Granular Expectations and International Financial Spillovers

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Abstract

Using a unique dataset linking investors' cross-country GDP growth expectations to their investments into mutual funds and to the mutual funds' cross-country allocation, we show that, while the flows into the funds are sensitive to the investors' fund-specific aggregate expectations (computed using the fund's portfolio shares), the funds' allocation reacts less to the country-level expectations. This gives rise to "co-ownership spillovers", whereby negative expectations about a country in which a fund invests can adversely affect capital flows to the other countries that are part of the fund's portfolio. Using a portfolio choice model with delegated investment, we show that these results arise naturally from a sticky portfolio friction. These spillovers matter in the aggregate only if the portfolio shares are granular. Finally, using our data-based estimates and our model, we quantify the aggregate implications of these spillovers and find that co-ownership spillovers account for one fifth of the expectation-driven capital flows while country-specific expectations account for a negligible share. Small countries are subject to larger co-ownership spillovers, which account for one fourth of their expectation-driven capital flows, while large countries are the biggest contributors to these spillovers.

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1 Introduction

Why do asset prices and business cycles comove in emerging economies? This comovement has been attributed to correlated fundamentals, global financial cycles, and real and financial contagion.[1] This study specifically examines the latter, and focuses on the role of equity investments by mutual funds, which manage a significant portion of capital flows schmidtyesin2022. Understanding how these intermediaries allocate their capital across countries, and whether this allocation is efficient, is critical.

More specifically, this paper studies whether changes in investments into mutual funds driven by investors' expectations generates comovements in capital flows across countries through "co-ownership spillovers".[2] Co-ownership spillovers can arise through the following mechanism. An investor can choose how much to invest in a variety of global, emerging, or regional mutual funds, which invest equity in different sets of countries, and they can also choose to invest in safer assets (cash or bonds). The investor controls how much capital is sent to the mutual funds, but not how the capital is allocated between the countries that are part of a fund's portfolio. Now suppose that the investor expects that one country's asset market is going to perform poorly. She will then take away capital from the funds that invest in that country. If the funds continuously update their portfolio shares, then the funds' capital will be reallocated to the other countries in the portfolio, and these countries will not be negatively affected. But if portfolio shares are sticky, the other countries will also undergo some capital retrenchment.

Using a unique dataset linking investors' cross-country GDP growth expectations to their investments into mutual funds and to the mutual funds' cross-country allocation, we show that while the flows into the funds are highly sensitive to the investors' fund-specific aggregate expectations (computed using the fund's portfolio shares), the funds' allocation reacts much less to the investor's country-level expectations. Using a simple delegated investment model, we show that this creates co-ownership spillovers, whereby negative expectations about one country that is part of a fund's portfolio can negatively impact investment in the countries that are part of the same portfolio through the mechanism described above.

But are these spillovers relevant at the aggregate level? That is, do they lead to a significant level of cross-country contagion? Our model shows that they do not necessarily do so. For instance, if the country-specific shocks to expectations (shocks that are uncorrelated across countries) average out in the aggregate, then these spillovers will be driven only by global shocks (shocks that are correlated across countries). In that case, the co-ownership

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

[2]We borrow this expression from Jotikasthira et al. (2012).

spillovers are not inefficient, as they are driven by global shocks that are relevant for all countries. However, if some countries compose a disproportionate share of fund portfolios, then expectations shocks specific to these countries spill-over to the other countries because they affect capital flows into the funds in a non-negligible way. The "granularity" of fund shares will thus matter (Gabaix, 2011).

We show formally that co-ownership spillovers relate to the granular residual of the investors' fund-specific aggregate expectations and to a key elasticity parameter that we estimate using our data. We then quantify the contribution of the co-ownership spillovers to the aggregate capital flows, using the estimated key elasticity and the effective country shares and expectations from the data. The co-ownership spillovers account for one fifth of the variance of expectation-driven capital flows in our sample. Interestingly, both small advanced countries and small emerging countries are typical recipients of these spillovers, which account for one fifth of that variance. Both large advanced and emerging countries, like the G7 and BRICS, are typical contributors. This channel of international financial contagion is different from the typical "funding" channels that have been documented so far, as it does not necessarily give rise to North-South transmission, but rather to a Large-Small one. As a result, some large emerging economies are important contributors and do not suffer from major spillovers, like China and South Korea.

We contribute to several strands of literature. First, we contribute to the large literature that examines how shocks, local or global, are transmitted by mutual funds. 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. 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 co-movement among emerging markets. In general, it has been established, using micro-evidence from mutual funds, that shocks to the investor base are an important driver of the comovement in emerging markets (Broner et al., 2006; Gelos, 2011; Raddatz and Schmukler, 2012; Puy, 2016). There is however scarce evidence on co-ownership spillovers and on their ability to generate contagion and undesired fluctuations in capital flows and asset prices. An exception is Jotikasthira et al. (2012), who identify co-ownership spillovers by calibrating their model to the data. We instead provide direct evidence for this phenomenon by using investor-level expectations to identify these spillovers. Our identification not only relies on the actual expectations to identifies this channel of contagion, but we also make use of the granular residual to disentangle contagion from global or regional shocks.

Second, we contribute to a growing literature estimating the elasticity of investments to real-life expectations using survey data. Vissing-Jorgensen (2003), Glaser and Weber (2005), Kézdi and Willis (2011) and Weber et al. (2012) focus on households' expectations and their stock holding behavior. Piazzesi and Schneider (2009) examine the role of expectations on the housing market and Malmendier and Nagel (2015) and Agarwal et al. (2022) investigate how inflation expectations affect households' portfolio choices. Giglio et al. (2021) use a survey administered to a large panel of wealthy retail investors to study the relation between the investors' beliefs and their trading activity, while Dahlquist and Ibert (2021) focus on large institutional investors. Finally, De Marco et al. (2021) study European banks' investments in sovereign bonds across the Euro area. To the best of our knowledge, we are the first to estimate how investors' beliefs affect the cross-country allocation of equity investments. Two results are worth emphasizing. The first one is that the investors' beliefs about GDP growth matter significantly for the allocation of resources across funds. Because funds specialize in different country groups and regions, this implies that GDP growth expectations matter for the allocation of resources across countries. However, funds themselves do not react significantly to the investors' expectations when allocating resources across countries within the fund. This finding is in line with the literature, which finds that expectations matter for portfolio decisions, but the elasticity is low compared to what models predict.

Finally, we contribute the literature that examines frictions in portfolio adjustment. Importantly, our model provides a simple mapping from the portfolio stickiness to the relative elasticity of capital flows to the country-specific expectation and to the fund-specific expectation. Hence, we find that mutual funds must update their portfolios every 13 months on average (every 10 months if we focus on active funds). 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.[3] Our estimate is in the ballpark of the one to two-year spans that have been identified using macroeconomic data (see for instance Bacchetta and van Wincoop (2017)).

Section 2 discusses the data and Section 3 estimates the elasticity of investment into and out of the mutual funds to investor's expectations. Section 4 lays down a portfolio choice model with delegated investment and shows when co-ownership spillovers appear and matter for the aggregate level. Section 5 identifies the elasticity that is relevant to co-ownership spillovers by establishing a mapping from model to data. Finally, Section 6 quantifies the the co-ownership spillovers.

[3] 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.

2 Data

Our dataset matches an expectation dataset from Consensus Economics, to an investor and mutual fund dataset from Emerging Portfolio Fund Research (EPFR).

2.1 Expectation dataset: Consensus Economics Data

For information about forecasts, we use data from Consensus Economics. Consensus Economics is a survey firm polling individual professional forecasters on a monthly frequency. Each month, forecasters provide estimates of several macroeconomic indicators for the current and the following year about a certain number of countries, for a maximum time span between 1989 and 2023. From this data, we use the real GDP growth forecasts for 51 advanced and emerging countries. The Consensus Economics data also provides the name of the institution providing each individual forecast. We extract and clean this information, which enables us to match the real GDP growth forecasts to our investor and mutual fund dataset.

2.2 Investor and mutual fund dataset: EPFR Data

The EPFR dataset is widely used to study cross-country investments in equity and bond markets. EPFR captures 5-20% of market capitalization in equity and bonds for most countries. It is a representative sample, as shown in Jotikasthira et al. (2012), show a close similarity between the EPFR data and matched CRSP data in terms of assets under management and average returns. Miao and Pant (2012) compare portfolio flows generated using EPFR data to portfolio flows computed with BOP data. Only a subset of institution investors flows are captured by the EPFR data, so there are clearly level differences, but the EPFR funds flows correlated well with BOP capital flows into Emerging Markets. Schmidt and Yesin (2022) shows that coverage is improving fast over time, and that, in 2021, EPFR flows capture a significant share of cross-border equity flows.

The EPFR data consists of two different datasets. The first dataset is a monthly dataset that contains information about country allocations at the fund level, that is, the share of the total assets invested in each country, the share of total assets held in cash, and the total assets managed by the fund.

The second dataset decomposes the weekly changes in assets under management of the mutual fund into weekly flows into the fund, and the weekly change in assets under management due to valuation changes. We aggregate this information to match the monthly frequency of the forecast data from Consensus Economics and the funds' monthly country allocations described below.

Both the weekly flow data and the monthly country allocation data contain information about the financial institution managing the fund. These fund managers are typically global banks, so we call them “investors”. We use this information to match the investors’ name to the institution reported by Consensus Economics. The country allocations of the funds managed by those investors overlap with the forecast information of Consensus Economics for 49 countries and 49 investors. Note that many expectation data are missing, since we have expectations only for 19% of countries on average for the funds that belong to our matched dataset, and only for 22% of countries when countries are weighted by portfolios. This leads to some econometric issues that we will address below.

As of January 2016, there are 17,260 mutual funds managing 14.1 trillion USD in assets reporting the weekly flows to EPFR and 1,151 mutual funds managing a total of 1 trillion USD in assets reporting monthly allocations. Of the 1,151 mutual funds in the EPFR data between 2001 and 2023, 737 funds managing 300 billion USD in assets are present in the matched EFPR sample with Consensus Economics. The funds that we manage to match to Consensus Economics dataset seem to represent well the rest of the sample. The distributions of assets under management and allocations in the whole EPFR Data and in our merged sample are similar.[4]

In our econometric analysis, we use two different samples, a fund sample, and an allocation sample. In the fund sample, we want to ensure that the variation of fund-level variables (like the weighted fund-level average forecast computed using the country allocation and the country-level expectations) is not driven by the variation in the sample countries used to compute these variables. We thus limit the number of entry and exit of a country in the dataset by excluding countries that have an allocation information and a forecast information for less than 90% of the observations of the best documented country in the fund. We also want the averages computed at the fund level to be economically and statistically relevant, so we exclude funds with less than 10 countries with forecast data, and we exclude funds for which we observe forecasts for less than 5% of the portfolio. In that sample, we have 11 investors, 83 funds, 47 countries and 5’600 fund-level observations. In the allocation sample, for each fund, we only keep countries that have forecast information and an allocation of at least 2% in the fund. In that sample, we have 46 investors, 502 funds, 37 countries and 80’000 allocation-level observations. Our results are not sensitive to our specific cleaning methodology.

[4] These results are available upon request.

3 Elasticity of Capital Flows to Expectations

The response of capital flows to the investor expectations will depend on how flows into the mutual funds respond to these expectations, and on how the mutual funds adjust their allocations across countries. We examine each in turn, and establish two main results. First, an increase in an investor' GDP growth expectations associated to a mutual fund portfolio is followed by a significant increase in the flows into that mutual fund. However, the mutual fund's country allocation responds mildly to that investor's country-specific GDP growth expectations.

3.1 Investor expectations and flows to mutual funds

Define the aggregate growth expectation at the investor and fund level as the average growth expectation weighted by the past country allocations:

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

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. $K(i,j)$ is the set of countries in which fund j invests and for which we observe expectations. The sum of 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 will address below.

We run the panel fixed-effects regression,

$$\ln\left(A_t^{i,j}\right) = \beta E_t^i g_{p,t}^{j,\text{next year}} + \lambda^j + \lambda_t^i + \epsilon_t^{i,j}, \tag{2}$$

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 $a_t^{i,j} = \frac{A_t^{i,j}}{\Omega_t^i}$, where $A_t^{i,j}$ is the total investor allocation to fund j. Our regression has investor-time fixed effects, so the above regression is equivalent to regressing $\ln\left(a_t^{i,j}\right)$ on the investor expectations and the fixed effects, where the investor's total assets are absorbed in the investor-time fixed effects. This specification helps us to estimate the impact of the expectations on the investor's allocation to the mutual fund even though we do not observe the investor's total wealth.

The use of investor-time fixed effects has many other advantages. It captures all the unobserved developments at the investor level that could drive the investor's allocation to the mutual fund. Among those are the global or investor-specific "funding shocks" that have been identified in the literature and could be correlated with expectations. They also include global or investor-specific expectation shocks that could, for instance, lead the investor to reallocate its wealth away from mutual equity funds and into bonds or cash. Finally, the fund fixed effects captures the investor-specific preference for a given fund. The identification of the role of expectations for investment into a fund comes from the relative evolution of the investor's expectation across funds (for example, if an investor's expectation about an Asian fund improves relative to a Latin American fund, then we should observe an increase in the assets managed by the Asian fund relative to the Latin American fund).

Table 1, column (1) reports the results for Equation (2). 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 aggregate weighted expected GDP growth by one percentage point is associated with an increase in investor allocations to the fund of about 28 percent.

Note that here we do not control for any fund-level time-specific development. Importantly, the fund-specific expectations could be correlated with the fund-specific equity returns or equity price changes, as equity price changes and returns may be relevant signals used to form expectations. On the other hand, equity price changes generate valuation effects that may or may not be balanced by the fund. To address this issue, we use a measure of fund-level returns due to change in 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 (2) and the results, which are barely changed, are reported in column (2).[5]

Another important issue is that we do not observe the investor's expectations for all the countries in the fund's portfolio. To understand, note that the "true" aggregate expectation can be decomposed into an observable and an unobservable component:

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

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

To circumvent this issue, we make a more specific assumption on the structure of expec-

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

	(1)	(2)	(3)	(4)	(5)
VARIABLES	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$
$E_t^i(g_p^{j,\text{next year}})$	0.279***	0.255***			
	(0.044)	(0.045)			
$\Gamma_t^{i,j}$			0.132**		
			(0.066)		
$\gamma_t^{i,j}$				0.427***	
				(0.117)	
$\bar{\gamma}_t^{i,j}$					0.408***
					(0.135)
$\Delta\log(Q_t^{i,j})$		-0.011**	-0.011**	-0.011**	-0.011**
		(0.004)	(0.005)	(0.004)	(0.005)
$\Delta\log(Q_{t-1}^{i,j})$		-0.011***	-0.012***	-0.012***	-0.012***
		(0.004)	(0.004)	(0.004)	(0.004)
Observations	5,275	4,717	4,717	4,717	4,719
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 1: 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 Driscoll-Kraay standard errors with 5 lags.

tations.

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

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

with $E(l_{k,t}^i) = 0$, $Cov(l_{k,t}^i, W_t^{i,j}) = 0$ and $Cov(l_{k,t}^i, l_{k',t}^i) = 0$ for all i, j 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, along the lines of Gabaix (2011) and Gabaix and Koijen (2021):

$$\Gamma_t^{i,j} = \sum_{k \in K(i,j)} w_{k,t-1}^{i,j} \left[E_t^i g_{k,t}^{\text{next year}} - \frac{1}{N^{i,j}} \sum_{k \in K(i,j)} E_t^i g_{k,t}^{\text{next year}} \right]. \quad (3)$$

Under Assumption 3.1, the simple average is a good estimate of the fund-specific driver:

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

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

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

Since $Cov(l_{k,t}^i, W_t^{i,j}) = 0$ and $Cov(l_{k,t}^i, l_{k',t}^i) = 0$ for all $k' \in \tilde{K}(i,j)$, then $Cov(\Gamma_t^{i,j}, E_t^i(g_{k',t}^{\text{next year}})) = 0$. The granular residual is thus immune to the missing variable bias.

In Table 1, Column (3) reports the results where the granular residual $\Gamma_t^{i,j}$ is used instead of the aggregate expectation $E_t^i(g_{p,t}^{j,\text{next year}})$. The coefficient is positive and significant. Interestingly, the coefficient of the granular component is halved as compared to the coefficient of the aggregate expectation, which confirms the presence of a strong positive missing variable bias.

We however do not account so far for a potential reverse causality from aggregate capital flows to growth and growth expectations. It also does not account for the potential inelasticity of the local supply of capital. In the limit, if this supply is completely inelastic, then we would not capture a positive response of capital flows to expectations, because, in equilibrium, any increase in the demand for equity would be absorbed by an increase in equity prices. Yet, this would not mean that the response of the demand for equity is zero. Note that if these effects exist, they would only concern the common drivers of expectations. We therefore make an additional assumptions on 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 then construct an alternative granular residual $\gamma_t^{i,j}$ by removing from the investor-specific granular term $\Gamma_t^{i,j}$ a granular term Γ_t^j computed using the consensus expectations:

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

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 component of expectations. Under Assumption 3.2, then Γ_t^j approximates the weighted average of the component of country-specific expectations that are common across investors:

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

and the super-granular component is only driven by the component of country-specific expectations that is specific to the investor:

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

It is thus 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 funds and investors are too small to matter for the total capital flows into the countries that the fund invests in, are uncorrelated to the total capital flows into these countries and to asset prices. It can be interpreted as the partial equilibrium impact of expectations on capital flows. The coefficient becomes much larger. This suggests that ignoring the inelasticity of supply and general equilibrium effects understates the expectation elasticity of the demand for equity, and that much 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 growth expectation is 43%. Growth expectations are thus very relevant to investors.

Finally, as a robustness, we replace the lagged allocation $w_{k,t-1}^{i,j}$ with the fund-specific 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.

3.2 Investor expectations and country allocations

Next, we test the relationship between investor expectations and the country allocation of the mutual funds. We run the following regression at the fund-country level,

$$\log\left(w_{k,t}^{i,j}\right) = \beta E_t^i g_k^{\text{next year}} + \lambda_{k,t} + \lambda_t^{i,j} + \lambda_k^{i,j} + \epsilon_{k,t}^{i,j}, \tag{5}$$

where $w_{k,t}^{i,j}$ is fund j's allocation to country k in percent of assets under management of investor i and $E_t^i x_{k,t+1}$ is investor i's expectations for future GDP growth in percent for country k. Fund-country fixed effects $\lambda_k^{i,j}$ capture heterogeneity in the funds' preferences for countries. Fund-time fixed effects $\lambda_t^{i,j}$ take into account global and investor-specific time-varying outside investment opportunities as well as global and investor-specific funding shocks.

Importantly, country-time fixed effects $\lambda_{k,t}$ take into account country-specific developments that simultaneously drive the country's supply of capital (and thus allocations $w_{k,t}^{i,j}$) and expectations, such as country growth, changes in local equity prices and monetary policy. They also capture reverse causality from capital flows to expectations, as capital flow surges may temporarily stimulate growth and growth expectations, or, on the opposite, increase the risks of a downturn. They also capture potential general equilibrium effects. The coefficient β is identified through the time variation in the idiosyncratic differences in investor expectations regarding a country relative to other countries.

Results of regression (5) are shown in Table 2. 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 3% (so a country with an initial 10% share will benefit from a 0.3 percentage point increase). This is one order of magnitude lower than the response of flows into the funds reported in the two last columns of Table 1. For the majority of funds that are active, the response of the fund portfolio allocation to investor forecast is 4%, while passive funds do not respond, as one would expect (columns (2) and (3)).

VARIABLES	(1) $\log(w_{k,t}^{i,j})$ All funds	(2) $\log(w_{k,t}^{i,j})$ Passive	(3) $\log(w_{k,t}^{i,j})$ Active
$E_t^i(g_k^{\text{next year}})$	0.028***	-0.007	0.039***
	(0.006)	(0.008)	(0.007)
Observations	82,485	9,842	71,723
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 2: 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. Standard errors Driscoll-Kraay standard errors with 5 lags.

All in all, this empirical section has established that, even though flows into funds respond to investors' expectations, the funds' cross-country allocations remain quite sticky in comparison.

4 Model

Motivated by the empirical evidence, the model presented in this section serves several purposes. First, it helps us understand how sticky portfolios at the mutual fund level affect the relation between expectations and capital flows at the country and fund level. Second, it enables us to discuss the aggregate consequences of the friction. Third, it will help us map relevant model parameters to the data and quantify these aggregate consequences. We first consider a simpler version of the model where investors are paired with only one mutual fund, then we analyze an extension where investors are paired with several mutual funds.

We outline a simple, two-period model of portfolio choice. There are M investors indexed by $i = 1, .., M$. Each investor i is paired with one equity mutual fund. In the first period, investors choose between investing in a safe asset and in the equity mutual fund, and equity mutual funds invest in the equity markets of N countries, indexed by $k = 1, .., N$. In the second period, portfolio returns are realized. Equity investments pay a stochastic dividend that is specific to the country. A fund's return thus depends on the country weights in the funds' portfolio. Investors and mutual funds maximize the same objective, which is the investors' utility.

Information and frictions in delegation are modeled as follows. In the first period, investors and mutual funds obtain information on the fundamental driving the stochastic dividend. We assume that investors and mutual funds share the same information and the same expectation formation process. Investors choose their portfolio allocation between the safe asset and the equity mutual fund conditional on that information, but cannot decide the mutual funds' allocation between countries. We assume that a mutual fund is able to update its allocation rule conditional on the new information only with probability $p \leq 1$. With a probability $1-p$, the fund does not update its portfolio.

4.1 Country returns and expectations

Equity held in country $k = 1, .., N$ pays a stochastic dividend in period $t+1$, $d_{k,t+1}$. Country k equity is traded at price $q_{k,t}$ in period t, so that the return is $R_{k,t+1} = \frac{D_{k,t+1}}{Q_{k,t}}$, where $Q_{k,t}$ is the price of a share in country k on period t and $D_{k,t+1}$ is the associated dividend on period $t+1$. We log-linearize the dividends and the share price around the world' averages D and Q, and we normalize $D/Q = 1$, so that the returns have a simple linear form:

$$R_{k,t+1} = \frac{D_{k,t+1}}{Q_{k,t}} = 1 + d_{k,t+1} - q_{k,t} \tag{6}$$

with $d_{k,t+1} = \log(D_{k,t+1}) - \log(D)$ and $q_{k,t} = \log(Q_{k,t}) - \log(Q)$.

We denote the vector of log-linearized dividends by $d_{t+1} = (d_{1,t+1}, .., d_{k,t+1}, .., d_{N,t+1})'$, the vector of log-linearized asset prices by $q_t = (q_{1,t}, .., q_{k,t}, .., q_{N,t})'$ and the vector of returns by $R_{t+1} = (R_{1,t+1}, .., R_{k,t+1}, .., R_{N,t+1})'$. We assume that the log-linearized dividends are exogenous and follow a Gaussian distribution: $d_{t+1} \sim \mathcal{N}(d, \Sigma)$, where $d = (d_1, .., d_k, .., d_N)'$ is the vector of the unconditional mean and Σ is the matrix of variance-covariance.

An investor-mutual fund pair $i = 1, .., M$ shares the same information on the fundamental d_{t+1}. In period t, we distinguish between the beginning-of-period information of investor-fund pair i, $\bar{\mathcal{I}}^i$, and their end-of period information $\mathcal{I}_t^i$. We assume that $q_t \in \mathcal{I}_t^i$, since q_t is an observable equilibrium variable. We denote by $\bar{E}^i(.) = E(.|\bar{\mathcal{I}}^i)$ the expectations conditional on $\bar{\mathcal{I}}^i$, the beginning-of-period information, and by $E_t^i(.) = E(.|\mathcal{I}_t^i)$ the expectations conditional on the end-of-period information. We have a relationship between the expected returns and the expected fundamentals d_{t+1}

$$\bar{E}^i_t(R_{t+1}) = 1 + \bar{E}^i_t(d_{t+1}) - \bar{E}^i_t(q_{t+1}), \qquad E^i_t(R_{t+1}) = 1 + E^i_t(d_{t+1}) - q_{t+1} \tag{7}$$

We denote by $\bar{V}(.) = V(.|\bar{\mathcal{I}}^i)$ the variance conditional on $\bar{\mathcal{I}}^i$, and by $V(.) = V(.|\mathcal{I}^i_t)$ the variance conditional on $\mathcal{I}^i_t$. We denote by $\bar{V}^R$ and V^R the conditional variances of returns:

$$\bar{V}^R = \bar{V}(R_{t+1}), \qquad V^R = V(R_{t+1}) \tag{8}$$

It will be useful to make the following assumption on the structure of learning:

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

This assumption states that the change in the conditional variance of returns between the beginning of period and the end of period is small compared to the conditional variance at the end of period.

4.2 Investors

Investor i enters period t with initial wealth Ω^i_t and invests a share a^i_t in equity fund i, which invests in countries $k = 1, .., N$, and a share $1 - a^i_t$ in a period bond. The decisions of the investor are taken after observing the new information $\mathcal{I}^i_t$, but before observing the country allocation of the fund.

In period $t+1$, portfolio returns are realized and the investor consumes all remaining terminal wealth defined as

$$\Omega^i_{t+1} = \left[R^i_{p,t+1} a^i_t + r(1 - a^i_t)\right] \Omega^i_t, \tag{9}$$

where the equity fund portfolio return $R^i_{p,t+1}$ is defined as

$$R^i_{p,t+1} = \sum_{k=1}^{N} w^i_{k,t} R_{k,t+1} = w^{i\prime}_t R_{t+1} \tag{10}$$

the real gross return on the safe asset is r, the return on country k's equity is $R_{k,t+1}$ and $w^i_{k,t}$ is the share of mutual fund i's portfolio that is invested in country k. The vector $w^i_t = (w^i_{1,t}, .., w^i_{k,t}, .., w^i_{N,t})'$ collects the country shares. Investors take the portfolio return as given. As we will see below, the country shares depend on whether the mutual fund updates its portfolio or not, which the investor does not know when deciding a^i_t.

Investors have mean-variance preferences and choose the investment share a_t^i to maximize the mean-variance utility of one unit of wealth,

$$U_{t+1}^i = E_t^i\left[R_{p,t+1}^i a_t^i + r(1-a_t^i)\right] - \frac{\gamma}{2} V\left[R_{p,t+1}^i a_t^i + r(1-a_t^i)\right], \tag{11}$$

where $E_t^i(.)$ and $V(.)$ are defined as the expectation and variance conditional on $\mathcal{I}_t^i$ and q_t as stated above, subject to the wealth accumulation equation (9) and the aggregate equity return (10), and taking the distribution of returns R and of portfolio shares w_t^i as given.

The optimal share of investment in equity must then satisfy

$$a_t^i = \frac{E_t^i(R_{p,t+1}^i) - r}{\gamma V(R_{p,t+1}^i)} \tag{12}$$

4.3 Mutual Funds

After investor i has decided her investment $a_t^i \Omega_t^i$ in fund i, the fund allocates $a_t^i \Omega_t^i$ across the different countries as follows.

At the beginning of period, the fund is endowed with information $\bar{\mathcal{I}}^i$ and sets the default country shares $\bar{w}^i$. The fund chooses the default country allocation $\bar{w}^i$ by maximizing the same objective (11) as the investor, but conditional on the beginning-of-period information $\bar{\mathcal{I}}_t^i$, subject to Equations (9), (10), $\sum_{k=1}^N \bar{w}_k^i = 1$ and taking the distribution of returns R as given. We can show that $\bar{w}^i$ satisfies, for all $k = 1, .., N$

$$\bar{E}^i(R_{t+1}) - \bar{E}^i(R_{k,t+1}) = \gamma(\bar{V}^R - \bar{V}_k^R)\bar{w}^i \bar{E}^i(a_t^i) \tag{13}$$

where $\bar{E}^i(a_t^i)$ is the expected investment share in fund i, and where each line of $\bar{V}_k^R$ is equal to $\bar{v}_k^R$, the k^{th} line of $\bar{V}^R$.

With probability $1-p$, the fund allocates the resources received from the investor across countries following the default portfolio shares $\bar{w}^i$. With probability p, the fund updates its portfolio after observing $\mathcal{I}_t^i$, i.e. the same information as the investor. In that case, the fund chooses the country allocation w_t^{i*} by maximizing the same objective (11) as the investor, conditional on $\mathcal{I}_t^i$, subject to Equations (9) and (10), $\sum_{k=1}^N w_{k,t}^{i*} = 1$ and taking the distribution of returns R as given. We can show that w_t^{i*} satisfies, for all $k = 1, .., N$

$$E_t^i(R_{t+1}) - E_t^i(R_{k,t+1}) = \gamma(V^R - V_k^R) w_t^{i*} a_t^i \tag{14}$$

where each line of V_k^R is equal to v_k^R, the k^{th} line of V^R.

4.4 Asset demand

Combining Equations (10), (12), (13) and (14), we can describe the asset demand for each country $k = 1, .., N$. We define the expected share of wealth invested in country k, conditional on $\mathcal{I}_t^i$, as $a_{k,t}^i = \tilde{w}_{k,t}^i a_t^i$, where $\tilde{w}_{k,t}^i = p w_{k,t}^{i*} + (1-p)\bar{w}_k^i$ is the expected fund allocation to country k. These flows depend both on the share allocated to the fund a_t^i and on the expected fund country allocation $\tilde{w}_{k,t}^i$.

The following lemma shows that two types of spillovers arise, portfolio reallocation spillovers, and co-ownership spillovers. The latter appear only in the presence of the portfolio friction.

Lemma 4.1 (Spillovers) *In the presence of a portfolio friction (if $p < 1$), and if Assumption 4.1 is satisfied, the final allocation to country k from investor i, $a_{k,t}^i = w_{k,t}^i a_t^i$, is given by:*

$$\begin{aligned} a_{k,t}^i =& p\frac{E_t^i(R_{k,t+1}) - r}{\gamma V_k^i} \\ &- p\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1})}{V_k^i} a_t^i \\ &+ (1-p)\bar{w}_k^i a_t^i \end{aligned} \tag{15}$$

where $V_k^i = V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^i)$, a_t^i is given by Equation (12) and $Cov(R_{k,t+1}, R_{p,k^-,t+1}^i)$ is the covariance between the return of the country k asset and the return of the portfolio that excludes k, $R_{p,k^-,t+1}^i = \sum_{j,j\neq k}^N w_{j,t}^i R_{j,t+1}/(1 - w_{k,t}^i)$.

Proof. See proof in Appendix B.1. ■

Consider first the result in the absence of return correlation, $(Cov(R_{k,t+1}, R_{p,k^-,t+1}) = 0)$ and without portfolio friction ($p = 1$). In that case, investment in country k is only affected by the expectations about country k's excess return, and is not affected by the total flows to the fund a_t^i. This implies that investment in country k is independent from the expectations about other countries in the portfolio.

Concretely, if the investor expects higher returns in country k', she will increase her allocation to the equity fund a_t^i. If the equity fund does not update its information, then these extra resources will be channeled to the countries according to previous information, generating spillovers to country k. But if the equity fund updates its portfolio, then it will increase the share that goes to country k'. This portfolio reallocation offsets the mechanical flow to country k due to the increased investment in the fund.

In general, portfolio reallocation generate another type of spillovers. They appear in the second term in Equation (15), which depends on the covariance between the return in country k and the return on the rest of the portfolio $(Cov(R_{k,t+1}, R_{p,k^-,t+1}))$, and, through a_t^i, on the expectation on the overall portfolio return $E_t^i(R_{p,t+1})$. Suppose that the covariance is positive. Higher expectations about country k' will generate a negative spillover on investment in country k, because country k is a close substitute to the rest of the portfolio. In that case, the portfolio reallocation spillovers are negative.

Consider now the last term in Equation (15). Take the same example as above, where the investor receives good news about country k'. With the portfolio friction ($p < 1$), the mutual fund does not adjust its portfolio shares with some positive probability ($1 - p > 0$), which implies that some of the funds destined to j end up in k. This spillover is positive whenever the "default" portfolio share $\bar{w}_k^i$ is positive. Since funds typically don't take short positions, these co-ownership spillovers are positive.

Finally, when the mutual fund's portfolio is sticky ($p < 1$), the capital allocated to country k is less elastic to the updated expectation on k's return $E_t^i(R_{k,t+1})$. This is because some funds destined to country k are channeled to other countries that are part of the portfolio if the portfolio shares are not adjusted.

If we take into account the fund's optimal setting of the default portfolio shares, we obtain the following capital flows as a function of expectations:

Proposition 4.1 *We assume that Assumption 4.1 is satisfied. In that case, Equation* (15) *can be written as:*

$$\begin{aligned} a_{k,t}^i =& p\frac{E_t^i(R_{k,t+1}) - r}{\gamma V_k^i} \\ &+ (1-p)\frac{\bar{E}^i(R_{k,t+1}) - r}{\gamma V_k^i \bar{E}^i(a_t^i)}\frac{E_t^i(R_{p,t+1}^i) - r}{\gamma V_p^i} \\ &- \frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^i)}{V_k^i}\frac{E_t^i(R_{p,t+1}^i) - r}{\gamma V_p^i} \end{aligned} \tag{16}$$

with $V_p^i = V(R_{p,t+1}^i)$.

Proof. See proof in Appendix B.2. ■

This proposition shows that the portfolio friction does not affect the portfolio reallocation spillovers, as we can see that the third term of Equation (16) does not depend on p. Indeed, these spillovers arise automatically from the "fixed" part of the portfolio share, which does not depend on expectations. The co-ownership spillovers arise from the ex ante excess return expectation for country k, $\bar{E}^i(R_{k,t+1}) - r$, which defines the part of the portfolio share of k that is truly "sticky", i.e. the part that would be adjusted in the absence of portfolio stickiness.[6]

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

4.5 Aggregate capital flows

Consider total capital flows to country $k = 1,..,N$. These correspond to the sum over all investor-mutual fund pairs $i = 1,..,M$: $A_{k,t} = \sum_{i=1}^{M} A^i_{k,t}$, where $A^i_{k,t} = a^i_{k,t}\Omega^i_t$ is the total flow from investor-fund i to country k. We will focus on $a_{k,t} = A_{k,t}/\Omega_t$, the share of total wealth $\Omega_t = \sum_{i=1}^{M} \Omega^i_t$ that goes to country k. We have

$$a_{k,t} = \sum_{i=1}^{M} \frac{\Omega^i_t}{\Omega_t} a^i_{k,t} \tag{17}$$

The share of global wealth that is invested in country k is an average of the individual investor shares, weighted by the investor-fund contribution to total wealth.

We now focus on the unexpected investment share to k, scaled by the expected share, and show that it relates to the investor-level unexpected investment shares to k:

$$\frac{a_{k,t} - \bar{E}(a_{k,t})}{\bar{E}(a_{k,t})} = \sum_{i=1}^{M} \sigma^i_{k,t} \frac{a^i_{k,t} - \bar{E}^i(a^i_{k,t})}{\bar{E}^i(a^i_{k,t})} \tag{18}$$

where $\sigma^i_{k,t} = \bar{E}^i(a^i_{k,t})\Omega^i_t / \sum_{i=1}^{M} \bar{E}^i(a^i_{k,t})\Omega^i_t$ is the share of investor-fund i in the total flows to country k. We used the fact that, because the Ω^i_ts are known in the beginning of period t, $\bar{E}(a_{k,t}) = \sum_{i=1}^{M} \frac{\Omega^i_t}{\Omega_t} \bar{E}^i(a^i_{k,t})$. As a result, surprises in capital flows are due to surprises in return expectations at the investor level, not to surprises in wealth (funding), which has been the focus of the literature thus far. These surprises at the investor level weigh more if the investor's average flows to k are relatively large.

According to Proposition 4.1, the share of wealth invested in country k by investor-fund i $a^i_{k,t}$ can be decomposed into a term that depends on the expectation on the country-k return and a term that depends on the expectation on the whole portfolio. As a result, the surprise capital flows to country k by investor-fund i can be written as

$$\frac{a^i_{k,t} - \bar{E}^i(a^i_{k,t})}{\bar{E}^i(a^i_{k,t})} = \beta^i_k[E^i_t(R_{k,t+1}) - \bar{E}^i(R_{k,t+1})] + \delta^i_k[E^i_t(R^i_{p,t+1}) - \bar{E}^i(R^i_{p,t+1})] \tag{19}$$

they only depend on the revisions in the country-specific and portfolio-specific return expectations, with β^i_k and δ^i_k the elasticities of capital flows to the country-specific expectations and to the fund-specific expectations. According to our model, these elasticities are $\beta^i_k = p\frac{1}{\gamma V^i_k \bar{E}^i(a^i_{k,t})}$ and $\delta^i_k = (1-p)\frac{\left[\bar{E}^i(R_{k,t+1}) - r\right]}{\gamma^2 V^i_k V^i_p \bar{E}^i(a^i_t)\bar{E}^i(a^i_{k,t})} - \frac{Cov(R_{k,t+1}, R^i_{p,k^-,t+1})}{\gamma V^i_k V^i_p \bar{E}^i(a^i_{k,t})}$. Note that δ^i_k, the

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.

elasticity to the fund-specific expectations, can be decomposed into two terms:

$$\delta_k^i = \eta_k^i - Cov_k^i \phi_k^i \tag{20}$$

with $\eta_k^i = (1-p)\frac{\bar{E}^i(R_{k,t+1})-r}{\gamma^2 V_k^i V_p^i \bar{E}^i(a_t^i)\bar{E}^i(a_{k,t}^i)}$, $\phi_k^i = \frac{1}{\gamma V_k^i \bar{E}^i(a_{k,t}^i)}$ and $Cov_k^i = \frac{Cov(R_{k,t+1}, R^i_{p,k^-,t+1})}{V_p^i}$. The first term, η_k^i, captures the co-ownership spillovers while the second term captures the portfolio reallocation spillovers.

4.6 When Are Co-ownership Spillovers Relevant?

Notice that, because the country-level and the portfolio-level expectations may be correlated, the funds received by country k through the co-ownership spillovers are not necessarily inefficient. At the limit, if all expectations are identical, capital flows generated by the co-ownership spillovers may still be related to expectations about fundamentals that are relevant to country k. It is therefore important to distinguish between the common component of expectations and their country-specific components. We thus make the following assumption on the structure of expectations:

Assumption 4.2 *We assume that expectations* $E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1})$ *are equal to the sum of a global component* W_t^i *and an idiosyncratic country-specific one* $l_{k,t}^i$*:*

$$E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1}) = W_t^i + l_{k,t}^i$$

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

Under Assumption 4.2, W_t^i can be then be estimated as the simple average across countries of investor i's expectations: $W_t^i \simeq \frac{1}{N}\sum_{k=1}^N [E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1})]$ and $l_{k,t}^i$ as a country-specific residual: $l_{k,t}^i = E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1}) - W_t^i$. Therefore, the portfolio return expectations can be decomposed into a global and a "granular" component:

$$E_t^i(R_{p,t+1}) - \bar{E}^i(R_{p,t+1}) = \Gamma_t^i + W_t^i \tag{21}$$

where the granular component Γ_t^i is by construction the weighted average of the local components:

$$\Gamma_t^i = \sum_{k=1}^N \left(w_{k,t}^i - \frac{1}{N}\right)[E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1})] \simeq \sum_{k=1}^N \tilde{w}_{k,t}^i l_{k,t}^i = \tilde{w}_t^{i\prime} l_{k,t}^i \tag{22}$$

where $l_t^i = (l_{1,t}^i, .., l_{k,t}^i, .., l_{N,t}^i)'$ is the vector of local components.

Using the definition of aggregate capital flow surprises (18), the model-implied investor-level capital flow surprises (19), our assumptions on expectations (**??**) and their aggregate implication (21), the surprises in aggregate capital flows can be decomposed as follows:

$$\frac{a_{k,t} - \bar{E}(a_{k,t})}{\bar{E}(a_{k,t})} = \sum_{i=1}^{M} \sigma_{k,t}^{i} \beta_{k}^{i} l_{k,t}^{i} + \sum_{i=1}^{M} \sigma_{k,t}^{i} (\beta_{k}^{i} + \delta_{k}^{i}) W_{t}^{i} + \sum_{i=1}^{M} \sigma_{k,t}^{i} \delta^{i} \Gamma_{t}^{i} \tag{23}$$

We can compare the effective equilibrium capital flows to the "frictionless" capital flows that would hold in the absence of portfolio friction. Note that capital flows under-react to $l_{k,t}^{i}$, the expectations that are specific to country k, as β_{k}^{i} is lower than its frictionless value (with $p = 1$). On the opposite, capital flows over-react to the the granular residual of expectations Γ_{t}^{i} as compared to their frictionless value, due to the co-ownership spillovers that affect δ_{k}^{i}. However, capital flows react to the global component W_{t}^{i} through two channels: the reaction to the country expectation (with an elasticity β_{k}^{i}) and the reaction to the portfolio expectation (with an elasticity δ_{k}^{i}). As a result, it is not clear whether there is an over- or an under-reaction to that component.

To go further, it is useful to make the following assumption:

Assumption 4.3 *For all $i = 1, .., M$, $\bar{E}^{i}(R_{k,t+1}) = \bar{E}^{i'}(R_{k',t+1})$ for all $k' \neq k$.*

We then derive the following corollary:

Corollary 4.1 *β_{k}^{i} is decreasing in $1 - p$. δ_{k}^{i} is increasing in $1 - p$ and is positive for a large $1 - p$. Additionally, under Assumption 4.3:*

- *$\beta_{k}^{i} + \delta_{k}^{i}$ is independent of p.*
- *$\beta_{k}^{i} / \eta_{k}^{i} = p/(1 - p)$.*

Proof. See proof in Appendix B.3. ■

When $p < 1$, the β_{k}^{i} terms, i.e. the reactions of capital flows to the investors' country expectations, are lower than what they would be in the optimum (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, the response to 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_{k}^{i} becomes positive. In that case, a larger $1-p$ increases δ_{k}^{i}, 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, under symmetric ex ante expectations, the reaction to the global component of expectations, $\beta_k^i + \delta_k^i$ does not depend on the friction and is equal to the optimal response. As a result, the comovement in capital flows across countries increases when p declines, and this is due to the granular component of expectations, and not to the global component of expectations.

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

4.7 Extension with multiple funds per investor

We consider here the more realistic case where a given investor i is associated with more than one fund. We therefore denote a fund by the index $j = 1, .., J(i)$ to distinguish it from the investor index i. Each fund potentially invests in a different set of countries. We denote by $\mathcal{S}(i,j)$ the set of countries in which fund j managed by investor i invests.

Now the investor budget constraint is

$$\Omega_{t+1}^i = \left[\mathcal{R}_{p,t+1}^i \left(\sum_{j=1}^{J(i)} a_t^{i,j} \right) + r \left(1 - \sum_{j=1}^{J(i)} a_t^{i,j} \right) \right] \Omega_t^i, \tag{24}$$

where $a_t^{i,j}$ is the share of investor i wealth invested in mutual fund j and $\mathcal{R}_{p,t+1}^i$ is the return on the total equity fund investments of investor i:

$$\mathcal{R}_{p,t+1}^i = \sum_{j=1}^{J(i)} \frac{a_t^{i,j}}{\sum_{j=1}^{J(i)} a_t^{i,j}} R_{p,t+1}^{i,j} \tag{25}$$

with $R_{p,t+1}^{i,j}$ the aggregate return on mutual fund j's portfolio. We assume as before that each fund adjusts her portfolio with probability $p \leq 1$. The return on the portfolio of fund j managed by investor i is therefore equal to

$$\begin{aligned} R_{p,t+1}^{i,j} &= \sum_{k \in \mathcal{S}(i,j)} w_{k,t}^{i,j*} R_{k,t+1} && \text{if the fund updates} \\ &= \sum_{k \in \mathcal{S}(i,j)}^{N} \bar{w}_k^{i,j} R_{k,t+1} && \text{if the fund does not} \end{aligned} \tag{26}$$

Updating funds choose $w_{k,t}^{i,j*}$ in order to maximize the investor's utility (11) subject to the wealth accumulation equation (24) and the aggregate equity return (26), and conditional on the end-of-period information $\mathcal{I}_t^i$. The default portfolio shares $\bar{w}_k^{i,j}$ are set to maximize the utility of the investor conditional on the beginning-of-period information $\bar{\mathcal{I}}^i$.

The other assumptions remain unchanged. In particular, we still assume that the investor and the funds share the same information, so information variables remain indexed by i only. We further assume that Assumption 4.1 is satisfied, and that $\bar{E}^i(a_t^{i,j}) \simeq \bar{a}^{i,j}$ where we define $\bar{a}^{i,j}$ as the share of investor i' wealth invested in fund i that would hold under the beginning-of-period information. We derive the equivalent of Lemma 4.1 and Proposition 4.1 in Appendix A.

The surprises in capital flows to country k by fund j, managed by investor i, can then be decomposed as follows:

$$\begin{aligned}\frac{a_{k,t}^{i,j} - \bar{E}^i(a_{k,t}^{i,j})}{\bar{E}^i(a_{k,t}^{i,j})} =& \beta_k^{i,j}[E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1})] + \delta_k^{i,j}[E_t^i(R_{p,t+1}^{i,j}) - \bar{E}^i(R_{p,t+1}^{i,j})] \\ &+ \theta_k^{i,j}[E_t^i(\mathcal{R}_{p,t+1}^i) - \bar{E}^i(\mathcal{R}_{p,t+1}^i)] \qquad (27)\end{aligned}$$

where $a_{k,t}^{i,j} = w_{k,t}^{i,j} a_t^{i,j}$ is the share of investor's i' wealth that is invested in country k through fund j, and $\beta_k^{i,j}$, $\delta_k^{i,j}$, $\theta_k^{i,j}$ are the elasticities of capital flows to the country-specific expectations, the fund-specific expectations and to the investor-specific expectations (that is, expectations on the returns of the whole investor's portfolio).

As compared to the simple case, there are some additional spillovers from the investor-wide expectations, that is, from the investor's expectations on its whole portfolio. These spillovers are governed by the $\theta_k^{i,j}$ parameter. These expectations also include a common component and a granular one. As we will see below, under some symmetry assumptions, these parameters are independent from p and reflect a form of portfolio reallocation spillovers between funds at the investor level.

Besides, now $\delta_k^{i,j}$ is written as follows:

$$\delta_k^{i,j} = \eta_k^{i,j} - \Delta Cov_k^{i,j} \phi_k^{i,j} \qquad (28)$$

where $\eta_k^{i,j}$ is proportional to $1-p$, $\phi_k^{i,j}$ is invariant in p, and

$$\Delta Cov_k^{i,j} = \frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}. \qquad (29)$$

See Appendix A for a precise definition of $\eta_k^{i,j}$, $\phi_k^{i,j}$, $\beta_k^{i,j}$ and $\theta_k^{i,j}$. The parameter $\eta_k^{i,j}$ represents the same co-ownership spillovers as in the simple case. The second term in (28) is close to the portfolio reallocation spillovers that we find in the second line of Equation (15), with the nuance that now this term is positively influenced by the covariance between the return in country k and the overall portfolio that excludes fund j. This effect comes from the fact that, for a given total allocation of investor i to equity funds, a higher allocation to fund j implies that investment in the other funds is less attractive. If returns in country k are positively correlated with the returns in these other funds, then some capital is reallocated to country k as k would be a relatively more profitable close substitute to these other funds.

As before, in order to assess the true excess capital flows arising from co-ownership spillovers, we assume that the structure of expectations laid down in Assumption 4.2 holds. We can then derive the global component $W_t^i \simeq \frac{1}{N}\sum_{k=1}^{N}[E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1})]$ and the local component $l_{k,t}^i \simeq E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1}) - W_t^i$, and the portfolio return expectations can be decomposed into a global and a "granular" component at the fund level:

$$E_t^i(R_{p,t+1}^{i,j}) - \bar{E}^i(R_{p,t+1}^{i,j}) = \Gamma_t^{i,j} + W_t^i \tag{30}$$

where the fund-specific granular component $\Gamma_t^{i,j}$ is again, by construction, the weighted average of the local components:

$$\Gamma_t^{i,j} = \sum_{k=1}^{N}\left(\tilde{w}_{k,t}^{i,j} - \frac{1}{N}\right)[E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1})] \simeq \sum_{k\in\mathcal{S}(i,j)} \tilde{w}_{k,t}^{i,j} l_{k,t}^i = \tilde{w}_t^{i,j\prime} l_t^i, \tag{31}$$

At the investor level, the portfolio return expectations can also be decomposed into a global and a "granular" component at the investor level:

$$E_t^i(\mathcal{R}_{p,t+1}^i) - \bar{E}^i(\mathcal{R}_{p,t+1}^i) = \Gamma_t^i + W_t^i \tag{32}$$

where the granular component Γ_t^i is described by

$$\Gamma_t^i = \sum_{k=1}^{N}\left(\tilde{w}_{k,t}^{i} - \frac{1}{N}\right)[E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1})] \simeq \tilde{w}_t^{i\prime} l_t^i \tag{33}$$

$\tilde{w}_{k,t}^i$ is the share of investor i's wealth that in invested in country k and $\tilde{w}_t^i$ is a vector that collects these shares.

We focus now on the aggregate implications of the portfolio friction. Using the model-implied capital flows (27), our assumption on expectations 4.2 and its implications (30) and (32), capital flows can be further decomposed into idiosyncratic country components, global components and fund-level and investor-level granular components:

$$\begin{aligned}
\frac{a_{k,t}-\bar{E}(a_{k,t})}{\bar{E}(a_{k,t})} &= \sum_{i=1}^{M}\sum_{j=1}^{J(i)} \sigma_{k,t}^{i,j} \frac{a_{k,t}^{i,j}-\bar{E}^i(a_{k,t}^{i,j})}{\bar{E}^i(a_{k,t}^{i,j})} \\
&= \sum_{i=1}^{M}\left(\sum_{j=1}^{J(i)} \sigma_{k,t}^{i,j}\beta_k^{i,j}\right) l_{k,t}^i + \sum_{i=1}^{M}\left(\sum_{j=1}^{J(i)} \sigma_{k,t}^{i,j}(\beta_k^{i,j}+\delta_k^{i,j}+\theta_k^{i,j})\right) W_t^i \\
&\quad + \sum_{i=1}^{M}\sum_{j=1}^{J(i)} \sigma_{k,t}^{i,j}\delta_k^{i,j}\Gamma_t^{i,j} + \sum_{i=1}^{M}\left(\sum_{j=1}^{J(i)} \sigma_{k,t}^{i,j}\theta_k^{i,j}\right)\Gamma_t^i \qquad (34)
\end{aligned}$$

where $\sigma_{k,t}^{i,j} = \bar{E}^i(a_{k,t}^{i,j})\Omega_t^i / \sum_{i=1}^{M}\Omega_t^i \sum_{j=1}^{J}(i)\bar{E}^i(a_{k,t}^{i,j})$ is the share of fund j managed by investor i in the total flows to country k.

We compare again the effective equilibrium capital flows to the "frictionless" capital flows that would hold in the absence of portfolio friction. Before that, it is useful to the introduce the following assumption:

Assumption 4.4 *For all $i = 1,..,M$ and $j = 1,..,J(i)$, $\bar{E}^i(R_{k,t+1}) = \bar{E}^i(R_{k',t+1})$ for all $k' \neq k$, and $Cov(R_{k,t+1}, \mathcal{R}_{p,t+1}^{i,j}) = Cov(R_{p,t+1}^{i,j^-}, \mathcal{R}_{p,t+1}^{i,j^-})$.*

We then derive the following corollary:

Corollary 4.2 *$\beta_k^{i,j}$ is decreasing in $1-p$. δ_k^i is increasing in $1-p$ and is positive for a large p. Additionally, under Assumption 4.4:*

- *$\beta_k^{i,j} + \delta_k^{i,j} + \theta_k^{i,j}$ and $\theta_k^{i,j}$ are independent of p.*
- *$\beta_k^{i,j}/\eta_k^{i,j} = p/(1-p)$*
- *$\theta_k^{i,j}$ is equal to*

$$\theta_k^{i,j} = -Cov^{i,j}\tau_k^{i,j} \qquad (35)$$

with $\tau_k^{i,j}$ defined in Appendix B.6 and

$$Cov^{i,j} = \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}} \qquad (36)$$

Proof. See proof in Appendix B.6. ∎

The results are similar to the simple case with a single fund per investor. The response of capital flows to the country-k specific expectations becomes stickier as p declines. Under symmetric ex ante expectations and symmetric covariances, the reaction to the global component of expectations is equal to the optimal response. Interestingly, the response to the investor-level granular component Γ_t^i is also independent of p. It is proportional to the minus the covariance between the fund-level return and the investor-level return, and thus reflects optimal portfolio reallocation between funds. Suppose that this covariance is positive. Higher expectations about fund j' will generate a negative spillover on investment in fund j, because fund j is a close substitute to the rest of the portfolio.

It is different again for the fund-level granular term $\Gamma_t^{i,j}$. Indeed, the response to capital flows responds more positively to the granular component when the portfolio becomes more sticky. If the co-ownership spillovers dominate the portfolio reallocation spillovers, the granular component can generate extra capital flow volatility. Besides, as p declines, the cross-country correlation in capital flows increases due to that component.

5 Identification

The purpose of this section is to identify the parameters $\beta_k^{i,j}$, $\delta_k^{i,j}$ and $\theta_k^{i,j}$. It will be useful to disentangle the contribution of $\eta_k^{i,j}$ and $\phi_k^{i,j}$ to $\delta_k^{i,j}$, as the latter is related to the efficient portfolio reallocation spillovers while the former is related to the inefficient co-ownership spillovers. This analysis will lead us to re-evaluate and interpret better our preliminary empirical results of Section 3. We will use these estimates to quantify the contribution of co-ownership spillovers to expectation-driven capital flows in the next section.

5.1 A Mapping from Model to Data

We approximate surprises in returns at the country, fund, and investor level as follows

$$\begin{aligned} E_t^i(R_{k,t+1}) - \bar{E}^i(R_{k,t+1}) &= 1 + E_t^i(d_{k,t+1}) - \bar{E}^i(d_{k,t+1}) - q_{k,t} + \bar{E}^i(q_{k,t}) \\ E_t^i(R_{p,t+1}^{i,j}) - \bar{E}^i(R_{p,t+1}^{i,j}) &= 1 + E_t^i(d_{p,t+1}^{i,j}) - \bar{E}^i(d_{p,t+1}^{i,j}) - q_{p,t}^{i,j} + \bar{E}^i(q_{p,t}^{i,j}) \\ E_t^i(\mathcal{R}_{p,t+1}^{i}) - \bar{E}^i(\mathcal{R}_{p,t+1}^{i}) &= 1 + E_t^i(d_{p,t+1}^{i}) - \bar{E}^i(d_{p,t+1}^{i}) - q_{p,t}^{i} + \bar{E}^i(q_{p,t}^{i}) \end{aligned} \quad (37)$$

where we used the approximation of returns (6) with $d_{k,t+1} = \log(D_{k,t+1}) - \log(D)$, $q_{k,t} = \log(Q_{k,t}) - \log(Q)$ are the log-deviations of dividends and asset prices at the country level from their average, $d_{p,t+1}^{i,j} = \sum_{k=1}^{N} \tilde{w}_{k,t}^{i,j} d_{k,t+1}$ and $q_{p,t+1}^{i,j} = \sum_{k=1}^{N} \tilde{w}_{k,t}^{i,j} q_{k,t+1}$ are the fund-specific weighted averages, and $d_{p,t+1}^{i} = \sum_{j=1}^{J(i)} \frac{A_t^{i,j}}{\sum_{j=1}^{J(i)} A_t^{i,j}} d_{p,t+1}^{j}$ and $q_{p,t+1}^{i} = \sum_{j=1}^{J(i)} \frac{A_t^{i,j}}{\sum_{j=1}^{J(i)} A_t^{i,j}} q_{p,t+1}^{j}$ are the investor-specific weighted averages.

5.2 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 return expressions (37), and assuming that β, δ and θ are homogeneous, Equation(27) can be rewritten as:

$$\log(w_{k,t}^{i,j}) = \beta E_t^i(d_{k,t+1}) + \lambda_{k,t} + \lambda_t^{i,j} + \lambda_k^{i,j} + \epsilon_{k,t}^{i,j} \tag{38}$$

with

$$\begin{aligned}
\lambda_{k,t} &= -\beta q_{k,t} + \beta + \delta \\
\lambda_t^{i,j} &= \delta[E_t^i(d_{p,t+1}^{i,j}) - q_{p,t}^{i,j}] + \theta[E_t^i(d_{p,t+1}^i) - q_{p,t}^i] - \log(a_t^{i,j}) \\
\lambda_k^{i,j} &= -\beta[\bar{E}^i(d_{k,t+1}) - \bar{E}^i(q_{k,t})] - \delta[\bar{E}^i(d_{p,t+1}^{i,j}) - \bar{E}^i(q_{p,t}^{i,j})] - \theta[\bar{E}^i(d_{p,t+1}^i) - \bar{E}^i(q_{p,t}^i)] + \log(\bar{E}^i(a_{k,t}^{i,j}))
\end{aligned}$$

$\lambda_{k,t}$ are country-time fixed effects that capture the impact of country-k asset prices, λ_t^i are fund-time fixed effects that capture the effect of the investor's expectations relative to her whole portfolio and the the fund's portfolio, and of the share of the investor's wealth invested in the fund, $\lambda_k^{i,j}$ are country-investor-fund fixed effects that capture the impact of investor ex ante expectations on country k and the impact of investor ex ante expectations on j's portfolio. The component of capital flows due to the expectations on country k is $\beta E_t^i(d_{k,t+1})$. Finally, $\epsilon_{k,t}^{i,j}$ is an error term.

This expression enables us to identify β. To do so, we can estimate a slightly modified version of Equation (38) where $E_t^i g_k^{\text{next year}}$ proxies for the expected dividends at the country level $E_t^i(d_{k,t+1})$. This allocation-level regression corresponds exactly to Equation (5) and to the analysis summarized in Table 2. Therefore, we can conclude that β is 3% or 4%, depending on whether we consider all funds or active funds only.

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 (27) at the fund level, we can write:

$$\log(A_t^{i,j}) = (\beta+\delta)E_t^i(d_{p,t+1}^{i,j}) - (\beta+\delta)q_{p,t}^{i,j} + \lambda_t^i + \lambda_k^{i,j} + \epsilon_t^{i,j} \tag{39}$$

with

$$
\begin{aligned}
\lambda_t^i \quad &= \theta[E_t^i(d_{p,t+1}^i) - q_{p,t}^i] + \log(\Omega_t^i) + \beta + \delta \\
\lambda^{i,j} \quad &= -(\beta+\delta)[\bar{E}^i(d_{p,t+1}^{i,j}) - \bar{E}^i(q_{p,t+1}^{i,j})] - \theta[\bar{E}^i(d_{p,t+1}^i) - \bar{E}^i(q_{p,t+1}^i)] + \log(\bar{E}^i(a_t^{i,j}))
\end{aligned}
$$

λ_t^i are investor-time fixed effects that capture the effect of the investor's expectations relative to her whole portfolio and of the investor's wealth, $\lambda^{i,j}$ are investor-fund fixed effects that capture the impact of investor ex ante expectations on j's portfolio. $\beta E_t^i(d_{p,t+1}^{i,j})$ is the component of capital flows due to the expectations on the specific countries in the portfolio, but aggregated at the fund level, and $\delta E_t^i(d_{p,t+1}^{i,j})$ represents the spillovers arising from expectations on the other countries in the portfolio. We cannot account for $q_{p,t}^{i,j}$ through the fixed effects, so we add it as a control. Finally, $\epsilon_{k,t}^{i,j}$ is an error term. Interestingly, the total response of inflows to the fund-level expectations is equal to $\beta+\delta$, which is independent of p.

We can use this expression to identify $\beta+\delta$. To do so, we estimate a slightly modified version of Equation (39), where $E_t^i g_p^{j,\text{next year}}$ proxies for the expected dividends at the fund level $E_t^i(d_{p,t+1}^{i,j})$, and the log-change in the fund-relevant equity price $\Delta\log(Q_{p,t}^{i,j})$ and its lag proxy for the log-deviation of equity prices from their average. This fund-level regression corresponds exactly to Equation (2) and to the analysis summarized in Table 1. Therefore, we can conclude that $\beta+\delta$ is 43%, which corresponds to our preferred estimate of Column (4). Therefore, $\delta = 40\%$, if we use the previous result that $\beta = 3\%$.

Disentangling portfolio and co-ownership spillovers However, remember that δ reflects both the portfolio reallocation spillovers and the co-ownership spillovers, as highlighted by Equation (28). In order to disentangle the portfolio reallocation spillovers from the co-ownership spillovers, we need to identify $\phi\Delta Cov$, the part of δ that is due to the portfolio reallocation. Using a measure of $\Delta Cov^{i,j}$ at the fund level, we can estimate the following modified version that includes an interaction term:

$$
\log(A_t^{i,j}) = (\beta+\eta)E_t^i(d_{p,t+1}^{i,j}) - \phi\Delta Cov^{i,j}E_t^i(d_{p,t+1}^{i,j}) - (\beta+\delta)q_{p,t}^{i,j} + \lambda_t^i + \lambda_k^{i,j} + \epsilon_t^{i,j} \tag{40}
$$

where $\Delta Cov^{i,j}$ is the weighted average of $\Delta Cov_k^{i,j}$ at the fund level. The spillovers arising from co-ownership are given by η while the spillovers arising from portfolio reallocation are given by $\phi\Delta Cov^{i,j}$.

	(1)	(2)	(3)
	$\log(A_t^{i,j})$	$\log(A_t^{i,j})$	$\log(A_t^{i})$
$E_t^i(g_p^{j,\text{next year}})$	0.250***		
	(0.045)		
$\gamma_t^{i,j}$		0.409***	
		(0.118)	
$E_t^i(g_p^{i,\text{next year}})$			-0.793***
			(0.209)
$\Delta Cov^{i,j} \times E_t^i(g_p^{j,\text{next year}})$	-0.712**	-0.602*	
	(0.323)	(0.328)	
$Cov^i \times E_t^i(g_p^{i,\text{next year}})$			0.697
			(0.846)
$\Delta \log(Q_t^{i,j})$	-0.010**	-0.010**	0.027***
	(0.005)	(0.005)	(0.010)
$\Delta \log(Q_{t-1}^{i,j})$	-0.011**	-0.011**	0.023**
	(0.004)	(0.004)	(0.010)
Observations	4,508	4,508	1,837
Fund FE	Yes	Yes	No
Investor-time FE	Yes	Yes	No
Investor FE	No	No	Yes
Time FE	No	No	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 (41). Column (3) reports the regression results of Equation (45). Standard errors Driscoll-Kraay standard errors with 5 lags.

Substituting the variables with their empirical counterparts, we obtain an extension of Equation (2) that includes the interaction of our measured $\Delta Cov_k^{i,j}$ with the aggregate expectation of GDP growth in the following regression:

$$\ln\left(A_t^{i,j}\right) = (\beta+\eta)E_t^i g_{p,t}^{j,\text{next year}} - \phi\Delta Cov^{i,j} \times E_t^i g_{p,t}^{j,\text{next year}} + \gamma_1 \Delta\log(Q_{p,t}^j) + \gamma_2\Delta\log(Q_{p,t-1}^j) + \lambda_t^i + \lambda^{i,j} + \epsilon_t^{i,j}. \quad (41)$$

The additional interaction term allows us to distinguish the portfolio reallocation spillover parameter ϕ from the co-ownership spillovers parameter η. Appendix C.1 provides details on how we compute $\Delta Cov_k^{i,j}$ and $\Delta Cov^{i,j}$. The summary statistics of $\Delta Cov^{i,j}$ are shown in Appendix C.3.

We present the results in Table 3. In Column (1), the interaction term appears to be significantly negative at -0.7, which is consistent with the model and implies $\phi = 0.7$. 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. Note that we face the same potential confounding factors as before, namely, asset supply shocks among the countries in which the fund invests, and general equilibrium effects that mitigate the coefficient of $E_t^i g_{p,t}^{j,\text{next year}}$. We are not worried about the identification of the interaction term, because the identification is driven also by fund-specific variation in the covariance term $\Delta Cov^{i,j}$. However, the linear term is subject to these confounding factors. Therefore, we use the super-granular residual $\gamma_t^{i,j}$, which is, as explained in Section 3, less subject to these confounders, and report the results in Column (2). The coefficient is very close to the one identified in Table 1. This implies that $\beta + \eta = 0.4$, so that $\eta = 0.4 - 0.03 = 0.37$, or $\eta = 0.4 - 0.04 = 0.36$, depending on whether we use the coefficient of β estimated for all funds or for active funds.

Using our estimates of β and η, we can get an estimate of the portfolio friction parameter p. To do so, we apply Corollary 4.1's prediction that $\beta/\eta = p/(1-p)$. This yields $p = \beta/(\eta+\beta) = 0.03/0.4 = 0.075$. This means that mutual funds update their portfolios every 13 months on average. If we consider only active funds, then $p = \beta/(\eta+\beta) = 0.04/0.4 = 0.1$, which means that active funds update their portfolios every 10 months on average. As a comparison, Bacchetta and van Wincoop (2017) estimate that $p = 0.04$ using a model with a Calvo-type portfolio friction. This implies an average portfolio updating span of two years. Their estimated frequency is lower, but is of a similar order of magnitude.

5.4 Investor-level regressions

Finally, to identify θ, we aggregate Equation (39) at the investor level:

$$\log(A_t^i) = (\beta+\delta+\theta)E_t^i(d_{p,t+1}^i) - (\beta+\delta+\theta)q_{p,t}^i + [\log(\Omega_t^i) - \log(\Omega_t)] + \lambda_t + \lambda^i + \epsilon_t^i \quad (42)$$

with

$$\begin{aligned} \lambda_t &= \log(\Omega_t) \\ \lambda^i &= -(\beta+\delta+\theta)[\bar{E}^i(d_{p,t+1}^i) - \bar{E}^i(q_{p,t+1}^i)] + \log(\bar{E}^i(a_t^i)) + \beta + \delta \end{aligned}$$

λ_t are investor-time fixed effects that capture the effect of total investor wealth, λ^i are investor fixed effects that capture the impact of investor ex ante expectations on their entire portfolio and of the average share of wealth invested in mutual equity funds. $\beta E_t^i(d_{p,t+1}^i)$ is the component of capital flows due to the expectations on the specific countries in the portfolio, but aggregated at the investor level, $\delta E_t^i(d_{p,t+1}^i)$ represents the spillovers arising from expectations on specific funds, but also aggregated at the investor level, and $\theta E_t^i(d_{p,t+1}^i)$ represents the portfolio reallocation spillovers at the investor level. We cannot account for $q_{p,t}^i$ through the fixed effects, so we add it as a control. Finally, ϵ_t^i is an error term.

Here as well, we can estimate a slightly modified version of Equation (42), where $E_t^i \mathsf{g}_{p,t}^{i,\text{next year}}$ proxies for the expected dividends at the investor level $E_t^i(d_{p,t+1}^i)$, and the changes in the investor-relevant equity price $\Delta \log \mathtt{Q}_{p,t}^i$ and its lag proxy for the log-deviation of equity prices from their average.

The aggregate GDP growth expectation is computed as

$$E_t^i \mathsf{g}_{p,t}^{i,\text{next year}} = \sum_{j \in J(i)} \frac{A_{t-1}^{i,j}}{\sum_{j \in J(i)} A_{t-1}^{i,j}} E_t^i g_{p,t}^{i,\text{next year}}, \quad (43)$$

where $E_t^i g_{p,t}^{j,\text{next year}}$ is defined in (1) and $A_{t-1}^{i,j}$ is the past value of total assets under management by fund j. The aggregate price changes are computed in the same way using the log-changes in the equity prices at the fund level and aggregating using the funds' past assets under management.

We do not include investor-time fixed effects, as they would absorb the investor-time specific expectation $E_t^i(\mathsf{g}_{p,t}^{i,\text{next year}})$ that we need to identify θ. In the absence of these fixed effects, we cannot account for Ω_t^i, the investor total wealth, for which we do not have a good measure. This means that we cannot account for funding shocks, which are an important driver of capital flows. The global drivers of these funding shocks are accounted for by the time fixed effects, but those do not account for the investor's own wealth dynamics. It is therefore difficult to identify $\beta + \delta + \theta$, because we cannot assume that investor expectations $E^i_t \mathtt{g}^{i,\text{next year}}_{p,t}$ (or even its super-granular component) are independent from shocks to investor-specific shocks to wealth $\Omega^i_t - \Omega_t$. We thus adopt a different strategy by using Corollary 4.2, which states that θ is proportional to a covariance term $Cov^{i,j}$, as highlighted by Equation (35). We extend Equation (42) to a version that includes an interaction term:

$$\begin{aligned}\log(A^i_t) = (\beta + \delta)E^i_t(d^i_{p,t+1}) - \tau Cov^i E^i_t(d^i_{p,t+1}) - (\beta + \delta + \theta)q^i_{p,t} \\ + [\log(\Omega^i_t) - \log(\Omega_t)] + \lambda_t + \lambda^i + \epsilon^i_t \end{aligned} \tag{44}$$

where Cov^i is the weighted average of $Cov^{i,j}$ at the investor level. The spillovers arising from portfolio reallocation are given by τCov^i.

Substituting the variables with their empirical counterparts, we obtain the following regression:

$$\begin{aligned}\ln\left(A^i_t\right) = (\beta + \eta)E^i_t \mathtt{g}^{i,\text{next year}}_{p,t} - \tau Cov^i \times E^i_t \mathtt{g}^{i,\text{next year}}_{p,t} \\ + \gamma_1 \Delta \log(\mathtt{Q}^i_{p,t}) + \gamma_2 \Delta \log(\mathtt{Q}^i_{p,t-1}) + \lambda_t + \lambda^i + \epsilon^i_t. \end{aligned} \tag{45}$$

The interaction term allows us to distinguish the investor-level portfolio reallocation spillover parameter τ. Appendix C.2 provides details on how we compute $Cov^{i,j}$ and Cov^i. The summary statistics of Cov^i are shown in Appendix C.3. While the coefficient of the linear term $E^i_t(d^i_{p,t+1})$ may be biased due to omitted variables that correlate with $E^i_t(d^i_{p,t+1})$, the coefficient of the interaction term $Cov^i E^i_t(d^i_{p,t+1})$ is not, because the identification will come from the variation in Cov^i. This will give us a reliable estimate of τ.

The results are presented in Column (3) of Table 3. The coefficient of the interaction term is not significant. We therefore retain the assumption that $\tau = 0$ and hence $\theta = 0$ in the rest of our analysis.

6 Quantifying Co-ownership Spillovers

Equation (34) provides a decomposition of capital flows to country k (as a percentage of total managed wealth) into the contribution of country-specific expectations, the contribution of global expectations and the contribution of the granular terms, which include the co-ownership spillovers. Because capital flows have many drivers besides expectations on GDP growth, we focus on the contribution of co-ownership spillovers to the variance of capital flows stemming from GDP growth expectations, which we call the expectation-driven capital flows.

We have shown that, in our model, the co-ownership spillovers are inefficient as they arise only in the presence of portfolio stickiness ($p < 1$). The data has shown us that portfolio stickiness is pervasive, confirming a hypothesis that has been previously made in the theoretical literature and widely documented empirically. It is therefore highly relevant to evaluate the contribution of this friction to expectation-driven capital flow volatility. Importantly, as Equation (34) and Corollary 4.2 have shown, co-ownership spillovers impact capital flows through the coefficient η, which we have estimated in the previous section, and through the granular term.

Define $\Gamma^a_{k,t}$ as the capital flows due to the co-ownership spillovers. We have assumed, in our baseline empirical analysis, that the coefficients $\eta^{i,j}_k$ are homogeneous across countries and funds. We make the same assumption here, so that $\eta^{i,j}_k = \eta$. This yields $\Gamma^a_{k,t} = \eta \Gamma_{k,t}$ where $\Gamma_{k,t}$ is a measure of the granular expectations relevant for country k:

$$\Gamma_{k,t} = \sum_{i=1}^{M} \sum_{j=1}^{J(i)} \sigma^{i,j}_{k,t} \Gamma^{i,j}_t \tag{46}$$

This term is an average of the fund-specific granular residuals, weighted by $\sigma^{i,j}_{k,t}$, the contribution of the fund to the capital flows of country k.

We can then estimate $\Gamma^a_{k,t}$ using the data. We have already a proxy for $\Gamma^{i,j}_t$ from our empirical analysis. The parameter η has been identified in Section 5 to be equal to 0.37 on average. Finally, $\sigma^{i,j}_{t,k}$ can be estimated as the average share of fund j in the total investment in country k: $\sum_{t=1}^{T} A^{i,j}_{k,t} / \sum_{t=1}^{T} A_{k,t}$. This share is fixed so that the variation in our co-ownership spillovers come entirely from variations in the granular residual of expectations. We can then identify the contribution of co-ownership spillovers to the aggregate capital flows.

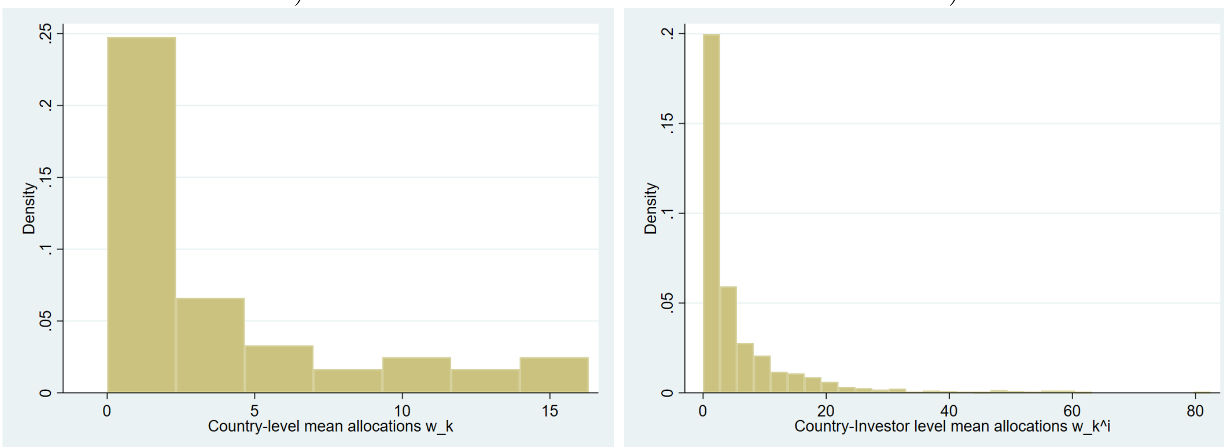
Using the definition of $\Gamma^{i,j}_t$, we can write:

$$\begin{aligned} \Gamma_{k,t} &= \sum_{k'=1}^{N} \sum_{i=1}^{M} l^i_{k',t} \left(\sum_{j=1}^{J(i)} \sigma^{i,j}_{k,t} \tilde{w}^{i,j}_{k',t} \right) \\ &= \sum_{k'=1}^{N} \sum_{i=1}^{M} \tilde{w}^i_{k,k',t} l^i_{k',t} \\ &= \left[\sum_{k'=1}^{N} \tilde{w}_{k,k',t} l_{k',t} + \sum_{k'=1}^{N} \sum_{i=1}^{M} \tilde{w}^i_{k,k',t} (l^i_{k',t} - l_{k',t}) \right] \end{aligned} \tag{47}$$

Here we distinguish between the 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 its investor-specific component

Figure 1: Distribution of country allocations

a) b)



$l^i_{k',t} - l_{k',t}$. These expectations are respectively weighted by the shares

$$\begin{aligned} \tilde{w}_{k,k',t} &= \left(\sum_{i=1}^{M} \sum_{j=1}^{J(i)} \sigma^{i,j}_{k,t} \tilde{w}^{i,j}_{k',t} \right) \\ \tilde{w}^i_{k,k',t} &= \left(\sum_{j=1}^{J(i)} \sigma^{i,j}_{k,t} \tilde{w}^{i,j}_{k',t} \right) \end{aligned} \tag{48}$$

$\tilde{w}_{k,k',t}$ is a weighted average of country k''s allocations across all funds, where the weights are the represented by the importance of a given fund in the total flows to country k. The aggregate expectation shocks on country k' $l_{k',t}$ will matter to country k if the funds that channel a large share of country k investment also invest a lot in country k'. $\tilde{w}^i_{k,k',t}$, on the other hand, is a weighted average of country k''s allocations across investor i's funds, where the weights are the represented by the importance of a given fund in the total flows to country k. Investor i's idiosyncratic expectation shocks on country k' $l^i_{k',t} - l_{k',t}$ will matter to country k if the funds managed by i that channel a large share of country k investment also invest a lot in country k'.

As shown by Gabaix (2011), the aggregate relevance of idiosyncratic shocks depends on the nature of the distribution of the shares. In our context, the aggregate relevance of expectations depends on the nature of the distribution of $\tilde{w}_{k,k',t}$ and $\tilde{w}^i_{k,k',t}$. If the shares $\tilde{w}_{k,k',t}$ are fat-tailed, that is, if some countries have disproportionate weight in global portfolios, then their country-specific expectation component $l_{k,t}$ will matter. Similarly, the idiosyncratic expectations will matter in the aggregate if the investor-specific country shares $\tilde{w}^i_{k,k',t}$'

distribution is fat-tailed. Figure 6 represents the distribution of the country allocations at the global level $\tilde{w}_k$ (panel a)), computed as the weighted average of country allocation across all funds, and the distribution of the country allocations at the investor level $\tilde{w}_k^i$ (panel b)), computed as the weighted average of country allocation across each investor's funds. These distributions show that a few shares are very large.

We compute an estimate of $\Gamma_{k,t}^a = \eta \Gamma_{k,t}$ based on Equation (46) using $\eta = 0.37$, and using our expectation and capital flow data to compute $\Gamma_{k,t}$. To measure expectations, we use the growth expectations $E_t^i g_k^{\text{next year}}$. However, since we have many missing expectations, we expand the expectation data as much as possible by imputing expectations when we do not observe them. To do so, we fit an ad hoc expectation process to our data and impute fictitious expectation data when that data is missing. See Appendix C.4 for details.

To isolate the role of expectations from that of the country weights, we examine the terms $\Delta\Gamma_{k,t}^a = \eta \Delta\Gamma_{k,t}$, with

$$\Delta\Gamma_{k,t} = \sum_{i=1}^{M} \sum_{k' \in \kappa(i)} \tilde{w}_{k,k',t-1}^i (l_{k',t}^i - l_{k',t-1}^i) \tag{49}$$

where $\kappa(i)$ is the set of countries for which we observe investor i's expectations or impute expectations. This is the innovation in capital flows to country k that is due to co-ownership spillovers. Indeed, the weights $\tilde{w}_{k,k',t-1}^i$ are kept equal to their past value. Because there are some countries in which investor i invests and for which we do not observe expectations, the magnitude of this term is under-estimated. Our estimates of the variance of $\Delta\Gamma_{k,t}^a$ will thus be conservative.

To compare these co-ownership spillovers to the total expectation-driven flows to country k, we compute also the common terms $\Delta W_{k,t}^a = (\beta + \eta + \theta)\Delta W_{k,t}$ and the idiosyncratic terms $\Delta l_{k,t}^a = \beta \Delta l_{k,t}$, where $\Delta W_{k,t}$ and $\Delta l_{k,t}$ are computed as

$$\begin{aligned} \Delta W_{k,t} &= \sum_{i=1}^{M} \left(\sum_{j=1}^{J(i)} \sigma_{k,t}^{i,j} \right) (W_t^i - W_{t-1}^i) \\ \Delta l_{k,t} &= \sum_{i=1}^{M} \left(\sum_{j=1}^{J(i)} \sigma_{k,t}^{i,j} \right) (l_{k,t}^i - l_{k,t-1}^i) \end{aligned} \tag{50}$$

and where $\beta = 0.03$, $\eta = 0.37$ and $\theta = 0$, as in our estimation.

Expectations			
Variance	$V\left(\Delta\Gamma_t^k\right)$	$V\left(\Delta W_{k,t}\right))$	$V\left(\Delta l_{k,t}\right))$
Value	-	.032	.121
	[-]	[.018,.052]	[.062,.398]
Contribution	-	31%	76%
	[-]	[9%,61%]	[47%,121%]

Implied capital flows			
Coefficients	η	$\eta+\beta$	β
	.37	.40	.03
Variance	$V\left(\Delta\Gamma_{k,t}^a\right)$	$V\left(\Delta W_{k,t}^a\right))$	$V\left(\Delta l_{k,t}^a\right))$
Value	.0011	.0050	.0001
	[.0022,.0066]	[.0028,.0117]	[.00006,.00036]
Contribution	17%	82%	1.1%
	[8%,48%]	[50%,109%]	[0.4%,5.5%]
Variance	$V\left(\Delta\Gamma_{k,t}^{a'}\right)$	$V\left(\Delta W_{k,t}^a\right))$	$V\left(\Delta l_{k,t}^{a'}\right))$
Value	.0020	.0050	.00036
	[.0007,.0067]	[.0028,.0117]	[.00011,.00155]
Contribution	16%	82%	3%
	[7%,47%]	[50%,109%]	[1%,13%]

Table 4: Variance decomposition of expectations and expectation-driven capital flows

Note: We report the median variances of expectations and implied capital flows 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 flows defined in (51).

We also take into account the portfolio reallocation spillovers $\tilde{\Gamma}_{k,t}^a = -\phi\Delta Cov\Gamma_{k,t}$, where $\phi = 0.7$, our estimate, and $\Delta Cov = -0.05$, the average of $\Delta Cov^{i,j}$ across all funds.

Then, according to Equation (34), the innovation in the expectation-driven capital flows, which we denote $\tilde{a}_{k,t}$, is the sum of the granular, common and idiosyncratic components as follows:

$$\frac{\tilde{a}_{k,t} - \tilde{a}_{k,t-1}}{\bar{E}(\tilde{a}_{k,t})} = \Delta\Gamma_{k,t}^a + \Delta\tilde{\Gamma}_{k,t}^a + \Delta W_{k,t}^a + \Delta l_{k,t}^a \tag{51}$$

The contribution of $\Delta\Gamma_{k,t}^a$, $\Delta W_{k,t}^a$ and $\Delta l_{k,t}^a$ to the variance of these expectation-driven flows is given in Table 4.

First, consider the upper part of Table 4, which focuses on the decomposition of expectations. The largest component of expectations is the idiosyncratic term with a median contribution of 76%, although it is highly heterogeneous. Panel a) of Figure 2 shows the variance decomposition of expectations for Emerging, Advanced, Small and Large countries. We define a country as "Large" when its average share in portfolios is in the top quartile (i.e., higher than 4.5%). The Large countries include the United States, the United Kingdom, Japan, Germany, France, Switzerland, the Russian Federation, South Korea, China, India, and Brazil. The idiosyncratic term is particularly large for Emerging economies, and even more so for Small Emerging economies, as panel a) shows. For Small Advanced economies, the idiosyncratic component is dominant as well.

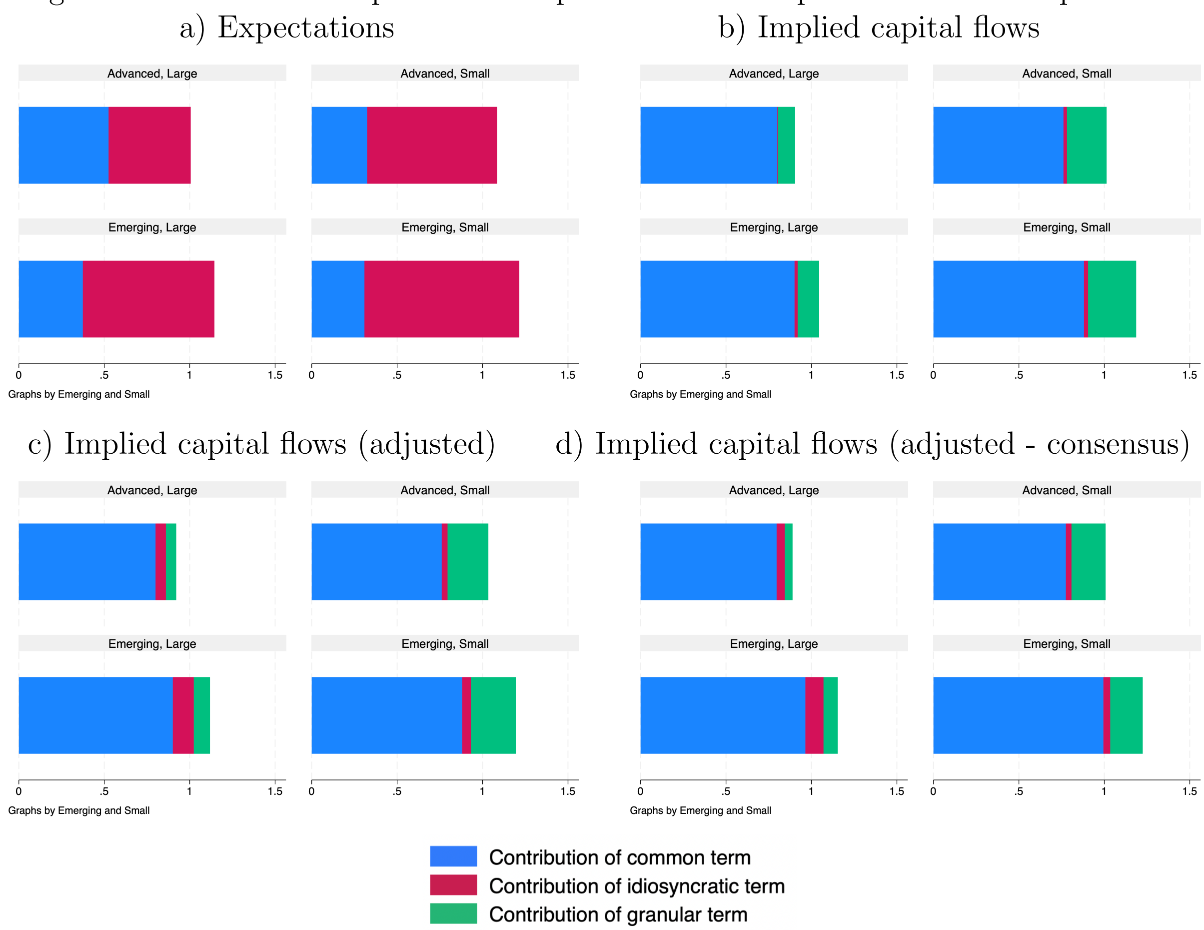
Now consider the lower part of Table 4 that describes the contributions of the different components to the expectation-driven capital flows. Because β is low relative to η, the common and granular terms have a much higher contribution relative to the idiosyncratic term: the granular term (co-ownership spillovers) explain 17% of the variance, and the common term explains 82%. This means that co-ownership spillovers explain about one fifth of the comovement in expectation-driven flows. The idiosyncratic component is almost irrelevant, due to the high estimated portfolio stickiness. Interestingly, the co-ownership spillovers are especially large for Small economies, both Emerging and Advanced, as shown in panel b) of Figure 2. For these countries, the contribution of the granular term is 26%, while it is 11% only for Large countries.

Note however that the large countries' granular term may not necessarily only reflect spillovers from other countries, because the granular term is precisely driven by the expectations about large countries. For instance, the investments of a fund in China could still reflect the expectations about China's growth even though the fund is inactive, just because the expectations about China have a non-trivial impact on the aggregate expectations that drive capital flows to the fund. We thus subtract from the granular term the following term:

$$\Gamma_{k,k,t} = \sum_{i=1}^{M} \tilde{w}^i_{k,k,t} l^i_{k,t} \tag{52}$$

This term reflects the impact of the investors' expectation on country k through the granular term. This term should actually be associated to the idiosyncratic term, not to the granular term. We thus compute a diminished granular term: $\Delta\Gamma^{a'}_{k,t} = \eta\Delta(\Gamma_{k,t} - \Gamma_{k,k,t})$, and an augmented idiosyncratic term: $\Delta lk,t^{a'} = \beta\Delta lk,t + \eta\Delta\Gamma_{k,k,t}$. The median contribution of the diminished granular term is not dramatically changed, as we can see in Table 4, because it is relevant only for large countries. In Panel c) of Figure 2, we can see that this is the case:

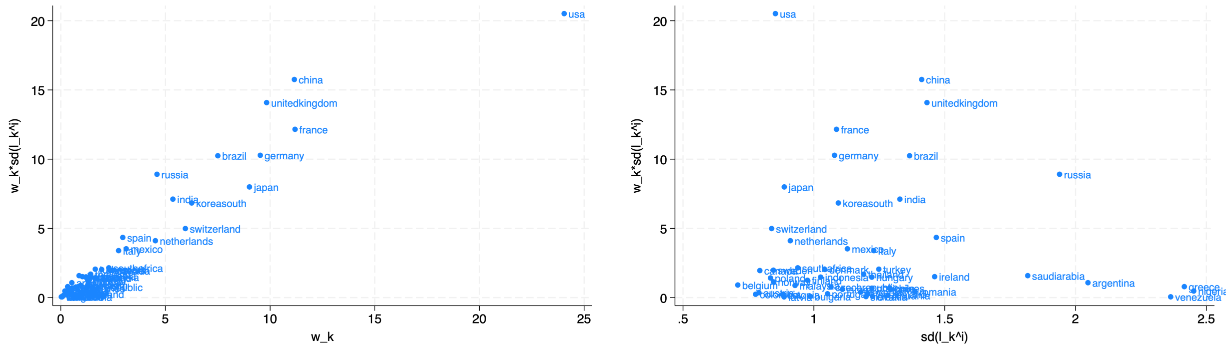
Figure 2: Variance decomposition of expectations and expectation-driven capital flows



Note: We report the average variances of expectations and implied capital flows across countries. Panel a) represents the contribution of $W_{k,t}$, $l_{k,t}$ and to the variance of expectations. Panel b) represents the contribution of $W^a_{k,t}$, $l^a_{k,t}$ and $\Gamma^a_{k,t}$ to the variance of implied capital flows. Panel c) represents the contribution of $W^a_{k,t}$, $l^{a'}_{k,t}$ and $\Gamma^{a'}_{k,t}$ to the variance of implied capital flows. Panel d) represents the contribution of $W^a_{k,t}$, $l^{a'}_{k,t}$ and $\Gamma^{a'}_{k,t}$ to the variance of implied capital flows when imputed expectations exclude the investor-specific component of expectations.

Figure 3: Contributors of co-ownership spillovers

a) b)



the relative contribution of the granular term becomes relatively smaller in Large Advanced and Emerging economies (down to 7.5%), while its relative size remains unchanged for Small countries.

As highlighted above and in Equation(47), there are two levels of granularity that may matter. The granularity of the shares of co-owned countries in portfolios, and the granularity of the contributions of the different funds to the flows of a country. Our sample is not exhaustive, so the contribution of the latter to capital flow volatility is over-stated. Note that the contribution of this term is driven by the investor-specific expectations $l^i_{k,t} - l_{k,t}$. We therefore represent a conservative decomposition by shutting down this term. This amount to represent a decomposition obtained without the investor-specific component of our imputed expectations. This is done in Panel d) of Figure 2. The contribution of the granular term is reduced. It becomes equal to one fifth in small countries.

Some countries are important contributors to co-ownership spillovers. We compute a measure of the contribution of countries as the average country allocations in portfolios $\tilde{w}_{k,t}$ multiplied by the volatility of the country-specific expectation residuals $l^i_{k,t}$. Figure 3 shows this measure and contrast it with the country allocations $\tilde{w}_{k,t}$ and with the volatility of $l^i_{k,t}$. First, it appears that the large contributors are mostly countries with large allocations in portfolios. Among emerging economies, those are the BRICs (Brazil, Russian Federation, India, China), but also South Korea and Mexico. Among advanced economies, those are the main G7 countries: UK, the US, France, Japan and Germany. However, 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 to co-ownership spillovers because they constitute a small share of portfolios.

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A Extension with multiple funds per investor - Model details

In this Appendix, we solve the model's extension presented in Section 4.7. We focus here on the equivalent of Lemma 4.1 and Proposition 4.1 of the main model. The main text in Section 4.7 focuses on the equivalent of Corollary 4.1.

We first derive the equivalent of Lemma 4.1 with multiple funds per investors:

Lemma A.1 *In the presence of portfolio friction (if $p < 1$), the final share of investor i's wealth invested in country k through mutual fund j, $a_{k,t}^{i,j} = \tilde{w}_{k,t}^{i,j} a_t^{i,j}$, is given by:*

$$\begin{aligned} a_{k,t}^{i,j} =& p\frac{E_t^i(R_{k,t+1}) - r}{\gamma V_k^i} \\ & - p\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_k^i} a_t^{i,j} \\ & - p\frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_k^i} \left(\sum_{j=1}^{J(i)} a_t^{i,j}\right) \\ & + (1-p)\bar{w}_k^{i,j} a_t^{i,j} \end{aligned} \tag{53}$$

where $V_k^{i,j} = V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})$, $a_t^{i,j}$, the share of investor i's wealth invested in fund j is given by

$$a_t^{i,j} = \frac{E_t^i(R_{p,t+1}^{i,j}) - r}{\gamma V_p^{i,j}} - \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}} \left(\sum_{j=1}^{J(i)} a_t^{i,j}\right), \tag{54}$$

and the $\left(\sum_{j=1}^{J(i)} a_t^{i,j}\right)$, the total share of investor i's wealth invested in equity is given by

$$\left(\sum_{j=1}^{J(i)} a_t^{i,j}\right) = \frac{E_t^i(\mathcal{R}_{p,t+1}^i) - r}{\gamma V(\mathcal{R}_{p,t+1}^i)} \tag{55}$$

where $V_p^{i,j} = V(R_{p,t+1}^{i,j}) - Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})$, $R_{p,k^-,t+1}^{i,j}$ is the return on fund j's portfolio excluding country k, and $Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j*})$ is the covariance between the return of the country k asset and the return of investor i's optimal portfolio that excludes fund j $\mathcal{R}_{p,j^-,t+1}^{i,j*} = \sum_{j'=1}^{J(i),j'\neq j} \left(\sum_{k\in\mathcal{S}(i,j')} \tilde{w}_{k,t}^{i,j'} R_{k,t+1}\right) a_t^{i,j'} / (\sum_{j=1}^{J(i),j'\neq j} a_t^{i,j})$.

Proof. See proof in Appendix B.4. ■

Equation (53) is similar to Equation (15). The last term represent the co-ownership spillovers. The third term is a new term that represents portfolio reallocation spillovers, but at the investor level. The second term is close to the fund-level portfolio reallocation spillovers that we find in the second line of Equation (15), with the nuance that now this term is positively influenced by the covariance between the return in country k and the overall portfolio that excludes fund j. This effect comes from the fact that, for a given total allocation of investor i to equity funds, a higher allocation to fund j implies that investment in the other funds is less attractive. If returns in country k are positively correlated with the returns in these other funds, then some capital is reallocated to country k as k would be a relatively more profitable close substitute to these other funds.

Similarly, if we take into account the fund's optimal setting of the default portfolio shares, we obtain the capital flows as a function of expectations and derive the equivalent of Proposition 4.1 with multiple funds per investor:

Proposition A.1 *We further assume that Assumption 4.1 is satisfied, and that* $\bar{E}^i(a_t^{i,j}) \simeq \bar{a}^{i,j}$ *where we define* $\bar{a}^{i,j}$ *as the share of investor i' wealth invested in fund i that would hold under the beginning-of-period information. In that case, Equation* (53) *can be written as:*

$$\begin{aligned} a_{k,t}^{i,j} =& p\frac{E_t^i(R_{k,t+1}) - r}{\gamma V_k^{i,j}} \\ &+ (1-p)\left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma V_k^{i,j} \bar{E}^i(a_t^{i,j})}\right) a_t^{i,j} \\ &- \left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_k^{i,j}}\right) a_t^{i,j} \\ &- p\frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}\left(\sum_{j=1}^{J(i)} a_t^{i,j}\right) \end{aligned} \tag{56}$$

Proof. See proof in Appendix B.5. ■

This proposition shows that the portfolio friction does not affect the portfolio reallocation spillovers at the fund level, as in Proposition 4.1, since we can see that the third term of Equation (56) does not depend on p. Indeed, these spillovers arise automatically from the "fixed" part of the portfolio share, which does not depend on expectations. The co-ownership spillovers arise from the ex ante excess return expectation for country k, $\bar{E}^i(R_{k,t+1}) - r$, similarly as before. The last term summarizes the contribution of the total investor's portfolio expectations to the capital flows to country k.

We define

$$\beta_k^{i,j} = p\left(\frac{1}{\bar{E}^i a_{k,t}^{i,j}}\right)\frac{1}{\gamma V_k^i}$$

$$\delta_k^{i,j} = (1-p)\left(\frac{1}{\bar{E}^i a_{k,t}^{i,j}}\right)\left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma^2 V_k^{i,j} V_p^{i,j} \bar{E}^i(a_t^{i,j})}\right)$$

$$- \left(\frac{1}{\bar{E}^i a_{k,t}^{i,j}}\right)\left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{\gamma V_k^{i,j} V_p^{i,j}}\right)$$

$$\theta_k^{i,j} = -p\left(\frac{1}{\bar{E}^i a_{k,t}^{i,j}}\right)\frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{\gamma V_k^{i,j} V_p^{i,j}} - \delta_i^k \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}} \tag{57}$$

Using Proposition A.1, we can then show that capital flows can be decomposed as described in Equation (27) in the main text.

If we define

$$\eta_k^{i,j} = (1-p)\left(\frac{1}{\bar{E}^i a_{k,t}^{i,j}}\right)\left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma^2 V_k^{i,j} V_p^{i,j} \bar{E}^i(a_t^{i,j})}\right)$$

$$\phi_k^{i,j} = \frac{1}{\bar{E}^i a_{k,t}^{i,j} V_k^{i,j}} \tag{58}$$

$$nonumber \tag{59}$$

then $\delta_k^{i,j}$ can be described by Equation (39).

B Proofs

B.1 Proof of Lemma 4.1

Note that we can now define the expected aggregate equity return for fund i, from the point of view of investor i:

$$E_t^i(R_{p,t+1}^i) = [pw_t^{i*} + (1-p)\bar{w}^i]' E_t^i(R_{t+1})$$
$$= \tilde{w}_t^{i'} E_t^i(R_{t+1}) \tag{60}$$

where $\tilde{w}_t^{i'} = pw_t^{i*} + (1-p)\bar{w}^i$. Indeed, when deciding a_t^i, the investor knows w_t^{i*} and $\bar{w}^i$, but does not know which allocation will hold.

Similarly,

$$\begin{aligned} V(R^i_{p,t+1}) &= \tilde{w}^{i\prime}_t V(R_{t+1})\tilde{w}^i_t \\ &= \tilde{w}^{i\prime}_t V^R \tilde{w}^i_t \end{aligned} \tag{61}$$

using the independence between the portfolio updating probability and the returns.

The optimal equity investment equation (12), combined with Equations (60) and (61), yields

$$\tilde{w}^{i\prime}_t E^i_t(R_{t+1}) - r = \gamma \tilde{w}^{i\prime}_t V^R \tilde{w}^i_t a^i_t \tag{62}$$

First consider the case where the fund can update its portfolio, described by Equation (14). We left-multiply Equation (14) by $\tilde{w}^{i\prime}_t$ and expand it:

$$\begin{aligned} \tilde{w}^{i\prime}_t E^i_t(R_{t+1}) - E^i_t(R_{k,t+1}) &= \gamma \tilde{w}^{i\prime}_t (V^R - V^R_k) w^{i*}_t a^i_t \\ &= \gamma \tilde{w}^{i\prime}_t V^R w^{i*}_t a^i_t - \underbrace{\gamma \tilde{w}^{i\prime}_t V^R_k w^{i*}_t A^i_t}_{\gamma v^R_k w^{i*}_t a^i_t} \\ &= \underbrace{\gamma \tilde{w}^{i\prime}_t V^R \tilde{w}^i_t a^i_t}_{\tilde{w}^{i\prime}_t E^i_t(R_{t+1}) - r} + \gamma \tilde{w}^{i\prime}_t V^R (w^{i*}_t - \tilde{w}^i_t) a^i_t - \gamma v^R_k w^{i*}_t a^i_t \\ &= \tilde{w}^{i\prime}_t E^i_t(R_{t+1}) - r + \gamma \tilde{w}^{i\prime}_t V^R (\underbrace{w^{i*}_t - \tilde{w}^i_t}_{(1-p)(w^{i*}_t - \bar{w}^i)}) a^i_t - \gamma v^R_k w^{i*}_t a^i_t \\ &= \tilde{w}^{i\prime}_t E^i_t(R_{t+1}) - r + \gamma (1-p) \underbrace{\tilde{w}^{i\prime}_t}_{\bar{w}^{i\prime} + p(w^{i*\prime}_t - \bar{w}^{i\prime})} V^R (w^{i*}_t - \bar{w}^i) A^i_t - \gamma v^R_k w^{i*}_t A^i_t \\ &= \tilde{w}^{i\prime}_t E^i_t(R_{t+1}) - r + \gamma (1-p) \bar{w}^{i\prime} V^R (w^{i*}_t - \bar{w}^i) a^i_t + \gamma p (1-p) (w^{i*\prime}_t - \bar{w}^{i\prime}) V^R (w^{i*}_t - \bar{w}^i) a^i_t - \gamma v^R_k w^{i*}_t a^i_t \\ &= \tilde{w}^{i\prime}_t E^i_t(R_{t+1}) - r + \gamma (1-p) \bar{w}^{i\prime} V^R (w^{i*}_t - \bar{w}^i) a^i_t + \gamma p (1-p) (w^{i*\prime}_t - \bar{w}^{i\prime}) V^R (w^{i*}_t - \bar{w}^i) a^i_t - \gamma v^R_k w^{i*}_t a^i_t \end{aligned} \tag{63}$$

Note that the the term $(w^{i*\prime}_t - \bar{w}^{i\prime}) V^R (w^{i*}_t - \bar{w}^i)$ is equal to $V(R^{i*}_{p,t+1} - \bar{R}^i_{p,t+1})$.

Besides, note that the term $\bar{w}^{i\prime} V^R (w^{i*}_t - \bar{w}^i) = Cov\left(\sum_{k=1}^N \bar{w}^i_k R_{k,t+1}, \sum_{k=1}^N (w^{i*}_{k,t} - \bar{w}^i_k) R_{k,t+1}\right) = \sum_{j=1}^N (w^{i*}_{j,t} - \bar{w}^i_j) \sum_{k=1}^N \bar{w}^i_k Cov(R_{j,t+1}, R_{k,t+1})$ can be approximated by zero. Indeed, the term $\sum_{k=1}^N \bar{w}^i_k Cov(R_{j,t+1}, R_{k,t+1})$ is known in the beginning of period, while $w^{i*}_{j,t} - \bar{w}^i_k$ is a surprise. This means that $w^{i*}_{j,t} - \bar{w}^i_j$ and $\sum_{k=1}^N \bar{w}^i_k Cov(R_{j,t+1}, R_{k,t+1})$ are uncorrelated across countries. Since the $w^{i*}_{j,t} - \bar{w}^i_j$ terms sum to 1, $\sum_{j=1}^N (w^{i*}_{j,t} - \bar{w}^i_j) \sum_{k=1}^N \bar{w}^i_k Cov(R_{j,t+1}, R_{k,t+1})$ should converge to zero as N goes to infinity. We assume that N is large enough to approximate $\bar{w}^{i\prime} V^R (w^{i*}_t - \bar{w}^i) = 0$.

Therefore, we have

$$\tilde{w}_t^{i'} E_t^i(R_{t+1}) - E_t^i(R_{k,t+1}) = \tilde{w}_t^{i'} E_t^i(R_{t+1}) - r + \gamma p(1-p)V(R_{p,t+1}^{i*} - \bar{R}_{p,t+1}^i)a_t^i - \gamma v_k^R w_t^{i*} a_t^i \tag{64}$$

After rearranging this equation, we obtain

$$\begin{aligned} w_{k,t}^{i*} a_t^i =& \frac{E_t^i(R_{k,t+1}) - r}{\gamma[V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*})]} \\ &- \frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*})} a_t^i \quad + p(1-p) \frac{V(R_{p,t+1}^{i*} - \bar{R}_{p,t+1}^i)}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*})} a_t^i \end{aligned} \tag{65}$$

where $w_{k,t}^{i*} a_t^i$ is the total flow to country k from investor i if the fund updates its portfolio, and $Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*}) = Cov(R_{k,t+1}, \sum_{j,j\neq k}^N w_{j,t}^{i*} R_{j,t+1}/(1-w_{k,t}^{i*}))$ is the covariance between the return of the country k asset and the optimal portfolio that excludes k.

Note that $Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*}) = Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i}) + Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*} - R_{p,k^-,t+1}^{i})$ and that $Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*} - R_{p,k^-,t+1}^{i}) = (1-p)Cov(R_{k,t+1}, \bar{R}_{p,k^-,t+1}^{i} - R_{p,k^-,t+1}^{i*}) = (1-p)\sum_{j=1,j\neq k}^N [\bar{w}_j^i/(1-\bar{w}_k^i) - w_j^{i*}/(1-w_k^{i*})] Cov(R_{k,t+1}, R_{j,t+1})$. The innovations is weights are uncorrelated to the covariance of the country-k return and the other country returns, which are constant terms. This covariance can then be approximated by zero. Therefore, $Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i*}) = Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i})$. This, together with $\tilde{w}_{k,t}^i = p w_{k,t}^{i*} + (1-p)\bar{w}_k^i$, yields Equation (15).

B.2 Proof of Proposition 4.1

We left-multiply (13) by $\bar{w}^{i'}$ and expand it:

$$\begin{aligned} \bar{w}_t^{i'} \bar{E}^i(R_{t+1}) - \bar{E}^i(R_{k,t+1}) &= \gamma \bar{w}^{i'}(\bar{V}^R - \bar{V}_k^R)\bar{w}^i \bar{E}^i(a_t^i) \\ &= \gamma \bar{w}^{i'} \bar{V}^R \bar{w}^i \bar{E}^i(a_t^i) - \gamma \bar{w}^{i'} \bar{V}_k^R \bar{w}^i \bar{E}^i(a_t^i) \\ &= \gamma \underbrace{\bar{w}^{i'} \bar{V}^R \bar{w}^i}_{\bar{V}(\bar{R}_{p,t+1}^i)} \bar{E}^i(a_t^i) - \gamma \underbrace{\bar{w}^{i'} \bar{V}_k^R}_{\bar{v}_k^R} \bar{w}^i \bar{E}^i(a_t^i) \\ &= \gamma \bar{V}(\bar{R}_{p,t+1}^i) \bar{E}^i(a_t^i) - \gamma \bar{v}_k^R \bar{w}^i \bar{E}^i(a_t^i) \end{aligned} \tag{66}$$

We then obtain

$$\underbrace{\bar{w}_t^{i\prime}\bar{E}^i(R_{t+1})}_{\bar{E}^i(\bar{R}^i_{p,t+1})} - \bar{E}^i(R_{k,t+1}) = \gamma\bar{V}(\bar{R}^i_{p,t+1})\bar{E}^i(a^i_t) - \gamma\bar{v}^R_k\bar{w}^i\bar{E}^i(a^i_t) \tag{67}$$

We define $\bar{a}^i$ such that

$$\bar{a}^i = \frac{\bar{E}^i(\bar{R}^i_{p,t+1}) - r}{\gamma\bar{V}(\bar{R}^i_{p,t+1})} \tag{68}$$

$\bar{a}^i$ is the investments share to fund i that would be consistent with the beginning-of-period information $\bar{\mathcal{I}}^i$. Note that this is not necessarily equal to $\bar{E}^i(a^i_t)$, the expected share conditional on $\bar{\mathcal{I}}^i$, which should satisfy

$$\bar{E}^i(a^i_t) = \bar{E}^i\left(\frac{E^i_t(R^i_{p,t+1}) - r}{\gamma V(R^i_{p,t+1})}\right) \tag{69}$$

We can therefore write

$$\gamma\bar{v}^R_k\bar{w}^i\bar{E}^i(a^i_t) = -\underbrace{\left[\bar{E}^i(\bar{R}^i_{p,t+1}) - r\right]}_{\gamma\bar{V}(\bar{R}^i_{p,t+1})\bar{A}^i} + \left[\bar{E}^i(R_{k,t+1}) - r\right] + \gamma\bar{V}(\bar{R}^i_{p,t+1})\bar{E}^i(a^i_t) \tag{70}$$

$$= \left(\bar{E}^i(R_{k,t+1}) - r + \gamma\bar{V}(\bar{R}^i_{p,t+1})\left[\bar{E}^i(a^i_t) - \bar{a}^i\right]\right) \tag{71}$$

After rearranging this equation, we obtain

$$\bar{w}^i_k\bar{E}^i(a^i_t) = \frac{\bar{E}^i(R_{k,t+1}) - r + \gamma\bar{V}(\bar{R}^i_{p,t+1})\left[\bar{E}^i(a^i_t) - \bar{a}^i\right]}{\gamma[\bar{V}(R_{k,t+1}) - \bar{Cov}(R_{k,t+1}, \bar{R}^i_{p,k^-,t+1})]} - \frac{\bar{Cov}(R_{k,t+1}, \bar{R}^i_{p,k^-,t+1})}{\bar{V}(R_{k,t+1}) - \bar{Cov}(R_{k,t+1}, \bar{R}^i_{p,k^-,t+1})}\bar{E}^i(a^i_t) \tag{72}$$

where $\bar{Cov}(R_{k,t+1}, \bar{R}^i_{p,k^-,t+1}) = \bar{Cov}(R_{k,t+1}, \sum_{j,j\neq k}^N \bar{w}^i_j R_{j,t+1}/(1-\bar{w}^i_k))$ is the covariance between the return of the country k asset and the predetermined portfolio that excludes k.

We then multiply both sides of this equation by $a^i_t/\bar{E}^i(a^i_t)$:

$$\bar{w}^i_k a^i_t = \frac{\bar{E}^i(R_{k,t+1}) - r + \gamma\bar{V}(\bar{R}^i_{p,t+1})\left[\bar{E}^i(a^i_t) - \bar{a}^i\right]}{\gamma[\bar{V}(R_{k,t+1}) - \bar{Cov}(R_{k,t+1}, \bar{R}^i_{p,k^-,t+1})]}\frac{a^i_t}{\bar{E}^i(a^i_t)} - \frac{\bar{Cov}(R_{k,t+1}, \bar{R}^i_{p,k^-,t+1})}{\bar{V}(R_{k,t+1}) - \bar{Cov}(R_{k,t+1}, \bar{R}^i_{p,k^-,t+1})}a^i_t \tag{73}$$

We multiply Equation (65) by p and Equation (73) by $1-p$ and sum both equations. We then obtain

$$\begin{aligned}
\tilde{w}_k^i a_t^i =& p\frac{E_t^i(R_{k,t+1})-r}{\gamma[V(R_{k,t+1})-Cov(R_{k,t+1},R^i_{p,k^-,t+1})]} + (1-p)\frac{\bar{E}^i(R_{k,t+1})-r}{\gamma[\bar{V}(R_{k,t+1})-\bar{Cov}(R_{k,t+1},R^i_{p,k^-,t+1})]}\frac{a_t^i}{\bar{E}^i(a_t^i)} \\
&+(1-p)\gamma\frac{\bar{V}(\bar{R}^i_{p,t+1})}{\gamma[\bar{V}(R_{k,t+1})-\bar{Cov}(R_{k,t+1},R^i_{p,k^-,t+1})]}\frac{\bar{E}^i(a_t^i)-\bar{a}^i}{\bar{E}^i(a_t^i)}a_t^i \\
&-\left(p\frac{Cov(R_{k,t+1},R^i_{p,k^-,t+1})}{V(R_{k,t+1})-Cov(R_{k,t+1},R^i_{p,k^-,t+1})}+(1-p)\frac{\bar{Cov}(R_{k,t+1},R^i_{p,k^-,t+1})}{\bar{V}(R_{k,t+1})-\bar{Cov}(R_{k,t+1},R^i_{p,k^-,t+1})}\right)a_t^i \\
&+p^2(1-p)\frac{V(R^{i*}_{p,t+1}-\bar{R}^i_{p,t+1})}{V(R_{k,t+1})-Cov(R_{k,t+1},R^i_{p,k^-,t+1})}a_t^i
\end{aligned} \tag{74}$$

where a similar argument as before has been applied to show that $\bar{Cov}(R_{k,t+1},\bar{R}^i_{p,k^-,t+1}) = \bar{Cov}(R_{k,t+1},R^i_{p,k^-,t+1})$.

Under Assumption 4.1, we would have

$$\begin{aligned}
&p\frac{Cov(R_{k,t+1},R^i_{p,k^-,t+1})}{V(R_{k,t+1})-Cov(R_{k,t+1},R^i_{p,k^-,t+1})}+(1-p)\frac{\bar{Cov}(R_{k,t+1},R^i_{p,k^-,t+1})}{\bar{V}(R_{k,t+1})-\bar{Cov}(R_{k,t+1},R^i_{p,k^-,t+1})} \\
&=p\frac{Cov(R_{k,t+1},R^i_{p,k^-,t+1})}{V(R_{k,t+1})-Cov(R_{k,t+1},R^i_{p,k^-,t+1})}+(1-p)\frac{\kappa Cov(R_{k,t+1},R^i_{p,k^-,t+1})}{\kappa V(R_{k,t+1})-\kappa Cov(R_{k,t+1},R^i_{p,k^-,t+1})} \\
&=\frac{Cov(R_{k,t+1},R^i_{p,k^-,t+1})}{V(R_{k,t+1})-Cov(R_{k,t+1},R^i_{p,k^-,t+1})}
\end{aligned} \tag{75}$$

Then, assuming $\bar{E}^i(a_t^i)-\bar{a}^i \simeq 0$, we obtain Equation (16).

B.3 Proof of Corollary 4.1

Consider β_k^i and δ_k^i as defined in equation (38). β_k^i is increasing in p and δ_k^i is decreasing in p.

Now consider $\beta_k^i+\delta_k^i$:

$$\begin{aligned}
\beta_k^i+\delta_k^i &= \frac{1}{\gamma V_k^i \bar{E}^i(a^i_{k,t})}\left[p+(1-p)\frac{\left[\bar{E}^i(R_{k,t+1})-r\right]}{\gamma V_p^i \bar{E}^i(a_t^i)}-\frac{Cov(R_{k,t+1},R^i_{p,k^-,t+1})}{V_p^i}\right] \\
&= \frac{1}{\gamma V_k^i \bar{E}^i(a^i_{k,t})}\left[p+(1-p)\frac{\left[\bar{E}^i(R_{k,t+1})-r\right]}{\left[\bar{E}^i(R^i_{p,t+1})-r\right]}-\frac{Cov(R_{k,t+1},R^i_{p,k^-,t+1})}{V_p^i}\right]
\end{aligned} \tag{76}$$

where we used (12). Assumption 4.3 implies that $\bar{E}^i(R_{k,t+1}) = \bar{E}^i(R^i_{p,t+1})$, then

$$\beta^i_k + \delta^i_k = \frac{1}{\gamma V^i_k \bar{E}^i(a^i_{k,t})}\left[1 - \frac{Cov(R_{k,t+1}, R^i_{p,k^-,t+1})}{V^i_p}\right] \tag{77}$$

which is independent of p.

Now we consider β^i_k/η^i_k:

$$\frac{\beta^i_k}{\eta^i_k} = \frac{p\frac{1}{\gamma V^i_k \bar{E}^i(a^i_{k,t})}}{(1-p)\frac{\bar{E}^i(R_{k,t+1})-r}{\gamma^2 V^i_k V^i_p \bar{E}^i(a^i_t)\bar{E}^i(a^i_{k,t})}} = \frac{p}{(1-p)\frac{\bar{E}^i(R_{k,t+1})-r}{\gamma V^i_p \bar{E}^i(a^i_t)}} \tag{78}$$

Then, note that $\bar{E}^i(a^i_t) \simeq \frac{\bar{E}^i(R^i_{p,t+1})-r}{\gamma V^i_p)}$. Therefore,

$$\frac{\beta^i_k}{\eta^i_k} = \frac{p}{(1-p)\frac{\bar{E}^i(R_{k,t+1})-r}{\gamma V^i_p \frac{\bar{E}^i(R^i_{p,t+1})-r}{\gamma V^i_p)}}} = \frac{p}{(1-p)\frac{\bar{E}^i(R_{k,t+1})-r}{\bar{E}^i(R^i_{p,t+1})-r}} \tag{79}$$

Under Assumption 4.3, $\bar{E}^i(R_{k,t+1}) - r = \bar{E}^i(R^i_{p,t+1}) - r$. Therefore, $\beta^i_k/\eta^i_k = p/(1-p)$.

B.4 Proof of Lemma A.1

We now derive a more general version of Equation (62):

$$\tilde{W}^{i'}_t E^i_t(R_{t+1}) - r = \gamma \tilde{W}^{i'}_t V^R \tilde{W}^i_t a^i_t \tag{80}$$

where $\tilde{W}^i_t = (\tilde{w}^{i,1}_t, .., \tilde{w}^{i,j}_t, .., \tilde{w}^{i,N_i}_t)$ is the matrix that collects the average portfolio weights of each individual investors and $a^{i'}_t = (a^{i,1}_t, .., a^{i,j}_t, .., a^{i,N_i}_t)'$ is the vector that collects the share of investor i's investment in each fund j. Note that, because each fund j invests in a limited set of countries $\mathcal{S}(i,j)$, some of the weights may be equal to zero. We have $\tilde{w}^{i,j}_t = pw^{i,j*}_t + (1-p)\bar{w}^{i,j}$ for all (i,j).

Updating funds will set their portfolio shares as follows:

$$Id(i,j)\left[E^i_t(R_{t+1}) - E^i_t(R_{k,t+1})\right] = \gamma Id(i,j)(V^R - V^R_k)W^{i*}_t a^i_t \tag{81}$$

where the k^{th} element of the diagonal of $Id(i,j)$ is equal to one if $k \in \mathcal{S}(i,j)$, and zero otherwise. For $k \notin \mathcal{S}(i,j)$, $w^{i,j*}_t = 0$. Therefore, $w^{i,j*'} Id(i,j) = w^{i,j*'}$.

The country allocation by passive funds, $\bar{W}^i$, is characterized as follows:

$$Id(i,j)\left[\bar{E}(R_{t+1}) - \bar{E}(R_{k,t+1}) = \gamma Id(i,j)(V^R - V_k^R)\bar{W}^i \bar{E}^i(a_t^i)\right] \tag{82}$$

where $\bar{E}^i(a_t^i)$ is defined by

$$\bar{E}^i(a_t^i) = \bar{E}^i\left(\left(\gamma \tilde{W}_t^{i\prime} V^R \tilde{W}_t^i\right)^{-1}\left(\tilde{W}_t^{i\prime} E_t^i(R_{t+1}) - r\right)\right) \tag{83}$$

For $k \notin \mathcal{S}(i,j)$, $\bar{w}^{i,j} = 0$. Therefore, $\bar{w}^{i,j\prime} Id(i,j) = \bar{w}^{i,j\prime}$.

In Equation (80), we focus on the j^{th} line:

$$w_t^{i,j\prime} E_t^i(R_{t+1}) - R - \gamma w_t^{i,j\prime} V^R W_t^i A_t^i = 0 \tag{84}$$

We left-multiply (81) by $\tilde{w}_t^{i,j\prime}$ to obtain

$$\tilde{w}_t^{i,j\prime} Id(i,j)[E_t^i(R_{t+1}) - E_t^i(R_{k,t+1})] = \gamma \tilde{w}_t^{i,j\prime} Id(i,j)(V^R - V_k^R) W_t^{i*} a_t^i \tag{85}$$

Using $\tilde{w}_t^{i,j\prime} Id(i,j) = \tilde{w}_t^{i,j\prime}$, we get

$$\begin{aligned}
\tilde{w}_t^{i,j\prime}[E_t^i(R_{t+1}) - E_t^i(R_{k,t+1})] &= \gamma \tilde{w}_t^{i,j\prime}(V^R - V_k^R) W_t^{i*} a_t^i \\
\tilde{w}_t^{i,j\prime} E_t^i(R_{t+1}) - E_t^i(R_{k,t+1}) &= \gamma \tilde{w}_t^{i,j\prime} V^R W_t^{i*} a_t^i - \gamma \underbrace{\tilde{w}_t^{i,j\prime} V_k^R}_{v_k^R} W_t^{i*} a_t^i \\
&= \underbrace{\gamma \tilde{w}_t^{i,j\prime} V^R W_t^i a_t^i}_{\tilde{w}_t^{i,j\prime} E_t^i(R_{t+1}) - r} + (1-p)\gamma \tilde{w}_t^{i,j\prime} V^R (W_t^{i*} - \bar{W}^i) a_t^i - \gamma v_k^R W_t^{i*} a_t^i \\
&= \tilde{w}_t^{i,j\prime} E_t^i(R_{t+1}) - r + (1-p)\gamma \bar{w}^{i,j\prime} V^R (W_t^{i*} - \bar{W}^i) a_t^i \\
&+ p(1-p)\gamma (w_t^{i,j*\prime} - \bar{w}^{i,j\prime}) V^R (W_t^{i*} - \bar{W}^i) a_t^i + \gamma v_k^R W_t^{i*} a_t^i
\end{aligned} \tag{86}$$

Note that the the term $(w_t^{i,j*\prime} - \bar{w}^{i,j\prime}) V^R (W_t^{i*} - \bar{W}^i) a_t^i$ is equal to $Cov(R_{p,t+1}^{i,j*} - \bar{R}_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i*} - \bar{\mathcal{R}}_{p,t+1}^i) \sum_{j=1}^{J(i)} a_t^{i,j}$, where $\mathcal{R}_{p,t+1}^i = \sum_{j=1}^{J(i)} (\sum_{k \in \mathcal{S}(i,j)} \tilde{w}_{k,t}^{i,j} R_{k,t+1}) a_t^{i,j} / (\sum_{j=1}^{J(i)} a_t^{i,j})$ refers to the conditional returns of the whole equity portfolio of investor i.

Besides, note that the term $\bar{w}^{i,j\prime} V^R (W_t^{i*} - \bar{W}^i)$ can be approximated by zero, using a similar arguments as in the proof of Lemma 4.1.

Therefore, we have

$$\tilde{w}_t^{i'} E_t^i(R_{t+1}) - E_t^i(R_{k,t+1}) = \tilde{w}_t^{i,j'} E_t^i(R_{t+1}) - r + \gamma v_k^R W_t^{i*} a_t^i + p(1-p)\gamma Cov(R_{p,t+1}^{i,j*} - \bar{R}_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i*} - \bar{\mathcal{R}}_{p,t+1}^{i}) \left(\sum_{j=1}^{J(i)} a_t^{i,j}\right) \quad (87)$$

After rearranging this equation, we obtain

$$\begin{aligned} w_{k,t}^{i,j*} a_t^{i,j} = & \frac{E_t^i(R_{k,t+1}) - r}{\gamma[V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j*})]} \\ & - \frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j*})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j*})} a_t^{i,j} \\ & - \frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j*})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j*})} \left(\sum_{j'=1}^{J(i),j'\neq j} a_t^{i,j'}\right) \\ & + p(1-p) \frac{V(R_{p,t+1}^{i,j*} - \bar{R}_{p,t+1}^{i,j})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j*})} \left(\sum_{j=1}^{J(i)} a_t^{i,j}\right) \end{aligned} \quad (88)$$

where $w_{k,t}^{i,j*} a_t^{i,j}$ is the total flow to country k from investor i if the fund updates its portfolio, $Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j*}) = Cov(R_{k,t+1}, \sum_{j,j\neq k}^{N} w_{j,t}^{i*} R_{j,t+1}/(1 - w_{k,t}^{i*}))$ is the covariance between the return of the country k asset and the optimal fund j portfolio that excludes country k, and $Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j*}) = Cov(R_{k,t+1}, \sum_{j'=1}^{J(i),j'\neq j} \left(\sum_{k\in\mathcal{S}(i,j')} \tilde{w}_{k,t}^{i,j'} R_{k,t+1}) a_t^{i,j'} / (\sum_{j=1}^{J(i)} a_t^{i,j})\right)$ is the covariance between the return of the country k asset and the optimal investor i portfolio that excludes fund j.

Using a similar arguments as in the proof of Lemma 4.1, we argue that $Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j*}) = Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})$ and $Cov(R_{k,t+1}, R_{p,j^-,t+1}^{i,j*}) = Cov(R_{k,t+1}, R_{p,j^-,t+1}^{i,j})$. This, together with $\tilde{w}_{k,t}^{i,j} = pw_{k,t}^{i,j*} + (1-p)\bar{w}_k^{i,j}$, yields

$$\begin{aligned}
w_{k,t}^{i,j*} a_t^{i,j} =& \frac{E_t^i(R_{k,t+1}) - r}{\gamma[V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})]} \\
& - \frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})} a_t^{i,j} \\
& - \frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})} \left(\sum_{j'=1}^{J(i),j'\neq j} a_t^{i,j'} \right) \\
& + p(1-p) \frac{V(R_{p,t+1}^{i,j*} - \bar{R}_{p,t+1}^{i,j})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})} \left(\sum_{j=1}^{J(i)} a_t^{i,j} \right)
\end{aligned} \tag{89}$$

This yields Equation (53), by applying .

By left-multiplying Equation (80) by $\frac{a_t^{i'}}{\sum_{j=1}^{J(i)} a_t^{i,j}}$, we can show that the total share allocated to equity $\left(\sum_{j=1}^{J(i)} a_t^{i,j}\right)$ must satisfy

$$\begin{aligned}
\left(\sum_{j=1}^{J(i)} a_t^{i,j} \right) &= \left(\gamma \frac{a_t^{i'}}{\sum_{j=1}^{J(i)} a_t^{i,j}} \tilde{W}_t^{i'} V^R \tilde{W}_t^i \frac{a_t^i}{\sum_{j=1}^{J(i)} a_t^{i,j}} \right)^{-1} \left(\frac{a_t^{i'}}{\sum_{j=1}^{J(i)} a_t^{i,j}} \tilde{W}_t^{i'} E_t^i(R_{t+1}) - r \right) \\
&= \frac{E_t^i(\mathcal{R}_{p,t+1}^i) - r}{\gamma V(\mathcal{R}_{p,t+1}^i)}
\end{aligned} \tag{90}$$

This yields Equation (55).

We can also derive $a_t^{i,j}$. To do so, we focus on the j^{th} line of Equation (80):

$$\begin{aligned}
\underbrace{\tilde{w}_t^{i,j'} E_t^i(R_{t+1})}_{E^i(R_{p,t+1}^{i,j})} - r &= \gamma \tilde{w}_t^{i,j'} V^R \tilde{W}_t^i a_t^i \\
&= \gamma \underbrace{\tilde{w}_t^{i,j'} V^R \tilde{w}_t^{i,j}}_{V(R_{p,t+1}^{i,j})} a_t^{i,j} + \gamma \underbrace{\tilde{w}_t^{i,j'} V^R \tilde{W}_t^{i,j^-} a_t^{i,j^-}}_{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})\left(\sum_{j'=1}^{J(i),j'\neq j} a_t^{i,j'}\right)}
\end{aligned} \tag{91}$$

where $\tilde{W}_t^{i,j^-}$ contains all the columns of $\tilde{W}_t^{i,j}$ except $\tilde{w}_t^{i,j}$ and a_t^{i,j^-} contains all the elements of a_t^i except $a_t^{i,j}$. This yields

$$a_t^{i,j} = \frac{E_t^i(R_{p,t+1}^{i,j}) - r}{\gamma[V(R_{p,t+1}^{i,j}) - Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})]} - \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V(R_{p,t+1}^{i,j}) - Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})} \left(\sum_{j=1}^{J(i)} a_t^{i,j} \right) \tag{92}$$

This yields Equation (54).

B.5 Proof of Proposition A.1

We left-multiply (82) by $\bar{w}^{i,j'}$ and expand it:

$$\begin{aligned}\bar{w}_t^{i,j'}\bar{E}^i(R_{t+1}) - \bar{E}^i(R_{k,t+1}) &= \gamma\bar{w}^{i,j'}(\bar{V}^R - \bar{V}_k^R)\bar{W}^i\bar{E}^i(a_t^i) \\ &= \gamma\bar{w}^{i,j'}\bar{V}^R\bar{W}^i\bar{E}^i(a_t^i) - \gamma\bar{w}^{i,j'}\bar{V}_k^R\bar{W}^i\bar{E}^i(a_t^i)\end{aligned} \tag{93}$$

and note that

$$\gamma\bar{w}^{i,j'}\bar{V}^R\bar{W}^i\bar{E}^i(a_t^i) = \gamma\underbrace{\bar{w}^{i,j'}V^R\bar{w}^{i,j}}_{\bar{V}(\bar{R}_{p,t+1}^{i,j})}\bar{E}^i(a_t^{i,j}) + \gamma\underbrace{\bar{w}^{i,j'}V^R\bar{W}_t^{i,j^-}\bar{E}^i(a_t^{i,j^-})}_{\bar{C}ov(\bar{R}_{p,t+1}^{i,j},\bar{\mathcal{R}}_{p,t+1}^{i,j^-})\left(\sum_{j'=1}^{J(i),j'\neq j}\bar{E}^i(a_t^{i,j'})\right)} \tag{94}$$

We then obtain

$$\underbrace{\bar{w}_t^{i,j'}\bar{E}^i(R_{t+1})}_{\bar{E}^i(\bar{R}_{p,t+1}^{i,j})} - \bar{E}^i(R_{k,t+1}) = \gamma\bar{V}(\bar{R}_{p,t+1}^{i,j})\bar{E}^i(a_t^{i,j}) + \gamma\bar{C}ov(\bar{R}_{p,t+1}^{i,j},\bar{\mathcal{R}}_{p,t+1}^{i,j^-})\left(\sum_{j'=1}^{J(i),j'\neq j}\bar{E}^i(a_t^{i,j'})\right) - \gamma\bar{v}_k^R\bar{W}^i\bar{E}^i(a_t^i) \tag{95}$$

We define $\bar{a}^i$ such that

$$\bar{a}^i = \left(\gamma\bar{W}^{i'}V^R\bar{W}^i\right)^{-1}\left(\bar{W}^{i'}\bar{E}^i(R_{t+1}) - r\right) \tag{96}$$

$\bar{a}^i$ is the investments share to fund i that would be consistent with the beginning-of-period information $\bar{\mathcal{I}}^i$. Note that this is not necessarily equal to $\bar{E}^i(a_t^i)$, the expected share conditional on $\bar{\mathcal{I}}^i$, which should satisfy (83). rom this equation, we can infer $\bar{a}^{i,j}$:

$$\bar{a}^{i,j} = \frac{\bar{E}^i(\bar{R}_{p,t+1}^{i,j}) - r}{\gamma[\bar{V}(\bar{R}_{p,t+1}^{i,j}) - \bar{C}ov(\bar{R}_{p,t+1}^{i,j},\bar{\mathcal{R}}_{p,t+1}^{i,j^-})]} - \frac{\bar{C}ov(\bar{R}_{p,t+1}^{i,j},\bar{\mathcal{R}}_{p,t+1}^{i,j^-})}{V(\bar{R}_{p,t+1}^{i,j}) - \bar{C}ov(\bar{R}_{p,t+1}^{i,j},\bar{\mathcal{R}}_{p,t+1}^{i,j^-})}\left(\sum_{j=1}^{J(i)}\bar{a}_t^{i,j}\right) \tag{97}$$

We can therefore replace $\bar{E}^i(\bar{R}^{i,j}_{p,t+1}) - r$ in Equation (95) and write

$$\gamma \bar{v}^R_k \bar{W}^i \bar{E}^i(a^i_t) = -\gamma[\bar{V}(\bar{R}^{i,j}_{p,t+1}) - \bar{C}ov(\bar{R}^{i,j}_{p,t+1}, \bar{\mathcal{R}}^{i,j^-}_{p,t+1})]\bar{a}^{i,j} - \gamma \bar{C}ov(\bar{R}^{i,j}_{p,t+1}, \bar{\mathcal{R}}^{i,j^-}_{p,t+1}) \left(\sum_{j=1}^{J(i)} \bar{a}^{i,j}_t \right)$$
$$+ \left[\bar{E}^i(R_{k,t+1}) - r\right] + \gamma \bar{V}(\bar{R}^{i,j}_{p,t+1}) \bar{E}^i(a^{i,j}_t) + \gamma \bar{C}ov(\bar{R}^{i,j}_{p,t+1}, \bar{\mathcal{R}}^{i,j^-}_{p,t+1}) \left(\sum_{j'=1}^{J(i),j' \neq j} \bar{E}^i(a^{i,j'}_t) \right) \tag{98}$$
$$= \bar{E}^i(R_{k,t+1}) - r + \gamma[\bar{V}(\bar{R}^{i,j}_{p,t+1}) - \bar{C}ov(\bar{R}^{i,j}_{p,t+1}, \bar{\mathcal{R}}^{i,j^-}_{p,t+1})] \left[\bar{E}^i(a^{i,j}_t) - \bar{a}^{i,j}\right]$$
$$+ \gamma \bar{C}ov(\bar{R}^{i,j}_{p,t+1}, \bar{\mathcal{R}}^{i,j^-}_{p,t+1}) \left[\left(\sum_{j=1}^{J(i)} \bar{E}^i(a^{i,j}_t) \right) - \left(\sum_{j=1}^{J(i)} \bar{a}^{i,j}_t \right) \right] \tag{99}$$

Assuming that $\bar{E}^i(a^i_t) \simeq \bar{a}^i_t$ and after rearranging this equation, we obtain

$$\bar{w}^{i,j}_k \bar{E}^i(a^{i,j}_t) = \frac{\bar{E}^i(R_{k,t+1}) - r}{\gamma[\bar{V}(\bar{R}_{k,t+1}) - \bar{C}ov(\bar{R}_{k,t+1}, \bar{R}^{i,j}_{p,k^-,t+1})]}$$
$$- \frac{\bar{C}ov(\bar{R}_{k,t+1}, \bar{R}^{i,j}_{p,k^-,t+1}) - \bar{C}ov(\bar{R}_{k,t+1}, \bar{\mathcal{R}}^{i,j}_{p,j^-,t+1})}{\bar{V}(\bar{R}_{k,t+1}) - \bar{C}ov(\bar{R}_{k,t+1}, \bar{R}^{i,j}_{p,k^-,t+1})} \bar{E}^i(a^{i,j}_t)$$
$$- \frac{\bar{C}ov(\bar{R}_{k,t+1}, \bar{\mathcal{R}}^{i,j}_{p,j^-,t+1})}{\bar{V}(\bar{R}_{k,t+1}) - \bar{C}ov(\bar{R}_{k,t+1}, \bar{R}^{i,j}_{p,k^-,t+1})} \left(\sum_{j=1}^{J(i)} \bar{E}^i(a^{i,j}_t) \right) \tag{100}$$

We then multiply both sides of this equation by $a^{i,j}_t / \bar{E}^i(a^{i,j}_t)$:

$$\bar{w}^{i,j}_k a^{i,j}_t = \frac{\bar{E}^i(R_{k,t+1}) - r}{\gamma[\bar{V}(\bar{R}_{k,t+1}) - \bar{C}ov(\bar{R}_{k,t+1}, \bar{R}^{i,j}_{p,k^-,t+1})]} \frac{a^{i,j}_t}{\bar{E}^i(a^{i,j}_t)}$$
$$- \frac{\bar{C}ov(\bar{R}_{k,t+1}, \bar{R}^{i,j}_{p,k^-,t+1}) - \bar{C}ov(\bar{R}_{k,t+1}, \bar{\mathcal{R}}^{i,j}_{p,j^-,t+1})}{\bar{V}(\bar{R}_{k,t+1}) - \bar{C}ov(\bar{R}_{k,t+1}, \bar{R}^{i,j}_{p,k^-,t+1})} a^{i,j}_t$$
$$- \frac{\bar{C}ov(\bar{R}_{k,t+1}, \bar{\mathcal{R}}^{i,j}_{p,j^-,t+1})}{\bar{V}(\bar{R}_{k,t+1}) - \bar{C}ov(\bar{R}_{k,t+1}, \bar{R}^{i,j}_{p,k^-,t+1})} \left(\sum_{j=1}^{J(i)} \bar{E}^i(a^{i,j}_t) \right) \frac{a^{i,j}_t}{\bar{E}^i(a^{i,j}_t)} \tag{101}$$

We multiply Equation (89) by p and Equation (101) by $1 - p$ and sum both equations.

Using Assumption 4.1, we obtain

$$
\begin{aligned}
a_{k,t}^{i,j} =& p\frac{E_t^i(R_{k,t+1}) - r}{\gamma V_k^{i,j}} \\
& - \left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_k^{i,j}}\right) a_t^{i,j} \\
& + (1-p)\left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma V_k^{i,j} \bar{E}^i(a_t^{i,j})}\right) a_t^{i,j} \\
& - p\frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})}\left(\sum_{j=1}^{J(i)} a_t^{i,j}\right) \\
& + p^2(1-p)\frac{V(R_{p,t+1}^{i,j*} - \bar{R}_{p,t+1}^{i,j})}{V(R_{k,t+1}) - Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})}\left(\sum_{j=1}^{J(i)} a_t^{i,j}\right) \qquad (102)
\end{aligned}
$$

This yields Equation (56).

B.6 Proof of Corollary 4.2

Consider $\beta_k^{i,j}$ and $\delta_k^{i,j}$ as defined in equation (57). $\beta_k^{i,j}$ is increasing in p and $\delta_k^{i,j}$ is decreasing in p.

Now consider $\beta_k^{i,j} + \delta_k^{i,j} + \theta_k^{i,j}$. After rearranging, we get

$$
\begin{aligned}
\beta_k^{i,j} + \delta_k^{i,j} + \theta_k^{i,j} = & \left(\frac{1}{\bar{E}^i a_{k,t}^{i,j} \gamma V_k^i}\right)\Bigg[p\left(1 - \frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}\right) \\
+(1-p)&\left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma V_p^{i,j} \bar{E}^i(a_t^{i,j})}\right)\left(1 - \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}}\right) \\
& - \left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}\right)\left(1 - \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}}\right)\Bigg] \qquad (103)
\end{aligned}
$$

Using Equation (80), we obtain

$$\beta_k^{i,j} + \delta_k^{i,j} + \theta_k^{i,j} = \left(\frac{1}{\bar{E}^i a_{k,t}^{i,j} \gamma V_k^i}\right) \Bigg[p \left(1 - \frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}\right)$$

$$+ (1-p) \left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j}) \left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\bar{E}^i(R_{p,t+1}^{i,j}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j}) \left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}\right) \left(1 - \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}}\right)$$

$$- \left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}\right) \left(1 - \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}}\right) \Bigg] \tag{104}$$

Assumption 4.4 implies that $\bar{E}^i(R_{k,t+1}) = \bar{E}^i(R_{p,t+1}^{i,j})$ and $Cov(R_{k,t+1}, \mathcal{R}_{p,t+1}^{i,j^-}) = Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})$, then

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

$$\left(\frac{1}{\bar{E}^i a_{k,t}^{i,j} \gamma V_k^i}\right) \left(1 - \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}}\right) \left[1 - \left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}\right)\right] \tag{105}$$

which is independent of p.

Finally, we can write $\theta_k^{i,j}$:

$$\theta_k^{i,j} = \left(\frac{1}{\gamma V_k^{i,j} \bar{E}^i a_{k,t}^{i,j}}\right) \Bigg[-p \frac{Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}$$

$$- \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}} \Bigg((1-p) \left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j}) \left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma V_p^{i,j} \bar{E}^i(a_t^{i,j})}\right)$$

$$- \left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}\right) \Bigg) \Bigg] \tag{106}$$

Again, we use Equation (80) and Assumption 4.4 and show that

$$\theta_k^{i,j} = -\left(\frac{1}{\gamma V_k^{i,j} \bar{E}^i a_{k,t}^{i,j}}\right) \frac{Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}} \left[1 - \left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})}{V_p^{i,j}}\right)\right] \tag{107}$$

which is independent of p.

As a result, $\theta_k^{i,j} = -\tau_k^{i,j} Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})/V_p^{i,j}$, with

$$\tau_k^{i,j} = \left(\frac{1}{\gamma V_k^{i,j} \bar{E}^i a_{k,t}^{i,j}}\right) \left[1 - \left(\frac{Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j}) - Cov(R_{k,t+1}, \mathcal{R}_{p,t+1}^{i,j^-})}{V_p^{i,j}}\right)\right] \tag{108}$$

Now we consider $\beta_k^{i,j}/\eta_k^{i,j}$:

$$\begin{aligned}
\frac{\beta_k^i}{\eta_k^i} &= \frac{p\frac{1}{\gamma V_k^i \bar{E}^i(a_{k,t}^{i,j})}}{(1-p)\left(\frac{1}{\bar{E}^i a_{k,t}^{i,j}}\right)\left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma^2 V_k^i V_p^{i,j} \bar{E}^i(a_t^{i,j})}\right)} \\
&= \frac{p}{(1-p)\left(\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,t+1}^{i,j^-})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma V_p^{i,j} \bar{E}^i(a_t^{i,j})}\right)}
\end{aligned} \tag{109}$$

Then, note that $\bar{E}^i(a_t^{i,j}) \simeq \frac{\bar{E}^i(R_{p,t+1}^i) - r - \gamma Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\gamma V_p^i}$. Therefore,

$$\frac{\beta_k^i}{\eta_k^i} = \frac{p}{(1-p)\frac{\bar{E}^i(R_{k,t+1}) - r - \gamma Cov(R_{k,t+1}, \mathcal{R}_{p,t+1}^{i,j^-})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}{\bar{E}^i(R_{p,t+1}^i) - r - \gamma Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})\left(\sum_{j=1}^{J(i)} \bar{E}^i a_t^{i,j}\right)}} \tag{110}$$

Under Assumption 4.4, $Cov(R_{k,t+1}, \mathcal{R}_{p,t+1}^{i,j^-}) = Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j^-})$ and $\bar{E}^i(R_{k,t+1}) = \bar{E}^i(R_{p,t+1}^i)$. Therefore, $\beta_k^i/\eta_k^i = p/(1-p)$.

C Data Appendix

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

According to Equation (29), $\Delta Cov_k^{i,j}$ is the difference between the scaled conditional covariance of the country return k with the fund-level return excluding country k with the fund-level return excluding country k $Cov(R_{k,t+1}, R_{p,k^-,t+1}^{i,j})/V_p^{i,j}$ and the scaled conditional covariance of the country return k with the investor-level return excluding fund j and $Cov(R_{k,t+1}, \mathcal{R}_{p,j^-,t+1}^{i,j})/V_p^{i,j}$. We proxy for these scaled covariances by using the surprises in GDP growth at the investor level.

Define the aggregate fund-level growth, the aggregate fund-level growth excluding country

k and the aggregate investor-level growth excluding fund j respectively as follows:

$$g_{p,k-,t}^{j,\text{next year}} = \sum_{l\neq k, l\in K(i,j)} \frac{w_{l,t}^{i,j}}{\sum_{l\neq k, l\in K(i,j)} w_{l,t}^{i,j}} g_{l,t}^{\text{next year}},$$

$$g_{p,t}^{j,\text{next year}} = \sum_{l\in K(i,j)} \frac{w_{l,t}^{i,j}}{\sum_{l\in K(i,j)} w_{l,t}^{i,j}} g_{l,t}^{\text{next year}},$$

$$g_{p,j-,t}^{i,\text{next year}} = \sum_{l\neq j, l\in J(i)} \frac{A_t^{i,l}}{\sum_{l\neq j, l\in J(i)} A_t^{i,l}} g_{p,t}^{j,\text{next year}}, \tag{111}$$

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 $g_{l,t}^{\text{next year}}$ is the country l's next year GDP growth in percent. We measure this realized growth rate as the first release in the IMF World Economic Outlook published in April of the following year, as Benhima and Bolliger (2023). We then define the investor surprises as $FE_{p,k-,t}^{i,j} = g_{p,k-,t}^{j,\text{next year}} - E_t^i(g_{p,k-,t}^{j,\text{next year}})$, the error on the partial fund-level growth, $FE_{p,t}^{i,j} = g_{p,t}^{j,\text{next year}} - E_t^i(g_{p,t}^{j,\text{next year}})$, the error on the full fund-level growth, $FE_{p,j-,t}^{i} = g_{p,j-,t}^{i,\text{next year}} - E_t^i(g_{p,j-,t}^{i,\text{next year}})$ the error on the partial investor-level growth and $FE_{k,t}^{i} = g_{k,t}^{\text{next year}} - E_t^i(g_{k,t}^{\text{next year}})$, the error on country growth. We then compute the scaled conditional covariances by country and fund-investor pair, $\frac{Cov^i(FE_k^i, FE_{p,k-}^{i,j})}{Var(FE_p^{i,j})}$ and $\frac{Cov^i(FE_k^i, FE_{p,j-}^{i})}{Var(FE_p^{i,j})}$. We then compute $\Delta Cov_k^{i,j}$ as the differential

$$\Delta Cov_k^{i,j} = \frac{Cov^i(FE_k^i, FE_{p,k-}^{i,j})}{Var(FE_p^{i,j})} - \frac{Cov^i(FE_k^i, FE_{p,j-}^{i})}{Var(FE_p^{i,j})}$$

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

$$\Delta Cov_t^{i,j} = \sum_{l\in K(i,j)} \frac{1}{T}\left(\sum_t \frac{w_{l,t}^{i,j}}{\sum_{l\in K(i,j)} w_{l,t}^{i,j}}\right) \Delta Cov_k^{i,j}$$

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 country-fund pairs for which we have less than 5 years of expectation data. The sample size is only slightly reduced as compared to Table 1.

C.2 Estimation of $Cov^{i,j}$

According to Equation (36), $Cov^{i,j}$ is the scaled conditional covariance of the fund-level return excluding country with the investor-level return excluding fund j and $Cov(R_{p,t+1}^{i,j}, \mathcal{R}_{p,t+1}^{i,j-})/V_p^{i,j}$.

We proxy for this scaled covariance using the surprises in GDP growth at the investor level.

The aggregate fund-level growth and the aggregate investor-level growth excluding fund j are defined above. We then compute the scaled conditional covariance by fund-investor pair, $Cov^{i,j} = \frac{Cov^i(FE_p^{i,j}, FE_{p,j-}^i)}{Var(FE_p^{i,j})}$, where $FE_p^{i,j}$ and $FE_{p,j-}^i$ are defined above, and estimate Cov^i as the weighted average at the investor level:

$$Cov^i = \sum_{l \in J(i)} \frac{1}{T} \left(\sum_t \frac{A_t^{i,l}}{\sum_{l \in J(i)} A_t^{i,l}} \right) Cov^{i,j}$$

In order to have a consistent estimation Cov^i, we exclude investor-fund pairs for which we have less than 5 years of expectation data.

C.3 Summary Statistics for $\Delta Cov^{i,j}$ and Cov^i

Table 5: Summary Statistics for $\Delta Cov^{i,j}$ and Cov^i

Variable	Mean	Median	S.D.	Min	Max
$\Delta Cov^{i,j}$	-.05	-.04	.12	-.62	.23
Cov^i	1.16	1.03	.44	.57	2.32

C.4 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:

$$E_t^i(g_k^{\text{next year}}) = E_{year}^i(g_k^{\text{next year}}) + u_{year,month,k}^i \tag{112}$$

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:

$$E_{year}^i(g_k^{\text{next year}}) = X_{k,year} + \zeta_k^i + v_{k,year}^i \tag{113}$$

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

$$v^i_{k,year} = \rho^v v^i_{k,year-1} + \tilde{v}^i_{k,year} \tag{114}$$

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 (113) 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 (114) 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:

$$u^i_{year,month,k} = Y_{year,month,k} + e^i_{year,month,k} \tag{115}$$

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:

$$e^i_{year,month,k} = \rho^e e^i_{year,month-1,k} + \tilde{e}^i_{year,month,k} \tag{116}$$

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 (115) 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 (116) 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:

$$\widehat{E}^i_t(g^{\text{next year}}_k) = \widehat{X}_{k,year} + \widehat{v}^i_{k,year} + \widehat{Y}_{year,month,k} + \widehat{e}^i_{year,month,k} \tag{117}$$

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 (113) and (115), if investor i has expectation data for country k, or they are simulated using the data-generating processes (114) and (116), using our estimates of ρ^v, ρ^e, σ_k^v and σ_k^e.