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Emerging market capital flows: the role of fund manager portfolio allocation*

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Abstract: We exploit individual security holdings data for global mutual funds to distinguish between two reasons why a fund's holdings of emerging market economy (EME) bonds might change: (i) the amount invested in the fund changes and (ii) the fund manager changes portfolio allocations. We find that funds' responsiveness to global macroeconomic conditions, "push factors", is explained by investor flow decisions. Conversely, funds' responsiveness to local macroeconomic conditions, "pull factors", is explained by manager reallocation decisions. We also identify other institutional factors which impact reallocation decisions: their leverage, their benchmark, and risk appetite (funds reallocate towards safer EMEs when global risk increases).

Keywords: mutual funds, capital flows, emerging markets, portfolio allocation
JEL Classification: F32, G11, G15, G23

Resumen: Empleamos datos desagregados de las tenencias de los fondos de inversión globales para distinguir entre las dos razones por las que pueden cambiar las tenencias de bonos de economías de mercado emergentes (EMEs) por parte de los fondos: (i) el monto invertido en el fondo puede cambiar y (ii) el administrador del fondo puede modificar la asignación del portafolio. Encontramos que la respuesta de los fondos a las condiciones macroeconómicas globales, "push factors", se explica por las decisiones de los inversionistas del fondo. Por otro lado, la respuesta de los fondos a las condiciones macroeconómicas locales, "pull factors", se explica por las reasignaciones en las tenencias por cuenta de los administradores de los fondos. Adicionalmente, identificamos otros factores instituciones que impactan las decisiones de reasignación: cambios en el apalancamiento, su índice de referencia, y su apetito de riesgo (los fondos reasignan recursos hacia EMEs más seguros ante incrementos en factores globales de riesgo).

Palabras Clave: Fondos mutuos, flujos de capital, mercados emergentes, asignación de portafolio

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1 Introduction

Emerging market economies' (EMEs)[1] participation in global financial markets has increased in recent decades. At end-2018, their external assets and liabilities were equivalent to around 130% of GDP, a near historic high for this measure of financial openness (Figure 1). Around 20% of EME bonds are now held by foreign investors, compared to 16.5% in 2006 (Figure 2).

Whilst foreign capital inflows can support economic growth, sudden surges or reversals can threaten economic and financial stability. Capital inflows can facilitate the adoption of more advanced technologies and reduce the cost of capital by enabling better global allocation of risk (Rogoff et al., 2004). Surges in capital inflows can, however, appreciate exchange rates and fuel excessive credit growth and current account deficits (Elekdag et al., 2009). And sudden reversals of such capital inflows can lead to currency crises, financial crises and slower economic growth (Calvo and Reinhart, 2000).

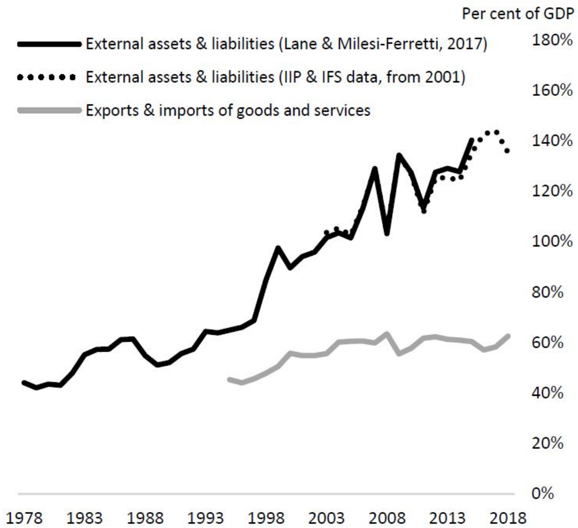
Certain types of foreign capital flows, such as portfolio debt flows, are particularly volatile (Pagliari and Hannan, 2017). The volatility of portfolio debt flows may have been exacerbated by the growth of mutual funds, which are susceptible to herding behaviour and liquidity shocks (IMF, 2019). In particular, open-ended mutual funds (OEFs) allow investor redemptions at any time, increasing the potential for a "run" on this type of fund.

Given the potential negative consequences of capital flow volatility, this paper analyses the behavior of mutual funds' as a possible channel, with attention to the particular features of these financial intermediaries. To do this we construct a novel dataset exploiting data on individual securities in mutual funds' portfolios for 2011 to 2017. This granular data enables us to distinguish between the two principal drivers of changes in mutual funds' holdings of an EME bond: (i) changes in the amount invested in the fund (investor flows) and (ii) changes in fund managers' portfolio allocations (manager reallocation).

We draw four key conclusions from our results. First, funds' responsiveness to changes in global conditions - referred to as "push factors" in the capital flows literature - is explained by investor flow decisions. This could be because investor flows tend to be closely linked to past fund performance. In other words, fund investors redeem from funds when they perform poorly and subscribe to funds when they perform well,

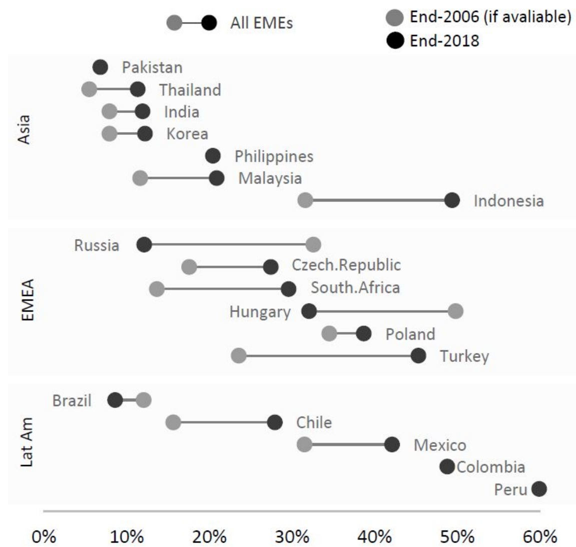
[1] We include as EMEs those countries classified as emerging markets by at least three of IMF, MSCI, S&P, Russell Group and Dow Jones. To this we add South Korea as it widely invested in by EME bond funds. We exclude UAE, Egypt and Taiwan as relevant financial and macroeconomic data are not available quarterly from 2011. We also remove Greece for sample coverage issues described in Section 2. The 18 remaining EMEs included in our analysis are shown in Figure 2.

Figure 1: Financial and trade openness for select EMEs



Financial openness defined as external assets and liabilities as a proportion of GDP. Trade openness defined as the sum of exports and imports as a proportion of GDP. Sources: IMF, Lane and Milesi-Ferretti (2018), World Bank and authors calculations.

Figure 2: Proportion of bonds held by overseas investors



Calculated as the value portfolio debt liabilities reported in IMF balance of payment statistics (for 2018) and Lane and Milesi-Ferretti (2018) (for 2006) divided by total debt liabilities reported by BIS.

so-called performance chasing. Also, global funds may invest in a group of EMEs to gain general exposure to this asset class. Thus their performance would be linked more closely to general EME performance than to specific individual EME performance.

Second, we find funds' responsiveness to changes in local macroeconomic conditions – or "pull factors" – is explained by manager reallocation decisions. Funds report their performance regularly (usually quarterly), and the threat of investor redemptions in response to poor relative returns creates incentives for managers to take short-term reallocation decisions to ensure their performance is no worse than their peers or their benchmark. Relative performance is in part determined by how they weight individual EMEs within their portfolio as compared to their peers and benchmark, Other institutional investors, such as pension funds, do not face short-term selling pressures created by short-dated liabilities and regular performance reporting.

Third, fund managers tend to reallocate towards safer emerging markets when global risk aversion increases. This could be motivated by liquidity concerns: funds are open-ended and so in anticipation of redemptions managers may seek to invest in more liquid EME bonds in times of stress (rather than hold additional cash which could dampen returns). Also, fund managers may be concerned about downside risks to their performance: prices of safer EME bonds are less volatile.

Fourth, other institutional factors are also relevant. Changes in the indices which funds benchmark against and fund leverage are also important drivers of manager reallocation decisions.

1.1 Related Literature

Our paper relates to two strands of literature: research on the drivers of global capital flows and the research on asset manager behavior. The intersection between these two bodies of literature is of growing relevance: overseas mutual funds are an increasingly important source of credit for EMEs. Mutual fund flows to emerging markets now account for around one third of total portfolio flows, compared to around one tenth pre-crisis (Carney, 2019). The assets of mutual funds investing in EME bonds have increased seven-fold since 2008 (Hui, 2018).[2]

Turning first to the capital flows literature. Many studies explore the implications of whether the capital flow takes the form equity, debt, FDI or bank lending. Cerutti et al. (2019) note that the relative importance of "push" factors varies greatly by type of flow. Bush (2019), for example, finds that capital account opening affects levels of FDI and inward equity flows, but not portfolio debt flows. Ghosh and Qureshi (2016) find that, compared to FDI, portfolio debt flows are associated with larger macroeconomic imbalances and financial vulnerabilities.

Other studies analyse the geography of the investor, differentiating between foreign and domestic investor flows. Ghosh and Qureshi (2016) find that foreign flows are more prone to causing economic overheating and domestic credit expansion than domestic flows. Forbes and Warnock (2012) focus on particular surges and "sudden stop" episodes for foreign flows finding these extreme events are associated with global factors. Broner et al. (2013) find that a collapse in foreigner inflows is often offset by a retrenchment in domestic outflows. Davis and Wincoop (2018) find that this correlation between foreign inflows and domestic outflows has increased substantially over time.

Where the capital flows literature analyses the role of particular types of investor, it often focuses on banks. That is partly given their historic importance: before the Great Financial Crisis (GFC), bank loans accounted for around 30% of non-FDI capital inflows to EMEs Cerutti and Hong (2018). And partly due to data availability: the Bank for International Settlements (BIS) publish data on cross-border bank lending. Takats (2010), for example, uses this data to conclude that cross-border bank lending to EMEs dropped during the GFC, principally due to a fall in the supply of overseas credit (rather than a lack of demand).

The limited literature which analyses capital flows associated with mutual funds has

[2]Meanwhile, the assets of open-ended investment funds (OEFs) globally have 'only' doubled (IIFA, 2019).

focused on decisions made by their benchmark providers and investors. Both Raddatz et al. (2017) and Arslanalp and Tsuda (2015) analyse the impact of changes to indices which funds benchmark against. They find that when a country's share of an index increases, it tends to receive positive capital inflows. Fratzscher (2012), using data on investor flows to/from funds, finds that "push factors" were the main drivers of capital flows during the GFC, while "pull factors" where more dominant in 2009/2010. Miyajima and Shim (2014) note that investor flows to funds reinforce EME asset price changes.

However these papers do not consider the decisions made by the fund managers themselves, a key factor that the broader asset management literature highlights. Around 98% of EME bond funds are actively managed (Shek et al., 2018). Managers often change their portfolios; for example when they experience investor redemptions. Manconi et al. (2012) find that in the GFC, funds which held both securitised bonds and corporate bonds tended to retain the former - which had become illiquid - and sell the latter. Funds thus reallocated away from corporate bonds towards securitised bonds. Morris et al. (2017) find that funds tend to hoard cash when facing redemptions, selling their bonds.

Unlike previous papers in the capital flows literature, we focus on whether fund manager reallocation decisions have an impact on portfolio debt flows to EMEs. Our findings suggest that, all else equal, the growth in global mutual fund holdings of EME bonds could make capital flows more responsive to changes in global and local macroeconomic conditions. The extent to which this affects EMEs will depend on the type of fund providing credit. Passive funds, which do not actively reallocate between assets unless their benchmark changes, respond predominantly to "push factors". Active funds respond to both "push factors" and "pull factors". We also show, like Cerutti et al. (2019), that sensitivity to global "push factors" varies by EME.

We also make two contributions to the asset management literature. First, we define and quantify portfolio debt flows driven by (i) investor-flows and (ii) manager reallocation decisions, exploiting security-level portfolio data. To our knowledge, this is the first paper that estimates and then analyses the dual role played by investor flows and manager reallocation in explaining mutual fund behavior. Second, we use a framework that combines both macroeconomic factors and a range of institutional factors characteristic of mutual funds (redemption management, leverage management and benchmark changes). Previous papers have focused on only a single institutional driver of manager allocation.

Our analysis has broad implications. In particular, we show that manager reallocation decisions are a greater driver of stress portfolio debt outflows from individual EMEs than investor flows. As such, reallocation decisions are relevant to analyses of fire-selling by mutual funds, and system-wide stress testing tools which model the behaviour of financial market participants (e.g.Calimani et al. (2017), Aikman et al. (2019)). Our method for distinguishing between (i) changes in capital available and (ii) reallocation decisions could also be applied to other non-bank institutions, data permitting.[3]

The remainder of the paper is structured as follows. Section 2 explains how we distinguish between investor flows and manager reallocation, and in doing so introduces our dataset. Section 3 assesses the extent to which these two components of mutual fund capital flows can be explained using a traditional push/pull framework. Section 4 extends this model to include institutional features which could also explain reallocation decisions. Section 5 briefly outlines the checks we have undertaken to verify the robustness of the results in the prior two sections. Section 6 concludes.

2 Distinguishing investor flows from manager reallocation

There are four reasons why the value of a fund's holding of a particular asset could change in any one period. First, the market price of the asset might change: fund managers mark their assets to market. Second, the currency in which the asset is denominated may appreciate or depreciate relative to the base currency of the fund. Third, the fund may experience a change in the amount of capital it is able to invest. Investment funds are mostly open-ended,[4] which means investors can choose to increase or decrease their investments in the fund at short-notice. As the amount invested in the fund waxes and wanes, the fund needs to buy and sell assets. We refer to this as "investor flows". Fourth, the fund may choose to change how it allocates its capital. Managers of active funds choose how much to invest in different assets, subject to any constraints in their mandate. To implement a change in their investment preferences, the manager can buy and sell assets. We refer to this as "manager reallocation".

To distinguish between these four effects, we exploit the security-level data from quarterly reports on funds' portfolios available through Morningstar. As far as we are aware, we are the first to use such data to analyse fund managers' reallocation behaviour.[5] The papers referenced above use price changes of country bond indices to estimate valuation effects (e.g. Morris et al. (2017),Raddatz et al. (2017),Arslanalp and

[3]For example, the Norwegian government recently announced the removal of EME bonds from the benchmark of the Government Pension Fund (Norway Ministry of Finance, 2019). We estimate this could lead to sales of around $9bn of EME bonds.

[4]For example at end-2018, US open-ended funds (OEFs) had around $21.4 trillion in assets under management. US closed-end funds had around $250 billion in assets under management (ICI, 2019).

[5]Maggiori et al. (2018) also use security level data but focus their analysis on the currency of mutual funds' investments.

Tsuda (2015)). However, as we have granular ISIN-level data on funds' portfolios, we are generally able to calculate the exact valuation change and FX effects experienced by funds. This means we do not mis-estimate valuation effects for funds whose portfolios do not match the country bond index (say because they invest in shorter-duration bonds or more hard-currency bonds).With this more precise estimate of valuation effects we can better analyse the residual changes in asset values.

Using Morningstar Direct, we first identify the top-1628 largest mutual fund investors in EME bonds. We then download the security-by-security data on their portfolios, before screening this dataset of funds' portfolios to ensure we only include data which is accurate and relevant. Specifically, we remove four sets of fund reports. First, funds which do not report full security-by-security portfolio data at the end of each quarter.[6] Second, duplicated reports of portfolio holdings. Third, we remove a funds' quarterly report if it is not preceded by a report for the prior quarter (or proceeded by a report for the following quarter). Fourth, we remove funds which are invested in the bonds of only one country. The vast majority of these funds are domiciled in the sole country in which they invest, and so we assume they are dedicated funds which can't reallocate from one country to another (so are are irrelevant to our analysis of reallocation behaviour). This reduces our sample size from 1628 funds to 391.[7] This is primarily due to the exclusion of funds which invest only in the bonds of one country.

Then we proceed to calculate for each security held in the portfolio, the valuation and currency effects on the value of the fund's overall holdings of that security. We can do this because We observe every security in the portfolio, both equities and bonds.

First, the change in the market value of each asset k in each portfolio between each quarter is calculated using one of seven pricing approaches. These approaches are set out in Annex B, in order of their precision. We are able to apply the most precise approach for around two-thirds of portfolio assets (and three-quarters of fund's bond assets). For these assets, we know the exact market value of the security used by the fund to calculate the fund's NAV at end-quarter. It is not possible to price all assets in this way, typically because they (i) don't have a unique ISIN which can track between quarters, (ii) the fund sells the asset between periods or (iii) the asset matures between quarters. In these situations, we use one of the six other less-precise pricing approaches.

Second, after pricing the securities, we calculate the change in the USD-value of the asset between quarters. Here, we apply a quarterly exchange rate change calculated using Bloomberg. **Valuation changes** $VC_{k,t}$ for asset k are thus comprised of changes

[6]But instead report intra-quarter, for example at end-May rather than end-June. These account for only 8% of funds by total asset value, and we run our regression analysis on end-quarter data

[7]For the pricing analysis – summarised in Annex B – when calculating the median price change over a quarter we include funds dropped for only investing in the assets of one country.

in the market prices of the asset and changes in relevant exchange rates, as set out in equation (1). For each asset k, AV is the total portfolio value of asset k in USD, AS is the number of shares the fund holds of that asset, and AC is the currency of that asset. Thus total valuation changes for fund j at time t are $\sum_{k \in j} VC_{k,t}$.

$$VC_{k,t} = AV_{k,t-1}\left(\frac{AV_{k,t}/AS_{k,t}}{AV_{k,t-1}/AS_{k,t-1}} - 1\right) + AV_{k,t-1}\left(\frac{AC_{k,t}/USD_t}{AC_{k,t-1}/USD_{t-1}} - 1\right) \quad (1)$$

We then calculate what we call **investor flows** for fund j as defined in equation (2), where PV is portfolio value (or NAV). Any change in portfolio value not due to price and FX changes, we call investor flows. This is a calculated measure that proxies for what we cannot observe directly. Furthermore, its accuracy depends on our underlying security level data.

$$InvestorFlows_{j,t} = PV_{j,t} - \left(PV_{j,t-1} + \sum_{k \in j} VC_{k,t})\right) \quad (2)$$

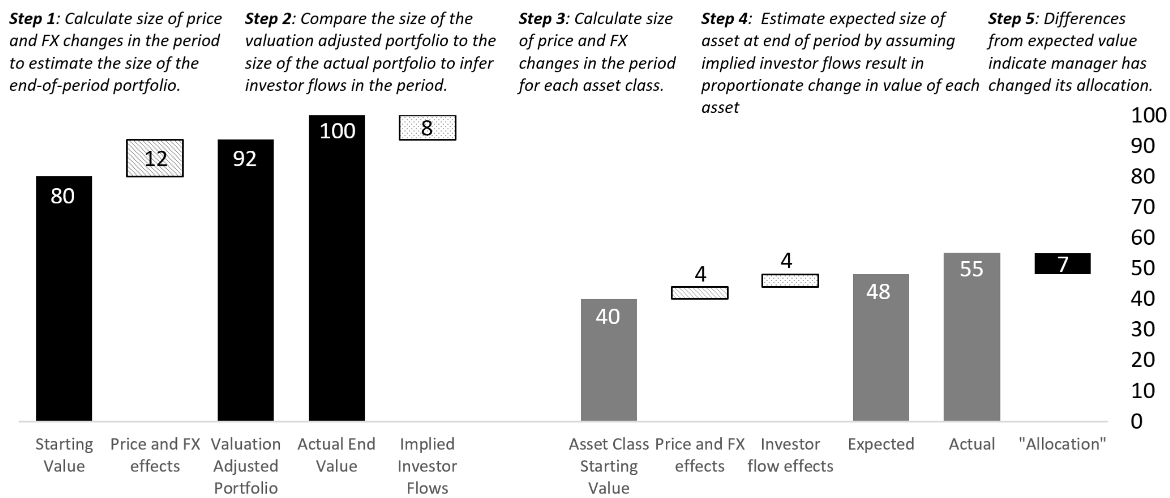
Our definition of manager reallocation is defined for asset k in equation 3. The change in the value of the fund's holdings of asset k, AV, not accounted for by valuation changes and investor flows, we accrue to portfolio **manager reallocation** ($MA_{j,k,t}$).

$$MA_{j,k,t} = AV_{j,k,t} - AV_{j,k,t-1}(1 + VC_{j,k,t}) - AV_{j,k,t-1}\left(\frac{InvestorFlows_{j,t}}{PV_{j,t-1}}\right) \quad (3)$$

Figure 3 describes the intuition behind our definitions. Security level data enables us to quantify valuation effects: that is, the impact of price and FX changes on a fund's portfolio over a period. By comparing the size of their valuation-adjusted portfolio at the end of a period to the reported size of the portfolio, we can infer changes in the amount investors have invested in the fund over that period (investor flows). We can then calculate, for each asset, what its portfolio value would have been at the end of the period had the manager not changed their allocation. That is, had investor flows resulted in a proportionate change in the AV of each security (i.e. 10% investor outflows results in a 10% fall in the holdings of each asset in the portfolio). Any difference between this expected value and the observed value indicates that the manager has changed how it allocates its capital.

As stated above, our method is an improvement and allows for better estimates of valuation and currency effects on a fund's portfolio. However, it relies on our ability to identify each security in the portfolio and track its market price and currency denomination in order to calculate these valuation and FX changes. When the data is not reported or faulty, we must use less precise techniques. Also, if the security is bought or sold during the quarter and there were dramatic changes within period, we will not capture this. Lastly, because our investor flow measure is a residual, and the manager allocation a further residual, these are subject to some measurement errors. Nevertheless, there is no reason to believe these measurement errors tilt consistently in one particular direction.

Figure 3: Calculating investor flows and manager allocation



Once we have applied our methodology for computing investor flows and manager reallocation, we clean the data further. First, we remove the quarterly-report for a fund if we are unable to calculate exchange-rate or price effects for more than 20% of their investments.[8] If we are unable to price a material proportion of securities in a portfolio, then we will inaccurately estimate portfolio flows and reallocation for individual securities.

Second, we remove the quarterly-report for a fund if the change in the total value of their assets is more than 15% different from the change in their reported net asset value (NAV).[9] These differences are rare and often due to the misreporting of a single security. This gives the impression of a larger-than-actual change in the holdings of that security, which our methodology would falsely attribute to reallocation decisions (as the change can't be explained through valuation effects or investor flows).

Third, we remove the quarterly report for a fund if there is a material change in

[8]We assume that, unless otherwise specified, cash securities are denominated in the base currency of the fund.

[9]Net asset value of a mutual fund is its trading price and set at the end of each day. It is defined as the assets of the fund (end of the day market value of its securities, cash and cash equivalents, plus any receivables and accrued income) minus its liabilities (lending received from banks, pending payments such as fees and charges, and all accrued operating expenses such as marketing and employee salaries).

assets for which portfolio data is not available. The funds' reported NAV is occasionally larger than the total value of assets for which we have ISIN level data. We treat these differences as "missing assets". When missing assets account for more than 33% of either total positive or negative reallocation decisions for the fund, we remove the fund quarterly report. Fourth, we remove the quarterly report for a fund if investor inflows exceed 20%. This is designed to capture funds which have been recently established and are expanding their NAV rapidly. Including such funds would bias our results when later analysing which factors determine investor flows.

Fifth, we remove the quarterly report for a fund where there is more than a 5% difference between our calculation and Morningstar's calculation for investor flows. Like us, Morningstar estimates investor flows for each fund by subtracting total net assets at the end of a period from total net assets at the start of the period, once adjusted for valuation effects. But Morningstar use daily and monthly data to calculate investor flows, whereas we use quarterly data. And they use portfolio-wide returns data provided by fund managers, whereas we use asset-by-asset returns inferred from quarterly portfolio changes. This given, Morningstar's estimates for investor flows will be more accurate, if still imperfect. We don't eliminate all but exact matches from our dataset as, given the above methodological differences, there will always be small differences in estimates for flows.[10]

We then check that our data does not over- or under-represent a particular EME.[11] We compare the total value of each EME's assets in the dataset to our estimate of their bonds held by non-domestic funds with discretion to divest (Chart 11 – Annex C). The coverage varies across EMEs, but the dataset is not dominated by one EME. It is, however, lacking data for Greece. We estimate we capture less than 1% of Greek bonds held in relevant funds at end-2017. Given that Greece also has the most extreme independent variables (such as real GDP growth in 2011), we remove it from the sample.

Finally, we aggregate security-level investor flow and manager reallocation effects by asset class and issuing country for each individual fund. We rely on Morningstar's classification of assets and countries for these purposes. We limit bonds to include government, corporate and local agency debt. Of the EME bonds held by our sample funds, the vast majority are government bonds. Detailed descriptive statistics for our sample, are included in Annex C.

[10] This leaves us with a large sample size, and the data looks reliable: regressing our implied flows against Morningstar estimated flows gives an R-squared of 96.4%.

[11] We also check that changes in the value of "missing assets" are not correlated with changes in the value of another asset class. They are not. Had they been correlated, changes which our methodology attributed to "reallocation" to/from a particular asset class could actually be driven by failure to consistently report a particular type of asset.

Our final sample includes data for 271 funds managed by 106 different managers. The data for a typical quarter, includes around 160 funds. That is partly because funds enter and leave the dataset throughout the sample period, but also because we remove the quarterly report of a fund if there is evidence we may not be able to reliably estimate reallocation decisions for that quarter due to missing data. The sample size for each quarter is shown in Figure 7 in Annex C), along side Figures 8-10 which show that the broad characteristics of the sample remain similar through time.

The funds in our sample held $100bn of EME government bonds in Q3 2017. Whilst that is only 2% of EME government bond debt outstanding, we estimate it represents about a quarter of the sample we are interested in: bonds held in overseas mutual funds with discretion to divest.[12] Investments in EME bonds account for only 9% of our sample funds' investments. EME bonds are often commingled with other asset classes: less than a fifth of the bonds in our sample are held by funds for whom EME bonds account for more than 60% of their assets. At end-2017, 43% of bonds in our sample were issued by Latin American countries, with countries in Asia and EMEA accounting for 33% and 24% respectively. That was broadly in line with each regions' share of total EME government debt outstanding (43%, 37% and 20% respectively).

2.1 "Reallocation" as a driver of capital flows

What we term "reallocation" is any change in a fund's holding of an asset which cannot be explained by changes in the price of the asset, exchange rate effects, or changes in the level of capital available to the fund (investor flows). Reallocation can lead to a change in the holdings of a particular asset, but across all assets held by a fund these changes sum to zero. A manager must sell one asset to buy another. Or, as possible in the case of sales to meet investor outflows, sell more of one asset in order to not sell any of another.

There are multiple reasons why a fund manager might reallocate from one asset to another. These include the manager's macroeconomic assessment, a change in the index against which the manager benchmarks their return, or a desire to increase portfolio liquidity given possible future redemptions. We test the influence of these factors in Section 4.

As a motivation, this section presents the results of our analysis of two episodes where we identify a material impact from manager reallocation decisions. First, Figure 4 shows the change in holdings of EME bonds from each region as a percentage of

[12] Using Morningstar data we estimate that at end-2017 around $430bn of EME bonds were held in non-domestic mutual funds which were not dedicated to bonds from a particular EME).

the fund's NAV, for the median sized fund during the 2013 Taper Tantrum. Investor redemptions (outflows) and valuation effects both reduced the value of funds' holdings of bonds from all three regions. Notice that manager allocation offset these effects in Latin America and Emerging Europe, Middle East and Africa (EMEA), and contributed a meaningful portion of the fall in holdings of EME Asia bonds. The reasons for the regional differences are beyond the scope of this paper, the key point is the importance of our allocation component. The pattern we identify is consistent with country-level portfolio debt flows data from the IMF, which show foreign capital inflows to Asia were -2% in this period, compared to +2% in EMEA and +10% in Latin America.[13]

As a second example of the significance of reallocation, Figure 5 shows the changes in holdings of Hungarian bonds for the funds in our sample. Between 2012 and 2014, holdings of these bonds grew due to a combination of investor inflows, positive valuation effects and positive reallocation. But this reversed sharply in 2015 when managers reallocated strongly away from Hungary. This coincided with an effort by the Hungarian government to increase "self financing" (MNB, 2015). To achieve this, the government replaced hard-currency debt with local-currency debt and issued more retail focused bonds, while the central bank replaced two-week central bank bills with three-month time deposits. Combined, these changes had the effect of driving domestic banks into short dated Hungarian sovereign debt (MNB, 2016) - which the funds in our sample were large holders of. Indeed one manager alone held 14% of total Hungarian sovereign debt at the start of 2015 – a position which it reduced to 0% within 6 quarters.

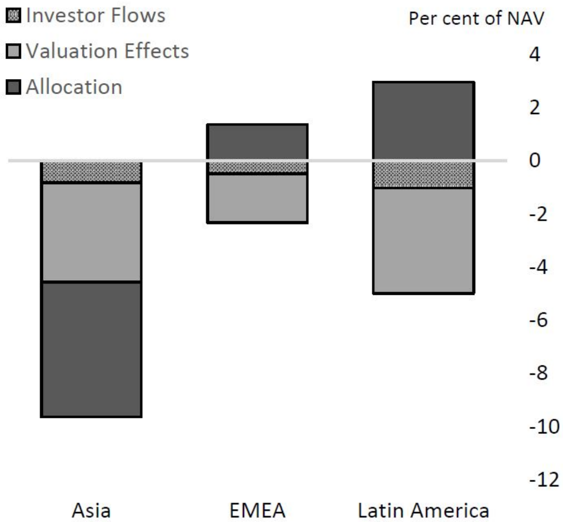
Consistent with this Hungarian case study, manager reallocation decisions are the more significant driver of portfolio debt outflows from individual countries. For each EME we identify the peak portfolio quarterly debt outflows they experienced between 2011 and 2017 using IMF data. In these quarters, manager reallocation decisions for our funds were equivalent to around 9% of the outflows. Sales due to investor flows were equivalent to around 4% of the outflows.

However, investor flows – or changes in the amount of capital a fund has available to investor – are the more significant driver of portfolio debt outflows from EMEs in aggregate. In quarters between 2011 and 2017 where aggregate fund holdings of EME bonds fell due to non-valuation effects, investor flows accounted for around three-quarters of the fall, while reallocation decisions only accounted for around one-quarter.

Our proxy of reallocation is imperfect as we don't know at what point in a quarter the manager changed its portfolio allocation. Our methodology assumes that transac-

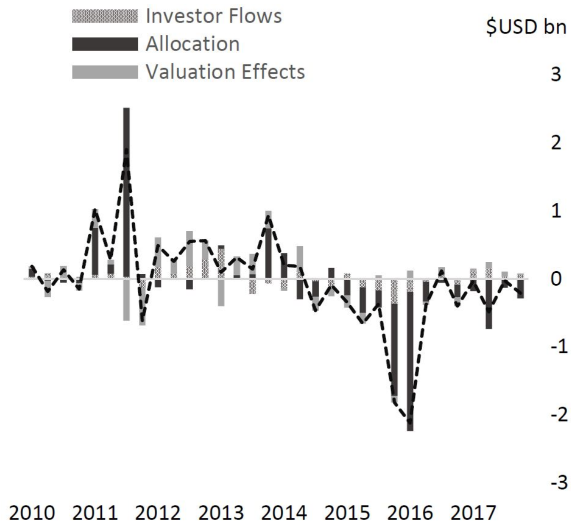
[13] These statistics include all of the EMEs in our sample, with the exception of Indonesia, South Africa, Malaysia and Russia as there is no IMF data for the quarterly stock of portfolio debt liabilities for these countries. The Taper Tantrum period defined as Q2 and Q3 2013.

Figure 4: Investor flows, valuation effects and reallocation in the 'Taper Tantrum'



Taper Tantrum defined as Q2 & Q3 2013. Chart shows, for the median fund, the change in holdings of bonds from each region as a percentage of the fund's starting NAV. Results are similar if mean is used to define the 'average' fund. Sources: Morningstar, Bloomberg & authors' calculations.

Figure 5: Drivers of changes in funds' holdings of Hungarian government bonds



BIS EME debt comparison just includes government debt as this accounts for the vast majority of our funds' holdings of bonds. Sources: Morningstar, Bloomberg & authors calculations.

tions take place at the end of each period. Say a fund holds \$5bn of Mexican bonds in both Q1 and Q2. But between these two quarters, the bonds experienced a 20% price rise. All else equal, our methodology would suggest that the funds' holdings of Mexican bonds increased to \$6bn, before the the fund sold \$1bn of them, leaving it with a residual \$5bn. Had we instead assumed that trading took place at the start of the quarter,[14] the methodology would suggest the fund sold \$0.83bn Mexican bonds, so its residual holdings of \$4.17bn Mexican bonds would experience the 20% price rise, such that it finished the quarter with \$5bn. Whilst our methodology overestimates reallocation when prices are rising, it underestimates it when prices are falling. Had there instead been a 20% price fall in the above example, our methodology would assume the fund had purchased \$1bn bonds. A methodology which assumed that trading took place at the start of the quarter would suggest purchases of \$1.25bn bonds. Nevertheless, our assumption ought to not result in a misleading estimate of the average size of reallocation effects because local currency EME bond prices fluctuated around the same level between 2011 and 2017.

[14]Calculating manager reallocation instead as

$$ManagerReallocation_{t,i} = \frac{AV_{i,t}}{1+VC_t} - AV_{i,t-1} - AV_{i,t-1}\left(\frac{InvestorFlows_t}{PV_{t-1}}\right)$$

3 Explaining investor-flows and reallocation-decisions using a traditional push/pull capital flows framework

As discussed in Section 1, mutual funds have a greater propensity than other overseas investors to change their holdings of EME bonds in response to changes in global and local macroeconomic conditions. This is likely due to the interplay of investor flows and manager reallocation.

Funds' investors are often able to increase or decrease their investments in the fund at short-notice. Their decisions to do so are closely linked to past fund performance: fund investors redeem from funds when they perform poorly and subscribe to funds when they perform well. The flow-performance relationship hinges on a range of factors, such as: fund age and fund size (Ferreira et al., 2010), performance volatility (Huang et al., 2007b), participation costs such as transaction costs (Huang et al., 2007a), greater media attention and affiliation with a large fund management company (Sirri and Tufano, 1998).[15] But, generally, investors have historically redeemed in response to relatively poor returns (Ferreira et al., 2010). As funds report their performance regularly, this in turn creates incentives for managers to take short-term reallocation decisions to ensure their performance is not materially worse than their peers (Ferreira et al., 2010).

This section explores to what extent funds' responsiveness can be explained by reallocation decisions and investor flows. To do so, we model both these drivers of capital flows for each country i in each period t for each fund j as a function of a vector of push factors ($\beta' Push_t$) and a vector of pull factors ($\gamma' Pull_{i,t}$):

$$CapitalFlowMeasure_{j,i,t} = \alpha_0 + \beta' Push_t + \gamma' Pull_{i,t} + \eta_{j,i} + \epsilon_{j,i,t}$$

We include fixed effects for each fund-country combination ($\eta_{j,i}$), as well as the age and the size of each fund as explanatory variables. The unexplained portion of the variation in capital flows is denoted $\epsilon_{j,i,t}$. We also use standard errors robust to heteroskedasticity, auto-correlation and cross-sectional dependence. In Section 5 we discuss robustness checks.

[15] Asset class also has a bearing on the sensitivity of flows to past performance. Goldstein et al. (2017) find that for corporate bond funds the relationship is asymmetrical: outflows are sensitive to bad performance more than inflows are sensitive to good performance. Leung and Kwong (2018) find that the reverse is true for EME bond funds.

3.1 Model specification: the dependent variables

Our two dependent variables are investor flows and manager reallocation. Investor flows for fund j are measured as described in equation 2. This is the change in the portfolio value that is not due to our micro-data based valuation effect. Intuitively, if the portfolio value is larger in the current period after accounting for valuation effects, this we assume is due to to investor inflows, if it is smaller, this is due to investor redemptions or outflows. This flow is at the fund level, an investor does not determine how the manager meets the redemption requirement or allocates the inflows.

In contrast, manager allocation, equation 3, is defined at the asset level. In this paper we are focused on bonds and as such we measure manager reallocation for EME bonds. Bonds are of particular importance both for macroeconomic and financial stability reasons. First, Bonds have been and continue to be a crucial source of emerging economy financing for sovereigns and increasingly for corporates. Second, unlike equity which is in perpetuity, bonds mature and require re-investment, creating roll-over risks. Finally, bonds are less liquid than equity and thus liquidity premiums are subject to destabilizing spikes. For these reasons we focus our attention on manager allocation decisions for EME bonds.

We scale our two capital flow measures - - in two ways. First, by the fund's total holdings of EME bonds at the start of the quarter. This suggests fund managers think about risk on an asset-class by-asset-class basis. For example, say a $1bn fund with $100mn in EME bonds increases its exposure to Mexico from $20mn to $50mn. This scaling suggests this is a 30% increase in risk to Mexico. Second, we scale our dependent variables by the funds' total net assets at the start of the quarter. This suggests managers assess risk on a portfolio basis. The fund in the example above has increased its allocation to Mexico by 3%.

There are good reasons why managers might adopt both a portfolio and asset-class perspective when assessing risk. Whilst they are judged on overall portfolio returns, they may have explicit or implicit limits on EME bonds.[16] Using two dependent variables also serves as a useful robustness check. The first dependent variable identifies the largest reallocation events as when funds with a small number of EMEs represented in their portfolio change their holdings, meanwhile the second dependent variable identifies the largest reallocation events as when funds with large EME bond portfolios change their holdings. As later noted, both dependent variables give similar results.

We transform the dependent variables prior to running the regression. The distributions for manager reallocation decisions, individual fund investor flows and capital

[16] An implicit limit might include, for example, a limit on non-investment grade bonds

flows are leptokurtic – they have thin shoulders and fat tails. When we run ordinary least squared regressions on these un-transformed variables the residuals are not normally distributed, which would lead to inaccurate inferential results regarding p-values and confidence interval coverage (Pek et al., 2018). To manage this, we transform the dependent variables by centering them relative to their median and then taking a cube root transformation.[17] Annex E explains why we use this particular transformation.

3.2 Model specification: the explanatory variables

Capital flows are traditionally modelled as a function of pull and push factors. Push factors refer to external conditions such as advanced economy interest rates that affect overseas demand for EME assets. Pull factors refer to domestic conditions such as GDP growth that help attract foreign capital. We base our choice of push and pull factors on Koepke (2019)'s survey of the capital flows literature, with three key pull factors and three key push factors.

In estimating push and pull factors using a vector of independent variables, our approach is similar to, for example, Forbes and Warnock (2012) and Rey (2013). Other papers have sought to capture global common factors by including time fixed effects in their regressions in lieu of changes in external factors such as advanced economy interest rates and systemic risk (e.g.Cerutti et al. (2019), Goldberg and Krogstrup (2018)). Time fixed effects capture all factors that affect capital flow pressures in the same way across countries, and so this approach is useful for assessing the extent to which EME capital flows are accounted for by global push factors. However, our objective is to compare different investors' responsiveness to specific push and pull factors, rather than distinguish between the relative size of total push and total pull factors for each investor. Hence, we use a vector of global push factors.[18]

The first push factor we include in our analysis is global risk aversion. When global risk aversion increases, capital flows to EMEs tend to fall. Koepke (2019) finds that the two most common proxies for global risk aversion used in the literature are US implied equity volatility (the VIX) and the US BBB-rated corporate bond spread over US Treasuries. Neither of these are ideal proxies for our analysis of bond flows. The former does not necessarily imply bond market volatility, it is based on US equity market options. The latter is driven by factors such as duration and liquidity, not just risk aversion. Furthermore, they are single measures. Our benchmark results use

[17]When modelling allocation/flows at the aggregate level, rather than the fund level, we centre the variable and take a square root transformation. This is only relevant to the regressions in Annex **??**.

[18]For this reason, we also don't include country-time fixed effects, as this would capture the effects we are trying to proxy with our push variables.

a composite measure, the Kansas City Fed financial stress index, which includes the VIX as well as a range of variables in order to capture financial stress.[19] This measure is meant to capture various factors such as flight to quality and liquidity as well as uncertainty about asset values or other investor behavior.

Our second push factor is external interest rates. When external interest rates increase, capital flows to EMEs tend to fall. Koepke (2019) notes this is typically proxied using US rates. We also use US rates, rather than developed market rates more generally, as US bonds alone account for over 60% of our sample funds' non-EME bond portfolios.[20] The average remaining maturity of our funds bond portfolios is 7.7 years, though we use 10 year bond yields. "On the run" bonds - such as the 10 year - are typically more liquid and easier priced - meaning data is better available.

Our third push factor is advanced economy output growth, though there are conflicting findings in the capital flows literature regarding its impact on capital flows to EMEs. Cerutti et al. (2019) note that a slowdown in advanced economy growth leads to an expansion of capital flows to EMEs as investors take advantage of better growth and higher yields. Their findings are echoed elsewhere (Reinhart and Reinhart, 2009). However, other analyses have identified a positive relationship between external growth and gross capital inflows to EME (eg. Forbes and Warnock (2012)). This is possibly because faster advanced economy growth results in greater investor risk appetite. We proxy external output growth in our analysis using the level of US growth.

Our fourth push factor is trade policy uncertainty, proxied by the text-search based index of US trade policy uncertainty from Baker et al. (2016).[21] This variable is traditionally not included as a push factor in the capital flows literature. However in the recent period, one can make a case for including trade policy uncertainty at a global level (here proxied by US trade policy uncertainty) as a push factor: de-globalization may ensue in financial markets as well, and at the least financial flows could be affected by concerns about trade relations.

Our first pull factor is domestic output growth. As domestic growth increases, capital flows to that EMEs tend to increase. Here we use each EME's real GDP growth

[19]For more detail on the construction and behavior of this stress index, please see Hakkio and Keeton (2009) and https://www.kansascityfed.org/data-and-trends/kansas-city-financial-stress-index/. Our results are robust to using the VIX and the US BBB-rated corporate bond spread over US Treasuries instead of the Kansas City Fed measure.

[20]This includes bonds which fall outside of our definition of EME, but are consider EMEs elsewhere – for example: Ukraine, Argentina, Venezuela, Serbia, Sri Lanka, Romania, Ghana and Croatia. So the US' share of advanced economy bonds is even higher.

[21]Available from https://www.policyuncertainty.com/categorical_epu.html. Trade policy words include import tariffs, import duty, import barrier, government subsidies, government subsidy, wto, world trade organization, trade treaty, trade agreement, trade policy, trade act, doha round, uruguay round, gatt, and dumping.

relative to the EME (GDP weighted) average. We use this relative measure as, when choosing to invest more or less in an EMEs in any one time period, what matters more to the manager is likely its current level relative to other EMEs rather than its current level relative to the history of EME growth rates.

Our second pull factor is domestic asset returns. As asset returns increase, capital flows to that EME increase. Whilst Koepke (2019) notes that the strongest evidence is for local stock market returns, we use bond yields as we're focusing specifically on portfolio debt flows. Specifically, for each country we use current real 10-year bond yields relative to the EME (GDP weighted) average.

Our third pull factor is country risk. As country risk increases, capital flows to that EME decrease. Koepke (2019) points towards increased debt to GDP and lower credit rating as indicators of increased country risk. So we include relative measures for both of these in our analysis. We also include reserves to GDP, whose importance to determining both outflows and inflows is explored in Alberola-Ila et al. (2015).

It is worth mentioning that concerns of endogeneity arise when country variables are used as regressors in capital flow regressions. For example, an EME domestic interest rate may be influenced by the country's capital flows, or both may be driven by some other variable. Hence our specification could suffer from simultaneity issues. We saturate the model with country and fund fixed effects for non-time varying traits. Also, our country pull factors are not measured as raw levels but as relative to the average for the set of EMEs.[22] Finally, our investor flow dependent variable is at the fund level, and while manager reallocation is country specific, neither are aggregate country capital flow measures.

In sum, our sample is from 2011 to 2017, at a quarterly frequency, and we cover fund holdings of bonds from 18 EMEs. Data for calculating fund investor flow and manager allocation variables, as well as fund institutional features, are sourced from Morningstar. Details and sources for Our pull (domestic) variables and push (external) factors are listed in Annex D.

3.3 Results

In Table 1 we show the results of four different models. Columns 1 and 2 show the results for the dependent variable investor flows, columns 3 and 4 show the results for manager reallocation. The dependent variable has been scaled by holdings of that country's EME bonds in columns 1 and 3, and scaled by the NAV of the fund in columns 2 and 4.

[22] For more detail, please see Appendix D.

Table 1: Drivers of investor flows and reallocation.

	Flows (1)	Flows (2)	Reallocation (3)	Reallocation (4)
Global Risk Aversion (-)	−10.64***	−6.46***	1.83***	1.32***
	(0.40)	(0.26)	(0.56)	(0.33)
External Interest Rates (-)	−6.19***	−4.12***	0.21	0.29*
	(0.19)	(0.14)	(0.25)	(0.15)
External Growth (-/+)	1.29***	0.86***	−0.41**	−0.20*
	(0.11)	(0.07)	(0.20)	(0.12)
Trade Uncertainty (-)	−3.85***	−2.66***	0.27	0.16
	(0.19)	(0.13)	(0.33)	(0.20)
Real GDP Growth (+)	0.40	0.29	1.02***	0.54**
	(0.30)	(0.19)	(0.38)	(0.23)
Real Bond Yields (+)	−0.22	−0.15	0.62**	0.46**
	(0.23)	(0.15)	(0.31)	(0.18)
Credit Rating (+)	−0.65***	−0.43***	−0.05	−0.01
	(0.21)	(0.13)	(0.22)	(0.13)
Debt to GDP (-)	−0.31	−0.09	−1.14	−0.93*
	(0.70)	(0.46)	(0.83)	(0.50)
Reserves to GDP (+)	−1.34**	−0.57	2.48***	1.77***
	(0.62)	(0.40)	(0.84)	(0.49)
Aggregate or Fund?	Fund	Fund	Fund	Fund
Clustered SEs	CountryFund	CountryFund	CountryFund	CountryFund
Fixed Effects	CountryFund	CountryFund	CountryFund	CountryFund
Observations	42,030	42,030	42,030	42,030
R^2	0.09	0.08	0.002	0.002

*p<0.1; **p<0.05; ***p<0.01

This table reports the results of the regressions on the set of push and pull variables presented in 3, during the period 2011 to 2017. Definitions, sources and frequency of all independent variables are presented in Annex D. The symbol in parentheses after each independent variable is the expected direction of the coefficient in the model. The columns report the results for the dependent variables as follows. Column (1) shows result for investor-flow driven change in fund's holdings of EME bonds as a percentage of funds' starting holdings of that EME's bonds. Column (2) shows results for investor flow driven change in fund's holdings of EME bonds as a percentage of funds' starting NAV. Column (3) show results for reallocation driven change in fund's holdings of EME bonds as a percentage of funds' starting holdings of EME bonds. Column (4) show results for reallocation driven change in fund's holdings of EME bonds as a percentage of funds' starting NAV. Clustered standard errors on country fund interaction are shown in parentheses.

These results suggests that investor flows are strongly responsive to global push factors - changes in global risk aversion, external rates and external growth and trade policy uncertainty. The coefficients for these variables are much larger, statistically significant and point in the expected direction in the investor flows models (columns 1 and 2) when compared to reallocation (columns 3 and 4). Following Haritou et al. (1995) we use a Z-test to compare the size of the coefficients and standard errors of the flow models and the reallocation models. The differences between the results of the two sets of models are all statistically significant at the 10% level, with the exception of that for real GDP growth and debt to GDP. (Annex A).

For "push factor" variables, manager reallocation effects seem to partially offset investor flows. Our results suggest manager reallocation decisions would offset around

19% of the global risk aversion effect, 5% of the external interest rate effect and 25% of the external growth effect. This may be because in order to meet investor outflows driven by these types of macroeconomic changes, managers disproportionately sell their non-EME bond assets, leading to a slight increase in the share of EME bonds in their portfolios. In this respect, managers' reallocation decisions seem to counter traditional push dynamics.

The results in Table 1 also suggest that reallocation decisions are more strongly affected by pull factors. With the exception of credit ratings, for real GDP growth, real bond yields, reserves, and debt to GDP, reallocation decisions are consistently larger, mostly significant and all point in the expected direction. The results for flows are all insignificant, and often point in the wrong direction. The differences in coefficients are again significant (Annex A).

Our results show that different factors affect manager reallocation and investor flow decisions differently. One explanation for why push factors may have a greater influence on investor flows is that, as described above, investor flows are closely linked to past fund performance. Fund investors tend to redeem from funds when they perform poorly and subscribe to funds when they perform well. Funds in our sample typically invest in a range of EMEs, thus fund performance can be more closely linked to general EME performance than it is to specific EME performance. The median fund in our sample invests in 10 different EMEs, with the largest EME investment typically accounting for only 6% of the portfolio. Given this diversification, push factors would dominate over country pull factors.

Conversely, we would expect manager reallocation decisions to be more responsive to specific EME performance. For the median fund in our sample, EME bonds account for 20% of their portfolio. So when making portfolio allocation decisions, they will often be moving between EME bond assets. Any mandate requirements which explicitly or implicitly limit their holdings of EME bonds (e.g. credit rating limits) likely increase the propensity of intra-EME bond movements.

4 Explaining reallocation-decisions using a framework which includes institutional features as well as push/pull factors

Reallocation decisions are not simply a function of manager's analysis of macroeconomic variables (such as push and pull factors). Managers also reallocate between assets based on institutional features of their fund. Institutional features include, for example, the liquidity and leverage of fund, as well as the benchmark which it tracks.

Such features have recently been of particular interest to regulators: the FSB's report into structural vulnerabilities in asset managers focused on both leverage and possible liquidity mismatch (FSB, 2017).

In this section we consider what bearing four institutional features have on reallocation decisions. To do so, we augment the model introduced above to include a vector of institutional factors ($\kappa' Institutional_{j,i,t}$). We use the same pull and push factors, and construct the reallocation capital flow measures in the same way.

$$CapitalFlowMeasure_{j,i,t} = \alpha_0 + \beta' Push_t + \gamma' Pull_{i,t} + \kappa' Institutional_{j,t} + \eta_{j,i} + \epsilon_{j,i,t}$$

The first institutional feature we proxy in the model is liquidity. Funds are open-ended and so may need to meet redemptions from investors at short-notice. In anticipation of such redemptions, funds may increase the liquidity of their portfolios in times of stress, manifesting as reallocation away from EME bonds. This would be consistent with the findings of Morris et al. (2017). To test if funds sell EME bonds when redemptions increase, we include an "outflows" variable in the model. This takes the value of 0 when the fund experiences inflows. When the fund experiences outflows, it is the level of those flows scaled by the NAV of the fund.

The second institutional feature is leverage. The links between fund leverage and the potential need to sell assets are discussed in Bank of England (2018). Broadly, funds can generate leverage through either derivatives or secured financing, so we include two variables to test for the impact of changes in leverage. First, changes in the market-to-market value of derivatives reported by the fund. Derivative positions can give rise to short notice cash requirements: if the mark-to-market value of a derivative asset falls funds will be required to post cash-equivalents to counterparties. In order to meet such increases in variation margin, funds may need to sell EME bonds. Second, changes in the ratio of gross non-derivative asset values to net non-derivative asset value between quarters. A fall in the value of cash leverage might mean that EME bonds can no longer be financed through secured funding markets, leading to a sale of those bonds.

The third institutional feature is changes in the indices which funds benchmark against. Raddatz et al. (2017) find that movements in benchmarks have important effects on bond fund portfolios, and can explain movements in capital flows. A large part of this is due to price and exchange rate effects that we have already captured. Bond indices are size weighted and so, all else equal, a relatively large fall in the price a country's bond will result in its share of the index falling. But they also find that exogenous events matter too, for example when countries are added or removed from an index. Thus, we include two variables to capture the effect of a country's share of the benchmark changes

The first captures changes to the two most popular indices in our sample: JPM's GBI-EM and FTSE's WGBI.[23] Arslanalp and Tsuda (2015), in their analysis of changes in the GBI-EM index on net foreign purchases of EME bonds, focus on three events when countries' share of the index significantly changed due to non-valuation effects. Of those, two involve countries in our sample of EMEs: Colombia and Peru. So we include as dummy variables Arslanalp and Tsuda (2015) estimates for the size of these countries' non-valuation driven share of the index. To our knowledge, there isn't a similar study which calculates when EME's share of WGBI has changed due to non-valuation effects. However, the share of EMEs in WGBI is low. In September 2019, our sample of EMEs accounted for 1.89% of the index, with no individual EME accounting for more than 0.62%. And so changes to their weightings have had very small effects. This given, we only include a dummy variable when countries are added or removed from the index, as these are larger and don't require us to calculate valuation effects. For WGBI, the only such event in our sampling period is South Africa's addition in October 2012 (it entered with a share of 0.45%).

The second benchmark effect variable captures changes to Barclays' Aggregate index, also commonly tracked by our funds. Unlike the prior two indices, this index does not focus only on government bonds. Nor does the provider make decisions about which countries to include: instead it includes bonds on a bond-by-bond basis provided they have an investment grade rating and are traded in the United States. It would be difficult to determine when every bond in our dataset was added or removed from the index. And so, we proxy this by assuming government bonds are removed from the index when they are downgraded to non-investment grade, and added to the index when they are upgraded to investment grade. Upgrades receive a dummy variable of 1, and downgrades a dummy variable of -1.[24]

The fourth institutional feature we include in our model is changes in risk appetite. There are multiple ways a fund could change its portfolio following a change in risk appetite. We explore one possible response: whether funds invest more in safe-haven EMEs, and less in other EMEs, when global risk aversion increases. To distinguish between safe haven EMEs, and non safe haven EMEs, we consider five criteria: (i) depth of bond market, (ii) depth of hedging market, (iii) accessibility and development of local market infrastructure, (iv) credit rating, (v) bond price volatility. We identify 11 metrics on which to grade EMEs against these criteria: these metrics, and their values for each EME, are shown in Annex H. To generate a composite score for each EME, we

[23] JPM's Government Bond Index-Emerging Markets and FTSE's World Government Bond Index

[24] Downgrades: Hungary in Q4 2011, Russia in Q1 2015, Brazil in Q3 2015, South Africa in Q2 2017. Upgrades: Colombia in Q1 2011, Philippines in Q2 2013, Hungary in Q3 2016, Indonesia in Q2 2017.

calculate its average rank across each of the five criteria. We calculate these metrics for two points in time. Korea, Mexico and Poland consistently topped the rankings as the “safer’ EMEs – so we give these countries a “safe haven” dummy variable of +1. The remainder receive a dummy of -1.[25] We then multiply these dummies by the difference between the Kansas City Fed Financial Stress Index and its median value. This is intended to capture where financial stress is “relatively high” or “relatively low”; when stress is high, risk aversion is high.

4.1 Results

The results for these institutional features are shown in Table 2. Models 1 and 3 show results for the reallocation dependent variable scaled by holdings of EME bonds. Models 2 and 4 show results for the variable scaled by the NAV of the fund.

Of the new variables, most give intuitive results and significant results in at least two versions of the model. First, funds tend to reduce holdings of EME bonds when they reduce their cash leverage. This is to be expected: funds need to sell some assets in the portfolio to deleverage. Second, funds tend to increase holdings of an EME bond when their share of the GBI-EM increases, their share of WGBI increases or if they are eligible for investment grade bond indices. This is consistent with the results of Arslanalp and Tsuda (2015). Third, funds tend to switch towards safer EME bonds when risk aversion is high. This effect is particularly strong if we focus on funds with higher EME bond holdings (see Annex F). Funds with fewer EME bonds are perhaps better able to allocate away from EME bonds to other asset classes (and not change their EME bond weights). Fourth, funds tend to reduce holdings of EME bonds when they experience losses on derivative positions - though this is the weakest of our ”institutional” factors. That is possibly because most funds reportedly make limited use of derivatives: derivative positions account for only 1.2% of the gross market value of our sample of funds’ portfolios.

The results for response to outflows are, however, raise additional questions. Across all models, the coefficient is negative. This suggests that the reallocation behaviour of managers slightly offsets negative investor flows. Although we use different modelling approaches, this contradicts the general finding of Morris et al. (2017): that bond funds

[25]It is not possible to compute our safe-haven scores on a quarterly basis. So we use a dummy variable, rather than a time-varying variable, to include a safe-haven metric in our analysis. We draw the line at the top-3 countries for three reasons:(i) these countries represent each of the major EME regions - Latin America, Asia and EMEA - so would be the safest investment option for any fund with a regional mandate; (ii) clustering analysis shows these are the only countries to consistently appear in the top-cluster when the countries are divided into anything between 2 and 6 clusters; (iii) they are the three safest countries in both 2013 and 2018 - other countries’ rankings changed through time.

Table 2: Drivers of reallocation, including institutional factors.

	Reallocation (1)	Reallocation (2)	Reallocation (3)	Reallocation (4)
Global Risk Aversion (-)	2.46***	1.91***	2.47***	1.86***
	(0.74)	(0.40)	(0.80)	(0.44)
External Interest Rates (-)	0.13	0.27*	0.24	0.44***
	(0.25)	(0.15)	(0.27)	(0.16)
External Growth (-/+)	−0.33	−0.17	−0.36*	−0.21*
	(0.20)	(0.12)	(0.21)	(0.12)
Trade Uncertainty (-)	0.22	0.15	0.37	0.31
	(0.33)	(0.20)	(0.38)	(0.23)
Real GDP Growth (+)	0.93**	0.47**	1.14***	0.61**
	(0.38)	(0.22)	(0.39)	(0.24)
Real Bond Yields (+)	0.59*	0.44**	0.37	0.32*
	(0.31)	(0.18)	(0.32)	(0.19)
Credit Rating (+)	−0.11	−0.03	−0.25	−0.15
	(0.23)	(0.13)	(0.24)	(0.14)
Debt to GDP (-)	−1.40*	−1.05**	−1.57*	−1.31**
	(0.84)	(0.51)	(0.87)	(0.51)
Reserves to GDP (+)	2.62***	1.89***	2.71***	1.95***
	(0.84)	(0.50)	(0.86)	(0.51)
Outflows (+)	−1.69***	−0.62**	−2.24***	−0.84***
	(0.54)	(0.25)	(0.55)	(0.27)
Derivative VM (+)	0.16	0.08	0.28*	0.19*
	(0.13)	(0.08)	(0.16)	(0.10)
Leverage Change (+)	0.45***	0.27***	0.43***	0.26***
	(0.12)	(0.07)	(0.14)	(0.09)
Benchmark Change (+)	8.72***	8.67***	8.63***	8.62***
	(2.87)	(2.58)	(2.65)	(2.32)
Inv. Grade Change (+)	2.30**	1.18*	2.31*	1.16
	(1.03)	(0.62)	(1.19)	(0.72)
SafeHaven Effect (+)	0.97**	0.75***	1.28**	0.91***
	(0.47)	(0.25)	(0.51)	(0.27)
Aggregate or Fund?	Fund	Fund	Fund	Fund
Clustered SEs	CountryFund	CountryFund	CountryFundQuarter	CountryFundQuarter
Fixed Effects	CountryFund	CountryFund	CountryFundQuarter	CountryFundQuarter
Observations	42,030	42,030	42,030	42,030
R^2	0.004	0.004	0.01	0.01

*p<0.1; **p<0.05; ***p<0.01

This table reports the results of the regressions on the set of push, pull and institutional variables presented in Section 4, during the period 2011 to 2017. Definitions, sources and frequency of all independent variables are presented in Annex D. The symbol in parentheses after each independent variable is the expected direction of the coefficient in the model. The columns report the results for the dependent variables as follows. Columns (1) and (3) show results for reallocation driven change in fund's holdings of EME bonds as a percentage of funds' starting holdings of EME bonds. Columns (2) and (4) shows results for reallocation driven change in fund's holdings of EME bonds as a percentage of funds' starting NAV. In Columns (1) and (2) we use country fund interactions as fixed effects, and clustered standard errors on the country fund interaction are shown in parentheses.In Columns (3) and (4) we use country-fund-quarter interactions as fixed effects, and clustered standard errors on the country fund quarter interaction are shown in parentheses.

tend to sell bonds in order to raise additional cash when redemptions increase.

To explore why this is the case, we analyse how these coefficients vary by fund type. The results, in Annex F show that the negative coefficient for redemptions is driven by fund types for whom EME bonds are not their principal asset class. For said funds, EME bonds are amongst the less liquid assets and account for only a minority of the portfolio. Therefore, if they wanted to temporarily and preemptively raise cash to meet future redemptions, they may turn to other asset classes first. For funds with higher holdings of EME bonds, the results are insignificant and only slightly negative.

5 Robustness checks

As well as using two differently constructed dependent variables, we undertake four additional robustness checks. All the variables identified as significant in the reported version of the model remain significant at a confidence interval of at least 90%. These results are available on request.

As a first robustness check, we change the fixed effects used in the models. For all models shown in Tables 1 and 2, we run regressions using country fixed effects, fund fixed effects, quarter-fund fixed effects and quarter-fund-country fixed effects.

As a second robustness check, we change the data cleaning tolerances we use to weed out potential data imperfections. Specifically, we run the regressions on data prepared using tighter cleaning tolerances (which reduce the sample size by a third).

As a third robustness check, we lag our redemptions variable. Our model assumes that reallocation decisions are influenced by investor flow decisions. But this relationship is plausibly reciprocal. Although most funds only publish full holdings quarterly, some publish monthly summaries of portfolio allocations. It may be that investors note the change in allocation in the monthly report and then decide to redeem or subscribe before end quarter. To check for endogeneity, re-run the model using lagged outflows.

As a fourth and final robustness check, we change the construction of the safe-haven variable. To generate our safe-haven score we chose: the criteria on which to assess "safeness"; the metrics on which to score each country according to these criteria; and the method by which to weight these metrics. However, Mexico, Korea and Poland consistently emerge as relative "safe-havens" irrespective of how we exercise our discretion. For example, these three countries remain in the top-4 of our rankings if we drop any one of our five criteria completely. They remain the top-3 if we change our weighting methodology, too. The only country that ranks amongst Poland, Korea and Mexico under certain designs of the variable is Malaysia. And so we also run the regressions including Malaysia as a "safe-haven".

Our key results are robust to all of the above. Recapitulating, managers' reallocation decisions explain most of mutual funds' responsiveness to changes in pull factors. Investor flow decisions explain mutual funds' responsiveness to global push factors, with reallocation decisions offsetting the reaction of investors. Managers allocate towards "safer" EMEs when global risk aversion increases. And finally, other institutional factors – notably changes in the indices which funds benchmark against and fund leverage – also drive reallocation behaviour.

6 Conclusions and implications

In conclusion, this paper provides evidence that fund manager allocation decisions are of first order importance. We exploit the most granular portfolio data available, at the security level, but there are still limitations due to the quality of the underlying micro-data. Also, although we present two examples to motivate our regressions, we do not provide in-depth analyses of episodes of global importance, such as the dramatic spike in trade tensions during 2016-17 or drop in oil prices in 2014. Furthermore, because our sample is 2011-2017, we are unable to study dynamics before the Global Financial Crisis, and compare them with the period after. Nevertheless, this research hopefully prompts a reconsideration of the role of fund manager decisions. Our results demonstrate the importance of considering asset manager reallocation – in addition to investor flows – when analysing the role of mutual funds in financial markets. This has implications for analyses of capital flows to EMEs, as well as analyses of the financial stability risks posed by mutual funds more generally.

Mutual funds are an increasingly important source of capital for EMEs. When assessing the extent to which this changes the risk of sudden surges and reversals, our analysis suggests four factors are important. First, the percentage of bonds held in open-ended funds (OEFs). Funds are more responsive to push factors than other overseas investors, principally because their investors subscribe/redeem from funds when global conditions improve/deteriorate. Second, the percentage of bonds held in funds which have the option to divest. All open-ended funds (OEFs) are exposed to investor flow risk, but only certain types of funds can reallocate. Funds which invest only in one country's bonds, for example, cannot. Therefore, the greater the proportion of a countries' assets which are held in non-domestic, active funds with broad investment mandates – the greater the risk of reallocation, and thus the greater the potential sensitivity to changes in pull factors. Third, whether the EME is a plausible safe-haven. Cerutti et al. (2019) establish that sensitivity to global and regional pull factors varies by EME. This is consistent with our analysis: less "safe" EMEs are more sensitive to increases in global risk aversion as fund managers switch towards safer EMEs. And fourth, the percentage of bonds held by the largest asset managers. This concentrates reallocation decision making power in one manager.

Looking across these three metrics our analysis suggests some EMEs are more vulnerable than others to fund reallocation outflows (Annex G). Peru scores highly on all four measures, for example.

Allocation decisions are also relevant to analyses of the role of mutual funds in financial markets more generally. Whilst financial stability policymakers and researchers have recently focused on risks related to funds fire selling assets in order to meet investor redemptions, our analysis suggests fund's reallocation decisions should also be analysed for at least two reasons. First, they are often a more significant driver of EME bond sales than investor flows. Second, the pooling of assets in mutual funds arguably reduces the risk of redemption-driven fire-sales (Blackrock, 2014); but it increases reallocation risk. Investment funds have tools to discourage/prevent redemptions by investors. If, instead, their investors invested in assets directly, there would not be barriers to their selling of an asset. However, investment funds concentrate decision making power regarding reallocation decisions. Individual investors would be unlikely to simultaneously switch from one asset to another, but asset managers can make such a decision on their collective behalf. Returning to our earlier Hungary example (see Figure 5), it is highly unlikely that individual investors would have simultaneously chosen to sell 15% of the country's government bonds.

Three issues where reallocation decisions have an important bearing on the profile of financial stability risks, provide opportunities for future research. First, what are the implications of the growth of passive funds for financial stability? A "reallocation perspective" would suggest this could reduce the sensitivity of fund driven sales to certain factors (e.g. pull factors), but potentially increase their sensitivity to others (e.g. push factors). Second, does the size of an asset manager have bearing on its systemic importance? A reallocation perspective would suggest yes - larger managers have greater market impact when reallocating. Third, how should we model portfolio reallocation decisions of managers in system-wide models? Our analysis suggests there are some pro-cyclical aspects to fund managers' decisions - they sell, for example, when EME growth slows, debt increases and reserves fall.

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A Annex: Z-test results for regression analyses

Following Haritou et al. (1995) we use the following Z-test to compare the size of the coefficients in two models. β_i, refers to the relevant coefficient from the first model, and β_j to the relevant coefficient from the second model. SE refers to the standard error on the coefficient.

$$Z = \frac{\beta_i - \beta_j}{\sqrt{SE\beta_i^2 + SE\beta_j^2}}$$

Comparison 1: Comparing the results of Models 1 and 3 in Table 1

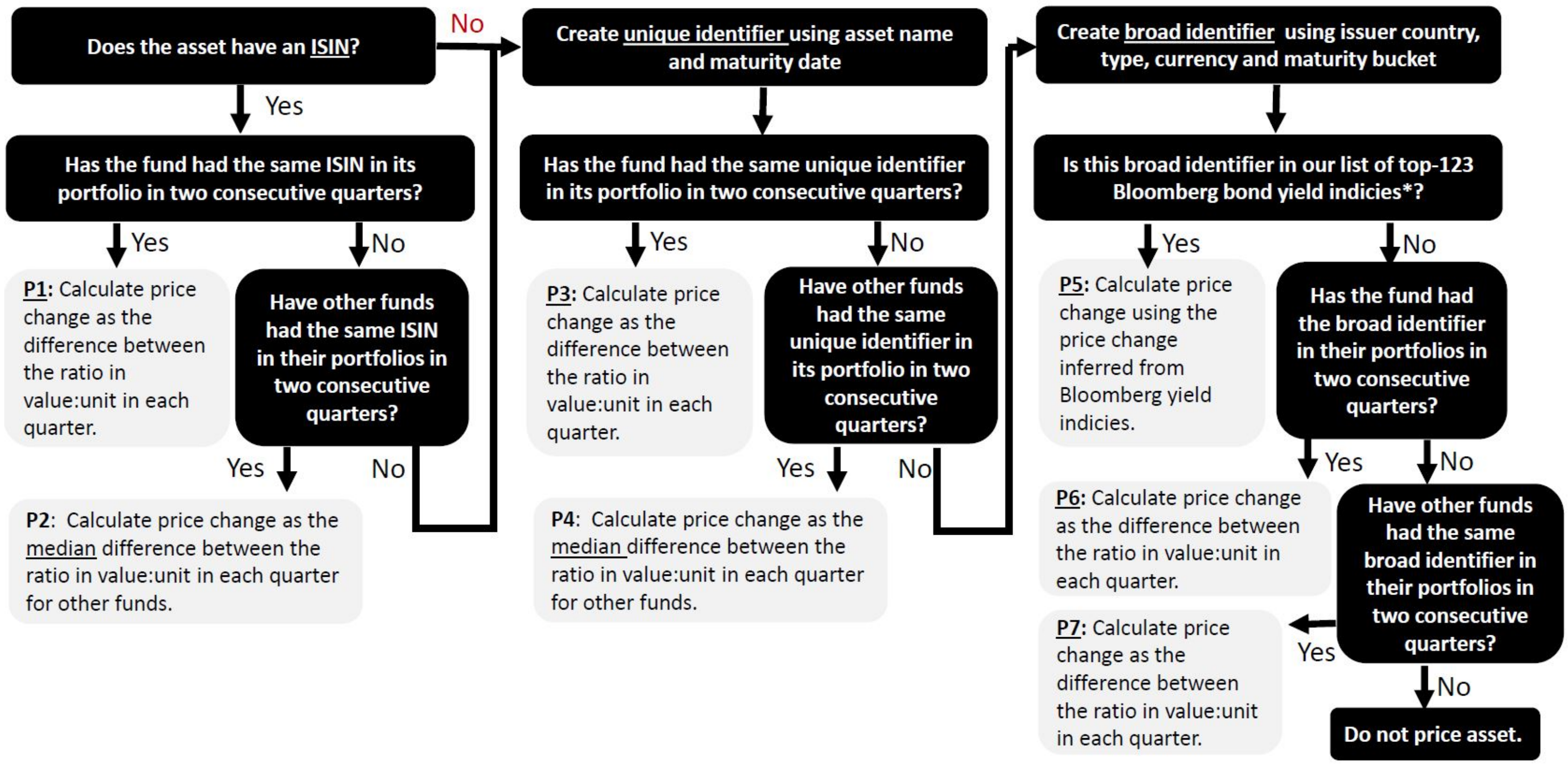
	term	Score	Prob
1	Global Risk Aversion	-19.71	0.00
2	External Rates	-23.00	0.00
3	External Growth	7.45	0.00
4	Trade Uncertainty	-10.51	0.00
5	Real GDP Growth	-1.35	0.15
6	Real Bond Yields	-2.37	0.02
7	Credit Rating	-2.41	0.02
8	Debt to GDP	0.93	0.35
9	Reserves to GDP	-4.29	0.00

Comparison 2: Comparing results of Models 2 and 4 in Table 1

	term	Score	Prob
1	Global Risk Aversion	-20.38	0.00
2	External Rates	-26.29	0.00
3	External Growth	7.80	0.00
4	Trade Uncertainty	-4.35	0.00
5	Real GDP Growth	-0.93	0.34
6	Real Bond Yields	-2.80	0.00
7	Credit Rating	-2.79	0.01
8	Debt to GDP	1.57	0.12
9	Reserves to GDP	-4.35	0.00

B Annex: Pricing Approaches

Figure 6: Approach for pricing assets within our dataset



For the most common government bonds in our dataset we download quarterly yield data for 1-year, 3-year, 5-year and 10-year from Bloomberg where it is available. We then convert quarterly changes in yields to quarterly changes in price calculating each bonds modified duration under the assumption that bonds pay coupons semi annually. For government bonds in our dataset we are unable to price using measures P1-P4, we apply which ever of these constructed pricing series is closest in maturity. We price around 2% of assets in this way.

C Annex: Descriptive Statistics for cleaned dataset

Figure 7: Number of funds and managers

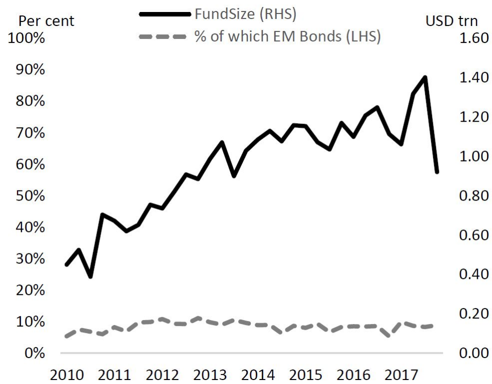


Figure 8: Fund size, % of which EME bonds

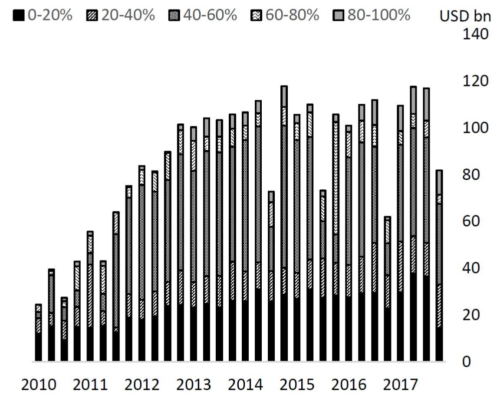


Figure 9: EME bonds, by type.

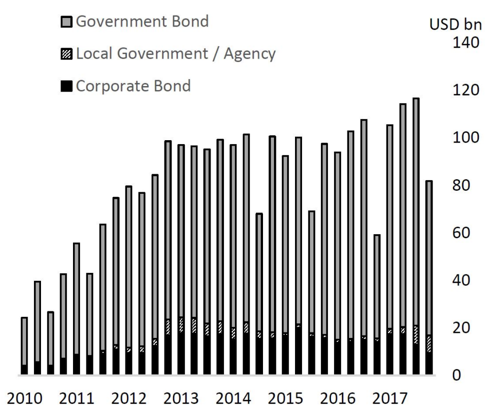


Figure 10: EME bonds, by % of fund's portfolio in EME bonds

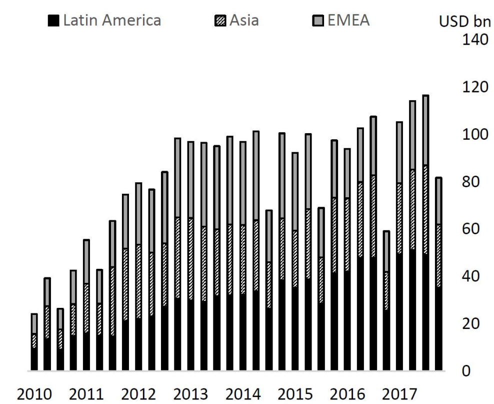


Figure 11: Estimated country coverage, end-2017

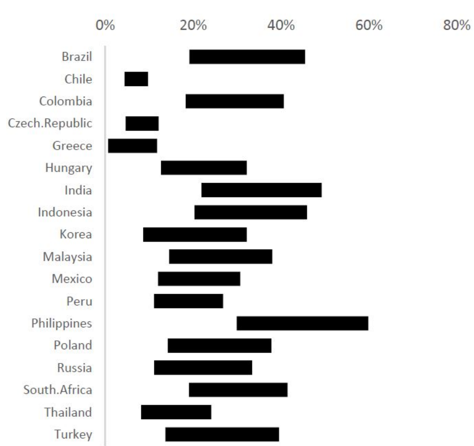
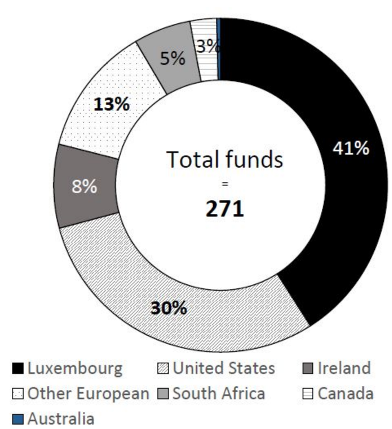


Figure 12: Domicile of funds.



D Annex: Independent Variables

Variable	Definitions / Calculations	Source
Global Risk Aversion	Federal Reserve Bank of Kansas City Financial Stress Index	Federal Reserve Bank of Kansas City
External interest rates	Annual yield on 10 year United States government bonds less annual inflation in the United States.	Bloomberg, IMF and author calculations.
External growth	Annual real GDP growth rate for the United States.	IMF and author calculations
Trade Uncertainty	US categorical Trade Policy Uncertainty index based on searching US news sources for terms relating to trade and uncertainty.	https://www.policyuncertainty.com/us_monthly.html
Real GDP growth rate	Difference between the annual real GDP growth rate for EME and the average annual real GDP growth rate for our sample of EMEs.	IMF and author calculations
Real bond yields	Difference between annual yield on 10 year government bonds for each EME (less annual inflation) and the average real yield for our sample of EMEs.	Bloomberg, IMF and author calculations.
Credit Rating	Difference between credit rating of each EME and average credit rating for our sample of EMEs. Each rating is given a number from 21 (for AAA) to 1 (for Defaulted)	S&P and author calculations
Debt to GDP	Difference between total government debt as a proportion of nominal GDP for each EME, and the EME average debt to GDP ratio.	BIS, IMF and author calculations
Reserves to GDP	Difference between reserves (excluding gold) as a proportion of nominal GDP for each EME, and the average EME reserve to GDP ratio.	IMF and author calculations
Outflows	Negative change in the net-asset-value of a fund not explained by changes in asset values or FX effects	Morningstar and author calculations
Derivative VM	Change in the market value of derivative assets held by the fund	Morningstar and author calculations
Leverage change	Change in the ratio of gross-asset-value to net-asset-value for the fund	Morningstar and author calculations
Benchmark change	Change in the weighting of a country in JP Morgans GBI-EM bond index or FTSE's WGBI index	Arslanalp and Tsuda (2015), FTSE-Russell and author calculations
Upgrade or Downgrade	Upgrade or downgrade of a government's bonds to or from investment grade rating	S&P and author calculations.
SafeHaven effect	Dummy of 1 for Korea, Mexico and Poland (and -1 for all other EMEs) multiplied by difference in Global risk aversion metric from its historic median value.	Federal Reserve Bank of Kansas City and author calculations. See Annex H for determinants of dummy variables for countries.

E Annex: Transformation

We transform the dependent variables prior to undertaking regression analysis. To identify the most effective transformation, for each model we calculate standardised residuals using a range of transformed dependent variables, inspired by Tukey's Ladder of Transformations (Tukey, 1977). Specifically, for each model we try the following four different power transformations that are appropriate for heavy-tailed data:

λ	$\frac{1}{3}$	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{2}{3}$	1
y	$\sqrt[3]{x}$	$\sqrt[2.5]{x}$	$\sqrt{x}$	$\sqrt[1.5]{x}$	x

To ensure our data is symmetric, we subtract each value from the median (in most case the median is very close to zero anyway). And, as we have both positive and negative values in our dataset, we apply the power transformation to the absolute value of the variable, before multiplying it by its original sign (as discussed in Cox (2011)). So the full transformation is as follows.

$$y_i = sgn(x_i) * |x_i - median(x))|^{\lambda}$$

We then split the models into those which use aggregated fund data and those which use individual fund. For each of these two groups, we find which transformation gives the lowest average Jarque-Bera score. We use Jarque-Bera rather than other normality tests as it is appropriate for large datasets and relatively effective when used with long-tailed datasets (Yap and Sim, 2011).

For the model using aggregated fund data shown in Annex **??**, this process suggests the most effective transformation is a square-root transformation. For the remaining models using individual fund data the most effective is a cube root transformation. Using the same transformations ensures the results are still comparable within these two groups.

These transformations ensure residuals are broadly normally distributed (qq-plots are available on request).

F Annex: Drivers of reallocation, regression by fund type

	High ¡br¿ (1)	Medium ¡br¿ (1)	Low ¡br¿ (1)	High ¡br¿ (2)	Medium ¡br¿ (2)	Low ¡br¿ (2)
Global Risk Aversion (-)	3.75***	1.89**	0.34	4.50***	2.86**	0.24
	(0.86)	(0.79)	(0.45)	(1.04)	(1.24)	(1.32)
External Interest Rates (-)	0.97***	−0.02	−0.19	1.17***	−0.20	−0.58
	(0.33)	(0.29)	(0.15)	(0.40)	(0.46)	(0.46)
External Growth (-/+)	−0.23	−0.17	−0.16	−0.16	−0.32	−0.57
	(0.26)	(0.22)	(0.12)	(0.32)	(0.35)	(0.36)
Trade Uncertainty (-)	−0.18	0.32	0.29	−0.14	0.30	0.58
	(0.46)	(0.33)	(0.22)	(0.54)	(0.54)	(0.67)
Real GDP Growth (+)	0.53	0.40	0.55**	0.51	0.68	1.62**
	(0.46)	(0.41)	(0.22)	(0.57)	(0.68)	(0.70)
Real Bond Yields (+)	0.60*	0.65*	−0.03	0.72*	0.95*	0.04
	(0.33)	(0.36)	(0.20)	(0.40)	(0.58)	(0.61)
Credit Rating (+)	0.04	0.13	−0.22	0.10	0.37	−0.62
	(0.27)	(0.24)	(0.14)	(0.33)	(0.39)	(0.43)
Debt to GDP (-)	−2.79***	−0.28	0.01	−3.26**	−0.39	−0.30
	(1.08)	(0.86)	(0.47)	(1.29)	(1.42)	(1.50)
Reserves to GDP (+)	3.10***	2.47***	0.20	3.85***	4.11***	0.73
	(0.98)	(0.84)	(0.49)	(1.16)	(1.34)	(1.67)
Outflows (+)	−0.03	−0.79	−0.93***	−0.03	−1.61*	−2.93***
	(0.56)	(0.55)	(0.26)	(0.70)	(0.94)	(0.98)
Derivative VM (+)	−0.03	0.20*	0.06	−0.002	0.33*	0.17
	(0.21)	(0.12)	(0.09)	(0.23)	(0.20)	(0.26)
Leverage Change (+)	0.30*	0.23**	0.25***	0.32*	0.31**	0.80***
	(0.16)	(0.10)	(0.10)	(0.18)	(0.15)	(0.30)
Benchmark Change (+)	9.59***	−2.18		9.99***	−4.35	
	(2.58)	(4.01)		(2.83)	(6.34)	
Inv. Grade Change (+)	1.55	0.73	1.12	2.04	1.77	3.09
	(1.20)	(1.17)	(0.71)	(1.43)	(1.89)	(2.02)
Safe Haven Effect (+)	1.50***	0.61	0.30	1.68**	0.73	0.42
	(0.55)	(0.53)	(0.28)	(0.66)	(0.83)	(0.86)
Clustered SEs	CountryFund	CountryFund	CountryFund	CountryFund	CountryFund	CountryFund
Fixed Effects	CountryFund	CountryFund	CountryFund	CountryFund	CountryFund	CountryFund
Observations	13,941	13,806	14,283	13,941	13,806	14,283
R^2	0.01	0.004	0.01	0.01	0.004	0.01

*p<0.1; **p<0.05; ***p<0.01

This reports the results of the same regression models on the set of push, pull and institutional variables as presented in Section 3, during the same period of 2011 to 2017, by fund type. Definitions, sources and frequency of all independent variables are presented in Annex 3. The dependent variable is manager-reallocation driven change in fund's holdings of EME bonds; for the first three columns as a percentage of funds' starting holdings of EME bonds, for the last three columns as a percentage of funds' starting NAV.

Fund types are defined as: **High** - funds for who EME bonds account for more than 43% of their portfolio; **Medium** - funds for whom EME bonds account for between 11% and 24% of their portfolio; **Low** - funds for whom EME bonds account for less than 11% of their portfolio.

G Annex: Vulnerability to global mutual fund reallocation decisions

Country	Sovereign bonds in OEFs	Sovereign bonds in OEFs with discretion to divest	Largest manager's share of OEFs with discretion to divest	Calculated Safe Haven score. See Annex H	Average rank across 4 vulnerability metrics
Peru	31%	31%	17%	29%	2
Brazil[a]	90%	37%	27%	48%	3
Indonesia	22%	21%	16%	39%	5
Colombia	19%	19%	9%	33%	7
Mexico	30%	25%	16%	75%	8
Greece	15%	15%	12%	44%	8
Chile	20%	19%	9%	52%	9
South Africa	23%	22%	5%	50%	9
Russia	15%	15%	5%	42%	10
Turkey	14%	13%	11%	44%	10
Thailand	11%	11%	16%	55%	11
India	7%	7%	25%	48%	11
Czech Republic	11%	11%	11%	60%	12
Hungary	11%	11%	8%	51%	12
Philippines	6%	6%	13%	40%	12
Korea	8%	7%	16%	91%	14
Malaysia	8%	8%	6%	63%	15
Poland	9%	8%	5%	68%	15

Sources: Morningstar, BIS and authors' calculations. [a] The share of Brazilian sovereign bonds held in OEFs is high for two reasons: (i) around 75% of Brazilian pension fund assets are in mutual funds(Central Bank of Brazil, 2018), (ii) this data includes repo positions backed by sovereign debt.

H Annex: Metrics used to calculate safe-haven variable

Criteria	Bond Market Depth		Hedging Market Size		Market Infrastructure & Accessibility				Default	Volatility	
Metric	Bond Turnover	Market Size	Rates Turnover	FX Turnover	Market Openness	IMF fin markets	Local Dealers	Chinn Ito	Ratings	Largest Qly loss	Correlation with USTs
Units	USD bn	USD bn	USD bn	USD bn	Average Score	0 to 1	USD bn	0 to 1	AAA to D	Basis Points	Per cent
Korea	1600	646	3188	21128	1.06	0.87	54	1.0	AA	87	62%
Mexico	1612	415	6434	24458	1.56	0.35	22	0.7	BBB+	167	65%
Poland	774	243	1394	8901	1.56	0.34	11	0.7	A-	137	40%
Malaysia	162	179	786	4559	1.67	0.65	8	0.4	A-	92	49%
Thailand	566	139	537	4596	1.4	0.6	11	0.2	BBB+	96	37%
India	1305	510	1425	14604	0.9	0.5	36	0.2	BBB-	182	14%
South Africa	640	188	4069	12422	1.8	0.5	30	0.2	BB	205	35%
Czech Republic	21	80	345	3587	1.6	0.2	4	1.0	AA-	121	56%
Brazil	2211	1443	1662	12773	1.2	0.5	21	0.2	BB-	434	5%
Chile	33	70	1056	3141	1.3	0.4	8	0.7	A+	164	11%
Philippines	NA	114	6	1774	1.3	0.4	3	0.4	BBB+	148	62%
Hungary	166	100	1927	3855	1.6	0.3	3	1.0	BBB	239	16%
Indonesia	352	225	56	2543	1.5	0.3	5	0.4	BBB-	297	60%
Turkey	NA	189	12	18349	1.4	0.5	22	0.4	B+	903	34%
Russia	112	162	31	14635	1.1	0.4	45	0.7	BBB-	636	-20%
Colombia	NA	126	356	1990	1.1	0.3	4	0.4	BBB-	253	34%
Peru	NA	38	4	977	1.3	0.3	1	1.0	BBB+	173	4%
Pakistan	197	111	NA	NA	1	0	NA	0	B-	400	5%
Sources	Various*	BIS and RBI	BIS	BIS	MSCI*	Svirydzenka (2016)*	BIS*	Chinn and Ito (2006)	S&P	Bloomberg*	Bloomberg*

Tables shows the latest data available for each metric. See following page for notes on how the starred metrics have been constructed

Footnotes to Annex I safe-haven table

Bond Turnover data has been collated on a best endeavours basis from various sources. Where possible we have sought to ensure the two legs of a trade are not double counted, and we have also sought to exclude repo. Sources are: ACRA, Asian Development Bank, Bank of Mexico, CEIC, Central Bank of Brazil, Central Bank of Chile, Clearing Corporation of India, Hungarian Government Debt Management Agency (AKK), Johannesburg Stock Exchange, Polish Ministry of Finance, Prague Stock Exchange, South African National Treasury, State Bank of Pakistan, TKB BNP Paribas Investment Partners, World Bank Group.

MSCI, in their regular Global Market Accessibility Review, assess the market accessibility of countries using 18 criteria. For each criteria they give a judgement of "no issues", "no major issues, improvements possible" and "improvements needed / extent to be assessed". We convert these judgements into a score of 2, 1 and 0 respectively, and then take the average for each country to create a market accessibility score.

Svirydzenka, 2016 scores countries on their financial development, based on six criteria. We show the scores for one of these criteria – financial market access – in the table.

Local dealers refers to the value of Interest rate and FX derivative contracts written in each respective country, according to BIS Triennial derivative survey data.

Quarterly Loss refers to the largest 90-day change in yield on the generic 10 year government bond for each country between January 2010 and July 2019.

Correlation with UST refers to the correlation, between January 2010 and July 2019, between the yield on the generic 10 year government for each country and the generic 10 year US Treasury bond. We use daily data.