A Survey of the Consequences of Passive Investment Funds for Financial Markets

Report for Financial Conducts Authority

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July 8, 2025

"*Growth in indexing strategies has been a stand out trend in the investment industry over the last ten years as investors have opted for low cost exposure to equity and fixed income indices.*" (Page 71; Investment Association, 2024)

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1 Introduction

The 21st century has witnessed a significant growth of passive investment strategies in the UK and other developed financial markets. A passive investment portfolio is one that simply replicates the portfolio weights in an index, and is also referred to as an indexing strategy or tracker-investing. Using data from the Investment Association's annual surveys of investment management in the UK, Figure 1 shows the growth in assets under management by UK-based fund managers from 2005-2023, and the split between assets managed actively and passively. Assets under management have increased from £2.8 trillion in 2005 when around 20 percent of assets were managed passively to £9 trillion in 2023 with 33 percent of assets managed passively.

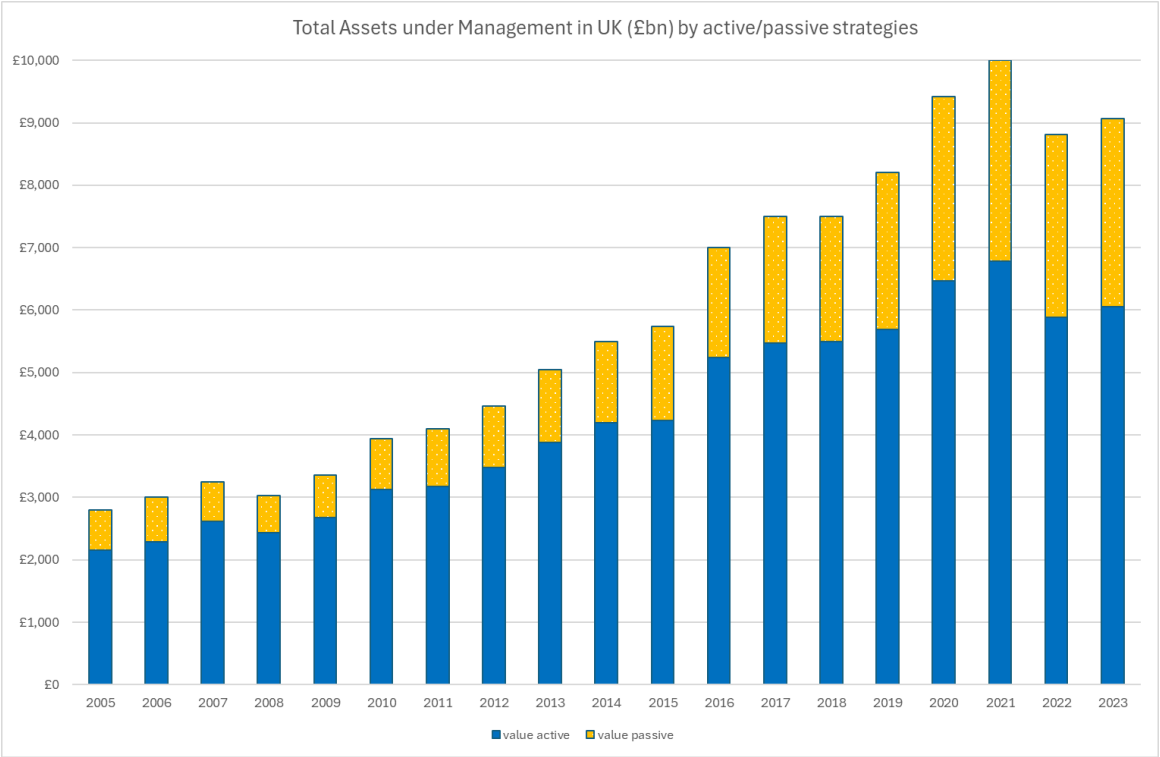

Figure 1: Growth in passive investment strategies in UK Total AUMs 2005-2023

The growth of passive investing is an international phenomenon affecting most developed stock markets (Bhattacharya et al., 2009). For the US, Jiang et al. (2020) report that by 2021, passive funds invested in US stocks managed 8.4 trillion of assets, representing 53 percent of the combined assets managed by active and passive funds. Sushko and Turner (2018) note that in EU countries passive equity funds have grown from 15 percent of investment fund assets in 2007 to 30 percent of total fund assets in 2017.

The data in Figure 1 represents the breakdown of active and passive strategies across all types of investment management contractual arrangements by fund managers based in the UK, but there are different types of fund management and these aggregate trends may hide composition effects. For instance, there may be differences between the retail and institutional sections of the asset management industry. Retail investment funds include open-end and closed-end investments and are sold to the general public as packages of pooled or co-mingled assets. The regulatory framework normally requires clear policy statements that allow for an active-passive classification. In contrast, institutional assets (which include pension and life assurance funds) may be managed as pooled or segmented vehicles in-house or by external fund managers, and the terms of the fund management mandate may not be publicly available. In addition, there is no unambiguous definition of what constitutes a passive investment strategy. Cremers and Petajisto (2009) point out that many active fund managers are in fact "closet trackers", basing a portfolio around an index and then deviating slightly in terms of over-weight and under-weight allocations. They classify funds across an active-passive spectrum via an active-share measure, and observe that while the fraction of pure index funds grew from about 1% to 15% of mutual fund assets over the 1990s, the fraction of closet indexers increased more dramatically with low active-share funds (20–60%) responsible for zero percent of AUMs in the 1980s increasing to about 30% of all mutual fund assets by 2003.

Further, there are many different types of indexing strategies. Gastineau et al. (2007) discuss the process for establishing a passive investment strategy, which starts by establishing a particular equity index as a benchmark. The chosen index will represent the manager's investment "neighbourhood", as well as measuring that asset-class' performance. The neighbourhood defines the market universe or stock sub-sectors. The greater the number of stocks diversified by industry and size, the better the index will measure broad market performance. Chosen indices may represent: domestic equities, emerging market equities, corporate bonds, or sub-sectors such as large/small stocks, industry-specific stocks and ESG stocks. Although most international stock market indices are weighted market capitalisations, some indices that cover similar universes may differ in how the index components are weighted: price weighted (ie Dow Jones, Nikkei), value-weighted (TOPIX), Float-weighted (FTSE 100, S&P 500), and equally-weighted (Value Line). Having defined the neighbourhood, Elton et al. (2009) suggests there

are three common approaches to construct an index fund: 1) hold each stock in the proportion it represents in the index; 2) form a portfolio with a limited number of stocks that best tracks the index historically; or 3) find a small number of stocks that matches the index in terms of pre-specified characteristics (for example, a single company may represent a particular sector in the index). Another type of index investing is based on factor investing or smart beta, where investors can choose a portfolio to be tilted towards certain factors with the constituent securities of that factor represented by an index. Index funds provide a cost-efficient way to expose investors to certain common risk factors (Cong et al., 2024). A measure of the performance of a particular passive strategy is how well it tracks the underlying index: its tracking error. Given the different ways of constructing an index portfolio, it is unsurprising that Elton et al. (2004), studying the performance of S&P 500 index funds from 1996-2001, find that there was a range of realised tracking errors, with the difference between the best- and worst-performing index funds being an average of 2.09% per year.

Whatever the definitions, it is generally acknowledged that there has been a significant growth in assets allocated to passive investment strategies over the last 35 years, and this growth has many implications for financial markets, and in this survey paper we will provide an overview of the academic literature addressing the issues associated with the growth in passive investing.

2 Scene-setting: descriptive statistics on numbers and size of passive mutual funds versus active mutual funds in UK and other countries

In this section, we set the scene for the growth of passive investing by concentrating on a clearly defined universe: the number and assets under management of open-ended investment funds (unit trusts) which are retail products sold to investors. We obtain this data from Morningstar and use their definition for an active/passive classification based around funds that identify themselves as index funds in their policy statements. Figure 2 shows the growth in the number of UK open-end funds from 1989 to 2024 and the corresponding assets-under-management

managed by these funds over the last 35 years. [2] This sample of 424 UK domestic funds was managing over £200 billion worth of assets by 2024 and each panel of Figure 2 is split each year by whether the funds and AUMs are active/passive. There has been a clear increase in the percentage of funds and AUMs operated under passive policy statements with 13 percent of domestic equity open-end funds representing 36 percent of AUMs that are passively managed in 2024. These percentages imply that funds operating passive strategies are larger than active funds. Indeed, from the data in Figure 2 of the 424 UK domestic equity open-ended funds operating in 2024 the average size of an active fund was £373 million AUM, but the average size of a passive fund was four times larger at £1,431 AUM. The relative growth in passive strategies over time and the larger average size of these funds suggests that concentration in the fund management industry is increasing. Panel A of Figure 2 reports that there are 74 passive open-end funds in UK equities in 2024. However, an interesting question is whether there is a need for competition in the passive sector? Is the passive sector a natural monopoly? In which case, it would be optimal to have a single large regulated passive fund. Brown et al. (2023) note that competing index funds have some degree of market power as evidenced by a wide variation in expense ratios (Hortaçsu and Syverson, 2004), which they attribute to investor inertia and information frictions.

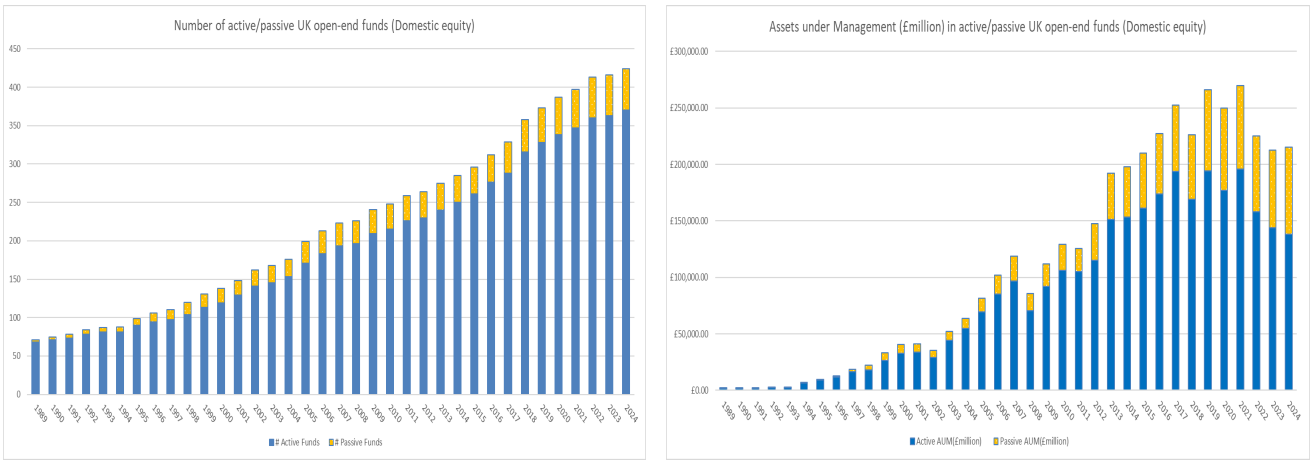

Figure 2: Growth in number and AUMs of active/passive UK open-end funds 1989-2023

We may also compare the relative growth in passive investments for open-end funds in other asset classes (European equities) and across countries for US domestic equities, German and

[2]Source: Morningstar 424 UK open-ended funds (funds classified under Global Broad Category Group= "Equity" & Investment Area="UK" and applying Morningstar index/non-index fund classification. The selection criteria include primary share classes for each fund and surviving funds only.

French European equities.[3] In Figure 3 we show both the growth in AUMs since the 1980s in all of these asset classes and we can see that in every panel passive investment strategies are taking up a larger share of AUMs over time. There has been very strong growth in the share of passive strategies in US domestic mutual funds, so that by 2024, 53 percent of US domestic-equity AUMs were managed under an indexing strategy. The growth in the passive share is less dramatic in UK European equities (13.6 percent by 2024), French European equities (10.6 percent in 2024) and German European equities (11.9 percent in 2024); but nonetheless the share is increasing, and because of the larger size of passive funds, so is market concentration in each of these asset classes. Bevza and O'Hagan Luff (2024) identify the three largest passive institutional investors in Europe (Blackrock, Vanguard, and Legal and General Investment Management (L&G)). They estimate that these three passive investors combined had ownership of more than 10% across 12% of the constituents of the EuroStoxx 600 index and ownership of between 5% and 10% across 37% of the constituents of the EuroStoxx 600 index. The Investment Company Factbook 2024 reports that the concentration of US mutual funds and ETFs assets managed by the largest fund families has increased over time. The 5-firm concentration ratio increased from 35% in 2005 to 56% in 2023. This was due to both the growth in passive strategies and inflows into bond mutuals and ETFs which are provided by the larger fund families.

What explains the structure of the mutual fund industry? Khorana et al. (2005) compare the size of the mutual fund industry across 56 countries and in common with the literature from law and economics confirm that a country's rules and norms affect its financial development. Strong legal and regulatory factors, such as fund industry regulations which protect shareholders' interests, have a positive impact on mutual fund industry size. Cremers et al. (2016) looks into indexing across the world. Explicit indexing and closet indexing by active funds are also associated with countries' regulatory and financial market environments. They find that actively managed funds are more active and charge lower fees when they face more

[3]Source: Morningstar 316 UK open-ended funds (funds classified under Global Broad Category Group= "Equity" & Investment Area="Europe"; 1,858 US open-ended funds (funds classified under Global Broad Category Group="Equity" & Investment Area="US-Equity"; 638 France open-ended funds (funds classified under Global Broad Category Group="Equity" & Investment Area="Europe"; 573 Germany open-ended funds (funds classified under Global Broad Category Group="Equity" & Investment Area="Europe"; and applying Morningstar index/non-index fund classification. The selection criteria includes primary share classes for each fund and surviving funds only.

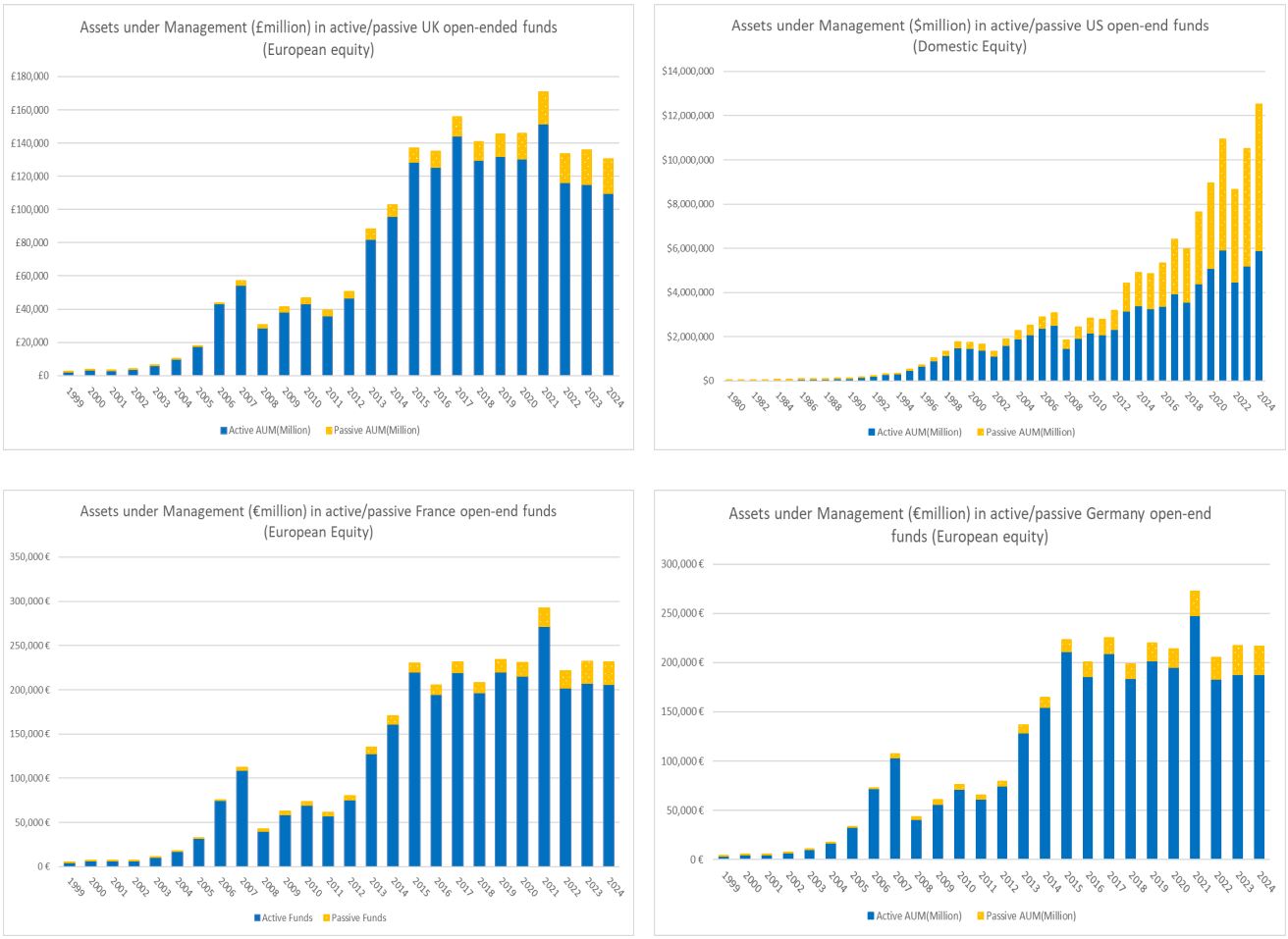

Figure 3: Growth in AUMs of active/passive UK European,US domestic, German & French European open-end funds over time

competitive pressure from low-cost explicitly indexed funds. [4] A quasi-natural experiment using the exogenous variation in indexed funds generated by the passage of pension laws supports a causal interpretation of the results. Moreover, the average alpha generated by active management is higher in countries with more explicit indexing and lower in countries with more closet indexing. Overall, their evidence suggests that explicit indexing improves competition in the mutual fund industry.

Dannhauser and Spilker III (2023) identify a recent trend that mutual fund families often offer both passive and active investment funds to investors as distinct from a fund family that specialises in one type of investment strategy. They document that between 1990 and 2020 in the US the percent of funds managed in active-only families fell from 80 percent to 42 percent, and go on to investigate the effects that internal competition from passive funds has on the performance of active funds within the same family. They find that active mutual funds have higher gross performance in families with greater percentage of passive mutual funds. A one standard deviation increase in the percentage of family assets in passive funds increases an active fund's gross excess returns by 0.37% annually. They also find that in families with higher proportions of passive funds, active funds have reduced performance-flow sensitivities and lower fees. The implication is that internal competition within a fund family has significant effects on active funds.

3 Causes of growth in passive investments

We start with the theoretical basis for passive investing. Tobin (1958) demonstrated that Markowitz's mean-variance portfolio selection framework leads to a two-fund separation property whereby all investors hold a combination of the same portfolio of risky assets (the market portfolio) and the risk-free asset. In Figure 4, all risky assets' risk-return characteristics lie to the south-east of the market portfolio and are combined to trace out the efficiency frontier of risk assets. The Capital Market Line shows combinations of the market portfolio and the risk-free asset that have the highest Sharpe ratio and are feasible.

In this steady state equilibrium the efficient markets hypothesis holds and an investor's degree of risk-aversion determines their location on the Capital Market Line: investors choose

[4] We discuss fees charged by active and passive funds in more detail in Section 5

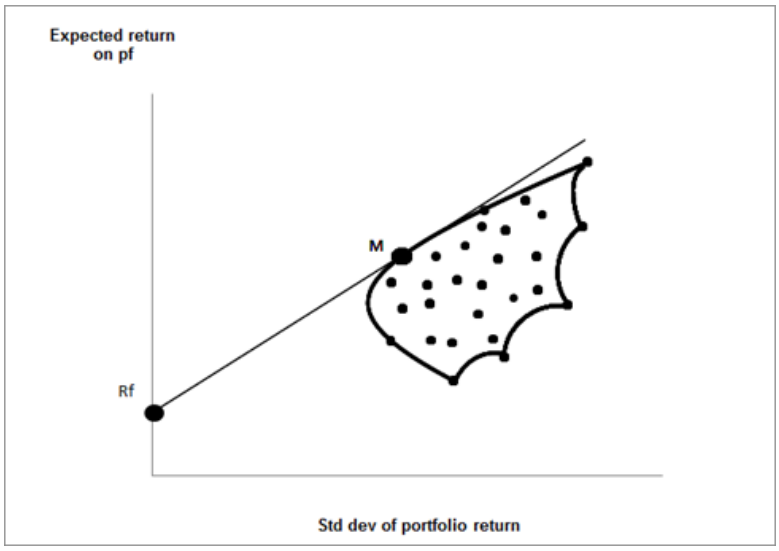

Figure 4: Efficiency of Market Portfolio

their own personal portfolios *pf* being a combination of the market portfolio and the risk-free asset. Passive index portfolios represent investments that approximate the market portfolio. This equilibrium leads to the Sharpe (1991) conclusion that simple arithmetic ensures that active fund management is a zero-sum game: "before costs, the return on the average actively managed dollar will equal the return on the average passively managed dollar" (p. 7). These conclusions on the superiority of passive over active strategies have been challenged by a number of authors.

Pedersen (2018) argues that the zero-sum game framework only applies to a static market portfolio devoid of growth, highlighting active fund management's role in channelling capital to innovative firms and signalling the decline of failing ones. Similarly, Jones and Wermers (2011) notes that while markets are generally efficient, temporary inefficiencies can allow active managers to earn abnormal returns.

3.1 The performance of active vs passive funds

The "conventional wisdom" held by finance researchers suggests that active management, on average, adds little value to investors and almost certainly less than the fees they charge – implying that investors should, in fact, switch to passive strategies. This view is challenged by the survey article of Cremers et al. (2019). In this section we briefly summarise the evidence on the performance of active fund management, and reiterate the main points of Cremers et al.

(2019) and discuss a couple of influential articles since the publication of that survey.[5]

The standard measure of fund performance is the estimated net alpha (alpha after fees) of a fund using a suitable benchmark. There is a long literature on the performance of mutual funds starting with Jensen (1968) and updated for example by Malkiel (1995) which explains and applies the methodology of performance evaluation tests. There are many different types of managed investment funds: as well as open-end mutual (unit trusts), there are closed-end funds (investment trusts) (Fletcher and Marshall, 2014), hedge funds (Fung et al., 2008), institutional funds such as pension funds (Blake et al., 2013), and sovereign wealth funds (Bernstein et al., 2013).

This literature typically finds that, on average fund-mangers cannot out-perform a benchmark, and there are many extensions to this literature summarised in Elton et al. (2019). For example, adjusting the criteria for measuring outperformance of star fund managers (Kosowski et al., 2006; Fama and French, 2010; Blake et al., 2014, 2017; Harvey and Liu, 2022); allowance for market timing (Jagannathan and Korajczyk, 1986); tests of performance persistence (Carhart, 1997) and allowances for survivorship bias (Carpenter and Lynch, 1999); extensions to funds with specific fund objectives (Basu and Huang-Jones, 2015; Goldstein et al., 2017); cross-country comparisons (Ferreira et al., 2013); the relevance of the benchmark (Carhart, 1997; Cremers et al., 2012; Hunter et al., 2014; Fama and French, 2015) and conditional performance evaluation (Ferson, 2022). Any abnormal performance that is identified in this literature is typically small, and does not compensate for fees incurred. Further, in the mutual fund industry fund flows between differentially performing active mutual funds may eliminate abnormal performance (Berk and Green, 2004; Ferreira et al., 2012; Christoffersen et al., 2014).

More recently, in an influential article, Berk and van Binsbergen (2015) develop a value-added-type measure of fund performance and show that it is highly persistent and it predicts fund growth – supporting the idea that investors reward performance. Follow-up research has shown that investment management firms add considerable value by reallocating funds to more skilled fund managers. Berk and van Binsbergen (2015) also estimate the average net alpha of funds but this time using tradeable benchmarks (instead of the standard approach which is to use an index or factor portfolios – both non-tradeable). In particular, for each mutual fund

[5]We note that the literature focusing on the performance of active fund management is vast, so any survey attempting to give an overview of the topic will inevitably be highly selective.

they find a Vanguard passive fund that is most similar in style to the respective fund. With these benchmarks, they do not find active funds to have significantly different performance compared to passive funds, a result contradicting the conventional wisdom.[6]

In comparing active and passive funds Elton et al. (2019) builds on the idea of using passive ETFs as benchmarks following Berk and van Binsbergen (2015). Elton et al. (2019) carefully select five passive ETFs that span well the population of indices typically used as benchmarks by active funds. They then show that portfolios built from these five ETFs have the ability to beat about 78% of actively managed mutual funds. But even a strategy requiring limited financial literacy (picking the ETF with an identical benchmark of the active fund) beats active funds 72% of the time (or by an average annual return of 1.01%).

When using the average performance of active funds (either equal-weighted or value-weighted), the implicit assumption is that all investors are equal. However, if investors can predict fund performance with the help of publicly available information (like past performance, past holdings and their relation to other observable stock trading data), then focusing on average performance will bias against finding positive performance. Cremers et al. (2019) discusses numerous articles that have found meaningful ways to predict fund performance using publicly available information. This suggests that investors should be able to take advantage of active funds – as long as they are sufficiently sophisticated to use public information when selecting among funds.

In a similar spirit, Kaniel et al. (2023) is a recent attempt that applies machine learning techniques to address whether one can predict which funds will perform well using publicly available information. Their results suggest that performance is predictable to a moderate degree, especially before 2000. Between 2000-2019, their model is still useful in identifying funds that will likely have negative abnormal performance – the performance of the decile of funds with the lowest predicted performance is indeed significantly lower than that of the rest. However, the decile with the best predicted performance is hardly better even than that of the second to *worst* decile, which suggests that picking winner funds has become increasingly difficult over time. The implication for investors (especially for unsophisticated/retail investors) is again to seek passive strategies.

[6]"the equally weighted net alpha is 3 bp per month and the value weighted net alpha is -1 bp per month. Neither estimate is significantly different from zero." page 3. of Berk and van Binsbergen (2015)

To sum up, the conventional wisdom of finance research has suggested since the late 1960s up to the early 2000s that passive investing should provide an attractive alternative for most investors as active investing appears to lose money on average, especially after fees are considered. Even the results most in favour of active management suggest an insignificant difference in net alpha compared to passive funds – that is before considering that ex ante returns of active funds will inevitably be more volatile. A more nuanced picture has emerged in the last decade that emphasizes how sophisticated investors could identify funds or fund managers with superior skill. However, even the most sophisticated selection criteria may only be sufficient to help avoid picking the funds with the weakest performance. In light of these results, the increased popularity of passive investing is hardly a surprise.

3.2 The emergence of exchange-traded funds (ETFs)

ETFs offer an attractive investing venue for many investors allowing for intra-day trading of baskets of securities, and the total assets managed by ETFs have continued to increase in the last decade[7]. For historical and regulatory reasons the first ETFs followed passive strategies and compared with index mutual funds they typically work with lower expense ratios. These combined with the concerns surrounding the value of active management discussed above created the perfect conditions for passive ETFs to experience exponential growth (Ben-David et al., 2017).

The academic literature remains mostly optimistic about the performance of passive ETFs. Jiang et al. (2023) selects a sample of comparable index funds and passive ETFs to show that, on average, index funds underperform ETFs by 42 bps per year almost exclusively due to higher expenses. Despite this, it appears that index funds are here to stay as they have experienced net inflows during the past decade (in stark contrast to actively managed funds).[8] Agapova (2011) reconciles this by arguing that there are clientele effects implying that index funds are likely to remain an attractive alternative for some investors. As she notes "Specifically, there is evidence of a tax clientele, suggesting that ETFs may be preferred by tax-sensitive investors while conventional funds may be preferred by tax-exempt investors or those insensitive to taxes

[7]Based on the 2024 Investment Company Fact Book, the total net assets of US registered ETFs increased from $2.0 trillion in 2014 to $8.0 trillion in 2023.

[8]See the 2024 Investment Company Fact Book.

who value the services of conventional mutual funds."[9]

An interesting thread in the literature focuses on the role played by active ETFs (Keswani et al., 2024). As Easley et al. (2021) point out, one has to carefully consider what constitutes an "active" or "passive" strategy. The traditional view of passive investing assumes that the fund aims to replicate a broad market index. However, in practice, many ETFs aim to replicate "designer indices" that load on specific factors, like momentum. Easley et al. (2021) argue that most ETFs are active in this sense. Ben-David et al. (2023a) shows that many ETFs target popular stocks at the time of launch to align with investor sentiment (because they are following active strategies).

To conclude, the rapid rise of ETFs has changed the landscape of fund management over the past couple of decades. ETF shares provide a more liquid and transparent venue compared to traditional mutual fund shares for investors to access a wide set of underlying portfolios in a cost-effective manner. Although, as Easley et al. (2021) note: "In 2020, more ETFs were liquidated than launched, suggesting that older ETF products may also be at risk of obsolescence."

3.3 The competitive fees of passive funds

Based on the 2024 Investment Company Fact Book, the average expense ratio (weighted with assets under management) of equity mutual funds decreased from 99 bps per year to 42 bps per year between 2000 and 2023. The declining trend in expenses can be observed across the board: mutual funds, ETFs, actively and passively managed funds and bond funds all have experienced declines in their expense ratios. As passive funds have been experiencing relatively larger inflows, this composition effect further decreases the average cost investors incur.

While fees associated with both active and passive fund management have been on the decline, the percentage difference of fees of passive funds relative to active funds has also decreased, and this has probably added to the attractiveness of passive funds. From the Investment Company Fact Book, in 2010 the expenses of actively managed equity funds were about 4 times as large as those of passive funds (106 bps vs 27 bps) but this ratio has increased to 13 by 2023

[9]Besides lower costs and potential tax advantages, ETF shares can be traded similarly to stocks throughout the trading day. As discussed below, the intraday/high-frequency trading of ETF shares are likely to contribute to the volatilities of the underlying assets (Ben-David et al., 2018).

(65 bps vs 5 bps). In section 5.5 we discuss several articles documenting the decline in fees. Overall, the observed decrease in fees is likely to underlie investors' preferences for low-cost funds.

As well as dissatisfaction with active funds performance and lower fees, Sushko and Turner (2018) suggest that the growth in passive investing may be a consequence of structural shifts in the financial advisory industry. These include: the rise of "robo advisors" (D'Acunto et al., 2019), the introduction of fiduciary duty requirements on active investors (see Section 7); and a move away from commission-based remuneration (Sokolinski, 2023). In the EU, the regulators' greater focus on fee transparency (MiFID 2) may also have played a role.

4 Macroeconomic consequences of passive funds: impacts of market concentration on financial stability

Sushko and Turner (2018) argue there are two key macroeconomic consequences from the growth in passive investing: a) distortions in the pricing of individual securities due to higher correlations between returns and less price-specific information; and b) whether investment flows and market price dynamics are amplified, destabilising aggregate stock prices. They note the rise in passive index mutual funds and ETFs across asset classes (bonds and equities) and across countries, although it is most evident in US equities. They caution that the documented growth in passive investments is within the global mutual fund industry particularly in equities which because of their perpetual nature and deep liquidity is easier to replicate via an index, and in fact the holdings of passive investment funds as a share of total outstanding securities is still relatively low because of other non-mutual fund investor-types even in US equities. They estimate that in June 2017 passive mutual funds share of outstanding market volumes was 14.7 percent in US equities but only 3.3 percent in European equities; and only 5 percent in US bonds, and less than one percent in European bonds. They also note the difficulties in identifying the percentage of passive/active investors because of closet tracking by some investors (Cremers and Petajisto, 2009). They note the outflows from active to passive mutual funds that tend to be concentrated into a small number of managers: in the US 70 percent of cumulated inflows over the period 2010-2017 were directed into the three largest specialist

passive fund managers. The growth in AUMs of these fund managers can benefit from scale economies which compress fees. They go on to provide an overview on the impact of passive investing on market efficiency, security pricing, and the behaviour of both investors and issuers. Since indices are typically value-weighted, if there is any market inefficiency such that stocks are over- or under-valued the large inflows into or out of passive funds could exacerbate rising or declining market movements. On the other hand because passive portfolios automatically rebalance (ignoring any redemptions or inflows) as distinct from active managers who may react to market events, then passive funds might provide a counter-balance to the procyclical behaviour of active funds. They further examine the evidence of the influence of passive funds on aggregate fund flows and market price dynamics during periods of market stress, comparing the behaviour of different fund types. They examine the stability of weekly fund flows across three fund types (index mutual funds, ETFs and active mutual funds) during three stress periods: 2013 bond taper tantrum; 2015 equity market turbulence; and 2016 US presidential election. They document three clear patterns. First, index mutual fund flows were the least volatile; second, ETFs exhibited the largest inflows and outflow; and third, active mutual funds suffered from the most persistent outflows across asset classes in all three stress periods.

Anadu et al. (2020) suggest that there are four potential macroeconomic consequences from the rise in passive investment strategies for financial stability: a) funds' liquidity transformations and redemption risks; b) asset market volatility due to indexing strategies that amplify shocks, c) asset management industry concentration, and d) co-movement of asset returns and liquidity due to index inclusion effects. They provide new evidence that aggregate investor flows for passive MFs are less sensitive to past performance than flows of active funds. For active funds, a 1% increase in monthly net return is associated with 0.03% (0.01%) same-month (lagged-month) inflows, whereas for passive funds the sensitivity is insignificantly different from zero. Hence passive MFs appear to face less redemption risks than active funds following poor returns, and particularly at times of financial stress. They note this lower flow-performance sensitivity may be because passive investors have less incentive to seek out potential abnormal performance. They argue some specialized passive investment strategies (leveraged-ETFs) will amplify price volatility for the assets they hold since they require portfolio managers to buy assets on days when the market rises and to sell assets when the market falls. However, these

specialised products are a small fraction of the ETF sector, and their effect on the aggregate market will be small. On the other hand they find that the larger size of passive investment funds means that market concentration has unambiguously increased. Finally they assess the importance of "index-inclusion" effects from increased co-movements of returns (Wurgler, 2010), but conclude the evidence on trends and causality is mixed. On balance, their findings suggest that while passive investing mitigates some risks, such as those related to liquidity transformation, it simultaneously increases others, including volatility and industry concentration.

Converse et al. (2023) study how the growth of international exchange-traded funds (ETFs) affects the sensitivity of international capital flows to the global financial cycle. Using fund-level data on investor flows, they report the sensitivity of ETF flows to global financial conditions of equity (bond) ETFs is 2.5 (2.25) times higher than for equity (bond) mutual funds. This is due to ETFs shorter-trading-horizon clienteles that trade more often in response to shocks. They also find that in countries' where ETFs hold a larger share of financial assets, equity inflows and prices are more sensitive to global risks.

5 Market efficiency and passive funds

5.1 Equilibrium percentages of active-passive investments

Grossman (1976) introduces the following paradox into the efficient markets paradigm. Suppose markets are efficient, such that prices reflect all available information about an asset, and that information is costly to acquire; then no trader will collect information, since it is costly, and the trader can obtain information through efficient prices for free; but if no trader collects information, then prices cannot reflect all available information. A paradox!

Grossman and Stiglitz (1980) resolve this paradox by demonstrating that market efficiency requires additional noise in the system such that uninformed traders cannot fully infer the private information about an asset from prices alone, incentivising informed investors to acquire private information. They develop an equilibrium pricing model with a safe and risky asset, where the risky asset has a random return but with a component that can be observed by informed investors. There are two types of trader in the market: a proportion λ who are informed (and pay a cost to observe the private information component of the risky asset's

return), and a proportion (1-λ) who are uninformed. They solve the model for a rational expectations equilibrium where price depends linearly on the information and unobservable noisy supply of the risky asset. Informed and uninformed investors submit their demands for assets conditional on their information sets to maximise their expected utility. For the informed, this information is the component of the return they have paid to observe. For the uninformed this information is inferred from equilibrium prices, which depend on the demands of the informed: informed buy more of the risky asset when the private information is positive, which through the market clearing condition raises prices, and vice versa when private information is negative. However, the uninformed when they observe prices are not able to fully infer the value of the private information, because of the noisy supply. The introduction of an unobservable noisy supply resolves Grossman's paradox since prices are not fully revealing. Alternative justifications for additional noise in the system include random endowments (Hellwig, 1980), or noise trader (non-rational) market participants (Shleifer and Summers, 1990). When the uninformed observe a high price, they cannot be sure whether it is because the informed have observed a positive piece of private information and have high demands, or whether the supply was restricted due to the noise in the system. This creates incentives for the informed to pay for the information because the informed can then make better portfolio decisions with higher expected utility than the uninformed. Grossman and Stiglitz (GS) go on to show that there will be an equilibrium in the information acquisition market when there is free entry to being informed.

It is common to draw a parallel between the informed/uninformed distinction with active/passive fund managers. Active fund managers relate to informed investors who incur the costs associated with collecting and analysing fundamental corporate information, whereas passive fund managers are uninformed investors who free-ride on the information gathering activities of the active managers. Equilibrium in the information acquisition market defines the percentage of active to passive fund managers.

In the GS model, wealth levels obtained from both groups' optimal demands and equilibrium prices can be substituted back into their respective utility functions to obtain the ratio of indirect expected utilities of both groups $\gamma(\lambda)$, where this ratio depends on the percentage of informed active investors in the market λ. They show that $\gamma(\lambda)$ is a strictly monotonically

decreasing function of λ, and there is a stable equilibrium where the expected utilities of both passive and active investors are equal.

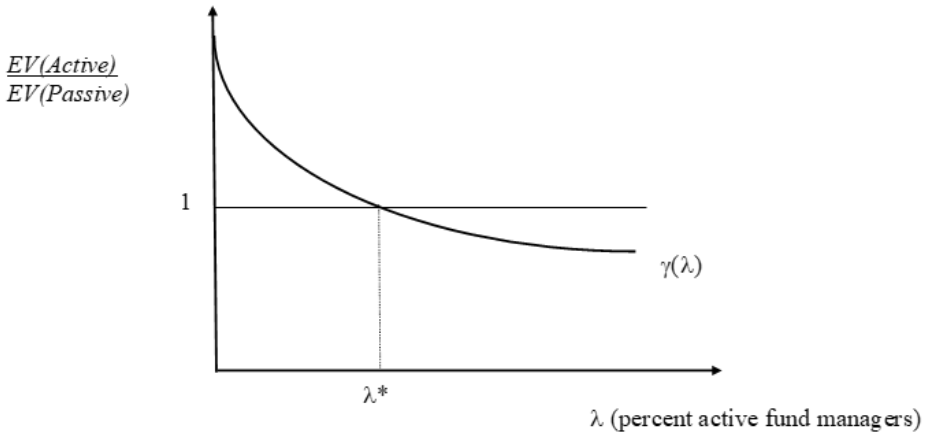

Figure 5: Equilibrium active/passive mix

This is a stable equilibrium, as illustrated in Figure 5. If there is only a small percentage of active investors in the market, prices will be uninformative and there is an advantage to adopting an active strategy. The expected utility of active investors is higher than that of passive investors, and there is an incentive for some passive investors to switch to being active and incur the costs of obtaining fundamental information about the risky asset, increasing λ. In doing so, prices become more informative, reducing the differential between the expected utilities of the informed and uninformed. When there is a large percentage of active investors in the market, prices are very informative and passive investors have higher expected utility than active investors who have incurred the cost of obtaining private information. It is not worth active investors paying for the costs of information (higher fees associated with active funds), and they will switch to a low-cost passive strategy. The GS model is silent about whether the switch between active and passive funds occurs with changes in the relative sizes of existing active/passive funds, or whether the mechanism works through the establishment of new funds. In Berk and Green (2004) fund flows dampen previous abnormal returns as existing funds grow in size and trigger diseconomies of scale. This is likely to reduce the effectiveness of the process for equilibrium in the informational acquisition market because according to Berk and Green

(2004) skilled fund managers appropriate all the rents from their abilities, and competition between outside investors means they can only expect to earn a normal return from their active investments. The GS model has implications for the institutional arrangements that evolve to protect acquired information. Admati and Pfleiderer (1990) demonstrate that if there is too much leakage of information through prices, it is optimal for an informed trader to sell this information indirectly by establishing a portfolio and selling shares in the portfolio to investors. This provides a rationale for the establishment of investment funds distinct from the more standard low cost diversification arguments.

Equilibrium in the information acquisition market (or the choice between being an active or passive fund manager) occurs when the expected utilities of both groups are the same:

$$\frac{EV(Active))}{EV(Passive)} = \gamma(\lambda^*) = 1 \tag{1}$$

and in Figure 5, this equilibrium percentage of informed investors is identified as λ^*.

The informativeness of prices is measured by the correlation coefficient between the equilibrium price and the information about the asset, which depends on the percentages of active/passive fund managers. Similarly, the quality of information is measured by the correlation coefficient between the private information component and random returns of the risky asset, which depends on their respective volatilities.

The predictions of the GS model can potentially explain the growth of passive investment strategies. For example, the observed increase in the share of passive strategies could be due to the widening gap between the costs of active and passive fund management, an increase in the quality of information, or changes in the degree of risk aversion of investors, as financial markets become more sophisticated.[10] Pástor and Stambaugh (2012) suggest that one explanation for the substantial size of the active management sector even after poor performance is due to investors not knowing the extent of decreasing returns to scale in the growing wealth management industry. Investors learn about these scale diseconomies from past performance, and will continue to invest in active vehicles because they believe that expected excess returns from active management continue to be positive going forward. Stambaugh (2014) outlines a

[10]Indeed, Turner et al. (2009) proposed that market participants had become overconfident that sophisticated risk management techniques increased the capacity to bear risks, and potentially contributed to the 2008 Global Financial Crisis.

model in which a decline in noise trading results in there being less profitable trading opportunities for active managers, and explains the growth in passive investments. Other extensions of the GS model in the context of active/passive investment strategies are due to Gârleanu and Pedersen (2018), Gârleanu and Pedersen (2022), Jiang et al. (2020), Baruch and Zhang (2022), Coles et al. (2022).

5.2 Effects of passive funds on market volatility, price discovery, market efficiencies

As we have already noted, mapping active funds to the "informed traders" and passive funds to "uninformed traders" in the GS model one can use their comparative statics to analyse the relation between the share of passive funds and stock market informational efficiency. Grossman and Stiglitz (1980) compute a number of comparative static properties of their equilibrium in their Theorem 4, where they show that the price system becomes more informative as: a) the quality of information increases; b) the cost of collecting information decreases; c) the risk-aversion parameter in the utility functions of the traders decreases. They also demonstrate the "remarkable result" that changes to other parameters in the system do not affect price informativeness due to the endogeneity of the percentage of informed traders. For example, an increase in the noisiness of the random supply reduces price informativeness, but at the same time increases the returns to collecting information and this increases the percentage of informed investors. These two effects are exactly offsetting in the GS model (which is unlikely to be a general result) and illustrate the offsetting effects of some parameter changes due to the endogeneity of the active-passive strategies. They also show that the equilibrium percentage of informed traders will increase as a) the volatility of the noisy supply increases, b) the volatility of the risky asset's returns increases (for a fixed quality of information); c) the cost of information decreases; and d) the quality of information falls.

With regards to market efficiency, it turns out that, depending on the sources of variation in the share of passive funds, price informativeness either decreases or remains unchanged with the share of passive funds in the model. For example, if the cost of information increases, there will be more passive funds and at the same time price informativeness deteriorates. However, while the GS model can generate such associations, it does not help us establish causal links between

the extent of passive investment and price informativeness as both of these are endogenous to model parameters. This is important to keep in mind, as even if some of the empirical literature documents significant associations between passive funds and measures of market efficiencies, both of these could be responding to changes in the underlying structure of the economy.

In addition to any endogeneity concerns, one also has to disentangle the rise of passive investing from other significant trends. Notably, this rise has occurred in parallel with the spread of ETFs, that allow for intra-day trading of fund shares[11], which in itself can contribute to volatility (Ben-David et al., 2018). Further, although not the topic of this survey, the rise of high-frequency and algorithmic trading has largely replaced human market makers (Brogaard et al., 2014), and improvements in data processing combined with financial technology have raised concerns about investors' incentives to produce information about fundamentals (Farboodi and Veldkamp, 2020). These trends have coincided with the rise of passive investing.

That said, most of the theoretical literature has taken the view that the increase in passive investing, while beneficial in many respects such as widening participation, is likely to come at the cost of some inefficiencies. Bond and García (2021) show that as the cost of index tracking decreases, investor welfare increases due to greater participation, while the price efficiency of the index deteriorates, although market efficiency is raised for individual stocks. In a conditional CAPM framework, Baruch and Zhang (2022) demonstrate that as investors opt out of the price discovery process by index investing, prices become more volatile and the comovement between stock prices increases. Jiang et al. (2020) show that the prices and return volatilities of the largest stocks will increase after a shift to passive investing in a model of symmetric information (allowing them to abstract from information frictions). In particular, their result follows from the trade-off of the remaining active investors, who find it too risky to engage in the correction of possibly overvalued large-cap stocks, as the idiosyncratic return volatilities of these stocks increase due to the dominance of passive investors.

The calibration exercise in Jiang et al. (2020) attempts to quantify the relation between passive investing and volatility. They reveal that a large shift to passive investing (that is, moving from 10% - 90% split in passive-active investing to a 60% - 40% split in passive-active investing) increases the volatilities of mid- and large market capitalization stocks by between 0 - 6% (e.g., from an annual volatility of 11.13 to 11.84). The impact is larger when the shift to

[11]Trades in traditional mutual fund shares are only settled once a day at the close price.

passive investing is driven by new passive investors entering the market and also when passive funds exclude small capitalization stocks from their portfolios.

The logic of Grossman and Stiglitz (1980) dictates that as some investors switch from informed trading to uninformed trading, prices should reveal less information unless others step in or become more aggressive with their informed trades. Haddad et al. (2025) attempts to directly test this using US data by building on the demand system approach of Koijen and Yogo (2019). This structural method utilises the holdings data of institutional investors. They find that as investors switch from active to passive strategies, the remaining investors will become more aggressive, but not to the extent to fully restore market efficiency. In turn, they argue that the rise of passive investing has led to larger price impact and volatility and has lowered price informativeness. In a competing paper, Koijen et al. (2024) use a similar modelling approach but arrive at the conclusion that the large shift to passive investing did not influence price informativeness as, on average, capital did not flow to less-informed investors.

Exploiting index additions and deletions, Coles et al. (2022) find no impact of passive investing on price informativeness. They first extend the GS model of so investors have to make two choices: first, they have to decide whether to be passive or active; and if they have chosen to be active, they must decide whether or not to acquire (and trade on) costly private information. From this extension, they predict that price informativeness should only depend on the cost of acquiring private information, though volatility is increasing in the share of passive investors. Empirically, they provide evidence suggesting that turnover, volatility and correlation with the index is increasing in passive investing, while measures of price informativeness are not associated with the extent of index investing.

If moving to passive investing has been the most important trend in financial markets, we should be able to detect its implications on aggregate measures associated with investor activeness and price informativeness based on stock trading and firm fundamentals data. However, Easley et al. (2021) point out that a simple measure of investor activeness based on the cross-sectional standard deviation of stock turnover is largely flat between 2000 and 2017. Similarly, aggregate measures of price informativeness show no sign of a trend during this period (see their Fig. 13.).

A potentially fruitful approach taken by some articles is to generate and test cross-sectional

predictions, i.e., passive investing may have heterogeneous effects on stocks with different characteristics. For instance, Jiang et al. (2020) predict that passive investing should increase the valuations and return volatilities of stocks with the largest market capitalization and also provide empirical support for this prediction. However, it is not immediately clear how these findings can be reconciled with those in Bai et al. (2016), who document that the price informativeness of S&P500 firms has increased since the 1960s, while for the rest of the stocks it has decreased and they attribute these findings to the large shift in institutional ownership. Kacperczyk et al. (2024) develop a theoretical framework in which the share of passive investors is a parameter (exogenous), and show numerical results suggesting that the price informativeness of medium market capitalization stocks are the most sensitive to the share of passive investing, while those of large caps and small caps are insensitive.

Overall, our understanding of the research suggests that passive investing increases the volatility of returns, though this is not equivalent to saying that volatilities have been rising over time. On the other hand, the literature has not settled on the question of passive investing's impact of price efficiency with many influential articles arguing for no impact at all.

5.3 Effects on stock prices of stock joining an index

The price impact of a stock joining an index is a complex issue with a rich history of research and debate. Pioneering work from Harris and Gurel (1986) and Shleifer (1986) find a significant price increase after a stock is added to the S&P 500 Index. Shleifer (1986) finds an abnormal return of 2.79% on the day of the announcement; Harris and Gurel (1986) reports an abnormal price increase of 3.13%. However, they disagree about the persistence of this price impact. While Shleifer (1986) find that the effect does not disappear for at least ten days after the inclusion, Harris and Gurel (1986) report a reversal of price returns to their pre-inclusion level within two to three weeks after the announcement.

Both Shleifer (1986) and Harris and Gurel (1986) explain their findings by the role of passive funds tracking the index, and both relate this role to the slope of the demand curve. However, they differ in their interpretation. According to Shleifer (1986) the stock demand curve is downward sloping. When a stock is added to an index, passive funds tracking the index will massively buy this stock, creating a demand shock. In the absence of new information (which

many argue is the case for index inclusion), this demand shock is exogenous. If the demand curve is flat (i.e., stocks have perfect substitutes so that arbitrage keeps the demand flat), this shock will be fully absorbed without price change. However, if the demand slopes downward (i.e., stocks do not have perfect substitutes), the price response is large (Beneish and Whaley, 1996; Chen et al., 2004; Wurgler and Zhuravskaya, 2002). A large price response is, therefore, indicative of a downward-sloping demand curve.

The temporary price effect found by Harris and Gurel (1986) can also be explained by the fact that the demand curve slopes downward. However, they argue that the demand curve only slopes downward in the short term. Their explanation is related to the price pressure hypothesis, where stock prices are momentarily affected by the demand shock due to passive funds. This price increase incentivises arbitrageurs to sell stocks and satisfy the excess demand. Once the excess demand is satisfied, prices return to their pre-inclusion level (Beneish and Whaley, 1996; Chen et al., 2004; Kaul et al., 2000; Petajisto, 2011).

Following this pioneering work, two questions became the focus of the literature on the price impact of index addition: (1) is the price impact temporary or permanent, and (2) what is the role of passive investing in this impact.

Regarding the first question, several papers find a permanent price increase for stocks added to the S&P 500 Index (Beneish and Whaley, 1996; Chen et al., 2004, 2006; Dhillon and Johnson, 1991; Lynch and Mendenhall, 1997; Wurgler and Zhuravskaya, 2002), although the time windows studied are rather short (60 days for Beneish and Whaley (1996), Chen et al. (2004), Chen et al. (2006) and **?**, two trading weeks for Lynch and Mendenhall (1997), and 10 days for Wurgler and Zhuravskaya (2002)). Namely, Beneish and Whaley (1996) reports that the inclusion in the S&P 500 Index seems to imply a permanent stock price increase of about five percent. For the sample period spanning from 1976 to 1989, Chen et al. (2004) document that the average announcement day abnormal return is a significantly positive 3.2%; this is larger for the sample period from 1989 to 2000, after that S&P introduced a delay between the announcement day and the execution date. In the latter period, they find that the price increases on average by 5% on the announcement day; they also observe that the cumulative abnormal return continues to increase (to 8.9%) between the announcement day and the execution date. Interestingly, they do not find a decrease in the price of stocks excluded from

the index. Examining a revision of the methodology to calculate the weights of stocks in the Toronto Stock Exchange 300 Index, Kaul et al. (2000) find statistically and economically significant excess returns of 2.34 percent for the 31 stocks in the week the revised weights became effective. Looking at the price impact until six weeks after the revision, they conclude that this is a permanent effect.

However, the question of whether a price impact is temporary or permanent is difficult to answer due to technical challenges. As explained in Wurgler and Zhuravskaya (2002) and Patel and Welch (2017), measuring long-run abnormal returns requires properly adjusting for risk, but there is not one generally accepted way to do so. Moreover, a long time window is potentially polluted by fundamental news. Using peer-adjustment techniques, Patel and Welch (2017) find a price effect on the announcement day for the stocks added to the S&P 500 index between 1979 and 2015 (3.2% in the 1980s, 4.3% in the 1990s, and 3.1% in the 2000s). However, this effect is temporary. More specifically, they find strong evidence for reversion from the 2000s and a near-complete reversal of the price impact three months after the index inclusion. Petajisto (2011) also finds that half of the initial price impact is reversed over the two months following index inclusions over the period 1990-2005, and notes that the lack of statistical power prevents him from analysing the impact over a longer time period.

Several papers analysing other indices find a temporary price impact. Madhavan (2003) analyses the effects of the annual reconstitution of the Russell 3000 and Russell 2000 indices between 1996 and 2002 and finds that a significant portion of the price impact is temporary. For instance, the permanent effect of the addition to the Russel 2000 is only 1.41%. A temporary price effect lasting no more than a month is also reported by Biktimirov et al. (2004) and Chen et al. (2006) who analyse the Russell 2000 index over the periods 1991-2000 and 1990-2002, respectively. Moreover, Petajisto (2011) (already mentioned above as he also studies the S&P 500 index) investigates a similar sample period (1990-2005) and finds that half of the price impact is reversed after two months. On the contrary, Chang et al. (2015) do not find any reversal of the temporary price impact until at least four months following inclusion in the Russell 2000 index in the 1996-2012 period. Analysing Russell indices offers several advantages over the S&P 500 index: Russell index additions and deletions are generally known in advance as they are fully determined based on a ranking of US companies according to their market

values, they take place on the same date each year, and more companies are replaced each year yielding a bigger sampler size. These advantages allow for the study of a much larger sample size while ensuring that additions and deletions do not carry any information content (which, on their own, could explain the price impact).

A few studies have investigated additions to the FTSE 100 index, which shares the same advantages as the Russell indices (inclusions and deletions are determined by a ranking by market capitalisation, and happen at regular intervals). Mase (2007) finds a temporary price impact. They show that the effect is mostly anticipatory with a CAR of 3.6% for added stocks before the announcement date; the effect quickly disappears after the announcement. Fernandes and Mergulhão (2016) report a very large CAR of 13.4% over the 45 days that precede additions to FTSE 100, which decreases to 7.94% when anticipatory trading is accounted for. They do not find any reversal of this impact over the 22 trading days following the announcement (the announcement precedes the inclusion by one day). They also show that a simple trading strategy consisting of taking long positions in the two stocks most likely to join the index and short positions in the two stocks most likely to leave the index yields positive returns.

It is also worth mentioning that Duffy et al. (2024) performed a laboratory experiment to investigate the price impact of index inclusion, and find a significant and positive impact, although they do not elaborate on whether this impact is temporary or permanent. With their experiment, they are able to confirm that the price impact is due to a downward-sloping demand curve.

More recently, Bennett et al. (2020) find that joining the S&P 500 index has a different effect depending on the time period. From 1997 to 2007, they report a transitory price impact, which is in line with the literature mentioned above. However, during the more recent period going from 2008 until 2017, they do not find any transitory impact. Instead, they report that the price of stocks included into the index is negatively affected by the inclusion and that the long-term returns are therefore negative. Greenwood and Sammon (2024) come to a similar conclusion and find that the abnormal return associated with inclusion into the S&P 500 index has decreased from 7.4% in the 1990s to less than 1% (and even insignificantly different from zero) in the 2010s. They also observe a similar decline for other indices such as the Russell 1000 and 2000, the Nasdaq 100 and other S&P mid- and small-cap indices.

The second question addressed in the literature is to determine the change in stock ownership following an index inclusion. As index fund managers need to maintain a small tracking error, they rebalance their portfolio around index changes, leading to a change in ownership for the stocks being included in (or excluded from) an index (Chen et al., 2006). Several papers empirically confirm such increase in passive ownership for stocks added to the S&P 500 index (Bennett et al., 2020; Harris and Gurel, 1986; Shleifer, 1986) and the Russell indices (Biktimirov et al., 2004), who find that the percentage ownership by institutions rises by 4% after a stock is added to the Russell 2000. There is also evidence of fund rebalancing following the revised weighting methodology of the Toronto Stock Exchange 300 index (Kaul et al., 2000). Bennett et al. (2020) also find that while firms added to the index see an increase in passive ownership, they experience a decrease in active ownership which fully matches the increase in passive ownership. Finally, Chinco and Sammon (2024) find that passive investors (index funds, but also closet index funds and institutional investors having internally managed index portfolio) tracking the five popular indices (Russell 1000, Russell 2000, S&P 500, S&P MidCap 400, and Nasdaq 100) collectively owned 33.5% of the US market in 2021.

Arbitrageurs have a significant role to play. As said above, index funds need to minimise the tracking error, and will therefore rebalance their portfolios on the date of the change in index composition. However, there is typically a lag between the announcement of a stock inclusion and the effective inclusion. This leaves plenty of time for arbitrageurs to step in ahead of index funds, buy the soon-to-be-included stock on the day of the announcement and sell it to index funds on the date of the effective inclusion (Beneish and Whaley, 1996; Chen et al., 2006; Petajisto, 2011). While arbitrageurs make a profit, index funds bear a cost from buying at a higher price and selling at a lower one (once the stock is removed from the index). This is the "index turnover cost" which is quantified by Petajisto (2011) and is substantial: its lower bound is estimated between 21–28 bp annually for the S&P 500 and 38–77 bp for the Russell 2000.

Both Petajisto (2011) and Chen et al. (2004) acknowledge the existence of such index turnover cost and propose solutions to it. However, as they do not agree on the source of the cost, they also disagree on the solutions. Chen et al. (2004) argue that arbitrageurs, and their timing game, are responsible for the cost borne by index funds. They, therefore, recommend

reducing the length of the pre-announcement period and introducing uncertainty around index changes (although they acknowledge that the SEC does not allow for that). Petajisto (2011) reaches the opposite conclusion: he argues that index changes should be fully transparent, predictable, and announced well in advance of the effective date. According to him, the index turnover cost (and the associated price impact) is driven by index funds that simultaneously increase their demand for the included stocks, rather than by arbitrageurs. In fact, arbitrageurs help mitigate this spike in demand by anticipating it and buying stocks before they are officially added to the index. The longer the pre-announcement period and the more predictable the index changes, the more time (and certainty) arbitrageurs have to build their inventory of shares to sell to index funds on the effective date. To limit index turnover cost, Petajisto (2011) proposes that index funds adopt index-neutral strategies, where a portion of the portfolio is invested in index stocks and the remainder in non-index stocks. Alternatively, funds could track a broad market index, such as the Russell 3000 or the DJ Wilshire 5000, which represent close to 100% of the US equity market capitalisation. The changes in these indices therefore represent only a negligible fraction of the total index, minimising turnover cost.

As mentioned above, the most recent evidence point at a disappearing effect of index inclusion. Greenwood and Sammon (2024) identify two main reasons for this. First, in the 1980s and 1990s, index inclusion led to mispricing, and, as for many anomalies, the market recognised it and took advantage: institutions devoted resources to anticipate index inclusions, and to build inventory ahead of an effective index change in order to be able to sell the added stocks to index funds. Second, migrations from one index to the other are more and more frequent. For example, stocks tend to migrate from the S&P MidCap index to the S&P 500. When such migrations happen, the selling from index funds tracking the S&P MidCap is matched by the buying from index funds tracking the S&P 500, leading to a smaller net demand shock upon the inclusion of the stock in the S&P 500 index. Therefore, their evidence shows that arbitrageurs are not the only liquidity providers, which is also confirmed by Chang et al. (2015) when analysing the Russell 2000 index. Vijh and Wang (2022) also analyse migrations from the S&P 400 index to the S&P 500 index and find a negative excess return following the migration. Specifically, over the sample 2016-2020, "upward additions" (from S&P 400 to the S&P 500 index) resulted in an average announcement abnormal return of –2.48% over a 3-day period.

On the opposite, "downward deletions" to the S&P 400 index resulted in an abnormal return of +1.37%. This contrasts the results in the earlier literature and is explained by the increase in institutional ownership of S&P 400 stocks relative to the institutional ownership of S&P 500 stocks, which reduces the demand from institutional investors after such migrations.

5.4 Effects on correlations of stock prices in a given passive fund and consequent impacts on investors

One of the main concerns raised by academics about passive investment is that it increases the correlations between stock returns, potentially decreasing investors' ability to diversify their risk. A few authors have identified "basket trading", that is, the tendency of trading a basket of stocks together, for example, when an indexed portfolio needs to be rebalanced because of inflows or outflows, as a major source of co-movements of stock prices. For instance, exploiting a broad redefinition of the Nikkei 225 Index in April 2000, Greenwood and Sosner (2007) document that, after the redefinition, the beta of the added stocks over a basket of the other index stocks increased from 0.56 to 1.01. In contrast, the beta of deleted stocks over a basket of the index stocks went down from 1.47 to 0.85. Similar patterns are uncovered by Barberis et al. (2005) and Wurgler (2010) for stocks' additions to the S&P500 index. For instance, using a bivariate regression of the returns of the added stock on the returns of the S&P 500 stocks and of the non-S&P 500 stocks, Barberis et al. (2005) find that the beta of included stocks on the S&P 500 increases by 0.33 when using daily returns, 0.17 when using weekly returns, and 0.32 when using monthly returns. On the contrary, the beta on the non-S&P 500 decreases by 0.32 when daily returns are used, 0.12 when weekly returns are used, and 0.25 when monthly returns are used.

Greenwood (2007) exploits the fact that the Nikkei 225 is an equally weighted index to distinguish comovements due to a shock to common factors from "basket trading". When Nikkei 225 index investor demand rises, investors purchase significantly more of some index stocks than they would if they were using the value-weighted market index as the benchmark: these are defined as overweighted stocks. The existence of a positive relationship between the extent of a stock's overweighting and the comovement of its returns with index returns supports the theory that excess covariation in stock returns is the result of commonality in investors'

demand due to indexing.

Importantly, we should note that benchmarking of active funds also contributes to an increase in index stocks' correlations (see, e.g., Basak and Pavlova (2013), Buffa and Hodor (2023)). However, a few papers have established a more explicit link between passive investment and the increase in the comovements of index stocks. For example, Sullivan and Xiong (2012) document a positive association between the passive market share (calculated as the percentage of total passive assets relative to the total U.S. stock market capitalization) and the pairwise correlations of the returns of the stocks traded on the NYSE, Amex, or NASDAQ. They also find that stock betas have converged for all size and style categories over the period 1997 - 2010, a result that they attribute to the growth of passive investment. While their analysis is not casual in nature, the evidence uncovered is suggestive that the growth of the passive investment industry has been accompanied by increased trading commonality and correlation among stocks and reduced diversification opportunities for investors. Similar evidence is also reported by Grégoire (2020), who finds a positive relationship between the average correlations of S&P 500 stocks and the lag of a measure of index's passive ownership.

Among passive funds, ETFs play a special role. Demand shocks to ETFs are reflected in the underlying securities through the arbitrage channel. When a demand shock hits the ETFs, its price deviates from the price implied by the basket of stocks it tracks. Therefore, arbitrageurs attempt to exploit the mispricing by buying the underpriced securities and selling the overpriced ones. This arbitrage involves simultaneous trades in all the index constituents, which is likely to increase the pairwise correlations of their returns (see, for instance, Leippold et al. (2016) for a simple model). Although this mechanism falls within the basket trading discussed above, ETFs have the potential to amplify the consequences of basket trading on stocks because they attract high-frequency demand (see discussion in Section 3.2).

Empirical findings support the view that ETFs contribute to increasing the correlations of equity returns through the arbitrage channel. For instance, Leippold et al. (2016) document that innovations to the ratio of ETF dollar trading volume to aggregate S&P 500 stock dollar trading volume (a proxy for ETF demand shocks) explain a substantial proportion of the time variation of the correlations of S&P500 stocks. Similarly, Da and Shive (2018) analyse a panel of US equity ETFs for a period spanning from July 2006 to December 2013 and find that

a one-standard-deviation increase in the turnover of a typical ETF is associated with a 1% increase in the average correlation between the stocks that it tracks. Importantly, they show that these results are not driven by stocks' common exposures to fundamental shocks and are not exclusive of ETFs on large indices with futures and options traded. Instead, the results are more pronounced in the presence of simultaneous trading of the ETFs and the underlying stocks, which is interpreted as evidence that they are driven by arbitrage trading. Interestingly, Baltussen et al. (2019) advocate that a similar arbitrage mechanism between index products and the underlying stocks has changed the serial dependence of index returns from positive to negative. Namely, they document a negative relationship between indexing and index serial dependence, which cannot be explained by a common time trend. Index serial dependence tracks index product serial dependence very closely, suggesting that arbitrage is at play.

The view that passive investing increases correlations is also well supported by theoretical models. For example, in Buss and Sundaresan (2023)' noisy rational expectations equilibrium, endogenous correlation among the returns of stocks comprising an index arises even when stocks' fundamental and noise shocks are independent. This is because a change in the price of any index stock affects the demand of all the other index members. Interestingly, in Chabakauri and Rytchkov (2021)'s dynamic exchange economy with heterogeneous investors, two distinct mechanisms affect stocks' volatilities and correlations when indexing is introduced. First, index investors trade all the stocks in the market portfolio simultaneously, increasing their correlations (the lockstep effect already identified and discussed above). However, a second effect arises because risk-sharing across investors is less in the indexing economy, which decreases stock correlation. Therefore, the final effect on correlation of stock returns is ambiguous and depends on which one of the two forces prevails. Therefore, this paper suggests that, to portray a more complete picture of how passive investment affects stock returns and their correlation, the ongoing debates on indexing should consider not only the effects of basket trading of stocks (as most of the literature discussed above has done) but also the general equilibrium effect of reduced risk sharing.

5.5 Effects on the market of lower fees and churn rates

The Investment Company Yearbook 2024 reports that expense ratios for US equity mutual funds across all objectives have fallen substantially from an asset-weighted average of 0.99% of AUMs in the year 2000 to 0.42% in 2023. During the same period, the expense ratios of active equity funds have fallen from 1.06% to 0.65%, and the expense ratios of index equity funds have fallen even more dramatically from 0.27% to 0.05%. This decline in average costs is attributed to economies of scale and competition in the fund management industry.

French (2008) documents the steady decline in fees and expenses for mutual funds which fell from 2.08% of assets under management in 1980 to 0.95% in 2006. He estimates investment management costs for institutions as being lower: falling from 0.34% in 1980 to 0.23% in 2006. He attributes this fall in costs to the reduction in load fees for mutuals, and the secular trend to a greater percentage of assets managed under cheaper passive strategies. He estimates the relative costs of active and passive investing in US equities and over the period 1980-2006 and argues that the average difference is 0.67%. That is, a small individual investor who switched their portfolio from an active fund to a passive fund would expect to earn an additional 0.67% return.

Khorana et al. (2009) compare mutual fund fees across countries. They study the fees charged by 46,580 mutual fund classes across 18 countries in 2002. (They focus on mutual fund classes since individual mutual funds may consist of different fund classes with a different fee structures). They concentrate on three types of fees: annual management fees; total annual expense ratios (TERs) (including management fees plus administration, servicing, transfer agency, audit, and legal fees); and total shareholder costs (TSCs) which includes the expense ratio plus annualized loads (on the assumption of a 5-year holding period). They find substantial variation across countries and asset classes. They report the unconditional mean management fee across funds in all countries and asset classes is 0.74 percent (74 basis point); mean TER is 1.05 percent; and mean TSC is 1.49 percent. In the UK equity funds domiciled in the UK have mean management fees of 1.07 percent, mean TER of 1.18 percent and mean TSC of 2.28 percent. In subsequent regression analysis controlling for such variables as asset class, fund size, family size, age, and an index fund dummy, they report that index funds are consistently cheaper for all types of funds, charging management fees that are 36 basis points below those of actively

managed funds. The difference is 69 basis points for TERs and 86 basis points for TSCs. They go on to investigate differences in fund management fees across countries assessing whether it is regulation and the legal system, competitiveness of the sector, buyer characteristics and national economies of scale that might explain these differences.

Ferreira et al. (2013) examine the performance of 118,233 active domestic equity mutual funds across 27 countries over the period 2000-2007 reporting underperformance of 0.2%. When they exclude the US, the sample falls to 59,276 mutuals with average underperformance of 0.1%. They explicitly exclude passive funds from their sample, but do report on the expense ratio and load fees as a fraction of total net assets. They report that for active mutual funds the average expense ratio (load fees) across countries is 1.46% (2.65%), and excluding the US rises to 1.62% (2.85%), illustrating that countries outside of the US have higher fees possibly demonstrating the effects of scale economies. They report average expense ratios for the UK as 1.46% and the load fee is a hefty 4.21%.

Madhavan et al. (2007) provide a detailed breakdown of fund management costs and fees charged for US equity transactions in 2005. They emphasise the "Plexus Iceberg" which distinguishes between visible explicit costs such as management fees (above the waterline) and trading costs which are implicit (hidden below the surface). The actual value of these hidden trading costs will depend on the investment style of the fund manager, and in particular portfolio turnover rates. Madhavan et al. (2007) estimates that the ratio of hidden costs to visible costs may be 82:18 percentage points. Other US-based studies have produced smaller estimates of this visible/hidden costs ratio. Edelen et al. (2013) report aggregate trading costs of 1.44% of assets under management compared with an expense ratio of 1.19% (a ratio of 55:45) Bogle (2014) estimates aggregate trading costs of 1.15% of assets under management for US equity mutual funds compared with an expense ratio of 1.12%: a ratio of 51:49. In all three cases, the hidden costs are higher than the visible costs. The decline in turnover rates for both active and passive mutual funds reported in Figure 6 may have reduced the size of the Plexus iceberg.

UK regulators have monitored costs associated with asset management. The Pensions Regulator imposed a pension charge cap of 0.75 percent on auto-enrolled default defined contribution pension schemes after 2015. Since the FCA's asset market study (FCA, 2017), the UK's financial markets regulator has published annual reports on the investment management industry.[12]

[12]https://www.fca.org.uk/data/investment-management-data-annual-report-2020-21

In the most recent version, AUM-weighted average ongoing fees for UK-domiciled passive funds are reported to have declined from 0.29% of AUM per year in 2015 to 0.15% in 2020. This can be compared with AUM-weighted average ongoing fees for UK-domiciled active funds which have also fallen over time to 0.89% in 2020. In relation to the performance of these passive funds, in the 12 months to April 2021, 95.3% of these funds tracked their benchmarks to within 75 basis points.

The received wisdom is that passive investments have lower turnover rates than active strategies, because a passive investment is similar to a long-term buy-and-hold strategy, whereas active investments involve the buying and selling of stocks based around over- and under-valuations, which are likely to be time-varying. However, the mechanics of tracking an index involve rebalancing as stocks enter and leave an index, and some active funds such as value-orientated funds base their investments around under-valuation, but hold these investments for the long-term with low turnover. The reconstitution of widely followed indexes can cause both temporary price distortions and lasting effects due to changes in liquidity. Madhavan (2003) analyzes the Russell index reconstitution and finds that stocks projected for addition (deletion) experience positive (negative) abnormal returns around the reconstitution date. While some of these effects are short-lived price pressures, others persist due to liquidity changes. As a result, investment managers rebalancing their portfolios near index revision dates face significant trading costs, particularly for funds tracking popular benchmarks, which experience concentrated trading around these changes. These effects seem to have disappeared in most recent years (Greenwood and Sammon, 2024).

Figure 6 shows a comparison between turnover rates in active and passive funds. It can be seen that the turnover rates for both types of funds have fallen over time and by the end of the sample passive funds had a turnover rate approximately 60% lower than active funds' turnover rates.[13] But the difference in turnover rates is small, and could be taken as an indicator that many active funds are closet-trackers. Pástor et al. (2020) investigate the extent of diseconomies of scale in active management and introduces the concept of "portfolio liquidity," which considers both the liquidity of individual holdings and the diversification of the portfolio, and is related to portfolio turnover. They suggest that active fund managers need to

[13]Source: Morningstar, figure reports the weighted average turnover rates across index and non-index funds for the same 1,858 US-equity funds reported in Figure 3, weighted by AUMs.

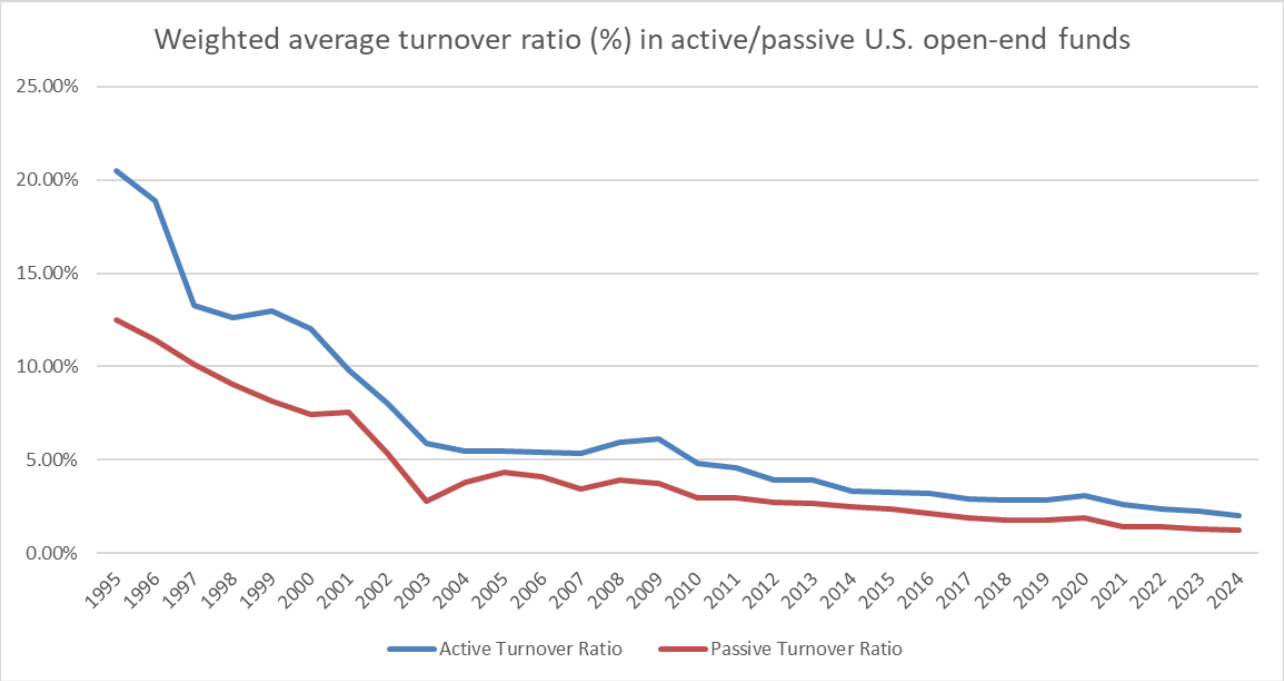

Figure 6: Turnover rates of active-passive funds

ensure their fund is more liquid to offset higher trading costs from diseconomies of scale. They find fund size, lower expense ratios, and higher turnover rates are associated with more-liquid portfolios. Indeed, they suggest their liquidity measure is another way of identifying whether a fund is active or passive, similar to the Active-Share measure of Cremers and Petajisto (2009).

6 Impact of passive investments on asset allocations of investors

Index funds have to invest in all companies that belong to the index they are tracking in proportion to each company's market capitalization share of that index. As funds flow to passive investment vehicles, flow-induced pressure has consequences on the asset being tracked, for instance, on the informativeness of their prices (as we have discussed in Section 6). There are also implications for the real economy, especially on firms' investment decisions. We discuss these implications in subsection 6.1. Yet, passive investment is supposed to have a positive effect on retail investors by increasing their participation in financial markets and offering low-cost diversification. In subsection , we analyse the consequences of indexing on investors' overall welfare.

6.1 Impact on capital allocation

Researchers have investigated the consequences for companies that belong (or do not belong) to the most tracked indexes. Most of this research has focused on the informational efficiency of the securities being tracked, an issue that we have discussed in Section 6. However, an equally important question concerns the allocational role of asset prices. In other words, the question is whether predominantly passive capital markets can allocate capital efficiently. In August 2016, Bernstein's investment strategist Fraser-Jenkins issued a report titled "The Silent Road to Serfdom: Why Passive Investing Is Worse Than Marxism," where he defended the "social" role of active funds and claimed that a capitalist system with indexed investing may be less desirable than a fully planned economy. [14]

This view is supported by the findings of Brogaard et al. (2018). They examine the impact of index investing on real economic outcomes, such as firm investment and profitability, by studying the link between commodity indices and firms that use the commodities tracked by those indexes in their production processes. A difference-in-differences comparison between the outcomes of firms that use indexed commodities in their business with those of firms that use non-indexed commodities reveals that the former experience a 6% increase in costs and a 40% decrease in operating profits relative to the latter. The evidence presented in their paper suggests that this difference in outcomes is due to a *feedback channel*: firms rely on commodity futures prices to make investment decisions; after the inclusion of a commodity in an index, its price becomes less informative, and firms make suboptimal decisions.

Recently, Jiang et al. (2020) argued that flows into passive funds disproportionately increase the stock prices of the largest firms in the economy, especially those overvalued by the market, thus lowering their financing costs and promoting the rise of mega-firms. This has a distortive effect on capital allocation as large, overvalued firms experience the steepest decline in their financing costs, although they may not be the ones with the best investment projects. Their model, which assumes that passive (non-informed) investors track a capitalization-weighted index (which can include all firms or a subset of them), makes two crucial predictions: passive flows raise the prices of large firms' stocks and their idiosyncratic volatilities. Furthermore, the increase in idiosyncratic risk discourages investors from correcting the flows' effects on prices.

[14] https://www.cnbc.com/2016/08/24/passive-investing-is-worse-than-marxism-bernstein-strategist-claims.html.

While the theoretical predictions hold even in the absence of noise traders, the key intuition is best understood in their presence. Assume that the stock of a large firm is in high demand by noise traders. In equilibrium, active, informed traders will take a short position in the stock. If some investors switch from active to passive, this generates additional demand for the stock because passive investors hold it proportionally to its weight in the market index, which is large. Active investors accommodate this further demand by scaling up their short position; however, they demand compensation for the non-negligible idiosyncratic risk they are taking on, which makes the stock price increase even more. Also, as the stock price increases, the absolute value of its idiosyncratic price movements becomes larger, initiating an amplification loop. Their arguments are empirically supported by the evidence that the largest firms in the S&P500 index experience the highest returns and increases in volatility following passive flows into passive funds or ETFs that track the index.

However, other academic papers have found support for a more benign and somewhat opposite view of indexing and its effect on capital allocation. For example, Antoniou et al. (2023) explored the link between real investment and ETF ownership and found that higher ETF ownership is associated with a greater sensitivity of real investment to Tobin's q. In other words, stocks with the largest proportion of passive ETF investors rely more on their stock price to make investment decisions. These findings, which challenge the arguments in Brogaard et al. (2018), are rationalized by the following model. ETF ownership promotes the collection of information on the common components of the firms' value. However, due to the competition effect (Subrahmanyam (1991)), when the number of traders informed about one component of the cash flow increases, the profit from trading on another component also increases for a given number of informed traders with signals about the other component. Therefore, when ETF ownership increases, prices become more informative; in turn, firm managers learn from the market price about fundamentals, so real investment is more sensitive to prices when ETF ownership is higher.

A positive relationship between real investments and indexing is also found in Buss and Sundaresan (2023). Central to their model is the fact that passive investors' demand for a firm is more inelastic than that of active investors. Therefore, firms with the largest share of passive investors invest more aggressively in growth opportunities (as they face a smaller "variance

discount" and, therefore, a lower cost of pursuing risky investments). Notably, their model postulates that index firms have higher stock prices than non-index firms as they benefit from the opportunities' positive (average) return. In addition, higher cash flow variance translates into a higher return variance for index stocks. Notably, whereas this paper offers opposite conclusions to Jiang et al. (2020) for what concerns the price informativeness of index stocks, the two latter predictions are compatible with the empirical findings concerning large stocks belonging to the S&P 500 reported in Jiang et al. (2020) and described above. It is also worthwhile noting that the practice of "benchmarking" (that is, evaluating asset managers' skills relative to a benchmark), which also applies to active funds, can generate effects on firms' investment decisions that are similar to those described above. Kashyap et al. (2021) call this the "benchmark inclusion subsidy".

6.2 Impact on the welfare of the investors

Index investment is a conventional recommendation that financial economists give to retail investors. For instance, in his 2013 letter to Berkshire Hathaway shareholders, Warren Buffet argued that "the goal of the non-professional should not be to pick winners [...] but should rather be to own a cross-section of businesses that in aggregate are bound to do well. A low-cost S&P 500 index fund will achieve this goal." Therefore, it seems natural to examine the effects of the growth of passive investments on the welfare of investors. Bond and García (2021) show that the availability of cheap index investments increases the market participation of uninformed investors, which in turn increases the welfare of all investors despite the decrease in index price efficiency. This is because investors benefit from trading in a market in which the average investor is relatively uninformed, which stems from Hirshleifer's effect that risk sharing is hampered by agents having accurate information at the time of trading. In other words, in Bond and García (2021)'s model, price efficiency decreases the amount of risk-sharing that the market enables.

As noted Chabakauri and Rytchkov (2021), the increasing availability of cheap passive investment vehicles has two effects: first, some investors will switch from active to passive investment, to minimize transaction and asset management costs; second, some households who previously did not participate to the market will participate. Chabakauri and Rytchkov

(2021) analyse these two mechanisms separately. Investors who switch from active to passive investment face two effects: the inability to arbitrarily change their portfolio's weights reduces their welfare; however, indexing by others changes investment opportunities increasing welfare. Chabakauri and Rytchkov (2021) find that the overall effect is a decrease in welfare, albeit this is very small; they estimate that an investor from the unconstrained economy would give up less than 0.004% of his wealth for not becoming a passive investor in the economy with indexing. However, the welfare effect on households who did not previously participate in the market is unequivocally positive and large, being equivalent to increasing cash flows in the economy without indexing by tens of percentage points. Therefore, the balance seems to be positive: passive investment makes previously excluded investors better off by facilitating risk sharing; in contrast, investors who switch from active to passive suffer a negligible welfare loss. While we often think about passive investing as passively tracking a broad index such as the FTSE Russell or the S&P 500, there exist quite a few specialised products (either funds or ETFs) that track thematic indexes (for instance, smart-beta or ESG indices). The size of this market is non-negligible: for instance, Ben-David et al. (2023b) document that in 2019 the asset under management of thematic ETFs was $460 billion. Given the importance of this sector, it is natural to wonder what the effects of these products are on the welfare of the investors.

Ben-David et al. (2023b) found that the performance of specialised ETFs is often disappointing. For instance, they show that the average performance of specialised ETFs launched between 2000 and 2019 was -6% in the first five years after inception. They argue that these products cater to investor sentiment by tracking popular trends in the market. Specifically, they specialise in sectors that experienced recent price run-ups, had recent media exposure (especially positive exposure, such as in the case of ESG stocks), and more positive earnings surprises. They conclude that, while broad-based ETFs are mostly held for risk-sharing purposes, specialised ETFs leverage on investors' extrapolation beliefs and they buy overvalued stocks that later underperform.

6.3 Asset Allocation of UK Pension schemes

In this section, we examine the asset allocation of UK pension schemes, and assess the effect of the tendency for DC pension schemes to investment in passive strategies. A current policy

debate is whether pension schemes underinvest in UK productive assets (Bailey et al., 2021; DWP, 2024), and whether this is exacerbated by the growth in DC pension schemes. Figure 7 starts by outlining the components of the pensions landscape in the UK using a diagram from the InvestmentAssociation (2024) page 59, which estimates that the total value of pension scheme assets in 2023 was £3.8 trillion. Wells (2024) estimates a lower value for UK pension assets of £3 trillion, with the difference mainly due to estimates of the size of DC schemes.[15]

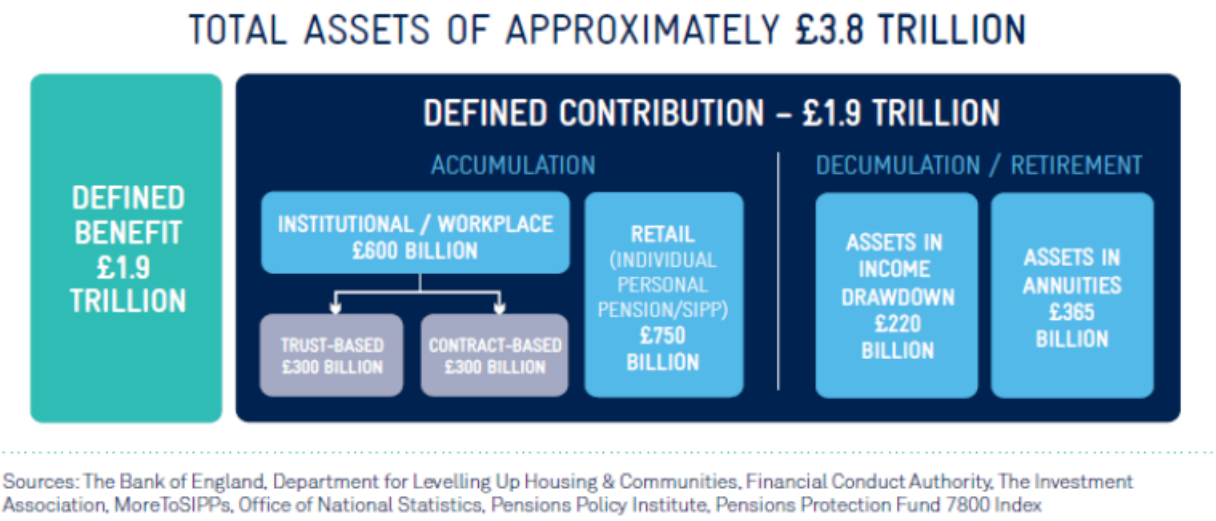

Figure 7: Overview of the UK's Pension Landscape 2023 (Investment Association, 2024)

Figure 7 shows that the defined benefit and defined contribution components are approximately of equal size at just under £2 trillion each, although over time the DC section is growing and the DB section is shrinking. Both funded DB and DC schemes will invest in a range of different asset classes. The DB section are all employer-sponsored occupational pension schemes, but the DC section includes both occupational pensions (valued at £600 billion) and individual personal pensions (valued at £750 billion). Assets in occupational DC pensions are likely to continue to grow due to the effects of auto-enrolment and the switch from DB to DC schemes. The DC section also includes assets held by insurance companies to fund the decumulation phase of DC pension schemes, which are typically invested in government and corporate bonds.

Using further data from the Investment Association annual reports, Figure 8 shows the split between active and passive mandates for institutional investors, and this can be seen as

[15]Following conversations with Jackie Wells, these differences are due to a range of data issues. Both reports access different data sources, and the underlying data may differ depending on whether the source is from population-based national accounts, or from survey-based samples. Different databases may be collected at different times, and not all definitions are unambiguous leading to possible double counting errors.

a subset of the data in Figure 1 which included both retail and institutional sections of the investment management industry. Figure 8 reports the increase in the value of assets managed by institutional investors (mainly pension funds) over time, with a value of £3.9 billion in 2023. Passive strategies have averaged 27% of the total institutional AUM over the last 16 years with no discernible trend. The figure also breaks down the allocation of these assets into two investment vehicles: pooled and segmented mandates.

According to The Pension Regulator in 2023 there were 31,270 trusted-based occupational pension schemes in the UK, with around 5,000 defined benefit or hybrid, and 25,190 defined contribution schemes. Many of these are micro-schemes with around 50 master-trusts responsible for around 81 percent of total DC AUMs.[16] The majority of small schemes are run as insured fund management or as pooled investment schemes. The trustees of the remaining relatively large pension funds typically delegate the management of the pension fund portfolio to fund managers and the trustees will choose whether to instruct these fund managers to operate pooled or segmented vehicles. These fund managers may be in-house, employed directly by the pension fund, or the trustees may out-source the management of the fund to an external fund management house. In a pooled vehicle, the fund manager simply purchases units of a co-mingled diversified investment from a financial institution such as an insurance company, and this is likely to follow a passive investment strategy. In a segregated vehicle the underlying assets are directly owned by the pension scheme, and the trustees hire a fund manager (in-house or out-sourced) to make the investment decisions on behalf of the fund according to some specified mandate and specific return expectation. The contract is usually on the basis of a rolling three to five year evaluation cycle with the fund manager reporting back to the trustees on a regular basis, (Myners, 2001) [paragraph. 5.64]. There is likely to be a correlation between the ratio of passive:active strategies and pooled:segmented vehicles, because when pension fund trustees hire fund managers under a segmented mandate they directly own the underlying securities; although the fund managers may decide to invest some of the pension funds in passive strategies - a process described by Chinco and Sammon (2024) as "internal-indexing".

Figure 8 shows the proportions of institutional assets managed under these two types of

[16]https://www.thepensionsregulator.gov.uk/en/document-library/research-and-analysis/occupational-defined-contribution-landscape-2023. Contract-based pension schemes are excluded from TPR universe,being regulated by the FCA and DWP (2024) estimates there are around 30 firms with an authorised DC workplace pension business.)

mandates has remained fairly constant over time at one-third pooled, two-thirds segmented. In comparing the trends in Figure 1 and Figure 8 we can see that passive investing has always been a feature of institutional investments, although it has waxed and waned over time, presumably as pension fund trustees weighed up the advantages and disadvantages of segmented over pooled mandates. The growth in passive investment strategies as a percentage of total AUMs documented in Figure 1 is really a shift in the retail section of the fund management market. This point is also made in Chinco and Sammon (2024) who suggest that for the US the emphasis on the growth of passive strategies for retail mutual funds disguises the true extent of passive strategies when account is taken of institutional investments.

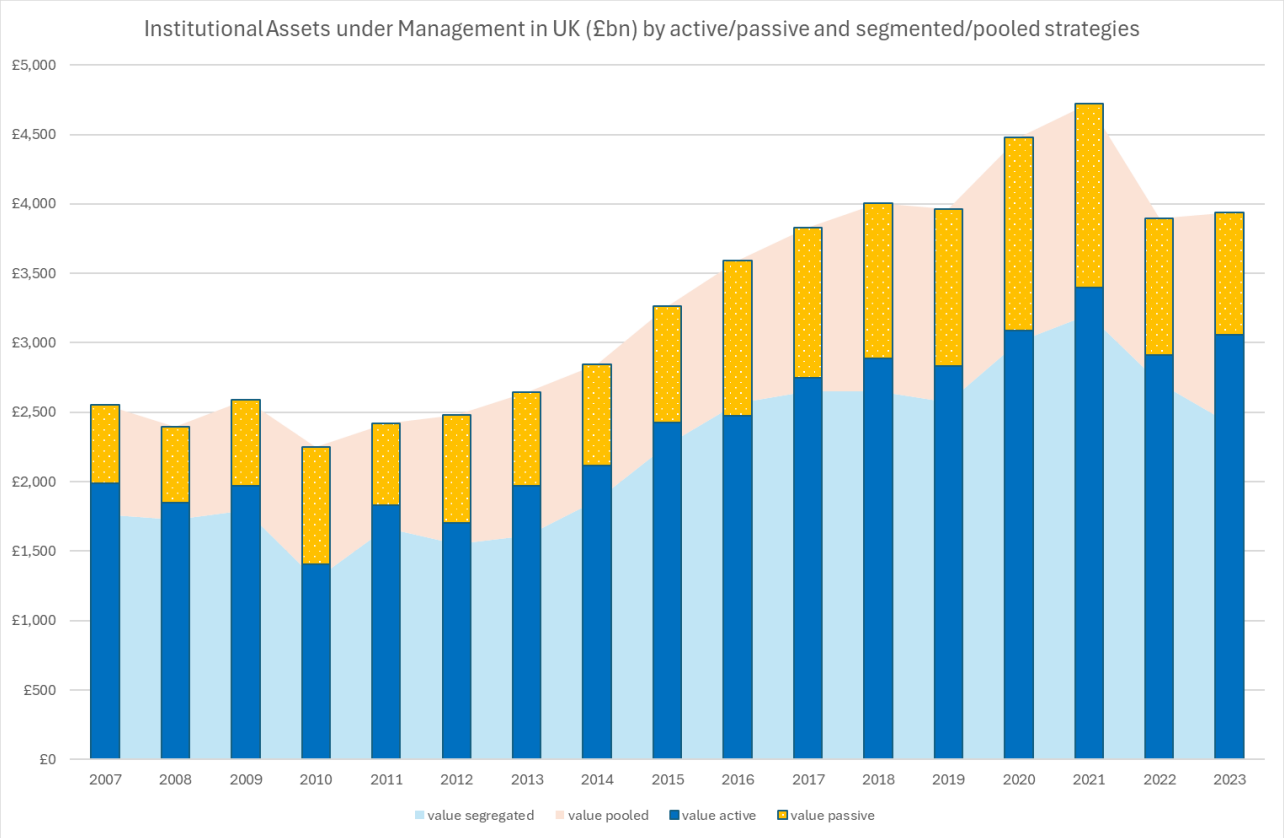

Figure 8: Institutional Assets under Management in UK (£bn) by active/passive and segmented/pooled strategies

How do pension funds allocate their assets? There are a number of official surveys collating the asset allocations of pension schemes across broad asset categories: cash and short-term money market securities; UK and overseas equities; UK and overseas government fixed interest securities; corporate fixed interest securities; index-linked securities; property and real estate, and other assets (sometimes referred to as alternative investments), including mutual funds, venture capital, private equity, hedge funds.

Traditionally the MQ5 survey of large defined benefit pension schemes provided this information which fed into the national accounts showing the asset allocation of these schemes. In 2017 this survey was closed down, due to acknowledged deficiencies and from 2019 was replaced with the Financial Survey of Pension Schemes (FSPS) which is a stratified survey of occupational pension schemes (both defined benefit and trust-based (not contract-based) defined contribution, public and private sectors). Since 2006 the PPF Purple Book has provided information on the asset allocations of around 5,000 private sector defined benefit pension schemes covered by the PPF, and is not a survey but is based on the annual returns by all eligible schemes to The Pensions Regulator. In addition, private sector organisations such as CAPS, WM and UBS have provided their own estimates, of these allocations.

Combining all these datasets is fraught with difficulties because of different definitions but is useful because the long time series of data allows for the identification of secular trends. Putting any difficulties aside, in Figure 9 we have combined these various datasets to enable us to identify long run patterns in pension scheme asset allocations.

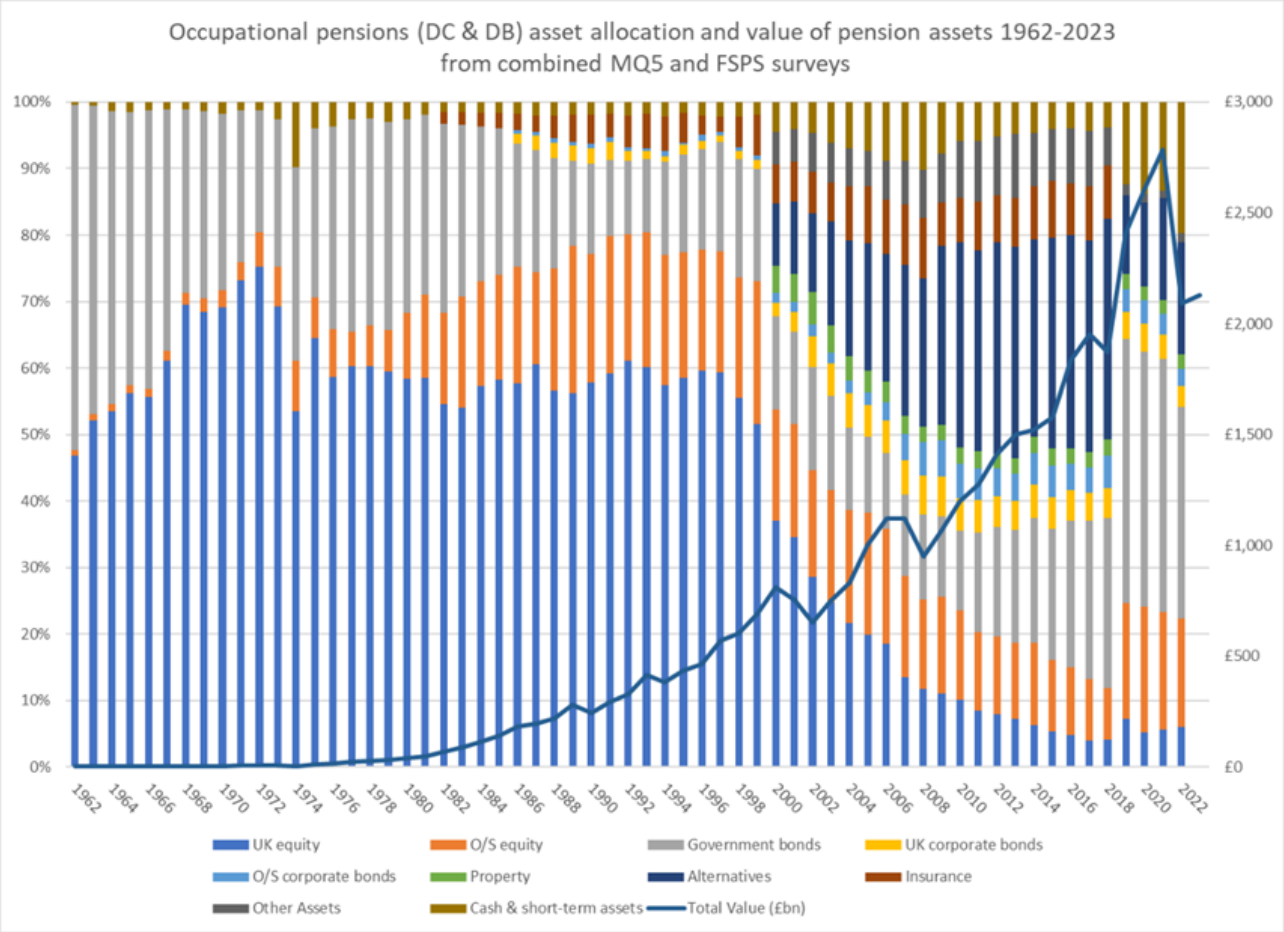

Figure 9: Occupational pensions' (DB & DC) values & asset allocations: long-run trends

Figure 9 shows the asset allocations of UK occupational pension schemes and in the right-hand axis the total value of pension scheme assets in £ billions.[17] Over the last couple of years with the increase in market yields since 2022, there have been significant falls in the total value of pension assets, mainly through the fall in the value of fixed income securities. The value of assets in occupational pension schemes including both DB and DC schemes was £2.13 trillion in 2023.

Describing the trends in pension scheme asset allocations: back in 1962 the asset allocation of pension schemes was very simple: 50 percent in UK equities and 50 percent in UK government bonds with small amounts in cash. Over time the asset allocation decision has become more complicated as more asset classes have become available. For example, the abolition of exchange controls in 1979 allowed for more overseas investments (equities and fixed interest), and the issuance of index-linked UK government bonds in 1981 allowed pension schemes to hedge inflation risks by holding index-linked securities. There are a number of broad trends in this figure:

- The percentage of pension fund assets invested in UK equity increased from around 50 percent in the early sixties to 60 percent in the mid-nineties, but has decreased dramatically more recently to between 5 - 10 percent;

- A substantial increase in the percentage of pension scheme assets invested in overseas equity since the early 'eighties, although this has stabilised to around 15 percent (but under 10 percent for DB schemes);

- The percentage of assets invested in fixed interest securities shrank to around 10 percent in the mid-nineties, but has subsequently increased to just under 40 percent; and there has been a growth in the share of index-linked securities from the early 'eighties to around 30 percent for DB schemes.

- Property investments have varied over time and can take a number of forms: direct property investments for schemes that have real estate divisions and/or real estate investment vehicles (investment trusts and unit trusts) for schemes without such infrastructure.

[17]Data in 9 is from the surveys of all occupational pension schemes (private and public sectors) combining information from MQ5 1962-2018 and the more recent FSPS, 2019-2023. We may obtain a very similar figure for the universe of private sector defined benefit pension schemes from UBS (2017) which draws on data from ONS (MQ5) for 1962-1995, WM for 1996-2016, and PPF 2017-2022

- Over the last 20 years there has been an increase in the asset allocation to alternative investments that include mutual funds and hedge funds, venture capital, private equity, infrastructure, commodities and buy-ins.

- More recently pension schemes have made use of derivatives to hedge against inflation and interest rate changes via LDI investments.

The relatively low percentage of pension fund assets allocated to UK equities by the end of the sample is a striking shift, although when overseas assets are included, the percentage allocated to equities rises to around 25%. It important to recognise a number of factors that underlie this shift in asset allocations. First, it is beneficial for occupational pension fund sponsors and members that pension scheme returns have low correlations with other assets in sponsors' and members' savings portfolios. Given that existing savings portfolios are likely to be highly correlated with domestic assets and employees' human capital, investing in overseas assets diversifies away some investment risks, and is a beneficial investment strategy for the individual pension scheme member. Second, there is a symmetric argument for overseas pension fund sponsors and members, who will benefit by diversifying into UK assets. We might expect an equilibrium is where UK pension funds invest in overseas assets, and overseas pension funds invest in UK assets (Levy and Sarnat, 1970).[18] Third, this shift is a consequence of DB pension funds deliberately reducing their exposure to risky equities and increasing their exposure to government and corporate bonds which arguably better matches their liabilities.

The asset allocations described in Figure 9 do not distinguish between passive and active strategies. Whatever this mix, the low percentage of UK pension scheme assets allocated to UK equities suggests that the consequences of UK pension fund passive investment strategies on UK equity markets will be small. However, this does not take into account the investment vehicles for overseas institutional investors in UK equity markets. We simply do not know how these overseas institutional investors are choosing to invest in UK equities; although we might infer from the data in Figure 2 that international investments are less inclined to be managed

[18] According to the ONS, the proportion of ordinary shares held by overseas investors in UK incorporated companies listed on the London Stock Exchange in 2022 was at a record high of 57.7%. Most of these holdings will be held by overseas institutional investors. In contrast, UK insurance and pension funds' proportions in UK quoted shares have fallen from 45.7% in 1997 to just 4.2% of UK listed shares in 2022 which is the lowest proportion jointly held by them on record: https://www.ons.gov.uk/economy/investmentspensionsandtrusts/bulletins/ownershipofukquotedshares/2022

through passive strategies. More recent data from FSPS surveys to distinguish between UK pension schemes' pooled and direct investments is available from 2019, and we discuss this recent evidence in Section 8

How does the asset allocation and ownership of equity by UK pension funds compare with pension funds in other countries? The OECD provide information on pension fund broad asset allocations for the last 20 years across all OECD countries. We reproduce this data in Figure 10 for six OECD member states (Australia, Canada, Netherlands, Switzerland, UK, USA), and we focus on these six countries because they each have large funded pension schemes as measured by the market value of pension assets to GDP.[19] However, we do not have any international comparisons on the differences in these pension fund allocations between active-passive strategies.

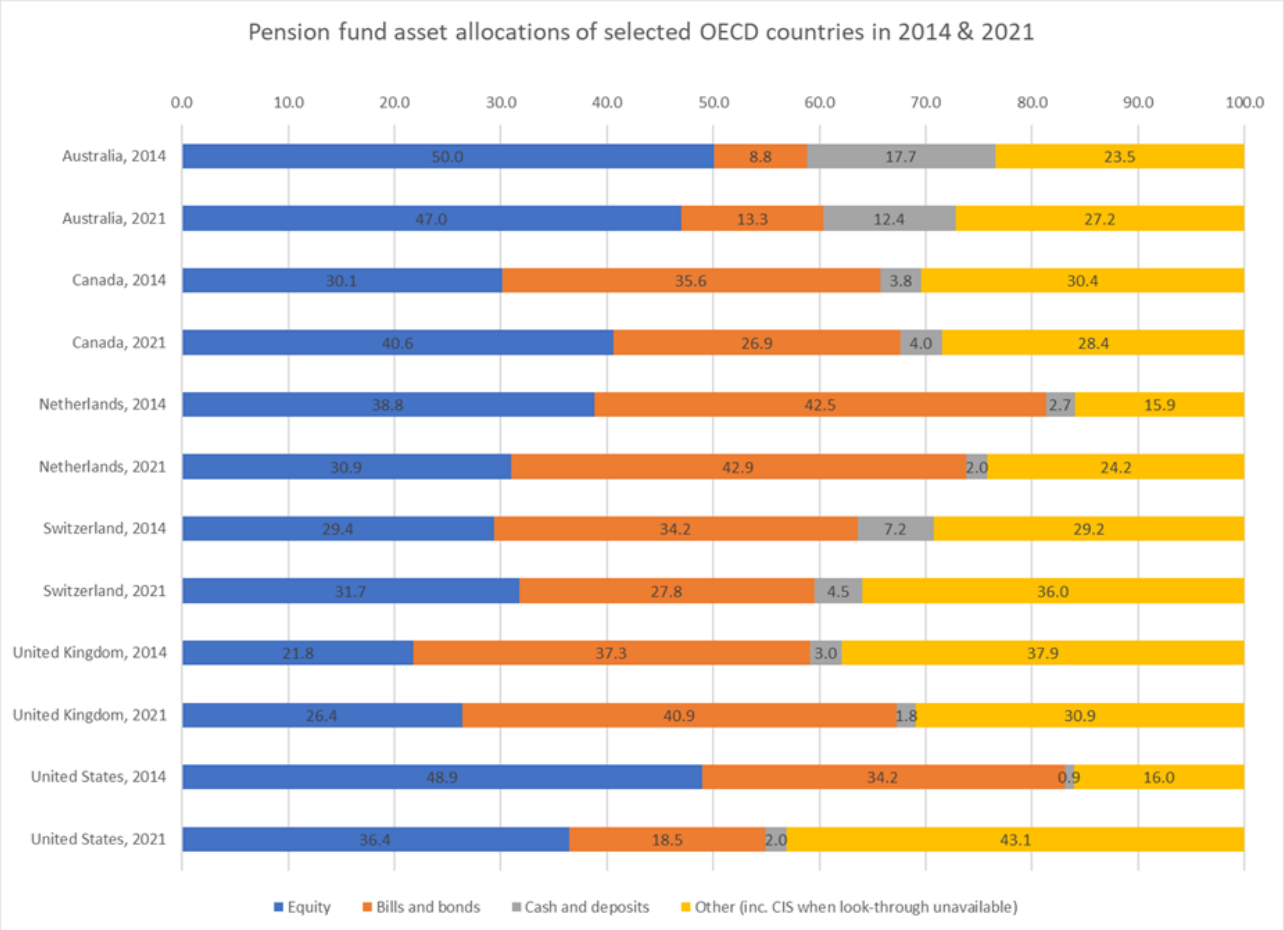

Figure 10: Pension fund asset allocations of selected OECD countries in 2014 and 2021

Figure 10 compares the asset allocations across two time periods: 2014 and 2021. We can see that the UK in 2021 appears to have a relatively small percentage of assets allocated to

[19]DWP (2024) also compare pension fund asset allocations in these same countries

equities (26.4 percent in UK and overseas equities, approximately consistent with Figure 9). But the UK asset allocation has a large percentage of "Other investments", which as the notes to the figure explain includes equity products. The figure suggests some convergence of asset allocations over time in comparing between countries. Countries that had a relatively high proportion of assets allocated to equities in 2014 had reduced this equity exposure by 2021, and vice versa: countries with relatively low equity exposure had increased their assets allocated to equities.

The UK government white paper from DCLG (2015) instigated an initiative to increase pension fund investment into UK infrastructure and require pension funds to explicitly explain how ESG factors are incorporated into investments. The initiative allowed for the consolidation of 89 Local Government Pension Scheme (LGPS) funds in England and Wales (Scottish funds were exempt) into eight 'pools' of assets typically established as an authorised contractual schemes (ACS), a fund structure that is regulated by the FCA. Thurley (2021) provides an update on this initiative and how these pooled schemes are making investment decisions, taking into account ESG issues, including the risks and opportunities associated with climate change and investment in infrastructure.

Wells (2024) estimates that around £541 billion of pension assets (18 percent of the estimated total) was invested in UK "productive assets" in 2023, where productive assets include listed equities, corporate bonds, private equity and alternatives. We do not have any data on the proportions of these amounts allocated to passive/active strategies. The FCA implemented a recommendation of the Productive Finance Working Group (Bailey et al., 2021) and in 2021 authorised the establishment of Long-Term Asset Funds (LTAFs). LTAFs are open-ended funds designed to enable pension funds and retail investors to invest efficiently in long-term, illiquid assets, such as venture capital, private equity, private debt, real estate and infrastructure. Although LTAFs are not envisaged to be passive investment vehicles, since such investments require active monitoring and there is no standard index to replicate. There is a recognition that fees associated with such active funds may violate the pension charges cap of 0.75 percent, and suitably designed performance-related fees should ensure pension scheme members' interested are protected. [20] In July 2023, the Conservative Government announced

[20]https://www.gov.uk/government/consultations/broadening-the-investment-opportunities-of-defined-contribution-pension-schemes

the Mansion House Compact, under which a number of the UK's largest DC schemes, signed up to the objective that by the year 2030 at least 5 percent of their default funds would be allocated to unlisted equities by 2030. The Labour government announced in May 2025 that it would continue this process of consolidation with master trusts required to have AUM of at least £25 billion by 2030, and promote investment in illiquid UK assets (HMTreasury, 2025).

7 Corporate governance

Index funds hold large stakes in companies and maintain a long-term commitment to the firms in their portfolios. Their substantial ownership gives them significant influence over corporate policies, particularly through voting and leveraging economies of scale (Brav et al., 2022).[21] Their long-term commitment stems from the inability to exit their holdings as long as the firms remain in the relevant index. This long-term orientation enables them to advocate for changes that may be costly in the short term but have the potential to enhance value over time. These characteristics would suggest that index funds are well positioned to improve corporate governance in the firms they own. Additional factors supporting their role as effective stewards include their fiduciary duty and reputational concerns (though these aspects are not unique to passive funds), as well as cultural norms and regulations, such as the UK Stewardship Code.

However, index funds charge low fees (typically, a fixed percentage of assets under management), which limits the resources they have available to invest on stewardship. In addition, the structure of compensation of index fund managers might reduce incentives to improve governance (Bebchuk and Hirst, 2019). While governance might improve the value of the company, managers only retain a small fraction of it in the form of fees, and other competing index funds holding the same stock can free ride that value increase. This can be partially offset by the indirect benefits of engagements, that is, whether the institution under- or overweights a firm relative to other investors and how strongly flows respond to institutions' relative performance (Lewellen and Lewellen, 2022). In addition, Morley (2018) argues that due to the size and complexity of index funds, they are too big to engage via activism, as the interests of the different parties within their families might conflict, leading to legal and practical issues. That

[21] This increase the direct benefits of engagement and also reduces the cost of it. For instance, their large voting power allows them to be pivotal voters without costly vote solicitation Brav et al. (2022).

is, activism by one of a manager's funds (e.g., equity fund) can damage the interests of the manager's other fund (e.g., debt fund).

From the above discussion, it remains theoretically unclear whether passive ownership leads to better or worse corporate governance. Ultimately, this is an empirical question, as the outcome depends on which forces prevail in practice.

Before discussing the empirical evidence, it is important to highlight that many investment managers centralize key stewardship decisions in a dedicated stewardship team (Fisch et al., 2019), so the literature often analyzes the role of passive investing at the family level rather than the fund level. In what follows, we will refer to family-level analyses unless otherwise indicated.

This section is divided in two parts. First, we will review whether index or passive funds exhibit weaker or stronger governance efforts, as proxied by voting, engagement, and other direct indicators of corporate governance. Second, we will review the boarder consequences of indexing on takeovers, innovation and other corporate events.

7.1 The consequences of passive investing for corporate governance

It is difficult to observe many of the governance efforts that index funds, and institutional investors in general, make. This is because disclosure of these activities is generally not mandatory (except for voting), and even when some investors voluntarily disclose, commercial database do not systematically collect this information. Most studies analyzing governance variables beyond voting consider a few investors. We start the discussion by focusing on the US Big Three (BlackRock, Vanguard, and State Street), the largest US indexers, which own around 25% of S&P500 companies. There is a substantial literature on the behaviours of these investors, and we then extend the findings to other index investors. Given the economies of scale in engagements (Brav et al., 2022), we would expect these investors to have the largest incentives to engage.

7.1.1 The US Big Three

One of the most comprehensive studies in terms of the governance mechanisms explored is Bebchuk and Hirst (2019), and we summarise their conclusions here. However, while their article

provides good indicators of governance efforts of these Big Three, as the authors acknowledge, both the optimal level of governance and whether ownership by indexers is better or worse than other forms of ownership (such as active ownership or individual investors) is unclear.

Investment in stewardship. Bebchuk and Hirst (2019) report that, as of 2019, each of the Big Three had between 12 and 45 stewardship personnel overseeing portfolios of more than 11,000 companies worldwide. Bebchuk and Hirst estimate that the stewardship budgets of these three investors are less than 0.2% of the fees they collect for managing equity assets, suggesting an underinvestment in stewardship. Furthermore, the stewardship teams at the Big Three may lack the incentive to target firms focusing on delivering shareholder value, as their performance is typically measured by the number of engagements rather than the success of those engagements (Aggarwal et al., 2023).

Engagement. Bebchuk and Hirst (2019) estimate that, from 2017 through 2019, the average proportion of portfolio companies with engagement was 11% for BlackRock, 5.8% for Vanguard, and 5.5% for State Street. Typically, these engagements consist of a single engagement per year. In other words, the Big Three engage with only a small minority of their portfolio companies, and have multiple engagements with a small minority of companies. Fisch et al. (2019), however, points towards the increase in the number of engagements in recent years.

Heath et al. (2024) find that while the Big Three engage with more firms than active fund families each year, they engage less than active fund families once they control position size and other determinants.[22] They find that while passive funds have larger positions, their fees are lower, so they do not capture as much of the value they create – in other words, the costs and the expected value creation is similar for active and passive fund families, but the expected benefit that accrues to passive fund families is much lower due to their fee structure; hence, passive institutions engage less.

Aggarwal et al. (2023) conduct an event study to evaluate whether news of Big Three engagements with public companies have an economically significant effect on firm value. They find no significant market reaction, suggesting that these engagements are not a credible signal of future improvements in governance or firm value. Likewise, they find that engagement is uncorrelated with firm (poor) financial performance, but it is rather determined by firm

[22]Their sample includes the fourth largest passive fund family, Northern Trust.

exposure to a given firm (i.e., ownership). They do not find evidence of improvements on governance outcomes at portfolio companies (CEO compensation, dual class stock, and the presence of female directors) or abnormal returns following engagements. This contrasts with the evidence of successful engagements by active funds, most notably, among hedge funds (Brav et al., 2008; Denes et al., 2017).[23]

There is some literature showing that engagements by the Big Three can be effective in improving certain governance variables. For instance, Azar et al. (2021) find that Big Three engagements targeting high carbon emitters are followed by reductions in CO2 emissions. Gormley et al. (2023) reports that engagement by the Big Three on board gender diversity is followed by improvements.[24]

Other work shows that broad-based public engagement, such as BlackRock's 'Dear CEO' letter or Norges Bank's expectation documents, has the power to influence firms' governance in the direction suggested in these public statements Aguilera et al. (2024); Pawliczek et al. (2021). This indicates that large passive investors can leverage their significant size to implement changes at a very low cost.

Focus on divergence from governance principles. According to Bebchuk and Hirst (2019), the Big Three's private, behind-the-scenes engagements focus on companies that diverge significantly from desirable governance principles, without taking underperformance into account. This aligns with the empirical evidence provided by Aggarwal et al. (2023).

Voting. Voting against management is a key channel through which investors can use their voice to affect corporate policies (McCahery et al., 2016). Bebchuk and Hirst (2019) find that index funds exhibit a pro-management behaviour when it comes to Say on Pay proposals (one of the most contentious items up for vote in the typical annual meeting) - between 2011 and 2018 each of the Big Three opposed between 2% and 4.4% of them. This is much less often than ISS. It is also less than half (and closer to one-third) of the frequency for the largest ten active managers. This pro-management behavior is documented in empirical studies by Heath et al. (2022) and Brav et al. (2024). For instance, Heath et al. (2022) find that passive mutual funds are 10.1 percent more likely to vote with management compared to active mutual funds.

[23]Other examples include Dimson et al. (2015), which, in analyzing a small (active) impact fund, finds positive abnormal returns following successful engagements.

[24]The mechanism is via voting. In particular, the Big Three started voting against the nomination or governance committee in firms with low gender diversity, which ultimately led to an increase in the percentage of female directors on the board (see also Michaely et al. (2024)).

Bebchuk and Hirst (2019) also argue that index investors fail to adequately pursue several actions, including: (i) monitoring firm performance, (ii) influencing the selection of directors, (iii) submitting shareholder proposals, (iv) engaging with regulators to influence policy, and (v) taking the lead plaintiff role in securities cases.

Fisch et al. (2019) claim that passive investors engage on market-wide issues such as potential corporate governance reforms, that have a broad market impact and might indirectly affect firm performance. They highlight market-wide initiatives to promote good governance by passive funds, such as the "Shareholder-Director Exchange Program" in 2014 or the "Investor Stewardship Group" in 2016. They also claim that indexers can influence the composition of the index themselves. For example, by persuading index providers to exclude firms with certain characteristics, such as dual class shares.[25]

7.1.2 Other investors

The empirical literature analysing the effect of index investors on corporate governance more broadly is unsettled, with some evidence suggesting that indexers improve governance (Appel et al., 2016) and others providing evidence of the opposite (Heath et al., 2022; Schmidt and Fahlenbrach, 2017).

It is worth noting that most studies rely on exogenous variation in passive ownership due to index assignment around the Russell 1000/2000 but with different implementations. Schmidt and Fahlenbrach (2017) find that an increase in passive ownership balances power in favour of CEOs, consistent with higher agency costs. Specifically, they find that board independence decreases (measured by board tenure) and CEO duality increases. They find that passive ownership does not affect the number of shareholder proposals submitted at their portfolio companies (the tool most accessible to passive investors). They find evidence that these changes are value decreasing, analysing announcement returns to the accumulation of titles by the CEO and new director appointments. While Appel et al. (2016) document that firms with higher passive ownership tend to exhibit greater board independence, are more likely to eliminate takeover defenses such as poison pills, enhance shareholders' ability to call special meetings, and decrease the prevalence of dual-class shares, Heath et al. (2022) present evidence suggesting the opposite.

[25]See Big Investor Group to Push for End to Dual-Class Shares here.

Various attempts have been made to understand the merits and pitfalls of each approach, and trying to reconcile the mixed empirical findings documented in the literature. Wei and Young (2024) claim that the specification employed by Appel et al. (2016) is akin to selection bias. Gormley and Kim (2024) point toward empirical misspecification in Heath et al. (2022). However, Aggarwal et al. (2023) use both approaches and find no evidence of governance improvements in firms with more passive ownership (focusing only on the Big Three).

Corum et al. (2023) argue that the effect of passive ownership depends critically on which investor (active or liquidity providers) is crowded out by passive owners. Chen and Heater (2024) provide empirical support for this claim, exploiting time-series variation in passive fund growth across a broad sample of U.S. companies, regardless of their proximity to index inclusion thresholds. Specifically, they find that passive ownership harms governance when they replace active owners, while it improves it when it replaces non-fund investors. The economic magnitude seems modest: a 5% increase in passive ownership increases *overall governance* by 0.024 (5% of its standard deviation).[26] While Appel et al. (2016) find no difference in active funds around the Russell index assignment cutoff, Heath et al. (2022) find a decrease in active funds around the Russell index assignment cutoff. While these results seem consistent with their findings, it is unclear why the same source of exogenous variation (i.e., reassignment around Russell 1000/2000) leads to different results regarding which investor is crowd out.

Heath et al. (2024) use counterfactual simulation to study the consequences of the recent rise in passive investment for engagement. In their scenarios, they assume that passive investment continues to grow at the pace it did over the last 20 years, eventually holding 90% of all AUM. In this case, engagement by passive families will continue due to their larger holdings. This shift will create value for investors and society.

7.1.3 The consequences of passive investing for corporate governance beyond the US

In 2017, Morningstar conducted a survey of the largest providers of index funds and exchange-traded funds—12 in total—across three regions, the United States, Europe, and Asia provides

[26] Their proxy for governance includes: (i) whether the board is fully independent (i.e., everyone but the CEO is independent), (ii) the board has an independent chairman, (iii) the firm does not have a staggered board, and (iv) the firm does not have a poison pill. Further tests reveal that the results are driven by (ii) and (iii).

the following highlights:[27]

- These passive investors have expanded their stewardship teams, increasingly committing to promoting ESG through engagement and voting. This should allow passive investors to undertake more and better-quality engagements with portfolio companies. These stewardship teams are still very small (Legal & General and UBS had 11 people in 2017, other asset managers typically had 5 people or less), similar to the findings in Bebchuk and Hirst (2019).

- Voting and engagement activities differ widely, influenced not only by the size and investment style but also by the philosophy, geographical location, and historical background of asset managers.

  - Large managers vote for all portfolio holdings where possible, while smaller asset managers and those with fewer resources focus more on their home country or region, or on their largest holdings.

  - Asset managers are typically supportive of company management and boards, as most votes are related to routine administrative matters. However, there are significant differences with respect to voting against management. For example, during the 2017 proxy season, Vanguard opposed management in 6% of votes, while Deutsche Asset Management did so in 23%. There is anecdotal evidence of increased dissent.

  - Index portfolio managers do not have a direct role in voting on their portfolio holdings, as this responsibility is centralized within the stewardship team. However, in some organizations, they may be consulted on policy-level decisions and kept informed about specific votes.

There are very few studies looking into the relationship between passive ownership and corporate governance using non-US firms, typically due to data availability.[28] One exception is Bevza and O'Hagan Luff (2024). In their paper, they analyse European companies (constituents of the EuroStoxx 600 index), and generally find that passive ownership is negatively

[27]The full report is not available; the results are based on a post they wrote based on the report (see here).

[28]European equity markets differ significantly from those in the US, with a higher prevalence of controlling shareholders and family ownership, a lower average free float, and more stringent restrictions on shareholder engagement (Bevza and O'Hagan Luff, 2024).

related to corporate governance. Specifically, higher ownership by passive investors is negatively associated with the fraction of women on the board, lower independence in audit and nominating committees, and higher executive pay. However, they find that higher passive ownership is positive associated with policies regarding directors' experience and equal treatment of shareholders.[29]

Although the evidence from previous studies that examined the relationship between passive ownership and corporate governance based on US data might not be generalizable to many other European economies, such as Germany and France due to their concentrated ownership structures (typically family firms) (Franks and Mayer, 2017), the UK market shares more similar characteristics that could make previous studies using US data more relevant to the UK.

7.2 The consequences of passive investing for takeovers, innovation and other corporate events

The evidence discussed above suggests that passive investors might engage in some form of broad principle-based governance (i.e., low-cost monitoring activities), but they do not seem to focus on firm-specific factors, such as poor financial performance. Evidence on broader, high-costs efforts is at best mixed, and generally point toward higher levels of ownership by passive investors reducing the quality of corporate governance.[30] Schmidt and Fahlenbrach (2017) examine the relationship between passive ownership and merger and acquisitions (M&As). According to Jensen (1986) corporate takeovers are a channel through which entrenched managers can extract private benefits. Hence, worst (better) governance by passive owners should be related to worst (better) M&As. Using the Russell 1000/2000 assignment for identification, Schmidt and Fahlenbrach (2017) find that an exogenous increase in passive ownership leads to worst M&A outcomes. Specifically, they find that a 1% increase in passive ownership leads to 0.32% to 0.38% lower M&A announcement returns. This result is in line with lower monitoring incentives of passive investors. Consistently, Fich et al. (2015), looking at *motivated monitors* (defined as investors with a high stake in a given firm) find evidence that the quality of M&A deals improves when the ownership by motivated monitors increase.

[29]These results have to be interpreted with caution. The authors use an instrumental variable that likely violates the exclusion restriction. Unfortunately, they do not report the OLS results for comparison.

[30]Consistently, Adler et al. (2024) find that banks adjust loan spreads and covenants when firms have higher ownership by institutional investors.

Despite the growing influence of passive investors, surprisingly little research examines their impact on other major corporate events such as bankruptcy. Given that passive investors allocate fewer resources to firm-specific monitoring, one might expect bankruptcy rates to increase as passive investment increases. However, other stakeholders may anticipate this reduced monitoring and take measures to compensate, potentially mitigating the expected increase in bankruptcies. For instance, Adler et al. (2024) find that banks charge higher loan spreads to firms with greater passive ownership. Specifically, they document an increase of approximately 13% in loan spreads for firms moving from the Russell 1000 to the Russell 2000, and a decrease of about 9% for firms moving in the opposite direction. However, they do not find evidence that these firms experience higher failure rates. Instead, banks appear to raise loan spreads to cover the cost of the additional monitoring they must undertake. These results highlight that the potential effects of passive ownership on corporate outcomes are also influenced by how other stakeholders react to their presence in the firm.

The higher or lower governance efforts of index investors can manifest into different firm outcomes, such as investment, innovation or financial reporting quality. Aghion et al. (2013) report that higher ownership by quasi-indexed institutions (following Bushee (1998) classification) have no association with innovation. Other types of institutional owners (dedicated and transient) have a positive association with innovation. However, these results have been recently challenged by Simeth and Wehrheim (2024) due to issues with the data in the original paper. After fixing these problems, they find that quasi-indexed ownership is negatively related to innovation, while results are statistically insignificant for other types of institutional investors. Consistently, Gutiérrez and Philippon (2017) find that higher ownership by quasi-indexed institutions is positively correlated with underinvestment.

Passive investors might matter for takeovers, bankrupcies and other corporate events *indirectly*. Specifically, the increasing concentration of ownership on passive investors might influence major corporate events by facilitating other investors' activities. For instance, while activists face a free rider problem (Grossman and Hart, 1980), large and concentrated ownership can ease activist ability to seek support for their demands and decrease coordination costs during solicitation. Appel et al. (2019) find that a firm's stock being held by passive investors does not affect the likelihood of being targeted by an activist. However, *conditional* on

being targeted, passive ownership does affect activists' strategic choices. For instance, passive ownership is positively related to campaigns seeking board representation (and the number of board seat sought), and negatively related to other campaigns, such as shareholder proposals and exempt solicitations. They also find that activists' campaigns are more hostile. In terms of economic magnitude, they find that a 1-standard-deviation increase in passive ownership (or 3.6% increase) is associated with about a 30 to 36% increase in the proportion of campaigns seeking board representation, with similar magnitudes for other types of campaigns. Taken together, the findings of (Appel et al., 2019) suggest that increased ownership by passive institutions increases the engagement of activists in costlier forms of activism.[31] Consistent with passive owners facilitating activits' campaigns, they find that passive ownership is associated with higher success rates of large magnitudes. A 1-standard-deviation increase in passive ownership is associated with a 16 to 20% higher likelihood of a proxy fight settlement (relative to the unconditional mean of 7%) and a 0.27 to 0.35-seat increase in number of board seats won when settlements occur (relative to the unconditional mean of 0.11).

Other streams of literature explore the consequences for financial reporting or audit quality, finding improvements in these variables when passive ownership increases. For example, Rawson and Rowe (2024) reports that greater passive ownership is associated with fewer abnormal accruals and benchmark beating of earnings and more readable, more negative, and more specific disclosures. Dong et al. (2024) document that higher passive ownership leads to higher audit quality proxied by audit fees, fewer restatements and smaller incidence of small profits. Boone and White (2015) find that higher institutional ownership leads to increased management disclosure, greater analyst coverage, and improved liquidity. Their findings indicate that indexing institutions' preference for reducing information asymmetries promotes information production, strengthening monitoring and lowering trading costs.

8 Demographics and the growth of passive funds

One important demographic trend is the rise in defined contribution pension schemes through the introduction of auto-enrollment in 2012 and the continuing transfer of DB to DC pension

[31] In line with this, they find that passive ownership increases the likelihood of activists seeking reimbursement from the company for their campaigns.

arrangements. According to DWP research celebrating 10 years of autoenrollment, in 2021 employees across the UK saved £114.6 billion into their pensions. This was a real terms increase of £32.9 billion compared to 2012, when Automatic Enrolment was introduced.[32] Typically in DC schemes, pension assets are held in low-cost index funds, so that the continuing rise in the share of DC pensions through auto-enrollment is likely to fuel the shift to passive strategies. We discussed in Section 6 the FSPS survey of occupational pension schemes carried out by the ONS and started in 2019. This survey provides information on the asset allocations of the three main types of occupational pension schemes: private-sector DC schemes; private-sector defined benefit and hybrid (DBH) schemes; and public sector DBH schemes. For each type, the FSPS survey distinguishes between whether the assets are held in pooled vehicles in which holdings are co-mingled with holdings from other schemes and will be typically be passive investments, and direct (or segmented) investments in which the pension schemes are the owners of the underlying assets. Figure 11 illustrates the asset allocation for each type of scheme across the pooled/direct investments, and also the value in £ billion of the size of each type of occupational pension scheme.[33]

In Q1 2004 the FSPS estimated that the size of the occupational DC sector was £289 billion up from £146 billion in 2019. The size of the private-sector DBH sector was estimated at £1,327 billion and the public-sector DBH sector at £547 billion. The FSPS estimates the total value of the occupational pensions sector was £2.1 trillion in 2024, slightly lower than the estimates in Figure 7. Although the DC sector is relatively small it is growing much more quickly that the DBH sectors, which have stagnated after the September 2022 gilts crisis. The asset allocations of these three sectors are very different. The large private DBH sector has almost 60 percent of its assets held via segmented mandates in direct investments with only around 5% invested in equities, as we discussed in Section 6 along with the well-documented shift into long-term debt securities. This sector holds almost 40% of its investments in pooled/passive vehicles with a slightly higher ratio to pooled equities rather than pooled debt. The public-sector DBH schemes have 60% of their assets invested through pooled/passive investments, and 40% through direct investments. In comparison with the private-sector, these public-sector DBH schemes have a higher percentage allocated to equities (both pooled, 34%, and direct, 17%) and a smaller share

[32]https://www.gov.uk/government/news/ten-years-of-automatic-enrolment-achieves-over-114bn-pension-savings

[33]Numbers in these diagrams are based on authors' estimates from the data in the FSPS data releases

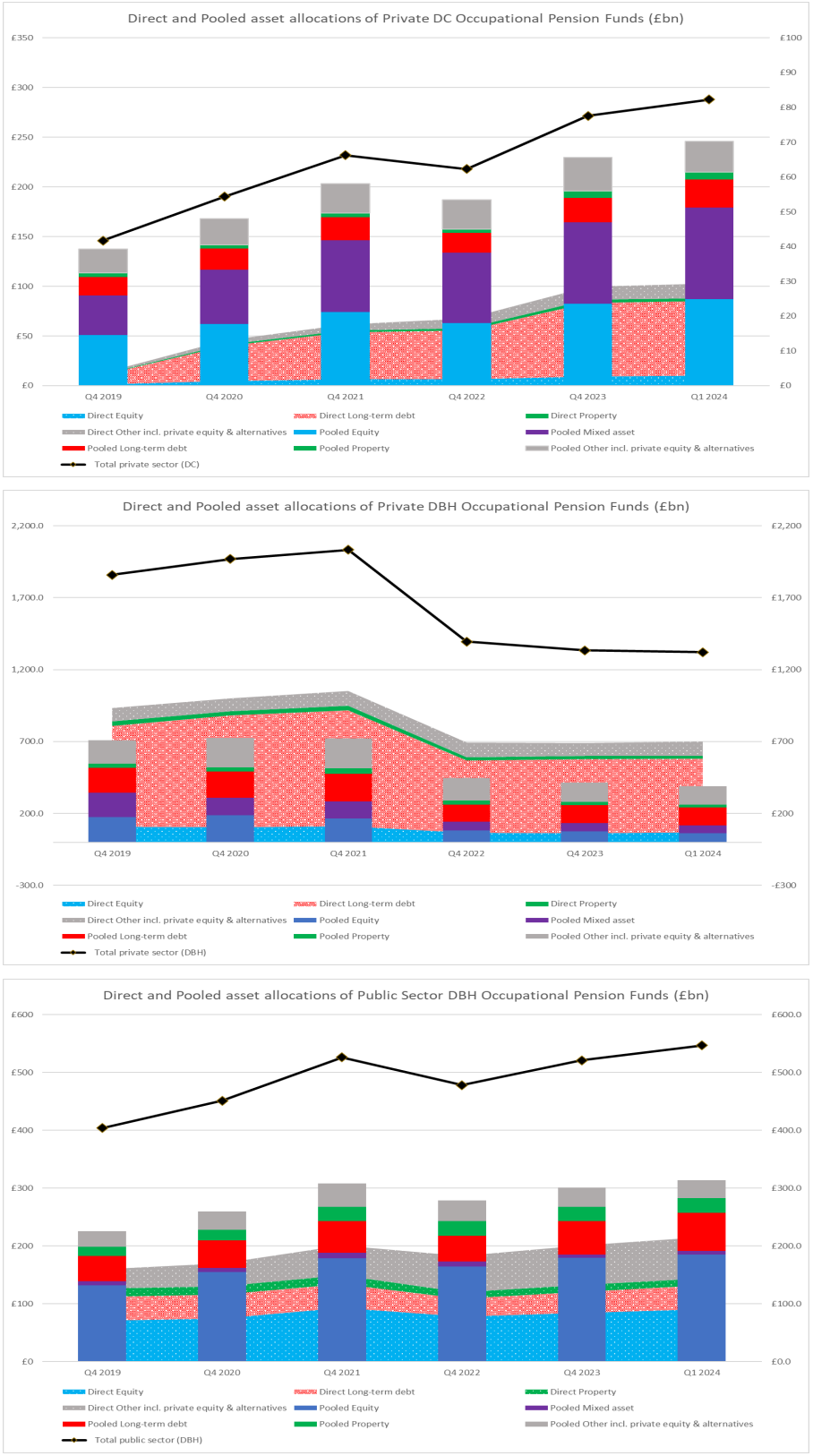

Figure 11: Asset allocations of Private-sector DC, Private-sector DBH and Public-sector DBH between Pooled and Direct investments

allocated to long-term debt (pooled, 11%, and direct, 8%). The public-sector DBH schemes have more investments in property, and both types of schemes have between 6% and 10% of their portfolios allocated to alternative investments (including private equity).

In contrast, the asset allocations of the private DC sector is very different: over 90 percent of assets are invested in pooled vehicles and hence passive strategies with over 30% in equity investments and only 10% in pooled debt vehicles. In addition, DC schemes have another type of pooled investment vehicles being a "mixed asset" investment, which is a pooled vehicle which invests in a mixture of debt and equity securities, and represents around 30% of the DC scheme asset allocations. Further occupational DC pensions unlike DB pensions are mainly invested in equity assets, with as much as 60% of funds invested in equities. The striking difference between equity investments of DB and DC investments is easy to explain. Corporate sponsors of DB pension plans have de-risked over the last 20 years attempting to match asset allocations to their defined benefit liabilities. These same corporate sponsors do not have any obligations with regards the accumulation of DC pensions and in consequence the default allocations of these funds are invested in riskier equities.

The DC segment of the pensions market is continuing to grow and therefore is likely that in the future there will be an increased allocation of pension funds to passive strategies and to equity investments. With regards the DB sector, the proportion of assets allocated to UK equities is now so low, there is little scope for any further reduction in allocations to this asset class.

A second and related demographic trend is the use of drawdown strategies in the decumulation phase of retirement planning. Traditionally, individual DC pension schemes adopted a lifestyle (or life-cycle) approach to financial planning: being fully invested in growth assets such as equities during the accumulation phase of the pension plan, and gradually moving into safe assets such as government bonds as the retirement date approaches (Booth and Yakoubov, 2000; Cannon and Tonks, 2013). Pre-2014, in the UK tax-priviliged DC pension pots were required to be annuitised at retirement, and after retirement annuity funds were typically invested by annuity providers (life insurance companies) in government and corporate bonds. However, the pension freedoms legislation of 2014 abolished the compulsory annuitisation requirement, and instead allowed retirees to access their pension pots via income drawdown arrangements

which allows the pension pot to remain partially or fully invested in growth assets, and phased withdrawals have grown in importance since 2014. Figure 7 reports assets of £220 billion in income drawdown arrangements in 2023. In the year to April 2019 the FCA Retirement Income Data reports there were 194,158 new drawdown arrangements set up - representing £28.4 billion of assets. By April 2024 these numbers had increased to 278,977 plans worth £35.8 billion. If these assets are invested in passive strategies they are likely to continue to be held in the same passive vehicles as part of drawdown arrangements, so the duration of pension plan equity holdings is increasing over time.

A third demographic trend is the rise in ESG investing (Environmental, Social and Governance): this is part of a wider shift in investor preferences towards socially responsible investing. The Investment Company Factbook 2024 reports that in 2023 913 US mutual funds and ETFs representing $532 billion of AUMs were classified as investing according to ESG criteria. This is almost double the 484 funds and $284 billion AUMs in 2019; although the rate of growth has slowed down in the last two years.

According to the bienniel GSIA Report on global sustainable investments, in 2022 $21.9 trillion was invested globally (excluding the US) in sustainable investing assets, representing an increase of 55% in non-US markets since 2016. For the US in 2022, $8.4 trillion was invested in sustainable assets.[34]. The Report notes that in Europe, the growth in sustainable investing has failed to keep up with the wider market growth and attributes this to increasing regulatory requirements regarding disclosures and more conservative reporting as the ESG sector develops. The UK's Stewardship Code is a voluntary code for institutional investors first released in 2010 by the Financial Reporting Council concerning corporate governance principles for promoting sustainable benefits for the economy, the environment and society. Although, in 2025 the FRC is consulting on revisions to the code following feedback on cumbersome reporting requirements.

The United Nations developed the Principles for Responsible Investment (UNPRI) in 2005 offering a framework for institutional investors to incorporate ECG factors into investment decisions.[35]. The 2024 Investment Company Report notes that there are three broad approaches to identifying portfolio constituents that satisfy ESG criteria: exclusionary investing (screen out companies that do not satisfy the criteria), inclusionary investing (only include companies

[34]https://www.gsi-alliance.org/wp-content/uploads/2023/12/GSIA-Report-2022.pdf

[35]Starting with 63 signatories in 2006, UNPRI had grown to 5,300 signatories by February 2025 from over 80 countries representing around US$130 trillion of AUMs.https://www.unpri.org/about-us/about-the-pri

that satisfy some ESG criteria) and impact investing (investments that generate a measurable social and environmental impact). All three approaches require a costly monitoring technology to assess portfolio constituents that satisfy the criteria. Given these costs, it is efficient for a limited number of institutions to undertake this assessment, and for passive investors to simply replicate the desired index composition. A number of index providers have constructed ESG indices (S&P 500 Scored & Screened Index; MSCI ESG Indices, FTSE4 Good Index), allowing passive investment portfolios to simply copy the asset composition of the respective index.

Experimental evidence in Hartzmark and Sussman (2019) on net fund flows into and out of high and low sustainable mutual funds suggests that retail investors are influenced by mutual funds sustainability criteria and performance. Similarly Krueger et al. (2020) documents the importance for institutional investors' portfolios of climate risks and their desire to engage with firms, rather than divestment, on the need to address environmental risks. Such trends in the more general ESG areas have implications for the size of passive strategies that address ESG matters as investors incorporate these factors into their investment portfolios.

9 Conclusions

We have argued that the growth of passive investments is unsurprising given the theoretical justification implied by two-fund separation, the low costs of holding a diversified portfolio of equity investments and the relatively poor performance of active investment funds. In addition there are structural and technological factors that may also have contributed to its growth. In this survey we have focused on the consequences of this growth in passive investment strategies for financial markets.

In Section 2 we set the stage for the growth in passive investments or indexing strategies with descriptive statistics on the numbers and size of passive mutual funds versus active mutual funds in the UK and other countries. We have documented the rise in the proportion of assets under management over the last 35 years allocated to passive investment strategies that replicate the returns on a designated index. In the UK, assets under management have increased from £2.8 trillion in 2005 when around 20 percent of assets were managed passively to £9 trillion in 2023 with 33 percent of assets managed passively. Institutional investors have always allocated investments to passive strategies, averaging around 27% of institutional AUMs

with no discernible trend. It is in the retail space that we have witnessed the increase in both the number and share of passive investments, most dramatically in US equity mutual funds, where 53 percent of domestic-equity AUMs were managed under an indexing strategy. Because passive funds are larger than active funds, the shift to passive strategies has increased industry concentration. The Investment Company Factbook 2024 reports that the 5-firm concentration ratio of assets managed by US mutual fund families increased from 35% in 2005 to 56% in 2023.

Section 3 considered the causes for this growth in passive investments. We started with a description of two-fund separation under the efficient markets paradigm. Research on active versus passive fund performance has traditionally concluded that active management typically fails to outperform benchmarks after fees. The early literature established that any abnormal returns are small on average and insufficient to cover fees, even when accounting for factors like market timing, survivorship bias, and persistence. Although some more recent studies suggest that sophisticated investors can identify skilled fund managers, the aggregate evidence indicates that most active managers underperform relative to passive strategies, reinforcing the conventional wisdom favouring passive investing.

The rapid growth of ETFs has further transformed the investment landscape by offering a more liquid, transparent, and cost-effective alternative to traditional mutual funds. As initially most ETFs pursued passive strategies, their growth coincided with the shift to passive fund management. However, the more recent rise of "active" ETFs reveals that investors are still interested in funds that follow active strategies in innovative ways.

While fund fees have been on the decline across the board, the relative decline of passive fund fees has probably contributed to their appeal. Over recent years, expense ratios have fallen significantly across various fund types, with passive fund fees converging towards zero (averaging 5 basis points in 2023), indicating that this is a natural monopoly. This trend to passive strategies is reinforced not only by the inherent cost-efficiency of passive management but also by broader industry shifts—such as the growth of robo-advisors, stricter fiduciary standards, and regulatory efforts promoting fee transparency—that collectively drive investors toward lower-cost, passive investment strategies.

Section 4 assessed the macroeconomic consequences of the growth in passive investment strategies on market concentration and financial stability. Anadu et al. (2020) provide new

evidence that aggregate investor flows for passive MFs are less sensitive to past performance than flows of active funds. For active funds, a 1% increase in monthly net return is associated with 0.03% (0.01%) same-month (lagged-month) inflows. The sensitivity of passive fund inflows to past performance is insignificantly different from zero. Hence, passive MFs appear to face less redemption risks than active funds following poor returns, and particularly at times of financial stress. There is evidence that the growth of international ETFs has increased the sensitivity of international capital flows to the global financial cycle. The sensitivity of investor fund flows to global financial conditions is 2.5 times higher for equity ETFs than for equity mutual funds. In summary, with respect to concerns about financial stability, while passive investing mitigates some macroeconomic risks, such as those related to liquidity transformation, it simultaneously increases others, including volatility and industry concentration.

Section 5 examined the general area of the effects of passive investments on market efficiency and passive funds. This section was broken down into a number of sub-sections. We first described the bedrock information paradigm of Grossman-Stiglitz and then considered the effects of passive funds on market volatility, price discovery and market efficiencies. Mapping active funds to "informed traders" and passive funds to "uninformed traders" in the Grossman–Stiglitz framework reveals that an increase in the share of passive funds can lead to reduced price informativeness, particularly when higher information costs drive more investors to passive strategies. However, the model shows that the effect on price informativeness depends on the source of variation in passive participation and remains inconclusive in establishing causality, since both passive investing and price informativeness are endogenous to market conditions. This issue is further complicated by concurrent trends such as the rise of ETFs, which allow intraday trading and may increase volatility, as well as the growth of high-frequency trading and improvements in data processing that affect how information is produced and disseminated.

The theoretical literature generally contends that although increased passive investing broadens market participation, it may also lead to inefficiencies such as higher volatility and altered return dynamics. Calibrations in Jiang et al. (2020) suggest that a large shift in active:passive investing (from a 90:10 split to a 40:60 split) increases the volatilities of mid- and large market capitalization stocks by between 0 - 6% (from an annual volatility of 11.13 to 11.84). More generally, empirical studies offer mixed evidence: some find that passive investing reduces price

informativeness or leads to higher price impact, while others, using different methodologies or focusing on cross-sectional effects, report no significant impact on overall price efficiency. Additionally, research suggests heterogeneous effects across assets, with large-cap stocks potentially experiencing increased valuations and volatilities, whereas smaller stocks might see a decline in price informativeness. Overall, while passive investing is linked to heightened volatility, its precise influence on market efficiency remains an open question.

We went on to examine the evidence on the effects on prices of a stock joining an index. In the literature, there is a general consensus that stock inclusions in an index are followed by an increase in the prices of the stock being included of around 3%. This effect is attributed to the price pressure exerted by passive investors. When the demand curve is downward sloping (that is, stocks are not perfect substitutes for each other), an increase in the demand by passive investors when stocks are included in the index they are tracking pushes their price up. However, no consensus has been reached on whether this effect is temporary or permanent. Contrasting results are probably due to the difficulties of measuring stock inclusions' effects over long windows and to the time-varying nature of such effects. Recently, Greenwood and Sammon (2024) showed that the inclusion effect has decreased over time and it is disappearing.

We summarised the effects on correlations of stock prices in a given passive fund and consequent impacts on investors. One of the main concerns regarding passive investing is that it increases correlations among stocks, thus reducing investors' diversification opportunities. This phenomenon has been widely documented in the literature that has found that when a stock is included in an index its correlation with other stocks in the index increases. This fact is attributed to "basket trading": passive funds that track the same index have to trade a basket of stocks together; for example, when an indexed portfolio needs to be rebalanced because of inflows or outflows. Greenwood and Sosner (2007) document that the beta of the added stocks over a basket of the other index stocks increased from 0.56 to 1.01. In contrast, the beta of deleted stocks over a basket of the index stocks went down from 1.47 to 0.85. The growth of ETFs has exacerbated this phenomenon, as these instruments are much more liquid than funds and are traded at high frequency. While there is a general agreement that passive investment, especially through frequently traded ETFs, is the cause of the increase in stocks' correlations, the recent theoretical literature calls for a more nuanced view. Chabakauri and

Rytchkov (2021) argue that, while basket trading increases correlations, the reduction of risk sharing in an "indexing economy" has an opposite effect. They argue that in equilibrium, the effect on correlations is not obvious but depends on which of the two channels prevails.

Finally in Section 5 we examined the effects on the market of lower fees and churn rates. We have documented the decline in management fees both for passive funds and active funds with some evidence that there is a causal relationship: competition from low-cost passive funds has reduced the fees charged by active funds. Expense ratios for active US equity mutual funds have fallen from 1.06% of AUMs in the year 2000 to 0.65% in 2023, and US index equity funds' expense ratios from 0.27% to 0.05%. FCA data reports AUM-weighted average fees for UK-domiciled passive funds have declined from 0.29% of AUM per year in 2015 to 0.15% in 2020, and fees for UK-domiciled active funds have fallen over time to 0.89% in 2020.

Section 6 considered the impact of passive investments on asset allocations of investors. First we examined the impact on capital allocation. An important question is whether passive investing impairs the allocation role played by capital markets. Contrasting findings have emerged in the literature. Some papers have shown that passive investment decreases the quality of firms' investment decisions promotes the rise of mega-firms and distorts capital allocation by disproportionally lowering the financing costs of overvalued firms. For example Brogaard et al. (2018) study the link between commodity indices and firms that use the commodities tracked by those indices in their production processes. They find that firms that use indexed commodities in their business models have 6% higher costs and 40% lower operating profits than firms that use non-indexed commodities. Other papers have presented a more positive view of the relationship between passive funds and firms' investment decisions. Buss and Sundaresan (2023) find that firms with the largest share of passive investors invest more aggressively in growth opportunities because passive investors' demand for their stocks is inelastic.

We then assessed the impact of passive investments on the welfare of investors. As indexing investment is a conventional recommendation that financial economists give to retail investors, it is important to understand whether passive strategies actually improves their welfare. Some work has investigated this issue and generally produced a positive view. The availability of cheap index investments increases the market participation of uninformed investors, who become better off. In contrast, the welfare of investors who were already participating in the

market only modestly decreases when they switch from active to passive strategies.

In Section 6 we looked at the asset allocation of institutional investors. We reported that pension funds allocate around 30% of their assets to passive strategies. Defined benefit pension schemes which constitute the largest group of institutional funds have reduced their allocation to equities over time, which we explain is due to risk management reasons, but defined contribution schemes are more likely to invest in equities and more likely to invest in passive vehicles. Through auto-enrollment, there is a strong demographic trend to UK pension funds being allocated to passive equity strategies.

In Section 7 we examined the role of passive investment funds with respect to corporate governance issues in the firms in which they invest. The role of index funds in corporate governance is nuanced and theoretically ambiguous. Their large and long-term ownership stakes coupled with their fiduciary duties and reputational concerns potentially give them substantial influence over corporate policies through voting and engagement. However, index funds operate under low-fee structures that limit the resources available for governance activities, and their fund managers may have weak incentives to actively push for corporate improvements. Additionally, conflicts of interest within fund families and the scale of index ownership raise concerns about their capacity to engage in activism effectively. As a result, whether passive ownership enhances or weakens governance remains an empirical question.

The existing evidence provides a complex picture. Studies show that index funds, particularly the "Big Three" (BlackRock, Vanguard, and State Street), have relatively small stewardship teams and engage with only a minority of portfolio companies (less than 11% of companies in their portfolios per year). Their engagements tend to focus on broad governance principles rather than firm-specific issues, and their voting behaviour often favours management (10 percent more likely to vote with management compared to active mutual funds). Some research suggests that index funds can drive improvements in areas like board diversity and ESG concerns, but other studies find limited effects on governance quality or firm performance. Evidence from event studies on Big Three engagements with companies in their portfolio has no effect on these firms' values. The effects on governance seems modest: a 5% increase in passive ownership increases overall governance by 0.024 (5% of its standard deviation). The consequences of passive investing appear to depend on which investors are displaced—replacing active funds

may weaken governance, while replacing non-fund investors may improve it.

Higher passive ownership at the firm level is linked to worse M&A outcomes, lower investment, and weaker innovation, likely due to reduced monitoring intensity. For example a 1% increase in passive ownership leads to 0.32% to 0.38% lower M&A announcement returns. However, evidence suggests that firms with greater passive ownership exhibit better financial reporting quality and increased disclosure. This implies that indexing institutions' preference for lower information asymmetries can foster information production, enhance monitoring, and reduce trading costs. Furthermore, the literature indicates that passive funds can indirectly influence firm outcomes by facilitating coordination with other shareholders, such as during activist campaigns.

Finally, in Section 8 we assessed the likely effects of demographic trends on the growth of passive investments, identifying three important trends: the growth of defined contribution pension schemes, the growth of drawdown arrangements for pensions in their decumulation phase - allowing investments to be fully invested in growth assets for a longer period - and investor demands for socially responsible investments. These three trends are likely to lead to increased demand for passive investment strategies.

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