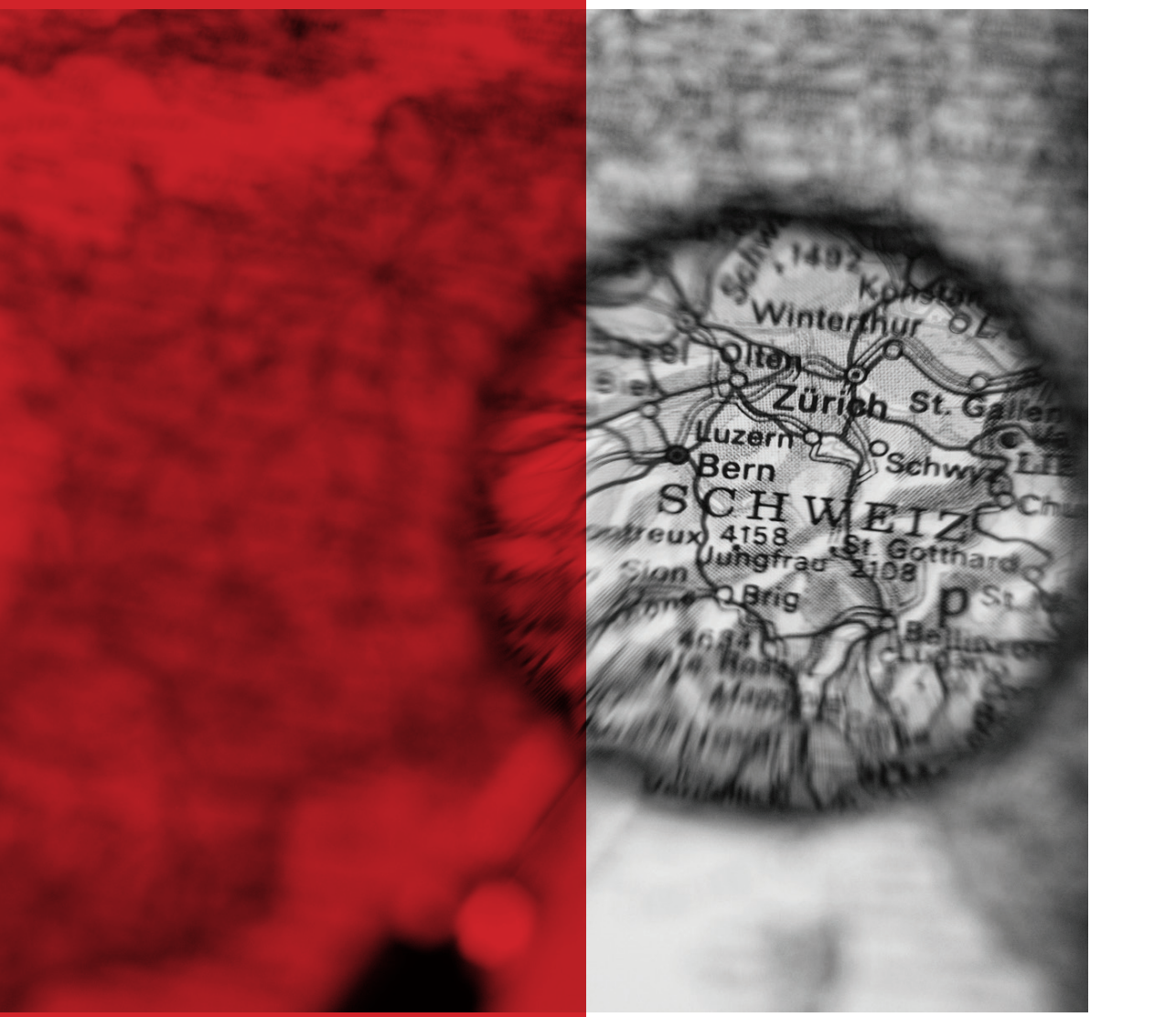


AUSSENWIRTSCHAFT

2022
SIAW-HSG

72.1

Aussenwirtschaft

Editors: Dr. Raphael A. Auer (Bank for International Settlements), Prof. Simon J. Evenett (University of St. Gallen), Prof. Reto Föllmi (University of St. Gallen) and Prof. Roland Hodler (University of St. Gallen).

Assistant Managing Editor: Dr. Stefan Legge (University of St. Gallen).

Editorial address: Schweizerisches Institut für Aussenwirtschaft und Angewandte Wirtschaftsforschung (SIAW-HSG), Bodanstrasse 8, CH-9000 St Gallen. Tel.: +41 (0)71 224 23 40; http://www.siaw.unisg.ch.

Inquiries about the journal should be directed to one of the editors, or by email to aussenwirtschaft@unisg.ch

Publisher: Since 2016, *Aussenwirtschaft* is published by Schweizerisches Institut für Aussenwirtschaft und Angewandte Wirtschaftsforschung (SIAW-HSG). The journal was previously published by Verlag Rüegger, Albisriederstrasse 80A, Postfach 1470, CH-8040 Zurich.

Availability online: All issues of *Aussenwirtschaft* since 2002 are available online at http://www.siaw.unisg.ch/en/journal/ausgaben. All previously published articles can be requested by email.

ISSN: 0004-82 16

Material Disclaimer: The opinions expressed in *Aussenwirtschaft* are those of the authors and contributors, and do not necessarily reflect those of the editors, the publisher, or the organizations to which the authors are affiliated.

The Editors express their gratitude to the Gesellschaft zur Förderung des Schweizerischen Instituts für Aussenwirtschaft und angewandte Wirtschaftsforschung at the University of St. Gallen for helping to finance the publication of this journal.

© SIAW-HSG, 2022.

Aussenwirtschaft

Schweizerische Zeitschrift für internationale Wirtschaftsbeziehungen

The Swiss Review of International Economic Relations

Volume 72, Issue 1, 2022

72. Jahrgang, Heft 1, 2022

Statement

The goal of *Aussenwirtschaft* is to publish high quality analyses of important international economic policy matters that affect Switzerland. Given the integration of many Swiss firms and markets into the European and global economy, articles published in this journal may relate to policy initiatives taken in foreign countries as well. Furthermore, reflecting the many forms of cross-border commerce in the twenty-first century, the range of policies considered is not confined to traditional international trade policies. The journal seeks to inform deliberations by decision-makers – political, corporate, employees, as well as civil society – in Switzerland and abroad.

Contents

About the authors

Iñaki Aldasoro is a Senior Economist at the Bank for International Settlements.

Stijn Claessens is Deputy Head of the Monetary and Economic Department and Head of Financial Stability Policy at the Bank for International Settlements.

Robert Czech is a Senior Research Economist at the Bank of England.

Ulf Lewrick is a Principal Economist in the Monetary and Economic Department at the Bank for International Settlements.

Richard Schmidt is an Analyst at StepStone Group.

Pınar Yeşin is an Economic Advisor at the Swiss National Bank.

The growing importance of investment funds in capital flows

Richard Schmidt and Pınar Yeşin[1]
StepStone Group; Swiss National Bank

In this paper, we first document the growing importance of foreign-domiciled investment funds in countries' portfolio liabilities over time and then show empirical evidence that cross-border fund flows are coincident with asset price movements. To measure the external liabilities of countries to foreign-domiciled funds, we complement conventional balance-of-payments and international investment position data with granular and real-time data on fund flows. We find that the external exposure of countries to investment funds has been steadily increasing both for advanced and emerging market economies. Furthermore, we find that this increased external exposure is coincident with higher exchange rate fluctuations, lower bond yields and higher stock returns. Because sustainability-themed investment funds are growing faster than conventional investment funds, we also focus on Environmental, Social and Governance (ESG) funds and construct an index of sustainable finance that can distinguish between its domestic and cross-border components. Our index reveals that ESG funds domiciled in European countries tend to invest predominantly in domestic markets, whereas ESG investment in emerging market economies to a large extent originates from foreign-domiciled investment funds.

JEL codes: investment funds, portfolio investment, fund flows, ESG funds, financial markets
Key words: F32, G15, G23

1 Introduction

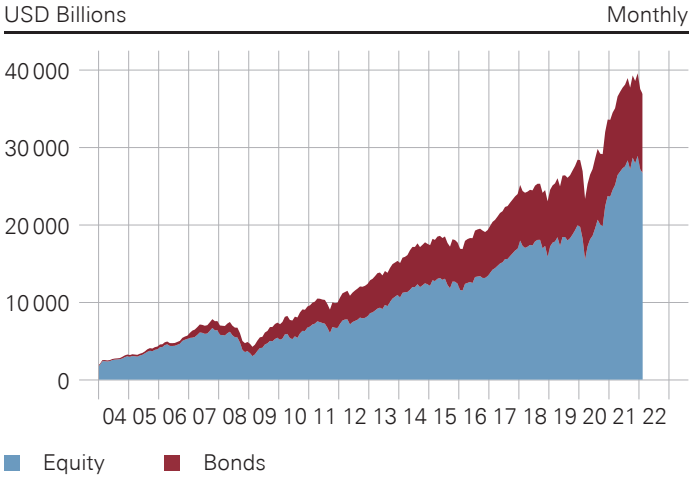
Financial markets are dynamic and continuously adapt to changing regulations, macroeconomic developments and technology. In recent years, numerous regulatory reforms in the banking sector triggered by the global financial crisis have contributed to a remarkable rise in nonbank financial intermediation. The FSB (2021) estimates that the balance sheets of nonbank financial intermediaries[2] (NBFIs) increased from USD 103 trillion in 2008 to USD 226 trillion in 2020.

1 Corresponding author: Pınar Yeşin (pinar.yesin@snb.ch). Richard Schmidt was affiliated with the SNB while working on this paper. We thank Iñaki Aldasoro for discussing our paper and giving us constructive comments at the 2022 *Aussenwirtschaft* workshop in Zurich. We also thank an anonymous referee, Martin Brown, Nathaniel Burkhalter, Cathérine Casanova, Anusha Chari, Andreas M. Fischer, Alain Gabler, Marie Hoerova, Fabio Natalucci, Richard Senner, Lukas Voellmy, Laurence Wicht and participants at the SNB brownbag seminar and the 2022 Aussenwirtschaft workshop for useful suggestions. We thank Simon Tièche and Christoph Kappeler for helpful discussions regarding the details of the data we use in this paper. Andrea Riccucci provided excellent research assistance. Any remaining errors are our own. The views, opinions, findings, and conclusions or recommendations expressed in this paper are strictly those of the author(s). They do not necessarily reflect the views of the Swiss National Bank (SNB) or StepStone Group (SSG). The SNB takes no responsibility for any errors or omissions in, or for the correctness of, the information contained in this paper..

2 Nonbank financial intermediaries include insurance corporations, pension funds, investment funds, central counterparties, broker-dealers, finance companies and structured finance vehicles, among others.

In particular, investment funds[3] other than money market funds and hedge funds exhibited striking growth after the global financial crisis. Figure 1 shows that between 2009 and 2022, assets under management (AUM) of equity and bond investment funds increased by a factor of six, to almost USD 40 trillion. During the last five years, they doubled.

Figure 1: AUM of investment funds globally



Notes: The figure shows total assets under management (AUM) of investment funds in equity and in bonds.
Source: EPFR.

As an example, Switzerland, with its large financial sector, also experienced the switch from bank finance to nonbank finance. Since the global financial crisis, its investment fund sector has boomed, while the growth of its banking sector has been subdued. Table 1 compares the total assets of investment funds domiciled in Switzerland to those of banks domiciled in Switzerland. Between 2005 and 2021, that is, during the last 16 years, the total assets of investment funds increased by almost 350% to more than CHF 1.2 trillion. This corresponds to an average annual increase of 22%. In contrast, banks' total assets increased by only 22% in total since 2005. Similarly, the number of investment funds increased by 127%, from fewer than 800 in 2005 to more than 1,800[4] in 2021, while the number of banks decreased by almost 30%, from 337 in 2005 to fewer than 240 in 2021.

3 An investment fund, also known as collective investment scheme or mutual fund, is a financial vehicle that pools money contributed by a group of investors to invest in securities and other financial instruments.

4 There were approximately 1,400 open-ended equity funds, bond funds and mixed funds domiciled in Switzerland in 2021. Their total assets amounted to 75% of the whole fund industry.

These trends indicate the growing importance of investment funds versus the declining importance of banks in the Swiss financial sector.[5]

Table 1: Investment funds versus banks domiciled in Switzerland

		2021	2005	Change
Investment funds[i]	Total assets (CHF billion)	1,230	275	347%
	Number of entities	1,803	796	127%
Banks[ii]	Total assets (CHF billion)	3,587	2,846	26%
	Number of entities	239	337	-29%

Notes: [i] Open-ended active collective investment schemes domiciled in Switzerland. [ii] Parent company perspective.
Source: SNB.

This evolving landscape of the global financial sector and the surge of investment funds have profound implications for international capital flows,[6] yet not all fund flows are capital flows. Importantly, not all investment funds have a mandate to invest cross-border and there is a significant degree of domestic investment by funds. But the commonly used data sources for capital flows cannot separately identify flows originating from investment funds. Consequently, the ongoing policy debate and research have sometimes used the terms "capital flows" and "fund flows" interchangeably. This paper fills this gap in the available data and literature by combining different data sources and properly measuring the external exposure of countries to foreign-domiciled investment funds over time.

In particular, we measure the growing importance of investment funds in international capital flows and cross-border exposures for a large group of countries by complementing the traditional lower-frequency and aggregate perspective balance of payments (BOP) and international investment position (IIP) data with the higher frequency and real-time fund flows data. In particular, we quantify the share of portfolio liabilities of each country to foreign-domiciled investment funds. This is an important step towards building a sectoral breakdown of the holders of countries' equity and debt liabilities. Although the IMF Coordinated Portfolio Investment Statistics (CPIS) provide information on "from where to where" regarding portfolio investment, they cannot answer the "from whom to whom" question. In particular, a sectoral breakdown of the holders of portfolio

5 Globally, NBFI assets' share in total financial assets increased significantly, while banks assets' share declined. At the same time, banks' links with NBFIs grew also strongly; see Aldasoro et al. (2020).

6 After the global financial crisis, international bank lending has decreased driven by the deleveraging of banks in advanced economies while market-based capital flows increased (CGFS, 2021).

liabilities of countries is not available in the conventional BOP and IIP data.[7] However, the answer to the question of which foreign sectors are financing the domestic economy may have important policy implications, depending on the investment horizon, existing exposures, externalities and regulation faced by the nonresident investor. We can partially fill this data gap by estimating the share of portfolio equity and bond liabilities to foreign-domiciled investment funds.[8]

Furthermore, we make use of the higher frequency and real-time fund flows data to nowcast countries' portfolio investment liabilities that are normally published at a lower frequency and with a longer lag. Such a nowcast can be useful for policy-makers in their external sector assessment, in estimating the external demand for domestic-currency denominated assets or in their monetary policy decisions, among others. Then, we conduct a simple empirical exercise to estimate the impact of growing external exposure on financial markets. In the second half of the paper, we focus on sustainability-themed funds – that is, Socially Responsible Investment (SRI) funds and Environmental, Social and Governance (ESG) funds (henceforth "ESG funds", for simplicity) – because they have boomed even more than conventional investment funds in recent years. We construct measures of sustainable finance that distinguish between the domestic and external components.

Our country sample consists of 20 advanced economies (AEs) and 13 emerging market economies (EMEs). Our main data sources are the EPFR and IMF Balance of Payment Statistics (BOPS) for fund flows and IIP, respectively. We focus on the period 2011–2021 and use monthly and quarterly data. We make use of either stocks data or flows data depending on the objective of the exercise we tackle.

In particular, we undertake four exercises. First, we estimate the share of investment funds in countries' portfolio equity and debt liabilities. We show that the external exposure of countries to foreign-domiciled investment funds has been increasing both for AEs and EMEs. This result is not surprising, because investment funds offer diversification, liquidity and professional management in a way that makes cross-border investment less cumbersome and less expensive for all investors across the globe. Second, we make use of the higher frequency of fund flow data to nowcast portfolio equity and bond liabilities. We find that our nowcast of portfolio equity liabilities outperforms a random walk in the vast majority of countries in our sample, while it is more difficult to nowcast portfolio

7 Although issuers of securities may know who initially acquires them in primary markets, subsequent purchases and sales cannot be traced back. In particular, the residency or the sector of the holder cannot be determined. Therefore, BOP and IIP statistics rely on data coming from banks regarding the custody accounts. Most of the time, banks aggregate these data based on residency but not on sector.

8 While this paper only analyzes countries' exposures to investment funds, the analysis can easily be repeated for other types of NBFIs, such as pension funds, if suitable data sources are available.

debt liabilities accurately using our methodology. This may be driven by the greater importance of financial institutions other than investment funds in bond markets. Third, we conduct a few empirical analyses to gauge the impact of fund flows on exchange rates and asset prices. We find that larger exposure to funds is coincident with higher exchange rate volatility and that larger fund flows are coincident with asset price increases. The latter result becomes stronger for fund flows arising from foreign-domiciled funds. Fourth, we focus on sustainability-themed funds by constructing a measure of sustainable finance and showing that sustainable finance has also impacted capital flows, though to a varying degree in different countries. In fact, we show that ESG flows to EMEs have a considerable cross-border nature, whereas ESG flows to AEs tend to be domestic investment.

Our paper adds to three strands of literature. First, it adds to the vast literature on capital flows and sheds light on the growing importance of investment funds for external exposures. Previous studies document the evolution of capital flows, external exposures and capital flow volatility and identify capital flow waves – see, for example, Calvo (1998), Lane and Milesi-Ferretti (2007), Forbes and Warnock (2012, 2021), Gelos et al. (2019), CGFS (2021) and Eguren-Martin et al. (2021), among others.[9] Due to sectoral data unavailability, however, these studies have focused on aggregate flows and did not consider sectoral capital flows. In this paper, we document that the switch from bank finance to market finance in recent years has affected how countries' exposures to foreign financial sectors have changed and provide a partial answer to the "from whom to whom" question concerning portfolio equity and debt liabilities.

Second, our paper is related to the literature on macro challenges and financial stability risks that NBFIs pose to the global economy. In particular, Claessens and Lewrick (2021) and FSB (2021) study the liquidity risks of investment funds, while Converse et al. (2020) show that the growing role of exchange-traded funds (ETFs) has amplified the exposure of EMEs to the global financial cycle. While capital flows are desirable, as they can bring significant benefits to countries, they can also be volatile and pose macro challenges and financial stability risks. This paper adds to this literature by quantifying countries' exposures to foreign-domiciled investment funds and presents evidence that countries' external exposure to investment funds has become an important channel for shocks to propagate across national borders. Thus, we show how volatile capital flows can become in response to large redemptions of investment fund shares in other countries, as observed in the March 2020 turmoil.

9 Yeşin (2015) and Yeşin (2017) focus on Switzerland and study capital flow waves and the empirical link between exchange rates and capital flows, respectively.

Third, our paper adds to the growing literature on sustainable finance. Since the United Nations' adoption of an ambitious agenda for sustainable development in 2015, the literature on sustainable finance has been growing at a rapid speed. It covers a wide set of questions from the prevalence and performance of sustainability-themed products to the impact of such products on achieving a sustainable economy to greenwashing (see, for example, Pastor et al., 2021; UNCTAD, 2021; Schoenmaker, 2018). We contribute to this literature by documenting the cross-border aspect of sustainability-themed investment funds.

Our analysis yields four important findings with policy implications. First, the external exposure of countries to investment funds is on the rise for both bonds and equity. Second, higher external exposure to bond funds is coincident with higher depreciations during the March 2020 turmoil. Third, our methodology to nowcast equity liabilities using the index of external exposure to investment funds performs better than using a random walk. Fourth, sustainable finance is on the rise for all countries, albeit at different level and with varying cross-border exposure.

2 Not all fund flows are capital flows

In this section, we explain the relationship between capital flows and fund flows, as well as the relationship between external liabilities and AUM. Although in the literature and in the media fund flow data are sometimes used as a proxy for capital flows, they in fact measure different concepts. Similarly, the AUM of investment funds in a given country should not be treated as external liabilities of that country. In this paper, we exploit the granularity of the fund flows data to identify capital flows channeled by foreign-domiciled investment funds.

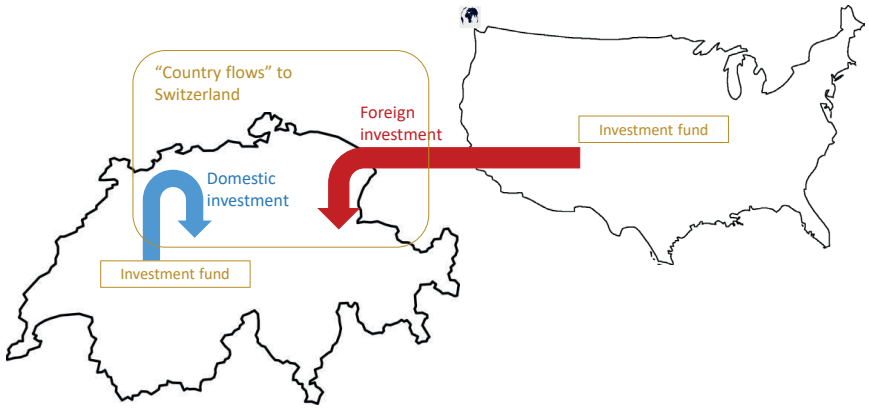
Capital flows occur through the transfer of ownership of a financial asset between residents and nonresidents of a country. Thus, a country's financial account records only the cross-border transactions as capital flows, while its IIP records cross-border asset and liability stocks. These data are compiled by national statistical authorities and follow the BOP accounting standards as described in the IMF Balance of Payments and International Investment Manual (BPM6). Countries report their data to the IMF on a regular basis. These data are available in the IMF's Balance of Payments Statistics (BOPS) database with a quarterly frequency and usually come with a long lag.[10]

10 Few countries compile and publish flows and stocks data at a monthly frequency. For a very small number of emerging market economies, IIF publishes daily or weekly data of capital inflows into portfolio investment, but the corresponding IIP data are not available at this high frequency.

In contrast, fund flows measure purchases and redemptions of fund shares by all investors independent of their residency. EPFR's flow and allocation data record investor demand for equity and bond funds as well as how funds allocate their investment to different countries.[11] Because not all investment fund transactions are between residents and nonresidents, fund flows data compiled by EPFR differ from capital flows data taken from the IMF BOPS. In fact, fund flows data mainly capture shifts in investor sentiment and momentum and in real time (Koepke and Paetzold, 2020; Ben-Rephael et al., 2012). These data are available on a daily frequency and have a short lag.

To illustrate how capital flows and fund flows are related to each other, Figure 2 depicts two countries – Switzerland and the United States – where two investment funds are domiciled. We assume, for simplicity, that there are no other countries and no other investment funds. In addition, we assume that both funds have a mandate to invest in Switzerland. Thus, they both invest in assets issued by Swiss-domiciled entities. In this case, fund flows to Switzerland will be the sum of the investments by these two funds into Swiss equity and bond markets. In contrast, only the flows of the investment fund domiciled in the United States and investing in Switzerland will be recorded as capital inflows to Switzerland. Similarly, the AUM of the United States investment fund vis-à-vis Switzerland will be recorded as external liabilities of Switzerland to the United States. Further information on how the EPFR and IMF BOPS data are related to each other can be found in Appendix A.

Figure 2: Fund flows versus capital flows



Notes: The figure shows investment into Switzerland by two investment funds. Fund flows to Switzerland (country flows) is the sum of all investment into Switzerland. However, only the claims of the investment funds that are domiciled in the United States are cross-border, therefore, fund flows will not be equal to capital flows.

Source: Authors' illustration.

11 Note also that funds generally maintain a cash buffer so that flows in and out of funds do not necessarily result in immediate corresponding transactions of the underlying asset.

3 Data used in our analysis

In this paper, we rely on two main sources of data: EPFR for fund flows and AUM data; and IMF BOPS for capital flows and IIP data. These data sources provide both end-of-period stocks data as well as during-the-period flows data, both of which we make use of.

Specifically, from EPFR, we use *country flows* data. Country flows measure total investment into each country from all fund types across the globe. They are a derived dataset by EPFR in which each fund's flow data are combined with its portfolio allocation information. Country flows data are available for equity and bonds separately. These data are actual flows and are not estimates based on changes in stocks and changes in asset prices or exchange rates. Therefore, country flows data reliably measure actual investment decisions. Furthermore, data on AUM are available for each country. In our analysis, we use monthly and quarterly data from EPFR.[12]

We use IMF BOPS data to select our sample of countries based on their global importance as destination countries for portfolio investment. We select the 30 countries with the largest portfolio investment liabilities in 2019 and the 30 countries with the largest portfolio investment inflows during 2015–2019.[13] Then, we merge these samples, as there is a significant overlap. Our final sample has 20 AEs and 13 EMEs with available EPFR and IMF data, covered approximately 88% of the world's portfolio investment liabilities in 2019, and was behind 87% of world GDP in 2019. Further information on our sample can be found in Appendix B.

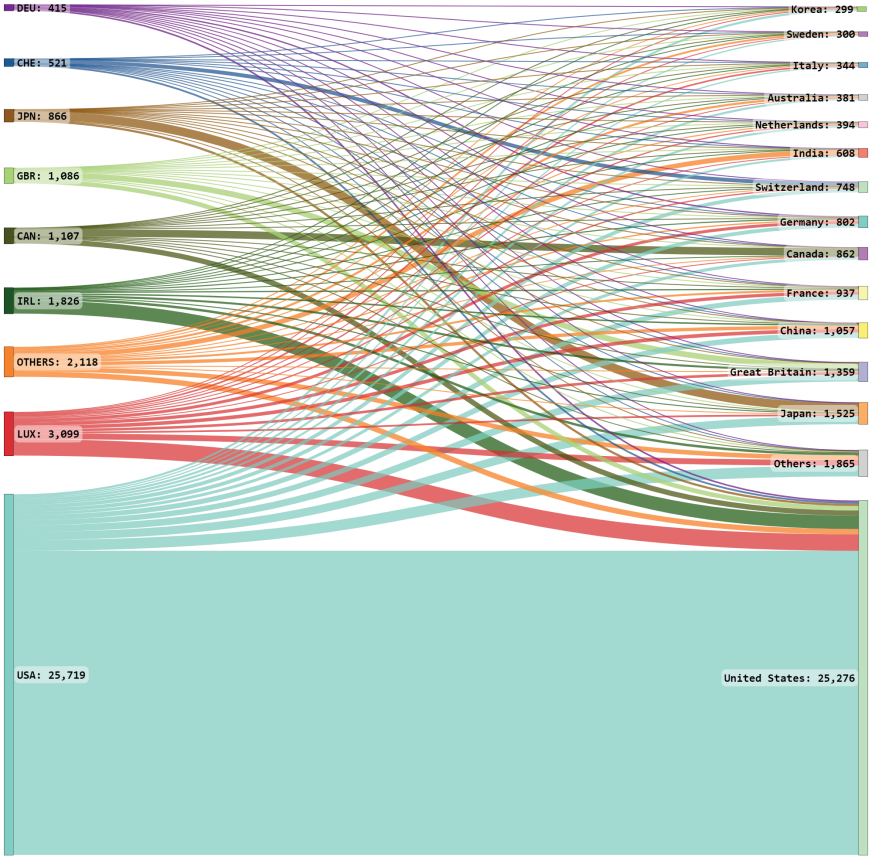
Figure 3 gives a quick look into the data we use in this paper. The figure illustrates the asset and liability positions of domicile and destination countries based on investment funds' AUM in our sample as of February 2022. Fund domicile countries are shown on the left-hand side, while the destination countries are shown on the right-hand side. The figure shows that investment funds are clustered in relatively few countries, such as the United States, Luxembourg, Ireland and Canada. The group "*Others*" on the left-hand side includes, in order of decreasing AUM, India, France, Australia, Sweden, China, Spain and the Netherlands, among others. The destination countries are far more diverse, ranging from the United States to Korea. Furthermore, there is significant inbound investment for

12 The EPFR also provides daily and weekly data that we do not use in this paper as the higher-frequency fund flows data do not add much benefit for our purposes.

13 We select our sample of countries based on their importance in global financial integration. There may be other countries not included in our sample that may be affected by the developments in global financial markets. However, those countries outside of the scope of our paper are less likely to be the source of a macrofinancial shock and/or policy changes that may be propagated internationally via portfolio investment exposures.

the United States, while less so for other countries such as Japan and Switzerland. The figure shows that it is important not to use fund flows and capital flows terms and data interchangeably, as inbound investment may blur the picture.

Figure 3: Domicile and destination countries of investment funds



Notes: The figure shows the AUM of equity and bond funds in our sample of countries as of February 2022. The countries on the left-hand side are those where investment funds are domiciled. The countries on the right-hand side are the recipients of fund flows.

Source: EPFR.

4 Measuring external exposure to investment funds

In this section, we construct an index to measure the external exposure of countries to foreign-domiciled investment funds. In particular, for each country in our sample, we calculate the share of portfolio liabilities channeled via foreign-domiciled investment funds to total portfolio liabilities. We calculate three versions of this index: portfolio equity, portfolio debt and total portfolio.

Specifically, for each country i at time t,

$$External\ exposure\ to\ funds_{i,t} = \frac{AUM\ Investment\ Funds_{i,t}^{Foreign\ domic}}{Portfolio\ investment\ liabilities_{i,t}} \quad (1),$$

where the denominator represents the portfolio investment liabilities of country i at time t, and the numerator is the value of AUM of foreign-domiciled investment funds investing in country i at time t.[14] In other words, the index measures the share of portfolio liabilities to nonresident investment funds in all portfolio liabilities of a country. The index takes a value between 0 and 1 when there are no data gaps in the IIP data. The index can be calculated for bonds and equity separately, as well as for total portfolio investment.

The index in Equation (1) has several advantages. It is a simple index to calculate and interpret. Higher values of the index indicate higher external exposure to investment funds; that is, the index tells us how exposed a country is to foreign-domiciled investment funds. Another advantage of the index is that it relies on existing financial data from two different sources; thus, any potential data gaps in these different sources will be unrelated to each other. A potential shortcoming of the index is that it only gives a lower bound for external exposure because currently the EPFR has an impressive but not full coverage of all funds globally.[15] Thus, in reality, the external exposure of countries to funds may be slightly higher than our estimates.

Note that the denominator is usually available only at a quarterly frequency because IIP data are compiled less frequently. In contrast, the numerator is available at daily, weekly and monthly frequencies because EPFR collects data from investment funds at these higher frequencies. Therefore, the index can be calculated at a quarterly frequency with exact precision, and at daily, weekly, or monthly frequencies with some imprecision, keeping the denominator fixed

14 There are alternative ways to measure exposure to investment funds. Since the focus of this paper is on capital flows, our index only measures the prevalence of foreign investment channeled via investment funds. Another way to measure exposure to investment funds would be to consider all stock market capitalization or total outstanding debt and AUM of all equity or bond funds in the respective country.

15 Our main assumption in this assessment is that the IIP data are compiled correctly, which may not be true.

during the quarter. For the scope of this paper, we calculate the index at monthly and quarterly frequencies as higher frequencies introduce a level of imprecision that would compromise the reliability of our results.

Tables 2 and 3 give a quick overview of the external exposure index to equity and bond funds in each country at the start and end of our sample period, respectively.[16] For the vast majority of countries in the sample, external exposure to both bond and equity funds is higher at the end of the sample period compared to at the start. For example, the external exposure of Switzerland to equity funds almost doubled from 0.15 in 2011 Q1 to 0.29 in 2021 Q4, while the exposure to bond funds increased by a factor of six from 0.02 in 2011 Q1 to 0.12 in 2021 Q4. Remarkably, there is large cross-country heterogeneity in the level and trend of the exposure index.

For the whole sample, external exposure to equity funds increased from 0.19 in 2011 Q1 to 0.26 in 2021 Q4. During the same period, external exposure to bond funds more than quadrupled from 0.02 to 0.09. Note also that, in general, the index has larger values for equities than for bonds. Consequently, foreign investment in bonds does not necessarily come via investment funds, whereas foreign-domiciled equity funds hold a substantial share of equity liabilities.

As mentioned earlier, the index may be inaccurate if the underlying data have measurement issues or gaps. For example, if the fund coverage is too low, the index may be underestimated. In contrast, if the IIP has any data gaps, then the index may be overestimated and, in extreme cases, may even exceed the value of 1. Potential gaps in our sample are easily visible in the cases of Argentina, Egypt and India, as seen in Table 2. In all three countries, the external exposure index to equity funds exceeds the value of 1 either at the beginning or at the end of the sample period, or both. This is because these countries' portfolio investment liabilities in the IIP are lower than the claims of foreign-domiciled funds in these countries, as reported by EPFR. Either or both of these data sources may potentially have data gaps, which are difficult to determine. However, for these countries, stock market capitalization is significantly higher than the reported AUM of investment funds; thus, we conclude that AUM is not overestimated. Instead, portfolio equity liabilities in official IIP statistics seem to be too low.[17] Regardless of what the source of the data gap is, we exclude these countries from our EME sample when using the external exposure index to equity funds in the remaining parts of our paper.

16 The total external exposure index will be a weighted average of these two indices, which we do not report separately here.

17 If these countries' portfolio liabilities are held in custody accounts at banks outside of the jurisdiction, an accurate data compilation may be difficult to achieve and data gaps may be significant.

Table 2: External exposure to equity funds

Country	2021 Q4	2011 Q1	Change (pp)
Egypt[i]	6.66	1.72	494
Argentina[i]	4.20	1.07	313
India	1.64	0.74	90
Indonesia[i]	0.63	0.27	36
Chile	0.61	0.39	22
China	0.60	0.54	6
Czech Rep.	0.59	0.38	21
France	0.51	0.21	30
South Africa[i]	0.49	0.37	12
Italy	0.44	0.18	26
Russia[i]	0.44	0.44	0
Norway[i]	0.43	0.36	7
Japan	0.41	0.28	13
Korea	0.40	0.39	-1
Denmark	0.39	0.20	19
Spain	0.38	0.14	24
Canada	0.37	0.11	26
Sweden	0.36	0.18	18
Brazil	0.35	0.35	0
Germany	0.35	0.19	16
United Kingdom	0.35	0.21	14
Mexico	0.35	0.25	10
Australia	0.33	0.16	17
Hong Kong	0.31	0.19	12
Singapore[i]	0.31	0.25	6
Thailand	0.31	0.37	-6
Finland	0.30	0.17	13
Switzerland	0.29	0.15	14
Austria	0.28	0.14	14
Netherlands	0.23	0.13	10
United States	0.19	0.08	11
Belgium	0.18	0.17	1
Ireland	0.01	0.01	0
Total	*0.26*	*0.19*	*7*

Notes: [i] The exposure index cannot be calculated in 2011 Q1 due to missing portfolio liabilities data in IMF BOPS. Instead, the first available data are shown under 2011 Q1. Countries are sorted in decreasing order by the value of the index in 2021 Q4.

Sources: EPFR; IMF BOPS; authors' own calculations.

Table 3: External exposure index to bond funds

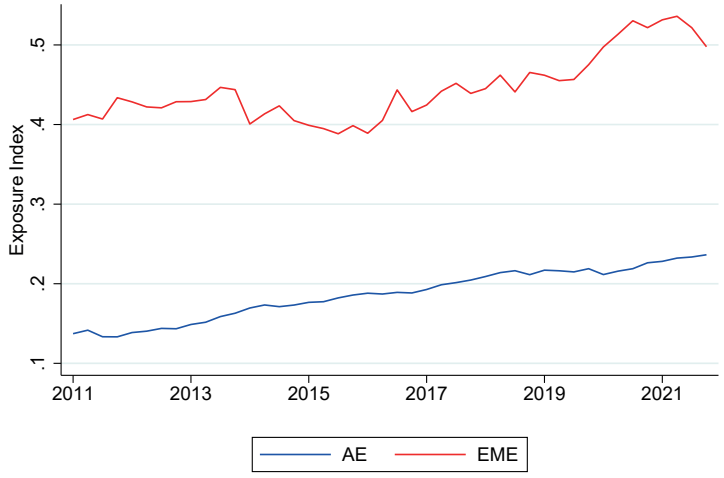
Country	2021 Q4	2011 Q1	Change (pp)
Russia[i]	0.33	0.73	-40
South Africa[i]	0.33	0.26	7
Thailand[i]	0.30	0.18	12
Indonesia[i]	0.28	0.24	4
Brazil	0.24	0.11	13
India	0.24	0.07	17
Egypt[i]	0.23	0.03	20
China	0.18	0.20	-2
Italy	0.17	0.02	15
Mexico	0.17	0.19	-2
Chile	0.15	0.12	3
Singapore[i]	0.14	0.23	-9
Czech Rep.	0.13	0.02	11
Spain	0.13	0.01	12
Hong Kong	0.13	0.08	5
Argentina[i]	0.12	0.10	2
Switzerland	0.12	0.02	10
Germany	0.10	0.02	8
Sweden	0.10	0.03	7
Belgium	0.08	0.01	7
Denmark	0.08	0.03	5
France	0.08	0.01	7
Korea	0.08	0.08	0
United States	0.08	0.01	7
Austria	0.07	0.01	6
United Kingdom	0.07	0.02	5
Norway[i]	0.07	0.04	3
Netherlands	0.06	0.01	5
Australia	0.05	0.03	2
Finland	0.05	0.01	4
Canada	0.04	0.02	2
Japan	0.04	0.03	1
Ireland	0.03	0.00	3
Total	*0.09*	*0.02*	*7*

Notes: [i] The index cannot be calculated in 2011 Q1 due to missing portfolio liabilities data in IMF BOPS. Instead, the first available data are shown under 2011 Q1. Countries are sorted in decreasing order by the value of the index in 2021 Q4.

Sources: EPFR; IMF BOPS; authors' own calculations.

Next, we calculate the exposure index for two subsamples separately – namely, for AEs and EMEs – to provide an aggregate overview of the evolution of the exposure index.[18] Figures 4 and 5 illustrate the exposure index to equity and bond funds over time in those two subsamples, respectively. The figures show that the indices have been steadily increasing in recent years in both subsamples. In other words, portfolio investment channeled by investment funds has been steadily growing over time both in AEs and in EMEs. Remarkably, both indices are at significantly higher levels in EMEs than in AEs. This may be driven by various factors, such as the risk aversion of retail investors and barriers to investing in EMEs for retail investors. . In other words, it may be easier, cheaper and less risky for an AE investor to invest in EMEs via investment funds. Note also that some of the volatility in the exposure index in earlier years is probably due to EPFR increasing its coverage of investment funds over time.

Figure 4: External exposure index to equity funds in AEs and EMEs over time

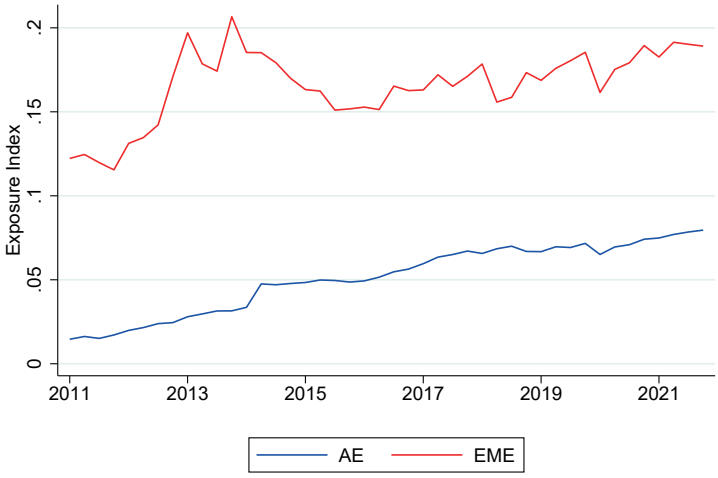


Notes: The figure shows the external exposure index to equity funds in AEs and in EMEs in aggregate, following Equation (1). We exclude Argentina, Egypt and India from the EME sample due to potential data gaps.

Sources: EPFR; IMF BOPS; authors' own calculations.

18 EMEs are Argentina, Brazil, Chile, China, Czech Republic, Egypt, India, Indonesia, Korea, Mexico, Russia, South Africa and Thailand. Argentina, Egypt and India are excluded from the calculations of the equity exposure index due to their apparent data gaps in IIP statistics.

Figure 5: External exposure index to bond funds in AEs and EMEs over time



Notes: The figure shows the external exposure index to equity funds in AEs and in EMEs in aggregate, following Equation (1).
Sources: EPFR; IMF BOPS; authors' own calculations.

5 Nowcasting portfolio investment liabilities

This section presents a methodology to nowcast portfolio equity and bond liabilities of each country using their external exposure index at a monthly frequency. A nowcast of portfolio liabilities is useful because IIP data are normally available with a long lag and at a low frequency, and therefore cannot be effectively used for policy-making in real time. We make use of the increasing importance of foreign-domiciled investment funds in portfolio investment and the higher frequency of EPFR data in our nowcast.

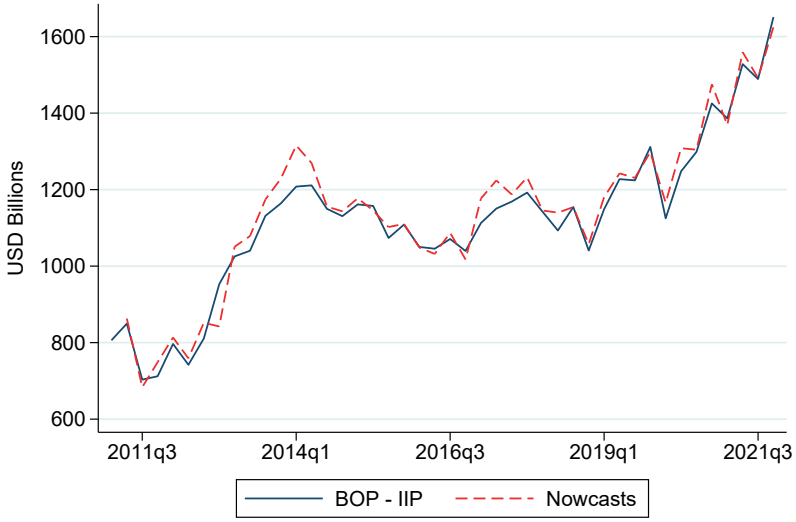
Following Equation (1), our nowcast of portfolio investment liabilities relies on the external exposure index value in the previous period and the AUM of investment funds in this period. Namely,

$$Portfolio\ investment\ liabilities\ nowcast_{i,t} = \frac{AUM\ Investment\ Funds_{i,t}^{Foreign\ domiciled}}{External\ exposure\ index_{i,t-1}} \quad (2),$$

Note that we implicitly assume that the exposure index remains relatively stable over time so that we can make accurate nowcasts.

We nowcast both equity liabilities and bond liabilities for each country in our sample over time following Equation (2). Figure 6 shows the official data juxtaposed with our nowcast for Switzerland at quarterly frequency. The figure shows that our nowcast is a fairly good indicator of official data that will be compiled and released with some lag. Note that the nowcast is almost spot on in some quarters, although there are also some apparent divergences in other quarters. In general, when the nowcast diverges from official data, it tends to overestimate. This overestimation may be driven by the increasing coverage of funds in EPFR data over time.

Figure 6: Nowcast and actual data for portfolio equity liabilities of Switzerland

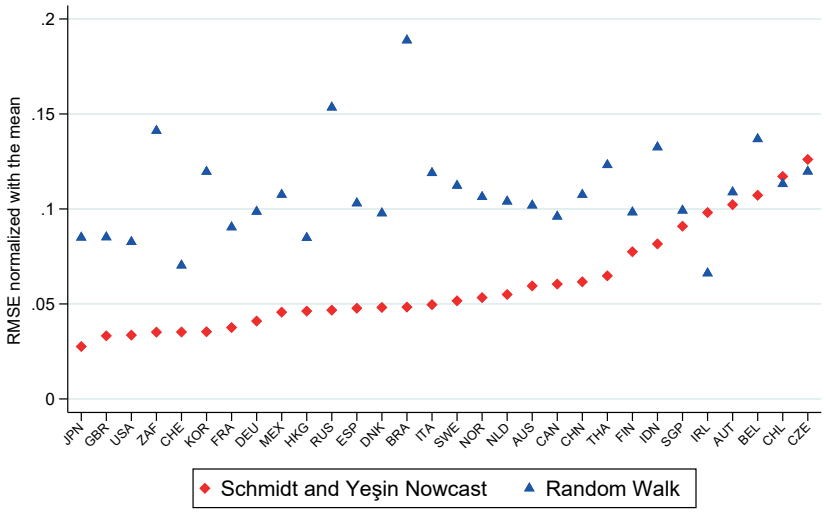


Notes: The figure shows official data for portfolio equity liabilities of Switzerland as published by the Swiss National Bank and its nowcast based on Equation (2).
Sources: EPFR; SNB; IMF BOPS; authors' own calculations.

We test the predictive power of our nowcasts for each country by comparing them to that of a random walk. We calculate the prediction errors at a quarterly frequency for each country using our method as well as for a random walk. Lower values of prediction errors indicate a higher prediction accuracy. We normalize by dividing the root mean square error by the mean of the variable in question to perform a cross-country comparison. Figure 7 illustrates that our equity liabilities nowcast is fairly successful in predicting portfolio equity liabilities in the vast majority of countries in our sample. Indeed, in all countries except Ireland, Chile and the Czech Republic, our nowcast of portfolio equity liabilities outperforms a

random walk. The outperformance of a random walk is largest for Ireland, while for Chile and the Czech Republic, the outperformance is negligible.

Figure 7: Predictive power of nowcast for portfolio equity liabilities



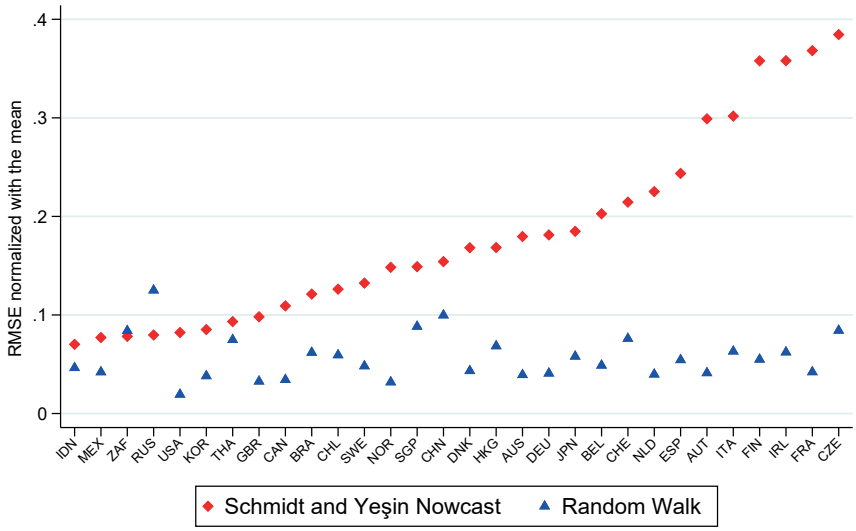
Notes: The figure shows the root mean square errors (RMSE) from the nowcast exercise and from a random walk normalized with the mean of the underlying variable.

Sources: EPFR; IMF BOPS; authors' own calculations.

In contrast, the predictive power of our nowcast for portfolio debt liabilities is very small. Figure 8 shows the root mean square errors (RMSE) for our nowcast and for a random walk.[19] Except for South Africa and Russia, a random walk outperforms our nowcast. There may be various reasons for the inaccuracy of our nowcast of bonds. Of the many potential reasons, the following three are the most likely. First, we note that the values of the external exposure index for bonds are rather low. That is, investment funds play a lesser role in bond liabilities; thus, the evolution of the bond funds' AUM is not very informative for the actual developments of the portfolio debt liabilities. Second, the coverage of bond funds in EPFR may be lower than that of equity funds, and/or its coverage may increase steeply over time, making the exposure index and the nowcast subject to errors. In other words, our assumption regarding the stability of the index over time may be violated. Third, countries' portfolio debt liabilities data may be imprecise or may include some data gaps.

19 We compare our nowcast to a random walk because a random walk is a simple and important model to forecast any time-series variable.

Figure 8: Predictive power of nowcast for portfolio debt liabilities



Notes: The figure shows the root mean square errors (RMSE) from the nowcast exercise and from a random walk normalized with the mean of the underlying variable.
Sources: EPFR; IMF BOPS; authors' own calculations.

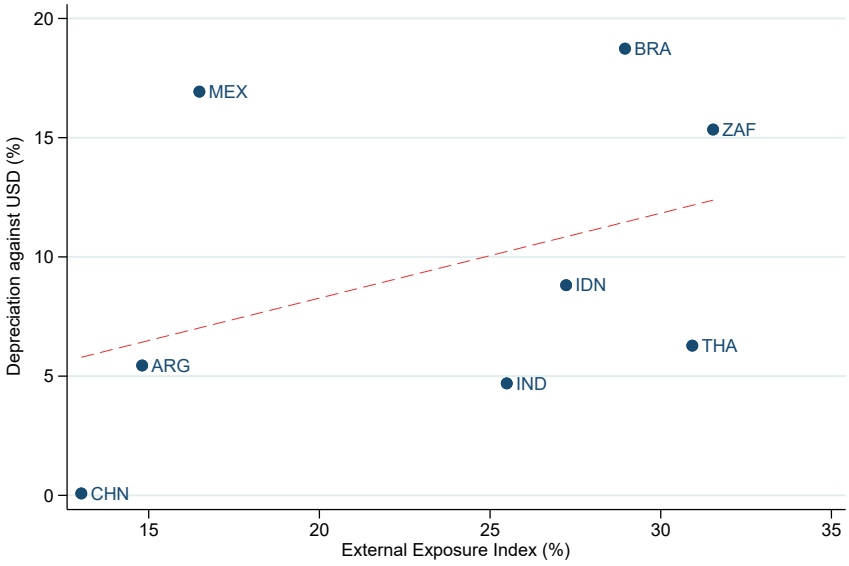
6 Relationship between fund flows and asset prices

In this section, we provide some empirical evidence for the relationship between fund flows, external exposure and movements of asset prices and exchange rates. Our analysis is inspired by the financial market developments during the March 2020 market turmoil with sudden capital outflows from EMEs and sharp asset price movements. In fact, FSB (2020), CGFS (2021) and FSB (2022) document that investment funds' transactions in March 2020 amplified capital outflows from EMEs. IMF (2020) finds that investment funds accounted for more than half of all portfolio outflows from EMEs in March 2020, although they were only one-third of the liabilities. The findings in Chari et al. (2020) imply that the actual conduits that facilitate investor flows matter in the transmission of shocks to investor risk appetite and to flows and returns.[20]

20 For example, the authors show that passive fund redemptions are more responsive to shocks than active fund redemptions.

Motivated by these findings, we first study the link between the external exposure index to bond funds and exchange rate movements in EMEs during the March 2020 turmoil. Figure 9 illustrates a positive correlation between the external exposure index to bond funds at the end of 2019 and exchange rate depreciations during the March 2020 turmoil in eight EMEs with available data. In particular, the figure shows that EMEs with higher external exposure to bond funds before the March 2020 turmoil experienced larger depreciations of their currencies against the US dollar during the turmoil. In other words, EMEs' external exposure to bond funds were coincident with their currencies' depreciation.

Figure 9: External exposure index to bond funds and the March 2020 turmoil



Notes: The vertical axis shows the nominal depreciation of the domestic currency vis-à-vis the USD from 1 January 2020 to 31 March 2020. The horizontal axis shows the external exposure to bond funds at the end of Q4 2019.

Sources: EPFR; IMF BOPS; BIS; authors' own calculations.

Motivated by Figure 9, we undertake a simple empirical exercise. Table 4 shows the results of the cross-sectional regression of exchange rate volatility on the external exposure index. In the first three columns, the dependent variable is the standard deviation of the exchange rate between 2011 and 2021, whereas, in the last three columns, we scale the standard deviation of the exchange rate by its mean. The table illustrates that countries with higher exposure indices tended to experience higher exchange rate volatility during the last 11 years. This exercise

formalizes the positive correlation observed in Figure 9 to a longer time period and covers all countries in our sample. In fact, higher exposure index values are associated with higher exchange rate volatility in our sample of countries. All estimated coefficients are statistically significant and economically relevant. In particular, exposure to bond funds is coincident with higher exchange rate volatility.

Table 4: Foreign exchange volatility and external exposure to funds

	FX volatility					
	Standard deviation of the nominal exchange rate with respect to the US dollar			**Standard deviation of the nominal exchange rate with respect to the US dollar divided by its mean**		
Equity Exposure Index	5.787*** (1.455)		3.658** (1.456)	0.0655*** (0.0231)		0.0359* (0.0198)
Bond Exposure Index		11.252*** (2.805)	10.161*** (2.942)		0.1516*** (0.0410)	0.1408*** (0.0433)
Observations	30	30	30	30	30	30
R-squared	0.312	0.117	0.355	0.317	0.084	0.340

Notes: The table shows the coefficient estimates from cross-sectional regressions of exchange rate volatility on the exposure index and a constant. Each country is a data point, with an average bond exposure index, an average equity exposure index, the standard deviation of the exchange rate and the normalized standard deviation of the exchange rate from January 2011 to December 2021 at a monthly frequency. Argentina, Egypt and India are excluded from the original sample. Standard errors are given in parentheses, with statistical significance indicated by * p<0.10, ** p<0.05, *** p<0.01.

Next, we run a panel regression with country and time fixed effects of asset returns on fund flows using monthly data from 2015 to 2021. Table 5 shows the estimated coefficients when we use total fund flows, while Table 6 shows the results when we use external fund flows as the explanatory variable. External fund flows are fund flows coming from foreign-domiciled investment funds. We have three main findings. First, higher equity fund flows are coincident with increases in stock market indices. Second, higher bond fund flows are coincident with lower bond yields. Interestingly, the results get stronger when we use external fund flows as independent variable. Third, exchange rate movements are coincident with total equity flows, but not with external equity flows.

Table 5: Fund flows and asset prices

	(1) Index prices	**(2) Bond yields**	**(3) Exchange rates**		
Equity flows	20.59*** (4.479)		0.0286* (0.0172)		0.0277 (0.0173)
Bond flows		-0.0540*** (0.0142)		0.0137 (0.0213)	0.0091 (0.0214)
Observations	2,616	2,616	2,532	2,532	2,532
R-squared	0.970	0.885	0.909	0.909	0.909

Notes: The table shows the coefficient estimates from panel regressions of asset prices on fund flows with time and country fixed effects. The data cover the whole sample at a monthly frequency from January 2015 to December 2021 subject to availability. Standard errors are given in parentheses, with statistical significance indicated by * p<0.10, ** p<0.05, *** p<0.01.

Table 6: External fund flows and asset prices

	(1) Index prices	(2) Bond yields	(3) Exchange rates		
External equity flows	26.24*** (5.433)		0.0265 (0.0205)		0.0228 (0.0205)
External bond flows		-0.0591*** (0.0166)		0.0361 (0.0246)	0.0320 (0.0245)
Observations	2,616	2,616	2,532	2,532	2,532
R-squared	0.970	0.646	0.909	0.909	0.909

Notes: The table shows the coefficient estimates from panel regressions of asset prices on external fund flows with time and country fixed effects. The data cover the whole sample at a monthly frequency from January 2015 to December 2021 subject to availability. Standard errors are given in parentheses, with statistical significance indicated by * p<0.10, ** p<0.05, *** p<0.01.

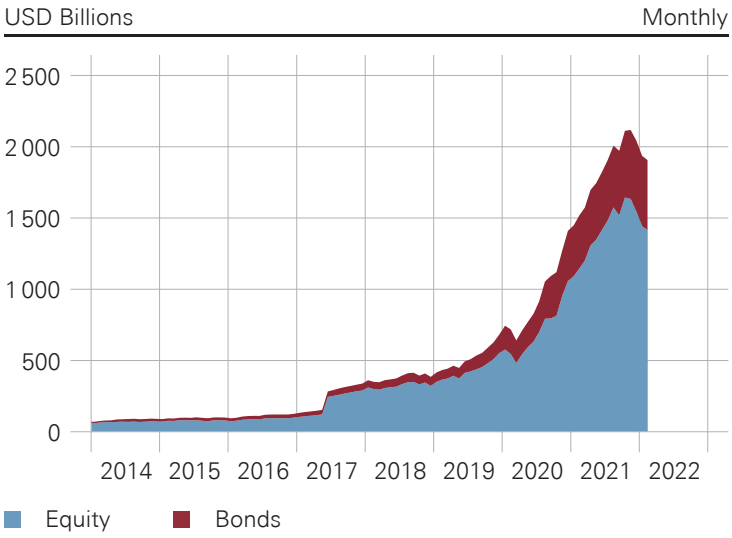
7 ESG funds warrant a closer look

This section gives a brief overview of sustainability-themed investment funds, including trends in the data, current policy discussions on sustainable finance and findings in the literature. It shows that in recent years, the urgency of transforming the world economy toward growth that is also sustainable has shaped financial markets that led to a surge in ESG funds. We elaborate on the factors that drive the supply and demand of sustainability-themed products and how the landscape may evolve with changing regulations and disclosure requirements. We argue that there soon may be a massive issuance of green, social and sustainable bonds, which may lead to a subsequent boom of ESG bond funds. Consequently, we

argue that ESG funds warrant a closer look and separate analysis for external linkages, as they have a different nature than conventional funds and are growing at a rapid pace.

Rising public awareness of climate change and other environmental problems in recent years has led to changes in investor preferences regarding ESG issues. Financial instruments that are labeled "sustainable" have become an increasingly attractive option to investors. At the same time, the increased demand for such products has spurred their supply. UNCTAD (2021) estimates that the value of sustainability-themed investment products increased from less than USD 0.5 trillion in 2015 to USD 3.2 trillion in 2020. These investment products include ESG funds, SRI funds, green bonds and social bonds. The soaring popularity of sustainability-themed investment funds can be seen in Figure 10. During the last five years, the AUM of ESG equity and bond funds has grown an impressive tenfold. As of February 2022, 5% of all funds' AUM was managed by an ESG fund.

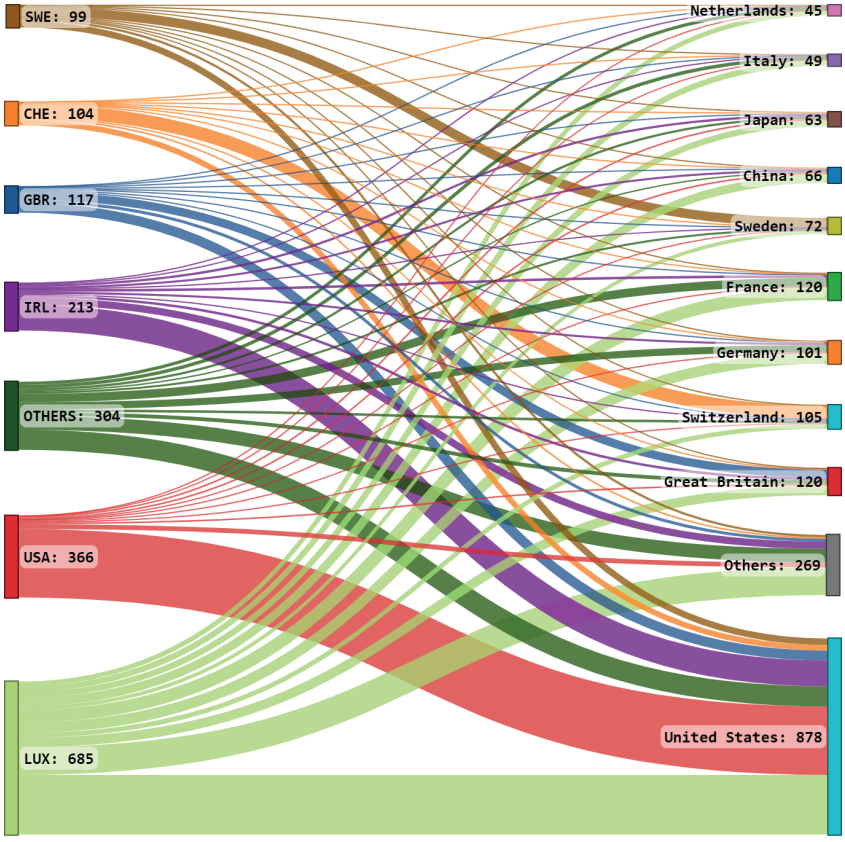
Figure 10: AUM of ESG funds globally



Notes: The figure shows total AUM of ESG- and SRI-labeled investment funds in equity and in bonds.
Source: EPFR.

ESG funds exhibit different domicile and destination patterns from conventional funds, as illustrated in Figure 11. Interestingly, the United States, the country with the largest fund sector, does not dominate as a domicile country of ESG funds. Instead, Luxembourg is the most prominent domicile country for ESG funds, followed by the United States and Ireland. Yet, the United States still receives the largest share of ESG fund flows, followed by the United Kingdom and Switzerland. Remarkably, several EU countries are major destinations for ESG investment.

Figure 11: Domicile and destination countries of ESG funds

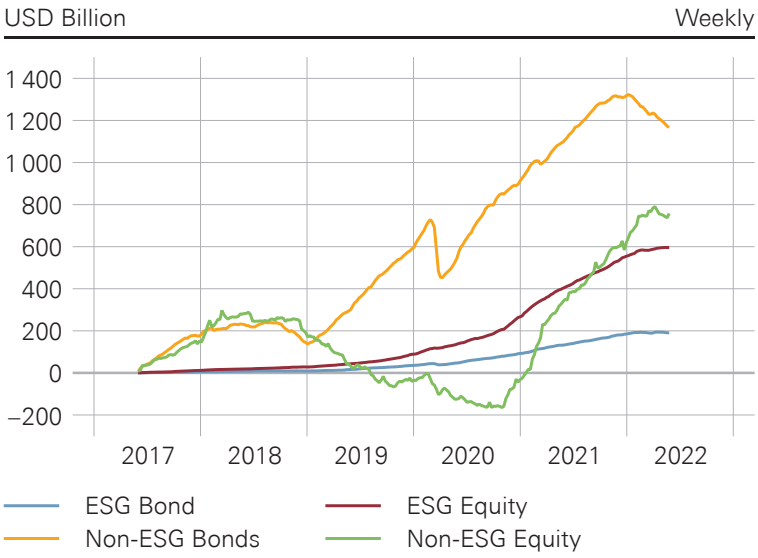


Notes: The figure shows the AUM of investment funds with ESG and SRI labels as of February 2022. The countries on the left-hand side are those where investment funds are domiciled. The countries on the right-hand side are the recipients of fund flows.

Source: EPFR.

The impressive growth of the AUM of ESG funds in recent years is not only a result of asset price changes but also of increased investment in these products by investors. This is particularly the case for ESG equity funds. Figure 12 shows that since 2017, ESG equity funds have attracted almost as much new investment as non-ESG equity funds have. In other words, half of the new investment in equity funds during the last five years went toward ESG funds, although the market share of these funds is still very small. It is also striking that from mid-2018 until approximately mid-2020, investors redeemed their shares of non-ESG funds while they continued to purchase shares of ESG funds at a nearly unchanged pace, as the figure shows. The reasons behind this unintuitive investor behavior may be manifold. The most compelling argument rests on the stark difference in the investor base of each asset class. While non-ESG investors would solely target higher returns, ESG investors may not only aim at increasing financial value now but probably also at lowering their societal and environmental impact or having a longer horizon for their investment, making them less likely to redeem their shares in downturns. In contrast, the cumulated investment in ESG bond funds continues to be small relative to the cumulated investment in non-ESG bonds. The figure shows that the cumulative investment in non-ESG bonds during the last five years is approximately six times larger than the cumulative investment in ESG bonds.

Figure 12: ESG and non-ESG fund flows



Notes: Cumulative flows for the last five years. ESG includes all ESG- and SRI-labeled investment funds.

Source: EPFR.

Previous studies, such as Pástor et al. (2020), confirm this observation that the strong and stable demand for sustainability-themed funds persisted even during the March 2020 turmoil. The authors find that more sustainable funds – particularly those that are more environmentally sustainable and those that employ exclusion criteria in their investment process – received relatively more net flows than less sustainable funds within the same style group during the March turmoil. Furthermore, the increased demand for ESG funds has been supported by their economic performance in 2019 and 2020 compared to their non-ESG peers (ESMA, 2021). In fact, the recent outperformance of ESG funds and of companies with high ESG ratings has been used by asset managers to attract new funding.[21] Pástor et al. (2020) argue that the high returns of sustainable funds suggest that market participant tastes continued to shift toward green assets and green products even during the March 2020 turmoil. Furthermore, the empirical results in Capotă et al. (2022) support the view that ESG investors may have longer-term investment horizons and may expect a higher level of performance from ESG funds in the future. In addition, Pástor et al. (2021) find that ESG preferences move asset prices and that green bonds can outperform brown bonds over a certain period when investors' ESG concerns have grown unexpectedly.

Although the outstanding volume of sustainable bond funds is still small relative to that of sustainable equity funds, this may change significantly in the near future. Government policy shifts and changes in business strategies by the private sector may lead to the massive issuance of green, social and sustainable bonds, which may spur a boom in ESG bond funds. Fiscal planning by the governments of major economies to incorporate climate change and sustainability issues is already evident. Some recent examples of such policy shifts are NextGenerationEU by the European Union, which aims to assist the green transition, and the Build Back Better Act in the United States, which includes provisions related to climate change and social policy. Overall, governments are expected to turn their commitments to sustainable growth into actions, with implications for sustainability-themed investment products Recent data support this view. Cheng et al. (2022) show that sovereign issuance of green, social and sustainable bonds has increased significantly since August 2020, reaching a monthly issuance of USD 88 billion on average compared with less than USD 30 billion during the previous three years. Sustainable bond issuance is, in fact, not limited to governments or AEs. Goel et al. (2022) show that the financial and nonfinancial sectors have also been issuing green bonds extensively in EMEs recently.[22]

21 Previous studies do not always agree if and to what extent a risk premium on green or social bonds exist. Despite the differences in their conclusions, they have developed a common terminology: the *greenium* (or *socium*) measures the amount by which the yield on a green (or social) bond is lower than that on a conventional bond (see, for example, Scatigna et al., 2021).

22 Green bonds of EMEs follow the landscape of regular EME bonds. They are issued not only in the local currency but also in USD and other foreign currencies. They also have higher coupons and shorter maturities.

The surge of sustainable finance also brings some regulatory challenges to financial markets. Here, we elaborate on two of these – namely, disclosure requirements of investment funds and financial stability risks arising from price developments in a rapidly growing asset class.[23] First, greenwashing remains a major concern. In particular, any investment fund could use the label ESG or SRI in its prospectus, signaling to investors that it invests in sustainable companies. However, there are no international disclosure standards or external certification by a third party to assess this label yet. Lack of transparency, greenwashing allegations and a regulatory vacuum remain major concerns in financial markets, although various institutions have recently started discussing how to strengthen the comparability and reliability of sustainability-related disclosures for companies, financial institutions and investment funds.[24] Second, while both the supply of and the demand for sustainability-themed products have been soaring and are expected to grow further, the surrounding financial stability risks related to sustainability-themed risks are also growing. For example, Aramonte and Zabai (2021) point out that the surge of the private label mortgage-based securities (MBS) market before the global financial crisis is comparable to that seen in ESG mutual funds and exchange-traded funds (ETFs), warning of a financial bubble. In this paper, we do not take any stance regarding these two challenges and assume that all ESG and SRI funds are sustainability-themed finance products that are priced correctly by financial markets.

8 Measuring sustainable finance and external exposure

In this section, we focus on ESG funds and construct three indices to measure the prevalence of sustainability-themed finance products in our sample over time. In particular, we reveal that the share of assets of sustainability-themed funds to total assets of all countries has been increasing sharply during the last two years.

We define the overall sustainability index of country *i* in period *t* as follows:

$$Overall\ sustainability\ index_{i,t} = \frac{AUM_{i,t}^{ESG}}{AUM_{i,t}} \quad (3),$$

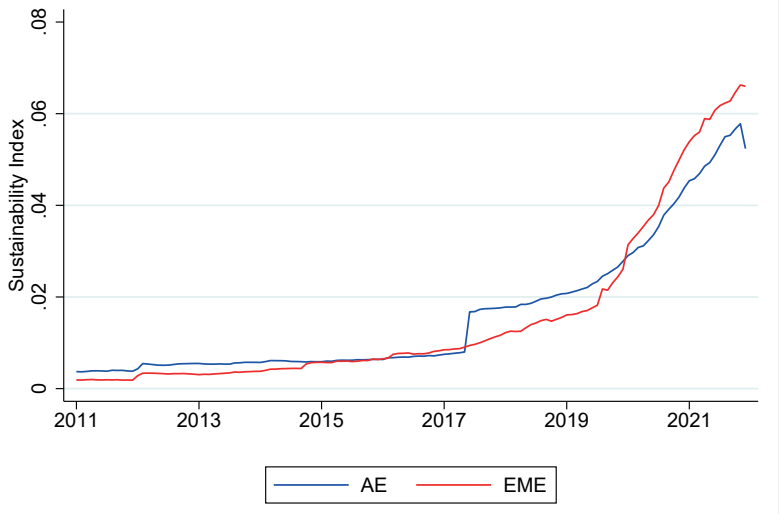
23 For a broader policy discussion concerning sustainable funds, see IMF (2021).

24 For example, in March 2021, the U.S. Securities and Exchange Commission (SEC) created a Climate and ESG Task Force that proactively identifies ESG-related misconduct and presses charges against companies and funds suspected of greenwashing. In the meantime, the SEC is designing regulation to standardize disclosures by funds about their ESG investment. Similarly, the European Securities and Markets Authority (ESMA) aims to ensure that financial markets support and promote the transition toward a greener and more sustainable economy and is providing technical expertise along with other European supervisory authorities such as the European Financial Reporting Advisory Group (EFRAG), European Banking Authority (EBA) and European Insurance and Occupational Pensions Authority (EIOPA) to set the European Sustainability Reporting Standards (ESRS).

where the denominator is the AUM of all investment funds investing in country *i* at time *t*, and the numerator is the value of the AUM of all ESG investment funds investing in country *i* at time *t*. In other words, the index measures the overall share of ESG funds in all funds. The index takes values between 0 and 1. The index can be calculated for bonds and equity separately, as well as for total portfolio investment.

We calculate the sustainability index for each country in our sample as well as for EMEs and AEs in aggregate over time following Equation (3). Figures 13 and 14 illustrate the sustainability index in AEs and EMEs for equity and bond funds, respectively. Both figures show a sharp rise after 2019. Remarkably, the index has similar values for both AEs and EMEs. Despite the sharp rise of the index, it is still at levels below 10% at the end of our sample period in both country groups and for both asset classes.

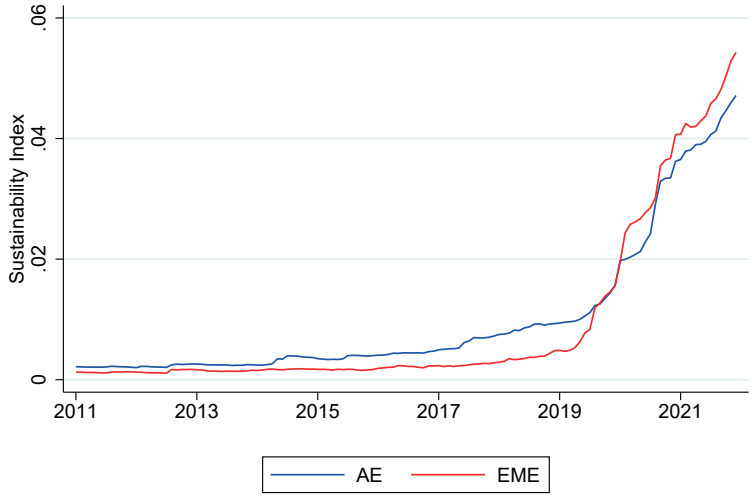
Figure 13: Sustainability index of equity funds



Notes: The figure shows the share of ESG and SRI equity funds' AUM to those of all funds, following Equation (5) in aggregate.

Sources: EPFR; authors' own calculations.

Figure 14: Sustainability index of bond funds



Notes: The figure shows the share of ESG and SRI bond funds' AUM to those of all funds, following Equation (5) in aggregate.

Sources: EPFR; authors' own calculations.

Next, we disentangle the sustainability index into two parts by separating domestically domiciled and foreign-domiciled investment funds. In other words, we calculate two versions of the sustainability index for each country, taking into account whether the investment fund is domiciled abroad or not. Equations (4) and (5) give the formulae for these indices.

$$Domestic\ sustainability\ index_{i,t} = \frac{AUM_{i,t}^{ESG-domestically\ domiciled}}{AUM_{i,t}^{domestically\ domiciled}} \tag{4}$$

$$Foreign\ sustainability\ index_{i,t} = \frac{AUM_{i,t}^{ESG-foreign\ domiciled}}{AUM_{i,t}^{foreign\ domiciled}} \tag{5}.$$

Again, these indices can be calculated for equity and bond funds separately and take values between 0 and 1. Note that the sum of domestic sustainability and foreign sustainability indices will not add up to the sustainability index, as the denominators of these indices are all different from one another. We choose not to have the AUM of all funds in the denominator because of the high concentration of investment funds in a handful of countries. We attempt to separate the overall surge of investment by funds in each country from the surge in ESG funds, as these developments are driven by different factors. Therefore, Equations 4

and 5 measure the share of AUM that is labeled ESG by domestic and foreign-domiciled investment funds investing in that country, respectively. Depending on investor preferences and the extent of domestic investment, we expect domestic and foreign sustainability indices to show wide variation both within and across countries.

Tables 7 and 8 show the domestic, foreign and overall sustainability indices for each country at the beginning and end of the sample period for equity and bond funds, respectively. Note that in 2021 Q4, the total sustainability index is highest in Sweden for both equity and bonds, at 0.19 and 0.38, respectively. In contrast, the United States exhibits very low values in 2021 Q4 both for equity and bonds, at 0.04 and 0.022, respectively. Note that in 2011 Q1, the domestic sustainability index is zero in many countries in our sample, while it has some positive values in 2021 Q4. This is driven by the fact that more and more investment funds are domiciled in those countries with an ESG label. It is also remarkable that the foreign sustainability index is significantly higher for countries that are not among the main fund domicile countries. In fact, for countries that do not host any ESG funds, all ESG flows come from foreign-domiciled investment funds and have a cross-border nature. In contrast, European countries such as Sweden, Switzerland and Austria exhibit higher values in the domestic sustainability index than they do in the foreign sustainability index. Note also that countries in which no investment fund is domiciled have a domestic sustainability index equal to zero by definition. Overall, we observe that ESG flows to EMEs have a cross-border nature, whereas ESG flows to AEs tend to be domestic investment.

Table 7: Sustainability index of equity funds

Country	Total		Domestic		Foreign	
	2021 Q4	2011 Q1	2021 Q4	2011 Q1	2021 Q4	2011 Q1
Sweden	0.190	0.005	0.356	0.000	0.102	0.005
Czech Rep.	0.132	0.001	0.000	0.000	0.132	0.001
Switzerland	0.124	0.005	0.201	0.000	0.093	0.005
Finland	0.112	0.005	0.401	0.000	0.099	0.005
Austria	0.111	0.006	0.128	0.000	0.107	0.006
Norway	0.111	0.004	0.201	0.000	0.097	0.004
France	0.110	0.005	0.270	0.006	0.095	0.005
Netherlands	0.107	0.005	0.237	0.000	0.105	0.005
Germany	0.106	0.004	0.076	0.001	0.112	0.005
Denmark	0.106	0.004	0.014	0.000	0.108	0.004
Ireland	0.106	0.005	0.167	0.003	0.101	0.005
Belgium	0.097	0.005	0.112	0.003	0.097	0.005
Spain	0.097	0.005	0.004	0.000	0.100	0.005
Italy	0.097	0.005	0.021	0.000	0.098	0.005
Mexico	0.095	0.001	0.301	0.000	0.075	0.001
Egypt	0.091	0.001	0.000	0.000	0.091	0.001
Russia	0.091	0.002	0.008	0.000	0.093	0.002
Chile	0.085	0.001	0.000	0.000	0.085	0.001
UK	0.081	0.006	0.082	0.009	0.081	0.004
Indonesia	0.075	0.002	0.058	0.000	0.075	0.002
South Africa	0.073	0.002	0.032	0.000	0.083	0.002
Brazil	0.072	0.001	0.006	0.000	0.076	0.001
China	0.071	0.002	0.030	0.000	0.079	0.002
Korea	0.071	0.003	0.024	0.000	0.078	0.003
Singapore	0.067	0.004	0.000	0.000	0.067	0.004
Argentina	0.064	0.003	0.000	0.000	0.064	0.003
Hong Kong	0.061	0.004	0.000	0.000	0.061	0.004
Australia	0.049	0.007	0.028	0.019	0.060	0.004
Canada	0.048	0.007	0.013	0.008	0.083	0.005
Thailand	0.045	0.003	0.001	0.000	0.072	0.003
India	0.044	0.001	0.007	0.000	0.073	0.001
Japan	0.042	0.004	0.004	0.000	0.069	0.004
USA	0.040	0.003	0.017	0.002	0.178	0.013
AE	0.052	0.004	0.022	0.003	0.120	0.006
EME	0.066	0.002	0.020	0.000	0.078	0.002
Total	*0.053*	*0.003*	*0.022*	*0.003*	*0.112*	*0.005*

Notes: The table shows the values of the three sustainability indices as defined in Equations (3), (4) and (5). The overall sustainability index is not equal to the sum of domestic and foreign indices.

Sources: EPFR; authors' own calculations.

Table 8: Sustainability index of bond funds

Country	Total		Domestic		Foreign	
	2021 Q4	2011 Q1	2021 Q4	2011 Q1	2021 Q4	2011 Q1
Sweden	0.379	0.001	0.493	0.000	0.308	0.001
Switzerland	0.212	0.000	0.229	0.000	0.146	0.001
Norway	0.203	0.001	0.179	0.000	0.225	0.001
Austria	0.194	0.001	0.274	0.000	0.187	0.001
Belgium	0.178	0.001	0.338	0.000	0.177	0.001
France	0.173	0.001	0.373	0.000	0.158	0.001
Finland	0.171	0.002	0.640	0.000	0.166	0.002
Italy	0.170	0.001	0.140	0.000	0.171	0.001
Spain	0.165	0.001	0.017	0.000	0.189	0.001
Germany	0.161	0.001	0.034	0.000	0.166	0.001
Denmark	0.154	0.001	0.001	0.000	0.168	0.001
Ireland	0.154	0.001	0.075	0.000	0.169	0.001
Netherlands	0.137	0.001	0.070	0.000	0.162	0.001
UK	0.105	0.001	0.108	0.000	0.103	0.001
Czech Rep.	0.082	0.001	0.000	0.000	0.082	0.001
Egypt	0.071	0.001	0.000	0.000	0.071	0.001
South Africa	0.070	0.001	0.000	0.000	0.070	0.001
Chile	0.069	0.001	0.000	0.000	0.069	0.001
Mexico	0.067	0.001	0.000	0.000	0.067	0.001
Russia	0.067	0.001	0.000	0.000	0.067	0.001
Brazil	0.063	0.001	0.000	0.000	0.063	0.001
Argentina	0.059	0.001	0.000	0.000	0.059	0.001
Indonesia	0.054	0.001	0.000	0.000	0.054	0.001
Hong Kong	0.053	0.000	0.000	0.000	0.053	0.000
Korea	0.052	0.001	0.000	0.000	0.052	0.001
Thailand	0.050	0.001	0.000	0.000	0.050	0.001
Japan	0.049	0.001	0.000	0.000	0.066	0.001
Australia	0.045	0.001	0.001	0.000	0.080	0.001
India	0.045	0.001	0.000	0.000	0.045	0.001
Singapore	0.040	0.001	0.000	0.000	0.040	0.001
China	0.039	0.001	0.000	0.000	0.039	0.001
USA	0.022	0.002	0.008	0.002	0.107	0.001
Canada	0.018	0.001	0.006	0.000	0.075	0.001
AE	0.047	0.002	0.016	0.002	0.132	0.001
EME	0.054	0.001	0.000	0.000	0.054	0.001
Total	*0.047*	*0.002*	*0.016*	*0.002*	*0.121*	*0.001*

Notes: The table shows the values of the three sustainability indices as defined in Equations (3), (4) and (5). The overall sustainability index is not equal to the sum of domestic and foreign indices.

Sources: EPFR; authors' own calculations.

9 Conclusion and policy implications

The external financial linkages of countries shape the cross-border propagation mechanism of macrofinancial shocks and changes in macroprudential regulation. The significance of NBFIs, in particular investment funds, in this cross-border propagation mechanism became evident during the market turmoil in March 2020. A health crisis brought about by the COVID-19 shock evolved into a debt and equity crisis and led to sudden capital outflows from EMEs, sharp asset price movements and a deterioration of US dollar funding conditions globally. Redemptions of investment fund shares amplified capital outflows from EMEs during the turmoil. Thus, the importance of investment funds for capital flows and asset prices across the globe became palpable in March 2020. Central banks had to respond to market developments quickly by participating in the standing swap arrangement with the U.S. Federal Reserve and by conducting US dollar repos with banks to enhance the provision of dollar liquidity, thereby lessening the strain on the global US dollar funding markets. The IMF provided liquidity to a very large number of countries. Overall, the turmoil showed that investment funds – a sector with little regulation and without access to lender-of-last-resort facilities – could pose a substantial threat to financial stability.

In this paper, we measure the growing importance of investment funds in international capital flows and for global financial stability. Motivated by the developments in global financial markets during the March 2020 turmoil, we undertake two main exercises. In the first exercise, we measure countries' external exposure to investment funds over time. We show that countries have been receiving portfolio investment inflows that are increasingly channeled by foreign-domiciled investment funds. In some countries, particularly in EMEs, the external exposure to investment funds is very high. We argue that those countries with high exposures may be subject to sudden capital outflows again if global investment funds face large redemptions. We also make use of this external exposure measure to nowcast countries' portfolio liabilities over time. As the official portfolio liabilities data come with a long lag, our nowcast can be useful for policy-makers in their decision making concerning external sector assessment or monetary policy. In the second exercise, we estimate the empirical relationship between fund flows and asset prices. We have three main findings. First, countries with higher external exposure to investment funds experience higher exchange rate volatility. Second, larger fund flows are coincident with higher equity prices and lower bond yields and the results are stronger when we focus only on fund flows originating from foreign-domiciled funds. Third, the empirical link between fund flows and exchange rate movements is not robust.

This paper also adds to the growing policy discussion on sustainability-themed investment funds. In particular, we develop sustainability indicators for each country over time that measure the share of ESG funds in total funds. While their levels are still relatively small, these sustainability indices are currently growing at a rapid pace. We also show that sustainable investment via investment funds has mostly a domestic investment nature in AEs, while for EMEs it mainly comes from foreign-domiciled funds. EMEs' cross-border exposure to ESG funds may be both beneficial and detrimental. In general, it may act as a buffer against external shocks because ESG investors seem to hold these assets for a longer period of time and with different investment purposes. However, it may also have a detrimental effect on capital flows and financial markets when disclosure requirements change for corporates and investment funds across the globe.

This paper's findings should be considered within the context of policy discussion concerning two issues. These are changes in NBFI regulation and disclosure requirements on climate-related issues.

First, our findings illustrate the potential importance of investment funds as a cross-border propagation mechanism if NBFI regulation changes in some countries. In particular, the boom of NBFIs, including that of investment funds after the global financial crisis, has been on the radar of international organizations for a while, yet the market turmoil in March 2020 made NBFIs a prominent work priority of the Financial Stability Board (FSB). The FSB's current work program in collaboration with standard-setting bodies and other international organizations aims to enhance the resilience of NBFIs and covers a wide range of issues, from margin calls in derivatives and securities markets, to liquidity risk in open-ended funds, to dealer behavior in core bond markets. Among the many and multifaceted topics concerning NBFIs, liquidity risk and its management in open-ended investment funds remains a challenging one. Yet the optimal regulation to mitigate systemic risk may have non-negligible spillovers and spillbacks according to our findings in this paper. In particular, if investment funds are regulated with macroprudential tools, as suggested by Claessens and Lewrick (2021), there may initially be non-negligible spillovers to destination countries' financial markets because funds are domiciled in handful of countries and many EMEs have substantial and growing exposure to foreign-domiciled funds, as we show in this paper. In other words, changes in regulation can lead to portfolio rebalancing of investment funds that in turn may spill over to financial markets elsewhere via external exposures. Although such a policy may ultimately strengthen the resilience of financial markets, its immediate adverse impact may be significant.

Second, the findings of our paper concerning ESG funds are subject to change with the upcoming changes in disclosure requirements on climate-related issues. In particular, our indicators for sustainable finance may need to be re-examined when the ESG fund landscape adjusts to new disclosure requirements. Indeed, there is currently a significant momentum towards developing internationally accepted disclosure standards for sustainability-themed finance products. In particular, the International Sustainability Standards Board (ISSB) is currently working on developing two standards – one on climate and one on general sustainability-related disclosures.[25] With the upcoming changes in regulation and disclosure requirements across the globe, it is possible that some ESG funds may lose their ESG label or may have to rebalance their portfolios. In addition, some currently non-ESG funds may suddenly earn an ESG label. Also, it may become possible to undertake a focused analysis of investment funds with a pure "E" or, better yet, climate focus, instead of the broad ESG concept that currently puts three very different aspects of sustainability in one label.

In Switzerland, there is currently a momentum towards developing green bonds markets and improving transparency in climate-related issues. First, Switzerland issued the inaugural green Confederation bond in autumn 2022. Second, the Federal Council is aiming to improve transparency regarding climate-related issues. The framework concerns both financial institutions and the real economy. For example, the Swiss Climate Scores were recently launched by the Federal Council. These are a set of current and forward-looking criteria that investors can use to assess how climate-friendly investment products actually are. Although currently a voluntary instrument, financial institutions are encouraged to use the Swiss Climate Scores for their products, while retail and institutional investors are encouraged to stay knowledgeable about the climate risks that their investments pose. Furthermore, from 2024, large companies will be required to disclose their impact on climate change. Public companies, banks and insurance companies with 500 or more employees and more than CHF 20 million in total assets or more than CHF 40 million in turnover will be legally bound to report on two aspects of their business. First, the firms have to disclose their financial or investment risks linked to climate change. Second, they have to report on the impact that the firm's commercial activities concretely have on the environment. This "double materiality" corresponds to the approach of the European Union.

25 The ISSB is a new international body that was announced at the 2021 United Nations Climate Change Conference (COP26) in November 2021. It aims to deliver a comprehensive global baseline of sustainability-related disclosure standards that provide investors and other capital market participants with information about companies' sustainability related risks and opportunities to help them make informed decisions.

References

Aldasoro, Inaki, Wenqian Huang and Esti Kemp (2020), Cross-border links between bank and non-bank financial institutions, *BIS Quarterly Review*, September, pp. 61–74.

Aramonte, Sirio and Anna Zabai (2021), Sustainable finance: trends, valuations and exposures, *BIS Quarterly Review*, September, pp. 4–5.

Ben-Rephael, Azi, Shmuel Kandel and Avi Wohl (2012), Measuring investor sentiment with mutual fund flows, *Journal of Financial Economics* 104 (2), pp. 363–382.

Calvo, Guillermo (1998), Capital Flows and Capital-Market Crises: The Simple Economics of Sudden Stops, *Journal of Applied Economics* 1 (1), pp. 35–54.

Capotă, Laura-Dona, Margherita Giuzio, Sujit Kapadia and Dilyara Salakhova (2022), Are ethical and green investment funds more resilient?, mimeo, Bank for International Settlements, May.

CGFS – Committee on the Global Financial System (2021), Changing Patterns of Capital Flows, CGFS Paper No. 66, Bank for International Settlements.

Chari, Anusha, Karlye D. Stedman and Christian Lundblad, (2020), Capital flows in risky times: Risk-on/ risk-off and emerging market tail risk, NBER Working Paper No. 27927.

Cheng, Gong, Thorsten Ehrlers and Frank Packer (2022), Sovereigns and sustainable bonds: challenges and new options, *BIS Quarterly Review*, September, pp. 47–55.

Claessens, Stijn and Ulf Lewrick (2021), Open ended bond funds: systemic risks and policy implications, *BIS Quarterly Review*, December, pp. 37–51.

Converse, Nathan, Eduardo Levy Yeyati and Tomás Williams, (2020), How ETFs Amplify the Global Financial Cycle in Emerging Markets, International Finance Discussion Paper No. 1268, Board of Governors of the Federal Reserve System.

Coppola, Antonio, Matteo Maggiori, Brent Neiman and Jesse Schreger (2021), Redrawing the map of global capital flows: The role of cross-border financing and tax havens, *Quarterly Journal of Economics* 136 (3), pp. 1499–1556.

Eguren-Martin, Fernando, Cian O'Neill, Andrej Sokol and Lukas von dem Berge (2021), Capital Flows-at-risk: Push, Pull and the Role of Policy, ECB Working Paper No. 2538.

ESMA – European Securities and Markets Authority (2022), The drivers of the costs and performance of ESG funds, TRV Risk Analysis, May.

Forbes, Kristin and Warnock, Francis (2012), Capital flow waves: Surges, stops, flight, and retrenchment, *Journal of International Economics* 88 (2), pp. 235–251.

Forbes, Kristin and Francis Warnock (2021), Capital flow waves—or ripples? Extreme capital flow movements since the crisis, *Journal of International Money and Finance* 116 (C).

FSB – Financial Stability Board (2020), *Holistic Review of the March Market Turmoil*, November.

FSB (2021), *Global Monitoring Report on Non-Bank Financial Intermediation 2021*, December.

FSB (2022), US Dollar Funding and Emerging Market Economy Vulnerabilities, April.

Gelos, R. Gaston, Gornicka Lucyna, Robin Koepke, Ratna Sahay and Silvia Sgherri (2019), Capital Flows at Risk: Taming the Ebbs and Flows, IMF Working Paper No. 19/279.

Goel, Rohit, Deepali Gautam and Fabio Natalucci (2022), Sustainable finance in emerging markets: evolution, challenges, and policy priorities, IMF Working Paper No. 22/182.

IMF – International Monetary Fund (2020), *Global Financial Stability Report,* April.

IMF (2021), *Global Financial Stability Report*, October.

Koepke, Robin and Simon Paetzold (2020), Capital Flow Data – A Guide for Empirical Analysis and Real-Time Tracking, IMF Working Paper No. 20/171.

Lane, Philip R. and Gian Maria Milesi-Ferretti (2007), The External Wealth of Nations Mark II, *Journal of International Economics* 73, pp. 223–50.

Pástor, Ľuboš, M. Blair Vorstaz and Jeffrey Pontiff (2020), Mutual Fund Performance and Flows during the COVID-19 Crisis, *Review of Asset Pricing Studies* 10 (4), pp. 791-833.

Pástor, Ľuboš, Robert F. Stambaugh, and Lucian A. Taylor (2021), Sustainable investing in equilibrium, Journal of Financial Economics 142 (2), pp. 550–571.

Schoenmaker, Dirk (2018), A Framework for Sustainable Finance, CEPR Discussion Paper No. 12603.

Scatigna, Michela, Dora Xia, Anna Zabai and Omar Zulaica (2021), Achievements and challenges in ESG markets, *BIS Quarterly Review*, December, pp. 83–97.

UNCTAD – United Nations Conference on Trade and Development (2021), *World Investment Report 2021*, United Nations.

Yeşin, Pinar (2015), Capital flow waves to and from Switzerland before and after the financial crisis, *Swiss Journal of Economics and Statistics* 151 (1), pp. 27–75.

Yeşin, Pinar (2017), Capital flows and the Swiss franc, *Swiss Journal of Economics and Statistics* 153 (4), pp. 403–436.

Appendix A: What types of data do EPFR and IMF BOPS record?

There are some differences in the type of data EPFR and IMP BOPS collect and compile, particularly regarding the residency of the investor. Figure A1 illustrates this point.

Assume that there is an investment fund domiciled in Switzerland. Both resident and nonresident investors can purchase and redeem shares of the fund. Depending on its mandate, the fund may be investing in assets issued in Switzerland, abroad or both.

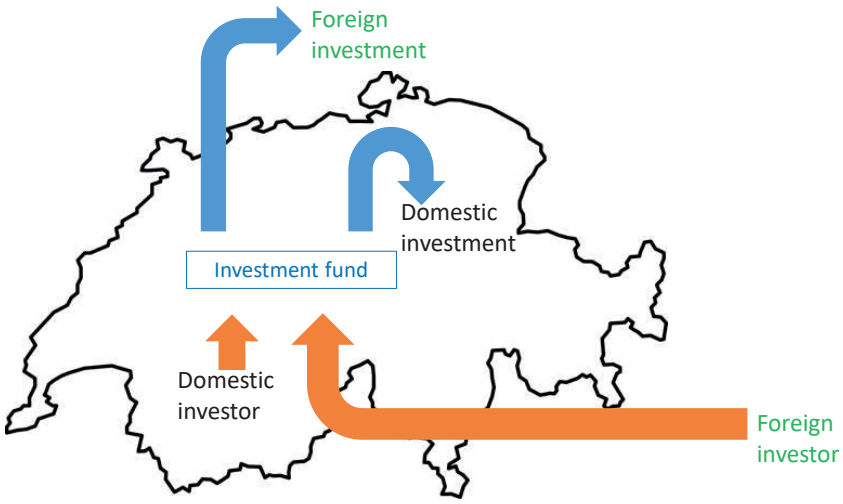
EPFR data do not record the country where the investor in the fund is located, only where the investment fund is domiciled and which countries the investment fund invests in. Thus, it is possible to allocate total assets of investment funds to those countries where the asset has been issued, but it is not possible to allocate total liabilities of investment funds to those countries where the investors are domiciled. In other words, in Figure A1, blue arrows can be identified, but red arrows cannot be identified when EPFR data are used.

This is in contrast to what IMF BOPS data record. All asset purchases by nonresident investors – including purchases of shares of investment funds by nonresident investors – are recorded in the financial account as capital inflows to Switzerland and lead to an increase in portfolio investment liabilities of Switzerland, as shown in the IIP. In other words, the red arrow coming into Switzerland as well as the blue arrow going out of Switzerland are relevant for the IMF BOPS but not for those that remain in Switzerland.

For a few countries, portfolio liabilities data can distinguish liabilities toward foreign-domiciled investment funds from those liabilities toward all the other nonresident investors. For those countries with data on the country of the investor in the investment fund, it would be possible to determine the true financial linkages/exposures of countries that are channeled via investment funds based on the IMF BOPS data (see also Coppola et al., 2021). However, many countries do not record the country of residency of the investor in the investment funds in their BOP and IIP data. All nonresident investors are grouped together in aggregate statistics, and the liabilities of investment funds are not compiled separately. Similarly, the investments of an investment fund into assets issued abroad are recorded in the financial account as capital outflows from Switzerland and lead to an increase in portfolio investment assets of Switzerland, as well as an increase in portfolio investment liabilities of the country that issued the financial asset. However, the Swiss BOP and IIP data do not provide a country, currency or investment-type breakdown of portfolio assets of Swiss-domiciled investment

funds. In this respect, the EPFR data provide more detailed information than the BOP and IIP data so that portfolio investment channeled by foreign domiciled investment funds can be disentangled.

Figure A1: Assets and liabilities of an investment fund and data sources



Notes: The figure shows the assets and liabilities of an investment fund vis-à-vis domestic and foreign counterparties.

Source: Authors' illustration.

Appendix B

Table B1: Sample of countries

Country	iso3 code	Group	Portfolio investment liabilities, 2019 (USD billions)	GDP, 2019 (USD billions)
Argentina	ARG	EME	72	445
Australia	AUS	AE	1,402	1,397
Austria	AUT	AE	434	445
Belgium	BEL	AE	716	533
Brazil	BRA	EME	570	1,878
Canada	CAN	AE	1,817	1,742
Chile	CHL	EME	106	279
China	CHN	EME	1,453	14,280
Czech Rep.	CZE	EME	69	251
Denmark	DNK	AE	499	350
Egypt	EGY	EME	40	303
Finland	FIN	AE	471	269
France	FRA	AE	3,946	2,716
Germany	DEU	AE	3,390	3,861
Hong Kong	HKG	AE	573	363
India	IND	EME	250	2,871
Indonesia	IDN	EME	299	1,119
Ireland	IRL	AE	4,439	399
Italy	ITA	AE	1,533	2,005
Japan	JPN	AE	3,631	5,065
Korea	KOR	EME	742	1,647
Mexico	MEX	EME	522	1,269
Netherlands	NLD	AE	2,704	907
Norway	NOR	AE	406	406
Russia	RUS	EME	302	1,687
Singapore	SGP	AE	276	374
South Africa	ZAF	EME	249	351
Spain	ESP	AE	1,368	1,393
Sweden	SWE	AE	740	531
Switzerland	CHE	AE	1,458	731
Thailand	THA	EME	164	544
UK	GBR	AE	4,765	2,831
USA	USA	AE	21,565	21,433
Sample total			*60,971*	*74,675*
World			*69,250*	*86,267*

Sources: IMF BOPS; World Bank WDI; authors' own calculations.

Comment on "Growing importance of investment funds in capital flows" by Richard Schmidt and Pınar Yeşin

Iñaki Aldasoro[1]
Bank for International Settlements

The remarkable growth of non-bank financial institutions (NBFIs) since the Great Financial Crisis has put them put them front and center on policy-makers' agendas. In principle, NBFIs can contribute to a more diversified funding mix, with attendant positive repercussions on the real economy and financial stability. At the same time, they can be a source of instability due to hidden leverage, liquidity mismatches or their potential contribution to fire sales and market illiquidity.

An important aspect of the growing footprint of NBFIs is the rise of investment funds, both passive and active. The cross-border dimension of this phenomenon is particularly important, not least from a policy perspective, as the investment behavior of foreign funds can significantly impact financial conditions in recipient countries. There is a rich and well-established literature on the impact of capital flows.

In their paper, Schmidt and Yeşin analyze the footprint of investment funds in capital flows.[2]

They do so by combining high-frequency data on investment funds' assets under management from EPFR (for both equity and bond funds) with lower frequency balance of payments data from the IMF for a sample of 20 advanced and 13 emerging economies. The intermediate goal is to estimate the share of portfolio equity and bond liabilities to foreign-domiciled investment funds. This requires that they clean the EPFR data to tease out the cross-border component of investment funds' positions, an interesting exercise in and of itself – useful not least from a policy monitoring perspective.

Schmidt and Yeşin show that the external exposure of countries to foreign-domiciled investment funds has been increasing both for advanced and emerging economies, and it is on average larger for the latter. This is in line with related research and policy work documenting the growing footprint of NBFIs, and

1 The views expressed are the author's own, and not necessarily those of the Bank for International Settlements. Email: inaki.aldasoro@bis.org

2 The paper contributes to a growing literature on the causes and consequences of the rise of NBFIs, as well as the impact on capital flows; see Aramonte et al. (forthcoming), Aldasoro et al. (2022), Converse et al. (2021) and references therein.

could have important implications for how key macroeconomic variables in those economies respond to shifts in foreign investor sentiment. The authors further use the data to nowcast portfolio bond and equity liabilities from the balance of payments, with mixed success (i.e., good for equity for most countries, not as good for bonds).

Armed with countries' exposure to foreign-domiciled investment funds, they then study the attendant impact of those fund flows on domestic variables such as the exchange rate and asset prices, focusing on emerging markets during March 2020. Fund flows, broadly defined to encompass both domestic and cross-border, positively affect equity prices and negatively affect bond yields, while also being associated to an appreciation of the domestic currency. Surprisingly, the latter finding on exchange rates is not present when focusing on foreign-domiciled funds only.

Finally, the paper applies the methodology of identifying foreign-domiciled funds' positions in order to provide stylized facts about the rapidly growing environmental, social and governance (ESG) element of investment funds. They also find these have been on the rise, for both bond and equity funds, as well as across advanced and emerging economies.

The contribution by Schmidt and Yeşin provides a useful starting point for a research agenda, which could benefit from some clarifications and which could be extended in various ways. From a methodology perspective, it becomes important to assess to what extent the documented rise in foreign-domiciled funds results from improvements in the reporting population. Of course, this is not to negate that the share of such funds has been objectively on the rise, but rather to obtain more precise estimates which could inform both policy (including nowcasting) and research work.[3] Related, given investment funds' assets under management are marked-to-market, it becomes important to asses to what extent the good correlation found between EPFR-sourced data and national data (such as that coming from the SNB) is an artefact of changes in the prices of the underlying securities. In addition, benchmarking the findings to those that can be obtained from other high-frequency sources of portfolio debt and equity data, such as those coming from the Institute of International Finance Portfolio Flows Tracker, should also be a fruitful exercise to undertake, not least to underscore the value added.

3 Similar fine-tuning would also benefit the ESG-related part of the analysis, as it is well-known and documented that so-called "green-washing" can be pervasive given that there is no universally accepted common definition of what is and is not ESG. This gives rise to self-labelling, which can impact measures like those of Schmidt and Yeşin.

From an economic perspective, this work opens to door to interesting future research. In particular, extending and refining the analysis of the impact of foreign-domiciled fund flows on domestic variables across countries and time should provide for interesting insights, potentially contributing to related work such as Converse et al. (2021). This could also help shed light on the somewhat counterintuitive finding that foreign-domiciled fund flows have no effect on the exchange rate.

To sum up, the paper by Schmidt and Yeşin makes a valuable contribution to a growing body of work documenting the rising footprint of NBFIs. This can already help policy monitoring work, and if refined with future work, can also help better understand the cross-border impact of the rise of NBFIs on borrowing countries.

References

Aldasoro, Iñaki, Sebastian Doerr and Haonan Zhou (2022), Non-bank lenders in the syndicated loan market, *BIS Quarterly Review*.

Aramonte, Sirio, Andreas Schrimpf and Hyun Song Shin (forthcoming), Non-bank financial intermediaries and financial stability, in The Research Handbook of Financial Markets, Edward Elgar.

Converse, Nathan, Eduardo Levy Yeyati and Tomas Williams (2021), How ETFs amplify the global financial cycle in emerging markets, Working Paper No. 57, Red Nacional de Investigadores en Economía (RedNIE).

Open-ended bond funds: Systemic risks and policy implications

Stijn Claessens and Ulf Lewrick[1]
Bank for International Settlements and CEPR;
Bank for International Settlements and University of Basel

Alongside other non-bank financial intermediaries, open-ended funds that invest in bonds ("bond OEFs") have grown rapidly over the past two decades. Besides their size, their business model and role in recent events suggest that bond OEFs can amplify stress in financial markets. The March 2020 market turmoil tested the effectiveness of bond OEFs' tools in dealing with large investor redemptions in the presence of liquidity mismatches. Their tools notwithstanding, bond OEFs had to liquidate assets on an elevated scale, thus collectively adding to bond market pressures. Without central bank interventions, broader fire sale dynamics could have been triggered. Regulation that takes a macroprudential perspective of the sector could support financial stability by ensuring that tools internalize the effect of spillovers arising from bond OEFs' actions.

JEL codes: liquidity, regulation, financial stability
Key words: G01, G23, G28, C72

1 Introduction

The March 2020 market turmoil revived concerns about the amplification of financial stability risks by non-bank financial intermediaries, including open-ended bond funds ("bond OEFs"). A bond OEF pools capital to invest in fixed income instruments – corporate and other bonds – while typically granting its investors the right to redeem their shares for cash on a daily basis. Through this liquidity transformation, bond OEFs collectively can give rise to financial stability risks. During the early days of the Covid-19 pandemic, bond OEFs experienced intensive but short-lived outflows amid a significant decline in market liquidity and high valuation uncertainty. Conditions remained tense until major central banks stepped in to backstop bond markets.

This episode has sparked a discussion about bond OEFs' resilience, the comprehensiveness of their liquidity management tools, especially in times of

1 The authors thank Robert Czech for the discussion of this paper at the SNB and SIAW-HSG Aussenwirtschaft workshop 2022. We also thank the workshop participants as well as Iñaki Aldasoro, Matteo Aquilina, Claudio Borio, Wenqian Huang, Benoît Mojon, Andreas Schrimpf, Hyun Song Shin and Nikola Tarashev for valuable comments and suggestions. We are grateful to the Luxembourg CSSF for providing data, and Alan Villegas and Giulio Cornelli for excellent research assistance. All errors are our own. The views expressed in this article are those of the authors and do not necessarily reflect those of the Bank for International Settlements (BIS). A previous version of this article was published in the BIS Quarterly Review, December 2021. Corresponding author email: ulf.lewrick@bis.org

stress, and the tools' adequacy for financial stability more broadly. Advocates of the current industry setup point to the swift market recovery and the reversal of fund outflows that followed the turmoil of March 2020. Critics, pointing to previous, similar episodes, question bond OEFs' ability to withstand large shocks without public sector support and call for these funds' regulation to be revisited.

In this article, we analyze redemption dynamics and bond OEFs' response during the March 2020 turmoil, asking whether funds' existing liquidity management tools are conducive to financial stability. Our focus is on actively managed high-yield, investment grade and general bond OEFs. Given their liquidity transformation, these OEFs employ several tools to manage the risk of large redemptions, such as holding liquidity buffers or using swing pricing. We find, however, that bond OEFs' lines of defense did not prevent spillovers across funds and procyclical asset sales.

The experience with bond OEFs during periods of financial turmoil and these funds' systemic importance call for revisiting the regulation of their liquidity management. Bond OEFs are exposed to the risk of concerted investor redemptions or strained market liquidity, which could lead to procyclical fire sales (ESRB, 2021). Macroprudential responses could include introducing new countercyclical tools and strengthening existing liquidity management tools.

We organize our analysis in three sections. In the first, we describe bond OEFs, outline their lines of defense against large investor redemptions and discuss how these mechanisms may or may not prevent shocks from propagating through the financial system. In the second, we review the March 2020 market turmoil, analyze how the drivers of fund flows during the turmoil differ from those in normal times, and study the effectiveness of bond OEFs' tools in mitigating large redemptions and related fire sales. In the final section, we discuss policy options, considering requirements for an effective macroprudential toolkit for bond OEFs.

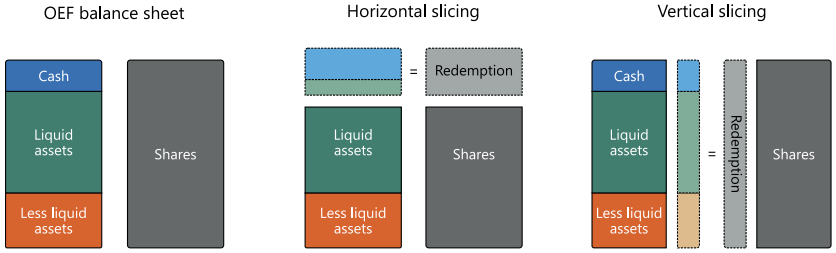
2 Bond OEFs and liquidity risk management

Bond OEFs are collective investment vehicles that hold portfolios of debt securities. They complement bank lending by providing an additional source of funding to financial and non-financial corporates, allowing borrowers to diversify their funding mix. For investors, bond OEFs offer diversified exposures at comparatively low cost.

A bond OEF's liquidity mismatch drives its response to investor redemptions. Figure 1 provides a stylized illustration of this. In its simplest form, the balance

sheet consists of cash and securities holdings on the asset side, with an equivalent amount of issued shares on the liability side (left-hand panel). Bond OEF shares can be redeemed at market value and at short notice, often daily. By contrast, the securities investments are less liquid, resulting in a mismatch. Unlike banks, which, in principle, can collectively expand their balance sheets and thus provide liquidity on demand to other sectors (McLeay et al., 2014), bond OEFs cannot elastically meet demand for cash because their shares are not a means of payment. And unlike exchange-traded funds (ETFs), bond OEFs typically do not "redeem in kind", i.e., pass on their assets to investors or dedicated financial intermediaries (Shim and Todorov, 2021), which would alleviate liquidity pressures. When net redemptions reduce the amount of outstanding shares, bond OEFs need to pay out in cash, either from an available buffer or after liquidating assets.

Figure 1: How open-ended funds (OEFs) can meet redemptions



Note: This stylized example abstracts from bond OEFs' use of derivatives, repos or credit lines.

Source: Authors' elaboration.

Given their liquidity mismatch, bond OEFs rely on a broad set of tools to manage large redemptions, some improving funds' redemption capacity and others reducing investors' redemption incentives. The first line of defense rests on cash and other liquid buffers. A fund's management choses the portfolio share that it holds as cash or invests in highly liquid securities (e.g., short-maturity sovereign bills and bonds) based on the bond OEF's characteristics (e.g., investment strategy and focus) and perceived redemption risks (e.g., investor composition and profiles). Clearly, in doing so, each fund faces a trade-off. While a high liquidity buffer reduces the need to sell less-liquid assets in response to large redemptions, it also weighs on the fund's returns during normal times, thus putting the fund at a competitive disadvantage.

For a given liquidity buffer, the cash management styles used to address redemptions can be classified into two contrasting types: "horizontal slicing" (also referred to as the "waterfall approach") and "vertical slicing". Under horizontal

slicing, the fund manager starts by using the existing cash and selling the most liquid assets (Figure 1, center panel). Under vertical slicing, the fund manager sells assets in proportion to their corresponding weights in the fund's portfolio (right-hand panel).

Neither approach fully addresses redemption pressures since each can give rise to a first-mover advantage, although through different channels. While horizontal slicing helps contain selling of relatively illiquid assets in a possibly strained market, it exposes the investors remaining with the fund to increased liquidity risk. The anticipation of this approach may thus lead more investors to swiftly redeem their shares, reinforcing the redemption pressure on the bond OEF. In turn, vertical slicing leaves the average liquidity of the portfolio unchanged but may amount to selling less-liquid assets into already strained markets. Unless the corresponding costs are charged to the redeeming investors, the expected dilution of the fund could prompt the remaining investors to redeem their shares ahead of others.

Since the first-mover advantage is inherently destabilizing, even for a single bond OEF, a second line of defense seeks to encourage redeeming investors to internalize the costs of their redemptions. It comprises price tools, such as swing pricing, anti-dilution levies and dual pricing, as well as quantity tools, such as redemption gates and the temporary suspension of redemptions (e.g., IOSCO, 2018).

Swing pricing is the most prevalent tool and has received the most attention.[2] While primarily designed as an anti-dilution mechanism, it enables the bond OEF to reduce the first-mover advantage by adjusting the redemption price according to the redemption size. If the fund exhibits net redemptions above a pre-defined threshold, the share price on that day is reduced by a swing factor set in advance by the management company.[3] If set high enough, the swing factor can reduce the first-mover advantage. However, since it is difficult to estimate the price impact and transaction costs of sales during episodes of market stress, swing factors typically rely on rough measures. In addition, swing factors and thresholds are typically not disclosed to investors on a regular basis. Given these various ambiguities, investors may still perceive a strong first-mover advantage, especially at times of unusual stress.

2 Roughly 80% of the bond OEFs studied in this article reported that they could apply swing pricing. For research on swing pricing see, for example, Jin et al. (2022), Lewrick and Schanz (2022) and Capponi et al. (2020). For policy discussions see, for example, IMF (2021) and FSB (2020).

3 Swing pricing is also applied to reduce the dilution that may result from large inflows. In this case, the price per share is raised by the swing factor if net subscriptions exceed a pre-set threshold.

By preventing investors from redeeming their shares, quantity tools such as redemption gates or the temporary suspension of redemptions directly relieve pressure from the fund to raise cash. Yet the prospect of such restrictions could also set off self-reinforcing redemptions. Investors observing a decline in the fund's liquidity position could exit pre-emptively, as has been documented for money market funds (FSB, 2021). Moreover, failure to meet redemptions in full could be perceived as indicating fund weaknesses. This suggests that fund managers could refrain from deploying such tools in order to avoid reputational damage (IOSCO, 2018).

Their liquidity management tools notwithstanding, two factors raise concerns that bond OEFs may contribute to systemic risk.[4] One is the size of the industry. Bond OEF assets under management have outpaced even the strong growth in corporate issuance since the Great Financial Crisis. They now represent about 18% and 17% of the outstanding corporate bonds in the United States and euro area, respectively – up from 7% and 8% in 2008. A disruption of bond OEFs could thus result in a severe tightening of corporate funding conditions.

The second cause for concern is that, in the presence of large redemptions, inherent liquidity mismatches and the constraints imposed by the structure of bond OEF balance sheets can lead to destabilizing behavior and fire sale dynamics. The liquidity management tools are primarily geared towards managing risks at the fund level, with little weight given to broader market impact. Since the bond OEF sector is unable to generate liquidity, cash-raising in response to large redemptions can lead to a fire sale of assets (e.g., Chen et al., 2010; Feroli et al., 2014; Goldstein et al., 2017). Such fire sales could depress specific bonds' market valuations and thereby propagate shocks to other market participants with similar bond exposures (e.g., Manconi et al., 2012; Jiang et al., 2020).[5]

Several factors increase the likelihood of fire sales and their impact. One stems from highly correlated holdings across funds – arising, for instance, from the targeting of common benchmarks – which would lead to the offloading of similar assets during stress. Another is the use of similar risk models and monitoring frameworks, making funds react similarly to market signals. Yet another factor is leverage via bond OEFs' use of derivatives, which can lead to concerted spikes in margin calls and hence cash needs during periods of high market volatility (e.g. Fache Rousová et al., 2020). A fourth factor is the reduction in dealers'

4 Systemic risk can be broadly defined as the risk of widespread disruption to the provision of financial services due to an impairment of all or parts of the financial system, potentially resulting in severely adverse consequences for the real economy (e.g., IMF, BIS and FSB, 2009).

5 OEFs can also spread risks to other market participants through financial interconnections. For instance, OEFs that manage their liquidity by investing in money market fund shares may opt to redeem these shares to raise cash during stressed market conditions, thereby transmitting the redemption pressure to money market funds.

intermediation capacity relative to the size of the market in recent years (e.g., Adrian et al., 2017), which implies that funds could face steeper discounts when trying to sell bonds en masse.

3 Bond OEFs and liquidity risk management

We revisit the market turmoil of March 2020 in order to assess the drivers of redemptions from actively managed bond OEFs and study these funds' use of liquidity management tools. Our analysis covers Undertakings for Collective Investments in Transferable Securities (UCITS) registered in Luxembourg, home to one of the largest OEF industries globally. We build on two data sets: a "broad" and a "survey" sample, which provide broader coverage and more detail, respectively.

The broad sample contains monthly data on fund characteristics from Refinitiv Lipper and daily flow data from Bloomberg. It is combined with semiannual supervisory information. Reporting funds have either more than €500 million of total net assets (TNA) or high leverage (above 2.5 times TNA, based on notional amounts). This sample comprises around 550 funds (henceforth, bond OEFs), with total TNA of around €690 billion in the run-up to the turmoil.[6] The OEFs are categorized in three broad classes: high-yield, investment grade and general bond funds.

The survey sample originates from a supervisory data collection. It contains detailed daily information on up to 57 funds for the first half of 2020, including granular data on swing pricing and cash balances. Total TNA of the OEFs in the survey sample was about €77 billion just before the turmoil.

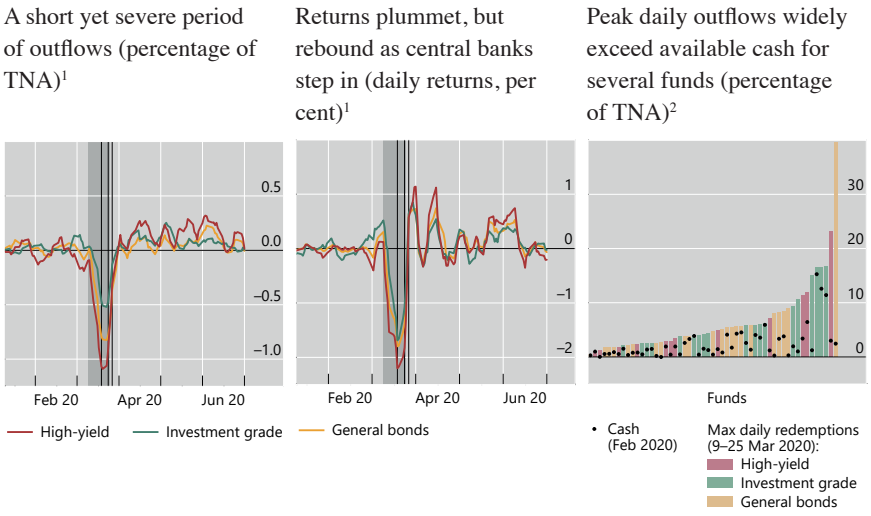
We start by documenting the scale and dynamics of redemptions in the broad sample. Up to the first week of March 2020, bond OEFs appeared broadly immune to the Covid-19-related uncertainty that had weighed on investor risk appetite earlier in the year (e.g., BIS, 2020; FSB, 2020). Average net flows hovered around zero.

The second week of March, however, marked a sudden break. Daily outflows accelerated quickly amid fast-declining returns (Figure 2, left-hand and center panels). By 25 March, within just 16 days, cumulative net outflows had grown to about 6% of TNA. Some funds experienced daily outflows of more than 10%

6 This corresponds to about 18% of the total TNA of all UCITS registered in Luxembourg (i.e., equity and fixed income funds, including money market funds).

(right-hand panel).[7] Stress was widespread, with developments closely mimicking the patterns observed for UK and US bond OEFs (e.g., Bank of England, 2021; Falato et al., 2021).

Figure 2 March 2020: Severe stress followed by swift rebound as central banks step in



Notes: The vertical lines in the left-hand and center panels indicate the following policy interventions in 2020: 18 March (ECB announces PEPP); 23 March (Federal Reserve announces PMCCF and SMCCF); 26 March (ECB begins purchases of corporate sector bonds under PEPP). The shaded area indicates 9–25 March (the period of elevated fund outflows). 1 Based on 549 bond OEFs (broad sample). Five-day moving averages, weighted by total net assets (TNA). 2 The bars represent the highest daily redemption during the period 9–25 March (as a share of TNA) reported by 53 broad sample bond OEFs whose cash ratio fell short of the highest daily redemption in March. The dots represent the cash ratio (as a share of TNA) at end-February 2020.

Sources: Luxembourg CSSF; Bloomberg; Refinitiv Lipper; authors' calculations.

The turmoil was short-lived, with markets rebounding in response to a series of central bank interventions. On 18 March, the ECB announced that, starting on 26 March, it would purchase up to €750 billion worth of bonds under its Pandemic Emergency Purchase Programme (€600 billion were added in June). On 23 March, the Federal Reserve announced the introduction of the Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF), specifying on 9 April that the combined size of the facilities would be up to $750 billion. These interventions, alongside other public

7 According to Carpantier (2021), 18% of bond, equity and mixed Luxembourg UCITS exhibited daily outflows of more than 10% at least once during the period from March to December 2020.

sector support measures, not only provided backstops to markets where bonds in OEFs' portfolios were traded but also restored general investor confidence. Thus, they supported bond valuations more broadly and eased redemptions (e.g., Breckenfelder et al., 2021; Gilchrist et al., 2021).

We find that bond OEF investors differentiate across funds according to several factors. Table 1 reports the coefficient estimates from multivariate regressions of monthly net fund inflows on several candidate explanatory variables, distinguishing between effects during normal market conditions and those in March 2020. For instance, the left-hand column shows that in normal times, all else equal, funds with a return that is one standard deviation below the sample mean (i.e., with an annualized monthly return of –0.7%, as opposed to the sample mean's return of 0.9%) face extra net outflows of about 0.4 percentage points of TNA. In addition, older funds or those with larger TNA would typically experience smaller inflows.

In March 2020, bond OEF characteristics affected fund flows differently than during normal market conditions (Table 1, right-hand column). In that month, funds' lower returns made investors much more prone to redeem, consistent with the findings in Carpantier (2021). Whereas in normal times, lower asset liquidity matters little for net flows, it was of great concern to investors during the turmoil, leading to large outflows from funds with less-liquid portfolios. Also different from normal times, bond OEFs with a larger share of institutional investors exhibited greater outflows in March 2020 than their peers. This is similar to dynamics observed for money market funds at the time (e.g., Avalos and Xia, 2021) and consistent with institutional investors monitoring conditions more closely than retail investors. At the same time, bond OEFs where few investors held a large share of the fund faced smaller outflows, suggesting that large investors internalize the effect of their redemptions more, consistent with prior research (e.g., Chen et al., 2010). Importantly, higher credit and market risks, as measured by value-at-risk, a larger share of lower-rated securities and greater exposures to emerging market economies, were associated with larger net outflows (including within fund asset classes, such as high-yield versus investment grade). These last findings suggest that the prospect of asset illiquidity also contributed to investors' redemptions.

Table 1: Bond OEF characteristics driving elevated redemptions[1]

Dependent variable: monthly net flows to an OEF as a percentage of its total net assets, 2012–20

	Normal	**March 2020**
Return (one-month, annualized)	0.393***	1.805***
Liquid asset ratio	–0.131*	1.200***
Total net assets	–0.346***	–0.794***
Years since launch of the fund	–0.660***	0.509***
Share of fund held by institutional investors	–0.075	–1.188***
Share of fund held by top 5 investors	–0.274***	0.908***
95% value-at-risk	0.079	–0.333***
Portfolio share below investment grade	–0.110	–1.815***
Investment focus on emerging markets (1, 0 variable)	–0.110	–5.507***
Excess flows of non-EME funds in March 2020 (1, 0 variable)		–3.598***
VIX	–0.372***	
Number of observations	37,246	
Adjusted R-squared	0.041	

Notes: */**/*** indicates statistical significance at the 10/5/1% level based on robust standard errors clustered by OEF and month. 1 OLS regression based on 427 bond OEFs. All regressors (except for the emerging market and excess flows dummies) are lagged by one period and standardized to z-scores. Coefficient estimates thus indicate the percentage point change in net flows (as a share of total net assets) that results from a one standard deviation increase in the corresponding regressor. Coefficients in the column labelled "normal" represent the regressors' effect during 2012–20, excluding March 2020; those in the column labelled "March 2020" represent the effect in March 2020. Excess flows indicate the additional outflows during March 2020 that are not explained by other regressors.

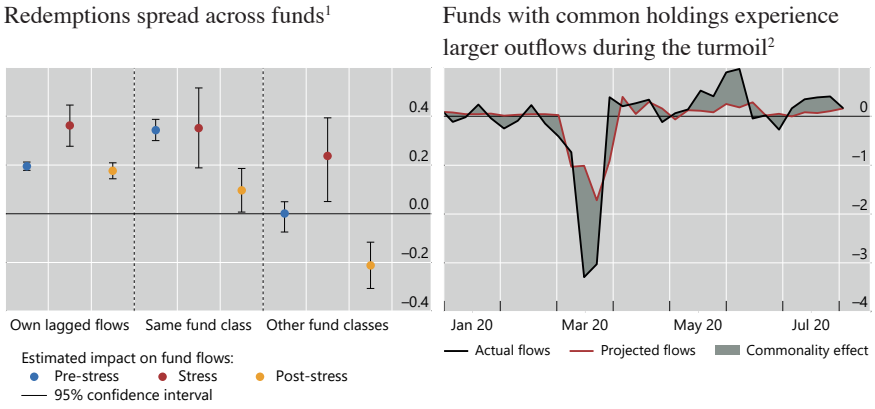
Sources: Luxembourg CSSF; Refinitiv Lipper; authors' calculations.

We find evidence of redemptions spreading across bond OEFs, including through asset price declines. Figure 3 (left-hand panel) depicts the relationship between fund redemptions and *preceding* flows to/from the same fund, other funds in the same class or funds in different classes. Examining this relationship over three distinct periods – pre-stress, stress and post-turmoil – suggests that the turmoil (red dots) stood out in terms of momentum in redemption activity (first triplet) and greater spillovers across similar funds and different fund classes (second and third triplets). This is consistent with spillovers throughout the bond OEF sector, as also documented for US bond OEFs during this period (Falato et al., 2021).

Similarity in funds' exposures seems to also have been a driver of redemption spillovers. Outflows were greater for bond OEFs whose returns co-move more strongly with the aggregate returns of funds in the same asset class (Figure 3,

right-hand panel). This suggests that common holdings or benchmarking across funds added to redemption dynamics, with the attendant asset sales depressing the valuations of bonds. This could have spilled over to the returns of other funds.

Figure 3: Spillovers and elevated redemptions due to common holdings (percentage of TNA)



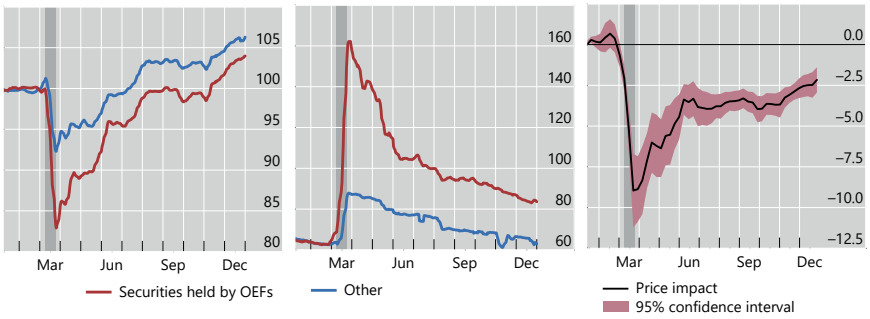
Notes: 1 Coefficient estimates based on a panel regression of weekly fund flows (percentage of total net assets (TNA)) on lagged fund flows, lagged total flows in the same bond OEF class (excluding the fund's own flows), and lagged total flows in other bond OEF classes. Each flow variable is interacted with a binary variable that indicates the pre-stress period (Jan 2012–first week of March 2020), the stress period (second–fourth week of March 2020), and the post-stress period (April–December 2020). The regression also controls for lagged returns, fund size, cash holdings and fund fixed effects. 2 The lines depict the actual and projected weekly flows of *high* correlation funds, which are defined as bond OEFs with returns most correlated (in the top quartile) with the aggregate return of their asset class during the pre-stress period. The estimation of the projected flows proceeds in two steps: the weekly flows of *low* correlation funds (in the bottom quartile) are regressed on a set of fund characteristics and a dummy for the stress period; the resulting regression coefficients are then used to predict the weekly flows of *high* correlation funds. This approximates the counterfactual of flows for *high* correlation funds if their return correlation were low, with the difference reported as the commonality effect.

Sources: Luxembourg CSSF; Bloomberg; Refinitiv Lipper; authors' calculations.

Consistent with the notion of fund-driven fire sales, bonds owned by OEFs at the onset of the turmoil underperformed comparable bonds of the same issuers and displayed worse liquidity during the turmoil. For instance, prices of bonds held by high-yield bond OEFs declined by an additional 10 percentage points on average relative to those of comparable bonds during the period of elevated fund outflows (Figure 4, left-hand panel). Likewise, the bid-ask spreads for assets held by high-yield bond OEFs increased nearly twice as much as those observed for similar bonds at the height of the turmoil (center panel). The differences in

prices and spreads persisted for several months and are robust to controlling for differences in issuer and bond characteristics (right-hand panel).

Figure 4: Bonds held by OEFs exhibit greater declines in price and liquidity[1]



Notes: 1 To maximise coverage, this graph uses an expanded sample of 179 high-yield Luxembourg bond OEFs for which monthly securities holdings data were available at end-February 2020. The sample comprises 34,497 USD- and EUR-denominated securities, of which 3,372 were held by these funds in February 2020. The sample was constructed by matching OEF-held securities with securities of the same issuers that had similar time to maturity but were not held by any of the bond OEFs. 2 Five-day moving average bond mid-prices. 3 Five-day moving average bid-ask spread measured as the difference between the ask and bid price, divided by half the sum of the ask and bid price. 4 The line depicts the estimated difference in the price of OEF-held securities and comparable securities after controlling for differences in bond maturity, currency denomination and issuer, as well as taking account of general market developments using weekly fixed effects in a panel regression.

Sources: Refinitiv Eikon; Refinitiv Lipper; authors' calculations.

Using the detailed survey sample, we assess the performance of bond OEFs' first line of defense through the behavior of two metrics. The first is the ratio of unencumbered cash to TNA ("cash ratio"), which provides a narrow measure of immediately available liquidity. The second is the "liquid assets ratio", which is the share of securities in the portfolio that can be liquidated within one day or less according to the fund manager's own classification.

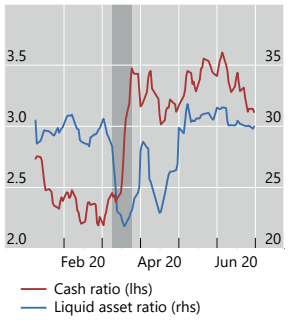
Despite the elevated redemptions in March 2020, bond OEFs actually raised their cash ratios (Figure 5, left-hand panel). This suggests that funds liquidated more assets than needed to meet the redemptions alone. Such procyclical behavior is consistent with prior research on cash hoarding by fund managers during periods

of stress (e.g., Morris et al., 2017; Schrimpf et al., 2021). Indeed, the relationship between fund flows and cash ratios changed during the turmoil (center panel).

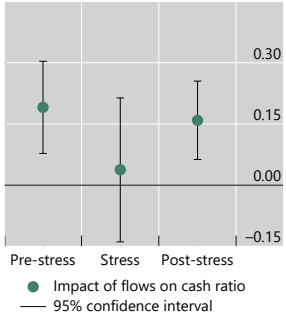
By contrast, funds' (self-reported) liquid asset ratio declined in March 2020 (Figure 5, left-hand panel). This means that bond OEFs sold some of their non-cash liquid assets to boost their cash ratios, tallying with findings for US OEFs (Ma et al., 2022) and suggesting a horizontal slicing approach.[8]

Figure 5: Procyclical liquidity management

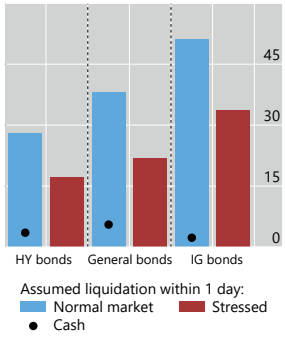
Cash ratios rise even as liquid asset ratios drop during turmoil (percentage of TNA)[1]



Decoupling of flows and cash ratio during the turmoil (coefficient estimate)[2]



Individual fund managers tend to overestimate liquidity under stress (percentage TNA)[3]



Notes: The shaded area in the left-hand panel indicates 9–25 March 2020 (the period of elevated fund outflows). 1 Five-day moving averages of total net assets (TNA)-weighted means of the ratio of unencumbered cash to TNA and the ratio of liquid assets to TNA, respectively. Based on the survey sample, with data from 42 bond OEFs for which daily data on cash and liquid assets were available. 2 Estimated increase in the cash ratio in response to a 1 percentage point increase in net fund flows per TNA. Subsample multivariate regressions of daily changes in cash ratios on fund flows, lagged log TNA, the share of top five investor holdings and the VIX for the period 2 January–6 March 2020 (pre-stress), 9–25 March 2020 (stress) and 26 March–30 June 2020 (post-stress). Based on the survey sample. 3 Reported cash ratio (dots) and liquid asset ratio (bars) under normal conditions and under stressed market conditions. TNA-weighted averages based on a balanced sample of 165 bond OEFs from the broad sample. Data as of end-2019.

Sources: Luxembourg CSSF; Bloomberg; Refinitiv Lipper; authors' calculations.

8 Consistent with the findings in Chernenko and Sunderam (2016), the bond OEFs in our analysis made little use of credit lines with banks – an additional source of cash – during the turmoil. Carpantier (2021) reports that only 2% (8%) of Luxembourg UCITS, including equity, bond and mixed funds, borrowed to meet daily (weekly) net redemptions that exceeded 10% (30%) of TNA.

In interpreting the above results, it is important to keep in mind that each individual bond OEF may overstate its assets' liquidity. Supervisory data of bond OEF reports during normal market conditions, and for some funds under a self-selected stress scenario, show that funds classify many bonds as highly liquid (Figure 5, right-hand panel). At end-2019, high-yield bond fund managers assumed that 28% of assets could be liquidated within one day or less, with this number remaining as high as 17% in a stress scenario. This corresponds to asset sales equivalent to €19 billion and €12 billion, respectively. For the broad sample, bond OEFs assumed that they could collectively sell more than €300 billion (or 45% of their TNA) within one day under normal conditions, suggesting strong reliance by funds on their first line of defense. But, as shown in March 2020, these assumptions underestimate the adverse effects of collective sales on market liquidity in times of stress.

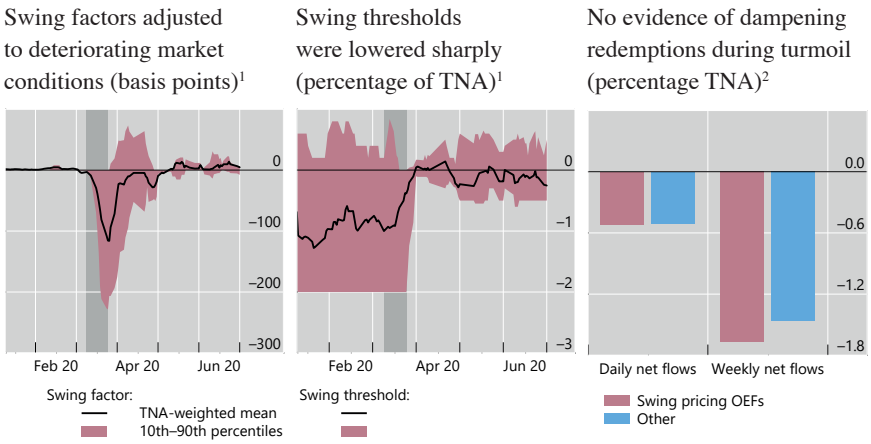
Turning to the second line of defense, bond OEFs intensified their usage of swing pricing during the turmoil and adjusted swing pricing parameters to mitigate dilution. While the average swing factor for the survey sample hovered around zero before the turmoil, it increased by more than 100 basis points on average during the market stress (Figure 6, left-hand panel). Funds also lowered swing thresholds, on average from net outflows of 1% of TNA before the turmoil to less than 0.5% (center panel).

Despite the adjustments in the swing factors and thresholds, we find no evidence of a dampening effect on investor redemptions in March (Figure 6, right-hand panel). The estimated effect of swing pricing on daily net outflows is insignificant in regressions that control for fund characteristics and market conditions. In fact, funds that apply swing pricing exhibited somewhat larger net outflows on a weekly basis. That said, these funds recouped roughly 0.06% of TNA on average from investors redeeming during the three weeks of elevated redemptions.

The swing factor might have been too modest to dissuade redemptions in this episode, in contrast to the dampening effect documented during more tranquil market conditions (Lewrick and Schanz, 2022). As liquidity in corporate bond markets evaporated, the pricing of bonds and the assessment of their liquidation costs became increasingly difficult. The swing factors may have thus fallen short of what investors perceived to be the true impact of liquidating assets on the funds' share price (Bank of England, 2021). The gap between the net asset value (NAV) per share and secondary market price of high-yield bond ETFs, for example, exceeded 800 basis points at the height of the turmoil, suggesting steep discounts on the underlying bonds (e.g., Aramonte and Avalos, 2020; Shim and Todorov, 2021). Bonds' illiquidity may have also led to predictable declines in funds' share prices (Choi et al., 2021), many bond OEFs exhibited several days

of consecutive price reductions during the height of the turmoil, which may have dominated the effect of the swing factor.

Figure 6: Swing pricing during the March 2020 turmoil



Notes: The shaded area in the left-hand and center panels indicates 9–25 March 2020 (the period of elevated fund outflows). 1 Five-day moving averages of the total net assets (TNA)-weighted mean swing factor and swing threshold across funds. Based on an unbalanced sample of 42 bond OEFs. 2 Estimated excess outflows as a share of TNA during the March 2020 market turmoil. Based on panel regressions using daily (weekly) observations to estimate the effect of the turmoil on net fund flows, while controlling for differences across funds with regard to performance, size, investor concentration, cash holdings and holdings of liquid assets. All control variables are lagged by one period. We allow the coefficients to differ for bond OEFs that apply swing pricing and those that do not.

Sources: Luxembourg CSSF; Bloomberg; Refinitiv Lipper; authors' calculations.

Lastly, the bond OEFs in our sample made relatively little use of quantity-based forms of defense. Only two management companies reported temporary suspensions of redemptions. In line with the findings in Grill et al. (2021), these companies attributed their decision to the difficulty of pricing assets, which made it hard to have an objective basis for payouts, rather than to imminent redemption pressures.[9]

9 Grill et al. (2021) estimate that 68 bond OEFs in Europe suspended redemptions during the turmoil, on average for five days. These funds' TNA averaged €210 million (for a total of €14.3 billion), meaning that many of them did not meet the reporting thresholds for inclusion in our broad sample.

4 Conclusion: Integrating a macroprudential perspective

The March 2020 episode revived concerns about the potential for OEFs to contribute to systemic risks. Even though it is notoriously difficult to disentangle the individual drivers of system-wide stress, the scale of fund redemptions indicated the pressure on OEFs to sell assets in increasingly illiquid markets. Decisive policy interventions to backstop bond markets quickly relieved pressure. At the same time, such interventions may nurture expectations of future policy support and provide the breeding ground for the build-up of new risks.

The turmoil raised questions about whether bond OEFs' own lines of defense can prevent the potential amplification of risks during periods of stress. Funds are more than a mere pass-through of investments – they provide liquidity to their investors. This liquidity provision hinges on a portfolio rebalancing, selling assets to raise cash. Large redemptions can then give rise to a first-mover advantage at the fund level: each fund benefits from selling ahead of the others. Since buyers are few in such a scenario, the liquidity of the underlying assets is impaired, with adverse spillovers.

Addressing this collective action problem calls for incorporating systemic considerations into bond OEFs' lines of defense. Adjusting existing tools could strengthen funds' resilience. Liquidity buffers could be expanded by a countercyclical add-on during times of ostensibly ample liquidity and released during periods of stress to provide leeway to OEFs. In addition, bond OEFs could be obliged to collectively move to redemption terms that are more closely aligned with the liquidity profile of their portfolio. This could, for example, include the introduction of notice periods that take account of negative externalities associated with large sales by individual funds and concerted selling by many funds under stress scenarios. For some bond OEFs, emulating ETF features, such as redemptions in kind supported by financial intermediaries to mitigate liquidity stresses, could be an alternative approach to enhance resilience. Swing pricing parameters, in turn, could be calibrated in a more comprehensive way to take account of the market-wide volume of potential sales. Notably, swing factors could be higher during periods of market stress to account for the impact of concerted selling.

Macroprudential tools would ideally be combined to meet several objectives. First, they would be stringent enough to help ensure liquidity mismatches are adequately managed and do not give rise to externalities. Second, they would help to identify and address systemic risks in the cross-section of bond OEFs. Third, they would materially support the liquidity of funds facing large redemptions. Finally, to serve as effective gatekeepers, the tools would be "usable" during

episodes of stress both from a regulatory perspective and from the point of view of the fund manager and investors (Borio et al., 2020).

Policy efforts at the national and international level to strengthen the resilience of bond OEFs and other non-bank financial intermediaries are under way (e.g., FSB, 2020; 2021). Clearly, expanding the macroprudential framework to fully integrate bond OEFs will raise implementation challenges and require cost-benefit considerations. Yet, the important role that bond OEFs play in funding the economy suggests that enhancing their resilience would yield significant macroeconomic benefits.

References

Adrian, Tobias, Nina Boyarchenko and Or Shachar (2017), Dealer balance sheets and bond liquidity provision, *Journal of Monetary Economics* 89, pp. 92–109.

Aramonte, Sirio and Fernando Avalos (2020), The recent distress in corporate bond markets: Cues from ETFs, *BIS Bulletin* No. 6, April.

Avalos, Fernando and Dora Xia (2021), Investor size, liquidity and prime money market fund stress, *BIS Quarterly Review*, March, pp. 17–29.

Bank for International Settlements (2020), A rude awakening for investors, *BIS Quarterly Review*, March, pp. 1–15.

Bank of England (2021), *Liquidity management in UK open-ended funds*, March.

Borio, Claudio, Marc Farag and Nikola Tarashev (2020), Post-crisis international financial regulatory reforms: A primer, BIS Working Papers No. 859.

Breckenfelder, Johannes, Niklas Grimm and Marie Hoerova (2021), Do non-banks need access to the lender of last resort? Evidence from mutual fund runs, mimeo.

Capponi, Agostino, Paul Glassermann and Marko Weber (2020), Swing pricing for mutual funds: breaking the feedback loop between fire sales and fund redemptions, *Management Science* 66 (8), pp. 3295–798.

Carpantier, Jean-François (2021), The impact of Covid-19 on large redemptions in the Luxembourg investment fund market, CSSF Working Paper, September.

Chen, Qi, Itay Goldstein and Wei Jiang (2010), Payoff complementarities and financial fragility: Evidence from mutual fund flows, *Journal of Financial Economics* 97 (2), pp. 239–62.

Chernenko, Sergey and Adi Sunderam (2016), Liquidity transformation in asset management: Evidence from the cash holdings of mutual funds, NBER Working Paper No. 22391.

Choi, Jaewon, Mathias Kronlund and Ji Y. Oh (2021), Sitting bucks: Zero returns in fixed income funds, *Journal of Financial Economics* 101 (2), pp. 296–317.

ESRB – European Systemic Risk Board (2021), *A review of macroprudential policy in the EU in 2020*, July.

Fache Rousová, Linda, Marios Gravanis, Audrius Jukonis and Elisa Letizia (2020), Derivatives-related liquidity risk facing investment funds, *ECB Financial Stability Review*, May.

Falato, Antonio, Itay Goldstein and Ali Hortaçsu (2021), Financial fragility in the Covid-19 crisis: The case of investment funds in corporate bond markets, *Journal of Monetary Economics* 123, pp. 35–52.

Feroli, Michael, Anil Kashyap, Kermit Schoenholtz and Hyun Song Shin (2014), Market tantrums and monetary policy", in *Proceedings of the US Monetary Policy Forum 2014*, Chicago Booth Initiative on Global Markets, pp. 7–60.

FSB – Financial Stability Board (2020), *Holistic review of the March market turmoil*, November.

FSB (2021), *Policy proposals to enhance money market fund resilience: Final report*, October.

Gilchrist, Simon, Bin Wei, Vivian Yue and Egon Zakrajšek (2021), The Fed takes on corporate credit risk: An analysis of the efficacy of the SMCCF, BIS Working Papers No. 963.

Goldstein, Itay, Hao Jiang and David T. Ng (2017), Investor flows and fragility in corporate bond funds, *Journal of Financial Economics* 126 (3), pp. 592–613.

Grill, Michael, Luis Molestina Vivar and Michael Wedow (2021), The suspension of redemptions during the COVID 19 crisis – a case for pre-emptive liquidity measures?, *Macroprudential Bulletin* Article No 12.

IMF – International Monetary Fund (2021), *Investment funds and financial stability: Policy considerations*, September.

IMF, BIS and FSB (2009), *Guidance to assess the systemic importance of financial institutions, markets and instruments: Initial considerations*, October.

IOSCO – International Organization of Securities Commissions (2018), *Open-ended fund liquidity and risk management – good practices and issues for consideration*, Final Report, February.

Jiang, Hao, Dan Li and Ashley Wang (2020), Dynamic liquidity management by corporate bond mutual funds, *Journal of Financial and Quantitative Analysis* 56 (5).

Jin, Dunhong, Marcin Kacperczyk, Bige Kahraman and Felix Suntheim (2022), Swing pricing and fragility in open-end mutual funds, *The Review of Financial Studies* 35 (1), pp. 1–50.

Lewrick, Ulf and Jochen Schanz (2022), Towards a macroprudential framework for investment funds: swing pricing and investor redemptions, *International Journal of Central Banking*, forthcoming.

Ma, Yiming, Kairong Xiao and Yao Zeng (2022), Mutual fund liquidity transformation and reverse flight to liquidity, *The Review of Financial Studies* 35 (1), pp. 4674–4711.

Manconi, Alberto, Massimo Massa and Ayako Yasuda (2021), The role of institutional investors in propagating the crisis of 2007–2008, *Journal of Financial Economics* 104 (3), pp. 491–518.

McLeay, Michael, Amar Radia and Ryland Thomas (2014), Money creation in the modern economy, *Bank of England Quarterly Bulletin*, March.

Morris, Stephen, Ilhyock Shim and Hyun Song Shin (2017), Redemption risk and cash hoarding by asset managers, *Journal of Monetary Economics* 89 (C), pp. 71–87.

Schrimpf, Andreas, Ilhyock Shim and Hyun Song Shin (2021), Liquidity management and asset sales by bond funds in the face of investor redemptions in March 2020, *BIS Bulletin* No. 39, March.

Shim, John J. and Karamfil Todorov (2021), ETFs, illiquid assets, and fire sales, BIS Working Papers No. 975, November.

Comment on "Open-ended bond funds: systemic risks and policy implications" by Stijn Claessens and Ulf Lewrick

Robert Czech[1]
Bank of England

The paper by Stijn Claessens and Ulf Lewrick addresses several highly important and policy-relevant issues, especially given the continued rise of non-bank financial intermediaries (NBFIs) and open-ended funds (OEFs) in particular. One of the most prominent features of OEFs is liquidity transformation. Although funds may invest in illiquid assets such as lower-rated corporate bonds, investors can typically redeem their shares on a daily basis. To meet large investor withdrawals, funds may have to sell illiquid holdings at discounted prices, and the liquidation cost is often borne by the remaining investors. Therefore, investors have a strong incentive to redeem ahead of others. This first-mover advantage can lead to large redemptions from open-ended funds, particularly during market downturns. Furthermore, the redemptions and funds' subsequent selling may lead to a further decline in the price of illiquid assets.

To provide evidence for this potential feedback loop, the authors use supervisory data on bond OEFs from Luxemburg during the recent Covid-19 market turmoil. The study shows that redemptions during the stress period exceeded the OEFs' available cash holdings, and funds resorted to procyclical sales of corporate bonds. Consistent with this result, the authors show that bonds held by OEFs exhibit larger price falls and tend to be less liquid. They also show that redemptions tend to be correlated across fund classes, and also find that funds with common asset holdings experienced larger redemptions. The authors then conclude that funds' liquidity management tools appear to be ineffective. More precisely, funds seem reluctant to use cash buffers to meet redemptions, and OEFs appear to experience larger outflows when they use swing pricing.

The policy implications of these results are important. According to the authors, funds' current use of swing pricing may be ineffective, potentially due to the loose calibration of swing factors. However, if swing factors are too tight and only activated during stress, this could potentially lead to pre-emptive runs and regulatory arbitrage. Second, the study warns that portfolio managers overestimate their portfolio liquidity under duress. Moreover, the stigma around suspensions prevents the use of this additional line of defense. The authors then put forward three potential remedies: countercyclical liquidity buffers, the alignment of

1 The views expressed in this comment are those of the author, and not necessarily those of the Bank of England or its committees.

redemption terms with portfolio liquidity and conservatism in assessment of portfolio liquidity.

The study contributes to a recent strand of the literature that provides conflicting results on the price impact of flow-induced sales of corporate bonds. For example, Jiang et al. (2021) show that investor redemptions generate price pressures and predict a reversal of corporate bond returns during high uncertainty periods. Similarly, Jiang et al. (2022) find that bonds with higher latent fragility experience higher return volatility and more flow-induced fund selling. In stark contrast to these findings, Choi et al. (2020) find little evidence that bond fund redemptions drive fire sale price pressure after controlling for time-varying issuer-level information.

An important assumption in all of these studies is that funds use vertical slicing (i.e., selling of both liquid and illiquid assets to preserve overall portfolio liquidity) in stress periods. However, the experience from the UK gilt market during the Covid-19 market turmoil suggests that OEFs use horizontal slicing: funds sell their more liquid gilts and reduce repo lending in response to outflows, with a large subsequent price impact (Czech et al. 2021). This finding is corroborated by Ma et al. (2022), who provide novel evidence that investors engage in a "reverse flight to liquidity" by selling their most liquid assets first under duress.

In terms of the data, the authors use a relatively limited sample of 179 high-yield funds, and they match bonds held by OEFs with bonds issued by the same firm with similar maturity and not held by OEFs. Given the relatively small size of the European high-yield bond market, the question arises whether the authors could extend their study to the more prominent market for investment grade bonds. Moreover, there are two further extensions that could help to increase the study's impact. First, the authors could try to account for actual flows in and out of these open-ended bond funds. Second, it would be interesting to replicate the regression results of Choi et al. (2020) using issuer-time fixed effects.

The authors also note that "the differences in prices and spreads persisted for several months". The long-lasting price impact may therefore indicate that the observed pattern is not a selling pressure story, but could rather be driven by unobserved bond fundamentals, such as duration, callability, seniority, currency, etc. (e.g., Cesa-Bianchi et al., 2021). The bonds' subsequent underperformance might be erroneously attributed to funds' selling pressure if such discretionary sales were to be misspecified as flow-driven. The authors could provide additional robustness tests to dismiss this alternative motivation for the funds' bond selling.

An important contribution of the paper is to investigate the effectiveness of swing pricing. The authors conclude that "swing factors may have thus fallen short of what investors perceived to be the true impact of liquidating assets on the funds' share price". This finding stands in sharp contrast to the prior literature. In their seminal paper, Jin et al. (2022) show that swing pricing eliminates the first-mover advantage and reduces outflows from UK funds, also during market stress. A way to reconcile these opposing views is to analyze the drivers behind the apparent inertia of swing factors during the early days of the crisis. In a joint Bank of England and Financial Conduct Authority survey of UK open-ended funds and their liquidity management practices (Bank of England and FCA, 2020), for instance, the results indicate that most funds use a standard swing factor (141), which they reviewed only weekly (37), monthly (48) or quarterly (53). Furthermore, fund managers often rely on historical bid-ask spreads of the underlying securities, which may dramatically underestimate trading costs under duress. Even when using current bid-ask spreads, quotes are often "stale", especially for illiquid securities such as high-yield bonds.

Overall, Claessens and Lewrick provide an excellent study on the feedback loops in OEFs, with several important policy implications. Consistent with their suggestions, a robust international consensus appears to emerge on aligning funds' redemption terms with their portfolio liquidity, as well as on establishing more adequate and responsive swing factors in stress periods. The authors' third suggestion to expand funds' liquidity buffers may prove to be more controversial, not least due to the drag on portfolio performance and the resulting impact on the availability of funding for real economy firms. To conclude, there is a clear necessity for more international evidence on the impact of flow-induced trading on corporate and sovereign bond prices.

References

Bank of England (2021), *Assessing the resilience of market-based finance*.

Cesa-Bianchi, Ambrogio and Fernando Eguren-Martin (2021), Dash for dollars, Bank of England Staff Working Paper No. 932.

Choi, Jaewon, Saeid Hoseinzade, Sean Seunghun Shin and Hassan Tehranian (2020), Corporate bond mutual funds and asset fire sales, Journal of Financial Economics 138 (2), pp. 432–457.

Czech, Robert, Bernat Gual-Ricart, Joshua Lillis and Jack Worlidge (2021), The role of non-bank financial intermediaries in the 'dash for cash'in sterling markets, Bank of England Financial Stability Paper 47.

Jiang, Hao, Dan Li and Ashley Wang (2021), Dynamic Liquidity Management by Corporate Bond Mutual Funds, *Journal of Financial and Quantitative Analysis* 56 (5), pp. 1622–1652.

Jiang, Hao, Yi Li, Zheng Sun and Ashley Wang (2022), Does mutual fund illiquidity introduce fragility into asset prices? Evidence from the corporate bond market, *Journal of Financial Economics* 143 (1), pp. 277—302.

Jin, Dunhong, Marcin Kacperczyk, Bige Kahraman and Felix Suntheim (2022), Swing pricing and fragility in open-end mutual funds, The Review of Financial Studies 35 (1), pp. 1–50.

AUSSENWIRTSCHAFT 72.1

Contents

ISSN 0004-82 16