one institutional security and one retail security in each country. Suppose the correlation between domestic and foreign institutional securities is $corr(r_I, r_{I^*}) = \rho$, the correlation between domestic retail and institutional securities is $corr(r_R, r_I) = \rho_R$, and the correlation between foreign retail and institutional securities is $corr(r_{R^*}, r_{I^*}) = \rho_R^*$. For any domestic security j, suppose its volatility is σ_j and its correlation with the domestic institutional security is $corr(r_j, r_I) = \rho_j$. Then its attainable return is $\hat{r}_j = \rho_j \frac{\sigma_j}{\sigma_I} r_I$. Simplifying (A.37), the risk premium of j can be expressed as:

$$\mu_j = \gamma M_W \rho_j \frac{\sigma_j}{\sigma_I} \mathbb{C}ov(r_I, r_{\hat{W}}) + \gamma \frac{\gamma^i}{\gamma^f} M_D \rho_j \frac{\sigma_j}{\sigma_I}(1-\rho^2)\mathbb{C}ov(r_I, r_{\hat{D}}) + \gamma^d M_R (1-\rho_j^2)\sigma_j \sigma_R \tag{A.38}$$

In this simplified case, domestic security j earns attainable world and institutional local risk premiums through its correlation with the domestic institutional security, ρ_j. The novelty in the model is the indirect covariance between domestic and foreign retail securities embedded in the attainable world risk premium of the domestic retail security: $\mathbb{C}ov(\hat{r}_R, \hat{r}_{R^*}) = \rho_R \rho \rho_R^* \sigma_R \sigma_{R^*}$. These two remote markets do not share a single common investor yet share risk through a chain of correlations: the correlation between domestic retail and institutional securities ρ_R, the correlation between domestic and foreign institutional securities ρ, and the correlation between foreign institutional and retail securities ρ_R^*.

The relative importance of global versus local risk premiums depends on three factors:

- *Coverage* of the institution's choice set, represented by ρ_j.
- *Correlation* between domestic and foreign institutional securities ρ, which determines the quantity of risk that can be shared internationally by trading institutional securities;
- The risk-bearing *Capacity* of the institutional investor, $1/\gamma^i$, which determines the level of the institutional local risk premium;

The correlation between a domestic security and the domestic institutional security reflects to what extent its exposure can be spanned by the institutional security (covered by the institution's mandate). Since the retail local risk premium is compensation for the unspanned retail risk, the higher the correlation, the lower the retail local risk premium. $\rho_j = 1$ when either j is an institutional security or a retail security that is perfectly correlated with the domestic institutional security. In this case, the retail local risk premium becomes zero. Notably, the correlation between a domestic retail security and foreign securities does not enter the equilibrium risk premium because international risk-sharing in the model is channeled through its correlation with the domestic institutional security.

Beta representation Applying A.37 to the attainable world market factor $\hat{W}$, the institutional local factor, and the retail local factor yields the following linear system:

$$\mu^{\hat{W}} = \gamma M_W var(f^{\hat{W}}) \tag{A.39}$$

$$\mu^{inst} = \frac{\gamma^i}{\gamma^f}\gamma M_D var(f^{inst}) \tag{A.40}$$

$$\mu^{retail} = \gamma^d M_R var(f^{retail}) \tag{A.41}$$

Substituting (A.39), (A.40), and (A.41) back into (A.37) yields the following beta representation of the risk premium of domestic security j:

$$\mu_j = \beta^{\hat{W}} \mu^{\hat{W}} + \beta_j^{inst} \mu^{inst} + \beta_j^{retail} \mu^{retail} \tag{A.42}$$

where

$$\beta_j^{\hat{W}} = \frac{\mathbb{C}ov(\hat{r}_j, f^{\hat{W}})}{\mathbb{V}ar(f^{\hat{W}})} \tag{A.43}$$

$$\beta_j^{inst} = \frac{\mathbb{C}ov(\hat{r}_j, f^{inst})}{\mathbb{V}ar(f^{inst})} \tag{A.44}$$

$$\beta_j^{retail} = \frac{\mathbb{C}ov(r_j - \hat{r}_j, f^{retail})}{\mathbb{V}ar(f^{retail})} \tag{A.45}$$

3. Equilibrium investments

Substituting (A.25) into the FOC of the domestic retail investor (A.9), I obtain the holdings of domestic institutional securities by the domestic retail investor:

$$\mathbf{x}_I^d = \frac{\gamma^D}{\gamma^d} \Phi_I^{-1} \Big[(V_{II} - \frac{\gamma^F}{\gamma^f} V_{II^*} V_{I^*I^*}^{-1} V_{I^*I}) \mathbf{s}_I + (V_{IR} - \frac{\gamma^F}{\gamma^f} V_{II^*} V_{I^*I^*}^{-1} V_{I^*I} V_{II}^{-1} V_{IR}) \mathbf{s}_R + (1 - \frac{\gamma^F}{\gamma^f}) V_{II^*} \mathbf{s}_{I^*} \tag{A.46}$$

$$+ (1 - \frac{\gamma^F}{\gamma^f}) V_{II^*} V_{I^*I^*}^{-1} V_{I^*R^*} \mathbf{s}_{R^*} \Big] - V_{II}^{-1} V_{IR} \mathbf{s}_R$$

Using the approximation (A.24), I simplify the equilibrium investment of the domestic retail investor in domestic institutional securities (A.46):

$$\mathbf{x}_I^d = \frac{\gamma^D}{\gamma^d}\theta \underbrace{\left[\mathbf{s}_I + V_{II}^{-1}V_{IR}\mathbf{s}_R\right]}_{\hat{D}} + \frac{\gamma^D\gamma^F}{\gamma^d\gamma^i}\theta \underbrace{\left[V_{II}^{-1}V_{II^*}\mathbf{s}_{I^*} + V_{II}^{-1}V_{II^*}V_{I^*I^*}^{-1}V_{I^*R^*}\mathbf{s}_{R^*}\right]}_{F^s} - \underbrace{V_{II}^{-1}V_{IR}\mathbf{s}_R}_{\hat{R}} \tag{A.47}$$

$$- \frac{\gamma^D\gamma^F}{\gamma^d\gamma^f}\theta \underbrace{\left[V_{II}^{-1}V_{II^*}V_{I^*I^*}^{-1}V_{I^*I}\mathbf{s}_I + V_{II}^{-1}V_{II^*}V_{I^*I^*}^{-1}V_{I^*I}V_{II}^{-1}V_{IR}\mathbf{s}_R\right]}_{H}$$

where I use the fact that $1 - \frac{\gamma^F}{\gamma^f} = \frac{\gamma^F}{\gamma^i}$.

The constants A^d, A^f, γ are defined as:

$$A^d = \frac{\gamma^D}{\gamma^d}\theta \tag{A.48}$$

$$A^f = \frac{\gamma^F}{\gamma^f}\theta \tag{A.49}$$

where A^d (A^f) measures the relative risk-bearing capacity of the domestic (foreign) retail investor with respect to the institutional investor.

By market clearing for the domestic retail securities, the domestic retail investor holds the domestic retail portfolio:

$$\mathbf{x}_R^d = \mathbf{s}_R \tag{A.50}$$

The domestic retail investor's dollar investment in domestic securities can be expressed in terms of its four components:

$$\mathbf{x}_I^d + \mathbf{s}_R^d = \underbrace{A^d\hat{D}}_{\text{attainable domestic}} + \underbrace{D - \hat{D}}_{\text{unattainable local risk}} + \underbrace{\frac{\gamma}{\gamma^d}F^s}_{\text{substitute for foreign}} - \frac{\gamma^i}{\gamma^d\gamma^f}\gamma H \tag{A.51}$$

where H is a portfolio of domestic institutional securities that optimally mimics the substitute portfolio for domestic investment D^s. This position serves as a hedge that the domestic retail investor provides to the institutional investor for their tilt away from the substitute portfolio for domestic investment D^s in the foreign country.[25]

The size of this position depends on the level of correlation between domestic and foreign institutional securities. To see this, consider the special case in which there is only one institutional security and one retail security in each country. Assuming that the correlation between the domestic institutional security and the foreign institutional security is $corr(r_I, r_{I^*}) = \rho$, H can be simplified as:

$$H = \rho^2 \hat{D} \tag{A.52}$$

Unless the correlation between domestic and foreign institutional securities is very high, the magnitude of this term is very small compared to the other components of investors' portfolios.

Using the market clearing condition for domestic institutional securities, the dollar investment in domestic institutional securities by the institutional investor is:

$$\mathbf{x}_I^i = (1 - A^d)\hat{D} - \frac{\gamma}{\gamma^d} F^s + \frac{\gamma^i}{\gamma^d \gamma^f} \gamma H \tag{A.53}$$

[25]Because the foreign retail investor tilts toward and the institutional investor tilts away from the foreign substitute portfolio, it is as if the institution "sells" the substitute portfolio to the foreign retail investor.

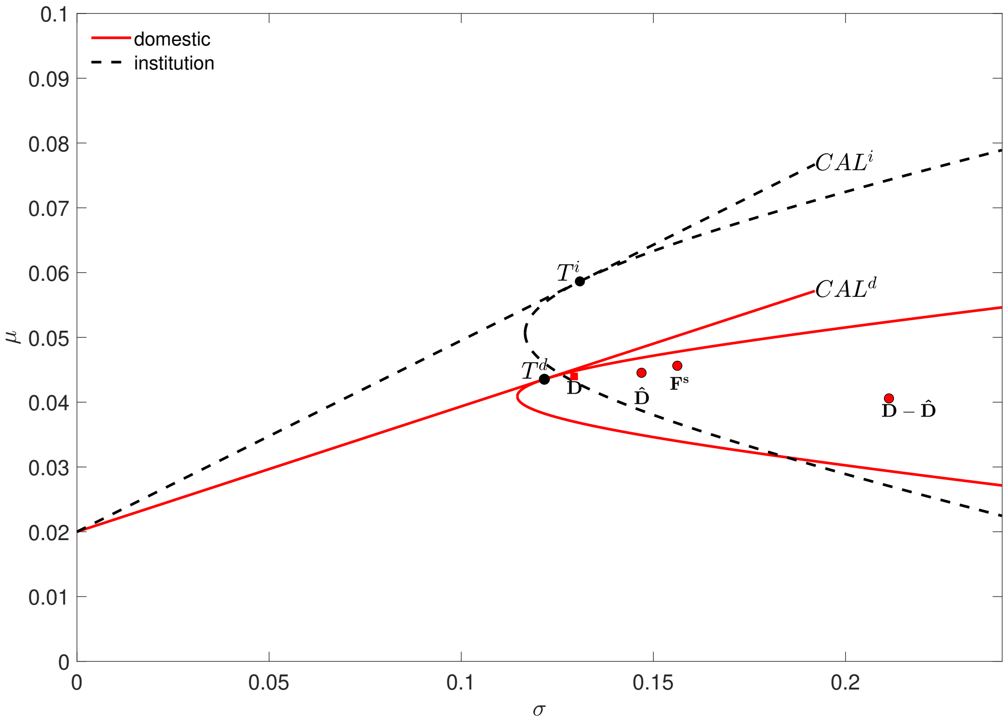

Figure 6. Efficient frontiers of the domestic retail investor and the institutional investor

This figure plots the efficient frontiers of the domestic retail investor and the institutional investor. T^i and T^d are the tangency portfolios of the institutional investor and the domestic retail investor, respectively. CAL^i and CAL^d are the capital allocation lines of the two investors.

Figure 6 shows the portfolio frontiers of the domestic retail investor and the institutional investor. Unlike existing partial segmentation models in which the frontier of an unrestricted investor is superior to that of a restricted investor, the portfolio frontiers of the two investors intersect.

B. Data construction

1. Stock universe

I start with the universe of securities from 48 countries included in the FTSE All-World Index, and I exclude countries with fewer than 10 stocks with positive global institutional ownership by the end of 2003. This results in a total of 38 countries in the sample.[26] I apply

[26] I exclude Colombia, Czech Republic, Egypt, Hungary, Kuwait, Pakistan, Qatar, Romania, Saudi Arabia, and the United Arab Emirates.

the following filters for securities to be included in the sample, following Chaieb, Langlois, and Scaillet, 2021:

1. Securities that are ordinary shares or depository receipts (tpci='0', 'F').
2. Remove non-common stocks based on the keywords used in Griffin, Kelly, and Nardari, 2010, Lee, 2011 according to securities' issue description (*dsci*).
3. Only keep securities that are the major security of their company. In Compustat, a security is considered the major security at a given time if its security identifier (iid) matches the value of the major security item (for companies located in the US and Canada (loc="USA", "CAN"), the primary security item is "PRIHISTUSA" and "PRIHISTCAN," and for companies from the rest of the world, the primary security item is "PRIHISTROW").

2. Security level variable calculation

Total return index I calculate the total return index of securities as $\frac{\texttt{prccd}}{\texttt{ajexdi}} \times \texttt{trfd}$. If `trfd` is missing, I set it to 1. I use the currency `curcdd` and the exchange rate from `exrt_dly` to convert total return indices to USD. I also apply a delisting return of -30% when delisting is performance-related (`dlrsni`). Erroneous returns are identified and removed as follows:

- A return is set to missing if its absolute value is greater than 2.
- A return is set to missing if it is less than -1.
- If the absolute value of a return is greater than 1, the absolute value of a one-period lagged return is greater than 1, and the absolute value of the geometric average return is less than 20%, the return is set to missing.
- To further limit the effect of outliers, I winsorize return observations at the 1% and 99% levels each month for each country.

Market capitalization I calculate market capitalization as $prccd \times cshoc/qunit$ from `g_secd` for non-North American stocks. For North American stocks, I calculate market capitalization as $prccd \times cshoi$. The last reported number of shares outstanding is from sec_afnd. I convert market capitalizations that are not denominated in USD into USD.

Institutional ownership I follow the SAS code of Ferreira and Matos, 2008 to calculate firm-level institutional ownership. Additionally, I calculate each institution's country and region weight for each quarter. Following Bartram et al., 2015, I define global institutions as those whose maximum weight invested in a single country in a given quarter does not exceed 90% and whose maximum weight invested in a single region in a given quarter does not exceed 80%.

Book-to-market ratio Following Davis, Fama, and French, 2000, I calculate book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (Compustat annual item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if it is available. If not, stockholders' equity is the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK) or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, I use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock. I calculate the monthly book-to-market ratio using the ratio between the last reported book value in December of each year and the market capitalization of each month. I winsorize the BM ratio at the 1% and 99% levels.

Dividend yield I calculate the annual dividend of each security as the sum of div in the security daily table over a year. I calculate the monthly dividend yield as the ratio between the annual dividend payment and the security price at the end of each month. I winsorize the dividend yield at the 1% and 99% levels.

C. Estimation methodology

This Appendix provides details about the two-pass regression method used to estimate time-varying risk premiums.

1. Regression framework

The first-pass time-series regression is:

$$r_{i,t} = b'_{1,i}x_{1,i,t} + b'_{2,i}x_{2,i,t} + \epsilon_{i,t} \tag{C.1}$$

$$x_{1,i,t} = (vech(X_t)', Z'_{c,t-1} \otimes Z'_{i,t-1})' \in \mathbb{R}^{d_1=p(p+1)/2+pq}$$

$$x_{2,i,t} = [(f'_{c,t} \otimes Z'_{c,t-1}), (f'_{c,t} \otimes Z'_{i,t-1})] \in \mathbb{R}^{d_2=K(p+q)} \tag{C.2}$$

where K is the number of factors, p is the number of common instruments, q is the number of stock-specific instruments. $X_t \in \mathbb{R}^{p\times p}$ is a symmetric matrix such that $X_{t,k,l} = Z^2_{c,t-1,k}$ if $k = l$, and $X_{t,k,l} = 2Z_{c,t-1,k}Z_{c,t-1,l}$ otherwise. $x_{1,i,t}$ contains $d_1 = p(p+1)/2 + pq$ terms, among which $vech(X_t)$ contains $p(p+1)/2$ interaction terms among common instruments and $Z'_{c,t-1} \otimes Z'_{i,t-1}$ contains pq interaction terms between common instruments and stock-specific instruments. $x_{2,i,t}$ contains $K(p+q)$ factors scaled by common and stock-specific instruments. In this specific setting, the total number of regressors in the first-pass time-series regression is $d = d_1 + d_2 = 9 + 12 = 21$.

The second pass regresses $\hat{b}_1$ on $\hat{b}_3$, which is a transformation of $\hat{b}_2$:

$$\hat{b}_{1,i} = \hat{b}_{3,i}\nu_c \tag{C.3}$$

$$\hat{b}_{3,i} = \Big((N_p[B'_i \otimes I_p])', [W_{p,q}(C'_i \otimes I_p)]'\Big)' \tag{C.4}$$

$$\nu_c = vec[\Lambda'_c - F'_c] \tag{C.5}$$

where $N_p = \frac{1}{2}D^+_p(W_{p,p}+I_{p^2})$, $W_{p,q}$ is the commutation matrix such that $vec[A'] = W_{p,q}vec[A]$

and D_p^+ is the $p(p+1)/2$-by-p^2 matrix such that $vech[A] = D_p^+ vec[A]$.

I run the estimation for individual stocks in each country using global and local factors, n_c denotes number of stocks in a country and T_c denotes the total number of periods when data in country c is available.

2. The instrument selection procedure

Because there is a large number of regressors arising from interaction terms between factor loadings and factor risk-premiums, in practice, some elements in B_i and C_i are set to zero to impose come structure. I use an instrument selection algorithm similar to Chaieb, Langlois, and Scaillet, 2021.

Let $\mathbb{I}_{Bi}$ and $\mathbb{I}_{Ci}$ be $K \times p$ and $K \times q$ indicator matrices whose elements are equal to one if the corresponding elements in B_i and C_i are non-zero. $\tilde{\mathbb{I}}_{B_i}$ is the p-vector whose j^{th} element is equal to one if at least one element in the j^{th} column of B_i is not zero, $\tilde{\mathbb{I}}_{C_i}$ is the q-vector whose j^{th} element is equal to one if at least one element in the j^{th} column of C_i is not zero. $\tilde{p}_i = \tilde{\mathbb{I}}'_{B_i} \iota_p$ is the number of columns in B_i with at least one nonzero element. $\tilde{B}_i$, $\tilde{C}_i$ are obtained by removing rows in $diag(vec[\mathbb{I}'_{B_i}])$, $diag(vec[\mathbb{I}'_{C_i}])$ for which all columns are zero. $\tilde{D}_i$ is the matrix $diag(vech[diag(\tilde{\mathbb{I}}_{B_i})]) + \iota_p \iota'_p - I_p])$ in which columns with all zeros have been removed. $\tilde{E}_i$ is the matrix $diag(\iota_p \otimes \tilde{\mathbb{I}}_{C_i})$ in which columns with all zeros have been removed.

Under the restrictions on B_i and C_i, the first-pass regression is performed as:

$$r_{i,t} = b'_{1,i} x_{1,i,t} + b'_{2,i} x_{2,i,t} + \epsilon_{i,t} \tag{C.6}$$

$$x_{1,i,t} = (vech(X_t)' \tilde{D}_i, (Z'_{c,t-1} \otimes Z'_{i,t-1}) \tilde{E}_i)'$$

$$x_{2,i,t} = [(f'_{c,t} \otimes Z'_{c,t-1}) \tilde{B}'_i, (f'_{c,t} \otimes Z'_{i,t-1}) \tilde{C}'_i]' \tag{C.7}$$

The coefficients $b_{1,i}$ and $b_{2,i}$ are transformation of the coefficients B_i, C_i, Λ_c and F_c of the linear specifications (14), (15), (16):

$$b_{1,i} = \Big((\tilde{D}_i' N_p[(\Lambda_c - F_c)' \otimes I_p] \tilde{B}_i' \tilde{B}_i vec[B_i'])', ([(\Lambda_c - F_c)' \otimes I_q] vec[C_i'])')' \tag{C.8}$$

$$b_{2,i} = \Big((\tilde{B}_{i,c} vec[B_i'])', (\tilde{C}_{i,c} vec[C_i'])' \Big)' \tag{C.9}$$

The restrictions $\mathbb{I}_{B_i}$ and $\mathbb{I}_{C_i}$ are determined using an iterative procedure:

1. Run the regression setting all elements in $\mathbb{I}_{B_i}$ and $\mathbb{I}_{C_i}$ to one.
2. Calculate the condition number of the matrix $\hat{Q}_{x,i} = \frac{1}{T_i} \sum_t I_{i,t} x_{i,t} x_{i,t}'$:

$$CN(\hat{Q}_{x,i}) = \sqrt{eig_{max}(\hat{Q}_{x,i})/eig_{min}(\hat{Q}_{x,i})} \tag{C.10}$$

3. If the condition number is above 15 or the determinant of Q_x is less than machine precision, then find the pair of regressors in $x_{i,2}$ that has the largest cross-correlation in absolute value. Of these two regressors, remove the one with the lowest absolute correlation with $r_{i,t}$ and set its corresponding element in $\mathbb{I}_{B_i}$ and $\mathbb{I}_{C_i}$ to 0.
4. Check the following condition on $\mathbb{I}_{B_i}$: the first column of B_i, i.e. constant are all selected [27]. Otherwise, I keep the regressor and look for the next regressor pair with the highest correlation.
5. Construct new regressors using updated indicator matrices $\mathbb{I}_{B_i}$ and $\mathbb{I}_{C_i}$ and rerun the regression.

3. WLS regression and inference

The second-pass cross-sectional regression under instrument selection is:

[27] I drop the requirement in Chaieb, Langlois, and Scaillet, 2021 that each stock-specific instrument is selected to predict at least one factor loading, because I would like to keep more stocks in the sample to preserve meaningful dispersion in institutional ownership.

$$\hat{b}_{1,i} = \hat{b}_{3,i}\nu \tag{C.11}$$

$$b_{3,i} = \left(\left(\tilde{D}_i' N_p[B_i' \otimes I_p]\right)', \left[W_{p,q}(C_i' \otimes I_p)\right]'\right)' \tag{C.12}$$

$$\nu_c = vec[\Lambda_c' - F_c'] \tag{C.13}$$

A weighted least squares (WLS) estimator for ν_c is:

$$\hat{\nu}_c^{WLS} = \hat{Q}_{b_3}^{-1} \frac{1}{n_c} \sum_i \hat{b}_{3,i}' \hat{w}_i \hat{b}_{1,i} \tag{C.14}$$

where $\hat{Q}_{b_3} = \frac{1}{n_c} \sum_i \hat{b}_{3,i}' \hat{w}_i \hat{b}_{3,i}$ and $\hat{w}_i = \mathbf{1}_i(diag[\hat{v}_i])^{-1}$ are the weights. The weights are set to be the inverse of the asymptotic variances of the standardized errors $\sqrt{T_c}(\hat{b}_{1,i} - \hat{b}_{3,1}\nu_c)$ in the cross-sectional regression for large T from a first step OLS regression. With the OLS estimator $\hat{\nu}$, I calculate standard errors $\hat{v}_i$ using the following relations: $\hat{v}_i = \tau_{i,c} C_{\hat{\nu}_c,i}' \hat{Q}_{x,i}^{-1} S_{ii} \hat{Q}_{x,i}^{-1} C_{\hat{\nu}_c,i}$. Where $\tau_i = \frac{T_c}{T_i}$, $\hat{Q}_{x,i} = \frac{1}{T_i}\sum_t I_{i,t} x_{i,t} x_{i,t}'$, $\hat{S}_{ii} = \frac{1}{T_i}\sum_t I_{i,t}\hat{\epsilon}_{i,t}^2 x_{i,t} x_{i,t}'$, $\hat{\epsilon}_{i,t} = r_{i,t} - \hat{b}_i' x_{i,t}$ and $C_{\hat{\nu}_c,i} = (E_{1,i}' - (I_{d_{1,i}} \otimes \hat{\nu}_c') J_{a,i} E_{2,i}')'$, $E_{1,i} = (I_{d_{1,i}}, \mathbf{0}_{d_{1,i},d_{2,i}})'$, $E_{2,i} = (\mathbf{0}_{d_{2,i},d_{1,i}}, I_{d_{2,i}})'$.

$b_{3,i}$ is obtained by invoking the following identity:

$$vec(b_{3,i}') = J_{a,i} b_{2,i} \tag{C.15}$$

$$J_{a,i} = \begin{bmatrix} J_{1,i} & O \\ O & J_{2,i} \end{bmatrix} \tag{C.16}$$

$$J_{1,i} = W_{p(p-1)/2+\tilde{p}_i,Kp}(I_{pK} \otimes (\tilde{D}_i' N_p) \times \{I_K \otimes [(W_p \otimes I_p)(I_p \otimes vec[I_p])]\}\tilde{B}_{i,c}' \tag{C.17}$$

$$J_{2,i} = W_{pq,pK}(I_K \otimes [(I_p \otimes W_{p,q})(W_{p,q} \otimes I_p)(I_q \otimes vec(I_p))])\tilde{C}_{i,c}' \tag{C.18}$$

where $W_{p,q}$ is the $p \times q$ commutation matrix and $N_p = \frac{1}{2} D_p^+ (W_{p,p} + I_{p^2})$ where D_p^+ is the $p(p+1)/2 \times p^2$ matrix such that $vech(A) = D_p^+ vec(A)$.

The distribution of the estimator $\hat{\nu}_c^{WLS}$ is:

$$\sqrt{n_c T_c}(\hat{\nu}_c^{WLS} - \frac{1}{T_c}\hat{B}_{\nu_c} - \nu_c) \Rightarrow N(0, \Sigma_{\nu_c}) \tag{C.19}$$

where B_ν is the bias correction:

$$\hat{B}_{\nu_c} = \hat{Q}_{b_3}^{-1} J_b \frac{1}{n_c} \sum_i \tau_i vec[E'_{2,i}\hat{Q}_{x,i}^{-1}\hat{S}_{ii}\hat{Q}_{x,i}^{-1}C_{\hat{\nu}_c}\hat{w}_i] \tag{C.20}$$

And the covariance matrix of the estimated risk premium ν_c is:

$$\begin{aligned}
&\hat{\Sigma}_{\nu_c} = \hat{Q}_{b_3}^{-1}\hat{S}\hat{Q}_{b_3}^{-1} \qquad \text{(C.21)}\\
&\hat{S} = \frac{1}{n_c}\sum_{i,j}\frac{\tau_i\tau_j}{\tau_{i,j}} b'_{3,i} w_i C'_{\hat{\nu}_c,i}\hat{Q}_{x,i}^{-1}\tilde{S}\hat{Q}_{x,j}^{-1}C_{\hat{\nu}_c,j}w'_{j,c}b_{3,j}, \tau_{i,j} = \frac{T_c}{T_{ij}}\\
&J_b = (vec[I_{d_{1,i}}]' \otimes I_{Kp})(I_{d_{1,i}} \otimes J_{a,i})\\
&C_{\hat{\nu}_c,i} = (E'_{1,i} - (I_{d_{1,i}} \otimes \hat{\nu}'_c)J_{a,i}E'_{2,i})'
\end{aligned}$$

The bias correction $\hat{B}_{\nu_c}$ accounts for the error-in-variable problem in the first-pass regression. A hard thresholded estimator $\tilde{S}_{ij} = \hat{S}_{ij}\mathbf{1}_{||\hat{S}_{ij}|| \geq \kappa_{n_c,T_c}}$ is used, where $\hat{S}_{ij} = \frac{1}{T_{ij}}\sum_t I_{i,t}I_{j,t}\hat{\epsilon}_{i,t}\hat{\epsilon}_{j,t}x_{i,t}x'_{j,t}$, $||\hat{S}_{ij}||$ is the Frobenius norm, $\kappa_{n_c,T_c} = M\sqrt{\frac{log(n_c)}{T_c}}$ is a data-dependent threshold and M is a positive number set by cross-validation.

To obtain estimates of time-varying risk premiums $\hat{\Lambda}_c$, a SUR of $f_{c,t}$ is ran on lagged common instruments $Z_{c,t-1}$.[28]:

$$f_{c,t} = F_c Z_{c,t-1} + u_t \tag{C.22}$$

[28]I impose the restriction on F_c that the loading of the world factor on country-specific instruments be zero and that the loadings of local factors on the world instrument be zero.

The estimator for F_c is:

$$\hat{F}_c = (\sum f_{c,t} Z'_{c,t-1})(\sum_t Z_{c,t-1} Z'_{c,t-1})^{-1} \tag{C.23}$$

Then $\hat{\Lambda}$ follows from the relation $\nu_c = vec(\Lambda'_c - F'_c)$.

The asymptotic distribution of Λ_c is: $\sqrt{T_c} vec[\hat{\Lambda}'_c - \Lambda'_c] \Rightarrow N(0, \Sigma_{\Lambda_c})$, where

$$\begin{aligned}
\Sigma_{\Lambda_c} &= (\mathbb{I}_K \otimes Q_z^{-1}) \Sigma_u (\mathbb{I}_K \otimes Q_z^{-1}) \qquad \text{(C.24)} \\
\Sigma_u &= E[u_t u'_t \otimes Z_{c,t-1} Z'_{c,t-1}] \\
Q_z &= E[Z_{c,t-1} Z'_{c,t-1}]
\end{aligned}$$

The asymptotic distribution of Λ_c is dominated by the asymptotic distribution of F_c because $\hat{\nu}_c$ has a faster convergence rate than F_c, as is explained in Gagliardini, Ossola, and Scaillet, 2016.

Finally, the time-varying risk premiums is calculated as $\hat{\lambda}_{c,t} = \hat{\Lambda}_c Z_{c,t-1}$. The time-varying risk premiums of each individual stock is calculated as $\mu_{i,t} = \hat{\beta}'_{i,t} \mu_{c,t}$. Where $\hat{\beta}_{i,t}$ is obtained from first-pass estimation $\hat{b}_i$ though (C.9) and (14).

References

Akbari, Amir, Francesca Carrieri, and Aytek Malkhozov (2022). "Can Cross-Border Funding Frictions Explain Financial Integration Reversals?" *The Review of Financial Studies* 35.1, pp. 394–437.

Alexander, Gordon, Cheol S Eun, and Sundaram Janakiramanan (1987). "Asset Pricing and Dual Listing on Foreign Capital Markets: A Note". *Journal of Finance* 42.1, pp. 151–158.

Anton, Miguel and Christopher Polk (2014). "Connected stocks". *The Journal of Finance* 69.3, pp. 1099–1127.

Bartram, Söhnke M et al. (2015). "How important are foreign ownership linkages for international stock returns?" *The Review of Financial Studies* 28.11, pp. 3036–3072.

Bekaert, Geert (1995). "Market integration and investment barriers in emerging equity markets". *The World Bank Economic Review* 9.1, pp. 75–107.

Bekaert, Geert, Campbell R Harvey, Andrea Kiguel, et al. (2016). "Globalization and asset returns". *Annual Review of Financial Economics* 8.1, pp. 221–288.

Bekaert, Geert, Campbell R Harvey, Christian Lundblad, et al. (2007). "Global Growth Opportunities and Market Integration". 62.3, pp. 1081–1137.

Chaieb, Ines and Vihang Errunza (2007). "International asset pricing under segmentation and PPP deviations". *Journal of Financial Economics* 86.2, pp. 543–578.

Chaieb, Ines, Vihang Errunza, and Hugues Langlois (2021). "How Is Liquidity Priced in Global Markets?" *The Review of Financial Studies* 34.9, pp. 4216–4268.

Chaieb, Ines, Vihang Errunza, and Lucie Lu (2023). "Who Invests in What? Public Firms Ownership Around the World". *Available at SSRN 4697585.*

Chaieb, Ines, Hugues Langlois, and Olivier Scaillet (2021). "Time-Varying Risk Premia in Large International Equity Markets". *Journal of Financial Economics.*

Chan, Kalok, Vicentiu Covrig, and Lilian Ng (2005). "What determines the domestic bias and foreign bias? Evidence from mutual fund equity allocations worldwide". *The Journal of Finance* 60.3, pp. 1495–1534.

Davis, James L, Eugene F Fama, and Kenneth R French (2000). “Characteristics, covariances, and average returns: 1929 to 1997”. *The Journal of Finance* 55.1, pp. 389–406.

De Jong, Frank and Frans A De Roon (2005). “Time-varying market integration and expected returns in emerging markets”. *Journal of financial economics* 78.3, pp. 583–613.

De Marco, Filippo, Marco Macchiavelli, and Rosen Valchev (2022). “Beyond Home Bias: International Portfolio Holdings and Information Heterogeneity”. *The Review of Financial Studies* 35.9, pp. 4387–4422.

Edelen, Roger M, Ozgur S Ince, and Gregory B Kadlec (2016). “Institutional investors and stock return anomalies”. *Journal of Financial Economics* 119.3, pp. 472–488.

Errunza, Vihang and Etienne Losq (1985). “International Asset Pricing under Mild Segmentation: Theory and Test”. *The Journal of Finance* 40.1, pp. 1–20.

Faias, José A and Miguel A Ferreira (2017). “Does institutional ownership matter for international stock return comovement?” *Journal of International Money and Finance* 78, pp. 64–83.

Fama, Eugene F and Kenneth R French (2007). “Disagreement, Tastes, and Asset Prices$”. *Journal of Financial Economics*.

— (2012). “Size, value, and momentum in international stock returns”. *Journal of financial economics* 105.3, pp. 457–472.

Fama, Eugene F and James D MacBeth (1973). “Risk, return, and equilibrium: Empirical tests”. *Journal of political economy* 81.3, pp. 607–636.

Ferreira, Miguel A and Pedro Matos (2008). “The colors of investors’ money: The role of institutional investors around the world”. *Journal of Financial Economics* 88.3, pp. 499–533.

Gagliardini, Patrick, Elisa Ossola, and Olivier Scaillet (2016). “Time-varying risk premium in large cross-sectional equity data sets”. *Econometrica* 84.3, pp. 985–1046.

— (2019). “A diagnostic criterion for approximate factor structure”. *Journal of Econometrics* 212.2, pp. 503–521.

Greenwood, Robin, Samuel G Hanson, and Gordon Y Liao (2018). "Asset price dynamics in partially segmented markets". *The Review of Financial Studies* 31.9, pp. 3307–3343.

Griffin, John M (2002). "Are the Fama and French factors global or country specific?" *The Review of Financial Studies* 15.3, pp. 783–803.

Griffin, John M, Patrick J Kelly, and Federico Nardari (2010). "Do Market Efficiency Measures Yield Correct Inferences? A Comparison of Developed and Emerging Markets". *Review of Financial Studies* 23.8, pp. 2935–2969.

Gromb, Denis and Dimitri Vayanos (2002). "Equilibrium and welfare in markets with financially constrained arbitrageurs". *Journal of Financial Economics* 66.2-3, pp. 361–407.

He, Zhiguo, Bryan Kelly, and Asaf Manela (2017). "Intermediary asset pricing: New evidence from many asset classes". *Journal of Financial Economics* 126.1, pp. 1–35.

Hollstein, Fabian (2020). "Local, Regional, or Global Asset Pricing?" *Journal of Financial and Quantitative Analysis, forthcoming.*

Hou, Kewei, Andrew Karolyi, and Bong-Chan Kho (2011). "What factors drive global stock returns?" *The Review of Financial Studies* 24.8, pp. 2527–2574.

Kacperczyk, Marcin, Jaromir Nosal, and Tianyu Wang (2022). *Global Volatility and Firm-Level Capital Flows.*

Kacperczyk, Marcin, Savitar Sundaresan, and Tianyu Wang (2021). "Do foreign institutional investors improve price efficiency?" *The Review of Financial Studies* 34.3, pp. 1317–1367.

Karlsson, Anders and Lars Nordén (2007). "Home sweet home: Home bias and international diversification among individual investors". *Journal of Banking & Finance* 31.2, pp. 317–333.

Karolyi, Andrew and Rene Stulz (2003). "Are Financial Assets Priced Locally or Globally?" *Handbook of the Economics of Finance*. Vol. 1. Elsevier, pp. 975–1020.

Karolyi, G Andrew and Ying Wu (2018). "A New Partial-Segmentation Approach to Modeling International Stock Returns". *Journal of Financial and Quantitative Analysis* 53.2, pp. 507–546.

Koijen, Ralph SJ, Robert J Richmond, and Motohiro Yogo (2023). "Which investors matter for equity valuations and expected returns?" *Review of Economic Studies*, rdad083.

Lau, Sie Ting, Lilian Ng, and Bohui Zhang (2010). "The world price of home bias". *Journal of Financial Economics* 97.2, pp. 191–217.

Lee, Kuan-Hui (2011). "The world price of liquidity risk". *Journal of Financial Economics* 99.1, pp. 136–161.

Lewis, Karen K (2011). "Global asset pricing". *Annual Review of Financial Economics*.

Luo, H. Arthur and Ronald J. Balvers (Feb. 2017). "Social Screens and Systematic Investor Boycott Risk". *Journal of Financial and Quantitative Analysis* 52.1, pp. 365–399. ISSN: 0022-1090, 1756-6916. DOI: 10.1017/S0022109016000910. URL: https://www.cambridge.org/core/product/identifier/S0022109016000910/type/journal_article (visited on 01/22/2024).

Matos, Pedro (2020). "ESG and responsible institutional investing around the world: A critical review". *CFA Institute Research Foundation*.

Merton, Robert C (1987). "A Simple Model of Capital Market Equilibrium with Incomplete Information". *Journal of Finance* 42.3, pp. 483–510.

Newey, Whitney K and Kenneth D West (1987). "A simple, positive semi-definite, heteroskedasticity and autocorrelationconsistent covariance matrix". *Econometrica* 55.3, pp. 703–708.

Pavlova, Anna and Taisiya Sikorskaya (2023). "Benchmarking intensity". *The Review of Financial Studies* 36.3, pp. 859–903.

Petzev, Ivan, Andreas Schrimpf, and Alexander F Wagner (2016). "Has the Pricing of Stocks become more Global?" *BIS Working Paper*.

Seasholes, Mark S and Ning Zhu (2010). "Individual Investors and Local Bias". *Journal of Finance* 65.5, pp. 1987–2010.

Stulz, Rene M (1981). "On the effects of barriers to international investment". *The Journal of Finance* 36.4, pp. 923–934.

Tuckman, Bruce and Jean-Luc Vila (1992). "Arbitrage With Holding Costs: A Utility-Based Approach". *The Journal of Finance* 47.4, pp. 1283–1302.

Zerbib, Olivier David (2022). "A Sustainable Capital Asset Pricing Model (S-CAPM): Evidence from Environmental Integration and Sin Stock Exclusion". *Review of Finance*.

Table 1 Summary statistics

This table reports, for each country, the total number of stocks (N), the average proportion of institutional stocks to the country's aggregate market capitalization (Proportion), annualized average returns, and volatilities of the institutional local factor (f^{inst}) and the retail local factor (f^{retail}). For each month, institutional stocks are stocks whose global institutional ownership is above the 50$^{\text{th}}$ percentile of all stocks in its country and higher than 1%. The institutional local factor is constructed as the residual from a 36-month rolling window regression of the attainable domestic market portfolio onto the foreign institutional portfolio. The retail local factor is constructed as the residual from a 36-month rolling window regression of the retail portfolio onto the domestic institutional portfolio. The sample period is monthly from January 2000 to December 2020.

			Annualized average return (%)		Annualized volatility (%)	
			A: Developed markets			
Country	N	Proportion	f^{inst}	f^{retail}	f^{inst}	f^{retail}
Australia	3209	0.854	3.239	-2.776	11.888	7.713
Austria	183	0.800	0.108	2.701	12.595	9.876
Belgium	290	0.812	-0.048	2.052	11.990	11.798
Canada	3622	0.926	1.562	-0.423	10.237	11.074
Denmark	378	0.816	7.052	-2.629	12.340	11.880
Finland	256	0.812	-3.014	4.769	16.718	18.504
France	1556	0.875	-2.048	2.223	9.006	8.509
Germany	1352	0.857	-4.351	4.563	9.256	10.886
Hong Kong	1924	0.869	4.099	-11.752	13.384	15.535
Ireland	176	0.820	2.245	-7.423	11.337	38.427
Israel	890	0.750	2.068	-0.026	15.582	15.135
Italy	679	0.881	-3.860	-8.395	13.150	11.868
Japan	4842	0.881	-1.450	-2.433	12.903	7.772
Netherlands	396	0.727	0.580	-5.190	10.602	11.700
New Zealand	273	0.741	6.739	-0.820	12.693	10.800
Norway	530	0.775	2.850	2.599	14.186	13.507
Portugal	114	0.883	-4.885	-3.554	13.806	21.639
Singapore	1006	0.834	2.433	-2.620	13.582	9.534
Spain	382	0.814	-0.458	-5.527	13.897	12.387
Sweden	995	0.879	-0.945	6.631	10.733	10.392
Switzerland	478	0.881	2.496	-3.762	9.234	11.509
UK	4333	0.843	-2.726	-2.482	7.549	7.108
US	15630	0.911	0.736	-5.019	7.530	13.921
			A: Emerging markets			
Country	N	Proportion	f^{inst}	f^{retail}	f^{inst}	f^{retail}
Brazil	526	0.657	6.916	-8.304	30.898	22.749
Chile	270	0.484	-5.052	7.072	20.929	12.733
China	5566	0.334	13.607	-5.355	17.531	22.553
Greece	464	0.719	-12.358	-6.588	26.010	16.203
India	4920	0.764	6.065	-1.609	23.338	13.591
Indonesia	805	0.649	12.245	-7.728	29.545	17.407
South Korea	3123	0.822	5.041	-12.964	18.253	13.053
Malaysia	1429	0.756	4.314	-2.040	16.005	8.925
Mexico	217	0.750	3.274	-0.292	15.271	11.611
Philippines	320	0.716	8.937	-1.341	19.408	13.528
Poland	1110	0.810	-0.364	-0.259	20.180	12.378
South Africa	831	0.782	6.393	-2.247	19.649	11.692
Taiwan	2494	0.802	2.055	-5.323	18.263	10.909
Thailand	956	0.677	12.596	-7.085	21.589	13.258
Turkey	524	0.777	1.634	-3.238	33.559	21.245

Table 2 Price of covariance risk estimated from unconditional Fama-MacBeth regression of individual stocks returns

This table reports the unconditional estimate of the price of covariance risk of the attainable world market factor, the institutional local factor and the retail local factor. I report the estimated price of covariance risk as the average across cross-sections. Newey and West, 1987 standard errors are used that account for heteroskedasticity and serial correlation.

$$E[r_i] = \alpha + \lambda^{\hat{W}} cov(r_i, r_{\hat{W}}) + \lambda^{inst} cov(r_i, f^{inst}) + \lambda^{retail} cov(r_i, f^{retail})$$

In each month, each covariance is estimated using a 36-month rolling regression to estimate each covariance. Then for each cross-section, I regress stock returns on the covariance estimates. For each country, I also report underneath the country name the average number of stocks in each cross-section, the average OLS adjusted R^2 in the first row and the GLS R^2 in the second row as measures of model fit. * indicates that the coefficient is significant at the 10% level, ** indicates that the coefficient is significant at the 5% level, and *** indicates that the coefficient is significant at the 1% level.

A: Developed markets					
Country	α	$\lambda^{\hat{W}}$	λ^{inst}	λ^{retail}	R2OLS/GLS
Australia	0.002	0.459	1.514***	0.495	0.030
1734	(0.588)	(0.782)	(3.555)	(0.945)	0.027
Austria	-0.000	-1.388	8.163***	5.778***	0.266
107	(-0.127)	(-0.906)	(4.387)	(4.813)	0.264
Belgium	0.002	0.611	3.360***	-2.470*	0.209
174	(0.523)	(0.419)	(3.087)	(-1.829)	0.202
Canada	-0.006***	1.232**	2.330***	0.881**	0.036
1796	(-3.063)	(2.383)	(3.176)	(2.014)	0.034
Denmark	0.005	-1.099	0.142	2.181**	0.108
209	(1.501)	(-1.103)	(0.128)	(2.316)	0.111
Finland	0.002	0.976	4.028***	0.885	0.120
148	(0.429)	(0.683)	(2.953)	(1.214)	0.126
France	0.004	-0.974	1.706***	0.082	0.054
881	(1.205)	(-1.247)	(2.773)	(0.098)	0.048
Germany	-0.005	-0.951	4.270***	0.981	0.063
822	(-1.102)	(-1.165)	(4.784)	(1.600)	0.060
Hong Kong	-0.001	-0.534*	1.201***	0.224	0.036
1165	(-0.188)	(-1.716)	(3.371)	(0.476)	0.034
Ireland	0.002	1.984*	6.422***	-1.101*	0.183
98	(0.724)	(1.837)	(3.036)	(-1.965)	0.199
Israel	-0.001	0.219	1.107**	2.276***	0.052
474	(-0.386)	(0.536)	(2.063)	(7.092)	0.049
Italy	0.003	-0.578	1.347	-2.181*	0.090
329	(1.600)	(-0.886)	(1.093)	(-1.940)	0.088
Japan	0.002	-0.717	2.089***	1.216	0.066
3515	(1.092)	(-1.308)	(4.996)	(0.823)	0.057
Netherlands	0.003**	-0.411	-0.169	-1.372	0.109
220	(2.448)	(-0.314)	(-0.150)	(-0.943)	0.111
New Zealand	0.004	-0.999	1.703**	-1.173	0.119
147	(0.730)	(-0.898)	(2.543)	(-1.167)	0.124
Norway	0.004	-1.126	-0.549	2.132***	0.104
231	(1.185)	(-1.630)	(-0.607)	(2.681)	0.104

Portugal	0.005	-1.511	-1.277	2.352***	0.194
63	(1.504)	(-1.204)	(-1.448)	(3.239)	0.220
Singapore	0.005***	-0.002	0.001	1.362**	0.072
608	(2.991)	(-0.002)	(0.002)	(2.285)	0.068
Spain	0.004	-1.422**	2.326***	0.366	0.097
189	(1.096)	(-2.120)	(2.748)	(0.244)	0.103
Sweden	-0.001	1.158**	3.424***	1.445	0.065
444	(-0.288)	(2.481)	(4.332)	(1.629)	0.062
Switzerland	0.001	0.236	6.335***	-0.256	0.114
299	(0.658)	(0.187)	(4.803)	(-0.268)	0.109
UK	-0.003	0.663	0.865	-2.689***	0.025
2251	(-1.129)	(1.615)	(1.642)	(-3.679)	0.023
US	-0.020***	3.120***	-1.000	-3.188***	0.026
8738	(-5.953)	(3.049)	(-0.943)	(-3.705)	0.022
		Emerging markets			
Country	α	$\lambda^{\hat{W}}$	λ^{inst}	λ^{retail}	R2OLS/GLS
Brazil	0.011	-0.471	0.700	1.846***	0.131
271	(1.536)	(-0.488)	(1.132)	(2.853)	0.104
Chile	0.009*	0.847	-0.771	1.983**	0.070
180	(1.833)	(1.199)	(-1.387)	(2.039)	0.056
China	-0.003	-0.143	2.103**	1.103*	0.128
2625	(-1.045)	(-0.344)	(2.036)	(1.895)	0.105
Greece	-0.004	2.339**	-0.507	-0.114	0.097
298	(-1.467)	(2.142)	(-1.227)	(-0.140)	0.096
India	0.007*	-0.462	1.515***	0.180	0.050
2321	(1.738)	(-1.132)	(5.463)	(0.376)	0.043
Indonesia	0.009**	-0.661	0.857***	2.189**	0.059
431	(2.335)	(-1.279)	(3.662)	(2.563)	0.055
Malaysia	0.004**	-0.460	0.788***	-0.393	0.043
977	(2.514)	(-1.030)	(2.663)	(-0.553)	0.041
Mexico	0.007*	-1.334	1.808**	3.103	0.128
126	(1.707)	(-0.901)	(2.100)	(1.312)	0.131
Philippines	0.006	0.406	0.803**	1.781***	0.077
231	(0.962)	(0.817)	(2.174)	(2.746)	0.079
Poland	-0.001	-0.163	0.476	2.152***	0.067
507	(-0.557)	(-0.231)	(1.397)	(3.807)	0.063
South Africa	0.000	0.859**	0.585	-2.004*	0.053
420	(0.048)	(2.314)	(1.028)	(-1.927)	0.051
South Korea	-0.008**	1.469***	1.548***	0.726	0.083
1726	(-2.368)	(2.764)	(4.641)	(0.710)	0.068
Taiwan	-0.001	1.410***	0.642**	0.727	0.056
1463	(-0.410)	(3.491)	(2.400)	(1.175)	0.049
Thailand	0.009***	-0.415	0.072	-0.784	0.081
570	(3.751)	(-0.792)	(0.168)	(-0.873)	0.061
Turkey	0.005	1.384***	0.654***	-0.006	0.082
345	(1.332)	(2.690)	(3.304)	(-0.020)	0.080

Table 3 Attainable world market, institutional local and retail local risk premiums estimated from the Gagliardini, Ossola, and Scaillet, 2016 conditional two-pass regression

This table presents, for each country, the estimates of the loadings of time-varying risk premiums on common instruments Λ_c in the linear specification of time-varying risk premiums in (15) whose components is given in (19). I also report the number of stocks (N) used in the second-step cross-sectional regression. Common instruments include a constant, world dividend yield DY_t and country dividend yield $DY_{c,t}$. As is explained in Section II.B, I impose the restriction that $\Lambda_{DY}^{inst} = \Lambda_{DY}^{retail} = 0$ in the estimation. Because I also impose the restriction that $\Lambda_{DY}^{\hat{W}} = F_{DY}^{\hat{W}}$ and the conditional mean of the global factor does not load on local dividend yield, $\Lambda_{DY}^{\hat{W}}$ is the same across countries. In this table, I only report the coefficients of the constant Λ_0 and of the local dividend yield Λ_{DY_c}. I first obtain estimates for the risk-premium ν_c from the second-pass regression, then F_c is estimated using a SUR of $f_{c,t}$ on $Z_{c,t-1}$. I then obtain Λ_c through the relation $\nu_c = vec(\Lambda_c' - F_c')$. The covariance matrix of Λ_c is given in (C.24). * indicates that the coefficient is significant at the 10% level, ** indicates that the coefficient is significant at the 5% level, and *** indicates that the coefficient is significant at the 1% level. All numbers are reported in annualized percentage terms.

A: Developed markets

		Attainable world		Institutional local		Retail local	
Country	N	Λ_0	Λ_{DY_c}	Λ_0	Λ_{DY_c}	Λ_0	Λ_{DY_c}
Australia	1681	3.041	3.386**	7.395	−4.665	3.622	−1.418
Austria	75	4.620*	−3.278*	4.273	−5.671*	7.967**	−3.048
Belgium	118	−2.172	−9.507***	24.925***	16.054***	−9.511*	5.271**
Canada	1529	8.627***	−3.071*	−1.686	−5.901	−2.510	−0.032
Denmark	158	3.068	1.444	12.044***	−4.986	−3.438	4.922*
Finland	122	11.120***	−0.787	−7.710	5.000	0.672	−1.906
France	717	−0.883	−0.190	6.384	−1.959	6.443	−0.013
Germany	721	6.005**	−2.636	−1.205	3.753	2.490	1.068
Hong Kong	1141	2.571	0.815	6.429*	4.386	7.837*	2.006
Ireland	77	12.974***	0.424	−7.984**	−2.718	20.742***	−2.501
Israel	453	9.429***	−0.691	−2.760	−0.403	7.550**	4.008
Italy	282	1.013	−0.299	1.826	−0.629	−4.378	−4.487
Japan	2670	3.919	−3.483**	1.051	2.638	5.406	0.584
Netherlands	185	4.519*	−0.934	3.509	−1.943	−5.113	3.985
New Zealand	120	11.733***	3.978**	0.109	−1.387	2.111	−0.680
Norway	202	7.317**	−5.357**	4.560	−3.770	1.602	3.178
Portugal	44	8.690***	−15.832***	−7.387	17.284***	−4.041	−13.193**
Singapore	562	6.882**	−0.637	−1.695	0.577	7.330	−1.096
Spain	155	5.071*	−3.796*	1.957	−3.739	−9.298	−8.968**
Sweden	393	4.188	2.892	6.175	0.449	5.753	−7.703**
Switzerland	222	2.804	−3.326*	11.680*	−1.844	−4.501	1.341
UK	1918	6.134**	−3.255**	−1.018	−1.858	2.285	0.906
US	7739	5.996**	−7.488***	2.646	5.050	0.261	0.534
Average		5.507		2.762		1.708	

B: Emerging markets

		Attainable world		Institutional local		Retail local	
Country	n	Λ_0	Λ_{DY_c}	Λ_0	Λ_{DY_c}	Λ_0	Λ_{DY_c}
Brazil	245	8.432***	4.762	4.062	−1.821	1.700	−4.555
Chile	131	7.508**	−1.025	2.336	−4.646	3.333	4.573*
China	2868	8.056***	3.358	6.055	−1.572	5.375*	−7.377*
Greece	292	6.674**	−5.010*	−17.841***	12.269***	11.812***	4.837
India	2322	1.068	−0.747	16.017***	16.266***	−1.505	5.525**
Indonesia	420	−1.955	4.834	28.115***	5.117	−8.007**	1.958
South Korea	1827	7.015**	2.067	3.444	5.478**	5.045*	−0.405
Malaysia	937	0.366	1.628	7.235*	4.495*	−0.801	−0.804
Mexico	104	14.508***	−3.463*	−7.007*	−3.945	4.109	5.294**
Philippines	209	4.967*	11.228***	8.638**	1.471	6.674	2.313
Poland	610	5.114*	4.543**	−4.001	−6.155	7.724*	−2.328
South Africa	323	−2.345	−5.644**	17.102***	8.657***	−0.976	−5.625**
Taiwan	1508	0.302	8.542***	5.815	0.918	3.437	−0.207
Thailand	512	−0.103	10.121***	19.581***	−12.402***	−6.134	3.119
Turkey	374	3.789	6.771*	4.549	−6.626	7.888**	−5.909
Average		4.226		6.273		2.645	

Table 4 Average model-implied risk premiums across firms by country

This table reports average model-implied risk premiums across individual stocks by country. For stock i from country c in month t, the total risk premium and its three components are calculated. For each country at each time, I calculate the equal-weighted risk premiums across individual stocks and report the time-series average. All numbers are reported in annualized percentage terms.

Country	Attainable world	Institutional local	Retail local	Total risk premium
		A: Developed markets		
Australia	5.211	6.949	4.238	16.397
Austria	4.818	2.656	3.471	10.944
Belgium	-1.732	12.172	-3.530	6.910
Canada	10.428	-2.341	-1.051	7.036
Denmark	3.231	7.665	-0.969	9.928
Finland	11.876	-3.530	0.290	8.636
France	-0.551	4.234	3.406	7.090
Germany	6.233	-0.428	1.143	6.949
Hong Kong	3.460	6.050	5.718	15.228
Ireland	14.498	-3.675	1.994	12.816
Israel	8.126	-2.017	5.311	11.420
Italy	1.620	1.574	-1.414	1.780
Japan	2.893	0.871	5.129	8.893
Netherlands	5.143	1.925	-1.232	5.835
New Zealand	12.753	-0.026	0.871	13.598
Norway	9.795	3.009	0.442	13.246
Portugal	7.439	-6.688	0.402	1.153
Singapore	8.411	-1.563	6.490	13.338
Spain	5.237	1.427	-3.361	3.303
Sweden	5.279	4.595	1.047	10.922
Switzerland	2.745	8.185	-1.395	9.535
UK	5.925	-1.154	1.007	5.778
US	4.885	1.438	-0.006	6.317
Average	5.278	1.426	1.818	8.522
		B: Emerging markets		
Brazil	12.364	3.231	1.312	16.907
Chile	6.326	1.748	2.871	10.945
China	7.833	3.869	4.791	16.492
Greece	7.975	-11.910	9.927	5.993
India	2.150	15.107	-1.542	15.716
Indonesia	-1.987	21.179	-4.782	14.410
South Korea	9.744	3.345	4.587	17.676
Malaysia	0.587	7.520	-0.940	7.168
Mexico	15.613	-5.506	1.549	11.656
Philippines	4.620	7.147	2.253	14.020
Poland	7.426	-3.198	5.454	9.682
South Africa	-2.652	12.866	-0.391	9.823
Taiwan	0.609	5.598	3.221	9.429
Thailand	-0.121	15.682	-5.293	10.268
Turkey	3.722	3.975	3.865	11.562
Average	4.519	6.636	1.968	13.122

Table 5 How institutional ownership affects global and local risk premiums in developed markets.
This table presents regression of firm-level model-implied total, attainable world market, institutional local and retail local premiums on institutional ownership (IO) and firm level controls. For each regression, I consider two alternative specifications, one including country-level institutional ownership (*CountryIO*) and the intermediary capital ratio of He, Kelly, and Manela, 2017 (*CR*), the other including country-time fixed effects. All standard errors are clustered at the firm level.

$$y_{i,t} = \beta_1 IO_{i,t-1} + \beta_2 \rho_i + \beta_3 X_{i,t-1} + \beta_4 CountryIO_{c,t-1} + \beta_5 CR_{t-1} + \alpha_{c,t} + \epsilon_{i,t},\ y \in \{\mu_{i,t}, \mu_{i,t}^{world}, \mu_{i,t}^{inst}, \mu_{i,t}^{retail}\}$$

	Total		World		Institutional local		Retail local	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IO	0.063***	0.036***	0.046***	0.014***	0.029***	0.019***	-0.012***	0.004***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)
ρ	0.163***	0.177***	0.100***	0.129***	0.039***	0.038***	0.024***	0.010***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
LOGMV	-0.009***	-0.007***	-0.005***	-0.003***	-0.001***	-0.001***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BM	-0.002***	-0.002***	0.000	-0.001***	-0.002***	-0.000	0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DY	-0.295***	-0.360***	-0.224***	-0.263***	-0.046***	-0.043***	-0.025***	-0.053***
	(0.012)	(0.011)	(0.010)	(0.007)	(0.008)	(0.006)	(0.005)	(0.005)
CountryIO	-0.219***		-0.044***		-0.034***		-0.141***	
	(0.005)		(0.004)		(0.004)		(0.002)	
CR	-2.576***		-1.718***		-0.481***		-0.377***	
	(0.021)		(0.018)		(0.013)		(0.008)	
Observations	3,220,189	3,220,189	3,220,189	3,220,189	3,220,189	3,220,189	3,220,189	3,220,189
R-squared	0.185	0.412	0.173	0.640	0.019	0.296	0.088	0.359
Country-time FE	N	Y	N	Y	N	Y	N	Y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. How institutional ownership affects global and local risk premiums in emerging markets.

This table presents regression of firm-level model-predicted total, attainable world market, institutional local and retail local premiums on institutional ownership (IO) and firm level controls. For each regression, I consider two alternative specifications, one including country-level institutional ownership ($CountryIO$) and the intermediary capital ratio of He, Kelly, and Manela, 2017 (CR), the other including country-time fixed effects. All standard errors are clustered at the firm level.

$$y_{i,t} = \beta_1 IO_{i,t-1} + \beta_2 \rho_i + \beta_3 X_{i,t-1} + \beta_4 CountryIO_{c,t-1} + \beta_5 CR_{t-1} + \alpha_{c,t} + \epsilon_{i,t},\ y \in \{\mu_{i,t}, \mu_{i,t}^{world}, \mu_{i,t}^{inst}, \mu_{i,t}^{retail}\}$$

	Total		World		Institutional local		Retail local	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IO	-0.128***	-0.081***	0.003	0.063***	-0.003	-0.043***	-0.128***	-0.102***
	(0.011)	(0.009)	(0.010)	(0.007)	(0.010)	(0.005)	(0.006)	(0.004)
ρ	0.093***	0.217***	0.039***	0.100***	0.107***	0.125***	-0.053***	-0.008***
	(0.005)	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)	(0.002)
LOGMV	0.007***	-0.003***	0.007***	-0.002***	-0.007***	-0.002***	0.006***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BM	0.014***	0.000	0.009***	0.002***	0.003***	-0.000	0.001***	-0.001***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
DY	-0.237***	-0.347***	-0.142***	-0.086***	-0.003	-0.194***	-0.092***	-0.066***
	(0.017)	(0.014)	(0.013)	(0.009)	(0.016)	(0.010)	(0.009)	(0.006)
CountryIO	0.211***		0.029***		-0.099***		0.281***	
	(0.014)		(0.011)		(0.013)		(0.008)	
CR	-3.466***		-3.869***		0.087***		0.317***	
	(0.028)		(0.025)		(0.018)		(0.009)	
Observations	1,790,675	1,790,675	1,790,675	1,790,675	1,790,675	1,790,675	1,790,675	1,790,675
R-squared	0.153	0.651	0.273	0.752	0.033	0.655	0.045	0.626
Country-time FE	N	Y	N	Y	N	Y	N	Y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Internet Appendix for
Institutional Investment and International Risk-sharing

Lucie Y. Lu

University of Melbourne

December 22, 2024

(Not for publication)

This Internet Appendix presents supplementary materials and results not included in the main body of the paper.

A. Special cases under alternative model assumptions

This appendix discusses the equilibrium risk premium of different assets under alternative assumptions about the choice sets of institutional investors and retail investors.

A.1. Institutional investors do not have mandate constraint

Suppose the institutional investor is free of any mandate constraint. Define the vector of domestic (foreign) excess returns as $\mathbf{r}_D = [\mathbf{r}'_R, \mathbf{r}'_I]'$ ($\mathbf{r}_F = [\mathbf{r}'_{I^*}, \mathbf{r}'_{R^*}]'$). The supply of domestic (foreign) securities in terms of market capitalization is denoted as $\mathbf{s}_D = [\mathbf{s}'_R, \mathbf{s}'_I]'$ ($\mathbf{s}_F = [\mathbf{s}'_{I^*}, \mathbf{s}'_{R^*}]'$). Denote the covariance matrix between domestic and foreign securities as:

$$\begin{bmatrix} V_{DD} & V_{DF} \\ V_{FD} & V_{FF} \end{bmatrix} = \begin{bmatrix} V_{RR} & V_{RI} & V_{RI^*} & V_{RR^*} \\ V_{IR} & V_{II} & V_{II^*} & V_{IR^*} \\ V_{I^*R} & V_{I^*I} & V_{I^*I^*} & V_{R^*R^*} \\ V_{R^*R} & V_{R^*I} & V_{R^*I^*} & V_{R^*R^*} \end{bmatrix}$$

The FOC of domestic and foreign retail investors remains the same and can be rewritten as:

$$V_{DD}\mathbf{x}_D^d = \frac{1}{\gamma^d}\boldsymbol{\mu}_D \tag{IA.1}$$

$$V_{FF}\mathbf{x}_F^d = \frac{1}{\gamma^f}\boldsymbol{\mu}_F \tag{IA.2}$$

The FOC of the institutional investors absent mandate constraint becomes:

$$V_{DD}\mathbf{x}_D^i + V_{DF}\mathbf{x}_F^i = \frac{1}{\gamma^i}\boldsymbol{\mu}_D \tag{IA.3}$$

$$V_{FD}\mathbf{x}_D^i + V_{FF}\mathbf{x}_F^i = \frac{1}{\gamma^i}\boldsymbol{\mu}_F \tag{IA.4}$$

From (IA.1) and (IA.2) solve the demand by domestic and foreign retail investors:

$$\mathbf{x}_D^d = \frac{1}{\gamma^d}V_{DD}^{-1}\boldsymbol{\mu}_D \tag{IA.5}$$

$$\mathbf{x}_F^d = \frac{1}{\gamma^f}V_{FF}\boldsymbol{\mu}_F \tag{IA.6}$$

Utilizing the market-clearing conditions of domestic and foreign assets, and (IA.5) and (IA.6), the holdings by institutional investors are:

$$\mathbf{x}_D^i = \mathbf{s}_D - \frac{1}{\gamma^d}V_{DD}^{-1}\boldsymbol{\mu}_D \tag{IA.7}$$

$$\mathbf{x}_F^i = \mathbf{s}_F - \frac{1}{\gamma^f}V_{FF}^{-1}\boldsymbol{\mu}_F \tag{IA.8}$$

Substitute (IA.7) and (IA.8) into the FOCs (IA.3) and (IA.4) yields the following linear system involving the risk premium of domestic and foreign securities:

$$\begin{aligned} V_{DD}\mathbf{s}_D - \frac{1}{\gamma^d}\boldsymbol{\mu}_D + V_{DF}\mathbf{s}_F - \frac{1}{\gamma^f}V_{DF}V_{FF}^{-1}\boldsymbol{\mu}_F &= \frac{1}{\gamma^i}\boldsymbol{\mu}_D \\ V_{FD}\mathbf{s}_D - \frac{1}{\gamma^d}V_{FD}V_{DD}^{-1}\boldsymbol{\mu}_D + V_{FF}\mathbf{s}_F - \frac{1}{\gamma^f}\boldsymbol{\mu}_F &= \frac{1}{\gamma^i}\boldsymbol{\mu}_F \end{aligned} \tag{IA.9}$$

The above linear system can be rewritten as:

$$(\frac{1}{\gamma^i} + \frac{1}{\gamma^d})\boldsymbol{\mu}_D + \frac{1}{\gamma^f}V_{DF}V_{FF}^{-1}\boldsymbol{\mu}_F = V_{DD}\mathbf{s}_D + V_{DF}\mathbf{s}_F \tag{IA.10}$$

$$(\frac{1}{\gamma^i} + \frac{1}{\gamma^f})\boldsymbol{\mu}_F + \frac{1}{\gamma^d}V_{FD}V_{DD}^{-1}\boldsymbol{\mu}_D = V_{FD}\mathbf{s}_D + V_{FF}\mathbf{s}_F \tag{IA.11}$$

Define the aggregate absolute risk aversion of investors in the domestic and foreign markets:

$$\frac{1}{\gamma^D} = \frac{1}{\gamma^i} + \frac{1}{\gamma^d}$$
$$\frac{1}{\gamma^F} = \frac{1}{\gamma^i} + \frac{1}{\gamma^f}$$

Rewrite the linear system in matrix form

$$\begin{bmatrix} \frac{1}{\gamma^D} V_{DD} & \frac{1}{\gamma^f} V_{DF} \\ \frac{1}{\gamma^d} V_{FD} & \frac{1}{\gamma^F} V_{FF} \end{bmatrix} \begin{bmatrix} V_{DD}^{-1} & \mathbf{O} \\ \mathbf{O} & V_{FF}^{-1} \end{bmatrix} \tag{IA.12}$$

Solve the linear system by inverting the block matrices

$$\begin{bmatrix} \boldsymbol{\mu}_D \\ \boldsymbol{\mu}_F \end{bmatrix} = \begin{bmatrix} V_{DD}\mathbf{s}_D + V_{DF}\mathbf{s}_F \\ V_{FD}\mathbf{s}_D + V_{FF}\mathbf{s}_F \end{bmatrix} \tag{IA.13}$$

$$\begin{bmatrix} \boldsymbol{\mu}_D \\ \boldsymbol{\mu}_F \end{bmatrix} = \begin{bmatrix} V_{DD} & \mathbf{O} \\ \mathbf{O} & V_{FF} \end{bmatrix} \begin{bmatrix} \frac{1}{\gamma^D} V_{DD} & \frac{1}{\gamma^f} V_{DF} \\ \frac{1}{\gamma^d} V_{FD} & \frac{1}{\gamma^F} V_{FF} \end{bmatrix}^{-1} \begin{bmatrix} V_{DD}\mathbf{s}_D + V_{DF}\mathbf{s}_F \\ V_{FD}\mathbf{s}_D + V_{FF}\mathbf{s}_F \end{bmatrix}$$
$$= \begin{bmatrix} V_{DD} & \mathbf{O} \\ \mathbf{O} & V_{FF} \end{bmatrix} \begin{bmatrix} \gamma^D \Phi_D^{-1} & -\frac{\gamma^D\gamma^F}{\gamma^f} \Phi_D^{-1} V_{DF} V_{FF}^{-1} \\ -\frac{\gamma^D\gamma^F}{\gamma^d} \Phi_F^{-1} V_{FD} V_{DD}^{-1} & \gamma^F \Phi_F^{-1} \end{bmatrix} \begin{bmatrix} V_{DD}\mathbf{s}_D + V_{DF}\mathbf{s}_F \\ V_{FD}\mathbf{s}_D + V_{FF}\mathbf{s}_F \end{bmatrix}$$

where the matrices Φ_D and Φ_F are defined as

$$\Phi_D = V_{DD} - \frac{\gamma^D\gamma^F}{\gamma^d\gamma^f} V_{DF} V_{FF}^{-1} V_{FD} \tag{IA.14}$$

$$\Phi_F = V_{FF} - \frac{\gamma^D\gamma^F}{\gamma^d\gamma^f} V_{FD} V_{DD}^{-1} V_{DF} \tag{IA.15}$$

Φ_D (Φ_F) can be interpreted as the conditional variance of domestic (foreign) assets not spanned by domestic (foreign) assets. The amount of conditioning is modulated by the ratio $\frac{\gamma^D\gamma^F}{\gamma^d\gamma^f}$. Without loss of generality, assume that all investors have the same relative risk aversion $\alpha = W^k\gamma^k$. Define the aggregate wealth of investors investing in the domestic market as $W^D = W^d + W^i$ and the aggregate wealth of investors investing in the foreign market as $W^F = W^f + W^i$, then

$$\gamma^D = \frac{\alpha}{W^D}$$
$$\gamma^F = \frac{\alpha}{W^F}$$
$$\frac{\gamma^D \gamma^F}{\gamma^d \gamma^f} = \frac{W^d W^f}{W^D W^F}$$

Intuitively, the ratio represents the relative importance of retail investors in both markets. The more important retail investors are, the more the spanning between domestic and foreign securities matters because only retail investors need to replicate exposures in the other country using their home assets.

In order to further simplify (IA.13) , I assume that the following approximation holds:

$$\Phi_D^{-1} \approx \theta V_{DD}^{-1} \tag{IA.16}$$
$$\Phi_F^{-1} \approx \theta V_{FF}^{-1} \tag{IA.17}$$

When there is only one domestic and one foreign security, the approximation holds exactly. Suppose that the correlation between the domestic and foreign security is $corr(r_D, r_F) = \rho$, then

$$\Phi_D = (1 - \frac{\gamma^D \gamma^F}{\gamma^d \gamma^f} \rho^2) V_{DD}$$
$$\Phi_D^{-1} = [1 - \frac{\gamma^D \gamma^F}{\gamma^d \gamma^f} \rho^2]^{-1} V_{DD}^{-1}$$
$$\Phi_F = (1 - \frac{\gamma^D \gamma^F}{\gamma^d \gamma^f} \rho^2) V_{FF}$$
$$\Phi_F^{-1} = [1 - \frac{\gamma^D \gamma^F}{\gamma^d \gamma^f} \rho^2]^{-1} V_{FF}^{-1}$$

in this case, $\theta = [1 - \frac{\gamma^D \gamma^F}{\gamma^d \gamma^f} \rho^2]^{-1}$.

Applying the approximation (IA.16) to further simplify the linear system (IA.13) and solve for the risk premium of domestic securities:

$$\begin{aligned}\boldsymbol{\mu}_D &= \gamma^D\theta(V_{DD}\mathbf{s}_D + V_{DF}\mathbf{s}_F) - \frac{\gamma^D\gamma^F}{\gamma^f}\theta V_{DF}V_{FF}^{-1}(V_{FD}\mathbf{s}_D + V_{FF}\mathbf{s}_F) \\ &= \gamma^D\theta\left[(V_{DD} - \frac{\gamma^F}{\gamma^f}V_{DF}V_{FF}^{-1}V_{FD})\mathbf{s}_D + (V_{DF} - \frac{\gamma^F}{\gamma^f}V_{DF})\mathbf{s}_F\right] \\ &= \gamma^D\theta\left[(1 - \frac{\gamma^F}{\gamma^f})(V_{DD}\mathbf{s}_D + V_{DF}\mathbf{s}_F) + \frac{\gamma^F}{\gamma^f}\Big(V_{DD} - V_{DF}V_{FF}^{-1}V_{FD}\Big)\right] \\ &= \frac{\gamma^D\gamma^F}{\gamma^i}\theta\left[(V_{DD}\mathbf{s}_D + V_{DF}\mathbf{s}_F) + \frac{\gamma^i}{\gamma^f}\Big(V_{DD} - V_{DF}V_{FF}^{-1}V_{FD}\Big)\mathbf{s}_D\right]\end{aligned} \tag{IA.18}$$

where I used $1 - \frac{\gamma^F}{\gamma^f} = \frac{\gamma^F}{\gamma^i}$.

Define aggregate risk aversion γ as:

$$\gamma = \frac{\gamma^D\gamma^F}{\gamma^i}\theta$$

The above pricing result can be expressed in terms of covariance with the world market portfolio and with the domestic market portfolio:

$$\boldsymbol{\mu}_D = \gamma\mathbb{C}ov(\mathbf{r}_D, r_W) + \frac{\gamma^i}{\gamma^f}\gamma\mathbb{C}ov(\mathbf{r}_D, r_D - r_{D^s}) \tag{IA.19}$$

where the excess return of the substitute portfolio for domestic securities is:

$$r_{D^s} = \frac{\mathbf{s}_D}{M_D}V_{DF}V_{FF}^{-1}\mathbf{r}_F$$

By symmetry, the risk premium of foreign securities is:

$$\boldsymbol{\mu}_F = \frac{\gamma^D\gamma^F}{\gamma^i}\theta\left[(V_{FD}\mathbf{s}_D + V_{FF}\mathbf{s}_F) + \frac{\gamma^i}{\gamma^d}\Big(V_{FF} - V_{FD}V_{DD}^{-1}V_{DF}\Big)\mathbf{s}_F\right] \tag{IA.20}$$

A.2. Retail investors do not have home bias

In the unrealistic case that retail investors do not have home bias and fully diversify in all global securities, the model is reduced to the market structure of Errunza and Losq, 1985; Luo and Balvers, 2017; Zerbib, 2022. In this case, institutional investors become the restricted investors who only invest in institutional securities, and retail investors become unrestricted investors who invest in all securities. Then international risk-sharing no longer depends on institutional investors. Define the set of domestic and foreign institutional securities as eligible securities (E) and retail securities as excluded securities (X). The vector of eligible securities excess returns is $\mathbf{r}_E = [\mathbf{r}'_I, \mathbf{r}'_{I^*}]$. The supply of eligible securities in terms of market capitalization is denoted as $\mathbf{s}_X = [\mathbf{s}_I, \mathbf{s}_{I^*}]$. Denote the covariance matrix between eligible and excluded securities as:

$$\begin{bmatrix} V_{EE} & V_{EX} \\ V_{XE} & V_{XX} \end{bmatrix} = \begin{bmatrix} V_{II} & V_{II^*} & V_{IR} & V_{IR^*} \\ V_{I^*I} & V_{I^*I^*} & V_{I^*R} & V_{I^*R^*} \\ V_{RI} & V_{RI^*} & V_{RR} & V_{RR^*} \\ V_{R^*I} & V_{R^*I^*} & V_{R^*R} & V_{R^*R^*} \end{bmatrix}$$

The FOCs of domestic and foreign retail investors now become the same, define $\frac{1}{\gamma^R} = \frac{1}{\gamma^d} + \frac{1}{\gamma^f}$ as the aggregate absolute risk aversion of retail investors, and $\mathbf{x}_E^R$, and $\mathbf{x}_X^R$ as their aggregate holdings in eligible and excluded securities.

$$V_{EE}\mathbf{x}_E^R + V_{EX}\mathbf{x}_X^R = \frac{1}{\gamma^R}\boldsymbol{\mu}_E \tag{IA.21}$$

$$V_{XE}\mathbf{x}_E^R + V_{XX}\mathbf{x}_X^R = \frac{1}{\gamma^R}\boldsymbol{\mu}_X \tag{IA.22}$$

The FOC of institutional investors remains the same:

$$V_{EE}\mathbf{x}_E^i = \frac{1}{\gamma^i}\boldsymbol{\mu}_E \tag{IA.23}$$

The equilibrium risk premium can be solved as in Errunza and Losq, 1985; Luo and Balvers, 2017; Zerbib, 2022. Summing (IA.21) and (IA.23) yields

$$\boldsymbol{\mu}_E = \gamma[V_{EE}\mathbf{s}_E + V_{EX}\mathbf{s}_X] \tag{IA.24}$$

where $\frac{1}{\gamma} = \frac{1}{\gamma^R} + \frac{1}{\gamma^i}$ is the aggregate absolute risk aversion of all investors, and I used the market-clearing conditions:

$$\begin{aligned} \mathbf{x}_E^R + \mathbf{x}_E^i &= \mathbf{s}_E \\ \mathbf{x}_E^R &= \mathbf{s}_R \end{aligned} \tag{IA.25}$$

From (IA.21) solves for the demand for eligible securities by retail investors

$$\mathbf{x}_E^R = \frac{1}{\gamma^R}V_{EE}^{-1}\boldsymbol{\mu}_E - V_{EE}^{-1}V_{EX}\mathbf{s}_X \tag{IA.26}$$

Substitute (IA.24) into (IA.26) yields:

$$\mathbf{x}^R_E = \frac{\gamma}{\gamma^R}\mathbf{s}_E + (\frac{\gamma}{\gamma^R} - 1)V_{EE}^{-1}V_{EX}\mathbf{s}_X \qquad \text{(IA.27)}$$
$$\mathbf{x}^i_E = (1 - \frac{\gamma}{\gamma^R})\Big[\mathbf{s}_E + V_{EE}^{-1}V_{EX}\mathbf{s}_X\Big]$$

Substitute (IA.26) into (IA.22) and simplify yields:

$$\boldsymbol{\mu}_X = \gamma[V_{XE}\mathbf{s}_E + V_{XX}\mathbf{s}_X] + (\gamma^R - \gamma)[V_{XX}\mathbf{s}_X - V_{XE}V_{EE}^{-1}V_{EX}\mathbf{s}_X] \qquad \text{(IA.28)}$$

The pricing equations (IA.24) and (IA.28) can be expressed in terms of their covariance with two factors:

$$\boldsymbol{\mu}_E = \gamma M_W \mathbb{C}ov(\mathbf{r}_E, r_W)$$
$$\boldsymbol{\mu}_X = \gamma M_W \mathbb{C}ov(\mathbf{r}_X, r_W) + (\gamma^R - \gamma)\mathbb{C}ov(\mathbf{r}_X, r_X|\mathbf{r}_E)$$

where r_W is the return on the world market portfolio and r_X is the return on the market portfolio of excluded (domestic and foreign retail) securities.

The generic expression for the risk premium of any security j becomes

$$\mu_j = \gamma M_W \mathbb{C}ov(r_j, r_W) + (\gamma^R - \gamma)\mathbb{C}ov(r_j, r_X|\mathbf{r}_E) \qquad \text{(IA.29)}$$

The second risk premium earned by excluded securities corresponds to the retail local premium in the full model, capturing the risk aversion specific to retail investors. However, there are two key differences. First, the local systematic risk in the excluded segment now includes both domestic and foreign retail securities and is influenced by the risk aversion of retail investors from both countries. Second, this local risk is conditioned on the entire span of both domestic and foreign institutional securities, rather than just the local institutional securities of each retail security. As a result, this special case is not entirely nested within the solution of the full model. The local risk premium also resembles the institutional local premium in the full model, as it reflects the relative risk aversion between unconstrained (retail) and constrained (institutional) investors:

$$(\gamma^R - \gamma)\mathbb{C}ov(\mathbf{r}_X, r_X|\mathbf{r}_E) = \frac{\gamma^R}{\gamma^i}\gamma\mathbb{C}ov(\mathbf{r}_X, r_X|\mathbf{r}_E) \qquad \text{(IA.30)}$$

(IA.29) can be further expressed in terms of beta representation with respect to the market portfolio of eligible securities as in De Jong and De Roon, 2005; Zerbib, 2022, or with respect to the world market portfolio as in Luo and Balvers, 2017.

A.3. Retail investors invest in foreign institutional securities

A more realistic scenario is that retail investors from both countries diversify internationally by investing in institutional securities from the other country, facing similar implicit barriers to international diversification as institutional investors. Retail securities, in contrast, are only held by local retail investors.

As in the previous case, define the set of domestic and foreign institutional securities as eligible securities. The vector of eligible securities excess returns is $\mathbf{r}_E = [\mathbf{r}'_I, \mathbf{r}'_{I^*}]$. The supply of eligible securities in terms of market capitalization is denoted as $\mathbf{s}_E = [\mathbf{s}_I, \mathbf{s}_{I^*}]$. The covariance matrix between eligible securities and domestic and foreign retail securities are

$$V_{ER} = \begin{bmatrix} V_{IR} \\ V_{I^*R} \end{bmatrix} \qquad V_{ER^*} = \begin{bmatrix} V_{IR^*} \\ V_{I^*R^*} \end{bmatrix}$$

The FOC of domestic retail investors is now:

$$V_{RR}\mathbf{s}_R + V_{RE}\mathbf{x}_E^d = \frac{1}{\gamma^d}\boldsymbol{\mu}_R \tag{IA.31}$$

$$V_{ER}\mathbf{s}_R + V_{EE}\mathbf{x}_E^d = \frac{1}{\gamma^d}\boldsymbol{\mu}_E \tag{IA.32}$$

The FOC of foreign retail investors is now:

$$V_{EE}\mathbf{x}_E^f + V_{ER^*}\mathbf{s}_{R^*} = \frac{1}{\gamma^f}\boldsymbol{\mu}_E \tag{IA.33}$$

$$V_{R^*E}\mathbf{x}_E^f + V_{R^*R^*}\mathbf{s}_{R^*} = \frac{1}{\gamma^f}\boldsymbol{\mu}_{R^*} \tag{IA.34}$$

The FOC of institutional investors remains the same as (IA.23). Summing up the FOC for investment in eligible securities (IA.32), (IA.33), (IA.23), applying the market clearing condition for eligible securities:

$$\begin{aligned} \boldsymbol{\mu}_E &= \gamma[V_{ER}\mathbf{s}_R + V_{EE}\mathbf{s}_E + V_{ER^*}\mathbf{s}_{R^*}] \\ &= \gamma M_W \mathbb{C}ov(\mathbf{r}_E, r_W) \end{aligned} \tag{IA.35}$$

where $\frac{1}{\gamma} = \frac{1}{\gamma^d} + \frac{1}{\gamma^i} + \frac{1}{\gamma^f}$. Since risk-sharing is perfect in the segment of eligible securities, these securities are priced globally. And the return of the world market portfolio is

$$r_W = \frac{1}{M_W}\left[\mathbf{s}'_R\mathbf{r}_R + \mathbf{s}'_E\mathbf{r}_E + \mathbf{s}'_{R^*}\mathbf{r}_{R^*}\right]$$

The risk premium of eligible securities (IA.35) is the same as the risk premium of globally accessible securities in Alexander, Eun, and Janakiramanan, 1987; Karolyi and Wu, 2018 or that of eligible securities in Chaieb and Errunza, 2007 without PPP deviation, with the addition of institutional investors who only invests in the investable securities in both countries. Therefore the aggregate risk tolerance is $\frac{1}{\gamma} = \frac{1}{\gamma^d} + \frac{1}{\gamma^i} + \frac{1}{\gamma^f}$.

Substitute (IA.35) into the FOCs (IA.32) and (IA.33) to solve for the investment in eligible securities by retail investors:

$$\mathbf{x}_E^d = \frac{1}{\gamma^d}V_{EE}^{-1}\boldsymbol{\mu}_E - V_{EE}^{-1}V_{ER}\mathbf{s}_R \tag{IA.36}$$

$$= (\frac{\gamma}{\gamma^d} - 1)V_{EE}^{-1}V_{ER}\mathbf{s}_R + \frac{\gamma}{\gamma^d}\left[\mathbf{s}_E + V_{EE}^{-1}V_{ER^*}\mathbf{s}_{R^*}\right]$$

$$\mathbf{x}_E^f = \frac{1}{\gamma^f}V_{EE}^{-1}\boldsymbol{\mu}_E - V_{EE}^{-1}V_{ER^*}\mathbf{s}_{R^*} \tag{IA.37}$$

$$= (\frac{\gamma}{\gamma^f} - 1)V_{EE}^{-1}V_{ER^*}\mathbf{s}_{R^*} + \frac{\gamma}{\gamma^f}\left[V_{EE}^{-1}V_{ER}\mathbf{s}_R + \mathbf{s}_E\right]$$

Substitute (IA.36) into (IA.31) and (IA.37) into (IA.34) yields the risk premium of retail securities:

$$\boldsymbol{\mu}_R = \gamma[V_{RE}V_{EE}^{-1}V_{ER}\mathbf{s}_R + V_{RE}\mathbf{s}_E + V_{RE}V_{EE}^{-1}V_{ER^*}\mathbf{s}_{R^*}] + \gamma^d\left[V_{RR} - V_{RE}V_{EE}^{-1}V_{ER}\right]\mathbf{s}_R \tag{IA.38}$$

$$\boldsymbol{\mu}_{R^*} = \gamma[V_{R^*E}V_{EE}^{-1}V_{ER^*}\mathbf{s}_{R^*} + V_{R^*E}\mathbf{s}_E + V_{R^*E}V_{EE}^{-1}V_{ER}\mathbf{s}_R] + \gamma^f\left[V_{R^*R^*} - V_{R^*E}V_{EE}^{-1}V_{ER^*}\right]\mathbf{s}_{R^*} \tag{IA.39}$$

Since the market structure is symmetric, henceforth, I focus on analyzing the pricing of domestic retail securities (IA.38). This result can be rewritten in terms of covariance forms:

$$\boldsymbol{\mu}_R = \gamma M_W \mathbb{C}ov(\hat{\mathbf{r}}_R, r_W) + \gamma^d M_R \mathbb{C}ov(\mathbf{r}_R, r_R - \hat{r}_R) \tag{IA.40}$$

where the attainable return of domestic retail securities is defined as the component of domestic retail securities returns that can be spanned by the entire set of eligible securities, including both domestic and foreign institutional securities.

$$\hat{\mathbf{r}}_R = V_{RE}V_{EE}^{-1}\mathbf{r}_E$$

The world market portfolio is the value-weighted portfolio of all securities:

$$r_W = \frac{1}{M_W}\Big[\mathbf{s}'_R\mathbf{r}_R + \mathbf{s}'_E\mathbf{r}_E + \mathbf{s}'_{R^*}\mathbf{r}_{R^*}\Big]$$

The attainable domestic retail portfolio is the component of the domestic retail portfolio that can be spanned by institutional securities:

$$\hat{r}_R = \frac{\mathbf{s}'_R}{M_R}V_{RE}V_{EE}^{-1}\mathbf{r}_E$$

The generic expression for the risk premium of any domestic security j becomes:

$$\mu_j = \gamma M_W \mathbb{C}ov(\hat{r}_j, r_W) + \gamma^d M_R \mathbb{C}ov(r_j, r_R - \hat{r}_R) \tag{IA.41}$$

which represents a special case of the pricing result in the full model, excluding the institutional local risk premium. This simplification arises because international risk-sharing now does not rely on institutional investors. However, since retail securities are only held by their respective local retail investors, they still exhibit a retail local risk premium. This special case deviates from the full model in two ways. First, the attainable returns for retail securities are now defined as the return on a portfolio of both domestic and foreign institutional securities, rather than just local institutional securities. Second, the world market factor is represented by the return on the world market portfolio, not the attainable world market portfolio. This adjustment is due to the fact that attainable returns of retail securities across countries are constructed from the same set of eligible securities. As a result, conditioning is already applied on the return of retail securities, removing the need to apply it again on the world market portfolio.

The solution (IA.38) is equivalent to the risk premiums of local stocks in Alexander, Eun, and Janakiramanan, 1987; Karolyi and Wu, 2018 or the ineligible securities in Chaieb and Errunza, 2007 without PPP deviation. To see the equivalence to Alexander, Eun, and Janakiramanan, 1987; Karolyi and Wu, 2018, rewrite (IA.38) by benchmarking the total risk premium with respect to the domestic market risk premium.

$$\begin{aligned}\boldsymbol{\mu}_R &= \gamma^d\Big[V_{RR}\mathbf{s}_R + V_{RE}\mathbf{s}_E\Big] - (\gamma^d - \gamma)\Big[V_{RE}\mathbf{s}_E + V_{RE}V_{EE}^{-1}V_{ER}\mathbf{s}_R\Big] + \gamma\Big[V_{RE}V_{EE}^{-1}V_{ER^*}\Big] \qquad \text{(IA.42)}\\ &= \gamma^d M_D \mathbb{C}ov(\mathbf{r}_R, r_D) - (\gamma^d - \gamma)M_D \mathbb{C}ov(\hat{\mathbf{r}}_R, r_D) + \gamma M_F \mathbb{C}ov(\hat{\mathbf{r}}_R, r_{R^*})\end{aligned}$$

where

$$
\begin{aligned}
M_D &= M_R + M_E \\
M_F &= M_{R^*} \\
r_D &= \frac{M_R}{M_D} r_R + \frac{M_E}{M_D} r_E
\end{aligned}
$$

where M_D is the aggregate market value of all domestic retail securities and eligible securities, and M_F, is the aggregate market value of all foreign retail securities.

Expression (IA.42) corresponds to equation (2c) in Karolyi and Wu, 2018 or (20) in Alexander, Eun, and Janakiramanan, 1987. The second term is the domestic externality (discount) for the domestic risk that can be shared with institutional and foreign retail investors through their diversification, the third term is the foreign externality (premium) for the compensation for bearing foreign systematic risk through their correlation with eligible securities.

The solution (IA.38) is also equivalent to the risk premiums of ineligible securities in the partial segmentation case of Chaieb and Errunza, 2007, in the absence of PPP deviation, it is also equivalent to (5) in Karolyi and Wu, 2018. To see this, rewrite the risk premium using the world market as a benchmark:

$$
\begin{aligned}
\boldsymbol{\mu}_R &= \gamma \Big[V_{RR}\mathbf{s}_R + V_{RE}\mathbf{s}_E + V_{RR^*}\mathbf{s}_{R^*} \Big] + (\gamma^d - \gamma) \Big[V_{RR} - V_{RE} V_{EE}^{-1} V_{ER} \Big] \mathbf{s}_R \\
&\quad - \gamma \Big[V_{RR^*} - V_{RE} V_{EE}^{-1} V_{ER^*} \Big] \mathbf{s}_{R^*} \\
&= \gamma M_W \mathbb{C}ov(\mathbf{r}_R, r_W) + (\gamma^d - \gamma) M_R \mathbb{C}ov(\mathbf{r}_R, r_R | \mathbf{r}_E) - \gamma M_{R^*} \mathbb{C}ov(\mathbf{r}_R, r_{R^*} | \mathbf{r}_E)
\end{aligned} \tag{IA.43}
$$

where the first local risk premium is the "conditional market risk premium" and the second local premium is the "cross-market risk premium".

B. The effect of global institutional investment on equilibrium risk premiums

How does the risk premium of a domestic retail stock k change after it is included in the choice set of global institutions? On the one hand, it would enjoy direct international risk-sharing and no longer earn the retail local risk premium. On the other hand, the attainable world market risk premium and the institutional local risk premium now depend on the covariance between the raw return of the security (r_k) with the risk factors rather than its attainable component ($\hat{r}_k$). Taking the difference between the risk premium of an institutional security k and a retail security k yields the change in its risk premium:[1]

$$\Delta\mu_k \approx \gamma\mathbb{C}ov(r_k - \hat{r}_k, r_{\hat{F}})M_F - \gamma^d\mathbb{C}ov(r_k - \hat{r}_k, r_R)M_R \tag{IA.44}$$

If a retail security can be perfectly replicated by its institutional counterpart, then inclusion in the institutional choice set has no effect on its risk premium. Otherwise, the effect of inclusion depends on how its non-attainable exposure covaries with local retail securities and with foreign attainable exposures. Securities that covary more with local retail securities and less with foreign attainable exposures get more reduction in risk premium post-inclusion.

[1] Here I assume that the local institutional risk factor lies in the span of domestic institutional securities.