CAHIER D'ÉTUDES
WORKING PAPER

N° 151

THE FLOW-PERFORMANCE RELATIONSHIP OF GLOBAL INVESTMENT FUNDS

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JANUARY 2021

BANQUE CENTRALE DU LUXEMBOURG
EUROSYSTÈME

The flow-performance relationship of global investment funds *

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January 2021

Abstract

We study how globalization affects the response of mutual fund flows to past performance. For that purpose, we use a novel dataset on bond funds from the internationalized Luxembourg fund industry. We find that flows into global funds, i.e. funds issuing shares in several currencies, are more sensitive to past performance than flows to domestic funds, i.e. funds distributing shares in mainly one currency. Moreover, global funds exhibit a higher flow sensitivity to low and high performance, while flows to domestic funds are more reactive to medium performance. These results are robust to using alternative measures of globalization to define domestic and global funds, like the geographical diversification in the distribution of shares and the geographical and currency diversification in the asset portfolio. Thus, the globalization dimension of mutual funds, neglected by related studies, raises the sensitivity of flows to past performance and needs to be taken into account by supervisory and regulatory authorities.

KEYWORDS: Mutual Funds, Multi-currency issuance, Globalization, Flow-performance relationship

JEL CODES: F30, G11, G23

*This paper should not be reported as representing the views of the BCL or the Eurosystem. The views expressed are those of the authors and may not be shared by other research staff or policymakers in the BCL or the Eurosystem. This paper has been produced in the context of the partnership agreement between the Toulouse School of Economics (TSE) and the Banque centrale du Luxembourg (BCL). We thank Patrick Fève, Paolo Guarda and the participants of the BCL economic seminar for useful comments.

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Résumé non-technique

Au cours des dernières décennies, l'industrie des fonds d'investissement a largement contribué au processus d'intégration financière mondial. La globalisation financière a certes permis d'améliorer l'efficience dans l'allocation du capital, mais elle a également contribué à une transmission accrue des chocs adverses au niveau international. Dans cette perspective, l'analyse du comportement des investisseurs et des déterminants des flux dans les fonds d'investissement revêt une importance primordiale.

La littérature économique a exploré cette problématique en se concentrant sur la sensibilité des flux nets à la performance passée des fonds d'investissement, à savoir la relation flux-performance. Les études existantes ont mis l'accent sur la non-linéarité de cette relation, c'est-à-dire que les investisseurs ne réagissent pas avec la même intensité aux bonnes et mauvaises performances des fonds, et sur les facteurs qui influencent cette relation, comme par exemple les coûts de participation et de recherche d'information (Sirri and Tufano, 1998, Huang et al., 2007), le degré de sophistication des investisseurs (Del Guercio and Tkac, 2002; Ferreira et al., 2012) ou encore la liquidité du portefeuille d'actifs (Chen et al., 2010; Goldstein et al., 2017). Cependant, les connaissances demeurent encore limitées quant à l'influence des facteurs internationaux sur le comportement d'investissement dans les organismes de placement collectif.

Ce papier contribue à cette littérature en mettant l'accent sur la manière dont la globalisation influence la relation flux-performance dans les fonds d'investissement. Notre analyse empirique est effectuée à partir d'une base de données sur les fonds obligataires domiciliés au Luxembourg. Les fonds obligataires permettent d'étudier les effets de la globalisation dans un environnement plus adapté, étant donné que ces derniers affichent un biais domestique plus prononcé que les fonds actions. En outre, en tant que première place financière mondiale pour la distribution transfrontalière des fonds d'investissement, le Luxembourg constitue un laboratoire approprié pour étudier les implications d'un marché global. Afin d'appréhender les effets de la globalisation, nous établissons une distinction entre les fonds domestiques et les fonds globaux et les données sur les fonds domiciliés au Luxembourg nous permettent de faire ressortir les caractéristiques de ces fonds.

Les fonds domestiques, qui sont principalement gérés par des acteurs locaux, distribuent généralement leurs parts en euros et dans la zone euro et proposent des produits qui sont davantage adaptés à une clientèle locale en termes d'allocation de portefeuille. Les fonds globaux, qui sont commercialisés par les grands gestionnaires d'actifs mondiaux, distribuent quant à eux leurs parts dans différentes devises et différentes régions du monde et s'adressent à des investisseurs internationaux à la recherche de produits sophistiqués. On peut citer le fonds *Lux-Bond Long Term EUR*, commercialisé par la Banque et Caisse d'Epargne de l'Etat, comme exemple de fonds domestique, et le fonds *Franklin Templeton Investment funds - Templeton Global Bond Fund*, comme

exemple de fonds global. Le premier, qui est investi dans des titres libellés en euros émis par des émetteurs résidents dans la zone euro, est vendu à ses clients par le biais de seulement deux types de parts émises en euros. Le second, qui est investi dans un portefeuille de titres globalement diversifié d'un point de vue géographique et monétaire, est commercialisé par le biais de 70 types de parts émises dans 15 devises différentes.

Il est intéressant de mentionner que la littérature sur le biais domestique (*home bias*) adresse la problématique de la diversification internationale des fonds d'investissement du point de vue de l'allocation des actifs, que ce soit en termes de ventilation géographique (Hau and Rey, 2008) ou de composition en devises du portefeuille (Maggiori et al., 2019). Dans notre étude, la dimension globale des fonds d'investissement est appréhendée non seulement au niveau du portefeuille de titres, mais également à travers la prise en compte de la diversification dans la distribution géographique et dans la devise d'émission des parts.

Des régressions de panel sont estimées avec des données mensuelles de janvier 2009 à juin 2019. Le critère de diversification en devises dans l'émission de parts est utilisé dans un premier temps pour différencier les fonds domestiques et les fonds globaux. Notre analyse empirique indique que les flux nets dans les fonds globaux, qui distribuent leurs parts dans plusieurs devises, sont davantage sensibles à la performance passée que les flux nets dans les fonds domestiques, qui distribuent principalement leurs parts dans une seule devise. Une augmentation d'un point de pourcentage dans la performance passée (rendement moyen sur les douze derniers mois) est associée à une augmentation des flux nets rapportés à l'actif net total de 0.37% pour les fonds domestiques, contre 0.60% pour les fonds globaux. L'estimation d'une régression linéaire par morceaux (*piecewise linear regression*), fondée sur le rang de performance des fonds, permet d'enrichir cette analyse. Alors que les flux dans les fonds domestiques et les fonds globaux répondent de manière relativement similaire aux performances moyennes, la sensibilité des flux aux performances extrêmes est seulement significative pour les fonds globaux. En outre, pour ces derniers, la sensibilité des flux nets des fonds affichant de bonnes et de mauvaises performances est nettement supérieure à celle des fonds affichant des performances moyennes. Ces conclusions sont robustes lorsque des critères alternatifs basés, notamment, sur la diversification géographique dans la distribution de parts et la diversification en pays et en devises dans l'allocation de portefeuille, sont utilisés pour différencier les fonds domestiques et les fonds globaux.

Dans l'ensemble, ces résultats suggèrent que les investisseurs dans les fonds globaux se caractérisent par un comportement plus prononcé de recherche de rendement (*return chasing*) que les investisseurs dans les fonds domestiques. Eu égard à nos résultats, les investisseurs dans les fonds globaux sont non seulement plus sensibles aux performances de marché, mais ils réagissent également de manière plus agressive aux performances relatives des gestionnaires de fonds, traduisant ainsi la plus grande concurrence qui règne parmi ces fonds pour

attirer des investisseurs globaux en quête de rendement. A contrario, les investisseurs dans les fonds domestiques se caractérisent par une plus grande inertie dans leur comportement d'investissement et par une plus faible propension à sanctionner les perdants et à récompenser les gagnants. Ces résultats peuvent s'expliquer par le fait que les fonds domestiques ciblent principalement des investisseurs non-sophistiqués, avec une aversion au risque plus importante, alors que les fonds globaux attirent plutôt des investisseurs sophistiqués affichant un profil avec un niveau de risque/rendement plus élevé. L'utilisation du critère de diversification en devises dans l'allocation de portefeuille pour différencier les fonds domestiques et les fonds globaux, ainsi que l'estimation de régressions séparées pour les fonds investissant dans des actifs plus sûrs et les fonds investissant dans des actifs plus risqués semblent corroborer cette interprétation. Les résultats obtenus à partir de ces analyses mettent en effet en exergue le degré de sophistication des investisseurs dans les fonds globaux, qui tendent non seulement à investir dans des produits plus risqués et plus illiquides, mais qui sont également davantage prêts à supporter un risque de change dans leur portefeuille obligataire.

Ce papier contribue à la compréhension du comportement des investisseurs dans les organismes de placement collectif, et, en tant que tel, apporte des éléments importants de réflexion pour les autorités de supervision. Les résultats obtenus indiquent que la sensibilité des flux à la performance est plus importante dans les fonds globaux, ce qui implique que ces derniers peuvent être plus vulnérables à des retraits massifs de la part des investisseurs, en particulier dans un contexte de choc adverse sur les marchés financiers. En outre, la forme de la relation flux-performance pour les fonds globaux crée une incitation pour les gérants à adapter leur stratégie de manière à augmenter leur attractivité. Dans un contexte de taux d'intérêt faibles, la concurrence exacerbée entre fonds globaux pour attirer les investisseurs à la recherche de rendement porte ainsi des implications importantes pour l'analyse de l'impact des décisions de politique monétaire sur le comportement de prise de risque des intermédiaires financiers.

1 Introduction

The mutual fund industry, with its asset managers targeting investors and seeking investment opportunities all over the world, is part of the financial integration witnessed over recent decades (Lane and Milesi-Ferretti, 2007, 2018). While more integrated financial markets open up investment opportunities and contribute to a more efficient capital allocation, they also facilitate the international transmission of negative shocks, as experienced during the recent global financial crisis (Raddatz and Schmukler, 2012; Puy, 2016). It is therefore important to investigate the determinants of flows in and out of mutual funds in order to understand the behavior of asset managers and investors. The economic literature does so by examining the factors affecting the response of net fund flows to past performance, i.e. the flow-performance relationship. However, only limited attention is given to international factors and little is known on how globalization influences the flow-performance relationship in the mutual fund industry.

This paper investigates the flow-performance relationship of domestic and global investment funds, using a novel dataset on Luxembourg bond funds. Focusing on bond funds allows examining the effects of globalization in a more contained environment, since bond funds usually display a stronger home bias than equity funds. Moreover, we rely on data of Luxembourg-domiciled funds because the Luxembourg fund industry constitutes an appropriate laboratory to study the implications of a global market. Luxembourg is not only a leading fund industry, being the first in Europe and the second in the world after the United States, it is also the most important financial center for the cross-border distribution of investment fund shares.[1] Indeed, Luxembourg serves as a gateway to international asset managers for the distribution of funds on both the European and the global market. As a corollary to this cross-border distribution strategy, a large proportion of the shares issued by Luxembourg-domiciled investment funds is held by non-residents and denominated in foreign currency. The Luxembourg fund industry is therefore characterized by what we call *domestic funds*, which distribute their shares and allocate their assets mainly in euro and in the euro area, and *global funds*, which sell their shares and invest in different currencies all over the world.

Our panel data represents well the internationalization of the Luxembourg bond fund industry as well as the distinct features of domestic and global funds. Aggregate data shows that half of the shares of bond funds are issued in euro and marketed in the euro area, while about two thirds of the asset portfolio of these bond funds are allocated outside the euro area and

[1] The United States and Europe hold the largest shares of the worldwide investment fund net assets in the third quarter of 2019, 47.7% and 32.5%, respectively, while Luxembourg arrives second in terms of the largest country share (8.9%), followed by Ireland (5.7%), Germany (4.5%) and France (3.8%), see EFAMA (2019). Moreover, PWC (2019) reports that the majority of the 113'495 registrations of the 13'669 cross-border funds investigated in 2018, i.e. funds distributed in at least three jurisdictions, were made in Luxembourg (60.5%) followed by Ireland (27.9%) and France (3.3%).

denominated in foreign currencies (see section 3). Looking at individual data helps illustrating the characteristics of domestic and global funds. At one end of the spectrum, domestic funds distribute the majority of their shares in one currency and to domestic investors, while they essentially invest in their domestic market and in domestic currency-denominated securities. These funds display a strong home bias, embed no currency mismatch and target principally non-sophisticated investors. Domestic funds are well exemplified by investment funds promoted by local banks and generally designed for local investors, such as the *Lux-Bond Long Term EUR* offered by the Luxembourg state-owned bank BCEE.[2] This fund invests in euro-denominated securities, issued by euro area investment-grade residents, and is sold to customers via only two share classes denominated in euro. At the other end of the spectrum, global funds sell shares in different currencies and countries and tend to invest internationally in more illiquid and risky products. These global funds are mainly sold to sophisticated investors who are ready to take on a foreign exchange risk in their bond portfolio allocation. The distribution strategy of these funds, which are in competition to attract investors searching for yield, is generally more aggressive than the one of domestically-oriented funds. Global funds are well represented by investment funds promoted by large management companies. These management companies rely on a global network of distributors to sell funds that are designed not only for local customers but also for foreign customers. One example of such a global fund is *Franklin Templeton Investment funds - Templeton Global Bond Fund*. This fund is sold by Franklin Templeton via 70 share classes in 15 different currencies and invests in a diversified portfolio of securities, issued by residents of different countries and denominated in various currencies.[3]

We run panel regressions to analyze the effects of global fund characteristics on the sensitivity of flows to performance. In doing so, we compare global funds, characterized by a high currency diversification in the issuance of shares, to domestic funds, which mainly issue shares in one currency.[4] One major result is that net flows to global funds are more sensitive to performance than flows to domestic funds. A percentage point increase in past performance (average return over the past 12 months) is associated with a net flow increase in the magnitude of 0.37% of domestic and of 0.60% of global funds' total net assets. A second finding is that the flow-performance relationship is not linear. Flows to domestic and global funds differ in their sensitivity to low and high performance though responding in a quite similar manner to medium performance. Flows to global funds react more strongly to extreme performance than to medium performance while the sensitivity of domestic fund flows to low and high perfor-

[2]BCEE stands for Banque et Caisse d'Epargne de l'Etat. For a description of the subfund *Lux-Bond Long Term EUR*, see *https://www.bcee.eu/luxfunds/luxbond/(comp)/25* (last accessed 28 December 2020).

[3]*https://www.franklintempleton.lu/investor/products/documents/256/Z/templeton-global-bond-fund* (last accessed 28 December 2020).

[4]As explained in section 3, we use the currency diversification in the distribution of shares as the principal measure to discriminate between domestic and global funds, but we also test the robustness of our results to other measures.

mance is small and statistically insignificant. More specifically, a 10 percentile improvement in the medium performance range (20^{th} to 80^{th} percentile region) is associated with an increase in net flows to both types of funds corresponding to 0.15% of their total net assets, while a similar improvement in the lowest or highest performance ranks (bottom and top 20 percentiles) goes along with an increase in net flows to global funds in the magnitude of about 0.35% of their total net assets. These results suggest that investors in global funds are characterized by a more pronounced return-chasing behavior than investors in domestic funds. The former do not only react more aggressively to changes in the market performance, but they also buy winners and sell losers more strongly. In contrast, investors in domestic funds exhibit a greater inertia in their investment behavior and a lower propensity to sanction bad and reward good performers.

We provide additional analyses based on alternative criteria to the currency diversification in the issuance of shares to distinguish between global and domestic funds. Our results are confirmed when defining domestic and global funds according to the diversification in the geographical distribution of shares and in the geographical and in the currency composition of funds' asset portfolio as well as to a combination of these various measures. Note that there is one exception, namely that the sensitivity of flows to global funds to extreme performance is less pronounced when these funds are characterized by an important geographical diversification in their asset portfolio. This result supports the study of Maggiori et al. (2019) finding that the portfolio home bias is better characterized by the currency than the country dimension.

Our findings can be rationalized by the fact that domestic funds mostly target non-sophisticated, risk-averse investors, while global funds likely attract sophisticated investors with a higher risk-reward profile. These differences in investor characteristics are comparable to the findings of Park et al. (2018), who document the greater return-chasing behavior of foreign investors compared to domestic investors in emerging bond markets. Note that using the diversification in the currency of investment or in the currency of share issuance produce similar results suggesting that investors in global funds are rather sophisticated since they are inclined to take on a foreign exchange risk in their portfolio. Finally, the differences in the characteristics of domestic and global fund investors is also supported by the additional results from separate regressions for safe-haven funds (i.e. short-term and government bond funds) and search-for-yield funds (i.e. high-yield and emerging markets bond funds). Indeed, flows to safe-haven funds react significantly only to medium performance and flows to search-for-yield funds more strongly to extreme than to medium performance.

This paper contributes to the understanding of investor behavior in mutual funds by highlighting the role of the global dimension of investment funds, a factor ignored so far in the flow-performance literature of mutual funds (see section 2). It thereby provides important insights for supervisory authorities as it suggests, for instance, that investors in global funds are

more sensitive to performance and in particular to extreme performance. On the one hand, this implies that global funds may be more vulnerable to large withdrawals, in particular in the context of an adverse market event (Lee, 2020). On the other hand, the shape of the flow-performance relationship of global funds creates an incentive for managers to increase the riskiness of their strategy in order to improve their ranking. In the context of low interest rates, the greater competition among global funds to attract investors searching for yield also bears important implications for the analysis of the impact of monetary policy decisions on the risk-taking behavior of financial intermediaries (Gungor and Sierra, 2014).

The rest of the paper is structured as follows. We discuss the related literature in section 2 and describe the openness of the Luxembourg fund industry in section 3. Section 4 presents the data and variables used in our empirical analysis. We discuss our main results in section 5 and provide a further analysis in section 6. Section 7 concludes.

2 Literature

Our study relates to the economic studies analyzing the response of flows to performance in order to understand the behavior of managers and investors in mutual funds. Studies typically find that the flow-performance relationship is non-linear and convex: funds with superior past performance disproportionately attract large net inflows while funds with bad past performance suffer smaller net outflows (Ippolito, 1992; Chevalier and Ellison, 1997; Sirri and Tufano, 1998). Investors may, for instance, strongly chase top performance but stay in funds having performed poorly, e.g. because they expect loosing funds to operate strategy and managerial changes (Lynch and Musto, 2003). The literature has also identified numerous factors conditioning the shape of the flow-performance relationship (Cuthbertson et al., 2010; Christoffersen et al., 2014).

Chevalier and Ellison (1997) stress that the flow-performance relationship is influenced by fund age, because managers of younger funds are more inclined to take risks and outperform the market to attract more inflows. Sirri and Tufano (1998) argue that marketing efforts raise the sensitivity of flows to top performance, because they render funds more visible and reduce the search costs faced by investors when collecting information about the funds. According to Huang et al. (2007), the performance threshold that has to be reached to attract investors can be lowered by reducing participation costs through e.g. marketing expenses, the fund's affiliation with a family that has produced a star fund or the existence of brand effects in relation with the size of the fund's family. Consequently, funds with lower participation costs display higher flow sensitivities in the medium performance range than their higher-costs counterparts. In the same vein, Ferreira et al. (2012) find that the sensitivity of flows to high performance is weaker in developed countries, where more sophisticated investors have lower participation costs and

are less influenced by advertising.

Several studies investigate how portfolio liquidity affects the shape of the flow-performance relationship in equity (Chen et al., 2010) and bond funds (Goldstein et al., 2017) and find that flows to funds with illiquid assets react more to bad performance. The authors attribute this result to strategic complementarities among investors, as outflows in illiquid funds impose a greater liquidity cost of adjusting the portfolio and, consequently, a first-mover advantage in the redemption decision. The concavity of the flow-performance relationship tends to disappear with factors weakening these strategic complementarities such as the institutional investor composition of the shareholder base or the existence of large cash buffers. Downs et al. (2016), focusing on real estate funds, confirm that flows are more sensitive to performance for funds with higher liquidity levels and participation costs.

Finally, various other fund characteristics have been found to affect the shape of the flow-performance relationship. Christoffersen and Xu (2017) find that funds exhibiting a greater attrition after bad performance display a flatter flow-performance relationship because they are left with relatively performance-insensitive investors. Focusing on the role of the distribution channels, Bergstresser et al. (2009) find no differences in the flow-performance relationship between direct-sold and broker-sold mutual funds, while Keswani and Stolin (2012) reveal that independently advised investor flows to UK mutual funds react more strongly to poor and good performance. Del Guercio and Tkac (2002) find that, in comparison to mutual funds, pension funds exhibit a rather linear flow-performance relationship, because their clientele punishes poorly performing managers without chasing disproportionately recent winners. Finally, Aragon et al. (2014) point to the role of regulatory constraints on marketing efforts to explain the lower sensitivity to high performance of US-domiciled (onshore) hedge funds compared to offshore funds.

Our contribution emphasizes the role of a novel factor conditioning the sensitivity of flows to past performance, which is the global dimension of investment funds. The effects of globalization appear not only on the asset side of funds' balance sheets when looking at the currency and country diversification of asset allocation, but also on the liability side when accounting for the currency and geographical diversification in the issuance of shares. Our paper therefore also contributes to the home bias literature, which addresses the global dimension of mutual funds from the point of view of the portfolio allocation. For instance, Hau and Rey (2008) find that investors widely underinvest in foreign markets and overinvest in domestic markets in their asset allocation. More recently, Burger et al. (2018) and Maggiori et al. (2019) documented the existence of a home currency bias in investors' portfolio composition. In this paper, we consider the home bias (in the geographical and currency diversification) both on the asset and the liability side of the balance sheet to study the impact of globalization on the flow-performance relationship.

3 The global dimension of Luxembourg bond funds

In this section, we briefly discuss the globalization extent of the asset and liability side of Luxembourg-domiciled funds. We provide some descriptive statistics regarding the currency and geographical varieties in the share distribution as well as in the portfolio allocation of bond funds located in Luxembourg. These statistics illustrate the distinct characteristics of domestic and global funds.

Let us first discuss the globalization extent of mutual funds' asset side. The home bias literature usually examines issues related to funds' global dimension using the international capital asset pricing model. Despite the benefits of global diversification and risk sharing, investors generally tilt their portfolio towards domestic markets and underinvest in foreign markets (Chan et al., 2005; Hau and Rey, 2008). Different explanations of this puzzle have been provided, ranging from the existence of transaction costs, e.g. regulatory and tax restrictions on foreign investments, to information asymmetries and cultural barriers driving the preferences of investors for domestic assets (Cooper et al., 2013). Burger et al. (2018) and Maggiori et al. (2019) have extended the analysis of the global dimension of mutual funds' asset allocation by emphasizing the existence of a home currency bias in investors' behavior, thus confirming previous research carried out by Fidora et al. (2007), which pointed at the role of real exchange rate volatility as a key determinant of home bias, in particular for bond securities.

Little is known on the global dimension of funds' liability side. Indeed, the home bias literature focuses on the asset side of the balance sheet, considering the home bias from the point of view of national investors. In particular, it assumes that the holders of US or French mutual funds are de facto US or French investors, respectively, buying shares in their home currency. However,the liability side of Luxembourg-domiciled funds displays an important global dimension, not only in terms of the geographical distribution of shares, but also in terms of the currency of issuance of the shares.[5]

In the case of an international fund industry like Luxembourg, at least four aspects signal the global content of mutual funds: on the asset side, the currency denomination of assets and the geographical asset allocation, and, on the liability side, the currency of issuance of shares and the geographical distribution of shares. Funds in the internationalized Luxembourg fund industry differ according to these four globalization aspects. Table 1 illustrates this hetero-

[5]Luxembourg is the most important financial center for the cross-border distribution of UCITS (Undertaking for Collective Investment in Transferable Securities) funds, which are subject to the European regulatory framework for open-ended funds investing in transferable securities such as shares and bonds. Although investment funds complying with the requirements of the UCITS Directive were initially intended to be marketed across the European Union, the UCITS brand is now recognized globally as a high quality and well-regulated product with significant levels of investor protection. As a result, numerous international asset managers have been establishing UCITS funds in Luxembourg with a clearly defined global distribution strategy (ALFI, 2017; PWC, 2019).

Table 1: Characteristics of funds managed by euro area (EA) and US companies

Nationality of the management company	EA	US	*All*
a. EA content - Liability side			
Shares issued in euro	87.3%	36.6%	*53.3%*
Shares distributed in the EA	89.9%	37.3%	*54.4%*
b. EA content - Asset side			
Funds' assets in euro	64.8%	23.0%	*36.8%*
Funds' assets in the EA	53.1%	21.4%	*31.7%*
c. Investment policy			
% of safe-haven funds	43.0%	9.5%	*30.3%*
% of search-for-yield funds	15.3%	48.9%	*21.5%*
d. Currency of share issuance			
% of funds issuing in only one currency group	82.9%	9.8%	*57.3%*
Number of funds	*258*	*82*	*557*

Data for 557 Luxembourg bond funds in our sample in June 2019. Geographical distribution and portfolio allocation in euro and in the euro area (EA), by nationality of the management company. Safe-haven funds comprise Short-term and Government bond funds, while search-for-yield funds include High Yield and Emerging markets bond funds. We consider 8 currency groups, including 5 national currencies and three baskets of currencies: euro, US dollar, Swiss franc, pound sterling, Japanese yen, plus a basket with Scandinavian currencies, one with the currencies of emerging countries and one with remaining currencies, see section 4.1.

geneity according to the nationality of the management company. Focusing on the liability side, panel *a* of table 1 reports that only about half of the bond funds located in Luxembourg distribute their shares in euro and in euro area countries (column *All*), but also hints at marked differences between funds managed by euro area (EA) and US companies. On the one hand, EA management companies display a pronounced home bias. About 87% of the outstanding amount of their shares are denominated in euro, while 90% of their shares are distributed in euro area countries (panel *a*, column EA). On the other hand, US management companies located in Luxembourg are more globalized in their distribution strategy, with a mere one third of the outstanding amount of their shares issued in euro and distributed in the euro area (panel *a*, column US). Panel *b* of table 1 indicates that the home bias of EA funds is less marked on the asset side than on the liability side of the balance sheet, but is still prevalent with about two thirds of the securities denominated in euro and more than half of the portfolio holdings issued by euro area residents (column EA). In contrast, US funds allocate less than one fourth of their portfolio in euro and in the euro area (column US), while these ratios amount to about one third for all the bond funds established in Luxembourg (column *All*).

Table 2: Globalization features of domestic and global bond funds

	Domestic funds	Global funds	*All*
Liability side			
% of funds issuing in one currency group	100%	0%	*57.2%*
% of funds distributing in one region	40.8%	3.4%	*24.8%*
Asset side			
% of funds allocating portfolio in one currency group	48.9%	20.2%	*36.6%*
% of funds investing in one region	18.2%	2.9%	*11.7%*

Data for 557 Luxembourg bond funds in our sample in June 2019. We consider 8 currency groups and 8 regions, see section 4.1.

Panel *c* of table 1 looks at funds' investment policy and indicates that a large proportion of the funds managed by EA companies (43%) invest in safe-haven markets. These are government and short-term bond markets, which are typically designed for home-biased investors searching for safety and, consequently, for assets that do not carry a foreign exchange risk. In comparison, the more open US funds tend to adopt a search-for-yield investment strategy (about 50%), i.e. focusing on high-yield and emerging market bonds, rather than a safe-haven strategy (less than 10%). Panel *d* introduces a statistic summarizing the openness of funds, which is the proportion of funds issuing shares in only one of eight currency groups, i.e. five national currencies plus three currency baskets: euro, US dollar, Swiss franc, pound sterling, Japanese yen, plus a basket with Scandinavian currencies, one with the currencies of emerging countries and one with remaining currencies (see section 4.1). Indeed, a large proportion (more than 80%) of EA managed funds distribute their shares in only one currency group while the share distribution of 90% of US managed funds occurs in more than one currency group.

It is important to stress that the currency diversification in the distribution of shares is our preferred measure to discriminate between domestic and global funds. Indeed, we focus on the liability rather than on the asset side. The cross-border distribution of shares (liability side) is the prominent characteristic differentiating Luxembourg from other financial centers, while mutual fund industries like the ones of France or the US do also feature a diversified portfolio allocation in terms of currencies and countries of investment (asset side). Moreover, our privileged globalization measure is currency rather than geographical diversification in the distribution of shares, because there is detailed information on the amount of shares distributed per currency. In contrast, the geographical diversification is an imperfect globalization indicator, since even locally-distributed shares could *in fine* be held by international investors, while it is reasonable to believe that Luxembourg funds selling shares in foreign currencies are sold

to non-euro area investors.

Table 2 compares the openness of funds selling shares in only one currency group, i.e. domestic funds, relative to funds issuing shares in more than one currency group, i.e. global funds. Global funds are more exposed internationally than domestic ones on both the liability side and the asset side of the balance sheet. On the liability side (line 2), about 41% of domestic funds sell shares in only one region compared to 25% for all funds, while about 97% of global funds distribute shares in more than one region. On the asset side, about half of the domestic funds and only one fifth of global funds hold their portfolio in one currency group (line 3), while about one fifth of domestic funds and less than 3% of global funds invest in one region (line 4). According to the above figures, domestic funds can be characterized as funds selling their shares mainly in a one currency and to domestic investors while investing essentially in their domestic market and in securities denominated in their domestic currency. At the opposite, global funds sell shares in different currencies and to investors all over the world and invest in an internationally diversified portfolio of securities denominated in several currencies.[6]

Against this background, we next analyze the flow-performance relationship of Luxembourg bond funds, focusing on the differences between domestic and global funds. To do so, we run panel regressions to compare the sensitivity of flows to performance between funds selling shares mainly in one currency and those selling shares in multiple currencies.

4 Data and descriptive statistics

In this section, we first describe the data sources and the construction of the main variables, before presenting some descriptive statistics.

4.1 Data

We use individual funds as our unit of observations, for which the detailed statistics are available on a monthly frequency, starting in December 2008.[7] We focus on funds rather than on shares, because we are interested on how flows react to performance for funds differing in

[6]Detailed statistics broken down by the nationality of the management company are presented in Appendix B. In our panel, domestic funds are mostly promoted by euro area and Scandinavian management companies, while global funds are largely marketed by US management companies. Funds offered by UK and Swiss management companies lie in between these two categories.

[7]In Luxembourg, funds are usually designed under an umbrella structure. An umbrella fund includes multiple subfunds (or compartments) under the same roof, each of them being characterized by its own investment policy. Reporting entities send statistical reports to the national supervisory authority and the central bank at the level of the subfunds. In the present paper, the term *fund* refers to a *subfund*, keeping in mind that the studied entity is a specific product offered to investors, defined according to the objectives and investment strategy contained in the Key Investor Information Document (KIID).

their degree of globalization (see further below). Nevertheless, performing the analysis at the level of shares does not change our main conclusions. Our database combines information from various data sources: the Commission de Surveillance du Secteur Financier (CSSF), the Banque centrale du Luxembourg (BCL) and the European Central Bank (ECB).

The CSSF database is used for the identification of bond funds, the distribution countries of the shares, the total net assets and the absolute net flows, i.e. the difference between the subscriptions into and the redemption of shares out of the funds (the net issuance of shares). The security-by-security composition of the balance sheet of Luxembourg bond funds is extracted from the reports collected by the BCL. This information is then matched to the ECB's Centralised Security DataBase (CSDB) to obtain the attributes of the security holdings and of the shares issued by the funds. This procedure provides the information on the currency and country of investment (asset side) as well as the currency of share issuance (liability side) .

Sample construction

The list of bond funds domiciled in Luxembourg is extracted for each period from the identifying database of the CSSF. The following categories of funds are then removed from the sample of bond funds: index funds, exchange traded funds, funds of funds, closed-ended funds and non-UCITS funds.[8] Our empirical study is based on a sample free of survivor bias (see e.g. Elton et al., 1996). To do so, we use an unbalanced panel including funds with a minimum of 36 months of continuous reporting in the sample. In addition, we winsorize flows at the bottom and top 1% of the distribution to reduce the impact of outliers and avoid measurement errors in transactions due to mergers and liquidations. In the end, the monthly database runs from January 2009 to June 2019 and comprises 719 bond funds, all of them being registered under the UCITS regulation.[9]

Total net assets, net flows and return

Funds report total net assets (TNA) and the absolute net flows into the fund (i.e. the net issuance of shares) directly in the CSSF U1.1 files. Mutual fund returns are calculated using end of month TNA and the net issuance of shares. The return of fund i at time t, $R_{i,t}$, is defined as:

$$R_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1} - AbsFlow_{i,t}}{TNA_{i,t-1}}$$

where $TNA_{i,t}$ represents total net assets of fund i at time t and $AbsFlow_{i,t}$ absolute net flow into the fund in period t. The numerator represents the valuation effect that includes price

[8] see footnote 5.

[9] Our sample begins in January 2009, since the BCL's security-by-security database starts in December 2008 and we need the lagged total net assets to compute the monthly return of the fund.

and foreign exchange adjustments on both the asset and the liability side of the balance sheet. As a result, we use the reporting currency to measure the performance of the fund instead of the outstanding amounts of TNA and the net issuance of shares expressed in euro. Indeed, the measure in reporting currency is more relevant from the point of view of investors.[10] The previous equation leads to the standard equation defining the dependent variable in our regressions, i.e. net flows relative to total net assets (Sirri and Tufano, 1998; Goldstein et al., 2017)

$$Flow_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1 + R_{i,t})}{TNA_{i,t-1}} \tag{1}$$

where $Flow_{i,t}$ is the ratio between the net flow into the fund in period t and the fund's total net assets in the previous period ($AbsFlow_{i,t}/TNA_{i,t-1}$).

Currency composition of shares

The global dimension of the fund is apparent in different balance sheet items. As explained in section 3, we use the currency diversification in the distribution of fund shares as the main variable distinguishing between domestically- and internationally-oriented funds. The BCL security-by-security database provides the outstanding amounts of shares by currency of issuance, referenced by the ISIN codes of the different share classes. We consider markets rather than individual countries and split the currencies of issuance into eight currency groups. These groups comprise five currencies, i.e. euro (EUR), US dollar (USD), pound sterling (GBP), Swiss franc (CHF), Japanese yen (JPY), plus three currency baskets, one with Scandinavian currencies (SCA), one with the currencies of emerging countries (EME) and one with the other currencies (OTH).[11] To construct the measure of the currency diversification in the issuance of shares of a given fund, we first compute a Herfindahl concentration index, which accounts for the relative importance of each currency group in the total share distribution. This index is defined as the sum of the squares of the proportions of shares issued in each of the eight currency groups.

[10] Note that fees are not available in our database, but that the TNA calculation already incorporates most of the fees charged to investors (like performance fees, redemption fees and fund's expense ratio), except subscription fees. A recent ESMA report documents that subscription fees have a marginal impact on the net performance of Luxembourg bond funds and that "[d]uring the period from 2008 to 2017, costs charged by [European] funds have remained broadly stable across asset classes" (ESMA, 2019, p.13). Our fixed-effect model should also capture any fees that have remained constant over the sample period and that are not included in the TNA calculation.

[11] Next to the 5 groups containing a single currency, the group SCA comprises the Danish krone, the Norwegian krone and the Swedish krone. The group EME is based on the emerging market country list of Morgan Stanley Capital International (MSCI) but excludes Greece, which is already in the group EUR. Thus EME includes the currencies of the following countries: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Qatar, Russia, Saudi Arabia, South Africa, Taiwan, Thailand, Turkey and United Arab Emirates. The remaining currencies are included in the group OTH. The same country arrangement is done for the regions of distribution as well as for the currency groups and regions of investment.

Given the currency group subscript $j = \{EUR, USD, GBP, CHF, JPY, SCA, EME, OTH\}$, fund i's Herfindahl index, $\mathcal{H}_i \in [0,1]$, is defined as

$$\mathcal{H}_i = \sum_j (\phi_{i,j})^2 \tag{2}$$

where $\phi \in [0,1]$ is fund i's proportion of shares distributed in currency group j. An elevated Herfindahl index indicates a high currency concentration in the issuance of shares and thus a weak diversification. The measure of the currency variety in the distribution of shares used in our econometric analysis is V, defined as one minus the above Herfindahl concentration index

$$V_i = 1 - \mathcal{H}_i \tag{3}$$

A high value of V reflects a rich currency diversification in fund i's share issuance. In our regressions, V is called $GlobalIndex$. We also consider an indicator variable for the currency diversification, dummy $GlobalDummy$, which determines whether the fund is domestic or global. The global dummy is zero when the globalization index is below or equal 1%, i.e. $GlobalDummy = 0$ when $V \leq 0.01$, which defines domestic funds, while for global funds, we have $GlobalDummy = 1$ when $V > 0.01$. Setting a threshold at 1% avoids qualifying funds with a positive but tiny index as global. Nevertheless, we test the robustness of our results accounting for alternative threshold levels to distinguish between domestic and global funds (globalization index above 0%, 5% and 10%). We also consider an alternative measure defining domestic funds as those funds distributing a given percentage of their shares (95%, 99% or 100%) in one of the eight currency groups, and global funds as those not fulfilling this condition (see Appendix E). Note that this latter measure captures less fine differences in the funds' currency diversification than the Herfindahl index.[12]

Additional globalization measures

As discussed before, our privileged measure of globalization is the currency diversification in the distribution of shares. However, to complete the picture, three additional variables are computed to capture the international dimension of the fund, namely the geographical diversification in the distribution of shares (liability side) and the currency and geographical diversification in the portfolio allocation (asset side). The latter two measures are obtained from the merger of the CSDB and BCL security-by-security databases, while the countries in which funds sell shares are retrieved from the O.4.1 reports of the CSSF. As already mentioned, the countries of distribution are an imperfect measure of the nationality of the shareholders. For instance, funds distributed only in Luxembourg would be classified as domestic while the composition of investors in these funds could basically be highly internationalized. That said,

[12]Consider two funds A and B distributing most of their shares (e.g. 95%) in euro. Fund A sells the remaining shares in US dollars and fund B in various currencies. These two funds would be categorized in the same group with the alternative measure but not necessarily with the Herfindahl index (which differs for fund A and B).

a large number of distribution countries is indicative on the globalization degree of the liability side of the fund.[13] We use the same eight groups as for the currencies of share issuance to classify the currencies and countries of these additional globalization measures, see Appendix A.

Investment policy

Bond funds are classified according to their investment policy. This classification not only allows measuring the relative performance variable within an homogeneous group of funds, but also accounting for sectoral flows among the control variables (see below). Six categories of funds are considered: (i) Short-term - bond funds mainly investing in securities with a short-term maturity, (ii) Government - bond funds mainly investing in securities issued by governments, (iii) Corporate - bond funds mainly investing in securities issued by corporates, (iv) Diversified - bond funds investing in securities issued by both governments and corporates, (v) High Yield - bond funds mainly investing in securities issued by non-investment grade issuers, and (vi) Emerging - bond funds mainly investing in securities issued by residents in emerging countries.[14]

Control variables

Control variables include (i) lagged transactions $(+)$, to account for persistence in the dependent variable and to control for autocorrelation, (ii) the size of the fund $(-)$, measured by the natural logarithm of TNA in the previous period, (iii) the age of the fund $(-)$, measured by the natural logarithm of the number of days in existence, (iv) the total net assets of the management company of the fund $(+)$, typically included as an indicator of the effectiveness of the brand and its distribution networks in lowering participation costs, and (v) the aggregate flows at the sectoral level $(+)$, i.e. flows to all the funds in the same investment category in order to capture the effect of the financial environment and investors' behavior on transactions. The size of the fund reflects the fact that an equal money flow will have a larger percentage impact on smaller funds (Sirri and Tufano, 1998). The age variable tests the hypothesis that younger funds have a greater incentive to change the riskiness of their portfolio in an attempt to catch up with the market (Chevalier and Ellison, 1997). Sirri and Tufano (1998) test whether funds in larger com-

[13]The nationality of the shareholders could be alternative measure of the geographical diversification on the liability side of the fund. However, these statistics are not available. Note also that the Security Holdings Statistics database of the ECB, which provides granular data for the euro area countries, could be used to calculate the percentage of shares held by investors resident in the other euro area countries for each fund in our panel, but not for investors residing outside the euro area. Indeed, the Coordinated Portfolio Investment Survey, a survey of cross-border portfolio holdings used to analyze the geography of cross-border investment, only provides aggregate figures at the country level (see e.g. Maggiori et al., 2019, and references therein).

[14]The methodology used to identify the investment categories of the funds is explained in Appendix C.

plexes grow faster, because they are more visible and easier to identify by investors. Aggregate flows into the fund investment category, controlling for unobserved factors as sentiment shifts, spur flows to the fund (Huang et al., 2007).

4.2 Descriptive statistics

Table 3 presents the summary statistics for all the funds in our sample over the period from January 2009 to June 2019. Columns *All funds* indicate that the average fund records net inflows of 0.15% per month and total net assets of EUR 197 million (19.1 in logs) and is about 11 and a half years old (8.35 in logs of days). Moreover, the average monthly return is 0.26% with a standard deviation of 0.61% and the average net flow to the fund sector, defined according to the fund investment objective, is 0.28%. The average size of a family, i.e. the average total net assets of the fund's management company, is EUR 35.8 billion. There is a diversification in the currency issuance of shares, as pointed out by the non-zero globalization index, $GlobalIndex$ of 8.8%, which is equivalent to a Herfindahl concentration index of 91.2%.

Table 3: Summary statistics

	(1)				(2)		(3)	
	All funds				Domestic funds		Global funds	
	mean	sd	min	max	mean	sd	mean	sd
Flow (%)	0.15	5.85	-45.0	89.4	-0.049	5.68	0.69	6.23
Log(Size)	19.1	1.58	12.3	24.4	18.8	1.43	20.1	1.54
Log(Age)	8.35	0.58	3.09	9.60	8.36	0.58	8.32	0.60
RawReturn(%)	0.26	0.61	-3.60	7.18	0.25	0.55	0.27	0.72
CategoryFlow (%)	0.28	1.77	-6.03	13.5	0.25	1.68	0.38	1.99
Log(FamilySize)	24.3	1.82	15.9	28.6	24.1	1.81	25.1	1.64
GlobalIndex	0.088	0.18	0	0.79	0.00017	0.00097	0.32	0.20
GlobalDummy	0.27	0.44	0	1	0	0	1	0
Observations	82646				60210		22436	

This table contains the summary statistics for 719 funds used throughout the analysis over the January 2009 to June 2019 period. The variables' mean, standard deviation, minimum and maximum are denoted by *mean*, *sd*, *min* and *max*, respectively. The table shows statistics for all funds and for domestic- and global funds separately, with a globalization index below or equal to 0.01 for domestic funds and above 0.01 for global funds. *Flow (%)* is the monthly net flow into the fund divided by total net assets (TNA) at the end of the previous month in per cent; *Log(Size)* is the natural log of the fund's TNA; *Log(Age)* is the natural log of the fund's age in days since its inception in the CSSF database; *RawReturn (%)* is the monthly raw return of the fund; *CategoryFlow (%)* is the net flow into the fund investment category as a percentage of the fund's investment category TNA in the previous month; *Log(FamilySize)* is the natural log of the assets under management by the fund's management company; *GlobalIndex* indicates the currency diversification of the fund's share distribution and equals one minus a currency-concentration index; *GlobalDummy* is an indicator variable that equals one if the fund's share distribution is multi-currency ($GlobalIndex > 0.01$) and zero if it is essentially in one currency ($GlobalIndex \leq 0.01$).

These statistics also show marked differences between domestic and global funds, see columns *Domestic* and *Global*. The diversification index is close to 0 (and equivalent to a Herfindahl concentration index close to one) for domestic funds and 32.4% for global funds. Global funds are characterized by more important and volatile returns. They outperform domestic funds by 2 basis points on average and display substantially higher net inflows, while average net flows into domestic funds are negative. The size of global funds is bigger, with average TNA of EUR 536 million (20.1 in log), compared to average TNA of EUR 146 million for domestic funds (18.8 in log). In addition, global funds belong to bigger management companies and to investment categories with larger transactions.

5 Results

In this section, we investigate the flow-performance relationship of Luxembourg bond funds. We run panel regressions to compare the sensitivity of net flows to performance between domestic and global funds.

Basic linear regression

Figure 1 provides evidence of the differences in terms of the flow-performance relationship between domestic and global funds. It plots the monthly averages of net flows for domestic and global funds against past performance. Net inflows and performance of global funds are higher and more dispersed than those of domestic funds. The steeper slope of global funds' flow-performance relationship indicates a higher sensitivity of flows to performance for these funds. Note that the different flow-performance pattern between domestic and global funds is not due to a composition bias in funds' investment policy.[15]

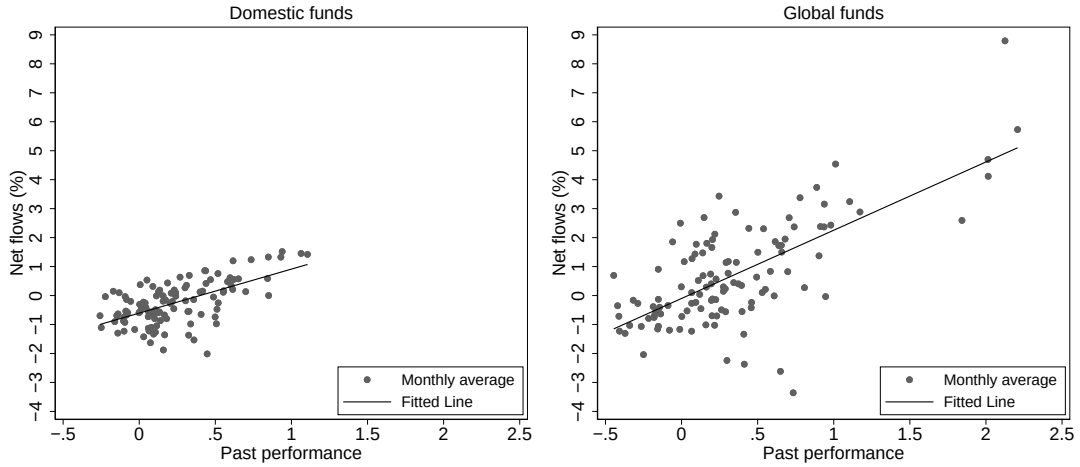
We next perform the following regression:

$$\begin{aligned} Flow_{i,t} = \alpha &+ \beta_1 RawReturn_{i,t-1\to t-12} + \beta_2 RawReturn_{i,t-1\to t-12} \times Global_{i,t-1} \\ &+ Controls + \epsilon_{i,t} \end{aligned} \tag{4}$$

where $Flow_{i,t}$ is the net flow into fund i in month t divided by total net assets in the previous month and $RawReturn_{i,t}$ is the average raw return of fund i over the past 12 months i.e.

[15] Domestic funds invest relatively more in safe-haven strategies (namely short-term and government bond strategies), while global funds invest relatively more in search-for-yield strategies (namely high-yield and emerging market strategies). However, the ratio between average net flows and the average performance is higher for global funds than for domestic ones, independently of the investment strategy (see Appendix B). We exclude therefore that the composition in the investment strategies of domestic and global funds drives the differences in the shape of the flow-performance relationship for the two types of funds.

Figure 1: Flow-performance relationship of bond funds



The figure shows the flow-performance relationship for domestic (left plot) and global funds (right plot). A scatter point represents an average over funds for one period. The vertical axis shows monthly net flows into the fund (in percent of the previous month's total net assets) and the horizontal axis the raw return over the last 12 months.

from $t-1$ to $t-12$, while $Global_{i,t-1}$ measures the currency diversification of the share distribution in the previous period either through the globalization index, $GlobalIndex$, or through the indicator variable $GlobalDummy$, i.e. $Global = \{GlobalIndex, GlobalDummy\}$. $GlobalIndex$ equals one minus the Herfindahl index over currency-denominated shares, i.e. one minus the sum of the squared proportions of shares issued in each currency, while $GlobalDummy$ is equal to zero if $GlobalIndex \leq 0.01$ and equal to 1 otherwise. $Controls$ encompasses a range of fund characteristics (ignoring the i index): $Flow_{t-1}$ is the dependent variable in the previous month, $Log(Size_{t-1})$ is the natural log of the fund's total net assets (TNA) in the previous month, $Log(Age_{t-1})$ is the natural log of the fund's age in days in $t-1$, $CategoryFlow_t$ is the net flow into the fund investment category adjusted by the fund's investment category TNA in the previous month, and $Log(FamilySize_{t-1})$ is the natural log of the fund's management company TNA in the previous month.[16] We estimate equation (4) with time and individual fixed effects and with standard errors clustered at the fund level. We introduce individual fund fixed effects to account for individual-specific unobservable effects (potentially correlated with other explanatory variables). Time fixed effects capture specific events such as the euro area sovereign debt crisis or the market tantrum in June 2013.

Table 4 reports the regression results of equation (4). We consider a specification that excludes

[16]We follow the literature in introducing current period category flow as an indicator of current market conditions, but using the lagged variable does not change our main findings.

Table 4: Determinants of flows to funds: basic linear regressions

	(1) Full Sample	(2) Full sample	(3) Full sample	(4) Domestic	(5) Global
$\text{RawReturn}_{t-1\to t-12}$	0.483***	0.284***	0.218***	0.367***	0.601***
	(0.000)	(0.001)	(0.007)	(0.000)	(0.000)
$\text{RawReturn}_{t-1\to t-12}$ x GlobalIndex_{t-1}		1.214***			
		(0.000)			
GlobalIndex_{t-1}		-0.162			
		(0.794)			
$\text{RawReturn}_{t-1\to t-12}$ x GlobalDummy_{t-1}			0.624***		
			(0.000)		
GlobalDummy_{t-1}			0.0354		
			(0.858)		
Flow_{t-1}	0.127***	0.126***	0.126***	0.101***	0.174***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Size}_{t-1})$	-0.686***	-0.675***	-0.680***	-0.660***	-0.852***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Age}_{t-1})$	-0.502	-0.392	-0.425	0.455	-1.896***
	(0.146)	(0.236)	(0.203)	(0.201)	(0.008)
$\text{Log}(\text{FamilySize}_{t-1})$	-0.0237	-0.0264	-0.0271	-0.00780	-0.0502
	(0.616)	(0.572)	(0.564)	(0.878)	(0.600)
CategoryFlow_t	0.505***	0.500***	0.497***	0.396***	0.634***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	74417	74417	74417	53530	20887
Adjusted R^2	0.088	0.089	0.089	0.052	0.175

Constant not reported. Regression include time and fund fixed effects. Standard errors are clustered at the fund level. p-values are given in parentheses below the coefficient estimates. Subscript $t-1$ denotes one-month lagged variables and subscript $t-1 \to t-12$ indicates variables computed as an average over the last 12 months. The dependent variable is the net flow in per cent, $Flow_{i,t}$, defined as the ratio between the net flow into fund i at time t divided by the fund total net assets (TNA) at the end of the previous month. *RawReturn* is the fund's average raw return over the last 12 months. *GlobalIndex* measures the currency diversification of the share distribution and equals one minus the Herfindahl index over currency-denominated shares, i.e. one minus the sum of the squared proportions of shares issued in each currency group. *GlobalDummy* is an indicator variable that equals one if the fund's share distribution is multi-currency ($GlobalIndex > 0.01$) and zero if it is essentially in one currency ($GlobalIndex \leq 0.01$). $Log(Size)$ is the natural log of the fund's TNA, $Log(Age)$ is the natural log of the fund's age, $Log(FamilySize)$ is the natural log of the fund's Management company total net assets and *CategoryFlow* is the net flow into the fund investment category as a percentage of the fund's investment category TNA in the previous month.

globalization effects, i.e. currency issuance diversification terms, see column (1). The results confirm those found in previous studies (Chevalier and Ellison, 1997; Sirri and Tufano, 1998; Huang et al., 2007; Ferreira et al., 2012). Net flows to bond funds are sensitive to past performance since the coefficient on raw returns is positive and significant. A one percentage point

increase in the raw returns over the last twelve months is associated with a 0.48% increase in net flows relative to total net assets. Lagged flows, controlling for autocorrelation in the dependent variable, significantly affect current flows. This persistence of flows in bond funds, which is a standard result in the literature, provides an indication of investor herding behavior (e.g. Warther, 1995). Consistent with the literature, funds grow more when they are younger and smaller and also when they experience larger aggregate flows into their fund investment category, while family size, which serves as a measure for search costs, is not significant.[17]

Columns (2)-(5) of Table 4 introduce global variables. The hypothesis is that a higher currency diversification in the distribution of shares makes funds more visible and accessible to investors. Thus the multi-currency aspect has similar effects than a reduction in search costs (Sirri and Tufano, 1998) or in participation costs (Huang et al., 2007). The regression in column (2) shows that the interaction term between performance and the globalization index is positive and significant, which confirms the conjecture that funds with a higher currency diversification are more sensitive to changes in performance. The effect is sizable, with the partial effect of an increase in the return on net flows equal to $0.284 + 1.214 * GlobalIndex$. This effect can be decomposed as follows. The coefficient on *RawReturn* in column (2) means that, in the absence of currency diversification (globalization index equal to zero), a 1 percentage point increase in the return over the past 12 months is associated with a net flow increase of 0.284% of funds' total net assets. The interaction term in column (2) indicates that any additional basis point increase in the globalization index raises the flow-performance sensitivity by 0.01214%. Let us interpret these results using the distinction between domestic ($GlobalIndex \leq 0.01$) and global funds ($GlobalIndex > 0.01$). Following a 1 percentage point increase in fund return, the average global fund, characterized by a globalization index of 0.32 (see table 3), would benefit from a net flow increase corresponding to 0.67% of TNA ($(0.284 + 1.214 \,\mathrm{x}\, 0.32) = 0.6725$).

Further insights are gained from introducing the indicator variable *GlobalDummy* instead of $GlobalIndex$. The results in column (3) show the larger flow-performance sensitivity of global funds compared to domestic funds. A 1 percentage point higher return is associated with a net flow increase (relative to TNA) of 0.218% in domestic and 0.842% in global funds. Columns (4) and (5) estimate equation (4) separately for domestic funds and global funds, respectively. The coefficient on the performance variable is smaller for domestic funds, which again testifies the superior flow-performance sensitivity of global funds. In addition, the greater ability to capture sectoral flows and the higher persistence of flows are indicators of larger dynamics of net flows into multi-currency funds. Finally, our results are robust to other measures of performance and

[17] See section 4.1, for a discussion of the findings of the literature concerning these control variables. Note that, *FamilySize*, which is supposed to indicate that larger complexes grow faster because they are more visible (Sirri and Tufano, 1998), is not significant, because it probably only imperfectly captures information cost reductions. In our analysis, this variable refers to the size of the funds locally managed by the group and not to the total size of the funds managed worldwide.

alternative threshold levels defining domestic and global funds, but also to using fund shares as the unit of observations, see Appendix E.

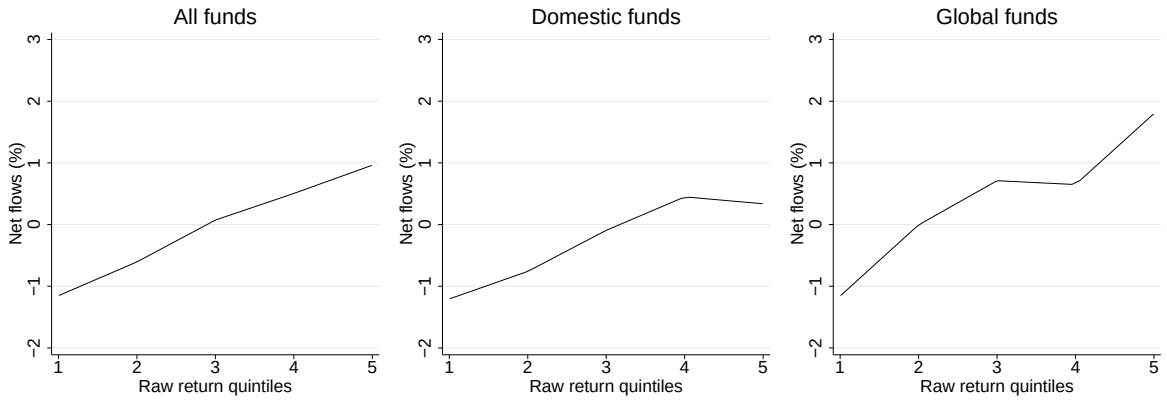
Piece-wise linear regression

We next examine the shape of the flow-performance relationship using a piece-wise linear regression like e.g. in Sirri and Tufano (1998). This approach allows for different flow-performance sensitivities at specific levels of relative performance. Each month we rank the funds according to their past performance from zero (lowest performance) to one (highest performance). In particular, past performance is based on funds' relative raw return within their respective investment objective categories over the previous 12 months. The slope of the flow-perfomance relationship may differ for the lowest quintile (*Low*), the middle three quintiles (*Mid*) and the top quintile (*High*):

$$\begin{aligned} Low_{i,t-1\to t-12} &= \min(0.2, Rank_{i,t-1\to t-12}) \\ Mid_{i,t-1\to t-12} &= \min(0.6, Rank_{i,t-1\to t-12} - Low_{i,t-1\to t-12}) \\ High_{i,t-1\to t-12} &= Rank_{i,t-1\to t-12} - (Low_{i,t-1\to t-12} + Mid_{i,t-1\to t-12}) \end{aligned} \tag{5}$$

where (ignoring time subscripts) $Rank_i$ is fund i's performance rank taking values from 0 to 1, Low_i corresponds to the performance rank for funds in the bottom 20% of the distribution, $High_i$ to the rank for those in the top 20% distribution and Mid_i is the rank for funds with performance falling into the middle three quintiles.

Figure 2: Flows by raw return quintiles



The figure shows average monthly net flows (in percentage of the fund's TNA in the previous month) by raw return quintile. The left, middle and right plots depict this relation for all funds, for domestic funds and for global funds, respectively.

Figure 2 shows the flow-performance relationship for different performance ranges. Eyeballing

the figure hints at a rather linear flow-performance relationship for all funds. The shape of this relationship appears concave for domestic funds, while flows to global funds are more sensitive in the bottom and top performance quintiles than in the mid-range performance region. We next estimate the following regression:

$$\begin{aligned} Flow_{i,t} \;=\; \alpha \;&+\; \beta_1\, Low_{i,t-1\to t-12} \;+\; \beta_2\, Low_{i,t-1\to t-12} \text{ x } Global_{i,t-1} \\ &+\; \beta_3\, Mid_{i,t-1\to t-12} \;+\; \beta_4\, Mid_{i,t-1\to t-12} \text{ x } Global_{i,t-1} \\ &+\; \beta_5\, High_{i,t-1\to t-12} \;+\; \beta_6\, High_{i,t-1\to t-12} \text{ x } Global_{i,t-1} \\ &+\; Controls \;+\; \epsilon_{i,t} \end{aligned} \tag{6}$$

where the monthly fractional ranks, *Low*, *Mid* and *High*, depend on the average raw return over the last 12 months, while $Global = \{GlobalIndex, GlobalDummy\}$, see explanation below equation (4). The performance ranks (with the associated coefficients β_1, β_3 and β_5) allow for the possibility of a non-linear flow-performance relationship. Within this framework, we can also examine the impact of the multi-currency distribution of shares on the flow-performance sensitivity at different performance levels, which occurs through the interaction terms between the performance ranks and a measure of the currency diversification of the share distribution (the associated coefficients are β_2, β_4 and β_6).

Table 5 presents the results of the piece-wise linear equation (6). Again, we start with a regression excluding the multi-currency variables, see column (1). Results confirm our previous findings concerning the control variables. Funds enjoy larger flows when they are younger and smaller and when their investment category experiences large inflows. These results also show that flows respond in a similar way to low, medium and high performance. The coefficient on *High* means that an improvement from the 80^{th} to the 90^{th} percentile is associated with an increase in net flows (relative to total net assets) of 0.15% (=1.544/100 x 0.1). An improvement in the mid-performance range, say from the 50^{th} to the 60^{th} percentile, is linked to a rise of 0.16% in net flows relative to the fund's previous month TNA. In the lowest performance range, a deterioration from say the 20^{th} to the 10^{th} percentile corresponds to a decreased net inflow of 0.16% of a fund's TNA.

Column (2) reports the results for equation (6) where *GlobalIndex* is used as the measure of the currency diversification in the distribution of shares. The interaction term coefficients are statistically significant and greater for low and high performance than for medium performance. This means that the greater the fund's currency diversification the stronger the reaction of net flows to extreme performance. Consider the average multi-currency fund, which is characterized by a currency diversification index of 0.32 (see table 3). Results suggest that a performance increase from the 80^{th} to the 90^{th} percentile goes along with a net flow increase into this fund of 0.32% of TNA $(=(0.384 + 8.9 \text{ x } 0.32)/100 \text{ x } 0.1)$. Moreover, in the absence of currency diversification in the issuance of shares, only performance in the mid-performance range have a

Table 5: Determinants of flows to funds: piece-wise linear regressions

	(1) Full Sample	(2) Full Sample	(3) Full Sample	(4) Domestic	(5) Global
$\text{Low}_{t-1\to t-12}$	1.577**	0.927	0.788	0.438	3.575**
	(0.026)	(0.229)	(0.314)	(0.582)	(0.012)
$\text{Mid}_{t-1\to t-12}$	1.633***	1.820***	1.752***	1.754***	1.253***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{High}_{t-1\to t-12}$	1.544**	0.384	0.0472	0.621	3.228***
	(0.034)	(0.645)	(0.956)	(0.471)	(0.007)
$\text{Low}_{t-1\to t-12}$ x GlobalIndex_{t-1}		6.180*			
		(0.096)			
$\text{Mid}_{t-1\to t-12}$ x GlobalIndex_{t-1}		-1.908**			
		(0.042)			
$\text{High}_{t-1\to t-12}$ x GlobalIndex_{t-1}		8.900**			
		(0.017)			
GlobalIndex_{t-1}		-0.531			
		(0.525)			
$\text{Low}_{t-1\to t-12}$ x GlobalDummy_{t-1}			2.555		
			(0.117)		
$\text{Mid}_{t-1\to t-12}$ x GlobalDummy_{t-1}			-0.359		
			(0.309)		
$\text{High}_{t-1\to t-12}$ x GlobalDummy_{t-1}			3.832***		
			(0.010)		
GlobalDummy_{t-1}			-0.173		
			(0.615)		
Flow_{t-1}	0.124***	0.124***	0.124***	0.0988***	0.170***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Size}_{t-1})$	-0.712***	-0.719***	-0.728***	-0.692***	-0.852***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Age}_{t-1})$	-0.474	-0.468	-0.467	0.497	-1.849***
	(0.167)	(0.168)	(0.170)	(0.158)	(0.008)
$\text{Log}(\text{FamilySize}_{t-1})$	-0.0276	-0.0301	-0.0335	-0.0153	-0.0411
	(0.552)	(0.519)	(0.474)	(0.760)	(0.661)
CategoryFlow_t	0.546***	0.547***	0.547***	0.425***	0.687***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	74417	74417	74417	53530	20887
Adjusted R^2	0.092	0.092	0.093	0.056	0.180

Constant not reported. Regression include time and fund fixed effects. Standard errors are clustered at the fund level. p-values are given in parentheses below the coefficient estimates. Subscript $t-1$ denotes one-month lagged variables and subscript $t-1 \to t-12$ indicates variables computed as an average over the last 12 months. The dependent variable is monthly net flow into the fund in per cent of the previous month's total net assets, $Flow_{i,t}$. *Low*, *Mid* and *High* are monthly fractional performance ranks within each fund's investment category based on the average raw return over the last 12 months (variable *RawReturn*). 6 investment categories are considered: Government bonds, short-term bonds, corporate bonds, diversified bonds, high-yield bonds and emerging market bonds. See text below table 4 for the description of the other variables.

statistically significant impact on net flows.

Column (3) introduces the indicator variable *GlobalDummy*, which distinguishes between domestic and global funds. As in column (2), results suggest that the flow-performance relationship of funds with a greater currency diversification in the distribution of shares is more sensitive for extreme performance than for medium performance. An improvement from the 80^{th} to the 90^{th} percentile is associated with higher net inflows of 0.38% ($=(0.0474 + 3.797)/100 \,\mathrm{x}\, 0.1$) of a global fund's total net assets. The slope of the flow-performance relationship of global funds is more elevated for bottom and top performance ranks (compared to domestic funds).

Columns (4) and (5) confirm the above results. In column (4), only the performance coefficient in the mid-value range is statistically significant in explaining the sensitivity of net flows into domestic funds. Results for global funds in column (5) show that the performance coefficients in the extreme ranges are not only statistically significant but also higher than in the mid-range.

Overall, our findings can be summarized as follows. According to the basic linear regressions, net flows to global funds are more reactive to past performance than those to domestic funds. Moreover, the piece-wise linear regression results indicate that the sensitivity of flows to domestic and global funds to medium performance is roughly similar, but only flows to global funds react significantly to extreme performance and in a stronger manner than to medium performance. These findings suggest that investors in global funds are characterized by a more pronounced return-chasing behavior than investors in domestic funds. They are more reactive to changes in the market performance and they also buy winners and sell losers more actively. As suggested in the next section, these results can be explained by the fact that domestic funds, like e.g. *Lux-Bond Long Term EUR* sold by the Luxembourg state-owned bank BCEE, are more domestically-oriented in the distribution of their share and attract less sophisticated and more risk-averse clients fund, see section 1. In contrast, global funds, like *Templeton Global Bond Fund* sold by Franklin Templeton, are more globally-oriented in the distribution of their shares and target more sophisticated investors with a higher risk-reward profile.

6 Further analysis

This section provides various additional analyses. A first subsection briefly describes the typical investor profile in domestic and global funds, while a second subsection analyzes the net flow response to performance of domestic and global funds when they are defined by alternative measures to the currency diversification in the distribution of shares. A third subsection subsequently investigates the flow-performance relationship characterizing domestic and global investment funds with a mix of different measures based on the balance sheet figures presented in section 3. Finally, a last subsection shows results supporting that the two categories of funds target different investor types.

6.1 Preliminary considerations

In the previous section, we have investigated the flow-performance relationship from a globalized perspective, using the diversification in the currency issuance of shares as a proxy to discriminate between more domestically-oriented and more globally-oriented funds. As mentioned in the introduction, domestic and global funds typically target two categories of investors with different risk profile.

Generally speaking, we can think of domestic investors as home-biased, risk-averse investors allocating their portfolio in their domestic market and their domestic currency. These investors, whose preferences may be fundamentally driven by important information asymmetries and cultural barriers, mostly buy investment fund shares at their local distributors. They are less sensitive to changes in the market environment and they are also less inclined to sanction or to reward investment fund performance. At the opposite, investors in global funds are more sophisticated, as they are more keen to invest in foreign assets and to take on a foreign exchange risk, and have a greater ability to discriminate among different sellers and products. Thus, the competition should be fiercer among global funds than among domestic funds given the greater propensity of investors to switch from one investment policy to another, and from one investment fund to another in the same investment category.

In the case of the Luxembourg fund industry, domestic funds rather typically investors located in the European Union (the reference perimeter for the establishment of funds under the UCITS Regulation), while investors residing outside the European Union should mainly be interested by global funds. That said, there may also be sophisticated customers domiciled in the European Union and willing to buy shares from funds that invest internationally, embed a currency mismatch and target more risky markets. On the contrary, Luxembourg funds distributed outside the European Union usually target global investors. Indeed, given the diversification in the geographical and currency composition of their asset portfolio (data not shown here), Luxembourg funds distributed in the Japanese or the Australian market do not enter into competition with local funds offering home-biased products. They rather offer international and sophisticated products to Japanese and Australian investors with a risk-taking behavior.[18]

[18]In the present analysis, there is no distinction between retail and institutional investors (Salganik-Shoshan, 2016) and domestic and global investors can either be retail or institutional. According to data extracted from Bloomberg (not shown here), the proportion of retail and institutional customers in domestic and global funds is about the same. Domestic investors can, for example, be households searching for a non-risky substitute to savings or pension funds constrained by the regulation in their risk management policy, while global investors can as well be high net worth individuals or institutional investors searching for more sophisticated products.

6.2 Alternative globalization measures

As discussed in section 3, globalization encompasses other aspects than the currency diversification in the distribution of shares. Funds differ also in the geographical distribution of their shares as well as in the country and currency diversification of their asset portfolio. We generalize equations (2) and (3) to quantify these other globalization aspects in the same manner as the currency diversification in fund i's distribution of shares

$$\mathcal{H}_i^{B,O} = \sum_j (\phi_{i,j}^{B,O})^2 \tag{7}$$

Superscript B=$\{L, A\}$ refers to the balance sheet component, indicating the diversification either on the liability side (B=L or on the asset side (B=A). Superscript O=$\{C, R\}$ stands for the openness dimension, whether the measure applies to a currency group (O=C) or a region (O=R). For example, $H^{L,C}$ corresponds to the Herfindahl currency concentration index in the distribution of shares, as defined in equation (2) further above. Subscript j is the indicator of the country or currency group. We split the countries or currencies into the same eight groups as for the share distribution, i.e. $j = EUR, USD, GBP, CHF, JPY, SCA, EME, OTH$. For instance, the currency groups on the asset side comprise five currencies, i.e. euro (EUR), US dollar (USD), pound sterling (GBP), Swiss franc (CHF), Japanese yen (JPY), plus three currency baskets, one with Scandinavian currencies (SCA), one with the currencies of emerging countries (EME) and one with the other currencies (OTH). The generalized formula for all the diversification measures is

$$V_i^{B,O} = 1 - \mathcal{H}_i^{B,O} \tag{8}$$

We therefore have four diversification measures. $V^{L,C}$ is the currency and $V^{L,R}$ the region variety on fund i's liability side (share distribution), whereas $V^{A,C}$ is the currency and $V^{A,R}$ the region diversification in fund i's asset portfolio. To distinguish between domestic or global funds using to one of these globalization aspects, we proceed like for currency diversification in the share distribution. We refer to an indicator variable, which equals zero if the diversification index $V^{B,G}$ is below or equal to 1% (domestic fund) and one otherwise (global fund). in the currency distribution of shares used in our econometric analysis is $CurrDist$, defined as one minus the above Herfindahl concentration index.

Table 6 presents regression results when distinguishing funds by these additional globalization measures. Columns (1)-(3) reproduce our previous columns (1), (4) and (5) of table 5, i.e. regressing equation (6) for all funds and for domestic and global funds, respectively. Columns (4) and (5) distinguish funds according to the region diversification on the liability side, i.e. the geographical diversification in the distribution of shares (irrespective of the currency diversification in the issuance of shares). Column (4) corresponds to funds with a low diversification in the regions of distribution indicating a home bias in the distribution of the shares. Alternatively, column (5) displays results for funds with a large network of regions of distribution.

These results suggest that investment funds, and in particular low-performing and the top-performing funds, having a greater geographical diversification in the distribution of shares display a higher for the flow-performance sensitivity. Overall, the coefficients of column (5) display about the same pattern as the one associated with global funds, i.e. column (3). These results are not surprising as the purpose of issuing shares in several currency groups is precisely to extend the investor base to other geographical areas.

The results reported in columns (6)-(9) look at the asset side of the balance sheet, i.e. the geographical and currency composition of the portfolio holdings. Column (6) describes the determinants of flows to funds with a weak currency diversification in the asset portfolio. These funds are designed for risk-averse investors avoiding a foreign exchange exposure in their portfolio allocation. Indeed, funds allocating assets mainly in one currency usually also issue shares in the same currency.[19] In contrast, column (7) concentrates on funds with a high currency diversification on the asset side of the balance sheet, which is indicative of a currency mismatch in the investor's position. These results show the higher sensitivity of flows to low- and top-performing global funds and reveal that these funds rather target sophisticated investors, who are more inclined to take on a foreign exchange risk in their portfolio allocation, than home-biased, risk-averse investors.

Column (8) focuses on funds with a low geographical diversification on the asset side and thus a home bias in the composition of the asset portfolio, while column (9) concentrates on investment funds having a greater exposure to international markets in their asset allocation. Again, the three performance rankings are statistically significant only for global funds. However, there is a less pronounced difference between the medium and extreme performance of global funds when using the geographical characteristic on the asset side rather than the other measures to define domestic and global funds. This result is not surprising. While holding a portfolio comprising securities denominated in different currencies is a salient characteristic of a sophisticated investor, the geographical diversification of the asset allocation is less relevant to distinguish global from domestic investors. As evidenced by Maggiori et al. (2019), the portfolio home-bias is primarily a home-currency bias. Domestic investors disproportionately hold securities denominated in their own country's currency, which does not impede them to invest in bonds issued by residents of foreign countries.

Finally, while the analysis so far focuses on the flow response to performance, it is interesting to briefly comment the effects of lagged flows and of flows to funds belonging to the same investment category. The coefficient associated with the lagged flow variable is higher for global funds than for domestic funds. This means that the former funds display more persistent flows, thus suggesting a greater herding behavior of investors in global funds. Moreover, the sensi-

[19] Unreported statistics show that about three fourth of bond funds holding securities denominated in one currency also issue their shares in that currency.

Table 6: Piece-wise linear regressions with alternative globalization measures

	(1) Full Sample	(2) Domestic – *Liability currency*	(3) Global – *Liability currency*	(4) Domestic – *Liability region*	(5) Global – *Liability region*	(6) Domestic – *Asset currency*	(7) Global – *Asset currency*	(8) Domestic – *Asset region*	(9) Global – *Asset region*
$Low_{t-1\to t-12}$	1.577**	0.438	3.575**	1.512	2.093**	0.677	2.216**	0.309	1.810**
	(0.026)	(0.582)	(0.012)	(0.159)	(0.021)	(0.565)	(0.012)	(0.879)	(0.017)
$Mid_{t-1\to t-12}$	1.633***	1.754***	1.253***	1.295***	1.766***	1.792***	1.556***	1.853***	1.690***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$High_{t-1\to t-12}$	1.544**	0.621	3.228***	-0.899	2.553***	0.522	2.052**	0.128	1.693**
	(0.034)	(0.471)	(0.007)	(0.400)	(0.006)	(0.648)	(0.027)	(0.942)	(0.034)
$Flow_{t-1}$	0.124***	0.0988***	0.170***	0.116***	0.121***	0.101***	0.137***	0.105***	0.124***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Log(Size_{t-1})$	-0.712***	-0.692***	-0.852***	-0.742***	-0.788***	-0.999***	-0.692***	-1.132***	-0.693***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Log(Age_{t-1})$	-0.474	0.497	-1.849***	0.237	-0.774*	0.678	-1.330***	1.087	-0.750*
	(0.167)	(0.158)	(0.008)	(0.651)	(0.096)	(0.150)	(0.007)	(0.153)	(0.054)
$Log(FamilySize_{t-1})$	-0.0276	-0.0153	-0.0411	0.0526	-0.0424	-0.169**	0.0362	-0.393***	-0.000597
	(0.552)	(0.760)	(0.661)	(0.582)	(0.433)	(0.028)	(0.525)	(0.002)	(0.990)
$CategoryFlow_t$	0.546***	0.425***	0.687***	0.459***	0.585***	0.518***	0.557***	0.383***	0.555***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	74417	53530	20887	24921	49496	32478	41939	10879	63538
Adjusted R^2	0.092	0.056	0.180	0.069	0.103	0.066	0.117	0.080	0.098

Constant not reported. Regression include time and fund fixed effects. Standard errors are clustered at the fund level. p-values are given in parentheses below the coefficient estimates. Subscript $t-1$ denotes one-month lagged variables and subscript $t-1 \to t-12$ indicates variables computed as an average over the last 12 months. The dependent variable is monthly net flow into the fund in per cent of the previous month's total net assets, $Flow_{i,t}$. *Low*, *Mid* and *High* are monthly fractional performance ranks within each fund's investment category based on the average raw return over the last 12 months (variable *RawReturn*). For the description of the explanatory variables, see text below table 4. Columns (1), (2) and (3) reproduce the results presented respectively in columns (1), (4) and (5) of table 5, where funds are considered *Domestic* if they have a weak currency diversification in the distribution of shares i.e. $GlobalIndex \leq 1\%$ and *Global* otherwise. Columns (4) and (5) distinguish funds according to the geographical diversification in the distribution of their shares. The currency, respectively geographical, diversification in funds' portfolio allocation determines the domestic/global distinction in columns (6) and (7), respectively columns (8) and (9).

tivity of transactions to sectoral flows is also larger for global funds than for domestic funds revealing that the former funds have a greater ability to capture sectoral flows during a portfolio rebalancing of investors. This can be explained by the fact that global funds are offered by large management companies operating worldwide and benefiting from larger distribution networks. More importantly, this also reflects the greater sensitivity of global investors to market performance and their higher propensity to switch from funds belonging to one investment strategy into funds belonging to another.

6.3 Investment fund profiles

Table 7 provides further evidence regarding the different shape of the flow-performance relationship between domestic and global funds. Again, columns (1) to (3) reproduce our previous results shown in columns (1), (4) and (5) of Table 5. We estimate our piece-wise regression described in equation (6) by distinguishing domestic and global funds using alternative criteria to the currency diversification in the issuance of shares. These criteria mix several of the globalization aspects at our disposal, i.e. currency and region diversification in the distribution of shares and in the portfolio allocation.

Columns (4) and (5) present results for a first distinction criterion based on a combination of our four globalization aspects. Column (4), 'Domestic-Mix', considers that domestic funds are those issuing shares only in euro and in euro area countries and allocating more than 50% of their assets in euro and in euro area countries. Column (5), 'Global-Mix', defines global funds as funds with a share distribution and a portfolio allocation of less than 90% in either of the two major regions (euro area and the US) and currencies (EUR and USD) and that also distribute at least 5% of their shares and allocate at least 5% of their assets in either of the remaining regions and currencies. Results confirm that flows to global funds are more sensitive to extreme than to medium performance, while domestic funds exhibit a "good father" investment strategy.

Columns (6) and (7) are based on the differences between EA and US management companies observed in the data of Table 1. Column (6), *EA-like*, runs the regression for funds disproportionately oriented towards the euro area, i.e. a distribution of shares of at least 85% and a portfolio allocation above 60% in the euro area and in euro, as observed for EA managed funds (see column EA in Table 1). Column (7), *US-like*, runs the regression for funds with a distribution of shares of less than 40% and a portfolio allocation of less than 20% in the euro area and in euro, like the one of US managed funds (see column US in Table 1). As expected, flows to EA-like managed funds are statistically significant to medium performance, while flows to US-like managed funds respond in a statistically significant manner to all performance levels and disproportionately more to low and top than to medium performance rankings.

The two last columns directly test the behavior of risk-averse and risk-taking investors without referring to our globalization measures. We focus on the investment strategy dimension discriminating between safe-haven funds (i.e. investors targeting Government and Short term bonds) and search-for-yield funds (i.e. customers attracted by Emerging and High Yield bonds). Column (8), *Safe Haven*, shows that the net flows into safe-haven funds react in a statistically significant manner only to mid-performance, while column (9), *Search for Yield*, indicates that flows to search-for-yield funds are disproportionately more sensitive to extreme performance than to medium performance. Sophisticated, risk-taking investors are more inclined to sanction bad and reward good performers than risk-averse investors who buy home-biased

Table 7: Piece-wise linear regressions with combined globalization measures

	(1) Full Sample	(2) Domestic – *Liab. curr.*	(3) Global – *Liab. curr.*	(4) Domestic – *Mix*	(5) Global – *Mix*	(6) Domestic – *EA-like*	(7) Global – *US-like*	(8) Safe Haven	(9) Search for Yield
$Low_{t-1\to t-12}$	1.577**	0.438	3.575**	-0.194	3.470***	-1.200	4.255**	-1.269	4.456**
	(0.026)	(0.582)	(0.012)	(0.893)	(0.003)	(0.366)	(0.043)	(0.254)	(0.017)
$Mid_{t-1\to t-12}$	1.633***	1.754***	1.253***	1.534***	1.017***	2.139***	1.632***	2.151***	1.161***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.002)
$High_{t-1\to t-12}$	1.544**	0.621	3.228***	0.405	2.938***	1.617	3.966**	-0.770	2.511*
	(0.034)	(0.471)	(0.007)	(0.755)	(0.007)	(0.235)	(0.021)	(0.516)	(0.092)
$Flow_{t-1}$	0.124***	0.0988***	0.170***	0.116***	0.123***	0.117***	0.154***	0.101***	0.207***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Log(Size_{t-1})$	-0.712***	-0.692***	-0.852***	-0.783***	-0.857***	-0.704***	-0.709***	-0.823***	-0.809***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Log(Age_{t-1})$	-0.474	0.497	-1.849***	0.599	-0.593	0.631	-1.666**	-0.211	-1.522*
	(0.167)	(0.158)	(0.008)	(0.442)	(0.334)	(0.261)	(0.039)	(0.662)	(0.081)
$Log(FamilySize_{t-1})$	-0.0276	-0.0153	-0.0411	-0.158	0.00703	-0.193*	0.256	-0.000864	0.0462
	(0.552)	(0.760)	(0.661)	(0.311)	(0.930)	(0.093)	(0.121)	(0.993)	(0.689)
$CategoryFlow_t$	0.546***	0.425***	0.687***	0.443***	0.635***	0.537***	0.611***	0.515***	0.607***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	74417	53530	20887	13562	27455	23273	11396	23602	15876
Adjusted R^2	0.092	0.056	0.180	0.086	0.122	0.084	0.133	0.060	0.202

Constant not reported. Regression include time and fund fixed effects. Standard errors are clustered at the fund level. p-values are given in parentheses below the coefficient estimates. Subscript $t-1$ denotes one-month lagged variables and subscript $t-1 \to t-12$ indicates variables computed as an average over the last 12 months. The dependent variable is monthly net flow into the fund in per cent of the previous month's total net assets, $Flow_{i,t}$. *Low*, *Mid* and *High* are monthly fractional performance ranks within each fund's investment category based on the average raw return over the last 12 months (variable *RawReturn*). For the description of the other variables, see text below table 4. Columns (1), (2) and (3) reproduce the results presented respectively in columns (1), (4) and (5) of table 5, where funds are considered *Domestic* if they have a weak currency diversification in the distribution of shares i.e. $GlobalIndex \leq 1\%$ and *Global* otherwise. Columns (4) and (5) as well as columns (6) and (7) distinguish domestic and global funds according to a combination of the four globalization measures. In column (4), funds are domestic if the shares are all distributed in euro and in the euro area and if at least 50% of the assets are allocated in euro and in the euro area. In column (5), funds are global if the distribution of their shares and their asset allocation is at least 90% in the two major regions (US and EA) and currencies (EUR or USD) and at least 5% in any other region or currency group. Column (6) (column (7)) considers funds as domestic (global) if the four globalization measures are similar to EA-managed (US-managed) funds. Column (8) shows results for safe-haven funds, i.e. belonging to investment categories Government and Short-term, and column (9) for search-for-yield funds, i.e. i.e. belonging to investment categories Emerging and High Yield.

products. Thus, investors in domestic funds behave like investors in safe-haven funds and investors in global funds like investors in search-for-yield funds. This result supports the conclusion that the different risk-reward profiles of investors to domestic and global funds explains the shape of the flow-performance relationship of both types of funds.

7 Conclusion

This paper contributes to the literature studying how past performance influences net flows to investment funds. It investigates how globalization affects the flow-performance relationship using a novel dataset on Luxembourg bond funds. In particular, we run panel regressions with monthly data from January 2009 to June 2019. We distinguish between domestic funds, issuing most of their shares in one currency, and global funds, issuing shares in various currencies. Our empirical analysis reveals that flows into global funds are more sensitive to past performance than flows to domestic funds. Further insights are obtained from a piece-wise linear regression. While flows to domestic and global funds respond similarly to medium performance, the sensitivity of flows to extreme performance is statistically significant only for global funds. Moreover, flows are more reactive to low- and top-performing global funds than to their mid-performing peers. Our main results are confirmed when considering alternative measures to the currency diversification in funds' share issuance to distinguish between domestic and global funds. Additional criteria include the geographical diversification in the distribution of shares and the geographical and currency diversification in the asset portfolio.

Overall, investors in global funds are characterized by a more pronounced return-chasing behavior than investors in domestic funds. According to our results, investors in global funds are more sensitive to market performance and they also react more aggressively to funds' relative performance within their investment category. The mutual fund industry, with asset managers targeting investors and seeking investment opportunities all over the world, is part of the increased financial globalization observed over the recent decades. The analysis of flows in and out of investment funds has become an important research topic contributing to the understanding of the determinants of international capital movements. The globalization measures introduced in this study play a significant role for the flow-performance relationship of investment funds and should be taken into account by supervisory and regulatory authorities.

References

Aragon, G., B. Liang, and H. Park (2014). Onshore and Offshore Hedge Funds: Are They Twins? *Management Science 60*(1), 74–91.

Bergstresser, D., J. M. R. Chalmers, and P. Tufano (2009). Assessing the Costs and Benefits of Brokers in the Mutual Fund Industry. *Review of Financial Studies 22*(10), 4129–4156.

Burger, J. D., F. E. Warnock, and V. C. Warnock (2018). Currency matters: Analyzing international bond portfolios. *Journal of International Economics 114*(C), 376–388.

Chan, K., V. Covrig, and L. Ng (2005). What Determines the Domestic Bias and Foreign Bias? Evidence from Mutual Fund Equity Allocations Worldwide. *Journal of Finance 60*(3), 1495–1534.

Chen, Q., I. Goldstein, and W. Jiang (2010). Payoff complementarities and financial fragility: Evidence from mutual fund outflows. *Journal of Financial Economics 97*(2), 239–262.

Chevalier, J. and G. Ellison (1997). Risk Taking by Mutual Funds as a Response to Incentives. *Journal of Political Economy 105*(6), 1167–1200.

Christoffersen, S. E., D. K. Musto, and R. Wermers (2014). Investor Flows to Asset Managers: Causes and Consequences. *Annual Review of Financial Economics 6*(1), 289–310.

Christoffersen, S. E. K. and H. Xu (2017). Investor Attrition and Fund Flows in Mutual Funds. *Journal of Financial and Quantitative Analysis 52*(3), 867–893.

Cooper, I., P. Sercu, and R. Vanpée (2013). The Equity Home Bias Puzzle: A Survey. *Foundations and Trends in Finance 7*(4), 289–416.

Cuthbertson, K., D. Nitzsche, and N. O'Sullivan (2010). Mutual fund performance: Measurement and evidence. *Financial Markets, Institutions & Instruments 19*(2), 95–187.

Del Guercio, D. and P. A. Tkac (2002). The Determinants of the Flow of Funds of Managed Portfolios: Mutual Funds vs. Pension Funds. *Journal of Financial and Quantitative Analysis 37*(04), 523–557.

Downs, D. H., S. Sebastian, C. Weistroffer, and R.-O. Woltering (2016). Real Estate Fund Flows and the Flow-Performance Relationship. *The Journal of Real Estate Finance and Economics 52*(4), 347–382.

EFAMA (2019). International Statistical Report Q3 2019. European Fund and Asset Management Association, Brussels.

Elton, E. J., M. J. Gruber, and C. R. Blake (1996). Survivorship Bias and Mutual Fund Performance. *Review of Financial Studies 9*(4), 1097–1120.

ESMA (2019). Performance and costs of retail investment products in the EU. ESMA 50-165-731, n.1 2019, European Securities and Markets Authority.

Ferreira, M. A., A. Keswani, A. F. Miguel, and S. B. Ramos (2012). The flow-performance relationship around the world. *Journal of Banking & Finance 36*(6), 1759–1780.

Fidora, M., M. Fratzscher, and C. Thimann (2007). Home bias in global bond and equity markets: The role of real exchange rate volatility. *Journal of International Money and Finance 26*(4), 631–655.

Goldstein, I., H. Jiang, and D. T. Ng (2017). Investor flows and fragility in corporate bond funds. *Journal of Financial Economics 126*(3), 592–613.

Gungor, S. and J. Sierra (2014). Search-for-Yield in Canadian Fixed-Income Mutual Funds and Monetary Policy. Staff Working Paper 14-3, Bank of Canada.

Hau, H. and H. Rey (2008). Home Bias at the Fund Level. *American Economic Review 98*(2), 333–338.

Huang, J., K. D. Wei, and H. Yan (2007). Participation Costs and the Sensitivity of Fund Flows to Past Performance. *Journal of Finance 62*(3), 1273–1311.

Ippolito, R. A. (1992). Consumer Reaction to Measures of Poor Quality: Evidence from the Mutual Fund Industry. *Journal of Law and Economics 35*(1), 45–70.

Keswani, A. and D. Stolin (2012). Investor Reaction To Mutual Fund Performance: Evidence From Uk Distribution Channels. *Journal of Financial Research 35*(3), 425–450.

Lane, P. R. and G. M. Milesi-Ferretti (2007). The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970-2004. *Journal of International Economics 73*(2), 223–250.

Lane, P. R. and G. M. Milesi-Ferretti (2018). The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis. *IMF Economic Review 66*(1), 189–222.

Lee, K.-S. (2020). Macroprudential stress testing: A proposal for the Luxembourg investment fund sector. BCL working paper n.141, Central Bank of Luxembourg.

Lynch, A. W. and D. K. Musto (2003). How Investors Interpret Past Fund Returns. *Journal of Finance 58*(5), 2033–2058.

Maggiori, M., B. Neiman, and J. Schreger (2019). International Currencies and Capital Allocation. Journal of Political Economy (Forthcoming).

Park, D., K. Taniguchi, and S. Tian (2018). Foreign and Domestic Investment in Global Bond Markets. Working Paper Series, n.535, January 2018, Asian Bank of Development.

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

PWC (2019). Benchmark your Global Fund Distribution. March 2019, PricewaterhouseCoopers Luxembourg.

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

Salganik-Shoshan, G. (2016). Investment flows: Retail versus institutional mutual funds. *Journal of Asset Management 17*(1), 34–44.

Sirri, E. R. and P. Tufano (1998). Costly Search and Mutual Fund Flows. *Journal of Finance 53*(5), 1589–1622.

Warther, V. A. (1995). Aggregate mutual fund flows and security returns. *Journal of Financial Economics 39*, 209–235.

A Appendix: Detailed statistics on global indicators

Table 8: Detailed statistics

(a) Currency diversification on the liability and asset sides

	Nationality of management company						*Nationality of management company*				
	EA	US	UK	CH	SC		EA	US	UK	CH	SC
Liability side - Distribution of shares by currency group (%)						**Asset side** - Portfolio allocation by curr. gr. (%)					
Euro (EUR)	87.3	36.6	46.1	45.7	41.1	EUR	64.8	23.0	31.8	30.1	23.6
United States dollar (USD)	9.6	50.0	39.7	33.0	6.5	USD	28.4	52.5	51.7	35.9	14.4
British pound sterling (GBP)	0.8	2.7	9.1	0.5	1.0	GBP	2.1	1.4	3.5	1.5	4.3
Swiss franc (CHF)	0.7	0.7	1.1	18.7	0.3	CHF	0.1	0.0	0.1	7.9	0.7
Scandinav. currencies (SCA)	0.7	1.3	0.1	0.0	51.2	SCA	0.3	0.3	0.1	0.1	57.1
Japanese yen (JPY)	0.0	1.2	0.2	0.6	0.0	JPY	1.5	0.6	1.4	1.9	0.0
Emerg. market curr. (EME)	0.3	3.7	3.4	0.3	0.0	EME	1.8	21.0	10.8	19.2	0.0
Other currencies (OTH)	0.6	3.9	0.3	1.2	0.0	OTH	1.0	1.3	0.7	3.4	0.0
% issuing in 1 currency group	82.9	9.8	27.4	56.9	45.5	*% 1 currency*	47.7	13.4	16.1	35	77.3

(b) Geographical diversification on the liability and asset sides

	Nationality of management company						*Nationality of management company*				
	EA	US	UK	CH	SC		EA	US	UK	CH	SC
Liability side - Distribution of shares by region (%)						**Asset side** - Portfolio allocation by region (%)					
Euro area (EA)	89.9	37.3	44.4	48.9	40.4	EA	53.1	21.4	26.4	30.5	17.2
USA (US)	2.3	4.7	4.0	3.1	0.4	US	20.4	33.7	30.0	18.2	8.5
United Kingdom (UK)	3.3	12.9	25.2	10.9	5.6	UK	5.1	3.3	6.9	4.0	4.6
Switzerland (CH)	1.2	1.3	2.3	31.2	0.8	CH	0.3	0.4	0.6	1.9	0.1
Scandinavian countries (SC)	1.2	2.2	0.3	0.1	52.4	SC	1.9	1.0	1.4	1.5	57.8
Japan (JP)	0.1	10.5	0.4	0.7	0.0	JP	2.0	0.9	1.7	2.8	0.3
Emerging markets (EM)	1.4	25.3	22.4	3.9	0.3	EM	7.4	26.8	18.2	26.1	4.1
Other countries (OT)	0.7	5.8	1.0	1.2	0.1	OT	9.7	12.5	14.8	15.0	7.4
% issuing in 1 region	48.1	3.7	9.7	1.6	13.6	*% 1 region*	20.9	2.4	4.8	0.0	27.3

(c) Investment strategy

	Nationality of management company				
	EA	US	UK	CH	SC
% safe-haven	43.0	13.4	21.0	20.3	40.9
% search-for-yield	15.9	45.1	30.6	11.4	13.6

In panel (a), on the liability side, *% issuing in 1 currency group* indicates the percentage of funds issuing shares in only one currency group, while, on the asset side, *% 1 currency* stands for the percentage of funds holding securities denominated in only one currency group. In panel (b), *% issuing in 1 region* and *% 1 region* is the equivalent for the geographical diversification. In panel (c), *% safe-haven* stands for the percentage of funds belonging to investment categories 'Government' or 'Short-term', while *% search-for-yield* indicates the percentage of funds belonging to categories 'Emerging' or 'High Yield'.

B Appendix: Statistics by investment category

Table 9 shows the flow and return statistics by investment category. Funds are classified into 6 investment categories: Government, Short-term, Corporate, Emerging, High Yield and Diversified.

Table 9: Flow and performance by investment category

(a) Investment categories: Government (GOV), Short-term (SHO) and Corporate (COR)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	GOV: all	GOV: dom	GOV: glo	SHO: all	SHO: dom	SHO: glo	COR: all	COR: dom	COR: glo
	mean	*mean*	*mean*	*mean*	*mean*	*mean*	*mean*	*mean*	*mean*
Flow (%)	-0.29	-0.35	0.27	-0.14	-0.24	0.62	0.35	0.26	0.59
RawReturn(%)	0.28	0.30	0.15	0.10	0.09	0.15	0.28	0.27	0.31
Observations	14589	13071	1518	11706	10309	1397	19806	14187	5619

(b) Investment categories: Emerging (EME), High Yield (HYI) and Diversified (DIV)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	EME: all	EME: dom	EME: glo	HYI: all	HYI: dom	HYI: glo	DIV: all	DIV: dom	DIV: glo
	mean	*mean*	*mean*	*mean*	*mean*	*mean*	*mean*	*mean*	*mean*
Flow (%)	0.80	0.76	0.82	0.64	0.45	0.82	-0.05	-0.24	0.71
RawReturn(%)	0.26	0.35	0.21	0.41	0.45	0.38	0.22	0.22	0.21
Observations	7272	2628	4644	10351	4880	5471	18922	15135	3787

Statistics for all funds (all), for domestic funds (dom), featuring a currency diversification index equal or below 1%, i.e. $GlobalIndex \leq 1\%$, and for global funds (glo), characterized by $GlobalIndex > 1\%$.

C Appendix: The classification of bond funds

The existing classification of the CSSF and the BCL is not sufficiently detailed to identify the investment categories of the funds. Nor is it possible to adequately identify these categories using the information provided by Bloomberg. To overcome this limitation, the following sequential methodology has been applied. Emerging markets: If the name of the fund or the fund contains 'emerging' or if the fund invests at least 60% of its assets in emerging markets. Otherwise, high yield: If the name of the fund or the fund contains 'high yield' or if the fund invests in a portfolio generating an average yield higher than 5%. Otherwise, short term: If the weighted average maturity of the fund portfolio is lower than 1095 days. Otherwise, government: If the name of the fund or the fund contains 'government' or if the fund invests at least 80% of its assets in government bonds. Otherwise, corporate: If the name of the fund or the fund contains 'corporate' or if the fund invests at least 80% of its assets in bonds issued by the private sector. Otherwise, diversified: If the fund does not belong to any of the above categories.

D Appendix: Data sources

Table 10: Data sources

Variable	Definition/Description	Source
Main variables		
Flow	Net flow of the month into the fund divided by fund total net assets (TNA) at the end of the previous month in per cent	CSSF, own calculation
RawReturn	Monthly percentage return of the fund	CSSF, own calculation
Log(Size)	Net Asset Value of the fund in logarithm	CSSF, own calculation
Log(Age)	Number of days since the opening of the fund in logarithm	CSSF, own calculation
CategoryFlow	Monthly percentage net flow of the fund's investment category as a percentage of the fund's investment category TNA in the previous month	CSSF, BCL, ECB, own calculation
Log(FamilySize)	Asset under management of the fund's management company in log.	CSSF, own calculation
GlobalIndex ($V^{L,C}$)	Currency group diversification of the fund's share distribution; equals to one minus a currency-concentration index (Herfindahl) of currency group shares	BCL, ECB, own calculation
GlobalDummy	Indicator variable that equals one if *GlobalIndex* is larger than 1% and 0 otherwise	BCL, ECB, own calculation
Additional variables		
Currencies shares sold (used for $\phi^{L,C}$)	Number of currency groups in which the fund's shares are sold	BCL, ECB, own calculation
Countries shares sold (used for $\phi^{L,R}$)	Number of regions in which the fund's shares are sold	CSSF, own calculation
Currencies asset allocated (used for $\phi^{A,C}$)	Number of currency groups in which the fund invests	BCL, ECB, own calculation
Countries asset allocated (used for $\phi^{A,R}$)	Number of regions in which the fund invests	BCL, ECB, own calculation
RiskfreeReturn	Monthly average of the 3-month US T-bill	Federal Reserve Bank of Saint-Louis
BenchmarkReturn (GOV)	The Government bond market return is the average return of two indexes: JP Morgan Government Bond index Global Unhedged EUR (JPEIGGEU) and Unhedged USD (JPMGBRUS)	Bloomberg
BenchmarkReturn (SHO)	The Short-term bond market return is the average return of two indexes: Barclays Global Aggregate Treasury 1-3 year index Unhedged EUR (LG13TREU) and Unhedged USD (LG13TRUU)	Bloomberg
BenchmarkReturn (COR)	The Corporate bond market return is the average return of two indexes: Barclays Global Aggregate Corporate index Unhedged EUR (LGCPTREU) and Unhedged USD (LGCPTRUU)	Bloomberg
BenchmarkReturn (DIV)	The Diversified bond market return is the average return of two indexes: Barclays Global Aggregate indexes Unhedged EUR (LEGATREU) and Unhedged USD (LEGATRUU)	Bloomberg
BenchmarkReturn (HYI)	The High Yield bond market return is the average return of two indexes: Barclays Global High Yield index Unhedged EUR (LG30TREU) and Unhedged USD (LG30TRUU)	Bloomberg
BenchmarkReturn (EME)	The Emerging bond market return is the average return of two indexes: JP Morgan Emerging Markets Bond index Global Core Unhedged EUR (JPEIHDEU) and the JP Morgan Emerging Markets Government Bond index Unhedged USD (JGENBDUU)	Bloomberg

Investment categories: Government (GOV), Short-term (SHO), Corporate (COR), Emerging (EME), High Yield (HYI) and Diversified (DIV).

E Appendix: Robustness

Table 11: Alternative performance measures

	(1) Reference *(Perform.= RawReturn)*	(2) Reference *(Perform.= RawReturn)*	(3) Perform.= Jensen's Alpha	(4) Perform.= Jensen's Alpha	(5) Perform.= Excess Benchmark	(6) Perform.= Excess Benchmark	(7) Perform.= Excess Category	(8) Perform.= Excess Category
$\text{Performance}_{t-1\to t-12}$	0.483***	0.218***	0.451***	0.210**	0.486***	0.221***	0.826***	0.661***
	(0.000)	(0.007)	(0.000)	(0.010)	(0.000)	(0.007)	(0.000)	(0.000)
$\text{Perf}_{t-1\to t-12}$ x GlobalDummy_{t-1}		0.624***		0.570***		0.625***		0.470***
		(0.000)		(0.000)		(0.000)		(0.006)
GlobalDummy_{t-1}		0.0354		0.0312		0.0382		0.232
		(0.858)		(0.876)		(0.847)		(0.234)
Flow_{t-1}	0.127***	0.126***	0.127***	0.126***	0.127***	0.126***	0.126***	0.126***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Size}_{t-1})$	-0.686***	-0.680***	-0.688***	-0.687***	-0.687***	-0.680***	-0.698***	-0.710***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Age}_{t-1})$	-0.502	-0.425	-0.526	-0.465	-0.501	-0.425	-0.469	-0.460
	(0.146)	(0.203)	(0.126)	(0.165)	(0.146)	(0.203)	(0.172)	(0.178)
$\text{Log}(\text{FamilySize}_{t-1})$	-0.0237	-0.0271	-0.0252	-0.0313	-0.0237	-0.0271	-0.0204	-0.0252
	(0.616)	(0.564)	(0.595)	(0.508)	(0.616)	(0.563)	(0.663)	(0.592)
CategoryFlow_{t}	0.505***	0.497***	0.509***	0.501***	0.505***	0.497***	0.546***	0.545***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	74417	74417	74417	74417	74417	74417	74417	74417
Adjusted R^2	0.088	0.089	0.088	0.089	0.088	0.089	0.090	0.090

Constant not reported. Regression include time and fund fixed effects. Standard errors are clustered at the fund level. p-values are given in parentheses below the coefficient estimates. Subscript $t-1$ denotes one-month lagged variables and subscript $t-1 \rightarrow t-12$ indicates variables computed as an average over the last 12 months. The dependent variable is monthly net flow into the fund in per cent of the previous month's total net assets, $Flow_{i,t}$. Columns (1) and (2) reproduce the results presented respectively in columns (1) and (3) of table 4, where the performance variable is based on the *RawReturn*, i.e. the average monthly raw return over the last 12 months. Columns (3) and (4) are based on Jensen's $Alpha$, which denotes the risk-adjusted performance over the last 12 months using Jensen's one-factor model, $\alpha_i = RawReturn_i - RiskfreeReturn - \beta_i(BenchmarkReturn_i - RiskfreeReturn)$. The risk-free return, *RiskfreeReturn*, and the market or benchmark return of the investment category, *BenchmarkReturn*, are described in table 10. *ExcessBenchmark* denotes the average difference between the fund's raw return and the benchmark return over the last 12 months. *ExcessCategory* indicates the average difference over the last 12 months between the fund's raw return and the return of the fund's investment category, which is the average return of the funds belonging to this investment category. See text below table 4 for the description of the other variables.

Table 12: Alternative currency diversification measures

	(1) Reference *(Domestic if Index≤1%)*	(2) Domestic if Index =0%	(3) Domestic if Index ≤5%	(4) Domestic if Index ≤10%	(5) Dom. if 100% of shares in 1 curr.	(6) Dom. if 99% of shares in 1 curr.	(7) Dom. if 95% of shares in 1 curr.
$\text{RawReturn}_{t-1\to t-12}$	0.218***	0.207**	0.262***	0.284***	0.207**	0.243***	0.278***
	(0.007)	(0.010)	(0.001)	(0.000)	(0.010)	(0.003)	(0.001)
$\text{RawReturn}_{t-1\to t-12}$ x GlobalDummy_{t-1}	0.624***	0.626***	0.565***	0.542***	0.626***	0.577***	0.558***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GlobalDummy_{t-1}	0.0354	0.113	-0.0152	-0.0996	0.113	0.128	-0.0473
	(0.858)	(0.542)	(0.941)	(0.625)	(0.542)	(0.534)	(0.818)
Flow_{t-1}	0.126***	0.126***	0.126***	0.126***	0.126***	0.126***	0.126***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Size}_{t-1})$	-0.680***	-0.687***	-0.680***	-0.677***	-0.687***	-0.686***	-0.680***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Age}_{t-1})$	-0.425	-0.433	-0.413	-0.415	-0.433	-0.423	-0.408
	(0.203)	(0.197)	(0.215)	(0.214)	(0.197)	(0.205)	(0.221)
$\text{Log}(\text{FamilySize}_{t-1})$	-0.0271	-0.0292	-0.0253	-0.0235	-0.0292	-0.0293	-0.0245
	(0.564)	(0.533)	(0.590)	(0.617)	(0.533)	(0.534)	(0.602)
CategoryFlow_t	0.497***	0.496***	0.499***	0.499***	0.496***	0.498***	0.499***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	74417	74417	74417	74417	74417	74417	74417
Adjusted R^2	0.089	0.089	0.089	0.089	0.089	0.089	0.089

Constant not reported. Regression include time and fund fixed effects. Standard errors are clustered at the fund level. *p*-values are given in parentheses below the coefficient estimates. Subscript $t-1$ denotes one-month lagged variables and subscript $t-1 \to t-12$ indicates variables computed as an average over the last 12 months. The dependent variable is monthly net flow into the fund in per cent of the previous month's total net assets, $Flow_{i,t}$. Column (1) reproduces the reference results presented in column (3) of table 4, where the currency diversification threshold equals 1%, i.e. funds are domestic if characterized by $GlobalDummy = 0$ i.e. $GlobalIndex \leq 0.01$ and are global otherwise. In columns (2), (3) and (4), the currency diversification threshold is set to 0%, 5% and 10%, respectively. Columns (5), (6) and (7) are based on an alternative currency diversification measure stating that funds are domestic ($GlobalDummy = 0$) if the proportion of their shares issued in one of the eight currency groups is at least 100%, 99% and 95%, respectively and that they are global otherwise. See text below table 4 for the description of the other variables.

Table 13: Robustness of piece-wise regression

	(1) Domestic *Reference*	(2) Global *Reference*	(3) Domestic *Perf= Alpha*	(4) Global *Perf= Alpha*	(5) Domestic *Dom. if Index=0%*	(6) Global *Glo. if Index>0%*	(7) Domestic *Dom. if Index≤5%*	(8) Global *Glo. if Index>5%*
$\text{Low}_{t-1\to t-12}$	0.438	3.575**	0.705	3.543**	0.635	2.971**	0.531	3.737**
	(0.582)	(0.012)	(0.363)	(0.011)	(0.439)	(0.026)	(0.508)	(0.012)
$\text{Mid}_{t-1\to t-12}$	1.754***	1.253***	1.782***	1.227***	1.679***	1.538***	1.762***	1.166***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{High}_{t-1\to t-12}$	0.621	3.228***	-0.127	2.855**	0.546	2.980**	0.993	2.712**
	(0.471)	(0.007)	(0.883)	(0.022)	(0.539)	(0.010)	(0.240)	(0.030)
Flow_{t-1}	0.0988***	0.170***	0.0991***	0.172***	0.0951***	0.168***	0.101***	0.172***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Size}_{t-1})$	-0.692***	-0.852***	-0.675***	-0.849***	-0.710***	-0.852***	-0.692***	-0.827***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Age}_{t-1})$	0.497	-1.849***	0.435	-1.884***	0.486	-1.796***	0.506	-1.968***
	(0.158)	(0.008)	(0.217)	(0.007)	(0.192)	(0.006)	(0.141)	(0.007)
$\text{Log}(\text{FamilySize}_{t-1})$	-0.0153	-0.0411	-0.00792	-0.0596	-0.0472	0.00926	-0.00975	-0.0136
	(0.760)	(0.661)	(0.874)	(0.536)	(0.347)	(0.921)	(0.845)	(0.884)
CategoryFlow_t	0.425***	0.687***	0.425***	0.686***	0.422***	0.689***	0.435***	0.712***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	53530	20887	53530	20887	50321	24096	55930	18487
Adjusted R^2	0.056	0.180	0.055	0.178	0.053	0.172	0.059	0.184

Constant not reported. Regression include time and fund fixed effects. Standard errors are clustered at the fund level. p-values are given in parentheses below the coefficient estimates. Subscript $t-1$ denotes one-month lagged variables and subscript $t-1 \to t-12$ indicates variables computed as an average over the last 12 months. The dependent variable is monthly net flow into the fund in per cent of the previous month's total net assets, $Flow_{i,t}$. Columns (1) and (2) reproduce the reference results presented respectively in columns (4) and (5) of table 5, where the performance variables *Low*, *Mid* and *High* are based on raw return, while *Domestic* and *Global* stand respectively for domestic funds with $GlobalIndex \leq 1\%$ and for global funds with $GlobalIndex > 1\%$. In columns (3) and (4), the performance variables are based on Jensen's $Alpha$, which denotes the risk-adjusted performance over the last 12 months using Jensen's one-factor model, see text below table 11. In columns (5), (6), (7) and (8), the *Domestic/Global* distinction is based on different threshold levels for the currency diversification index than in columns (1) and (2). *Domestic* funds in columns (5) and (7) are characterized by $GlobalIndex \leq 0\%$ and $GlobalIndex \leq 5\%$, respectively, while *Global* in columns (6) and (8) by $GlobalIndex > 0\%$ and $GlobalIndex > 5\%$, see also text below table 12. For the description of the other variables, see text below table 4.

Table 14: Flow-performance relationship at the level of fund shares

	(1) Full Sample	(2) Full Sample	(3) Domestic	(4) Global	(5) Full Sample	(6) Full Sample	(7) Domestic	(8) Global
$\text{RawReturn}_{t-1\to t-12}$	0.732***	0.277***	0.570***	0.763***				
	(0.000)	(0.003)	(0.000)	(0.001)				
$\text{RawReturn}_{t-1\to t-12}$ x GlobalDummy_{t-1}		0.612***						
		(0.001)						
GlobalDummy_{t-1}		0.0238				-0.838***		
		(0.878)				(0.001)		
$\text{Low}_{t-1\to t-12}$					4.027***	0.790	-0.462	5.867***
					(0.000)	(0.403)	(0.633)	(0.000)
$\text{Mid}_{t-1\to t-12}$					3.004***	2.916***	2.835***	3.158***
					(0.000)	(0.000)	(0.000)	(0.000)
$\text{High}_{t-1\to t-12}$					1.592**	-0.863	0.377	2.578***
					(0.024)	(0.422)	(0.730)	(0.004)
$\text{Low}_{t-1\to t-12}$ x GlobalDummy_{t-1}						5.018***		
						(0.000)		
$\text{Mid}_{t-1\to t-12}$ x GlobalDummy_{t-1}						0.207		
						(0.519)		
$\text{High}_{t-1\to t-12}$ x GlobalDummy_{t-1}						3.608***		
						(0.009)		
Flow_{t-1}	0.0980***	0.0977***	0.0741***	0.103***	0.0960***	0.0960***	0.0723***	0.101***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Size}_{t-1})$	-0.763***	-0.766***	-0.847***	-0.696***	-0.771***	-0.780***	-0.883***	-0.655***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\text{Log}(\text{Age}_{t-1})$	-1.428***	-1.335***	0.363	-2.447***	-1.352***	-1.319***	0.473	-2.300***
	(0.000)	(0.000)	(0.424)	(0.000)	(0.000)	(0.000)	(0.296)	(0.000)
$\text{Log}(\text{FamilySize}_{t-1})$	-0.0652	-0.0696	-0.0770	-0.0532	-0.0559	-0.0596	-0.0757	-0.0551
	(0.257)	(0.224)	(0.315)	(0.531)	(0.327)	(0.296)	(0.322)	(0.513)
CategoryFlow_t	0.701***	0.697***	0.443***	0.760***	0.766***	0.767***	0.487***	0.832***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	400981	400981	150844	250137	400981	400981	150844	250137
Adjusted R^2	0.037	0.037	0.019	0.046	0.038	0.039	0.020	0.049

Constant not reported. Regression include time and fund fixed effects. Standard errors are clustered at the fund level. p-values are given in parentheses below the coefficient estimates. Subscript $t-1$ denotes one-month lagged variables and subscript $t-1 \to t-12$ indicates variables computed as an average over the last 12 months. The total net assets and the price of a fund's share class are used to calculate the flow and the performance variables. The dependent variable $Flow_{i,t}$ is the monthly net flow into fund's class share i expressed as a percentage of the previous month's total net assets of that fund's class share and calculated as in equation (1). The return of fund class share i is calculated using the growth rate of the price of this fund's class share. *RawReturn* is the fund's class share average raw return over the last 12 months. $Flow_{i,t-1}$ is the lagged dependent variable. *Size* is the total net assets of the fund issuing class share i. *Low*, *Mid* and *High* (the fractional performance variables) are computed at the level of the fund's class share, while *GlobalDummy*, *Age*, *FamilySize* and *CategoryFlow* depend on the fund to which the share belongs, see also text below table 4.

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