Granular Portfolios, Expectations, and International Capital Flows*

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Abstract

We identify a novel channel of international financial contagion driven by investor expectations. Using a unique dataset linking investors' cross-country GDP growth expectations to their equity mutual fund investments and to funds' country allocations, we show that inflows into mutual funds respond strongly to fund-level expected growth, whereas funds' country allocations react only weakly to country-specific expectations. This asymmetry generates co-ownership spillovers: negative expectations about one country propagate mechanically to other countries held in the same funds, even in the absence of changes in the country's own expected fundamentals. We develop a portfolio choice model with delegated investment and portfolio stickiness to rationalize this pattern. Because country weights in global portfolios are highly granular, these spillovers are quantitatively important, accounting for about 80% of expectation-driven capital flow reallocation. Small countries are disproportionately exposed to these spillovers, while large countries are their main sources.

Keywords: International portfolio allocation; Capital flows; Expectations; Financial contagion; Portfolio frictions; Mutual funds.

JEL codes: D84, F32, G11, G15, G23.

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1 Introduction

Why do asset prices and business cycles comove across countries? Existing explanations emphasize correlated fundamentals, global financial cycles, and real and financial contagion.[1] A large literature highlights financial contagion driven by funding shocks to global banks, which typically transmit disturbances from advanced economies–home to most of these banks–to emerging markets. Yet the role of expectations in shaping international financial spillovers remains poorly understood, in part because direct evidence on how expectations affect cross-country portfolio allocation is scarce.

In this paper, we provide new evidence that expectations play a central role in driving capital flows and can generate financial contagion even in the absence of funding shocks or changes in local fundamentals.[2] Expectations about the future performance of one country's asset market can induce large capital reallocations toward or away from other countries, even when expectations about those countries' own fundamentals do not change.

This mechanism arises because investment in global equity markets is predominantly delegated. Investors choose how much capital to allocate across global, regional, or emerging-market equity funds, but they do not control how these funds allocate capital across the countries in their portfolios. Using a unique dataset that links investors' cross-country GDP growth expectations to their mutual fund investments and to funds' country allocations, we show that fund flows respond strongly to investors' fund-level expectations (constructed using the fund's portfolio weights), while funds' country allocations respond weakly to investors' country-level expectations. As a result, flows into funds are substantially more elastic than cross-country portfolio reallocations, implying substantial portfolio stickiness.

Using a delegated-portfolio model, we show that this stickiness generates comovement in capital flows through "co-ownership spillovers."[3] When investors become pessimistic about one country, they reduce investments in funds exposed to that country. If funds continuously updated their portfolios, reallocations would insulate other countries in the fund. When portfolios are sticky, however, this capital retrenchment mechanically spills over to all countries in the portfolio.

Whether such spillovers generate meaningful international contagion depends on the structure of expectations. Suppose that expectations are driven by global shocks and by country-specific shocks. If the country-specific shocks to expectations average out in the aggregate, then these spillovers will be driven only by global shocks that are relevant for all countries. However, since some countries compose a disproportionate share of fund portfolios

[1]See Forbes and Rigobon (2001), Karolyi (2003), Forbes (2012), and Rigobón (2019) for surveys.

[2]Mutual funds manage a large share of global capital flows; see Schmidt and Yesin (2022).

[3]We borrow this term from Jotikasthira et al. (2012).

(the ten largest countries account for 65% of portfolio holdings), then shocks specific to these countries spillover to the other countries because they affect capital flows into the funds in a non-negligible way. The "granularity" of fund shares is thus key (Gabaix, 2011).

We formalize this mechanism by linking co-ownership spillovers to the granular component of investors' fund-level expectations and to capital-flow elasticities. We then quantify the importance of this channel using estimated elasticities, observed portfolio weights, and expectations. The granularity of portfolios and the high portfolio stickiness imply that co-ownership spillovers account for roughly 80% of the variance of expectation-driven capital flow reallocation, making them the dominant force. Because these spillovers are unrelated to recipient countries' fundamentals, they have important implications for capital misallocation.

Small advanced and emerging economies are the primary recipients of these spillovers, while large advanced and emerging economies–such as the G7 and BRICS–are the main contributors. Unlike traditional funding contagion, this channel does not imply a systematic North-South transmission, but rather a Large-to-Small-country one. As a result, some large emerging economies, such as China and Brazil, contribute strongly to spillovers while being relatively insulated themselves. These findings suggest that policymakers in small economies should pay attention not only to large shocks on global financial centers but also on large countries with overlapping investor bases.

We contribute to several strands of literature. First, we contribute to the literature on granularity in financial markets. Existing work emphasizes that aggregate and cross-country fluctuations may arise from idiosyncratic shocks to large actors—such as firms or sectors—when size distributions are fat-tailed.[4] In financial markets, related mechanisms operate through shocks to large banks or institutional investors.[5] In contrast, granularity in our setting arises from the distribution of country weights within portfolios, not from investor size. A small number of countries account for a disproportionate share of global equity fund holdings, so expectation shocks to these countries propagate internationally even when investors themselves are small and diversified. Moreover, this mechanism operates through portfolio reallocation across countries rather than changes in aggregate investment.

Second, we contribute to the literature on international shock transmission through mutual funds. Existing work shows that shocks to the investor base generate comovement in emerging markets and affect asset prices.[6] However, direct evidence on co-ownership

[4]See Gabaix (2011); Acemoglu et al. (2012); di Giovanni et al. (2014); Carvalho and Grassi (2019); Herskovic et al. (2020); Gaubert and Itskhoki (2021).

[5]See Ben-David et al. (2016); Amiti and Weinstein (2018); Galaasen et al. (2020); Camanho et al. (2022); Gabaix and Koijen (2021).

[6]See Broner et al. (2006); Gelos (2011); Raddatz and Schmukler (2012); Puy (2016). Coval and Stafford (2007) show that U.S. mutual funds redeem investments as a consequence of funding shocks that originate from their investor base, and that these forced redemptions significantly impact U.S. domestic equity prices.

spillovers remains limited. While Jotikasthira et al. (2012) infer such spillovers through calibration, we identify them directly using investor-level expectations and quantify their contribution using the data.

Third, we contribute to the literature on portfolio adjustment frictions. Our model delivers a simple mapping between portfolio stickiness and the relative elasticity of capital flows to country- versus fund-level expectations. Using this mapping, we estimate that mutual funds update portfolios roughly every 22 months (16 months for active funds), consistent with existing estimates based on delayed adjustment models (see for instance Bacchetta and van Wincoop (2017)). Previous evidence of delayed portfolio adjustment has been based on imputed expectations (that is, expectations constructed from observables, such as past returns) or on the persistence of portfolios.[7]

Fourth, we contribute to the growing literature linking survey-based expectations to investment behavior.[8] To our knowledge, we are the first to estimate how investors' beliefs shape the cross-country allocation of equity investments.[9] We show that investors' expectations strongly affect allocation across funds but only weakly affect within-fund country allocations. As a result, cross-country reallocation primarily occurs through shifts across funds, even when fund portfolios themselves are sticky.

Methodologically, our approach exploits the granular instrumental-variable (GIV) framework developed by Gabaix and Koijen (2021, 2024) to identify capital-flow elasticities.[10] We apply the granular logic to address a missing-variable bias due to incomplete observation of country-level expectations within fund portfolios. To estimate the elasticity of capital flows, we therefore replace the raw fund-level expectation with a granular residual constructed as a weighted average of idiosyncratic, country-specific expectations, which is orthogonal to the missing data. Exploiting the investor dimension of our data, we further remove consensus expectations to construct an investor-specific "super-granular" residual that is orthogonal to global market beliefs and identifies the partial-equilibrium response of capital flows to investor expectations.

Jotikasthira et al. (2012) show that global funds, domiciled in developed markets, display the same forced trading behavior as US domestic funds. They show that this flow-induced trading has a significant effect on prices, country betas and return comovement among emerging markets.

[7] Bohn and Tesar (1996), Froot et al. (2001), find that international portfolio flows are highly persistent and strongly related to lagged returns, and more recently Bacchetta et al. (2020) test a delayed adjustment model using mutual fund data.

[8] See Vissing-Jorgensen (2003); Glaser and Weber (2005); Kézdi and Willis (2011); Weber et al. (2012); Piazzesi and Schneider (2009); Malmendier and Nagel (2015); Agarwal et al. (2022); Giglio et al. (2021); Dahlquist and Ibert (2021); Ma et al. (2022).

[9] The cross-country allocation of sovereign bond holdings and bank credit supply have been investigated respectively by De Marco et al. (2021) and Li and Ongena (2025).

[10] See Gabaix and Koijen (2024) for a survey of papers using GIVs.

Section 2 describes the data. Section 3 estimates the responsiveness of mutual fund flows to investors' expectations. Section 4 develops a delegated portfolio-choice model and characterizes co-ownership spillovers. Section 5 maps the model to the data and identifies key elasticities. Section 6 quantifies the contribution of co-ownership spillovers.

2 Data

Our dataset combines economic expectations data from Consensus Economics with investor and mutual fund data from Emerging Portfolio Fund Research (EPFR).

2.1 Expectation dataset: Consensus Economics Data

We use forecast data from Consensus Economics, a survey firm that collects monthly projections from professional forecasters. Each month, respondents provide their current-year and next-year forecasts for key macroeconomic indicators for a range of countries. The dataset spans the period 1989–2023. Our primary variable of interest is the forecasted real GDP growth for 51 advanced and emerging economies. Consensus Economics reports the institutional affiliation of each forecaster, which we extract, clean, and match to the corresponding financial institutions reporting information in the EPFR mutual fund data.

2.2 Investor and mutual fund dataset: EPFR Data

EPFR provides monthly fund-level country allocations, cash shares, assets under management, weekly fund flows, and valuation changes. These data are widely used to study international equity and bond investments and capture between 5 and 20% of market capitalization for most countries; existing work shows they closely match CRSP and balance-of-payments data in terms of equity flows and returns.[11]

The EPFR data contain information about the financial institution managing the fund. These fund managers are typically global banks, which we refer to as "investors". We match these investors to the institution reported by Consensus Economics using token-based fuzzy matching methods complemented by manual verification using additional sources on corporate relationships. Using our procedure, we are able to match the country allocations, flows, and forecasts for 52 countries and 64 investors. One limitation of our data is that we observe expectations data for only an average of 17% of countries into which our mutual funds invest (24% when weighted by portfolio shares). We address this potential issue with our empirical methodology outlined in Section 3.

[11]See Jotikasthira et al. (2012); Miao and Pant (2012); Schmidt and Yesin (2022).

Our matched set of investors and mutual funds is a representative subset of the EPFR universe.[12] Over our sample from January 2000 to December 2023, there are 3,428 mutual funds reporting their monthly allocations in the EPFR data, with the median fund managing 258 million USD in assets. Of these funds, 1,096 funds are matched to Consensus Economics data, with the median fund managing 272 million USD in assets; their assets and allocations closely resemble those of the full EPFR sample.[13]

To clean our data, we adopt the following steps. At the fund level, the sample of countries for which we have investor forecast data might change over time. To ensure comparability, we restrict the sample to countries with forecasts in at least 90% of periods and to funds investing in at least 10 such countries and with forecast coverage exceeding 20% of portfolio weight. Using this cleaned sample, we construct a fund-level dataset with 9 investors, 102 funds, and 5,400 fund-level observations. We also construct an allocation-level dataset. In this larger dataset, we keep countries that have forecast information and an allocation of at least 2.5% in the fund, resulting in a sample with 48 investors, 787 funds, 39 countries and 130,000 allocation-level observations. The results that follow are not sensitive to our specific cleaning methodology.

3 Elasticity of Capital Flows to Expectations

The response of capital flows to investor expectations operates through two channels: inflows into mutual funds and the reallocation of fund portfolios. We document two findings. First, increases in an investor's portfolio GDP growth expectations[14] are followed by large increases in inflows into the corresponding mutual funds. Second, mutual fund country allocations respond only weakly to investor country-level expectations, implying substantial portfolio stickiness. These results motivate our analysis of co-ownership spillovers.

3.1 Investor expectations and country allocations

First, we test the relationship between investor expectations and the country allocation of the mutual funds. Henceforth, we refer to this relationship as the fund elasticity. We run the following regression at the fund-country level,

[12] We classify a fund as passive if its country allocation tracks a buy-and-hold benchmark, defined as a correlation exceeding 0.75 between the fund's country allocation and the benchmark allocation; all remaining funds are classified as active.

[13] These results are available upon request.

[14] Defined as the GDP growth expectations for each country in the portfolio, weighted by the previous period's portfolio weights, as specified in equation 2.

	(1)	(2)	(3)
	$\log(w_{k,t}^{i,j})$	$\log(w_{k,t}^{i,j})$	$\log(w_{k,t}^{i,j})$
VARIABLES	All funds	Passive	Active
$E_t^i(g_k^{\text{next year}})$	0.023***	0.007	0.032***
	(0.005)	(0.007)	(0.006)
Observations	107,256	23,336	83,060
R-squared	0.001	0.000	0.001
Country-fund FE	Yes	Yes	Yes
Country-time FE	Yes	Yes	Yes
Fund-time FE	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1: Mutual Fund Allocations, Investor Expectations

Note: The dependent variable is the log of $w_{k,t}^{i,j}$, the share of fund j's assets under management that is allocated to country k in month t. Passive funds are those whose country allocations exhibit a correlation above 0.75 with a buy-and-hold benchmark. Standard errors are Driscoll-Kraay standard errors with 5 lags.

$$\log\left(w_{k,t}^{i,j}\right) = \lambda_0 E_t^i g_k^{\text{next year}} + \lambda_{k,t} + \lambda_t^{i,j} + \lambda_k^{i,j} + \epsilon_{k,t}^{i,j}, \tag{1}$$

where $w_{k,t}^{i,j}$ is fund j's allocation to country k in percent of assets under management of investor i and $E_t^i g_k^{\text{next year}}$ is investor i's expectations for future GDP growth in percent for country k. Fund-country fixed effects $\lambda_k^{i,j}$ capture time-invariant fund preferences across countries. Fund-time fixed effects $\lambda_t^{i,j}$ account for global, investor- and fund-specific time-varying outside investment opportunities and funding shocks.

Importantly, country-time fixed effects $\lambda_{k,t}$ account for country growth and monetary policy that simultaneously drive the country's supply of capital and expectations, and for reverse causality from aggregate capital flows to growth and expectations. They also capture potential general equilibrium effects that could bias the estimated elasticity downward. For instance, if all investors become optimistic about a country, then capital flows into the country can be mitigated by the equilibrium increase in the equity price. These global surges in optimism (or pessimism) about a country are captured by the country-time fixed effects, so that the coefficient λ_0 identifies the impact of a change in expectations that is specific to investor i, and it can then be interpreted as a partial-equilibrium elasticity.

Results of regression (1) are shown in Table 1. In Column (1), the response of mutual funds to the investor forecasts is significant but relatively small: a 1 percentage point rise in the investor's growth forecast regarding a country increases the share of wealth invested in that country by about 2.3% (so a country with an initial 10% share will benefit from a 0.23 percentage point increase). Columns (2) and (3) in Table 1 shows results for active and passive funds. Passive funds do not respond, as one would expect, but the response of active funds remain small, at 3.2%.

3.2 Investor expectations and flows to mutual funds

Next, we test the relationship between investor expectations and the flows into mutual funds. Henceforth, we refer to this relationship as the investor elasticity. Define the portfolio GDP growth expectations at the fund level as the average of the corresponding investor's growth expectation weighted by the previous period country allocations:

$$E_t^i g_p^{j,\text{next year}} = \sum_{k \in S(i,j)} w_{k,t-1}^{i,j} E_t^i g_{k,t}^{\text{next year}}, \tag{2}$$

where $w_{k,t-1}^{i,j}$ is mutual fund j's allocation to country k in month $t-1$, and $E_t^i g_{k,t}^{\text{next year}}$ is investor i's GDP growth expectation for the following year at date t, for country k, in percent. Subscript p denotes a portfolio-level growth expectation. $S(i,j)$ is the set of countries in which fund j invests and for which we observe expectations. The weights $w_{k,t-1}^{i,j}$ do not necessarily sum to 1, because we do not observe expectations for all countries. This generates some identification issues that we address below.

We run the panel fixed-effects regression,

$$\ln\left(A_t^{i,j}\right) = \beta E_t^i g_{p,t}^{j,\text{next year}} + \lambda^j + \lambda_t^i + \epsilon_t^{i,j}, \tag{3}$$

where $A_t^{i,j}$ are the total assets managed by fund j in month t, λ^j are fund fixed effects, λ_t^i are investor-time fixed effects, and $\epsilon_t^{i,j}$ is an error term.

The share of investor assets allocated to mutual fund j can be written as $a_t^{i,j} = \frac{A_t^{i,j}}{\Omega_t^i}$, where Ω_t^i is the total assets of the investor. Because we include investor-time fixed effects, the above specification is equivalent to a regression with $\ln\left(a_t^{i,j}\right)$ as the dependent variable, isolating the impact of the expectations on the investor's allocation to the mutual fund and abstracting from changes in total investor wealth.

Including investor-time fixed effects has several other advantages. It captures unobserved

	(1)	(2)	(3)	(4)	(5)
VARIABLES	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$
$E_t^i(g_p^{j,\text{next year}})$	0.364***	0.321***			
	(0.043)	(0.044)			
$\Gamma_t^{i,j}$			0.214***		
			(0.060)		
$\gamma_t^{i,j}$				0.286***	
				(0.100)	
$\bar{\gamma}_t^{i,j}$					0.272**
					(0.116)
$\Delta \log(Q_t^{i,j})$		-0.011***	-0.013***	-0.012***	-0.012***
		(0.004)	(0.004)	(0.005)	(0.005)
$\Delta \log(Q_{t-1}^{i,j})$		-0.012***	-0.013***	-0.011**	-0.011**
		(0.004)	(0.004)	(0.004)	(0.004)
Observations	4,591	4,127	4,127	4,127	4,127
R-squared	0.047	0.041	0.012	0.009	0.007
Fund FE	Yes	Yes	Yes	Yes	Yes
Investor-time FE	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Mutual Fund Flows and Investor Expectations

Note: The dependent variable $A_t^{i,j}$ is the log of investor i's allocation to fund j in logs, measured as the total assets under management of fund j during month t. Standard errors are Driscoll-Kraay standard errors with 5 lags.

developments at the investor level that could drive the investor's allocation to the mutual fund. Among these are global or investor-specific "funding shocks" that have been identified in the literature and could be correlated with expectations, and global or investor-specific alternative investment opportunities. Fund fixed effects capture the investor-specific preference for a given fund.

Table 2, column (1) reports the results for Equation (3). Investor expectations of future GDP growth are positively associated with the flows allocated to mutual funds. Investor expectations impact mutual fund flows in an economically meaningful way. An increase in the expected portfolio GDP growth by one percentage point is associated with an increase in investor allocations to the fund by about 36 percent.

There are several potential challenges to our identification. We address each in turn.

First, thus far we have not controlled for any fund-level time-specific development. Importantly, portfolio expectations could be correlated with the portfolio equity returns at the fund level or equity price changes, because equity price changes and returns may be relevant signals used to form investor expectations. On the other hand, equity price changes generate valuation effects that may or not be balanced by the fund. To address this issue, we use a measure of fund-level returns derived from the underlying asset prices of the investments in the portfolio, which we denote $\Delta \log(Q_t^j)$. This variable and its lag are added to specification (3) and the results, which are similar, are reported in column (2).[15]

Second, an important issue is that we do not observe the investor's expectations for all countries in the fund's portfolio, which might bias our estimates. To understand this, note that we can decompose the "true" aggregate expectation into an observable and an unobservable component:

$$E_t^{i,true}(g_{p,t}^{j,\text{next year}}) = \sum_{k \in S(i,j)} w_{k,t-1}^{i,j} E_t^i(g_{k,t}^{\text{next year}}) + \sum_{k \in \tilde{S}(i,j)} w_{k,t-1}^{i,j} E_t^i(g_{k,t}^{\text{next year}})$$

where $\tilde{S}(i,j)$ is the set of countries for which we do not observe expectations. The first term is what we use as a proxy for the true aggregate expectation. The second term is an unobservable component that will be captured in the error term. If the observed and unobserved component are positively correlated, which is the case if they are driven by common shocks, then there will be a positive missing variable bias.

To circumvent this issue, we adopt a granular instrumental variable approach à la Gabaix and Koijen (2024). We add an assumption on the structure of expectations.

Assumption 3.1 *Assume expectations $E_t^i g_{k,t}^{\textit{next year}}$ are equal to the sum of a term common to the investor W_t^i and an idiosyncratic country-specific one $l_{k,t}^i$:*

$$E_t^i g_{k,t}^{\textit{next year}} = W_t^i + l_{k,t}^i$$

with $E(l_{k,t}^i) = 0$, $Cov(l_{k,t}^i, W_t^i) = 0$ and $Cov(l_{k,t}^i, l_{k',t}^i) = 0$ for all i and $k \neq k'$.

We then compute the average investor expectation and a granular residual defined as the weighted average of the differences between the country-specific expectation and an unweighted mean:

$$\Gamma_t^{i,j} = \sum_{k \in S(i,j)} w_{k,t-1}^{i,j} \left[E_t^i g_{k,t}^{\text{next year}} - \frac{1}{K(i,j)} \sum_{k \in S(i,j)} E_t^i g_{k,t}^{\text{next year}} \right]. \tag{4}$$

[15] The results do not change if we construct $\Delta \log(Q_t^j)$ based on the country-level MSCI indices.

where $K(i,j)$ is the number of elements in $S(i,j)$. Under Assumption 3.1, the simple average is a good estimate of the fund-specific driver:

$$\frac{1}{K(i,j)} \sum_{k \in S(i,j)} E_t^i g_{k,t}^{\text{next year}} \simeq W_t^i$$

and the granular component is only driven by the country-specific components:

$$\Gamma_t^{i,j} \simeq \sum_{k \in S(i,j)} w_{k,t-1}^{i,j} l_{k,t}^i$$

Since $Cov(l_{k,t}^i, W_t^i) = 0$ and $Cov(l_{k,t}^i, l_{k',t}^i) = 0$ for all $k' \in \tilde{S}(i,j)$, then $Cov(\Gamma_t^{i,j}, E_t^i(g_{k',t}^{\text{next year}})) = 0$. Thus, the granular residual is unaffected by the missing variable bias.[16]

Table 2, column (3) reports the results where the granular residual $\Gamma_t^{i,j}$ is used instead of the portfolio GDP growth expectation $E_t^i(g_{p,t}^{j,\text{next year}})$. The coefficient is positive and significant. Notably, the coefficient of the granular component is diminished by about one third compared to the coefficient of the portfolio GDP growth expectation, confirming the presence of a positive missing variable bias.

We next consider potential reverse causality from aggregate capital flows to growth and growth expectations, as well as general equilibrium effects. While such concerns can be addressed in the allocation regressions through the inclusion of country-time fixed effects, this approach is not feasible in the fund-level regressions. Importantly, should these effects be present, they would only concern the common drivers of expectations. We therefore make an additional assumptions on the structure of expectations:

Assumption 3.2 *We assume that the investor's country-specific component $l_{k,t}^i$ is the sum of a component common to all investors (denoted $l_{k,t}$) and an idiosyncratic component specific to investor i (denoted $\tilde{l}_{k,t}^i$):*

$$l_{k,t}^i = l_{k,t} + \tilde{l}_{k,t}^i$$

with $E(\tilde{l}_{k,t}^i) = 0$, $Cov(\tilde{l}_{k,t}^i, l_{k,t}) = 0$ and $Cov(\tilde{l}_{k,t}^i, l_{k,t}^{i'}) = 0$ for all k, and $i \neq i'$.

We construct an alternative granular residual, that removes the common components across all investors. This new granular residual, $\gamma_t^{i,j}$, is constructed by removing a granular term

[16] In principle, investor fixed effects control for the common component W_t^i, which by itself treats the missing variable bias due to the common component of expectations. However, some fund specialize in specific regions. Investor fixed effects do not capture these fund-specific regional components and would thus not be enough to correct for the missing variable bias. But by removing the simple average of expectations, we remove these regional components, correcting for the bias.

Γ_t^j computed using the consensus expectations from the investor-specific granular term $\Gamma_t^{i,j}$:

$$\gamma_t^{i,j} = \underbrace{\sum_{k \in S(i,j)} w_{k,t-1}^{i,j} \left[E_t^i g_{k,t}^{\text{next year}} - \frac{1}{K(i,j)} \sum_{k \in S(i,j)} E_t^i g_{k,t}^{\text{next year}} \right]}_{\Gamma_t^{i,j}}$$
$$- \underbrace{\sum_{k \in S(i,j)} w_{k,t-1}^{i,j} \left[\bar{E}_t g_{k,t}^{\text{next year}} - \frac{1}{K(i,j)} \sum_{k \in S(i,j)} \bar{E}_t g_{k,t}^{\text{next year}} \right]}_{\Gamma_t^j}. \tag{5}$$

where $\bar{E}_t g_{k,t}^{\text{next year}}$ is the median expectation for country k across all forecasters. We call $\gamma_t^{i,j}$ the super-granular residual. Under Assumption 3.2, Γ_t^j approximates the weighted average of the component of country-specific expectations that are common across investors: $\Gamma_t^j \simeq \sum_{k \in S(i,j)} w_{k,t-1}^{i,j} l_{k,t}$, and the super-granular component is only driven by the component of country-specific expectations that is specific to the investor:

$$\gamma_t^{i,j} \simeq \sum_{k \in S(i,j)} w_{k,t-1}^{i,j} \tilde{l}_{k,t}^i.$$

Importantly, it is orthogonal to the common component of expectations.

Column (4) reports the same regression but replaces $\Gamma_t^{i,j}$ with $\gamma_t^{i,j}$. The coefficient of $\gamma_t^{i,j}$ measures the reactions of the assets under management by the fund to expectations on the fund that are specific to the investor managing the fund and, in principle, if we assume that the typical investor is not too large, it can be interpreted as the partial equilibrium effect of expectations on capital flows. It therefore has a similar interpretation as the coefficient estimated in the allocation regressions. In this specification, the coefficient becomes larger, suggesting that ignoring general equilibrium effects understates the expectation elasticity of the demand for equity, and that a part of the aggregate demand for equity actually translates into equity prices. In this specification, the elasticity of flows into a fund to a one percentage point increase in the portfolio GDP growth expectation is 29%. Growth expectations are therefore highly relevant for investors.

As a robustness check, we replace the lagged allocation $w_{k,t-1}^{i,j}$ with the average $\bar{w}_k^{i,j}$ to compute an alternative super-granular component, which we call $\bar{\gamma}_t^{i,j}$. The results, presented in Column (5), barely change.

At this stage, our results have established that flows into funds respond in a significant way to investors' expectations. By contrast, funds' cross-country allocations remain relatively sticky, which motivates our structural approach to studying co-ownership spillovers using a model with delegated investment and portfolio frictions.

4 Model

Motivated by the empirical evidence, we develop a two-period delegated-portfolio model with sticky fund portfolios to (i) understand how sticky fund portfolios affect the relation between expectations and capital flows to a country and (ii) discuss the aggregate consequences of the friction.

There are M investors indexed by $i = 1, .., M$. Each investor i is paired with $\mathcal{J}(i)$ equity mutual funds indexed by $j = 1, .., \mathcal{J}(i)$. There are K countries in which the mutual funds can invest, indexed by $k = 1, .., K$. Each fund potentially invests in a different set of countries $\mathcal{S}(i, j)$ with $\mathcal{K}(i, j)$ elements.

In the first period, after receiving new information, investors allocate wealth between a safe asset and the funds; funds allocate received assets across countries but can update country weights only with probability p. In the second period, country returns are realized and investors consume terminal wealth. Investors and funds observe the same information and maximize the same mean–variance objective, but investors do not control funds' country weights.[17]

4.1 Country returns and expectations

An equity share held in country $k = 1, .., K$ is traded at a normalized price of one in the first period and pays a stochastic return R_k. We denote the vector of returns by $R = (R_1, .., R_k, .., R_K)'$. We assume that the returns are exogenous and follow a Gaussian distribution: $R \sim \mathcal{N}(\bar{R}, \Sigma)$, where $\bar{R} = (\bar{R}_1, .., \bar{R}_k, .., \bar{R}_K)'$ is the vector of the unconditional mean and Σ is the matrix of variance-covariance.

Investor i and the corresponding mutual funds $j = 1, .., \mathcal{J}(i)$ share the same information on the returns R. In the first period, we distinguish beginning-of-period information $\bar{\mathcal{I}}^i$ and end-of-period information $\mathcal{I}^i$, with corresponding operators $\bar{E}^i(\cdot)$ and $E^i(\cdot)$, and variances $\bar{V}(\cdot)$ and $V(\cdot)$. Let $\bar{V}^R = \bar{V}(R)$ and $V^R = V(R)$. We assume learning is gradual:

Assumption 4.1 $\bar{V}^R - V^R << V^R$.

[17] We model portfolio frictions using an adjustment probability as in Bacchetta et al. (2022); Bacchetta, Davenport, and van Wincoop (2022) use adjustment costs and show that the modelling choice does not affect the main implications.

4.2 Investors

Investor i enters the first period with initial wealth Ω^i and invests a share $a^{i,j}$ in equity fund j, $j = 1, .., \mathcal{J}(i)$, and the remaining share $1 - \sum_{j=1}^{\mathcal{J}(i)} a^{i,j}$ in a safe asset with return r. The decisions of the investor are taken after observing the new information $\mathcal{I}^i$, but before observing the country allocation of the fund.

In the second period, portfolio returns are realized and the investor consumes all remaining terminal wealth $\left[\mathcal{R}_p^i \left(\sum_{j=1}^{\mathcal{J}(i)} a^{i,j}\right) + r\left(1 - \sum_{j=1}^{\mathcal{J}(i)} a^{i,j}\right)\right] \Omega^i$, where $\mathcal{R}_p^i$ is the return on the full portfolio of funds:

$$\mathcal{R}_p^i = \sum_{j=1}^{\mathcal{J}(i)} \frac{a^{i,j}}{\sum_{j=1}^{\mathcal{J}(i)} a^{i,j}} R_p^{i,j} = \frac{a^{i'} R_p^i}{\sum_{j=1}^{\mathcal{J}(i)} a^{i,j}} \tag{6}$$

The vector $a^{i'} = (a^{i,1}, .., a^{i,j}, .., a^{i,\mathcal{J}(i)})'$ collects the fund shares, the vector $R_p^{i'} = (R_p^{i,1}, .., R_p^{i,j}, .., R_p^{i,\mathcal{J}(i)})'$ collects the fund portfolio returns.

Investors have mean-variance preferences and choose the fund allocation a^i to maximize the mean-variance utility of one unit of wealth,

$$U^i = E^i \left\{ \mathcal{R}_p^i \left(\sum_{j=1}^{\mathcal{J}(i)} a^{i,j} \right) + r \left(1 - \sum_{j=1}^{\mathcal{J}(i)} a^{i,j} \right) \right\} - \frac{\gamma}{2} V \left\{ \mathcal{R}_p^i \left(\sum_{j=1}^{\mathcal{J}(i)} a^{i,j} \right) + r \left(1 - \sum_{j=1}^{\mathcal{J}(i)} a^{i,j} \right) \right\}, \tag{7}$$

where $E^i(.)$ and $V(.)$ are defined as the expectation and variance conditional on $\mathcal{I}^i$, subject to the portfolio return definition (6). As we will see below, this return depends on the funds' country shares and on whether the mutual funds update their portfolio, which the investor does not know when deciding a^i.

The investor's decisions are summarized in the following Lemma:

Lemma 4.1 *Total equity investments must satisfy*

$$\sum_{j=1}^{\mathcal{J}(i)} a^{i,j} = \frac{E^i(\mathcal{R}_p^i) - r}{\gamma V^i} \tag{8}$$

with $V^i = V(\mathcal{R}_p^i)$, and the optimal allocation to equity funds j $a^{i,j}$ must satisfy, for all $j = 1, .., \mathcal{J}(i)$,

$$a^{i,j} = \frac{E^i(R_p^{i,j}) - r}{\gamma V^{i,j}} - Cov_{i,j} \left(\sum_{j=1}^{\mathcal{J}(i)} a^{i,j} \right) \tag{9}$$

where $V^{i,j} = Cov(R_p^{i,j}, R_p^{i,j} - \mathcal{R}_p^{i,j-})$ *and* $Cov_{i,j} = Cov(R_p^{i,j}, \mathcal{R}_p^{i,j-})/V^{i,j}$ *are constant terms, and* $\mathcal{R}_p^{i,j-} = \sum_{j',j'\neq j} a^{i,j'} R_p^{i,j'} / \left(\sum_{j'=1,j'\neq j}^{\mathcal{J}(i)} a^{i,j'}\right)$ *is the return of the full portfolio of funds when excluding fund* j*.*

Proof. See proof in Appendix A.1. ∎

The allocation to fund j by investor i depends on the expected excess return $E^i(R_p^{i,j}) - r$, with an elasticity that depends on the variance of the returns and on risk aversion γ. It also depends on the hedging properties of fund j through the covariance between the fund excess return and the investor portfolio.[18]

4.3 Mutual Funds

Consider fund j managed by investor i. The country allocation of fund j determines the fund portfolio return $R_p^{i,j}$:

$$R_p^{i,j} = \sum_{k\in\mathcal{S}(i,j)} w_k^{i,j} R_k = w^{i,j\prime} R, \tag{10}$$

where $w_k^{i,j}$ is the share of mutual fund j's portfolio that is invested in country k. The vector $w^{i,j} = (w_1^{i,j}, .., w_k^{i,j}, .., w_{K,t}^{i,j})'$ collects the country shares, where $w_k^{i,j} = 0$ if $k \notin \mathcal{S}(i,j)$.

In the beginning of period, we assume $w_k^{i,j}$ to be fixed to some predetermined value $\bar{w}_k^{i,j}$ that is conditional on the beginning of period information, $\bar{\mathcal{I}}^i$. At the end of period, after investor i has decided her fund shares a^i, each fund $j = 1, .., \mathcal{J}(i)$ allocates $a^{i,j}$ across the different countries, either according to the predetermined fund portfolio shares $\bar{w}_k^{i,j}$, with probability $1 - p$, or to updated shares that take into account the investor's information $\mathcal{I}^i$, with probability p.

In the case where the fund updates the allocations, the fund chooses $w_k^{i,j}$ in order to maximize the same objective as the investor (7), subject to the return definitions (6) and (10), and to $\sum_{k\in\mathcal{S}(i,j)}^{N} w_k^{i,j} = 1$, taking the distribution of returns R as given. We denote the resulting optimal allocation by $w^{i,j*}$.

Lemma 4.2 *The optimal allocation* $w^{i,j*}$ *is such that* $a_k^{i,j*} = w_k^{i,j*} a^{i,j}$*, the total investment share of investor* i *that is channeled to country* k *through fund* j*, satisfies, for all* $k \in \mathcal{S}(i,j)$

$$a_k^{i,j*} = \frac{E^i(R_k) - r}{\gamma V_k^{i,j}} - Cov_k^{i,j} \left(\sum_{j=1}^{\mathcal{J}(i)} a^{i,j}\right) - \Delta Cov_k^{i,j} a^{i,j} \tag{11}$$

[18] This result arises from standard static mean–variance portfolio choice: assets are held not only for their expected returns but also for how they covary with the rest of the portfolio (Markowitz, 1952; Lintner, 1965).

where $V_k^{i,j} = Cov(R_k, R_k - R_{p,k-}^{i,j})$, $Cov_k^{i,j} = Cov(R_k, \mathcal{R}_p^{i,j-})/V_k^{i,j}$ *and* $\Delta Cov_k^{i,j} = \left(Cov(R_k, R_{p,k-}^{i,j}) - Cov(R_k, \mathcal{R}_p^{i,j-})\right)/V_k^{i,j}$ *are constant terms, and* $R_{p,k-}^{i,j} = \sum_{k',k'\neq k} w_k^{i,j} R_{k'}/(1-w_k^{i,j})$ *is the return of the fund portfolio that when excluding country* k*.*

Proof. See proof in Appendix A.2. ■

The first two terms of this equation resemble (9). The optimal share of investor's wealth allocated to country k through fund j, $a_k^{i,j*}$, depends on the expected excess return of the country $E^i(R_k) - r$, with an elasticity that depends on the variance of the returns and on risk aversion γ. It also depends on the hedging properties of country k with respect to the investor's portfolio through the covariance between the country return and the investor portfolio.

An additional term captures the hedging properties of country k with respect to fund j. It is proportional to $a^{i,j}$ and loads on $-\Delta Cov_k^{i,j}$, which can be interpreted as the fixed share of the investor's allocation to fund j that is routed to country k to hedge exposure to the fund. When $a^{i,j}$ rises, the investor's exposure to the rest of her portfolio falls, so this fixed share depends negatively on the covariance of country k with the *fund* portfolio and positively on its covariance with the *investor* portfolio. Accordingly, less of $a^{i,j}$ is allocated to k when k is a poor hedge for the fund, and more when it is a poor hedge for the investor portfolio.

4.4 Asset demand

Conditional on $\mathcal{I}^i$ and before observing whether the fund updates, expected country flows to country k coming from investor i through fund j satisfy $a_k^{i,j} = \tilde{w}_k^{i,j} a^{i,j}$ with $\tilde{w}_k^{i,j} = p w_k^{i,j*} + (1-p)\bar{w}_k^{i,j}$, equivalently

$$a_k^{i,j} = p a_k^{i,j*} + (1-p)\bar{w}_k^{i,j} a^{i,j} \tag{12}$$

where $\bar{w}_k^{i,j}$ is predetermined, $a^{i,j}$ follows Equation (9), and $a_k^{i,j*}$ is given by Equation (11).

If we take into account the fund's optimal setting of the default portfolio shares, we obtain the following characterization of $a_k^{i,j}$ as a function of expectations:

Proposition 4.1 *Define the excess-return news as the end-of-period updates in the return expectations:* $E^i(r_k) = E^i(R_k) - \bar{E}^i(R_k)$, $E^i(r_p^{i,j}) = E^i(R_p^{i,j}) - \bar{E}^i(R_p^{i,j})$ *and* $E^i(\mathfrak{r}_p^i) = E^i(\mathcal{R}_p^i) - \bar{E}^i(\mathcal{R}_p^i)$*. If Assumption 4.1 is satisfied, then the share of investor* i'*s wealth that is channeled* *to country k through fund j can be written as:*

$$
\begin{aligned}
a_k^{i,j} =& p\frac{E^i(r_k)}{\gamma V_k^{i,j}} && \} \textit{ Excess Return} \\
&+ (1-p)\frac{\bar{a}_k^{i,j}}{\bar{E}^i(a^{i,j})}\frac{E^i(r_p^{i,j})}{\gamma V^{i,j}} && \} \textit{ Co-ownership} \\
&- \Delta Cov_k^{i,j}\frac{E^i(r_p^{i,j})}{\gamma V^{i,j}} && \} \textit{ Hedging (fund-level)} \\
&- \widetilde{Cov}_k^{i,j}\frac{E^i(\mathfrak{r}_p^i)}{\gamma V^i} - (1-p)\left(\frac{\bar{a}_k^{i,j}}{\bar{E}^i(a^{i,j})}Cov^{i,j} - Cov_k^{i,j}\right)\frac{E^i(\mathfrak{r}_p^i)}{\gamma V^i} && \} \textit{ Hedging (inv.-level)} \\
&+ \bar{E}(a_k^{i,j}) && (13)
\end{aligned}
$$

where $\widetilde{Cov}_k^{i,j} = Cov_k^{i,j} - Cov^{i,j}\Delta Cov_k^{i,j}$, $\bar{E}(a_k^{i,j}) = \bar{a}_k^{i,j} - \Delta Cov_k^{i,j}\bar{E}^i(a^{i,j})$, $\bar{a}_k^{i,j} = (\bar{E}^i(R_k) - r)/\gamma V_k^{i,j} - Cov_k^{i,j}(\bar{E}^i(\mathcal{R}_p^i) - r)/\gamma V^i$ *and* $\bar{E}^i(a^{i,j}) = (\bar{E}^i(R_p^{i,j}) - r)/\gamma V^{i,j} - Cov^{i,j}(\bar{E}^i(\mathcal{R}_p^i) - r)/\gamma V^i$ *are constant terms.*

Proof. See proof in Appendix A.3. ■

As shown in the first line of Equation (13), capital flows to country k react to the news on country k's return $E^i(r_k)$ through the excess-return channel, but these capital flows are less elastic in the presence of the friction ($p < 1$). This is because channeling more capital flows to country k can happen only if the fund reallocates its portfolio shares towards country k, which is less likely when $p < 1$.

The second line corresponds to the co-ownership spillovers. In the presence of portfolio frictions ($p < 1$), capital flows react to the news on fund j's return $E^i(r_p^{i,j})$. To understand, suppose that the investor expects higher returns in another country k' from the fund portfolio. In that case, she will increase her allocation to the fund $a^{i,j}$ as $E^i(r_p^{i,j}) > 0$ (see Equation (9)). If the fund updates its portfolio, then it will increase the share that goes to country k'. This portfolio reallocation fully offsets the mechanical flow to country k due to the increased investment in the fund. If the fund does not update its portfolio, these extra resources will be channeled to country k according to its default weights, generating spillovers. Since funds typically don't take short positions, these co-ownership spillovers are generally positive.

The hedging terms on the third and fourth lines operate both at the fund level and at the investor level in our delegated investment setting. The fund-wide hedging term (third line) depends on the news on fund j's return $E^i(r_p^{i,j})$. This term is independent of the portfolio friction p. Indeed, the hedging of fund flows arise automatically from the optimal "fixed" part of the portfolio share, which does not depend on new information.[19]

[19]Here, Assumption 4.1 ensures that the "fixed" part of the portfolio shares, which depends on the ratio

The investor-wide hedging term (fourth line) depends on investor's return on the full portfolio of mutual funds $E^i(\mathfrak{r}_p^i)$. When investors get positive news on the global return, they increase their equity investments globally, including their investments into fund j. The exposure to fund j is mechanically hedged, as explained above, but the global exposure is not, which implies that this hedging term depends on p. As we will see, this hedging term is actually independent from p under some symmetry assumption that we specify below.

All in all, according to Proposition 4.1, the surprise capital flows to country k by investor i through fund j can be written as a function of the surprise expected returns:

Corollary 4.1 *Equation 13 yields*

$$\frac{a_k^{i,j} - \bar{E}^i(a_k^{i,j})}{\bar{E}^i(a_k^{i,j})} = \beta_k^{i,j} E_t^i(r_k) + \delta_k^{i,j} E_t^i(r_{p,}^{i,j}) + \theta_k^{i,j} E^i(\mathfrak{r}_p^i) \tag{14}$$

$\beta_k^{i,j}$, $\delta_k^{i,j}$ and $\theta_k^{i,j}$ are the elasticities of capital flows to the country-specific expectations, to the fund-specific expectations, and to the investor-specific expectations. According to our model, these elasticities are $\beta_k^{i,j} = p/\gamma V_k^{i,j} \bar{E}^i(a_k^{i,j})$, $\theta_k^{i,j} = -[\widetilde{Cov}_k^{i,j} + (1-p)\left(Cov^{i,j}\bar{a}_k^{i,j}/\bar{E}^i(a^{i,j}) - Cov_k^{i,j}\right)]$ $/\gamma V^i \bar{E}^i(a_k^{i,j})$ and:

$$\delta_k^{i,j} = \eta_k^{i,j} - \phi_k^{i,j} \Delta Cov_k^{i,j} \tag{15}$$

with $\eta_k^{i,j} = (1-p)\bar{a}_k^{i,j}/\gamma V^{i,j} \bar{E}^i(a^{i,j}) \bar{E}^i(a_k^{i,j})$ and $\phi_k^{i,j} = 1/\gamma V^{i,j} \bar{E}^i(a_k^{i,j})$.

The elasticity of capital flows to the fund-specific expectations $\delta_k^{i,j}$, can be decomposed into $\eta_k^{i,j}$, which captures the co-ownership spillovers, and $\phi_k^{i,j} \Delta Cov_k^{i,j}$, which captures the hedging spillovers.

4.5 Aggregate capital flows

Consider total capital flows to country $k = 1,..,K$. These correspond to the sum over all investors and mutual funds $i = 1,..,M$, $j = 1, \mathcal{J}(i)$: $A_k = \sum_{i=1}^{M} \sum_{j=1}^{\mathcal{J}(i)} A_k^{i,j}$, where $A_k^{i,j} = a_k^{i,j} \Omega^i$ is the total flow from investor-fund i to country k through fund j. We will focus on $a_k = A_k/\Omega$, the share of total wealth $\Omega = \sum_{i=1}^{M} \Omega^i$ that goes to country k. We have

$$a_k = \sum_{i=1}^{M} \sum_{j=1}^{\mathcal{J}(i)} \frac{\Omega^i}{\Omega} a_k^{i,j} \tag{16}$$

of the conditional covariance to the variance, is invariant whether the fund updates its shares or not and that the default shares are not significantly affected by any precautionary behavior.

The share of global wealth that is invested in country k is an average of the fund shares $a_k^{i,j}$, weighted by the investor contribution to total wealth.

The surprise global investment share to k a_k, scaled by the ex-ante share, is the corresponding weighted average of fund-level surprises:

$$\frac{a_k - \bar{E}(a_k)}{\bar{E}(a_k)} = \sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \frac{a_k^{i,j} - \bar{E}^i(a_k^{i,j})}{\bar{E}^i(a_k^{i,j})} \tag{17}$$

where $\sigma_k^{i,j} = \bar{E}^i(a_k^{i,j}) / \sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a_k^{i,j}) = \bar{E}^i(A_k^{i,j})/\bar{E}^i(A_k^i)$ is fund j's ex-ante share in investor i's flows to country k, and $\sigma_k^i = \sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a_k^{i,j})\Omega^i / \sum_{i=1}^{M} \sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a_k^{i,j})\Omega^i = \bar{E}^i(A_k^i)/\bar{E}^i(A_k)$ is investor i's ex-ante share in aggregate flows to k. These fund-level surprises carry more weight when the fund's average flows to k are relatively large.

It will be useful to decompose aggregate capital flows to country k into a portfolio reallocation component $\tilde{\Delta} a_k$ (that results from the reallocation of equity to country k from other countries), and a portfolio growth component Δa (that results from the growth of all equity investments):

$$\frac{a_k - \bar{E}(a_k)}{\bar{E}(a_k)} = \underbrace{\frac{a_k - \bar{E}(a_k)}{\bar{E}(a_k)} - \frac{a - \bar{E}(a)}{\bar{E}(a)}}_{\tilde{\Delta} a_k} + \underbrace{\frac{a - \bar{E}(a)}{\bar{E}(a)}}_{\Delta a} \tag{18}$$

where $a = A/\Omega$, with A representing all the equity investments $A = \sum_{k=1}^{K} A_k$.

4.6 The Aggregate Consequences of Co-ownership Spillovers

We have shown that, in the presence of a portfolio friction ($p \leq 1$), capital flows to country k are, in part, driven by co-ownership spillovers. However, co-ownership spillovers do not necessarily have meaningful aggregate consequences. In the limit, if all expectations are identical, capital flows generated by these spillovers would coincide with the capital that would flow to country k in the absence of friction. Whether they generate extra, frictional volatility depends on whether the country-level and the fund-level expectations are positively correlated. We therefore decompose expectations into a common component and country-specific components and show that these spillovers matter in the aggregate only through the presence of country-specific components, and that they only affect portfolio reallocation, not portfolio growth.

We make the following assumption on the structure of expectations, analogous to the assumption on growth expectations in Section 3.2:

Assumption 4.2 (Structure of expectations) *We assume that expectations $E^i(r_k)$ are* *equal to the sum of a global component W^i and an idiosyncratic country-specific one l_k^i:*

$$E^i(r_k) = W^i + l_k^i \tag{19}$$

with $E(l_k^i) = 0$, $Cov(l_k^i, W^i) = 0$ and $Cov(l_k^i, l_{k'}^i) = 0$ for all i and and $k \neq k'$.

Under Assumption 4.2, W^i can be then be estimated as the simple average across countries of investor i's expectations: $W^i \simeq \frac{1}{\mathcal{K}(i,j)} \sum_{k \in \mathcal{S}(i,j)} E^i(r_k)$ and l_k^i as a country-specific residual: $l_k^i \simeq E^i(r_k) - W^i$. Therefore, the portfolio return expectations can be decomposed into a global and a "granular" component:

$$E^i(r_p^{i,j}) = \Gamma^{i,j} + W^i \tag{20}$$

where the granular component $\Gamma^{i,j}$ is the weighted average of the country-specific components:

$$\Gamma^{i,j} = \sum_{k \in \mathcal{K}(i,j)} \left(w_k^{i,j} - \frac{1}{\mathcal{K}(i,j)} \right) E^i(r_k) \simeq \sum_{k \in \mathcal{K}(i,j)} w_k^{i,j} l_k^i = w^{i,j\prime} l^i \tag{21}$$

where $l^i = (l_1^i, .., l_k^i, .., l_K^i)'$ is the vector of local components.

We can also decompose the investor-wide portfolio return expectations:

$$E^i(\mathfrak{r}_p^i) = \Gamma^i + W^i \tag{22}$$

where the granular component Γ^i is the average of the country-specific components, weighted by the country shares at the investor level:

$$\Gamma^i = \sum_{k=1}^{K} \left(w_k^i - \frac{1}{K} \right) E^i(r_k) \simeq \sum_{k=1}^{K} w_k^i l_k^i = w^{i\prime} l^i \tag{23}$$

where $w^i = (w_1^i, .., w_k^i, .., w_K^i)'$ is the vector of country shares at the investor level, with $w_k^i = \sum_{j=1}^{\mathcal{J}(i)} a_k^{i,j} / \sum_{j=1}^{\mathcal{J}(i)} \sum_{k \in \mathcal{S}(i,j)} a_k^{i,j}$.

In order to aggregate capital flows, we define the aggregated version of the coefficients:

Definition 4.1 (Aggregate coefficients) *For $x \in \{\beta, \delta, \eta, \phi\Delta Cov, \theta\}$, define $x_k^i = \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} x_k^{i,j}$, $x_k = \sum_{i=1}^{M} \sigma_k^i x_k^i$ and $x = \sum_{k=1}^{K} \sigma_k x_k$, with $\sigma_k = \bar{E}^i(a_k)/\bar{E}^i(a)$ the ex-ante share of country k in the total equity investments.*

We also make the following technical assumptions:[20]

[20] Assumption 4.3 ensures that the granular residual remains relevant while allowing us to make useful

Assumption 4.3 (Orthogonality) *For all* $i = 1, .., M$ *and for all* $k = 1, .., K$, $\sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j}(\theta_k^{i,j} - \theta_k^i)\Gamma^{i,j}$, $\sum_{i=1}^{M} \sigma_k^i(\beta_k^i - \beta_k)l_k^i$, $\sum_{i=1}^{M} \sigma_k^i(\delta_k^i - \delta_k)\left(\sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j}\Gamma^{i,j}\right)$, $\sum_{i=1}^{M} \sigma_k^i(\theta_k^i - \theta_k)\Gamma^i$, $\sum_{i=1}^{M} \sigma_k^i(\beta_k^i + \delta_k^i + \theta_k^i - \beta_k - \delta_k - \theta_k)W^i$, $\sum_{k=1}^{K} \sigma_k(\beta_k - \beta)l_k$ *and* $\sum_{k=1}^{K} \sigma_k(\delta_k - \delta)\Gamma_k$ *are small relative to* $\sum_{k\in\mathcal{S}(i,j)} w_k^{i,j} l_k^i$.

Assumption 4.4 (Symmetry) *For all* $i = 1, .., M$, $j = 1, .., \mathcal{J}(i)$ *and* $(k, k') \in \mathcal{S}(i,j)^2$, $k \neq k$:

(a) $\bar{E}^i(R_k) \simeq \bar{E}^i(R_{k'})$;

(b) $Cov(R_k, \mathcal{R}_p^{i,j-}) \simeq Cov(R_{k'}, \mathcal{R}_p^{i,j-})$ *and* $Cov(R_k, R_{p,k-}^{i,j}) \simeq Cov(R_{k'}, R_{p,k'-}^{i,j})$;

(c) $\sum_{i=1}^{M} \sum_{j=1}^{\mathcal{J}(i)} \left(\frac{\bar{E}^i(A_k^{i,j})}{\bar{E}^i(A_k)} - \frac{\bar{E}^i(A^{i,j})}{\bar{E}^i(A)}\right) x^{i,j} \simeq 0$, *where* $x^{i,j} = \sum_{k\in\mathcal{S}(i,j)} w_k^{i,j} x_k^{i,j}$ *for all* $x_k^{i,j} \in \{\beta_k^{i,j}, \eta_k^{i,j}, (\phi\Delta Cov)_k^{i,j}, \delta_k^{i,j}, \theta_k^{i,j}\}$.

Using the model-implied investor-level capital flow surprises (14), the definition of aggregate capital flows (17) and their decomposition (18), the surprises in aggregate capital flows can be written as follows:

Proposition 4.2 *We assume that Assumptions 4.2, 4.3 and 4.4 are satisfied. Denote by* $\Theta = \beta + \delta + \theta$ *the sum of the country-level, fund-level and investor-level elasticities, and by* $\sigma^i = \bar{E}^i(a^i)\Omega^i/\bar{E}^i(a)\Omega = \bar{E}^i(A^i)/\bar{E}^i(A)$ *the ex-ante share of investor* i *in total equity investments. In that case, Equation* (17) *can be written as:*

$$\begin{aligned}
\frac{a_k - \bar{E}(a_k)}{\bar{E}(a_k)} &= \underbrace{\beta\left(\sum_{i=1}^{M} \sigma_k^i(l_k^i - \Gamma^i)\right) + \delta\left(\sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j}(\Gamma^{i,j} - \Gamma^i)\right)}_{\tilde{\Delta} a_k} \\
&\quad + \underbrace{\Theta\left(\sum_{i=1}^{M} \sigma^i(W^i + \Gamma^i)\right)}_{\Delta a} \qquad (24)
\end{aligned}$$

where $\beta \propto p$ *and* $\delta = \eta - (\psi\Delta Cov)$ *with* $\eta \propto 1 - p$.

Proof. See proof in Appendix A.4. ■

approximations while aggregating capital flows. It requires that the elasticity coefficients are orthogonal to portfolio shares and expectations. Assumption 4.4 ensures that the elasticity coefficients can be considered as homogeneous across countries. It requires that two countries in a given fund (a) have close enough ex-ante return expectations and (b) close enough hedging properties, and (c) that fund-level elasticities are unrelated to a fund's contribution to total country flows.

For a given investor, W^i and Γ^i are common terms that affect all expectations in the same way, across all countries and funds. Thus, they determine portfolio growth Δa. Portfolio reallocation $\tilde{\Delta} a_k$ depends on $l_k^i - \Gamma^i$, which is the excess return of country k relative to the whole investor portfolio, through the excess return motive summarized by β. It also depends on $\Gamma^{i,j} - \Gamma^i$, which is the excess return of fund j relative to investor i's portfolio, through the fund-level hedging motive and the co-ownership spillovers, subsumed in δ.

We can compare the effective "frictional" capital flows to the "frictionless" capital flows that would hold in the absence of portfolio friction. While portfolio reallocation is clearly affected by the friction (through β and δ, which both depend on p), it is not clear that portfolio growth is. Indeed, portfolio growth reacts to the common components $\Gamma^i + W^i$ through several channels summarized by Θ: the reaction to the country expectation (with an elasticity β), the reaction to the fund expectation (with an elasticity δ) and the reaction to the investor expectation (with an elasticity θ). As a result, it is not clear whether there is an over- or an under-reaction to these common components.

We then derive the following corollary, which allows us to summarize the role of the friction:

Corollary 4.2 *We assume that Assumptions 4.3 and 4.4 are satisfied. In that case,*

(i) β *is decreasing in* $1-p$, δ *is increasing in* $1-p$ *and is positive for a large* $1-p$,

(ii) Θ *is independent of* p,

(iii) $\beta/\eta = p/(1-p)$.

Proof. See proof in Appendix A.5. ■

When $p < 1$, the elasticity of capital flows to the investors' country expectations, β, is lower than what it would be in the frictionless case (with $p = 1$), which means that the response of capital flows to the country-k specific expectations is too sticky as compared to the frictionless benchmark.

It is different for the granular term. Indeed, capital flows responds more positively to the granular component when the portfolio becomes more sticky (when p decreases). If $1-p$ is large, the co-ownership spillovers dominate the portfolio reallocation and δ becomes positive. In that case, a larger $1-p$ increases δ, and the granular component generates extra capital flow volatility. Therefore, as p declines (as portfolios becomes more sticky), the contribution of the country component of expectations to the country capital flows declines, while the contribution of the granular component increases.

Interestingly, the reaction to the common component of expectations, Θ, does not depend on the friction and is equal to the frictionless case. In other words, capital flows to country

k due to portfolio growth Δa are unaffected by the friction. The friction affects capital flows to k only through portfolio reallocation $\tilde{\Delta} a_k$.

The last result states that the ratio of β over η, that is, the elasticity to the country expectations over the co-ownership spillover coefficient provides an approximation for the strength of the friction.

5 Identification

As we have just seen, capital flows respond to country return surprises and to fund-level returns partly due to co-ownership spillovers. In this section, we identify the parameters β and δ that govern the size of the response of capital flows. It will be useful to disentangle the contribution of η and ϕ to δ, as the latter is related to hedging reallocation, while the former is related to the frictional co-ownership spillovers. This analysis will also allow us to better interpret our preliminary empirical results in Section 3. Finally, we will use the identification of the parameters to quantify the contribution of co-ownership spillovers to capital-flow reallocation in the next section.

5.1 A Mapping from Model to Data

We now add time subscripts and map the theoretical equations to empirically testable equations, at the country allocation level and at the fund level. We assume that the coefficients β, η and ϕ are homogeneous across countries.

5.2 Country allocation-level regressions

Noting that $\frac{a_{k,t}^{i,j} - \bar{E}^i(a_{k,t}^{i,j})}{\bar{E}^i(a_{k,t}^{i,j})}$ can be approximated as $\log(a_{k,t}^{i,j}) - \log(\bar{E}^i(a_{k,t}^{i,j}))$, and that $a_{k,t}^{i,j} = w_{k,t}^{i,j} a_t^{i,j}$, using the homogeneity of coefficients, Equation (14) can be rewritten as:

$$\log(w_{k,t}^{i,j}) = \beta E_t^i(r_{k,t+1}) + \lambda_t^{i,j} + \lambda_k^{i,j} + \epsilon_{k,t}^{i,j} \tag{25}$$

with

$$\begin{aligned}
\lambda_t^{i,j} &= \delta E_t^i(r_{p,t+1}^{i,j}) + \theta E_t^i(\mathfrak{r}_{p,t+1}^i) - \log(a_t^{i,j}) \\
\lambda_k^{i,j} &= -\beta \bar{E}^i(r_{k,t+1}) - \delta \bar{E}^i(r_{p,t+1}^{i,j}) - \theta \bar{E}^i(\mathfrak{r}_{p,t+1}^i) + \log(\bar{E}^i(a_{k,t}^{i,j}))
\end{aligned}$$

λ_t^i are fund-time fixed effects, $\lambda_k^{i,j}$ are country-investor-fund fixed effects, and $\epsilon_{k,t}^{i,j}$ is an error term.

This expression enables us to identify β. To do so, we can estimate a slightly modified version of Equation (25) where $E_t^i g_k^{\text{next year}}$ proxies for the expected returns at the country level $E_t^i(r_{k,t+1})$. This allocation-level regression corresponds to Equation (1), except for the country fixed effects; we therefore identify β to 2.3% directly from Table 1.

5.3 Fund-level regressions

Similarly, noting that $a_t^{i,j} = A_t^{i,j}/\Omega_t^i$, with $A_{k,t}^{i,j}$ the total capital invested by investor i in country k through fund j and Ω_t^i the total wealth of investor i, and aggregating Equation (14) at the fund level, we can write:

$$\log(A_t^{i,j}) = (\beta + \delta)E_t^i(r_{p,t+1}^{i,j}) + \lambda_t^i + \lambda_k^{i,j} + \epsilon_t^{i,j} \tag{26}$$

with

$$\begin{aligned}
\lambda_t^i &= \theta E_t^i(r_{p,t+1}^i) + \log(\Omega_t^i) + \beta + \delta \\
\lambda^{i,j} &= -(\beta + \delta)\bar{E}^i(r_{p,t+1}^{i,j}) - \theta \bar{E}^i(\mathfrak{r}_{p,t+1}^i) + \log(\bar{E}^i(a_t^{i,j}))
\end{aligned}$$

λ_t^i are investor-time fixed effects, $\lambda^{i,j}$ are investor-fund fixed effects, and $\epsilon_{k,t}^{i,j}$ is an error term. $\beta E_t^i(r_{p,t+1}^{i,j})$ is the component of capital flows due to the expectations on the specific countries in the portfolio, but aggregated at the fund level, and $\delta E_t^i(r_{p,t+1}^{i,j})$ represents the spillovers arising from expectations on the other countries in the portfolio.

We can use this expression to identify $\beta + \delta$. To do so, we estimate a slightly modified version of Equation (26), where $E_t^i g_p^{j,\text{next year}}$ proxies for the expected returns at the fund level $E_t^i(r_{p,t+1}^{i,j})$. This fund-level regression corresponds to Equation (3), except for the equity price controls; we therefore identify $\beta + \delta$ to 29% directly from Table 2, which corresponds to our preferred estimate of Column (4). As a consequence, $\delta = 27\%$, if we use the previous result that $\beta = 2.3\%$.

Disentangling portfolio and co-ownership spillovers Recall that $\delta = \eta - \phi \Delta Cov$, combining co-ownership and hedging spillovers. In order to identify the co-ownership spillover parameter η, we need to identify $\phi \Delta Cov$. To do so, we exploit the variations of ΔCov at the fund level. Using a fund-level measure of $\Delta Cov^{i,j}$, we can estimate the following modified version that includes an interaction term:

$$\log(A_t^{i,j}) = (\beta + \eta)E_t^i(r_{p,t+1}^{i,j}) - \phi \Delta Cov^{i,j} E_t^i(r_{p,t+1}^{i,j}) + \lambda_t^i + \lambda_k^{i,j} + \epsilon_t^{i,j} \tag{27}$$

VARIABLES	(1) $\log(A_t^{i,j})$ All funds	(2) $\log(A_t^{i,j})$ All funds
$E_t^i(g_p^{j,\text{next year}})$	0.377***	
	(0.046)	
$\gamma_t^{i,j}$		0.511***
		(0.101)
$E_t^i(g_p^{j,\text{next year}}) - \gamma_t^{i,j}$		0.364***
		(0.047)
$\Delta Cov_t^{i,j}$	-4.137***	-4.096***
	(0.826)	(0.825)
$\Delta Cov_t^{i,j} \times E_t^i(g_p^{j,\text{next year}})$	-0.755***	-0.754***
	(0.201)	(0.200)
$\Delta\log(Q_t^{i,j})$	-0.011**	-0.011**
	(0.004)	(0.004)
$\Delta\log(Q_{t-1}^{i,j})$	-0.013***	-0.013***
	(0.004)	(0.004)
Observations	3,878	3,878
R-squared	0.082	0.084
Fund FE	Yes	Yes
Investor-time FE	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Spillovers due to Portfolio Reallocation and Co-ownership

Note: The dependent variable in Columns (1) and (2) is the log total capital invested by investor i in fund j on month t. Columns (1) and (2) report results for regression Equation (28). Standard errors Driscoll-Kraay standard errors with 5 lags.

Substituting the variables with their empirical counterparts and adding appropriate controls, we obtain an extension of Equation (3) that includes an interaction term:

$$\ln\left(A_t^{i,j}\right) = (\beta+\eta)E_t^i g_{p,t}^{j,\text{next year}} - \phi\Delta Cov_t^{i,j} \times E_t^i g_{p,t}^{j,\text{next year}} \\ + \gamma_0\Delta Cov_t^{i,j} + \gamma_1\Delta\log(Q_{p,t}^j) + \gamma_2\Delta\log(Q_{p,t-1}^j) + \lambda_t^i + \lambda^{i,j} + \epsilon_t^{i,j}. \quad (28)$$

The additional interaction term allows us to distinguish the portfolio reallocation spillover parameter ϕ from the co-ownership spillovers parameter η. Appendix B.1 provides details on how we compute $\Delta Cov_k^{i,j}$. Then $\Delta Cov_t^{i,j}$ is the average of $\Delta Cov_k^{i,j}$ weighted by the portfolio shares. The summary statistics of $\Delta Cov^{i,j}$ are shown in Appendix B.2. Note that, because portfolio shares vary over time, $\Delta Cov_t^{i,j}$ is time-varying. We thus need to include the linear term $\Delta Cov_t^{i,j}$ in the regression.

We present the results in Table 3. In Column (1), the interaction term appears to be significantly negative at -0.75, which is consistent with the model and implies $\phi = 0.75$. Portfolio reallocation spillovers are therefore at play: investors do consider the covariance of returns and the potential for risk sharing (when ΔCov is negative), as well as arbitrage opportunities (when ΔCov is positive) when reacting to their expectations.

In Column (2), we replace the linear term $E_t^i g_{p,t}^{j,\text{next year}}$ with the super-granular residual $\gamma_t^{i,j}$ because identification is subject to the same potential confounding factors as before. We are not worried about the identification of the interaction term, because the identification is driven by fund-specific variation in the covariance term $\Delta Cov^{i,j}$. We however add $E_t^i(g_p^{j,\text{next year}}) - \gamma_t^{i,j}$ as an additional control, so that the interaction term remains well-identified. The coefficient of $\gamma_t^{i,j}$ is 0.51 and is higher than the one identified in Table 2. This implies that $\beta + \eta = 0.51$, so that $\eta = 0.51 - 0.02 = 0.49$, or $\eta = 0.51 - 0.03 = 0.48$, depending on whether we use the coefficient of β estimated for all funds or for active funds.[21]

Using Corollary 4.2, we infer the portfolio adjustment probability as $p = \beta/(\beta + \eta)$. Our estimates imply $p = 0.045$, corresponding to portfolio updating every 22 months; for active funds, $p = 0.06$, or an updating frequency of once every 16 months. These values closely match the estimates in Bacchetta and van Wincoop (2017).

6 Quantifying Co-ownership Spillovers

Co-ownership spillovers arise only with portfolio stickiness ($p < 1$), which our estimates support. We therefore quantify how much this friction contributes to the variance of expectation-

[21] The fact that the estimated $\eta = 0.49$ is larger than the estimated $\delta = 0.27$ is consistent with the fact that the estimated ϕ is positive and that $\Delta Cov_t^{i,j}$ is positive on average (see Appendix B.2).

driven capital-flows reallocation, $\tilde{\Delta} a_k$. We focus on the reallocation component because Corollary 4.2 implies that portfolio growth is largely unaffected by stickiness.

We combine the insights of Proposition 4.2 to write the following decomposition of portfolio reallocation, adding time subscripts:

$$\tilde{\Delta} a_{k,t} = \underbrace{\beta \tilde{l}_{k,t}}_{\text{exc. return}} + \underbrace{\eta \Gamma_{k,t}}_{\text{co-own. spill.}} - \underbrace{\phi \Delta Cov \Gamma_{k,t}}_{\text{hedging}} \tag{29}$$

with

$$\tilde{l}_{k,t} = \sum_{i=1}^{M} \sigma^i_{k,t} (l^i_{k,t} - \Gamma^i) \tag{30}$$

$$\Gamma_{k,t} = \sum_{i=1}^{M} \sigma^i_{k,t} \sum_{j=1}^{\mathcal{J}(i)} \sigma^{i,j}_{k,t} (\Gamma^{i,j}_t - \Gamma^i_t) \tag{31}$$

Equation (29) decomposes reallocation into excess-return, co-ownership, and hedging components. Our purpose is to evaluate the contribution of each of these three terms to the variance of capital flow reallocation. We parametrize β, η, ϕ and ΔCov using our estimates from Section 5, and compute $\Gamma_{k,t}$ and $\tilde{l}_{k,t}$ from fund allocations and investor GDP growth expectations.

Measurement and calibration $\tilde{l}_{k,t}$ captures investors' *excess* optimism about country k relative to their overall portfolios, aggregated using investors' shares in flows to k $\sigma^i_{k,t}$. $\Gamma_{k,t}$ captures investors' *excess* optimism about funds investing in k relative to their overall portfolios, aggregated using fund- and investor-level flow shares $\sigma^i_{k,t}$ and $\sigma^{i,j}_{k,t}$.

We construct the expectation components as

$$l^i_{k,t} = E^i_t g^{\text{next year}}_{k,t} - \frac{1}{K} \sum_{k=1}^{K} E^i_t g^{\text{next year}}_{k,t},$$

$$\Gamma^i_t = \sum_{k=1}^{K} w^i_{k,t} \left(E^i_t g^{\text{next year}}_{k,t} - \frac{1}{K} \sum_{k=1}^{K} E^i_t g^{\text{next year}}_{k,t} \right),$$

$$\Gamma^{i,j}_t = \sum_{k \in \mathcal{S}(i,j)} w^{i,j}_{k,t} \left(E^i_t g^{\text{next year}}_{k,t} - \frac{1}{\mathcal{K}(i,j)} \sum_{k \in \mathcal{S}(i,j)} E^i_t g^{\text{next year}}_{k,t} \right),$$

Because expectations are missing for many investor–country pairs, we expand coverage by imputing missing expectations using an estimated expectation process; the expanded panel contains 468 investors, 2,282 funds, and 2,660,000 monthly observations (Appendix B.3).[22]

We estimate the flow-share weights as $\sigma^i_{k,t} = A^i_{k,t}/A_{k,t}$ and $\sigma^{i,j}_{k,t} = A^{i,j}_{k,t}/A^i_{k,t}$, then compute $\tilde{l}_{k,t}$ and $\Gamma_{k,t}$ from (30) and (31) using contemporaneous weights $\sigma^i_{k,t}$, $\sigma^{i,j}_{k,t}$ and $w^{i,j}_{k,t}$ (results are similar with lagged or average weights).

We set $\beta = 0.023$, $\eta = 0.49$, and $\phi = 0.75$, reflecting our point estimates from Section 5. We set $\Delta Cov = 0.07$, the average of $\Delta Cov^{i,j}$ across all funds (see Table B.2 in Appendix B.2).

Contributions The resulting contribution of $\beta\tilde{l}_{k,t}$, $-\phi\Delta Cov\Gamma_{k,t}$ and $\eta\Gamma_{k,t}$ to the variance of the expectation-driven capital flow reallocation, $\tilde{\Delta}a_{k,t}$, is shown in Table 4. First, consider the variance of expectations (upper part of Table 4). The variance of the idiosyncratic, country-specific expectations, $\tilde{l}_{k,t}$ (0.91), is 9 times higher on average than the variance of the granular term $\Gamma_{k,t}$ (0.11). Despite this, the co-ownership term has a much higher contribution relative to the excess-return term: co-ownership spillovers explain on average 93% of the variance, and the excess return term explains 6% (lower part of the Table). The hedging component is almost irrelevant at 1%. This is because β much lower than η.

Figure 1 splits countries by development status (Advanced/Emerging) and portfolio size (Large/Small). A "Large" country has an average share in portfolios in the top quartile (i.e., higher than 3.5%). The Large countries include the United States, the United Kingdom, Japan, Germany, France, Switzerland, the Russian Federation, South Korea, China, India, Mexico, and Brazil. The excess-return contribution is slightly higher for small economies (about 7%) than for large economies (about 3%).

For large countries, $\Gamma_{k,t}$ can partly reflect *own-country* expectations rather than spillovers, precisely because the granular term is driven by the expectations about large countries. We therefore subtract from the granular term $\Gamma_{k,t}$ the following term:

$$\Gamma_{k,k,t} = \sum_{i=1}^{M} \sigma^i_{k,t} w^i_{k,t} (l^i_{k,t} - \Gamma^i_t) \tag{32}$$

and reclassify $\eta\Gamma_{k,k,t}$ as "excess return" rather than spillovers. We thus compute a diminished co-ownership spillover term: $\eta(\Gamma_{k,t} - \Gamma_{k,k,t})$, and an augmented excess return term:

[22] Because there are some countries in which investor i invests and for which we do not have expectations (real or imputed), we use the formulas $\Gamma^{i,j}_t = \sum_{k\in\kappa(i,j)} w^{i,j}_{k,t}\left[E^i_t g^{\text{next year}}_{k,t} - \sum_{k\in\kappa(i,j)} E^i_t g^{\text{next year}}_{k,t}/\kappa^{i,j}\right]$, and $\Gamma^i_t = \sum^K_{k\in\kappa(i)} w^i_{k,t}\left[E^i_t g^{\text{next year}}_{k,t} - \sum^K_{k\in\kappa(i)} E^i_t g^{\text{next year}}_{k,t}/\kappa^i\right]$. where κ^i and $\kappa^{i,j}$ are the set of countries for which we observe investor i's expectations or impute expectations at the fund and investor level. This amounts to setting the expectations of these countries to zero, so the estimated co-ownership spillovers will be under-estimated. In this sense, we provide a conservative estimate of the variance of $\Gamma_{k,t}$.

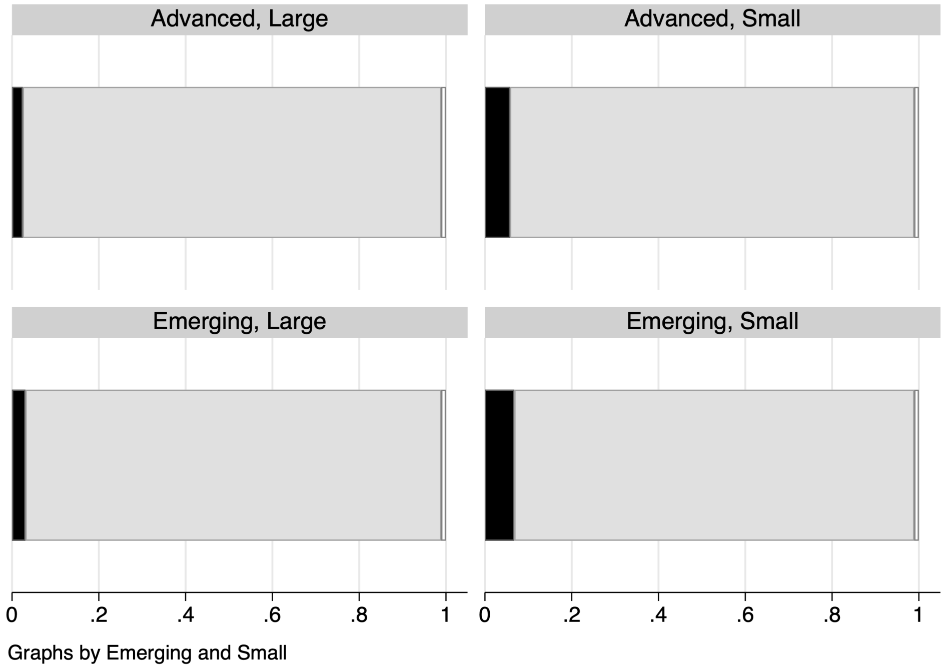
Expectations			
Variance	$V\left(\tilde{l}_{k,t}\right)$	$V\left(\ \Gamma_{k,t}\right)$	
Value	.91	.11	
	[.17,1.82]	[.03,.21]	
Implied capital flows			
Coefficients	β	η	$-\phi\Delta Cov$
	.023	.49	$-.052$
Variance	$V\left(\beta\tilde{l}_{k,t}\right)$	$V\left(\eta\Gamma_{k,t})\right)$	$V\left(-\phi\Delta Cov_{k,t}\right)$
Value	.0005	.0142	.0002
	[.0001,.0012]	[.0019,.0308]	[.0000,.0004]
Contribution	6%	93%	1%
	[1%,13%]	[86%,98%]	[.9%,1%]
Variance	$V\left(\beta\tilde{l}_{k,t}+\eta\Gamma_{k,k,t}\right)$	$V\left(\eta\Gamma_{k,t}-\eta\Gamma_{k,k,t}\right)$	$V\left(-\phi\Delta Cov_{k,t}\right)$
Value	.0023	.0128	.0002
	[.0002,.0059]	[.0018,.0290]	[.0000,.0004]
Contribution	19%	80%	1%
	[2%,54%]	[46%,97%]	[.9%,1%]

Table 4: Variance decomposition of expectation-driven capital flow reallocation

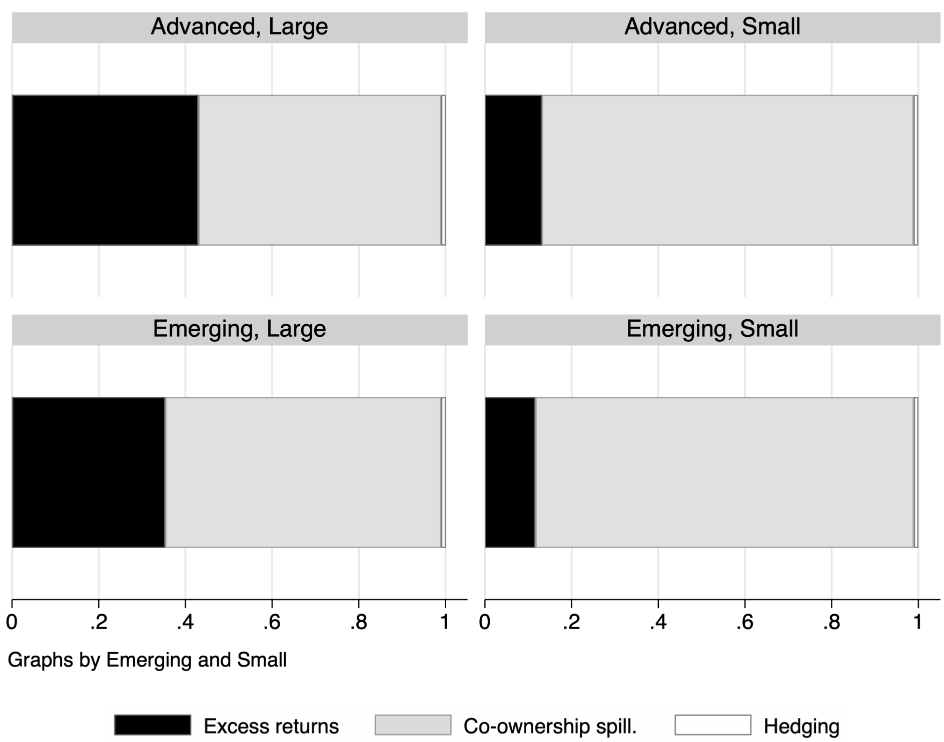
Note: We report the average variances of expectations and implied capital flow reallocation across countries, as well as the 10^{th} and 90^{th} percentile (in brackets). The contributions are the ratio of the variance to the total variance of expectation-driven flow reallocation.

Figure 1: Variance decomposition of expectation-driven capital flows

a) Implied capital flows



b) Implied capital flows (adjusted)



Note: Panel a) represents the contribution of the variance of $\beta\tilde{l}_{k,t}$, $\eta\Gamma_{k,t}$ and $-\phi\Delta Cov_{k,t}$ to the variance of implied capital flow reallocation. Panel b) represents the contribution of the variance of $\beta\tilde{l}_{k,t} + \eta\Gamma_{k,k,t}$, $\eta\Gamma_{k,t} - \eta\Gamma_{k,k,t}$ and $-\phi\Delta Cov_{k,t}$ to the variance of implied capital flow reallocation.

$\beta\tilde{l}_{k,t} + \eta\Gamma_{k,k,t}$. Under this adjustment, the average co-ownership spillover contribution falls (from 93% to 80%) and the excess-return contribution rises (from 6%to 19%), with changes concentrated among large economies. In Panel b) of Figure 1, the contribution of the co-ownership term becomes relatively smaller in Large economies (from 96% down to 61%), while it increases only slightly for Small countries (from 92% to 86%).

The role of co-ownership linkages Using the definition of $\Gamma_t^{i,j}$ and Γ_t^i, we can notice that $\Gamma_t^{i,j} - \Gamma_t^i$ is a weighted average of the country-specific expectations:

$$\Gamma_t^{i,j} - \Gamma_t^i = \sum_{k=1}^{K} \Delta w_{k,t}^{i,j} l_{k,t}^i$$

where the weight $\Delta w_{k,t}^{i,j} = w_{k,t}^{i,j} - w_{k,t}^i$ is a relative allocation. It is the difference between the country portfolio share in the fund and in the full investor portfolio. What makes this term relevant is the extent to which the fund portfolios are concentrated relative to the investor's portfolio.

The granular component that is relevant for country k, $\Gamma_{k,t}$ can then itself be written as a weighted average of all the country-specific expectations:

$$\Gamma_{k,t} = \sum_{k'=1}^{K} \sum_{i=1}^{M} \sigma_{k'}^i \Delta w_{k,k',t}^i l_{k',t}^i \tag{33}$$

where the country-specific expectations, $l_{k',t}^i$, are weighted by the share of investor i in the total flows to k $\sigma_{k,t}^i$ and by $\Delta w_{k,k',t}^i$, with

$$\Delta w_{k,k',t}^i = \left(\sum_{j=1}^{J(i)} \sigma_{k,t}^{i,j} \Delta w_{k',t}^{i,j} \right) \tag{34}$$

$\Delta w_{k,k',t}^i$ measures the *co-ownership linkages* between country k and country k' at the investor level. It is a weighted average of country k''s relative allocations across investor i's funds, where the weights are represented by the importance of a given fund in the total flows of investor i to country k. It thus reflects the exposure of country k to country k': investor i's expectations about country k' will matter to country k if the funds managed by i that invest in country k also invest a large share in country k'.

Country granularity versus investor granularity The idiosyncratic expectations $l_{k,t}^i$ are both country-specific and investor-specific. We therefore decompose them into the average country-specific component of expectations across investors for country k, $l_{k,t} = (\sum_{i=1}^{M} l^i_{k,t})/M$ and their investor-specific component $l^i_{k,t} - l_{k,t}$. We can then decompose the granular term into a term that is driven by "country granularity", and two terms that are driven by "investor granularity":

$$\Gamma_{k,t} = \underbrace{\sum_{k'=1}^{K} \Delta w_{k,k',t} l_{k',t}}_{\Gamma^{country}_{k,t}} + \underbrace{\sum_{k'=1}^{K}\sum_{i=1}^{M} \sigma^i_{k,t}\left(\Delta w^i_{k,k',t} - \Delta w_{k,k',t}\right)\left(l^i_{k',t} - l_{k',t}\right) + \sum_{k'=1}^{K} \Delta w_{k,k',t} \sum_{i=1}^{M}\left(\sigma^i_{k,t} - \frac{1}{M}\right)\left(l^i_{k',t} - l_{k',t}\right)}_{\Gamma^{investor}_{k,t}} \tag{35}$$

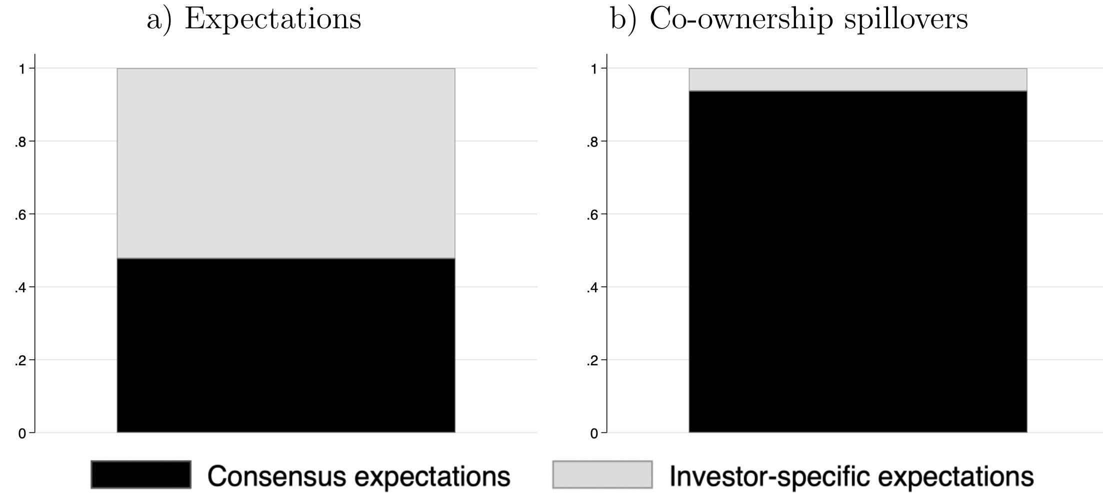
where $\Delta w_{k,k',t}$ is an average of the co-ownership linkages between country k and country k' across all investors, weighted by the importance of a given investor in the total flows to country k:

$$\Delta w_{k,k',t} = \left(\sum_{i=1}^{M} \sigma^i_{k,t} \Delta w^i_{k,k',t}\right) \tag{36}$$

The first term in Equation (35) shows that "consensus expectations" $l_{k,t}$ will matter if average co-ownership spillovers are granular. We refer to this term as the "country granular component" because its importance is driven by the granularity of countries' portfolio shares. Investor-specific expectations $l^i_{k,t} - l_{k,t}$ will matter when the linkages are heterogeneous and granular at the investor level (first term), and when the investor's contribution to country k capital flows is granular. The second and third terms thus constitute the "investor granular component".

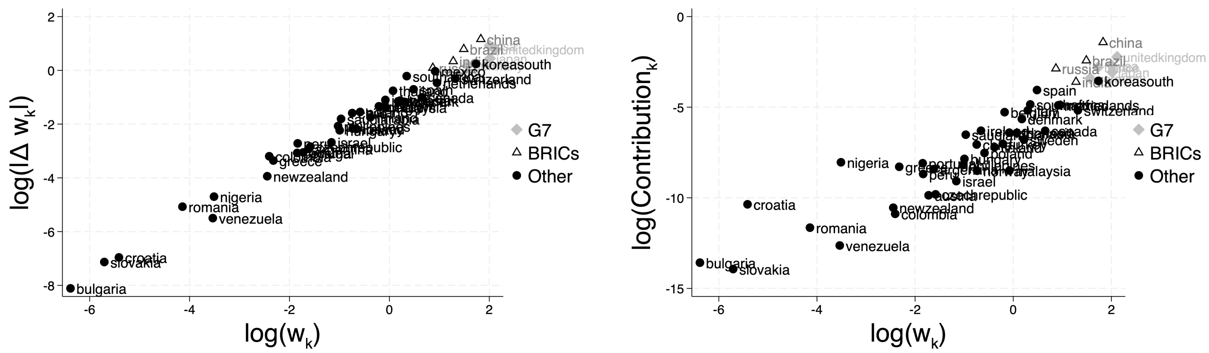
Figure 2 shows the relative contributions of consensus expectations and investor-specific expectations, to expectations $l^i_{k,t}$ themselves (Panel a)), and to co-ownership spillovers (Panel b)). The variance of $l^i_{k,t}$ is due for almost equal shares to the consensus and investor-specific components. However, consensus expectations contribute to more than 90% to the variance of capital flow reallocation. This is due to the granularity of the associated weights, which can be measured by their standard deviation (Gabaix, 2011; di Giovanni et al., 2014). The weights of the consensus expectations, the average co-ownership linkages $\Delta w_{k,k',t}$, have a much higher standard deviation (by a factor of 2 orders of magnitude) than the weights of the investor-specific expectations ($\sigma^i_{k,t}(\Delta w^i_{k,k',t} - \Delta w_{k,k',t})$ and $\Delta w_{k,k',t}(\sigma^i_{k,t} - 1/M)$), which

Figure 2: Variance decomposition of expectations and co-ownership spillovers



Note: The figure represents the relative contributions of consensus expectations $l_{k,t}$ and investor-specific expectations $l^i_{k,t} - l_{k,t}$, to expectations $l^i_{k,t}$ themselves (Panel a)), and to co-ownership spillovers (Panel b)). In Panel a), the contribution of consensus expectations $l_{k,t}$ to expectations $l^i_{k,t}$ is measured as $V(l_{k,t})/V(l^i_{k,t})$, and the contribution of investor-specific expectations $l^i_{k,t} - l_{k,t}$ to expectations $l^i_{k,t}$ is measured as $V(l^i_{k,t} - l_{k,t})/V(l^i_{k,t})$. In Panel b), the contribution of consensus expectations to co-ownership spillovers $\Gamma_{k,t}$ is measured as $V(\Gamma^{country}_{k,t})/V(\Gamma^i_{k,t})$, and the contribution of investor-specific expectations to co-ownership spillovers $\Gamma_{k,t}$ is measured as $V(\Gamma^{investor}_{k,t})/V(\Gamma^i_{k,t})$.

Figure 3: Role of country average allocation



Note: The left panel represents the scatter plot of the average allocations $w_k = \sum_{i=1}^{M} \sigma_k^i w_k^i$ against the log of the average absolute value of co-ownership linkages $|\Delta w_k| = \sum_{k'=1}^{K} \sigma_{k'} |\Delta w_{k',k}|$. The right panel represents the scatter plot of the average allocations $w_k = \sum_{i=1}^{M} \sigma_k^i w_k^i$ against the log of average contributions $Contribution_k = \sum_{k'=1}^{K} \sigma_{k'} Contribution_{k',k}$.

explains the disproportionate contribution of consensus expectations (see Figure C.2 in the Appendix).

This is reassuring for external validity: what matters is the *average* portfolio structure $\Delta w_{k,k',t}$, so our results require only that observed portfolios are representative of global portfolio weights.

Contributors Noting that the variance of country k co-ownership spillovers can be written as $\eta^2 V(\Gamma_k)$, and that $V(\Gamma_k) = \sum_{l=1}^{K} (\Delta w_{k,l})^2 V(l_l)$, we compute a measure of the contribution of country k' to country k co-ownership spillovers as follows:

$$Contribution_{k,k'} = \frac{(\Delta w_{k,k'})^2 V(l_{k'})}{\sum_{l=1}^{K} (\Delta w_{k,l})^2 V(l_l)} \tag{37}$$

We find that the large contributors are mostly countries with large allocations in portfolios. Figure C.3 in the appendix shows the average contribution of country k' across our sample, computed as $Contribution_{k'} = \sum_{k=1}^{K} \sigma_k Contribution_{k,k'}$. Among emerging economies, those are the BRICs (Brazil, Russian Federation, India, China), but also South Africa, South Korea and Mexico. Among advanced economies, those are the main G7 countries: UK, the US, France, Japan and Germany. Next, we explore the role of country size in portfolios. Figure C.4 in the appendix shows that the variation in the contribution is driven mostly by the average absolute weights $|\Delta w_{k,k'}|$, not by the idiosyncratic volatility $V(l_{k'})$. The country volatility is not per se a systematic source of contribution. For instance, Nigeria, Argentina, Greece and Venezuela have volatile expectations but do not contribute meaningfully to co-ownership spillovers. The key driver of the contribution is the average absolute weights as shown in Figure 3. These average absolute weights are highly correlated with the average shares in portfolios $w_{k'}$, resulting in a high correlation between the average portfolio shares and the contributions.

7 Conclusion

Using a unique dataset linking subjective expectations to investor and mutual fund behavior, and a structural model of delegated investment and portfolio frictions, we have shown that changes in investments into mutual funds driven by investors' expectations generate comovements in capital flows across countries through "co-ownership spillovers". We have also determined the conditions under which they emerge and matter for aggregate capital flow volatility.

Our findings carry important implications for understanding the behavior of equity mutual funds, which have grown in importance recently both in terms of domestic equity markets and in international portfolio flows. We have identified a channel that, until now, has only been discussed theoretically, by which countries are subject to capital flows generated from shocks to other countries in the same portfolios. The co-ownership spillovers are the dominant driver of expectation-driven capital flow reallocation and are thus an important source of capital-flow misallocation. Understanding the source and destination of these spillovers is therefore crucial for policy-makers. They operate, not through a center-periphery, or North-South channel, often emphasized, but via a Large-Small channel–both emerging and developed markets contribute. These results imply that policy-makers in small economies should pay attention to large shocks on the financial centers from which capital flows originate, but also to large countries with overlapping investor base.

This paper abstracts from several important dimensions of investor behavior and capital flows, which we leave for future work. In particular, one might consider how our spillovers compare in contribution to overall capital volatility to the more usual suspects, such as funding shocks, which are central to the literature on capital flow contagion, and what is the global origin-destination structure of co-ownership linkages. We have also made several simplifying assumptions that have allowed us to map our theory to the data in a more tractable way. For example, we abstract from information frictions between the investor and mutual fund and do not model the expectation formation and information acquisition process explicitly.

References

Acemoglu, D., V. M. Carvalho, A. Ozdaglar, and A. Tahbaz-Salehi (2012). The network origins of aggregate fluctuations. *Econometrica 80*(5), 1977–2016.

Agarwal, S., Y. H. Chua, P. Ghosh, and C. Song (2022). Inflation expectations and portfolio rebalancing of households: Evidence from inflation targeting in india. *SSRN Electronic Journal*.

Amiti, M. and D. E. Weinstein (2018). How much do idiosyncratic bank shocks affect investment? evidence from matched bank-firm loan data. *Journal of Political Economy 126*(2), 525–587.

Bacchetta, P., M. Davenport, and E. van Wincoop (2022). Can sticky portfolios explain international capital flows and asset prices? *Journal of International Economics 136*, 103583. NBER International Seminar on Macroeconomics 2021.

Bacchetta, P., S. Tièche, and E. van Wincoop (2020, June). International Portfolio Choice with Frictions: Evidence from Mutual Funds. CEPR Discussion Papers 14898, C.E.P.R. Discussion Papers.

Bacchetta, P. and E. van Wincoop (2017, April). Gradual portfolio adjustment: Implications for global equity portfolios and returns. Working Paper 23363, National Bureau of Economic Research.

Bacchetta, P., E. van Wincoop, and E. R. Young (2022, 08). Infrequent random portfolio decisions in an open economy model. *The Review of Economic Studies 90*(3), 1125–1154.

Ben-David, I., F. Franzoni, R. Moussawi, and J. Sedunov (2016, May). The granular nature of large institutional investors. Working Paper 22247, National Bureau of Economic Research.

Bohn, H. and L. L. Tesar (1996, May). U.S. Equity Investment in Foreign Markets: Portfolio Rebalancing or Return Chasing? *American Economic Review 86*(2), 77–81.

Broner, F. A., R. Gaston Gelos, and C. M. Reinhart (2006). When in peril, retrench: Testing the portfolio channel of contagion. *Journal of International Economics 69*(1), 203–230. Emerging Markets.

Camanho, N., H. Hau, and H. Rey (2022, 04). Global portfolio rebalancing and exchange rates. *The Review of Financial Studies 35*(11), 5228–5274.

Carvalho, V. M. and B. Grassi (2019, April). Large firm dynamics and the business cycle. *American Economic Review 109*(4), 1375–1425.

Coval, J. and E. Stafford (2007). Asset fire sales (and purchases) in equity markets. *Journal of Financial Economics 86*(2), 479–512.

Dahlquist, M. and M. Ibert (2021). Return expectations and portfolios: Evidence from large asset managers. *Mutual Funds*.

De Marco, F., M. Macchiavelli, and R. Valchev (2021, 12). Beyond Home Bias: International Portfolio Holdings and Information Heterogeneity. *The Review of Financial Studies 35*(9), 4387–4422.

di Giovanni, J., A. A. Levchenko, and I. Méjean (2014). Firms, destinations, and aggregate fluctuations. *Econometrica 82*(4), 1303–1340.

Forbes, K. (2012, October). The "big c": Identifying contagion. Working Paper 18465, National Bureau of Economic Research.

Forbes, K. and R. Rigobon (2001). *Measuring Contagion: Conceptual and Empirical Issues*, pp. 43–66. Boston, MA: Springer US.

Froot, K. A., P. G. O'Connell, and M. S. Seasholes (2001). The portfolio flows of international investors. *Journal of Financial Economics 59*(2), 151–193.

Gabaix, X. (2011). The granular origins of aggregate fluctuations. *Econometrica 79*(3), 733–772.

Gabaix, X. and R. S. J. Koijen (2021, June). In search of the origins of financial fluctuations: The inelastic markets hypothesis. Working Paper 28967, National Bureau of Economic Research.

Gabaix, X. and R. S. J. Koijen (2024). Granular instrumental variables. *Journal of Political Economy 132*(7), 2274–2303.

Galaasen, S., R. Jamilov, R. Juelsrud, and H. Rey (2020). Granular credit risk. Technical report, National Bureau of Economic Research.

Gaubert, C. and O. Itskhoki (2021). Granular comparative advantage. *Journal of Political Economy 129*(3), 871–939.

Gelos, R. G. (2011). International mutual funds, capital flow volatility, and contagion – a survey1. *IMF Working Papers 2011*(092), A001.

Giglio, S., M. Maggiori, J. Stroebel, and S. Utkus (2021, May). Five facts about beliefs and portfolios. *American Economic Review 111*(5), 1481–1522.

Glaser, M. and M. Weber (2005, 01). September 11 and Stock Return Expectations of Individual Investors*. *Review of Finance 9*(2), 243–279.

Herskovic, B., B. Kelly, H. Lustig, and S. Van Nieuwerburgh (2020). Firm volatility in granular networks. *Journal of Political Economy 128*(11), 4097–4162.

Jotikasthira, C., C. Lundblad, and T. Ramadorai (2012). Asset fire sales and purchases and the international transmission of funding shocks. *The Journal of Finance 67*(6), 2015–2050.

Karolyi, G. A. (2003). Does international financial contagion really exist? *International Finance 6*(2), 179–199.

Kézdi, G. and R. J. Willis (2011, November). Household Stock Market Beliefs and Learning. NBER Working Papers 17614, National Bureau of Economic Research, Inc.

Li, X. and S. R. G. Ongena (2025). Global banks' macroeconomic expectations and credit supply. Technical report. Discussion Paper No. 8/2025, Halle Institute for Economic Research (IWH) and CEPR.

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The Review of Economics and Statistics 47*(1), 13–37.

Ma, Y., T. Paligorova, and J.-L. Peydró (2022). Expectations and bank lending. Working Paper.

Malmendier, U. and S. Nagel (2015, 10). Learning from Inflation Experiences *. *The Quarterly Journal of Economics 131*(1), 53–87.

Markowitz, H. (1952). Portfolio selection. *The Journal of Finance 7*(1), 77–91.

Miao, Y. and M. Pant (2012). Coincident indicators of capital flows. IMF Working Papers 2012/055, International Monetary Fund.

Piazzesi, M. and M. Schneider (2009, May). Momentum traders in the housing market: Survey evidence and a search model. *American Economic Review 99*(2), 406–11.

Puy, D. (2016). Mutual funds flows and the geography of contagion. *Journal of International Money and Finance 60*, 73–93.

Raddatz, C. and S. L. Schmukler (2012). On the international transmission of shocks: Micro-evidence from mutual fund portfolios. *Journal of International Economics 88*(2), 357–374. NBER Global.

Rigobón, R. (2019, April). Contagion, Spillover, and Interdependence. *Economía Journal 0*(Spring 20), 69–99.

Schmidt, R. and P. Yesin (2022, December). The growing importance of investment funds in capital flows. *Aussenwirtschaft 72*(01), 1–40.

Vissing-Jorgensen, A. (2003). Perspectives on behavioral finance: Does "irrationality" disappear with wealth? evidence from expectations and actions. *NBER Macroeconomics Annual 18*, 139–194.

Weber, M., E. U. Weber, and A. Nosić (2012, 07). Who takes Risks When and Why: Determinants of Changes in Investor Risk Taking. *Review of Finance 17*(3), 847–883.

A Proofs

A.1 The investor's optimal asset allocation

We proceed to solving the investors' program and derive Equations (8) and (9).

Maximizing (7) with respect to $a^{i,j}$, subject to (6), yields the following first-order condition:

$$\begin{aligned}
E^i(R_p^{i,j}) - r &= \gamma \sum_{j'=1}^{\mathcal{J}(i)} a^{i,j'} Cov(R_p^{i,j}, R_p^{i,j'}) \\
&= \gamma \left(a^{i,j} V(R_p^{i,j}) + \left(\sum_{j'=1}^{\mathcal{J}(i)} a^{i,j'} - a^{i,j} \right) \sum_{j'=1, j'\neq j}^{\mathcal{J}(i)} \frac{a^{i,j'}}{\sum_{j'=1,j'\neq j}^{\mathcal{J}(i)} a^{i,j'}} Cov(R_p^{i,j}, R_p^{i,j'}) \right) \\
&= \gamma \left(a^{i,j} V(R_p^{i,j}) + \left(\sum_{j'=1}^{\mathcal{J}(i)} a^{i,j'} - a^{i,j} \right) Cov \left(R_p^{i,j}, \underbrace{\sum_{j'=1, j'\neq j}^{\mathcal{J}(i)} \frac{a^{i,j'}}{\sum_{j'=1,j'\neq j}^{\mathcal{J}(i)} a^{i,j'}} R_p^{i,j'}}_{\mathcal{R}_p^{i,j-}} \right) \right)
\end{aligned} \tag{38}$$

This yields Equation (9).

Equation (8) is obtained either by taking the sum of the above first-order condition across funds, weighted by $a^{i,j} / \sum_{j=1}^{\mathcal{J}(i)} a^{i,j}$, or by taking the derivative of (7) with respect to $\sum_{j=1}^{\mathcal{J}(i)} a^{i,j}$.

A.2 The fund's optimal asset allocation

We proceed to solving the fund's program and derive Equations (11).

Maximizing (7) with respect to $w_k^{i,j}$, subject to (6) and (10), yields the following first-order condition for any $(k, K) \in \mathcal{S}(i,j)^2$ pair of countries in the fund's portfolio:

$$\begin{aligned}
\big(E^i(R_k) - E^i(R_K)\big) &= \gamma \sum_{j=j'}^{\mathcal{J}(i)} a^{i,j'} \left(\sum_{k' \in \mathcal{S}(i,j)} w_{k'}^{i,j'} Cov(R_k, R_k') - \sum_{k' \in \mathcal{S}(i,j)} w_{k'}^{i,j'} Cov(R_K, R_k') \right) \\
&= \gamma \sum_{j=j'}^{\mathcal{J}(i)} a^{i,j'} \left(\sum_{k' \in \mathcal{S}(i,j)} w_{k'}^{i,j'} Cov(R_k, R_k') - \sum_{k' \in \mathcal{S}(i,j)} w_{k'}^{i,j'} Cov(R_K, R_k') \right)
\end{aligned}$$

Noting that this is true for all $K \in \mathcal{S}(i,j)$, this can be written in vector form as follows:

$$Id(i,j)\left[E^i(R_k) - E^i(R)\right] = \gamma Id(i,j)(V_k^R - V^R)W^i a^i \tag{39}$$

where $W^i = (w^{i,1}, .., w^{i,j}, .., w^{i,\mathcal{J}(i)}$ is a $K \times \mathcal{J}(i)$ matrix of portfolio weights, $Id(i,j)$ is a $K \times K$ diagonal matrix, where the k^{th} element of the diagonal is equal to one if $k \in \mathcal{S}(i,j)$, and zero otherwise. For $k' \notin \mathcal{S}(i,j)$, $w_{k'}^{i,j} = 0$. Therefore, $w^{i,j'} Id(i,j) = w^{i,j'}$.

Left-multiplying by $w^{i,j'}$, we obtain

$$E^i(R_k) - E^i(R_p^{i,j}) = \gamma w^{i,j'}(V_k^R - V^R)W^i a^i \tag{40}$$

Note that (38) can also be written in a vector form:

$$E^i(R_p^{i,j}) - r = \gamma w^{i,j'} V^R W^i a^i$$

Substituting into (40), we obtain

$$\begin{aligned}
&E^i(R_k) - r = \gamma w^{i,j'} V_k^R W^i a^i \\
&= \gamma \sum_{j'=1}^{\mathcal{J}(i)} a^{i,j'} \sum_{k' \in \mathcal{S}(i,j')} w_{k'}^{i,j'} Cov(R_k, R_{k'}) \\
&= \gamma \left(a^{i,j} \sum_{k' \in \mathcal{S}(i,j)} w_{k'}^{i,j} Cov(R_k, R_{k'}) + \left(\sum_{j'=1}^{\mathcal{J}(i)} a^{i,j'} - a^{i,j} \right) \underbrace{\sum_{j'=1, j' \neq j}^{\mathcal{J}(i)} \frac{a^{i,j'}}{\sum_{j'=1, j' \neq j}^{\mathcal{J}(i)} a^{i,j'}} \underbrace{\sum_{k' \in \mathcal{S}(i,j')} w_{k'}^{i,j'} Cov(R_k, R_{k'})}_{Cov(R_k, R_p^{i,j'})}}_{Cov(R_k, \mathcal{R}_p^{i,j-})} \right) \\
&= \gamma \left(a^{i,j} \left(w_k^{i,j} V(R_k) + (1 - w_k^{i,j}) \underbrace{\sum_{k' \in \mathcal{S}(i,j), k' \neq k} \frac{w_{k'}^{i,j}}{1 - w_k^{i,j}} Cov(R_k, R_{k'})}_{Cov(R_k, R_{p,k-}^{i,j})} \right) + \left(\sum_{j'=1}^{\mathcal{J}(i)} a^{i,j'} - a^{i,j} \right) Cov(R_k, \mathcal{R}_p^{i,j-}) \right)
\end{aligned}$$

This yields Equation (11).

A.3 Proof of Proposition 4.1

We follow similar steps as in A.2 to derive the default shares $\bar{w}_k^{i,j}$, taking into account the fact that the fund investments $a^{i,j}$ are not known:

$$\bar{w}^{i,j} = \frac{\bar{E}^i(R_k) - r}{\gamma \bar{V}_k^{i,j} \bar{E}^i(a^{i,j})} - \overline{Cov}_k^{i,j} \frac{\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right)}{\bar{E}^i(a^{i,j})} - \overline{\Delta Cov}_k^{i,j}$$

with $\bar{V}_k^{i,j} = \overline{Cov}(R_k, R_k - R_{p,k-}^{i,j})$, $\overline{Cov}_k^{i,j} = \overline{Cov}(R_k, \mathcal{R}_p^{i,j-})/\bar{V}_k^{i,j}$ and $\overline{\Delta Cov}_k^{i,j} = \left(\overline{Cov}(R_k, R_{p,k-}^{i,j}) - \overline{Cov}(R_k, \mathcal{R}_p^{i,j-})\right)/\bar{V}_k^{i,j}$. $\bar{V}(.)$ and $\overline{Cov}(.)$ are the variance and covariance conditional on the beginning-of-period information $\bar{\mathcal{I}}^i$. Under Assumption 4.1, these terms can be replaced by their end-of-period counterparts:

$$\bar{w}^{i,j} = \frac{\bar{E}^i(R_k) - r}{\gamma V_k^{i,j} \bar{E}^i(a^{i,j})} - Cov_k^{i,j} \frac{\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right)}{\bar{E}^i(a^{i,j})} - \Delta Cov_k^{i,j} \tag{41}$$

Using the definition of $a_k^{i,j}$, (12), the optimal updated and ex ante allocations, (11), and Equation (41), we obtain:

$$\begin{aligned}
a_k^{i,j} =& p \left(\frac{E^i(R_k) - r}{\gamma V_k^{i,j}} - Cov_k^{i,j} \left(\sum_{j=1}^{\mathcal{J}(i)} a^{i,j} \right) - \Delta Cov_k^{i,j} a^{i,j} \right) \\
&+ (1-p) \left(\frac{\bar{E}^i(R_k) - r}{\gamma V_k^{i,j} \bar{E}^i(a^{i,j})} - Cov_k^{i,j} \frac{\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right)}{\bar{E}^i(a^{i,j})} - \Delta Cov_k^{i,j} \right) a^{i,j} \\
=& p \left(\frac{E^i(R_k) - r}{\gamma V_k^{i,j}} - Cov_k^{i,j} \left(\sum_{j=1}^{\mathcal{J}(i)} a^{i,j} \right) \right) \\
&+ (1-p) \left(\frac{\bar{E}^i(R_k) - r}{\gamma V_k^{i,j} \bar{E}^i(a^{i,j})} - Cov_k^{i,j} \frac{\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right)}{\bar{E}^i(a^{i,j})} \right) a^{i,j} - \Delta Cov_k^{i,j} a^{i,j}
\end{aligned} \tag{42}$$

We take the beginning-of-period expectation, and subtract it:

$$
\begin{aligned}
a_k^{i,j} - \bar{E}^i(a_k^{i,j}) =& p\left(\frac{E^i(r_k)}{\gamma V_k^{i,j}} - Cov_k^{i,j}\left(\sum_{j=1}^{\mathcal{J}(i)} a^{i,j} - \sum_{j=1}^{\mathcal{J}(i)} E^i(a^{i,j})\right)\right) \\
&+ (1-p)\left(\frac{\bar{E}^i(R_k) - r}{\gamma V_k^{i,j}\bar{E}^i(a^{i,j})} - Cov_k^{i,j}\frac{\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right)}{\bar{E}^i(a^{i,j})}\right)\left(a^{i,j} - \bar{E}^i(a^{i,j})\right) \\
&- \Delta Cov_k^{i,j}\left(a^{i,j} - \bar{E}^i(a^{i,j})\right)
\end{aligned}
$$

Using (8) and (9), we obtain:

$$
\begin{aligned}
a_k^{i,j} - \bar{E}^i(a_k^{i,j}) =& p\left(\frac{E^i(r_k)}{\gamma V_k^{i,j}} - Cov_k^{i,j}\frac{E^i(\mathfrak{r}_p^i)}{\gamma V^i}\right) \\
&+ (1-p)\left(\frac{\bar{E}^i(R_k) - r}{\gamma V_k^{i,j}\bar{E}^i(a^{i,j})} - Cov_k^{i,j}\frac{\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right)}{\bar{E}^i(a^{i,j})}\right)\left(\frac{E^i(r_p^{i,j})}{\gamma V^{i,j}} - Cov^{i,j}\frac{E^i(\mathfrak{r}_p^i)}{\gamma V^i}\right) \\
&- \Delta Cov_k^{i,j}\left(\frac{E^i(r_p^{i,j})}{\gamma V^{i,j}} - Cov^{i,j}\frac{E^i(\mathfrak{r}_p^i)}{\gamma V^i}\right) \\
=& p\frac{E^i(r_k)}{\gamma V_k^{i,j}} + (1-p)\frac{\bar{a}_k^{i,j}}{\bar{E}^i(a^{i,j})}\frac{E^i(r_p^{i,j})}{\gamma V^{i,j}} - \Delta Cov_k^{i,j}\frac{E^i(r_p^{i,j})}{\gamma V^{i,j}} \\
&- \left(Cov_k^{i,j} - \Delta Cov_k^{i,j} Cov^{i,j}\right)\frac{E^i(\mathfrak{r}_p^i)}{\gamma V^i} - (1-p)\left(\frac{\bar{a}_k^{i,j}}{\bar{E}^i(a^{i,j})}Cov^{i,j} - Cov_k^{i,j}\right)\frac{E^i(\mathfrak{r}_p^i)}{\gamma V^i}
\end{aligned}
$$

with $\bar{a}_k^{i,j} = (\bar{E}^i(R_k) - r)/\gamma V_k^{i,j} - Cov_k^{i,j}\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right)$.

Finally, the beginning-of-period expectation of $a_k^{i,j}$ obtained from (42) is $\bar{E}^i(a_k^{i,j}) = (\bar{E}^i(R_k) - r)/\gamma V_k^{i,j} - Cov_k^{i,j}\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right) - \Delta Cov_k^{i,j}\bar{E}^i(a^{i,j})$. Then we take the beginning-of-period expectations of $a^{i,j}$ and $\sum_{j=1}^{\mathcal{J}(i)} a^{i,j}$ by using (9) and (8) and obtain $\bar{E}^i(a^{i,j}) = (\bar{E}^i(R_p^{i,j}) - r)/\gamma V^{i,j} - Cov^{i,j}\left(\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j})\right)$ and $\sum_{j=1}^{\mathcal{J}(i)} \bar{E}^i(a^{i,j}) = (\bar{E}^i(\mathcal{R}_p^i) - r)/\gamma V^i$. This yields Proposition 4.1.

A.4 Proof of Proposition 4.2

We first prove the following lemma:

Lemma A.1 (Aggregation) *We assume that Assumptions 4.2 and 4.3 are satisfied. In* *that case, Equation* (17) *can be written as:*

$$\frac{a_k - \bar{E}(a_k)}{\bar{E}(a_k)} = \underbrace{\beta_k \left(\sum_{i=1}^{M} \sigma_k^i (l_k^i - \Gamma^i) \right) + \delta_k \left(\sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} (\Gamma^{i,j} - \Gamma^i) \right) + (\Theta_k - \Theta) \left(\sum_{i=1}^{M} \sigma^i (W^i + \Gamma^i) \right)}_{\tilde{\Delta} a_k}$$

$$+ \underbrace{\Theta \left(\sum_{i=1}^{M} \sigma^i (W^i + \Gamma^i) \right)}_{\Delta a} \tag{43}$$

where $\Theta_k = \beta_k + \delta_k + \theta_k$ *is the sum of the country-, fund- and investor-level elasticities,* $\sigma^i = \bar{E}^i(a^i)\Omega^i / \bar{E}^i(a)\Omega = \bar{E}^i(A^i)/\bar{E}^i(A)$ *is the ex-ante share of investor* i *in total equity investments.*

Proof. Using Assumption 4.2, the surprise capital flows (14) admit the following decomposition:

$$\frac{a_k^{i,j} - \bar{E}^i(a_k^{i,j})}{\bar{E}^i(a_k^{i,j})} = \beta_k^{i,j} l_k^i + \delta_k^{i,j} \Gamma^{i,j} + \theta_k^{i,j} \Gamma^i + \Theta_k^{i,j} W^i$$

with $\Theta_k^{i,j} = \beta_k^{i,j} + \delta_k^{i,j} + \theta_k^{i,j}$.

We replace in Equation (17):

$$\begin{aligned}
\frac{a_k - \bar{E}(a_k)}{\bar{E}(a_k)} &= \sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \left(\beta_k^{i,j} l_k^i + \delta_k^{i,j} \Gamma^{i,j} + \theta_k^{i,j} \Gamma^i + \Theta_k^{i,j} W^i \right) \\
&= \sum_{i=1}^{M} \sigma_k^i \beta_k^i l_k^i + \sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \delta_k^{i,j} \Gamma^{i,j} + \sum_{i=1}^{M} \sigma_k^i \theta_k^i \Gamma^i + \sum_{i=1}^{M} \sigma_k^i \Theta_k^i W^i
\end{aligned}$$

Note that

$$\sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \delta_k^{i,j} \Gamma^{i,j} = \delta_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \Gamma^{i,j} + \underbrace{\sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} (\delta_k^{i,j} - \delta_k^i) \Gamma^{i,j}}_{\simeq 0}$$

where we used Assumption 4.3. Therefore:

$$\frac{a_k - \bar{E}(a_k)}{\bar{E}(a_k)} \simeq \sum_{i=1}^{M} \sigma_k^i \beta_k^i l_k^i + \sum_{i=1}^{M} \sigma_k^i \delta_k^i \left(\sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \Gamma^{i,j} \right) + \sum_{i=1}^{M} \sigma_k^i \theta_k^i \Gamma^i + \sum_{i=1}^{M} \sigma_k^i \Theta_k^i W^i$$

Take the first term:

$$\sum_{i=1}^{M} \sigma_k^i \beta_k^i l_k^i = \beta_k \sum_{i=1}^{M} \sigma_k^i l_k^i + \underbrace{\sum_{i=1}^{M} \sigma_k^i (\beta_k^i - \beta_k) l_k^i}_{\simeq 0}$$

where we used Assumption 4.3 again. We apply similar steps to the other terms, and we obtain, using Assumption 4.3:

$$\frac{a_k - \bar{E}(a_k)}{\bar{E}(a_k)} \simeq \beta_k \left(\sum_{i=1}^{M} \sigma_k^i l_k^i \right) + \delta_k \left(\sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \Gamma^{i,j} \right) + \theta_k \left(\sum_{i=1}^{M} \sigma_k^i \Gamma^i \right) + \Theta_k \left(\sum_{i=1}^{M} \sigma_k^i W^i \right) \tag{44}$$

We aggregate the country flows using Equation (44):

$$\begin{aligned}
&\frac{a - \bar{E}(a)}{\bar{E}(a)} \\
&\simeq \sum_{k=1}^{K} \sigma_k \left(\beta_k \left(\sum_{i=1}^{M} \sigma_k^i l_k^i \right) + \delta_k \left(\sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \Gamma^{i,j} \right) + \theta_k \left(\sum_{i=1}^{M} \sigma_k^i \Gamma^i \right) + \Theta_k \left(\sum_{i=1}^{M} \sigma_k^i W^i \right) \right) \\
&\simeq \sum_{k=1}^{K} \sigma_k \beta_k \left(\sum_{i=1}^{M} \sigma_k^i l_k^i \right) + \sum_{k=1}^{K} \sigma_k \delta_k \left(\sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \Gamma^{i,j} \right) + \sum_{k=1}^{K} \sigma_k \theta_k \left(\sum_{i=1}^{M} \sigma_k^i \Gamma^i \right) + \sum_{k=1}^{K} \sigma_k \theta_k \Theta_k \left(\sum_{i=1}^{M} \sigma_k^i W^i \right)
\end{aligned}$$

Take the first term:

$$\begin{aligned}
\sum_{k=1}^{K} \sigma_k \beta_k \left(\sum_{i=1}^{M} \sigma_k^i l_k^i \right) &= \beta \sum_{k=1}^{K} \sigma_k \left(\sum_{i=1}^{M} \sigma_k^i l_k^i \right) + \sum_{k=1}^{K} \sigma_k (\beta_k - \beta) \left(\sum_{i=1}^{M} \sigma_k^i l_k^i \right) \\
&= \beta \sum_{i=1}^{M} \sum_{k=1}^{K} \sigma_k \sigma_k^i l_k^i + \underbrace{\sum_{k=1}^{K} \sigma_k (\beta_k - \beta) l_k}_{\simeq 0} \\
&\simeq \beta \sum_{i=1}^{M} \sigma^i \sum_{k=1}^{K} w_k^i l_k^i = \beta \sum_{i=1}^{M} \sigma^i \Gamma^i
\end{aligned}$$

Take the second term:

$$
\begin{aligned}
\sum_{k=1}^{K} \sigma_k \delta_k \left(\sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \Gamma^{i,j} \right) &= \delta \sum_{k=1}^{K} \sigma_k \left(\sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \Gamma^{i,j} \right) + \sum_{k=1}^{K} \sigma_k (\delta_k - \delta) \left(\sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} \Gamma^{i,j} \right) \\
&= \delta \sum_{k=1}^{K} \sum_{i=1}^{M} \sum_{j=1}^{\mathcal{J}(i)} \sigma_k \sigma_k^i \sigma_k^{i,j} \Gamma^{i,j} + \underbrace{\sum_{k=1}^{K} \sigma_k (\delta_k - \delta) \Gamma_k}_{\simeq 0} \\
&\simeq \delta \sum_{i=1}^{M} \sum_{j=1}^{\mathcal{J}(i)} \sigma^i \sigma^{i,j} \Gamma^{i,j} \underbrace{\sum_{k \in \mathcal{S}(i,j)} w_k^{i,j}}_{=1} \\
&\simeq \delta \sum_{i=1}^{M} \sigma^i \sum_{j=1}^{\mathcal{J}(i)} \sigma^{i,j} \sum_{k \in \mathcal{S}(i,j)} w_k^{i,j} l_k^i \\
&\simeq \delta \sum_{i=1}^{M} \sigma^i \sum_{j=1}^{\mathcal{J}(i)} \sum_{k \in \mathcal{S}(i,j)} \sigma^{i,j} w_k^{i,j} l_k^i \\
&\simeq \delta \sum_{i=1}^{M} \sigma^i \sum_{k=1}^{K} l_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma^{i,j} w_k^{i,j} \\
&\simeq \delta \sum_{i=1}^{M} \sigma^i \sum_{k=1}^{K} w_k^i l_k^i \\
&\simeq \delta \sum_{i=1}^{M} \sigma^i \Gamma^i
\end{aligned}
$$

Take the third term:

$$
\begin{aligned}
\sum_{k=1}^{K} \sigma_k \theta_k \left(\sum_{i=1}^{M} \sigma_k^i \Gamma^i \right) &= \theta \sum_{k=1}^{K} \sigma_k \left(\sum_{i=1}^{M} \sigma_k^i \Gamma^i \right) + \sum_{k=1}^{K} \sigma_k (\theta_k - \theta) \left(\sum_{i=1}^{M} \sigma_k^i \Gamma^i \right) \\
&= \theta \sum_{k=1}^{K} \sum_{i=1}^{M} \sigma_k \sigma_k^i \Gamma^i + \underbrace{\sum_{k=1}^{K} \sigma_k (\theta_k - \theta) \Gamma_k}_{\simeq 0} \\
&\simeq \theta \sum_{i=1}^{M} \Gamma^i \sum_{k=1}^{K} \sigma_k \sigma_k^i \\
&\simeq \theta \sum_{i=1}^{M} \sigma^i \Gamma^i
\end{aligned}
$$

We follow similar steps for the fourth term and find

$$\sum_{k=1}^{K} \sigma_k \Theta_k \left(\sum_{i=1}^{M} \sigma_k^i W^i \right) \simeq \Theta \sum_{i=1}^{M} \sigma^i W^i$$

Noting that $\Theta = \beta + \delta + \theta$, aggregate capital flows can be written as

$$\frac{a - \bar{E}(a)}{\bar{E}(a)} \simeq \Theta \sum_{i=1}^{M} \sigma^i (W^i + \Gamma^i) \tag{45}$$

Combining (44) and (45) yields the decomposition (43).

■

We now prove the following lemma:

Lemma A.2 (Elasticity homogeneity) *Under Assumption 4.4,* $\beta_k \simeq \beta$*,* $\eta_k \simeq \eta$*,* $(\phi \Delta Cov)_k \simeq (\phi \Delta Cov)$*,* $\delta_k \simeq \delta$ *and* $\Theta_k \simeq \Theta$*. Additionally,* $\beta \propto p$ *and* $\delta = \eta - (\phi \Delta Cov)$ *with* $\eta \propto 1 - p$*.*

Proof. Consider Assumption 4.4. Denote

$$\Delta^i \simeq \bar{E}^i(R_k) \simeq \bar{E}^i(R_p^{i,j}) \simeq \bar{E}^i(\mathcal{R}_p^i)$$

$$\rho^{i,j} \simeq Cov(R_k, \mathcal{R}_p^{i,j-}) \simeq Cov(R_p^{i,j}, \mathcal{R}_p^{i,j-})$$

Then, notice that

$$V_k^{i,j} \bar{a}_k^{i,j} \simeq V^{i,j} \bar{E}^i(a^{i,j}) \simeq \frac{\Delta^i}{\gamma} \left(1 - \frac{\rho^{i,j}}{V^i} \right) \tag{46}$$

Similarly,

$$V_k^{i,j} Cov_k^{i,j} \simeq V^{i,j} Cov^{i,j} \simeq \rho^{i,j} \tag{47}$$

Note that Assumption 4.4 implies $V_k^{i,j} \Delta Cov_k^{i,j} = V_{k'}^{i,j} \Delta Cov_{k'}^{i,j}$ for all $k' \neq k$. Let's denote

$$V_k^{i,j} \Delta Cov_k^{i,j} = \Delta \rho^{i,j} \tag{48}$$

Now, we can rewrite the coefficients as follows, using Corollary 4.1:

$$
\begin{aligned}
\beta_k^{i,j} =& \frac{p}{\gamma V_k^{i,j} \bar{E}^i(a_k^{i,j})} \simeq \frac{p}{\Delta^i \left(1 - \frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j} \bar{E}^i(a^{i,j})} = \beta^{i,j} \\
\eta_k^{i,j} =& (1-p) \frac{\bar{a}_k^{i,j}}{\gamma V^{i,j} \bar{E}^i(a^{i,j}) \bar{E}^i(a_k^{i,j})} = (1-p) \frac{V_k^{i,j} \bar{a}_k^{i,j}}{\gamma V^{i,j} \bar{E}^i(a^{i,j}) V_k^{i,j} \bar{E}^i(a_k^{i,j})} \\
\simeq& \frac{1-p}{\gamma V_k^{i,j} \bar{E}^i(a_k^{i,j})} \simeq \frac{1-p}{\Delta^i \left(1 - \frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j} \bar{E}^i(a^{i,j})} = \eta^{i,j} \\
\phi_k^{i,j} \Delta Cov_k^{i,j} =& \frac{\Delta Cov_k^{i,j}}{\gamma V^{i,j} \bar{E}^i(a_k^{i,j})} = \frac{V_k^{i,j} \Delta Cov_k^{i,j}}{\gamma V^{i,j} V_k^{i,j} \bar{E}^i(a_k^{i,j})} = \frac{\Delta\rho^{i,j}}{V^{i,j} \left(\Delta^i \left(1 - \frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j} \bar{E}^i(a^{i,j})\right)} \\
=& (\phi \Delta Cov)^{i,j} \\
\delta_k^{i,j} =& \eta_k^{i,j} - \phi_k^{i,j} \Delta Cov_k^{i,j} \simeq \eta^{i,j} - (\phi \Delta Cov)^{i,j} = \delta^{i,j} \\
\theta_k^{i,j} =& - \frac{\widetilde{Cov}_k^{i,j}}{\gamma V^i \bar{E}^i(a_k^{i,j})} - (1-p) \frac{Cov^{i,j} \bar{a}_k^{i,j} / \bar{E}^i(a^{i,j}) - Cov_k^{i,j}}{\gamma V^i \bar{E}^i(a_k^{i,j})} \simeq - \frac{\widetilde{Cov}_k^{i,j}}{\gamma V^i \bar{E}^i(a_k^{i,j})} \\
\simeq& - \frac{Cov_k^{i,j} - Cov^{i,j} \Delta Cov_k^{i,j}}{\gamma V^i \bar{E}^i(a_k^{i,j})} \simeq - \frac{V_k^{i,j} Cov_k^{i,j} - Cov^{i,j} V_k^{i,j} \Delta Cov_k^{i,j}}{\gamma V^i V_k^{i,j} \bar{E}^i(a_k^{i,j})} \\
\simeq& - \frac{\rho^{i,j} - Cov^{i,j} \Delta\rho^{i,j}}{V^i \left(\Delta^i \left(1 - \frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j} \bar{E}^i(a^{i,j})\right)} = \theta^{i,j}
\end{aligned} \tag{49}
$$

which also implies that $\Theta_k^{i,j} = \beta_k^{i,j} + \delta_k^{i,j} + \theta_k^{i,j} \simeq \beta^{i,j} + \delta^{i,j} + \theta^{i,j} \simeq \Theta^{i,j}$. Within a fund, all the coefficients are homogeneous across countries.

We now aggregate the country-specific coefficients across funds. For country $k = 1, .., K$, and for $x = \{\beta, \delta, \eta, \phi\Delta Cov, \Theta\}$, we have

$$
x_k = \sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} x_k^{i,j} \simeq \sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} x^{i,j} \simeq x + \sum_{i=1}^{M} \sigma_k^i \sum_{j=1}^{\mathcal{J}(i)} \sigma_k^{i,j} (x^{i,j} - x)
$$

where

$$
x = \sum_{k=1}^{K} \sigma_k x_k
$$

Consider the second term:

$$\begin{aligned}
\sum_{i=1}^{M}\sigma_k^i\sum_{j=1}^{\mathcal{J}(i)}\sigma_k^{i,j}(x^{i,j}-x) &= \sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\sigma_k^i\sigma_k^{i,j}x^{i,j} - \sum_{k'=1}^{K}\sigma_{k'}\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\sigma_{k'}^i\sigma_{k'}^{i,j}x^{i,j} \\
&= \sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\underbrace{\sigma_k^i\sigma_k^{i,j}}_{\frac{\bar{E}^i(a_k^{i,j})\Omega^i}{\bar{E}^i(a_k)\Omega}}x^{i,j} - \sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}x^{i,j}\underbrace{\sum_{k'=1}^{K}\underbrace{\sigma_{k'}\sigma_{k'}^i\sigma_{k'}^{i,j}}_{\frac{\bar{E}^i(a_k^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}}}_{\frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}} \\
&= \sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\left(\frac{\bar{E}^i(a_k^{i,j})\Omega^i}{\bar{E}^i(a_k)\Omega} - \frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}\right)x^{i,j} \\
&= \sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\left(\frac{\bar{E}^i(A_k^{i,j})}{\bar{E}^i(A_k)} - \frac{\bar{E}^i(A^{i,j})}{\bar{E}^i(A)}\right)x^{i,j} \\
&\simeq 0
\end{aligned}$$

where we used Assumption 4.4. Therefore, $x_k \simeq x$, for $x = \{\beta, \delta, \eta, \phi\Delta Cov, \Theta\}$. This proves coefficient homogeneity.

Now, note that, for $x = \{\beta, \delta, \eta, \phi\Delta Cov, \Theta\}$:

$$\begin{aligned}
x &= \sum_{k=1}^{K}\sigma_k x_k = \sum_{k=1}^{K}\sigma_k\sum_{i=1}^{M}\sigma_k^i\sum_{j=1}^{\mathcal{J}(i)}\sigma_k^{i,j}x^{i,j} = \sum_{k=1}^{K}\sigma_k\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\frac{\bar{E}^i(a_k^{i,j})\Omega^i}{\bar{E}^i(a_k)\Omega}x^{i,j} \\
&= \sum_{k=1}^{K}\sigma_k\left(\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}x^{i,j} + \underbrace{\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\left(\frac{\bar{E}^i(a_k^{i,j})\Omega^i}{\bar{E}^i(a_k)\Omega} - \frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}\right)x^{i,j}}_{\simeq 0}\right) \\
&= \sum_{k=1}^{K}\sigma_k\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}x^{i,j} = \underbrace{\left(\sum_{k=1}^{K}\sigma_k\right)}_{=1}\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}x^{i,j} = \sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}x^{i,j}
\end{aligned} \tag{50}$$

Using the expression for $\beta^{i,j}$ and $\eta^{i,j}$ in (49), we obtain:

$$\begin{aligned}\beta &= \sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)} \frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega} \frac{p}{\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j}\bar{E}^i(a^{i,j})} \\ &= p\left(\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)} \frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega} \frac{1}{\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j}\bar{E}^i(a^{i,j})}\right) \propto p \end{aligned} \tag{51}$$

$$\begin{aligned}\eta &= \sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)} \frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega} \frac{1-p}{\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j}\bar{E}^i(a^{i,j})} \\ &= (1-p)\left(\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)} \frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega} \frac{1}{\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j}\bar{E}^i(a^{i,j})}\right) \propto 1-p \end{aligned} \tag{52}$$

Moreover, since $\delta_k^{i,j} = \eta_k^{i,j} - \phi_k^{i,j}\Delta Cov_k^{i,j} = \eta_k^{i,j} - (\phi\Delta Cov_k)^{i,j}$, then $\delta = \eta - (\phi\Delta Cov)$.

■

Combining Lemma A.1 and A.2, we obtain decomposition (24) of Proposition 4.2.

A.5 Proof of Corollary 4.2

Point (i) derive directly from proposition 4.2, which states that $\beta \propto p$ and $\delta = \eta + (\phi\Delta Cov)$ with $\eta \propto 1-p$.

Point (ii) can be derived as follows. Note that $\Theta = \beta + \delta + \theta = \beta + \eta + (\phi\Delta Cov) + \theta$. Consider $\beta + \eta$, $(\phi\Delta Cov)$ and θ separately. First, using (51) and (52), we obtain:

$$\beta + \eta = \underbrace{(p + 1 - p)}_{=1} \underbrace{\left(\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)} \frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega} \frac{1}{\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j}\bar{E}^i(a^{i,j})}\right)}_{\text{Independent from } p}$$

Second, using expression (50) with $x = \{\phi\Delta Cov, \theta\}$, along with the expressions for $(\phi\Delta Cov)^{i,j}$ and $\theta^{i,j}$ in (49)), we obtain:

$$(\phi\Delta Cov) = \underbrace{\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)} \frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega} \frac{\Delta\rho^{i,j}}{V^{i,j}\left(\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j}\bar{E}^i(a^{i,j})\right)}}_{\text{Independent from } p}$$

$$\theta = \underbrace{\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega} - \frac{\rho^{i,j} - Cov^{i,j}\Delta\rho^{i,j}}{V^i\left(\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right) - \Delta\rho^{i,j}\bar{E}^i(a^{i,j})\right)}}_{\text{Independent from } p}$$

Therefore, Θ is independent from p.

To show point (iii), we take the ratio of β to η using (51) and (52):

$$\frac{\beta}{\eta} = \frac{p}{1-p}\underbrace{\frac{\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}\frac{1}{\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right)-\Delta\rho^{i,j}\bar{E}^i(a^{i,j})}}{\sum_{i=1}^{M}\sum_{j=1}^{\mathcal{J}(i)}\frac{\bar{E}^i(a^{i,j})\Omega^i}{\bar{E}^i(a)\Omega}\frac{1}{\Delta^i\left(1-\frac{\rho^{i,j}}{V^i}\right)-\Delta\rho^{i,j}\bar{E}^i(a^{i,j})}}}_{=1}$$

B Data Appendix

B.1 Estimation of $\Delta Cov_k^{i,j}$

According to Lemma 4.2, $\Delta Cov_k^{i,j}$ is the difference between the scaled covariance of the country return k with the fund-level return excluding country k $Cov(R_k, R_{p,k^-}^{i,j})/V_k^{i,j}$ and the scaled covariance of the country return k with the investor-level return excluding fund j and $Cov(R_k, \mathcal{R}_{p,j^-}^{i,j})/V_k^{i,j}$, where $V_k^{i,j} = Cov(R_k, R_k - R_{p,k-}^{i,j})$. We proxy for these scaled covariances by using the country equity MSCI return data.

Define the aggregate fund-level return, the aggregate fund-level return excluding country k and the aggregate investor-level return excluding fund j respectively as follows:

$$\begin{aligned}
R_{p,k-,t}^{i,j} &= \sum_{l\neq k, l\in\mathcal{S}(i,j)}\frac{w_{l,t}^{i,j}}{\sum_{l\neq k,l\in\mathcal{S}(i,j)} w_{l,t}^{i,j}}R_{l,t},\\
R_{p,t}^{i,j} &= \sum_{l\in\mathcal{S}(i,j)}\frac{w_{l,t}^{i,j}}{\sum_{l\in\mathcal{S}(i,j)} w_{l,t}^{i,j}}R_{l,t},\\
\mathcal{R}_{p,j-,t}^{i} &= \sum_{l\neq j,l=1}^{J(i)}\frac{A_t^{i,l}}{\sum_{l\neq j,l\in J(i)} A_t^{i,l}}R_{p,t}^{i,j},
\end{aligned} \tag{53}$$

where $w_{l,t}^{i,j}$ is mutual fund j's allocation to country l, $A_t^{i,l}$ is fund l total assets under management and $R_{l,t}$ is country l's equity MSCI return in month t. We then compute the covariances by country and fund pair, and compute $\Delta Cov_k^{i,j}$ as the differential

$$\Delta Cov_k^{i,j} = \frac{Cov(R_k, R_{p,k-}^{i,j})}{Cov(R_k, R_k - R_{p,k-}^{i,j})} - \frac{Cov(R_k, \mathcal{R}_{p,j-}^{i,j})}{Cov(R_k, R_k - R_{p,k-}^{i,j})}$$

and estimate $\Delta Cov^{i,j}$ as the weighted average at the fund-level:

$$\Delta Cov_t^{i,j} = \sum_{l \in K(i,j)} w_{l,t}^{i,j} \Delta Cov_k^{i,j}$$

where $w_{l,t}^{i,j}$ is the share of country l in the portfolio of fund j. In order to have a consistent estimation $\Delta Cov_t^{i,j}$, we exclude measures below the 5^{th} and above the 95^{th} percentiles. The sample size is only slightly reduced as compared to Table 2.

B.2 Summary Statistics for $\Delta Cov^{i,j}$

Table B.1: Summary Statistics for $\Delta Cov^{i,j}$

Variable	Mean	Median	S.D.	Min	Max
$\Delta Cov^{i,j}$	.07	.05	.17	-.31	.61

B.3 Imputation of Expectations

We assume that expectations are the sum of a year-specific term and a month-specific term that are independent from each other:

$$E_t^i(g_k^{\text{next year}}) = E_{year}^i(g_k^{\text{next year}}) + u_{year,month,k}^i \tag{54}$$

where $t = 12 \times year + month$. We make the identifying assumption that $E(u_{year,month,k}^i) = 0$, so that $E_{year}^i(g_k^{\text{next year}})$ can be estimated as $E_{year}^i(g_k^{\text{next year}}) = \frac{1}{12}\sum_{month=1}^{12} E_{year\times 12+month}^i(g_k^{\text{next year}})$, and $u_{year,month,k}^i = E_t^i(g_k^{\text{next year}}) - \frac{1}{12}\sum_{month=1}^{12} E_{year\times 12+month}^i(g_k^{\text{next year}})$.

The year-specific component $E_{year}^i(g_k^{j,\text{next year}})$ has three independent components: a country-time component, a country-investor component, and a year-country-investor-specific residual:

$$E_{year}^i(g_k^{\text{next year}}) = X_{k,year} + \zeta_k^i + v_{k,year}^i \tag{55}$$

Here as well, we make identifying assumption that $E(v_{k,year}^i) = 0$. We allow $v_{k,year}^i$ to be autocorrelated:

$$v_{k,year}^i = \rho^v v_{k,year-1}^i + \tilde{v}_{k,year}^i \tag{56}$$

with $v^i_{k,year} \sim N(0, \sigma^v_k)$. The autocorrelation parameter ρ^v is common across countries, but the variance of the innovation σ^v_k is country-specific.

We estimate Equation (55) using a fixed-effect regression. $X_{k,year}$ and ζ^i_k are estimated as the country-time and country-investor fixed effects. $v^i_{k,year}$ is estimated as the residual of the regression. We then fit the autoregressive process (56) on that residual to estimate ρ^v. The country-specific standard deviation σ^v_k is estimated as the standard deviation of the residuals of the autoregressive equation.

The month-specific component $u^i_{year,month,k}$ has two independent components: a country-time component and a residual specific to the investor:

$$u^i_{year,month,k} = Y_{year,month,k} + e^i_{year,month,k} \tag{57}$$

where we assume that both components are zero in expectations: $E(Y_{year,month,k}) = 0$ and $E(e^i_{year,month,k}) = 0$. We allow $e^i_{year,month,k}$ to be autocorrelated:

$$e^i_{year,month,k} = \rho^e e^i_{year,month-1,k} + \tilde{e}^i_{year,month,k} \tag{58}$$

with $e^i_{year,month,k} \sim N(0, \sigma^e_k)$. The autocorrelation parameter ρ^e is common across countries, but the variance of the innovation σ^e_k is country-specific.

We estimate Equation (57) using a fixed-effect regression. $Y_{k,year,month}$ are estimated as the country-time fixed effects. $e^i_{k,year,month}$ is estimated as the residual of the regression. We then fit the autoregressive process (58) on that residual to estimate ρ^e. The country-specific standard deviation σ^e_k is estimated as the standard deviation of the residuals of the autoregressive equation.

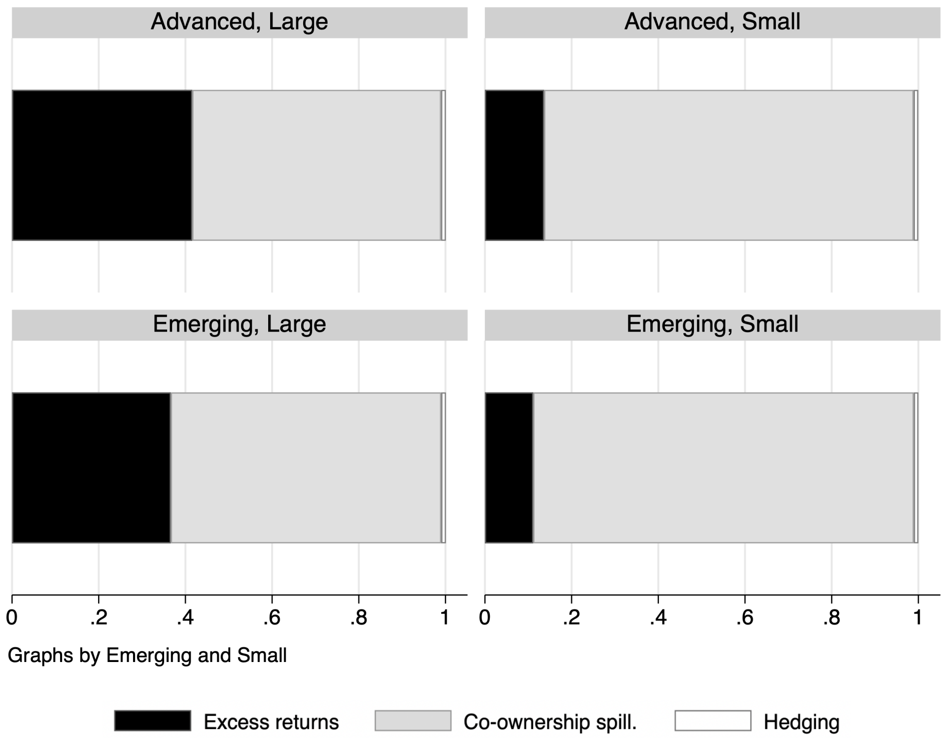
These estimations are performed on the subset of investors and countries for which we have expectation data. We then impute expectations for all the investors in our dataset as follows:

$$\widehat{E}^i_t(g_k^{\text{next year}}) = \widehat{X}_{k,year} + \widehat{v}^i_{k,year} + \widehat{Y}_{year,month,k} + \widehat{e}^i_{year,month,k} \tag{59}$$

where $\widehat{X}_{k,year}$ and $\widehat{Y}_{year,month,k}$ are the estimated fixed effects and $\widehat{v}^i_{k,year}$ and $\widehat{e}^i_{year,month,k}$ are either the residuals of Equations (55) and (57), if investor i has expectation data for country k, or they are simulated using the data-generating processes (56) and (58), using our estimates of ρ^v, ρ^e, σ^v_k and σ^e_k.

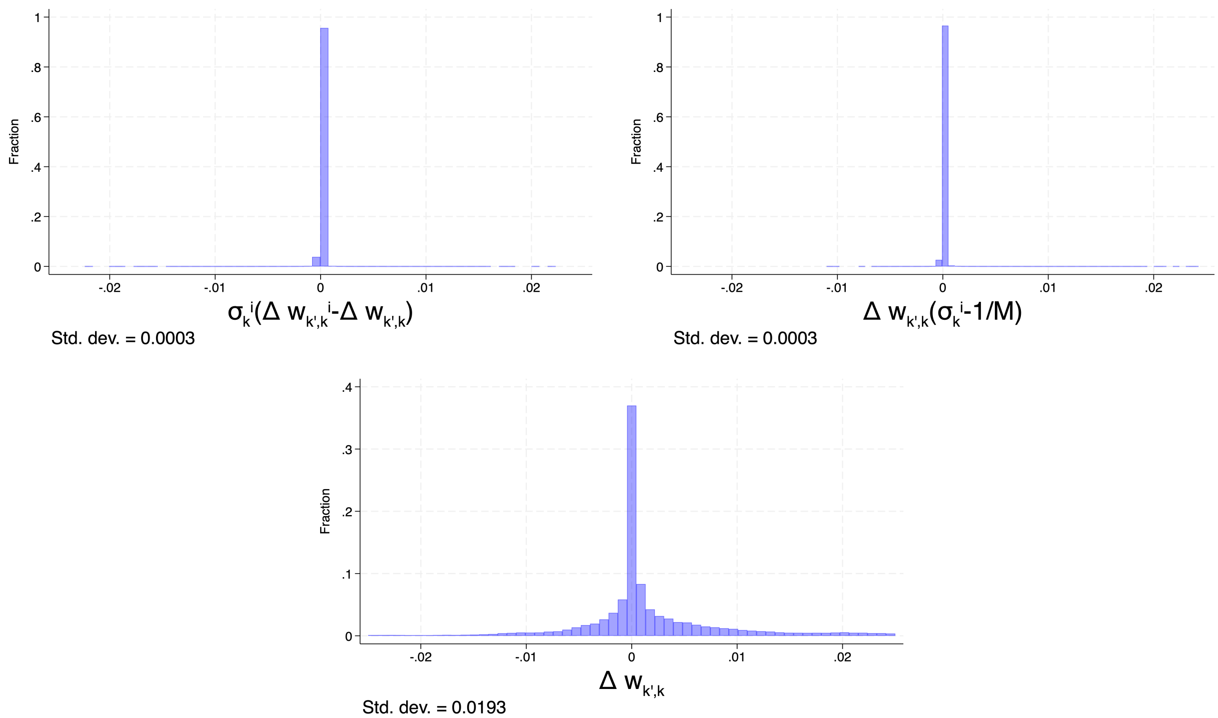
C Additional Figures

Figure C.1: Variance decomposition of expectation-driven capital flows - Consensus expectations



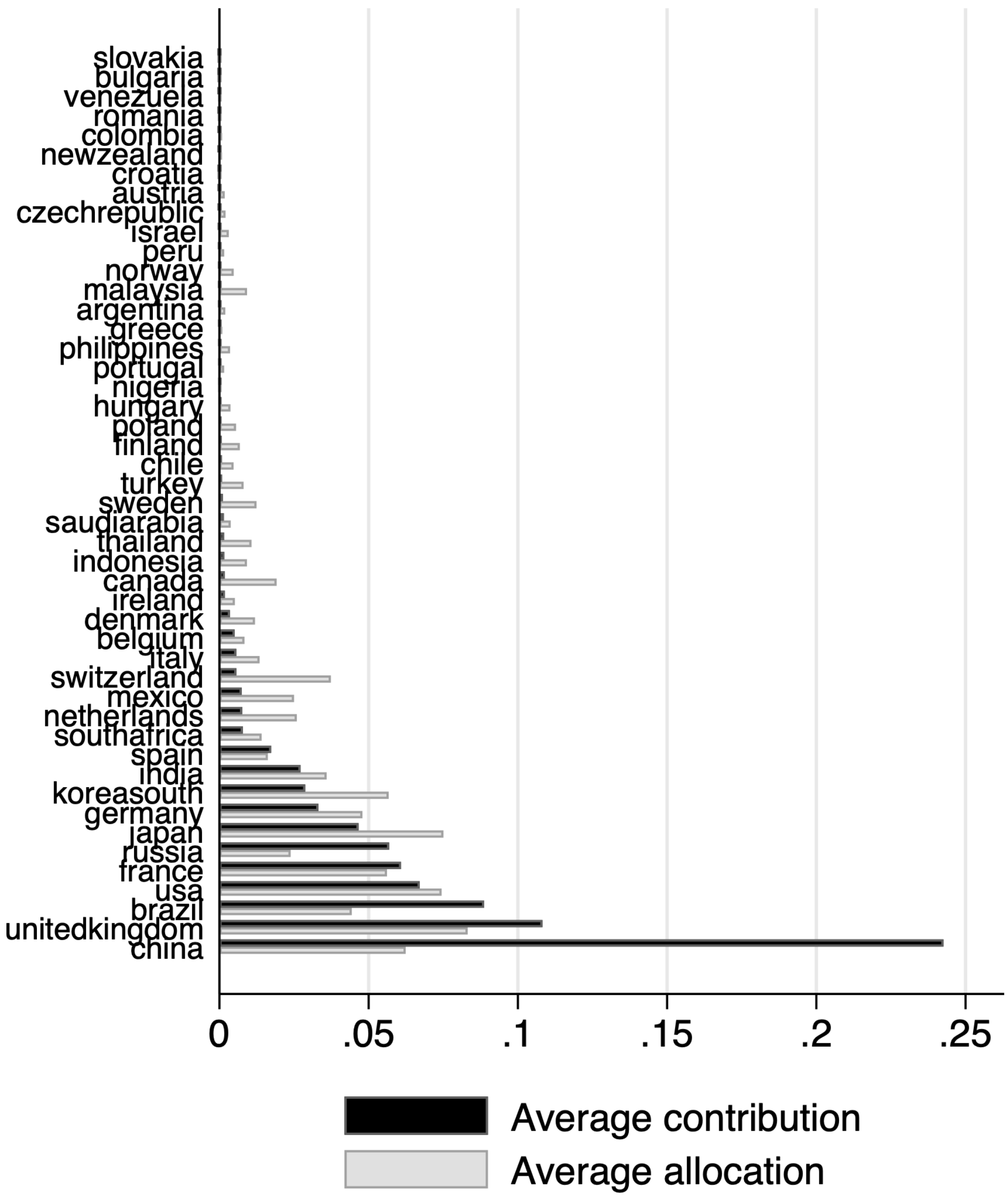
Note: The figure represents the contribution of the variance of $\beta\tilde{l}_{k,t} + \eta\Gamma_{k,k,t}$, $\eta\Gamma_{k,t} - \eta\Gamma_{k,k,t}$ and $-\phi\Delta Cov_{k,t}$ to the variance of implied capital flow reallocation, when we use consensus expectations.

Figure C.2: Distribution of weights



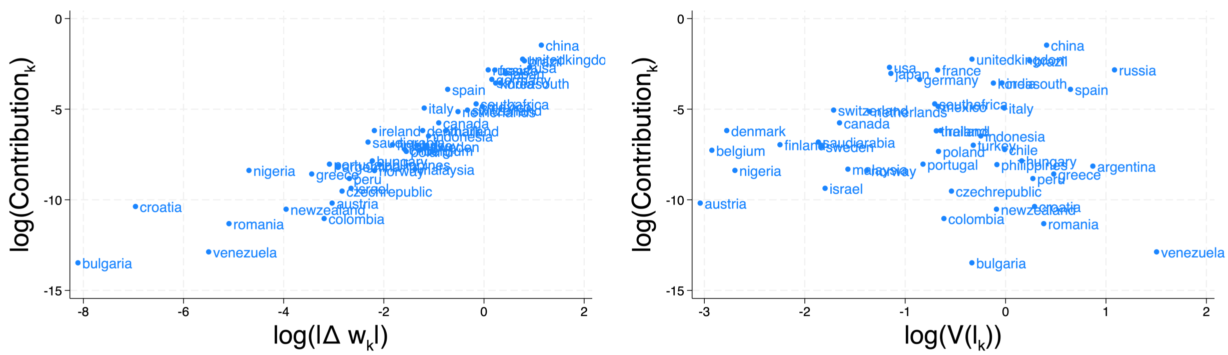
Note: The left panel represents the distribution and standard deviation of $\sigma^i_{k,t}(\Delta w^i_{k,k',t} - \Delta w_{k,k',t})$ across country pairs and investors. The right panel represents the distribution and standard deviation of $\Delta w_{k,k',t}(\sigma^i_{k,t} - 1/M)$ across country pairs and investors. The bottom panel represents the distribution and standard deviation of $\Delta w_{k,k',t}$ across country pairs.

Figure C.3: Contributors to co-ownership spillovers



Note: The figure represents the scatter plot of the average weights $w_k = \sum_{i=1}^{M} \sigma_k^i w_k^i$ against the average contributions $Contribution_k = \sum_{k'=1}^{K} \sigma_{k'} Contribution_{k',k}$.

Figure C.4: Role of weights and idiosyncratic volatility



Note: The left panel represents the scatter plot of the log of the average absolute value of co-ownership linkages $|\Delta w_k| = \sum_{k'=1}^{K} \sigma_{k'} |\Delta w_{k',k}|$ against the log of average contributions $Contribution_k = \sum_{k'=1}^{K} \sigma_{k'} Contribution_{k',k}$. The right panel represents the scatter plot of the log of the variance of country-speicifc expectations $V(l_k)$ against the log of average contributions $Contribution_k = \sum_{k'=1}^{K} \sigma_{k'} Contribution_{k',k}$.