



Banc Ceannais na hÉireann
Central Bank of Ireland

Eurosystem

Financial Stability Notes

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Vol. 2025, No. 2

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Central Bank of Ireland

2025

Abstract

In this note, we explore whether the way fund managers invest can lead to risks that affect the entire financial system. We found that managers of bond funds in Ireland tend to invest in riskier assets when interest rates drop, possibly to achieve higher returns. In contrast, managers of equity funds do the opposite. We also discovered that bond funds receive more money from investors when interest rates are higher. Furthermore, equity funds attract more investments when they take on more risk. Our analysis is based on how fund managers allocate their investments, revealing their willingness to take risks. When fund managers seek higher returns by taking more risks, it can make the financial system more vulnerable and increase the chance of severe economic downturns. These insights are crucial for monitoring financial stability and guiding policies for non-bank financial institutions, which have become more significant since more assets have shifted from banks to non-banks after 2008.

1 Introduction

The European Commission's adoption of the Savings and Investments Union (SIU) strategy aims to enhance the EU financial system by channelling savings into productive investments, thus broadening citizens' access to capital markets and improving business financing.³ This initiative could increase the role of non-banks, reinforcing a shift from traditional banks to non-bank entities like investment funds. A more diverse and interconnected financial

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³ See EU Commission's relevant [communication](#).

landscape could either bolster resilience by allocating risks to better-equipped areas or become a channel for contagion, spreading financial shocks and threatening stability. Two approaches to effective risk allocation are possible: ring-fencing specific entities to prevent contagion or adopting a system-wide regulatory approach, the latter increasingly favoured. A system-wide approach necessitates moving beyond entity-level monitoring towards an activity-based surveillance, as exemplified by the methods in this Financial Stability Note, which employ return-based analysis to complement more commonly employed holdings-based assessments of leverage, liquidity, and interconnectedness.

We looked at how fund managers' willingness to take risks changes based on their investment choices, returns, and volatility. We found that managers of bond funds in Ireland tend to take more risks when interest rates go down. This could have financial stability implications because their search for higher returns might lead to bigger and longer economic downturns if things go wrong.⁴ On the other hand, we noticed that managers of equity funds do the opposite and become more cautious. This difference is likely because stocks and bonds have complementary characteristics. From a broader economic viewpoint, this mix can help reduce overall risk and balance out the riskier actions of bond funds.

We found that investment funds tend to receive more money from investors when interest rates are higher, with this effect being especially strong for bond funds. At the same time, funds that primarily invest in stocks attract more investors when they take on greater risks—both by choosing riskier investments (showing less caution) and by borrowing more money to invest (increasing leverage). This pattern is similar to what previous research, like the study by Chevalier and Ellison in 1997, has observed. These findings could have implications for financial stability because they suggest that investment funds compete for investors by taking on more risk.

These findings come from analysing how much risk each fund manager is willing to take every quarter, using ideas from modern portfolio theory. We figure out the level of risk a manager is likely to accept based on current market conditions and how they have allocated their assets by the end of the quarter. Unlike other methods, like the Sharpe ratio and volatility, which look at past returns, our approach considers current market conditions and the actual choices managers make with their assets. This gives a more detailed and up-to-date picture of their risk preferences. Besides the insights shared here, these calculations help the Central Bank of Ireland track changes in how investment funds handle risk. We discuss some of these trends from recent years in Section 4.

Understanding how much risk investment funds are willing to take is important for keeping the financial system stable. This is particularly true in Ireland, where the investment fund

⁴ See [IMF's note](#) on the subject.

industry is growing quickly. In fact, Ireland has the second largest investment fund sector in Europe, just after Luxembourg, and it's the fourth largest in the world.⁵ These funds can increase overall financial risk because they sometimes face issues like not having enough liquid assets, borrowing too much, and being closely connected with other financial institutions, including both non-banking entities and banks.⁶ Our findings can help guide ongoing efforts to create rules that ensure investment funds operate safely within the broader financial system.⁷

Our findings also add to the discussion about how monetary policy affects risk-taking in investment funds. Previous studies by Choi & Kronlund (2018) and Giuzio et al. (2023) have shown that when monetary policy is relaxed, it can lead to increased risk-taking in U.S. corporate bond mutual funds and euro area bond funds. We found similar results for bond funds based in Ireland. Additionally, Choi & Kronlund (2018) and Kaufmann (2023) argue that U.S. bond funds tend to attract more money when managers adjust their portfolios to include higher-yield investments. Our research adds to this by showing that, in the case of Irish bond funds, taking on less risk doesn't impact the amount of money flowing into these funds.

2 Methodology

The Modern Portfolio Theory (MPT) refers to a framework that allows investors to construct an investment portfolio that maximizes expected return for a given level of risk (Markowitz, 1952). According to the MPT, there is a trade-off between risk and return in portfolio optimization. The coefficient known as risk aversion, determines this trade-off. Therefore, if we knew the risk aversion of investors, we could derive the optimal portfolio that satisfies it.

However, investors' risk aversion is not directly observable. Instead, we observe fund manager's realized investment decisions in funds' holdings and the associated market prices, and estimate the most likely risk aversion that would lead to the realized holdings given standard MPT assumptions. Our application closely follows the methodology proposed by Yu, Wang and Dong (2023), who use inverse optimization to determine the hidden decision variable (risk aversion) that controls the portfolio optimization process.⁸

It is important to acknowledge certain assumptions and limitations in the methodology employed in this study. Firstly, we assumed that fund managers behave rationally and did not

⁵ The gross value of actively managed funds increased by 70.6%, from roughly €1.7 trillion in Q1 2016 to roughly €2.9 trillion in Q2 2023. For details, see Central Bank of Ireland: [Market Based Finance Monitor 2023](#).

⁶ Liquidity mismatch in investment funds implies that some of the assets cannot be liquidated within the same timeframe that is required by the fund to fulfil under its redemption policy scenario. Refer European Central Bank report: [A theoretical model analysing investment funds' liquidity management and policy measures](#).

⁷ See Central Bank of Ireland Discussion Paper 11: [An approach to macroprudential policy for investment funds](#) and European Commission's consultation paper: [Assessing the Adequacy of Macroprudential Policies for Non-Bank Financial Intermediation \(NBFI\)](#).

⁸ The detailed explanation of the inverse optimization methodology used to calculate risk aversion can be seen in Appendix 1.

account for the unique requirements of different funds, presuming that all seek to construct the optimal investment portfolio (i.e., the highest Sharpe ratio). Second, due to data constraints, we only considered bond and equity assets within the funds, neglecting the potential impact of other asset types. Future research is needed to explore these issues and their implications in greater depth.

We use resampling to capture the estimation error of risk aversion, in line with portfolio optimization literature (Delcourt & Petitjean, 2011). The potential for error lies in using particular realizations of asset returns instead of the underlying stochastic distribution of risk (which is unknown). To address this, we use Monte Carlo simulation method to generate multiple groups of simulated investment funds. Each simulated fund holds the same assets as the original, but the daily returns of these assets are simulated based on their distributions. We use the standard deviation of the risk aversion from simulated funds as a measure of the uncertainty in the estimated risk aversion of the original fund.

3 Data

This *Note* focuses on investment funds domiciled in Ireland over the 2016-2023 period. We use monthly capital flows (redemption and subscription) data and quarterly securities holdings data from the Money Market and Investment Fund Return (MMIF) collected by Central Bank of Ireland. For each asset held by the funds, we collect the asset class (equity and debt), region of the issuer (US, UK, EU, Ireland and other), sector of the issuer (Banks, Asset Managers, NFCs, Government, and other), currency, and market value. We obtain daily prices for equity and debt instruments from Eikon Refinitiv and IHS MarkIT, respectively. As we focus on fund managers' asset allocation decisions, we only consider actively managed funds and exclude money market funds (MMFs) due to their specific business model (quarterly data would not capture fast-paced dynamics in MMFs).

Since pricing data are not available and the model assumptions do not hold for derivatives, we concentrate on equity and debt exposures in funds. Thus, we only consider funds containing at least 70 per cent of debt and equity exposure (with daily prices available) in their portfolios with respect to funds gross asset value. We are left with a sample of 3,183 funds, as shown in Table 1. The categorization of funds used in this *Notes* aligns with the cohorts classification method used in the [Market Based Finance Monitor 2023](#), encompassing Equity, Bond, Hedge, Irish Property, Other and GBP LDI (liability-driven investment) funds.

For each fund, we measure risk preference as the inverse of risk aversion, where higher values denote higher risk. To calculate the risk aversion, we group assets into categories with similar characteristics. Hence, assets are classified by *type* (Equity, Debt), *region* (US, UK, EU, Ireland, Other), and *sector of the issuer* (Banks, Asset Managers, NFCs, Government, Other), consistent with the approach in Fiedor & Katsoulis (2019). Our results are robust with regards to the

choice of specific categories. Additionally, we calculate leverage as gross asset value divided by net asset value, and interest rate at fund level as average interest rates of underlying assets weighted by their share of the portfolio. Fund inflows and outflows are measured as a ratio of cumulative subscriptions (redemptions) within the quarter to fund's total net asset value.⁹

Over the 2016-2023 period, equity and hedge funds were the best performers, on average, in terms of quarterly returns, with 1.89% and 1.34% respectively (the average quarterly return of all funds is 0.86%). Bond funds have, on average, the lowest risk preference (0.64) and relatively low return (0.27%). GBP LDI funds took, on average, higher risk than other groups, both on the asset side (with 4.61 risk preference) and on the funding side (with 2.31 leverage on average)¹⁰, and also had negative quarterly average return (-3.16%).

Fund Type	Initial N.	In Scope N.	Risk Preference	Leverage	Return (%)	Interest Rates	GAV (EUR bn)	Inflows	Outflows
Equity Funds	2079	1446	1.05 (0.83)	1.01 (0.06)	1.89 (0.16)	1.58 (1.65)	0.39 (0.83)	0.08 (0.16)	0.07 (0.10)
Bond Funds	1239	765	0.64 (0.77)	1.04 (0.18)	0.27 (0.13)	1.38 (1.61)	0.49 (0.94)	0.09 (0.15)	0.08 (0.11)
Hedge Funds	842	73	1.25 (0.88)	1.47 (3.45)	1.34 (0.08)	1.05 (1.32)	0.58 (0.16)	0.07 (0.15)	0.07 (0.11)
Other Funds	2361	693	1.05 (0.91)	1.03 (0.09)	0.48 (0.07)	1.04 (1.37)	0.37 (0.12)	0.08 (0.14)	0.06 (0.09)
GBP LDI Funds	464	206	4.61 (1.80)	2.31 (1.28)	-3.16 (0.18)	1.07 (1.41)	1.29 (1.42)	0.11 (0.19)	0.06 (0.11)
Total	6985	3183	1.18 (1.30)	1.11 (0.63)	0.86 (0.14)	1.38 (1.58)	0.47 (1.02)	0.09 (0.16)	0.07 (0.10)

Table 1: The summary statistics of funds grouped based on MBF Monitor cohorts. This table reports the summary statistics for main variables of Irish domiciled investment funds in each cohort in our sample. The column 'Initial N.' indicates the number of the funds populating each cohort in the initial sample collected from MMIF. The column 'In Scope n.' represents the funds have more than 70% of total assets in equity or debt with available pricing data. Leverage is measured by the ratio of total gross asset value to total net asset value. Interest rate is the average interest rate weighted by the share of portfolio exposures to different currency areas. Return measures the quarterly return of funds, and GAV represents the gross asset value. Inflows and Outflows are measured by cumulative subscription and redemption within the quarter divided by fund's averaged total net asset value, respectively. We show the average value for funds in a given group across the sample period, and its standard deviation in parentheses.

4 Results

Risk Preference Trend Analysis

GBP LDI funds exhibit higher risk preference than other funds cohorts, as illustrated in Figure 1. This is consistent with the specific asset allocation priorities of GBP LDI funds, diverging

⁹ To make flow and stock variables comparable, we use the average of net asset value between the beginning and the end of the quarter in the denominator.

¹⁰ LDI funds contributed to the disruption in the UK gilt market due to their excessive use of leverage. For details, see Financial Stability Notes: [Irish-resident LDI funds and the 2022 gilt market crisis](#).

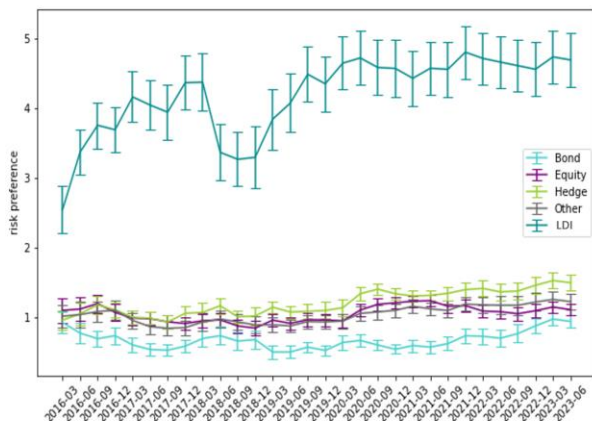
from the pursuit of optimal investment portfolios. These funds target a particular duration for hedging purposes for the pension funds they serve, thereby resulting in their relatively higher risk preference (allowing relatively high volatility for small returns). Thus, we conclude that at least on the first impression our estimator of risk preference in funds appears to capture risk aversion in funds appropriately. Moreover, the utilized estimator of risk preference is fairly stable over time and is not merely depend on realized market volatility, a common pitfall of other estimators of risk aversion in investment funds.

At the onset of COVID-19, the risk preference of bond funds decreased, whereas equity funds exhibited an upward trend. To consider other funds cohorts in more detail, LDI funds are excluded from Figure 2. In the analysis of trends, we concentrate on equity and bond funds as they have a reasonable coverage (see Table 1), the other groups may not be entirely representative. During the beginning phase of the COVID-19 pandemic, bond funds have become more risk averse, consistent with flight-to-safety dynamics (Adrian, Crump, & Vogt, 2019). Conversely, risk preference for equity funds showed an upward trend during that time. This reflects pursuit of higher yields amid market turbulence exhibited by these funds' target investors. Arguably the equity fund managers could not use the flight to safety mechanism as any safe assets would be outside their investment mandate, so they had to pursue another strategy. In addition, policy interventions aimed at cushioning the economic and financial impact of the pandemic may had an impact here, such that fund managers might have anticipated that these policies would have boosted the stock market rebound, prompting them to increase their investments in risky assets.¹¹

Following the end of the pandemic, we observe a decrease in risk preference for equity funds and an increase for bond funds. The decrease risk preference in equity funds reflects the decline in volatility in the equity markets. In contrast to equity funds, bond funds have seen an increase in risk preference after the pandemic, consistent with bond market being characterised by very low volatility in this period.

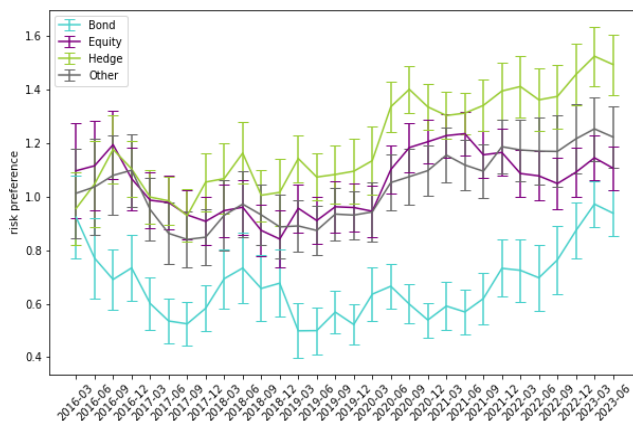
¹¹ See Central Bank of Ireland signed article: [Recovery Paths from COVID-19 and the Impact of Policy Interventions](#).

Figure 1: GBP LDI funds have the highest risk preference



Note: This figure displays the average risk preference of Irish-domiciled funds in separate cohorts. The vertical lines represent average uncertainty of the central estimate of risk preference. Lower values denote higher risk aversion. The fund cohorts are classified in line with **Market Based Finance Monitor 2023**. Source: Central Bank of Ireland, authors' calculation.

Figure 2: Bond funds increased their risk preference after COVID



Note: This figure displays the average risk preference of Irish-domiciled funds in separate cohorts (excluding GBP LDI funds). The vertical lines represent average uncertainty of the central estimate of risk preference. Lower values denote higher risk aversion. Source: Central Bank of Ireland, authors' calculation.

Search-for-Yield Behaviour

We analyse the relation between interest rates and risk aversion to verify whether the search-for-yield hypothesis holds empirically. We conduct fixed effect regressions¹² with risk preference as the dependent variable and interest rate as the independent variable of interest. As portfolio tends to be sticky due to frictions (Gârleanu & Pedersen, 2016), we control for autocorrelation by including lagged independent variable. In addition, we control for effects of scale and leverage by including total asset value¹³ and the ratio of gross asset value over net asset value, which is standard in the literature on funds (Chan, Faff, Gallagher, & Looi, 2009; Barth, Hammond, & Monin, 2020). We conduct the regression for all funds, and also bond funds and funds other than bond funds separately.

	Dependent Variable: Risk Preference		
	All Funds	Bond Funds	Non-Bond Funds
	(1)	(2)	(3)
Constant	0.239*** (0.054)	0.310*** (0.112)	0.213*** (0.061)
Interest Rate (lag)	0.020*** (0.004)	-0.014** (0.007)	0.021*** (0.004)
Leverage	0.008 (0.006)	0.033 (0.031)	0.005 (0.006)
log GAV	0.004 (0.003)	-0.003 (0.006)	0.007** (0.003)
Risk Preference (lag)	0.707*** (0.003)	0.585*** (0.007)	0.731*** (0.003)
Time FE	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes
Observations	55548	14074	41474
R-squared	55.1%	36.1%	59.2%

Table 2: Influence of interest rate on funds' risk preference. This table presents regression results with fixed effects. In the regression models, risk preference is the dependent variable, lagged one-period interest rate is the explanatory variable. Control variables include fund leverage, the logarithm of gross asset value, and lagged one-period risk preference. *, **, and *** indicate statistical significant at less than the 10%, 5%, and 1% level, respectively.

As shown in Table 2, we find a negative relationship between interest rates and risk preference in bond funds (column 2), indicating bond funds may engage in search-for-yield when rates get lower and may seek safety when interest rates rise. This result is aligned with the Financial Stability Review (November 2022), which points out bond funds expanding the share of investment grade securities and reducing the share of high-yield assets in the context of rising interest rates during 2022. In this FSN, we focus on the low interest rate scenario, as

¹² Fixed effects regression is a method of controlling for *all* variables, whether they're observed or not, as long as they stay constant within some larger category. The details seen in Appendix 2

¹³ In natural logarithm as is standard in the literature.

search-for-yield behaviour may have financial stability implications and can lead to procyclical behaviour. During a downturn interest rates usually decline, and if bond funds then increase risk-taking due to search-for-yield dynamics, this may lead to asset bubbles and excessive debt accumulation. When the cycle turns, the subsequent tightening of credit and de-risking can sharply contract economic activity, prolonging and deepening the recession. It is worth noting that one of the objectives of a looser monetary policy is to stimulate demand for risk instruments. Consequently, this behaviour by investment funds is natural, though it may require monitoring from a financial stability perspective.

We also show (in column 3) that funds investing predominantly in equities exhibit the opposite behaviour, taking on more risk in their portfolio allocation when interest rates rise. This is natural, as a decline in interest rates leads to an increase in the relative investment return of equity instruments compared to debt. From a financial stability perspective, this provides a counterbalance to the potential procyclicality in bond funds.

Impact of Fund Managers' Risk Preferences on Capital Flows

We also perform regressions looking at how fund managers' risk preferences influence the inflows and outflows from their funds. This involves using lagged one-period risk preference as independent variable and using funds' inflows and outflows as dependent variables. The inflows (outflows) of each fund is the ratio of cumulative subscriptions (redemptions) within the quarter to fund's total net asset value (average of the values at the beginning and the end of the quarter). In addition to the control variables included in the previous specifications, we also add controls for interest rates and returns, as these variables are often used in studies of funds' capital flows (Choi & Kronlund, 2018; Banegas, Montes-Rojas, & Siga, 2016). We include time and fund fixed effects to control for time-specific factors and potentially omitted fund characteristics. As in the previous empirical setup, we run the regressions separately for all funds, bond funds, and funds other than bond funds, so as to identify the key factors that influence the capital flows within each cohort.

While risk preference has no significant effect on outflows, an increase in risk preference encourages capital inflows, particularly in equity investing funds. In Table 3, we report that both interest rates and risk preference have no significant impact on outflows (columns 1-3). It is perhaps natural, as outflows would likely be mediated either through shocks to funds or funding liquidity shocks to the investors. We are unable to capture the impact of these shocks by using quarterly data. However, high interest rates do attract capital inflows to investment funds (column 4), and this impact is higher in bond funds (column 5). This is consistent with the general flow of funding towards debt instruments as interest rates rise. In addition, investing predominantly in equities attracts more subscriptions when they take on more risk, both in terms of asset allocation (lower risk aversion) and funding (higher leverage), as shown in column 6. Since both interest rates and risk preferences have no significant impact on

outflows, their influence on net flows is primarily dominated by the results of inflows (columns 7-9). Increased risk preference thus incentivises capital inflows. From a financial stability perspective this is worrying, as it suggests there is a risk-based competition among equity-focused funds, where they may feel compelled to take on more risk to attract investors, potentially incentivising funds to raise their risk profile in order to compete for funding.

Dependent Variable:	Outflows			Inflows			Net Outflows		
	All Funds	Bond Funds	Non-Bond Funds	All Funds	Bond Funds	Non-Bond Funds	All Funds	Bond Funds	Non-Bond Funds
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-0.191*** (0.014)	-0.364*** (0.033)	-0.140*** (0.016)	0.921*** (0.021)	0.891*** (0.045)	0.944*** (0.023)	-1.139*** (0.022)	-1.278*** (0.047)	-1.111*** (0.025)
Risk Preference (lag)	0.001* (0.001)	0.002 (0.002)	0.001 (0.001)	0.007*** (0.001)	-0.002 (0.003)	0.009*** (0.001)	-0.005*** (0.001)	0.004 (0.003)	-0.007*** (0.001)
Interest Rate (lag)	0.000 (0.001)	0.001 (0.002)	-0.000 (0.001)	0.003** (0.001)	0.008*** (0.003)	0.001 (0.002)	-0.003* (0.001)	-0.007** (0.003)	-0.001 (0.002)
Leverage (lag)	0.008*** (0.002)	-0.002 (0.010)	0.009*** (0.002)	0.086*** (0.003)	0.030** (0.013)	0.088*** (0.003)	-0.079*** (0.003)	-0.032** (0.014)	-0.080*** (0.003)
LogGAV (lag)	0.013*** (0.001)	0.023*** (0.002)	0.010*** (0.001)	-0.051*** (0.001)	-0.045*** (0.002)	-0.053*** (0.001)	0.066*** (0.001)	0.069*** (0.002)	0.065*** (0.001)
Return (lag)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Outflows (lag)	0.048*** (0.004)	0.038*** (0.007)	0.052*** (0.004)						
Inflows (lag)				0.120*** (0.004)	0.081*** (0.008)	0.132*** (0.004)			
Net Outflows							0.148*** (0.004)	0.102*** (0.008)	0.162*** (0.004)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54052	13730	40322	54052	13730	40322	54052	13730	40322
R-squared	0.9%	1.6%	0.8%	7.5%	3.5%	9.0%	9.1%	6.6%	10.1%

Table 3: Influence of risk preference on funds' net outflows. This table presents regression results with fixed effects. In the regression models, fund's outflows, inflows and net outflows are the dependent variable, respectively. Lagged one-period fund's risk preference is the explanatory variable. Control variables include lag one-period fund leverage, lag one-period interest rates, lag one-period return, lag one-period outflows/inflows/net outflows, and lag one-period logarithm of gross asset value. *, **, and *** indicate statistical significant at less than the 10%, 5%, and 1% level, respectively.

5 Conclusion

In this note, we present two important findings related to financial stability. First, we found that bond funds based in Ireland tend to invest in riskier assets when interest rates are low, in

a behaviour known as "search-for-yield." This approach can make companies more vulnerable to economic downturns because they rely more on debt, potentially worsening recessions by causing a sharp drop in debt funding. As a result, the risky investment strategies of bond funds could lead to economic instability, highlighting the need for careful monitoring. Second, we discovered that funds primarily investing in stocks compete for investors' money by taking on more risk, both in their investment choices and by borrowing more money (leverage). This can lead to excessive borrowing and rapid increases in asset prices. Therefore, understanding how these funds manage risk and their impact on the economy is crucial for assessing overall financial system risks, including factors like borrowing levels, liquidity, and connections between financial entities. Further research is needed to explore these issues more deeply. The risk assessment tool developed in this study enhances the Central Bank's ability to monitor investment fund activities, supporting ongoing efforts to develop policies that ensure the stability of this sector.¹⁴

References

- Adrian, T., Crump, R., & Vogt, E. (2019). Nonlinearity and Flight-to-Safety in the Risk-Return Trade-Off for Stocks and Bonds. *The Journal of Finance*, 74, 1931–1973.
- Banegas, A., Montes-Rojas, G., & Siga, L. (2016). Mutual Fund Flows, Monetary Policy and Financial Stability. working paper.
- Barth, D., Hammond, L., & Monin, P. (2020). Leverage and Risk in Hedge Funds. Working Paper.
- Central Bank of Ireland. (n.d.). Discussion Paper 11: An approach to macroprudential policy for investment funds.
- Central Bank of Ireland. (n.d.). Market Based Finance Monitor 2023.
- Chan, H. W., Faff, R. W., Gallagher, D. R., & Looi, A. (2009). Fund Size, Transaction Costs and Performance: Size Matters! *Australian Journal of Management*, 34(1), 73-96.
- Chevalier, J., & Ellison, G. (1997). Risk Taking by Mutual Funds as a Response to Incentives. *Journal of Political Economy*, 105(6), 1167-1200.
- Choi, J., & Kronlund, M. (2018). Reaching for Yield in Corporate Bond Mutual Funds. *The Review of Financial Studies*, 31(5), 1930-1965.

¹⁴ In line with Central Bank of Ireland Discussion Paper 11: [An approach to macroprudential policy for investment funds](#).

- Delcourt, F., & Petitjean, M. (2011). To What Extent is Resampling Useful in Portfolio Management? *Applied Economics Letters*, 18.
- European Central Bank. (November, 2022). *Financial Stability Review*.
- Fiedor, P., & Katsoulis, P. (2019). An Lonn Dubh: A Framework For Macroprudential Stress Testing of Investment Funds. *Financial Stability Note*, 2.
- Gârleanu, N., & Pedersen, L. H. (2016). Dynamic portfolio choice with frictions. *Journal of Economic Theory*, 165, 487-516.
- Gianstefani, I., Metadger, N., & Moloney, K. (2023). Interest Rate Sensitivity of Irish Bond Funds. *Financial Stability Notes*, Central Bank of Ireland.
- Giuzio, M., Kaufmann, C., Ryan, E., & Cappiello, L. (2023). Investment funds, risk-taking, and monetary policy in the euro area. *European Central Bank*.
- Kaufmann, C. (2023). Investment funds, monetary policy, and the global financial cycle. *Journal of the European Economic Association*, 21(2), 593-636.
- Markowitz, H. M. (1952). Portfolio Selection. *Journal of Finance*, 7(1), 71-91.
- Yu, S., Wang, H., & Dong, C. (2023). Learning risk preferences from investment portfolios using inverse optimization. *Research in International Business and Finance*, 64.

Appendix 1: risk preference via inverse optimization

The Markowitz mean-variance portfolio theory asserts that investors minimize the risk of a portfolio at a given expected return. In other words, investors are averse to risk, and will only accept more risk if compensated by higher expected returns. More formally, this can be written as the investor minimizing the variance in the portfolio (measure of risk) at a given expected level of return:

$$\min_{w \in \mathbb{R}^n} \frac{1}{2} w' \Sigma w - \lambda w' \mu \quad s.t. Ax \geq b$$

where w denotes a vector of portfolio weight, $\Sigma \in \mathbb{R}^{n \times n}$ indicates the covariance matrix for the returns on the assets in portfolio, μ represents a vector containing the expected returns for underlying asset level, and λ is the risk aversion coefficient (how much return the investor requires to accept another unit of risk or variance in the portfolio, an inverse of the estimated value in the paper), and in the constraints.

For each fund, we observe w as the realized portfolio at the end of quarter, μ as the returns of assets held by the fund, and Σ as the realized covariance matrix of returns on assets held

by the fund. The only unknown in the equation is λ . We estimate it by finding a value that is the most likely value to match the above-mentioned observed realizations of other variable in this equation. This is done with reverse optimization method (Yu et al., 2023), which solving the below:

$$\begin{aligned} \min_{\lambda, w, p, z} \quad & \frac{1}{2} \| \lambda_t - \lambda_{t-1} \|^2 + \frac{v}{\sqrt{t}} \| w_t^* - w \|^2 \\ \text{s.t.} \quad & Ax \geq b, \\ & p \leq Mz, \\ & Ax - b \leq M(1 - z), \\ & \Sigma_t w - \lambda \mu_t - A^T p = 0, \\ & \mu \in \mathbb{R}^n, p \in \mathbb{R}_+^m, z \in \{0, 1\}^m \end{aligned}$$

where $\frac{v}{\sqrt{t}}$ is the learning rate in round t, z is a vector of binary variables used to linearize Karush-Kuhn-Tucker (KKT) conditions, and M is an appropriate number used to bound p and $Ax - b$.

Appendix 2: fixed effects regression

H1: Low interest rates lead to a search-for-yield behaviour in funds (higher risk preference at low interest rates)

$$\sigma_{i,t} = \beta_0 + \beta_1 I_{i,t-1} + \beta_k Controls_{k,i,t-1} + \varepsilon_{i,t-1}$$

Here $\sigma_{i,t}$ is the risk level of investment fund i at time t, $I_{i,t-1}$ is the weighted interest rates of the underlying assets at time t-1, and $\varepsilon_{i,t}$ is the error term that uncorrelated with interest rates. $Controls_{k,i,t}$ include lagged one-period risk preference, funds' size, and one-period lagged the leverage. Fund and time fixed effects are controlled for in the regressions.

H2a: Funds compete for investors to attract capital inflows (More inflows at high risk preference)

H2b: Existing investors in funds are sensitive to risk preference (High risk preference drives outflows)

$$InF_{i,t} = \beta_0 + \beta_1 \sigma_{i,t-1} + \beta_k Controls_{k,i,t-1} + \varepsilon_{i,t}$$

$$OutF_{i,t} = \beta_0 + \beta_1 \sigma_{i,t-1} + \beta_k Controls_{k,i,t-1} + \varepsilon_{i,t}$$

Here $InF_{i,t}$ and $OutF_{i,t}$ represent capital inflows and outflows at time t, respectively.

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