

Do Passive ETFs Replace Active Open-Ended Funds? Association Rule Mining Evidence from the European Fund Market

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Extended abstract

The rapid expansion of exchange-traded funds (ETFs) has become one of the most important structural changes in global asset management. In the first quarter of the twenty-first century, regulated investment funds grew not only in scale, but also in importance as vehicles through which households and institutions access capital markets. According to data reported by the Investment Company Institute, the assets of regulated investment funds worldwide increased from USD 11.9 trillion in 2000 to USD 38.2 trillion in 2015 and USD 88.0 trillion in 2025. Over the same period, Europe strengthened its position as the second-largest fund market after the United States. The net assets of European open-ended investment funds increased from approximately USD 3.3 trillion in 2000 to USD 27.9 trillion in 2025, i.e. more than eightfold. In 2025, Europe accounted for 31.7% of global open-ended fund assets, compared with 50.9% for the United States.

The development of ETFs has been particularly visible in the last decade. Although the US ETF market remains much larger in absolute terms, the European UCITS ETF segment has expanded rapidly. ETF assets in the United States rose from USD 2.1 trillion in 2015 to USD 13.36 trillion in 2025, while European ETF assets increased from USD 0.53 trillion to USD 3.11 trillion. Thus, the European ETF market grew almost sixfold over the decade, with assets increasing by more than 40% in the last year alone. This rapid growth raises an important question for European asset management: do passive ETFs replace active open-ended investment funds, or do both types of vehicles serve different and complementary roles in investor portfolios?

This paper investigates whether the growth of passive ETFs in Europe has occurred at the expense of actively managed open-ended investment funds, or whether the relationship between the two segments is more complex. The study shifts the focus from the traditional active-versus-passive performance debate to investor preferences revealed through capital flows. Instead of asking only whether ETFs outperform or underperform active funds, the paper examines whether outflows from

active funds are followed by inflows into passive ETFs and whether such patterns differ across investment categories and market conditions.

The empirical analysis is based on Morningstar Direct data covering European open-ended investment funds and ETFs over the period 2010–2025. The dataset includes monthly information on fund returns, estimated net flows, assets, fund type and investment category. The data are organised as a fund-month panel, which makes it possible to observe investor allocation decisions over time and to compare flow patterns across active and passive vehicles. The association rule analysis is based on a one-month lag structure, allowing the study to examine whether outflows from a given fund segment in month t are followed by inflows into another segment in month $t+1$. This design reflects the possibility that investors react to market signals, past performance or uncertainty with a delay.

The study consists of three complementary stages. First, the development of active funds and ETFs is compared in terms of assets, flows and broad market structure. Second, the paper examines the flow-performance relationship, including the possibility of delayed investor reaction to past returns. Third, association rule mining is applied to identify recurring patterns of capital reallocation between active open-ended funds and ETFs, including patterns that may indicate substitution, complementarity or flight-to-safety behaviour.

Association rule mining is particularly useful in this context because investor behaviour may not be fully captured by linear relationships or average effects. The method identifies interpretable patterns in large datasets by detecting rules of the form: if a specific condition is observed, then another outcome tends to occur. In this study, the rules describe whether outflows from selected fund types and categories are associated with subsequent inflows into the same or other fund segments. The strength of the rules is evaluated using support, confidence and lift. Support measures how frequently a given rule occurs in the dataset, confidence measures the conditional probability of the consequent given the antecedent, and lift indicates whether the association is stronger than would be expected under independence. A lift value above 1 suggests a positive association, while a value close to or below 1 indicates weak or no positive association.

The association analysis identifies a broad set of rules linking outflows from selected active mutual fund or ETF categories with subsequent inflows into the same or other categories. The rules are considered both for the full research period and for subperiods corresponding to different market environments, including the pre-pandemic period, the COVID-19 shock and the post-pandemic/inflationary period. Two groups of rules are of particular interest. The first captures potential substitution between active funds and passive ETFs within the same broad investment category. The second captures flight-to-safety behaviour, understood as a shift from equity or more aggressive fund categories toward fixed income, allocation or other more defensive categories.

The preliminary results suggest that the relationship between active open-ended funds and passive ETFs in Europe is more complex than a simple substitution mechanism. Initial association rules do not indicate a uniform and permanent pattern in which outflows from active funds are systematically followed by inflows into passive ETFs within the same investment category. Instead, the strength and direction of the observed associations appear to vary across asset classes and market conditions. This indicates that ETF growth may partly reflect substitution in selected segments, but it should not be interpreted as a general one-for-one replacement of active funds across the entire European fund market.

The initial findings also suggest that the active-passive relationship may become more pronounced in periods of elevated market uncertainty. In such periods, investors may use ETFs as flexible instruments for reallocating capital within or across broad investment categories. However, the preliminary evidence points to heterogeneity rather than a universal pattern: some segments show stronger signs of reallocation between active and passive vehicles, while others do not. This supports the interpretation that ETFs may serve different functions depending on the market environment, including tactical allocation, liquidity management and exposure adjustment, rather than only acting as lower-cost substitutes for active funds.

A second group of preliminary rules relates to flight-to-safety behaviour. The initial results indicate that during periods of market stress investors were more likely to reallocate capital from equity or more aggressive fund categories toward more defensive exposures, including fixed income or allocation funds. This pattern is consistent with the view that investor flows are shaped not only by past performance, but also by changing preferences for safety, liquidity and portfolio resilience. At the same time, the strength of these associations appears to differ across subperiods, suggesting that flight-to-safety effects are episodic rather than permanent features of fund-flow dynamics.

The paper contributes to the literature on fund flows, ETF growth and investor behaviour in three ways. First, it provides recent evidence from the European fund market, which is large, institutionally distinct and strongly shaped by the UCITS framework. Second, it applies association rule mining to fund-flow analysis, offering an interpretable data-driven method for detecting recurring allocation patterns that may be missed by average-effect models. Third, it shows that the active-passive relationship should be analysed as heterogeneous across asset classes and market regimes. The growth of ETFs should therefore be interpreted not only as a cost-driven shift from active to passive management, but also as part of a broader transformation in the way investors use fund vehicles for allocation, liquidity management and risk reduction.

The findings have potential implications for asset managers, ETF providers, investors and regulators. For active fund managers, the results may help identify the segments in which competition from passive products is strongest and those in which active management continues to serve distinct

investor needs. For ETF providers, the results highlight the growing role of passive products not only in strategic allocation, but also in tactical and crisis-period reallocations. For regulators and market observers, the coexistence of substitution and complementarity implies that ETF growth should not be interpreted simply as the decline of active management, but rather as a reconfiguration of investor preferences and capital allocation mechanisms.

Summarizing, the preliminary evidence indicates that passive ETFs do not simply replace active open-ended funds in Europe. Rather, the European fund market appears to be characterised by partial and episodic substitution, combined with functional complementarity between active and passive vehicles. ETFs may absorb part of the demand previously directed toward active funds, especially in segments where low-cost and liquid market exposure is particularly valuable. At the same time, active funds may continue to play a role in areas where investors seek delegated management, specialised exposure or broader portfolio services. The results therefore call for a more nuanced interpretation of ETF growth in Europe: not as the end of active management, but as a transformation of investor preferences and fund-market structure.

Keywords: ETFs, active mutual funds, UCITS, fund flows, association rule mining, investor preferences, flight-to-safety, European fund market

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